

MINUTES OF PROCEEDINGS

BEFORE

THE DEPARTMENTAL COMMITTEE

Appointed to inquire what Degree of Colour-Blindness or Defective Form-Vision in Persons holding responsible positions at Sea causes them to be incompetent to discharge their Duties; and to advise whether any, and if so, what alterations are desirable in the Board of Trade Sight Tests at present in force for Persons serving or intending to serve in the Merchant Service or in Fishing Vessels, or in the way in which those Tests are applied.

Held at the Board of Trade, 7, Whitehall Gardens, S.W.

FIRST DAY.

Friday, 8th July 1910.

PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).

The LORD RAYLEIGH, O.M., F.R.S.  
Mr. RAYMOND BECK.  
Captain THOMAS GOLDING.  
Professor FRANCIS GOTCH, F.R.S.  
Mr. NORMAN HILL.  
Mr. EDWARD NETTLESHIP, F.R.C.S.

Mr. J. H. PARSONS, F.R.C.S.  
Professor J. H. POYNTING, F.R.S.  
Professor E. H. STARLING, M.D., F.R.S.  
Dr. WILLIAM WATSON, F.R.S. } Secretaries.  
Mr. S. G. TALLENTS }

Sir WALTER J. HOWELL, K.C.B., called and examined.

1. (Chairman.) I think you are one of the Assistant Secretaries to the Board of Trade, and Chief of the Marine Department, are you not?—Yes.

2. We should be glad to get some idea from you of the present position of the Board of Trade with regard to their sight tests. The tests date back I think to 1877?—Yes. In 1876 the British Chargé d'Affaires at Stockholm reported upon certain inquiries which Professor Holmgren was then making into the colour-vision, in particular, of railway employes. It was in consequence of those reports that the Marine Department of the Board of Trade in January 1877 began to test the colour-vision of candidates for certificates of competency as master or mate in our merchant service. I should perhaps point out that the Board of Trade, for the purpose of granting such certificates, were authorised by section 132 of the Merchant Shipping Act, 1854, to lay down rules as to the conduct of the examinations and as to the qualifications of the applicants. It was under this section that the original sight tests were instituted; the Board of Trade, that is to say, made a rule that ability to pass a colour-vision test should be one of the qualifications required of candidates for masters' or mates' certificates. The provisions of section 132 have been re-enacted in substance in section 94 of the Merchant Shipping Act, 1894, and it is under this latter section that the tests are now applied.

3. Will you tell us why it is the Board of Trade regard colour-blindness as dangerous in an officer of the merchant service?—It is evident, I think, that an officer in the merchant service requires good colour perception for several purposes. Ships, for example, use coloured

flags to communicate with each other according to the international code of signals. I suppose it is not often that a man will be left to read signals of that kind alone, and I do not wish to lay too much stress upon the point. Again, it was once suggested to me by the president of the Mercantile Marine Service Association that good colour perception may enable a man to judge the depth of the water by its colour. He thought it might become an important point where a man had to navigate a ship among coral reefs, for example; and he told me that at Mombasa he had been able to judge from the colour of the water how to steer his ship.

4. Still it is at night, I suppose, that good colour-vision is considered to be so important?—Certainly. It is perhaps unfortunate that red and green, the colours which the colour-blind are most likely to confuse, are in practice found (besides white) to be the best for signal lights. The Royal Society's Committee pointed out—it is on page 15 of their report—that a pure blue light would be the only one that a man suffering from the commonest forms of colour-blindness would be able without fail to distinguish from a red one. But a blue light, for reasons for which I will refer you to the report, is an impossible one for ordinary use, though there are a certain number of blue coast lights in existence.

5. I think I had better ask you to give us some account of the lights that an officer may ordinarily be required to distinguish at sea?—In the first place he may have to pick up the lights of beacons, buoys, or lighthouses; and sometimes he will have to distinguish them from the lights of a town. In the second place he has to look out for the lights of other ships, and here

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I should perhaps explain briefly what lights a ship is required to carry.

6. I think a good many of the Committee would be glad to have that point made clear?—Practically every sea-going ship is required by international agreement to show between sunset and sunrise (while she is under way) a red light on the port side and a green light on the starboard side. In a sailing ship these lights are generally, I believe, hung forward, at the break of the fore-castle head or in the fore rigging; but foreign ships sometimes hang them in the mizen rigging. In a steamer, on the other hand, they are generally on the navigating bridge, unless there are lighthouses on the fore-castle head.

7. Am I right in taking it that every vessel must carry these two lights, red and green, steamers and sailing ships alike?—Yes, but a steamer must also show a white masthead light; and she may carry a second white masthead light. But in the latter case certain conditions apply, of which the most important is that the aftermost light must be at least 15 feet higher than the forward one. I should add that these white lights must be visible on a dark night with a clear atmosphere for at least five miles; while the red and green side lights must be visible for at least two. There are certain exemptions in the case of small boats (which must, however, carry a specified light of some kind) and there are other regulations for ships at anchor, aground, or engaged, it may be, in towing another vessel, in laying a cable, or in fishing. I will however, hand in a copy of the Regulations for Preventing Collisions at Sea, in so far as they deal with lights, which will give the Committee any details they may desire and will show, for example, exactly in what direction the lights to which I have referred must be visible. (See Appendix A., No. 1.)

8. May we have copies of that for each member of the Committee?—Yes.

9. Then are there regulations prescribing the exact colour of the red and green lights?—Yes. In 1891 the Board of Trade adopted the standard tints used by the Admiralty, and in 1892 they adopted a special standard green for use in electric side lights. I will put in a set of the glasses which the Board issue to their officers. Besides the standard green for electric light there are two shades of red and two shades of green for use in oil lamps, lenses or slides of these or of intermediate shades of red and green may be passed. But full details as to colour, size of wick, &c., are given in the Board's Instructions as to the Survey of Lights and Fog Signals, of which I will put in so much as is relevant. The documents and glasses I will hand in for the information of the Committee. (*Handing in the same: see Appendix A., No. 2.*)

10. Why are there two shades of red and two shades of green?—That is just the scale; they must not be darker than the one or lighter than the other. They are to show the extremes.

11. Is there any international agreement about the exact tint or shade of side lights?—No, not as to the exact tints. Of course it is done by international agreement. I fear that the Board of Trade have no complete information as to the requirements of foreign countries. But I believe that the question was investigated scientifically in Germany about 1893 and 1894; and regulations issued that the tint of the port side light should preferably be copper colour and that of the starboard light bright blue green, not yellowish or grass green.

12. Could we get more complete information as to that?—We could certainly endeavour to give you that if you wished it, or anything else that the Committee wish to have.

13. Now will you take us back to the ship at sea and tell us who is responsible for looking out for lights at night?—There will always be three persons on the deck of a ship of any size that is under way at night. First of all there is the look-out man, who will almost invariably be one of the able seamen; secondly, there is the officer of the watch; and thirdly there is the helmsman, whose main duty, of course, is not to look out but to steer. On some steamers the look-out will be up aloft in the crow's nest; but in ships

where there is no crow's nest he will be placed upon the fore-castle head in fair weather, and will stand on the bridge, generally on the opposite side to the officer of the watch, when it is too rough for him to go forward.

14. He is there to report anything that he sees, especially lights?—Yes, different ships have slightly different ways of reporting lights. On board some ships—especially, I believe men-of-war and liners—the look-out gives the colour of any light that he picks up. He will call "Red light on the port bow" or "Green light right ahead." But on some tramp steamers the look-out will generally report simply "Light on the starboard bow." "Two bright lights on the port bow." I should add that a white light is usually called a bright light at sea. He is reporting, of course, to the officer of the watch, whose place is near the helmsman; and it is the officer who is ultimately responsible for the correct reading of the light, whether the look-out reports its colour or not.

15. Then in anything like crowded waters the officer of the watch will be drawing constant inferences from the lights that he sees?—Yes, if he sees a ship's lights clearly, he can tell whether she is a steamer or a sailing ship, and he can judge, generally speaking, in what direction she is going. For example, if he sees a red light on his port bow, he will know that the ship which carries it is going in the opposite direction to his own, or in some other direction involving no danger of collision. I am trying to confine myself to the statement of a very simple case, and I hope that I am making the point clear.

16. Then it may, I take it, be a matter of doubt how far a colour-blind man is unable to distinguish the colour of a light at sea under certain conditions. But it is not a matter of doubt, I imagine, that if a man for any reason does mistake the colour of another vessel's lights, he becomes at once a source of danger?—In my opinion he does most certainly; it follows from his mistake that he will draw a false inference as to the course of the ship whose lights he is watching, and I need not, I think, point out how readily such a false inference may lead to disaster.

17. One of the difficulties we find from your evidence is that the Board of Trade do not appear, as a matter of fact, to have direct knowledge that any particular disaster at sea is traceable to such a mistake?—I do not think that they have, but I do not wish the Committee to infer that such disasters are not likely to have occurred. There are a certain number of ships that disappear inexplicably, and a certain number of collisions for which it is impossible to account. Such casualties are, of course, the happy hunting ground of the man with a fixed idea. One man, I mean, will attribute all the unexplained losses to the new load-line regulations; others will put everything down to mistakes in the reading of lights, to uncharted rocks, to derelicts, or what not. I find it hard to believe that defective vision may not have caused some of these disasters. There is also this consideration to be borne in mind, that whatever criticisms have been levelled against our tests, they have undoubtedly prevented many short-sighted and colour-defective persons from holding responsible posts in the mercantile marine.

18. Of course if no proof could be obtained in the old days of accidents having been caused by defective sight, it is even more hopeless for us to expect such proof now, when effective tests have been employed for some years in this country and probably in others?—I think that is quite an irresistible inference.

19. Have the Board of Trade ever received information of mistakes due to colour blindness having been noticed at sea, even though they led to no disaster?—I do not wish to suggest that such mistakes have often been reported to the Board. But perhaps I may call the Committee's attention to the evidence of Captain Heasley, given on page 47 of the Colour-Vision's Committee's Report, as to the mistake made by his second officer. I should also like to read you an extract from a letter addressed to the Board by the master of the barque "Peru" in 1894. "The time was about 11.30 p.m. and the weather was quite clear with a starry sky. One of the men on the look-out

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"reported a light on the port bow. I asked the mate 'What kind of light is it?' and he replied 'A red light, sir.' I went for my glasses, and on looking through them found the light to be a green one." I cried out, "That be damned. It's a green light." I gave orders to about ship, and this order was carried out, and as we passed on the starboard side of the steamer, I could easily have thrown a stone on to the deck of such steamer." I may add that the officer to which that complaint refers was tested by the Board of Trade on his return to England, and found to be colour-blind. An endorsement to that effect was made upon his certificate; and at a later date it was cancelled on the ground of his colour-blindness by the London Local Marine Board.

20. Of course other instances of that kind might easily have happened. What led the master of the "Peru" to write to you. Was it simply to give you information?—Yes, I think so. He probably thought it was dangerous and should be stopped.

21. Of course the same kind of thing might have happened and the master might not have written to you?—That is quite possible. I think in the majority of cases they probably would not do so. They would be afraid of doing their officer some injury, or something of that sort.

22. Shall we now go back to the institution of the sight tests? It would be useful to the Committee to have a little history of the tests before them from the beginning. Will you give us a brief account of the original test?—Yes. The original test was a colour-vision test only; there was no form-vision test until 1894. In January 1877 the Board of Trade issued a circular to the examiners of masters and mates, of which I hand in a copy (see Appendix A., No. 3). It directed that "all candidates for examination for 'masters' and mates' certificates should pass a test of examination as to their ability to distinguish the following colours, which enter largely into the combinations of signals by day or night used at sea, namely, black, white, red, green, yellow, and blue." Cards and glasses of those colours were sent to the examiners, who were directed to make sure that a candidate could distinguish each of them without mistake. But no special instructions were given at first as to how the cards and glasses should be used.

23. Was that examination limited to actual candidates for certificates?—Yes, originally: the Board of Trade have gradually spread their net wider. But I think I can give you a clearer idea of the matter if I first describe the evolution of the tests, and then turn back and show how the number of persons to undergo the test has increased. In 1885, a kerosene lamp and cards and glasses of an improved pattern were issued to examiners, with a circular giving instructions for their use. I will put in a copy of that circular (though it is printed on page 92 of the report of the Royal Society's Committee on Colour Vision). In this circular the luminosities and dominant wavelengths of the colours used in the test are inserted from the report. (See Appendix A., No. 4.) I will only add that a candidate was required by this test to prove his ability to name the various colours shown him. If he appeared to be uncertain as to names, he was required to match the coloured cards.

24. How long did that test continue in force?—It continued till 1894. But in the late eighties the question of colour-blindness attracted a good deal of attention, and when the Royal Society offered in 1890 to appoint a Committee to inquire into it, the Board of Trade were glad to accept their offer. A Committee was accordingly appointed in March 1890, with Lord Rayleigh as Chairman, and reported in April 1892. The Committee have, I believe, copies of that report before them.

25. That was the starting point of the present system of sight tests?—Yes, the present tests were modelled very closely on the Committee's recommendations. The regulations for them were framed, at the request of the Board of Trade, under the close personal supervision of Captain (now Sir William) Abney, who had been Secretary to the Committee. He also under-

took the instruction of the examiners in the tests; but I should propose to deal with the important question of the examiners later in my evidence, and to give you now an outline of the tests which came into force in September 1894, and are now held at 32 different places in the United Kingdom. These tests, as suggested in the fourth and fifth recommendations of the Committee (page 2 of their report), are three in number: a form-vision, a colour-vision, and a colour-ignorance test.

26. We do not, of course, want to cross-examine you upon the scientific details of the tests, but we should be glad if you would give us some description of each of them?—The form-vision test is based on Snellen's principles, as laid down in Appendix VI of the report (page 115). I will put in a copy of the regulations at present governing the sight tests, as well as examples of the Snellen sheets of letters used in the form-vision tests. The sheets marked I are an example of those in use from 1894 to November 1909. Those marked II came into use on the 1st November last, and are drawn to Snellen's prescription with greater accuracy, I understand, than their predecessors. (See Appendix A., Nos. 5 and 6.) A higher standard is in course of being introduced into the form-vision test, which is consequently at present in a transitional stage. The Colour-Vision Committee, in their fifth recommendation, said that it would generally be sufficient if half-normal vision in each eye were required of candidates. As a matter of fact, in the old form-vision test (which all candidates will be allowed to take up to 1st January 1914, and, thereafter, anyone who has gained a certificate before that date), a candidate is allowed to use both eyes at once, and is required to attain a standard which is, I am informed, practically half-normal vision. You will find that standard expressed in terms of the letters which a candidate is required to read at a distance of 16 feet from the sheets of letters in the regulations of which I have put in a copy. Between 1894 and 1909 sheets of black dots on a white ground were issued for testing men who could not read. But the test was not a very satisfactory one; it was very little used, and has now been abolished.

27. Under what circumstances did you decide that the standard should be raised above that suggested by Lord Rayleigh's Committee?—The question of sight tests came under discussion at the Colonial Merchant Shipping Conference, which met in London in the spring of 1907. Stress was then laid upon the additional tests which a New Zealand Shipping Company had found it desirable to impose upon their officers at regular intervals during their career, and a unanimous resolution was carried—"That the Board of Trade be urged to take into immediate consideration the question of eyesight tests with a view to effecting an improvement, if found necessary."

28. Is there a verbatim report of the discussion which led to that resolution?—Yes, it is all reported and published in a parliamentary blue book.

29. I mean to say were there grounds urged then, such as accidents which could be traced to defective vision, and matters of that sort?—I do not think any specific cases were given. I had to meet the resolution, and I rather took the line that our regulations were all right. But the New Zealanders seemed to be very much under the impression that they wanted levelling up.

30. (Mr. Norman Hill.) I was at that Conference and there really was no argument upon that. It was a compromise?—Yes, it was a compromise resolution.

(Mr. Norman Hill.) There was a great deal of compromising done at that Conference, and from the shipowners' point of view we were dealing with far more serious matters than these.

31. (Chairman.) It is rather important to know the circumstances under which the resolution was passed?—Yes. But I should like to say in reply to what Mr. Norman Hill has just said, that from my point of view nothing could be more important than this inquiry on which we are engaged. Of course, the whole basis of the interference of the Board of Trade with shipowners is that of safety. The Board realized

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that the increased speed of modern ships, though it had undoubtedly been accompanied by increasing aids to navigation, had made good eyesight of growing importance to officers in the merchant service. I think that is quite obvious. On November 1st, 1909, therefore they introduced, with the advice and assistance of Sir William Abney, a somewhat higher standard of form vision test, and any candidate at his option may now undergo the new test instead of the old one. I will refer again, if I may, to the regulations for the details of this higher standard, under which a candidate must have each eye tested separately, and must possess full normal vision in one, and not less than half normal vision in the other. I should add, that the Board of Trade calculated, from an analysis of the results of their tests during several months, that about ten per cent. of those who passed the old test would fail to pass the new one; but, as I have already mentioned, no hardship to existing interests will be involved, since anyone who holds a certificate before January 1st, 1914, will not be required to pass the more severe test in order to obtain a higher certificate. I think we act in a spirit of reasonableness and with a desire not to be hard on candidates who require to pass the form-vision test. That will become general in 1914.

32. Has this matter been a subject of complaint in any quarter?—No, I have heard of none.

33. (*Mr. Norman Hill.*) It will not come into operation till January 1914?—No, unless a candidate chooses to take it voluntarily.

34. (*Chairman.*) I suppose it is not generally known?—Yes, it is known. A great many of the candidates are now very sensibly taking the new tests.

35. Then do the Board of Trade, in their regulations, lay down absolutely that the form-vision test shall always be applied before either of the other tests?—Yes; that rule again is the outcome of the Colour Vision Committee's Report. They distinguished between two kinds of colour-blindness, congenital and acquired, the latter being due to injury, disease, or excessive smoking. The congenital type, they reported, was often accompanied by good form-vision, and could only be detected by a test with colours. It was also incurable. The acquired type they considered to be accompanied invariably by defective form-vision. If, therefore, the colour-vision test proper were always preceded by a satisfactory form-vision test, men suffering from acquired colour-blindness would always fail to pass the first test and would never reach the colour-vision test at all. There is this additional reason for the rule, that a man with acquired colour-blindness can often detect the colour of objects of the size, for example, of a skein of wool, "particularly," as the Committee said, "when the diseased area is confined to a small central spot in the retina" (page 22). It is, therefore, important not to depend upon the wool test to detect colour-blindness of this kind.

36. Are you quoting from Lord Rayleigh's report?—Yes, the report of the Royal Society, page 22.

37. There is a reference there to a pellet test devised by Sir William Abney. Do you use that?—Yes. The Board of Trade provided their examiners with sets of pellets in May 1895. I will hand in a set of these pellets and a copy of the circular explaining the test, which the Board issued in that year (*handing in the same*). The pellet test has since then been applied, for purposes of diagnosis, to all those who fail in the form-vision test. Its principle is exactly that of the wool test, which I will describe presently, and failure to pass it implies that the defective form sense is due to disease or accident. Candidates who cannot pass this test are failed at once by the local examiner; there is no reference to the Principal Examiner of Masters and Mates in London, as there is in the case of those who fail with the Snellen sheets only.

38. Is there any appeal?—There is no appeal.

39. Can a candidate who has failed in form-vision never appeal against his failure?—Not in ordinary cases; he is allowed, you see, to be re-examined at intervals of three months, and the fee for entering for the sight tests is only one shilling. As a matter of fact, the Board have allowed two certificated officers,

who had failed in form-vision, to be specially examined in London. But they only allow such an appeal in doubtful cases, where a candidate's certificate may be at stake. But, you see, he can go up and try the same test again and again.

40. Now I think we may pass on to the colour-vision test. There has been a great deal of controversy about that test, I believe?—Yes. The colour-vision test, introduced in 1894, in accordance with the fourth recommendation of the Royal Society's Committee, was a wool test based on Professor Holmgren's principles; in fact, the original sets of wools issued to examiners were obtained from Professor Holmgren himself in Upsala. That wool test, with slight modifications, which I will presently point out, is the colour-vision test still in force. Elaborate instructions for its conduct are given in the Regulations I have handed in, and I think that I cannot do better than hand in also a specimen set of the wools as they are at present issued by the Board of Trade to their examiners (*handing in the same*). It is a complete set.

41. I suppose those are exactly the same as we shall see in a fortnight's time when we are going to pay a visit to the Imperial College for the purpose?—Yes. In its original form, the test was conducted with three "test skeins," light green, pink (some people call it magenta), and red. In addition to these three skeins, 133 small skeins of various selected shades were laid out on a white cloth, the candidate was shown each of the test skeins in turn, and was asked to pick out and place beside it any skeins of the same colour as the test skeins, though they might be lighter or darker. In order that a candidate might not fail through misunderstanding what was expected of him, the examiner was instructed to go through the test himself before the candidate, if necessary, or to let him watch other candidates being put through it.

42. Has there been some slight modification in the testing since 1894?—Yes. There has not been any fundamental alteration in it, but last autumn two new test skeins were added on Sir William Abney's suggestion—purple and yellow. This addition was not made with any idea of raising the standard of colour-vision to be required from candidates, but was simply designed to provide a more emphatic demonstration of colour-blindness where it existed.

43. I suppose that did not make the test any harder on the candidate?—No.

44. It was only an additional proof?—Yes. At the same time several alterations were made in the rules for the conduct of the test when the regulations which I have handed in were issued in October last. As they were designed to bring the test more into accord with the spirit of Holmgren's instructions, I think it would hardly be fair to describe these latter alterations as modifications of the Holmgren wool test. Under the old regulations, a candidate was given an opportunity at the end of the test of putting back into the heap of wools any skeins that he thought upon reconsideration he had chosen wrongly. That privilege, which may easily have led to the passing of a colour-blind candidate, has under the new regulations been withdrawn. Further, the examiner is required now to make a note of any incorrect skeins which the candidate "seriously handles" or compares with a test skein. I mean if he takes it up or half puts it down, or something of that sort, the examiner will make a note of it. I may perhaps refer to the remark upon page 21 of the Colour-Vision Committee's Report—"there is but a little doubt that almost as much information is conveyed to the examiner by the way in which the different skeins are picked up to match the test skeins as by the absolute matching itself."

45. I gather that you attach some importance to these alterations in the instructions for the wool test?—Yes. While we do not wish to exaggerate it, I think that the value of the wool test depends so much on the way in which it is applied, that these reforms, if apparently trivial, were really not unimportant. I should add that Captain Harvey, the Principal Examiner of Masters and Mates, went round the great majority of the examination ports in the course of last summer and autumn, and he then took the opportunity

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of supervising the examiners personally while they were conducting the test, and impressing upon them that it must not be allowed to degenerate into a mechanical operation.

46. We are thinking of seeing Captain Harvey. Do you think it would be useful for us to call him?—Yes, I think he will be able to give you very valuable evidence.

47. Do you think that the examiner must not be content because the candidate has achieved a certain number of matches?—Yes. I feel it a little difficult to define the proper attitude of an examiner, but perhaps I can express my meaning by saying that he must get into touch with the candidate. However, that is only one side of the question, and I will return to the point when we are going more specifically into the question of the examiners.

48. Is it your general view that it has made the whole thing a more certain means of detecting colour-blindness?—I think there is evidence of that, though I do not wish to more than suggest the point for the consideration of the Committee. The Board of Trade are anxious to secure a thorough investigation. There is another point I ought to mention. Since June 1909 an unusual number of candidates have failed in the colour-vision test who had passed it on a previous occasion.

49. Does that mean an appeal?—No, they were candidates who had passed the test, for example, when they came up for their first certificate; but failed to pass on entering for a higher certificate. There were, as a matter of fact, 13 such failures in the 12 months ending May 31st of this year.

50. Is that an unusual number?—Yes, that is an unusual number. That is a fact which from one point of view I deplore, but I think it may also mean that the tests have come to work more exactly. It is only fair to the Board's examiners to add that six of the 13 were originally passed by one examiner, who has since been specially tested and carefully instructed again as to the proper way of conducting the test. I think it might interest you to see two specimen reports I have here of recent failures. They are most interesting and most graphic in the way they are set out (*handing in the same*).

51. Will you describe the conditions under which appeal is allowed against failure in colour-vision?—A candidate who fails in the wool test is debarred by the Board's regulations from undergoing the test again, but he may appeal against his failure, and in practice the Board always allow him to be examined on appeal. He is then tested by Sir William Abney or by Dr. Watson with the help of the Principal Examiner of Masters and Mates or his deputy.

52. Are they always present?—Yes. The Colour-Vision Committee advised (page 19), "In cases of appeal the examinations should take a wider range. The test with the spectroscopic is decisive." I will leave it to Sir William Abney to describe the spectroscopic test he applies to candidates who appeal, and will only say that the Board's nautical advisers agree that it is a very realistic one. There is a note upon it in Appendix V. to the 1892 Report, page 113. Candidates who pass this test have their expenses paid at a stated rate, but candidates who fail on appeal pay their own in ordinary cases.

53. Do you think that the question of expense deters candidates from appealing who might ultimately have passed if their defect had been more accurately defined by the spectroscopic test?—I think it possible it may have deterred them in the past; and therefore, since June 1909, the Board have allowed their Principal Examiner to offer a candidate, whose case appears to be doubtful, an appeal and to pay him his expenses. The same method is now also adopted in the case of certificate holders who fail in the test, and occasionally in the case of candidates whose poverty might debar them from coming to London and taking the risk of having to pay their own expenses.

54. On the whole you do not think people are debarred from appealing by expense?—I think they are not debarred on the whole.

55. Do you think they have a clear idea of their own interests?—Yes, I think so. We give every consideration to exceptional cases.

56. Is there only one centre for appeal?—That is so. The Colour-Vision Committee evidently anticipated very few appeals. When the Board were considering the adoption of their proposals, they wrote to the Committee suggesting that there should be an expert—or rather that there might be an expert—at each examination port charged with testing on appeal, and they asked whether the Committee considered that the doctors already recognised by the Board of Trade at these ports for other purposes would be suitable. The Committee replied that the cases of appeal would probably be very few, and suggested that, at any rate at first, only one or at most two such experts should be appointed. The Board therefore asked Sir William Abney to test candidates on appeal, and this, with the permission of the Science and Art Department, he consented to do. I should perhaps add that this assistance was given by him quite gratuitously while he continued in the public service. I can only say that the Board of Trade have set too high a value upon his unique knowledge of the subject and his special apparatus to wish to transfer any of the appeals away from London.

57. And the Board of Trade have still no wish to do anything except to bring them up to one single centre?—No: unless this Committee comes to a different conclusion.

58. But you say the number of candidates failing has been increasing of late years?—Yes. I will put in statistics to show the results of the Board's examinations (*see Appendix A., No. 7*). One criticism brought against them is that a considerable number of candidates are successful in their appeal; but that criticism loses sight of the fact that Sir William Abney is able in some cases to define, as of a harmless kind, a defect which the wool test has discovered, and that men whose cases appear doubtful are sometimes failed locally and sent up to him for final decision. It also makes no allowance for the fact that an occasional candidate seems to fail in the wool test through sheer nervousness, or perhaps through temporary indisposition. Some such causes at least appear to underlie the failure of a small number of candidates with, it may be, practically normal colour-vision to pass the local test; but I do not wish to suggest that these cases are other than rare. Their number is a very small proportion indeed of the total number examined.

59. When you say "the wool test," do you mean he might fail in the local test and might succeed in the spectroscopic test?—Yes.

60. Which you look upon as being the most fair?—Yes, the most certain.

61. (*Dr. Watson.*) I think it is rather this, that the examiners are not allowed to exercise any judgment. Any mistake has to be fatal. I mean they are not allowed to trust to their own opinion as to whether this example is a bad one or not. Any mistake has to be registered and the man is failed? (*Witness.*) I should like to add a word or two to that. It is very important that the tests laid down by the Board of Trade should be uniform throughout the country, and that we should not have different minds exercising different discretions in different ports. It would be certain to lead to the absolute failure of any system if we had the same person being passed in Leith and failing in London. Whatever tests we have, it is obvious they must be uniform and they must be laid down definitely, and the examiners then will do exactly as they are told.

62. (*Chairman.*) But already you have found a difficulty in getting all the examiners to act in the same way?—We are so impressed with the necessity of having absolute uniformity that we take every possible precaution we can. Whenever we see there is necessity we make inquiries. But I cannot too much emphasize the importance of uniformity of practice. Otherwise the Board of Trade would be blamed all round.

63. Can you tell us what these examinations on appeal cost the Board in a year?—I find that in 1908 they cost about 62l., while in 1909, when the number



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of appeals increased, they cost the Board about 1417. These figures are obtained by adding the fees paid to the special examiners to the expenses refunded to some of the candidates who appealed.

64. Then I think we are left with the colour-ignorance test. We need not spend very much time on that?—No. In practice no candidate has ever failed to pass it. It consists in the naming of a few of the more obvious colours—red, green, and so on—and it would of course prevent a foreigner, who did not know their names, from passing the sight tests. Staff-Surgeon Preston, R.N., told the Committee of the Royal Society (p. 60) that he had also found boys of the agricultural labourer's class to be colour-ignorant sometimes; but the Board of Trade have had no difficulty in this respect.

65. We are asked to determine what degree of colour blindness renders an officer incompetent to perform his duties. I gather from your evidence that the local wool test will detect colour-blindness of varying degrees, but that the Board do not attempt to judge from a candidate's mistakes with the wools the degree of the colour-blindness from which he suffers?—No, I do not think that they could do so except approximately. I must speak very cautiously here, for I feel that I am on the borderland of the more strictly scientific field. But I think our experience makes it evident that a candidate who is seriously colour-blind may be coached to make fewer mistakes with the wools than one who is less colour-blind but is perhaps unconscious of his defect.

66. I note what you say about the spectroscopic test and I gather that by the more elaborate test you would be more likely to ascertain the true defect. Is that your view?—Yes, quite.

67. I gather it may happen that a candidate is failed by the wool-test, and if he were examined by the more elaborate test he would be passed on the ground that his defect was not of a kind or not of a degree to render him dangerous at sea?—It is possible; but of course every candidate who fails may appeal if he wishes; and when he does so the question of degree at once arises. The Board have never issued any explicit instructions as to the degree of colour-blindness which they consider dangerous; but in practice they have followed in general the advice of the Royal Society's Committee in deciding whether a candidate should be passed or failed on appeal. I will read, with your permission, an extract from page 13 of their Report:—“Incomplete colour-blindness is less likely to lead to accident than that which is complete; but any colour-blindness in which there is approximately a neutral or grey point in the spectrum should be regarded with great suspicion. On the other hand, there are many people who have a slightly shortened spectrum, who are yet able to distinguish all colours and see no neutral point, these cannot be considered to be practically colour-blind.” When a candidate is examined on appeal, Sir William Abney or Dr. Watson reports upon the degree of his defect, if he has one, and the Board, with that standard in their mind, and advised by their principal examiner, decide whether he should be passed or not.

68. Is it a difficult matter sometimes to decide that particular question on the report?—Yes; but in ordinary cases the report of the special examination is generally fairly definite.

69. May we see copies of the reports that you have received?—Yes, certainly; and of course I will arrange for you to see anything else that you wish.

70. Will you tell us who in practice come to have their sight tested by the Board of Trade?—Well, candidates fall into two classes; some undergo the tests as a necessary part of their examination for a certificate of competency; others come up voluntarily, at least so far as the Board are concerned. What I mean by that is that some insist on their apprentices being passed. But that is entirely voluntary on their part. When the tests started in 1877 the only persons examined at all were the candidates for masters' and mates' certificates, and they were obliged to be tested whenever they came up for a certificate. In March 1880 the tests were thrown open to “any person serving

or about to serve in the Mercantile Marine,” the idea being, of course, to give everyone a chance of finding out whether his colour-vision fitted him for a sea career.

71. Taking only those who are compelled to be tested, has the requirement been extended since 1877?—It has been extended in rather an important matter. In 1880 at Grimsby, skippers and second hands of trawlers were first examined for certificates, and they were subjected to the colour-vision test when they came up for examination. In 1883 certificates were first required to be held by skippers of trawlers of a certain size, and in 1887 this requirement was extended to second hands. Fishermen continued to undergo the colour-vision test with cards and glasses until November 1900, when the new tests were first applied to them. At the present moment the Board have just brought into force the requirement that certificated men shall be carried on other fishing boats, namely, “liners” and “drifters”; and the result has been that large numbers of fishermen have been coming up this year for the certificate examination, and therefore for the tests.

72. Would that mean more than one person on each boat?—Yes, it would mean the skippers and second hands.

73. In every case?—Yes.

74. Is that relatively a new regulation?—Yes, it is quite recent.

75. Then the compulsory test has not been extended to additional classes of men in the Merchant Service apart from fishing vessels?—Only to this extent, that from time to time the Colonies have started their own examinations for certificates of competency, and in some cases have laid down their own requirements as to the certificated officers which a British ship shall carry on leaving a port within their jurisdiction. By Order in Council, under section 102 of the Merchant Shipping Act, 1894, the Board of Trade recognise such certificates as equal to those granted in the United Kingdom, but only on condition that the examination for them is substantially the same as our own. A reform, therefore, of the sight tests in the United Kingdom would generally imply a similar reform in the tests applied by the 14 colonial authorities who now grant certificates that are valid in Great Britain or in any British Possession; in fact, we accept theirs and they accept ours, supposing the requirements are reasonably approximate.

76. Have you reason to know that their methods are similar?—Yes. We do not agree until we are sure that their methods are fairly approximate to our own.

77. Have you any means of testing their methods?—We see their regulations before we agree, and if they are reasonably approximate we accept them. We do also on occasion make inquiry as to the way in which they are put in force.

78. How far is a British merchantman required to carry certificated officers?—Every British foreign-going ship and every home trade passenger ship is compelled to carry a certificated master when she goes to sea from any port in the United Kingdom, and there are similar requirements, which I need not enter into in detail, with regard to certificated mates. Many steamship companies, however, go considerably beyond the bare legal requirements in this respect. An ordinary vessel in the home or coasting trade however is not required to carry a certificated master or a certificated mate or any certificated officer at all unless it carries passengers.

79. Is that a matter which is considered at all with a view to the future? Is there likely to be any change in that respect?—The Board of Trade have promised to consider the question of introducing legislation requiring those vessels to carry certificated officers.

80. Is that not rather a big question?—Yes, and there may be considerable opposition to it.

81. Now we come to the question of the candidates who come up voluntarily for the tests. Will you give us some idea of their numbers?—The throwing open of the tests in 1880 had not at first very much effect. In December 1884 the Board of Trade issued a circular to pilotage authorities suggesting that if they had no colour-vision tests they should send their men to be tested by the Board's examiners. But seamen in

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general did not avail themselves of the tests. The chief of the Marine Department, reporting in 1885 said, “While it is not desirable to make the colour test more elaborate than at present, it is certainly desirable to apply it more generally. . . . I have never heard that a shipowner or even a master of a ship applies the colour test to men employed as A.B.s.”

82. Has that indifference continued?—No, I am glad to say it has not. There has been considerable improvement in the matter. In October 1885 the Board instructed their superintendents to distribute circulars on the subject to young men starting on a sea career and to parents and others intending to apprentice boys. At the same time they sent round a circular letter to the authorities of training ships. The result was that the numbers of those voluntarily tested rose from 110 in the year ending in May 1885 to 294, 415, and 837 respectively in the following years.

83. Does that mean in the years immediately following?—Yes.

84. Then that does not give us anything more recent?—It simply shows, I think, that the supply of candidates ready to undergo the test is an elastic one.

85. Have the shipowners helped by compelling their crews to be tested?—Yes; I think the feeling is increasing. The Orient Line in January 1888 compelled all deck hands engaging in their vessels to pass the colour test, and their example has been followed by most of the large lines. I have no complete return of the companies who send their employés to be tested, but I find, for example, that the Union Castle Line send all their officers and deck hands to have their sight tested by us once a year. The Cunard, the White Star, and the Moss Lines send their officers and look-out men to undergo a periodical test. The P. and O., I believe, test their officers themselves, but both they and the British India Line send their quartermasters to us regularly. I am not attempting to give you a complete list, but only to show you that there is a tendency for owners to go beyond the letter of the law.

86. Do you suppose we could get more information if we asked for a circular as to how many companies do it?—There can be no difficulty in doing that.

87. Then are apprentices examined when first they go to sea?—Not always, but a great many lines now refuse to allow an apprentice to sign indentures unless he holds a certificate that he has passed the Board of Trade sight tests.

88. Now we should be glad to hear about the examiners who are entrusted with the conduct of the tests?—The Colour Vision Committee of 1894 laid considerable stress on the question of the examiners. The experience of the Board of Trade fully endorses their conclusion as to its importance, and I propose with your permission to go into the question in some detail. The actual recommendation of the Committee was simply “that the testing should be entrusted to ‘examiners certificated by the central authority.’” But in the body of their report they said (page 22), “Testing such as we have recommended requires careful training, and is not to be learnt except by practice, for it requires not only a registration of absolute mistakes, but also a ready observation of the manner in which the candidate acts whilst under examination. The Committee would not insist upon the examiner being a medical practitioner, but it is probable that a medical training would be of advantage.”

89. Have the Board of Trade, as a matter of fact, required any medical knowledge from their examiners?—No. The history of the matter is this: In 1892, when they were considering the Committee's report, the Board wrote to the Royal Society and asked if the Committee would help them to ascertain whether their existing examiners were qualified to conduct the new tests. The Committee in reply suggested that classes for the examiners should be held in London, and that at the end of them the instructor should report upon their individual fitness to conduct the tests. Sir William Abney held those classes in

November 1893, and as a result of them three examiners were declared unfit to conduct the new tests.

90. Will you tell us exactly who conduct the local tests?—There are 32 local examination centres in the United Kingdom, and there are in all 50 examiners authorised to conduct the tests when required. The authority is not given them till they have been tested by Sir William Abney or Dr. Watson at South Kensington, and have satisfied the principal examiner of their ability to conduct the test. At the present moment there are 17 examiners of masters and mates, 9 nautical surveyors, and 24 superintendents and deputy superintendents who hold that authority.

91. Are all those men engaged in examining individually?—Yes.

92. Then what sort of men are there in each of those classes?—The examiners of masters and mates are officers who have served as masters of foreign-going merchant ships, and their present salaries vary from 200l. to 400l. per annum.

93. Are those their ordinary salaries in the execution of their ordinary duties?—Yes, in the execution of their duties as examiners of masters and mates, conducting the whole of the examination for a certificate. That is to say, they examine in every subject. They are appointed by the Local Marine Boards at the various ports subject to a qualifying technical examination held by the Board of Trade. But after appointment they are required to adhere strictly to any rules that the Board may make for the conduct of the examinations: so that although the patronage is with the Local Marine Boards, they are absolutely under the control of the Board of Trade. Then the next class are much the same. The nautical surveyors are drawn from the same class and are on salaries varying from 200l. to 420l. per annum. The Local Marine Boards have nothing to do with their selection. They are appointed after a competitive technical examination held by the Board of Trade, and a literary examination conducted by the Civil Service Commissioners.

94. In that competitive examination is there something about colour-vision?—No; nothing at all. Every examiner who is employed in colour testing has to pass at South Kensington and to satisfy our own chief examiner.

95. Is that done after his appointment?—No; it is a condition of his appointment. Those two classes account for about half the examiners between them. In addition to these are the superintendents and deputy superintendents, who are clerical officials in mercantile marine offices. The superintendents and deputy superintendents perform the duty of engaging and discharging crews. Every crew has to be engaged before they are discharged before them, and they have very difficult duties indeed to perform. Their present salaries vary from 114l. to 440l. a year. Nine of the examiners in this class are, however, officers of the Customs, who also transact the local business of the Board of Trade. These nine are almost solely examiners of fishermen; their salaries are not paid by the Board of Trade, but I understand that their present salaries vary from 105l. to 500l. a year.

96. Whom are they paid by?—They are paid by the Customs. They do this work for us. They all have to pass an examination to show they are qualified before they are entrusted with this work.

97. Then have they been put in places where you have not got anyone?—That is precisely the position.

98. I believe it has been suggested sometimes that medical men should conduct the Board's sight tests?—Yes, that suggestion has frequently been made, and no doubt it is a question on which the Committee will express an opinion. At the same time there are one or two points upon which I should like to touch. The present tests are based on scientific principles, but I believe I am right in saying they do not require special scientific knowledge in those who conduct them. The colour-vision test is the less mechanical of the two, but it requires of an examiner careful and uniform compliance with the rules laid down for his guidance, together with sympathy and observation, rather than medical knowledge. It is most important to maintain a uniform standard everywhere. And I consider that



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it might be very difficult to enforce this with examiners who would never be at all directly under the control of the Board of Trade. I think that in passing I should mention to the Committee that candidates who have been shown beyond doubt by the spectroscopic test to be colour blind, have on more than one occasion obtained from an oculist a certificate that their colour-vision was normal. Lastly—I do not want to exaggerate this point—there is of course the question of expense. The Board of Trade regard it as important that the fee for the tests should be nominal, so that no one should be deterred on grounds of expense from finding out whether his eyesight qualifies him for a sea career. I do not attach much importance to that question of expense.

99. Now I understand that completes all the main points of your evidence in chief?—Yes; but may I in conclusion state quite briefly the Board's present situation? They are challenged to bring proof of what they had always regarded as an axiom, that defective vision is dangerous at sea; and they realise that, even if that danger can be fully proved, it is yet important to define more exactly what I may perhaps describe as the "danger-point"—particularly of colour-blindness. It is now nearly 16 years since the present tests were instituted on the advice of a Committee of the Royal Society to which my department is under the greatest obligations. The Board of Trade believe that undue emphasis has been laid on the few cases in which there may have been a temporary failure in the tests or in their application, and that too little account has been taken of the great amount of quiet and efficient work performed by their examiners in the testing of some five or six thousand candidates each year. But they also realise that every instance in which the tests are not consistent involves a real hardship upon an individual, and they have, therefore, asked the Committee to advise them, not merely as to the practical dangers of colour-blindness and defective form-vision, but also as to any improvements that the experience of the last 16 years may have made desirable in a system of tests that does not aim at registering minute defects of vision, but is rather designed to prevent incompetent persons from holding responsible positions at sea. I should like to add that the resources of my Department are, of course, at the disposal of the Committee for the purpose of their inquiry, and that I shall be only too glad to instruct any of the Board's officers to attend as witnesses or to assist in any other way that the Committee may think desirable.

100. (Lord Rayleigh.) On the question of policy I should like to know what the feeling of the Board of Trade is, whether they think it more important to exclude anyone who might become a source of danger, or, on the other hand, to avoid the hardship to the individual that might occur supposing too stringent a test was applied. It must, I suppose, in the end be a question of balancing those two considerations. Perhaps you could tell us to which side of the alternative the Board of Trade attach the greatest importance?—I should say the key-note of the Board of Trade's action in every matter of this kind is safety, even if their action involves hardship upon an individual. That requirement being satisfied, they should consider the interests of the individual in every way that lies in their power.

101. There was one point that came up in conversation before you entered the room as to the recommendation of the Committee that sat 20 years ago. I think they suggested that in cases of inquiry into accidents which might possibly be attributed to colour blindness, the lookout men concerned should subsequently be tested or re-tested. Can you tell us whether that has ever been done?—So far as I know that has never been carried out in wreck inquiry cases, and I do not know of any case in which it appeared to be necessary for it to be done. That is what the solicitor to the Board of Trade tells me. I do not remember a single case of a formal investigation into a shipping casualty in which there has been any question of the colour test raised at all.

102. But there might be a question, even if it were not raised at the inquiry?—Yes.

103. Would you not agree that it might be desirable in certain cases to make sure that the lookout men were not in fact colour-blind?—I think it is of the utmost importance. I think if there was the smallest question of that kind it should be probed to the bottom.

104. (Chairman.) The suggestion was made by Lord Rayleigh's Committee, was it not?—Yes. It is in their Report. I have no doubt that has been done if the Court has thought it necessary. But I do not remember a case where they have thought it necessary. There may have been cases in the Admiralty Court in which the Court may have thought it necessary to be done, but I do not know of any.

105. Have the Board of Trade got the power?—Yes. The Board of Trade can put any form of question they choose. I may explain that in every case of inquiry there is an elaborate brief drawn up, and this ends with a series of categorical questions. If the smallest question arose it would be included in the questions by our solicitor. The brief is drawn up by the Solicitor's Department, and submitted to the nautical officers for criticism. Therefore, I am quite sure if there was any question raised as to the colour vision of any officers concerned, it would be put in a question. I do not remember any case occurring.

106. (Mr. Norman Hill.) That is a casualty inquiry. I think Lord Rayleigh had in his mind an action in the Admiralty Court?—I have replied to Lord Rayleigh in regard to that. I am only speaking definitely about casualty inquiries. I said in reply to Lord Rayleigh that I thought it possible those inquiries might have been made in the case of actions in the Admiralty Court.

107. (Lord Rayleigh.) I should have thought it might be desirable that when the men were together there for the purposes of giving evidence they should, almost as a matter of course, be re-tested?—That would undoubtedly be done if there were any question of confusion at all. I do not remember the point ever being raised in one of the Board of Trade casualty cases. It may have been raised in Admiralty cases.

108. (Lord Rayleigh.) I thought in half the number of cases it was a question of what lights were seen?

[(Captain Golding.) I may explain to Lord Rayleigh that it is not a case of a single witness in one of these actions. There will probably be four or five on one side and the same number on the other, and they will give directly opposite evidence. It is a question of swearing more than anything else. It is often dependent not on actual perjury on the part of the witnesses, but that the casualty has occurred some time before and they have actually forgotten the circumstances. Then these men are not well educated, and it would be suggested by counsel that they have seen so-and-so, and they actually believe they have done so. I do not believe it is perjury at all.] (Witness.) I wish to be quite clear, that in the Board of Trade inquiries I do not remember a single instance of that kind having occurred where there has been some confusion of the colour of lights. If that had been the case I am quite sure we should have framed one of the specific questions with a view to deciding whether any of the officers' colour-vision was defective.

109. (Mr. Nettleship.) I suppose we should be right in concluding that the very small percentage of people who fail, as is shown in this table, was due to a large number having eliminated themselves beforehand?—I think that is quite clear.

110. So that even if it should turn out that no cases of accident could be proved to have been caused by colour-blindness, if persons with defective vision had been prevented from becoming officers, it might be true that a certain number had been prevented?—Yes. I should like to say that many persons are deterred by their defective vision from entering for a certificate.

111. (Professor Gotch.) In these colour glasses, white and red, and dark green for electric sidelights, what latitude is allowed for selecting a shade between the light and the dark? Does the Board of Trade determine the shade, or do the different ships do it? Can they take anything they like?—I have in my hand

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the two shades, and anything that comes in between those two shades is passed.

112. Can any ship take the light red if it likes?—Yes, any colour between those two.

113. There is a very great difference between the colour that comes through the dark and the light?—Yes, and it is the same with the green. There are special glasses for electric light.

114. I could not realise from your description what latitude was allowed in a ship. You say that latitude is allowed—the latitude between those colours?—Yes, and in the case of oil lamps, lenses or slides of any intermediate tint may be used.

115. I understood that the whole responsibility of deciding the colour rested with the officer of the watch?—I believe so. That is rather a seamen's question, but that is what I understand. Of course, the look-out man ought to be able to report correctly, and he would probably be soon found out by the officer of the watch if he did not. But the officer of the watch is the responsible officer.

116. Then would it not be more important, in your opinion, for the officers to be subjected to a stringent test rather than for the look-outs?—Yes. We have no power to enforce it upon the look-out men, who may be able seamen or ordinary seamen. But we have power to enforce it on the officers. All officers who take certificates are required to pass the test.

117. (Professor Starling.) I take it that no fault of vision will be allowed that requires the use of spectacles. Would any fault of vision be allowed which requires the use of spectacles, which can be completely corrected by spectacles?—I had better quote the actual instruction on that point. "Candidates . . . must not be allowed to use spectacles or glasses of any kind."

118. (Captain Golding.) Would the coloured lights of all vessels have to conform to the Board of Trade standards, or only those vessels applying for passenger certificates?—Every vessel must do so, home trade and foreign-going ships alike.

119. Then it is not a question only of passenger ships?—No. Every vessel has to have lights in accordance with the Board of Trade regulations.

(Captain Golding.) I should like to answer a question for Sir Walter which Professor Gotch put. There is very little reporting done by word of mouth now. It is nearly all done by signal, either by striking bells or by signalling from the crow's nest, or it is done by telegraph. In big, high-speed vessels, it would be impossible to do it by word of mouth.

(Chairman.) Are you speaking with regard to all the larger vessels, or are you referring even to small vessels?

(Captain Golding.) It is mostly the case with even small vessels now, and particularly so with steamers.

(The Witness.) The means by which the signal is made does not alter my argument at all.

120. But he would say he saw a light in such a position, and would not state the colour of it?—That may be so.

121. (Mr. Norman Hill.) With regard to the use of glasses, is that a subject of substantial complaint amongst the older men, the men who are getting on in years a little bit?—Sometimes I have heard complaints made about that. A man will say, "I can see perfectly with my glasses, and yet I am not allowed to go to sea." The answer I have heard made by our officers is, "You may lose your glasses, or the glasses may be obscured by mist or water."

122. But have there been cases in which men who have passed all the examinations and have got their certificates have been thrown out because they have been getting a little on in years?—There would have to be a rather cumbersome procedure to get rid of them. A master has his official certificate and the Board of Trade cannot themselves take it away from him. We have to prove to a court that his defect makes him incompetent to perform his duties, and that is not a very satisfactory method of procedure. We have, for instance, to send men before a Local Marine Board, and possibly not one single member is competent to deal with the question. We had one man whose sight was in question, and the Local Marine Board proceeded

to show him pieces of wool and ask him the colours, and then came to a conclusion on that. In other cases Local Marine Boards seem to have gone on the line of testing the weight of evidence. Those decisions were far more satisfactory. Then there is another alternative, the one that was adopted in the well-known Trattles case, in which a "person" was appointed to inquire into the matter.

123. (Chairman.) Was he appointed as a court?—Yes. These are the only ways in which the Board of Trade can deal with their own certificates. However bad a case may be they can only deal with it if there is a judgment of some court against the man or something in the law equivalent to a crime.

124. I think it is rather important that we should have a short memorandum on that?—I shall be pleased to have one prepared for you. (See Appendix A., No. 8.)

125. (Lord Rayleigh.) Can the Board of Trade set up a court for the purpose?—Yes, consisting of a "person" with a legal assessor.

126. (Mr. Norman Hill.) Or you can order a Local Marine Board Inquiry?—Yes, as I have already told you. I am very glad this question has been raised. It is one of the utmost importance, and we should be glad to know what the Committee think of such an arrangement. I want to guard myself at this stage against expressing an opinion in regard to a matter which is, so to speak, *sub judice*.

127. I have been told—I know absolutely nothing of it in my own knowledge—that your officers, if they saw a master on board in dock wearing glasses, would very frequently require him to submit himself again for examination?—We could not do it. We have no power whatever to do anything of the sort. Do you mean an officer of any kind, or only a master?

128. I mean a master?—We have no power whatever to do it, and any officer attempting to do it is exceeding his duty.

129. You can do nothing to a man who holds a certificate until you have proved to the Court that he is not competent to hold the certificate?—That is exactly the case. Let me make it quite clear. Take a second mate; he will be tested when he comes up again for a higher certificate.

130. Quite, but take a man who has got his certificate?—We have no power over him unless we have reason to believe that he is incompetent, and then we have to send him before a court of some kind.

131. Then you told us that the form-vision tests are to be strengthened as from January 1914, and strengthened to the point that you think the new test will throw out 10 per cent. of the men who now pass?—That is our present advice.

132. And, apart from the resolution of the Colonial Conference, the only reason is the increased speed in vessels?—That is one of the reasons, and I think that was concurred in by all our technical advisers.

133. And although the speed of vessels has greatly increased, the power of manoeuvring has equally increased, has it not?—The power of manoeuvring has undoubtedly increased, but vessels also approach each other much more rapidly.

134. And you get out of one another's way much more rapidly?—No doubt, but it is obvious nevertheless that there is still room for collisions between vessels travelling at a great speed.

135. (Captain Golding.) In order to revoke the certificate of a man who is blind, you would have to employ the same machinery as to revoke the certificate for a misdemeanour?—Yes. I ought to add one thing. If a man has been convicted of any criminal offence or any offence before a court we can revoke his certificate. We can only do it as the outcome of the decision of a court. We are continually doing that. If a man is committed to prison for five years or something of that sort, we generally suspend his certificate.

136. (Mr. Norman Hill.) There is just one point I should like to put in order to clear up a possible ambiguity. Your Board has nothing to do with the ordinary collision action which is tried in the Admiralty Court?—No, nothing whatever

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[Continued.]

137. But you know that the money questions involved in these actions are very large?—Yes, I should say they are enormous.

138. And the parties would be directly interested, the one side in alleging that the look-out man or the officer of the watch on the other side had defective colour-vision?—In certain circumstances I should think it would be of the utmost importance.

139. So there is a very strong reason for raising that point if the collision can be attributed to such a defect?—There is no doubt about that.

140. (Mr. Raymond Beck.) Has the Board of Trade been in the habit of getting frequent complaints protesting against the unfairness of either the system or methods employed by the examiners?—No, I think I may say not. There are occasional complaints. But I think I tried to indicate our position to the Committee in one of my answers. I think there has been an immense amount of very successful work done, and that the number of unsatisfactory cases are very few. But

I still recognise these few cases may cause real hardship to individuals; my first idea is to secure the safety of life and property at sea, but with as little hardship to individuals as possible.

141. I think you also told us there were very few appeals?—I will put in statistics showing the exact number.

142. May we take it there were very few appeals?—There have not been a very great many.

143. I wanted to know whether you would think it would be a fair inference from that, that the great percentage of the candidates who have been thrown out are more or less themselves convinced, and that it may be inferred that they themselves are satisfied that the test was a satisfactory one, and that they were colour-blind?—Yes. I think I ought to point out that we absolutely encourage appeals. Whenever our examiners have the slightest doubt we are anxious that the men should have every opportunity for appeal.

The witness withdrew.

Adjourned till Friday, July 22nd, at 3 p.m.

## SECOND DAY.

Friday, 22nd July 1910.

### PRESENT :

The Right Hon. A. H. D. ACLAND (Chairman).

The Lord RAYLEIGH, O.M., F.R.S.  
Sir ARTHUR RÜCKER, F.R.S.  
Mr. RAYMOND BECK.  
Captain THOMAS GOLDING.  
Mr. NORMAN HILL.

Mr. EDWARD NETTLESHIP, F.R.C.S.  
Mr. J. H. PARSONS, F.R.C.S.  
Professor J. H. POYNTING, F.R.S.  
Professor E. H. STARLING, M.D., F.R.S.

Dr. WILLIAM WATSON, F.R.S. } Secretaries.  
Mr. S. G. TALLENTS }

[Dr. Watson showed to the Committee, by kind permission of Sir William Abney, the instruments used in the examination of candidates on appeal. Captain Saul, of the London Local Marine Board, examined four candidates before the Committee in the regulation Board of Trade sight tests.]

Captain J. M. HARVEY called and examined.

144. (Chairman.) You are the principal examiner for the Board of Trade, and you visit the examiners all over the country from time to time and see them test candidates?—Yes.

145. And any points which do not conform to the regulations you look into and instruct the examiners about them?—Yes.

146. Do you see each examiner every two or three years?—I see each examiner about every two years; some of them I see oftener.

147. In the case of the appointment of a new examiner, if there is any vacancy, does that come before you?—Yes, he has to come here and pass before Sir William Abney or Dr. Watson and myself. Then we instruct him as well.

148. So you are always present when new men are admitted?—Yes, always, either myself or my deputy. If I am away Captain Fulton will come up.

149. Then you put them through the wool test?—Yes.

150. We are now speaking of examiners entirely? Are you satisfied that that is a good test for them?—They are also tested here with the apparatus up in Sir William's room.

151. Do they go through the spectroscopic test?—Yes, and the wools also. Then when I go round to the different ports I test them with the wools. I make them pick out all the right wools to show the candidates.

152. When you bring a new examiner here, is the spectroscopic test the best test?—That is the principal

test. He is put through the wool test too, because he may pass the spectroscopic test, and yet not be appointed an examiner.

153. Now with regard to the examiners during a period covered by the wool test at present in use, I understand that 149 men have been tested?—Yes.

154. They have been tested with a view to their appointment as examiners?—Yes.

155. How many of those have failed?—There were 24 who failed.

156. Did they all fail in relation to colour in some way?—A few of them were colour-blind. But a great many of them had not a proper colour perception. They were not colour-blind, but had not got a quick colour perception.

157. And of course the test for that is stricter for an examiner than for a candidate?—Yes.

158. Are you pretty well satisfied now that all your examiners are thoroughly satisfactory from the test point of view?—Yes, I think so.

159. Then as to the way in which they deal with the candidates, to what extent are you able to test them in the way they handle the candidates, as we have been seeing them dealt with just now?—When I go round and visit them I always see them examine candidates.

160. Do you sometimes find that some are much more apt in testing candidates than others are?—Yes, some are much more tactful than others and seem to gain the confidence of the candidate almost at once,

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[Continued.]

which leads to a quicker and better examination. It applies to the whole examination really.

161. But want of aptitude does not lead to the withdrawal of an examiner from his work?—No. They examine right enough, but some of them are quicker than others in making the candidates understand what they are required to do. I have sometimes to speak to them about a few points.

162. Because even the half-dozen I have seen down in the East End and here to-day seem to show that there is a good deal of difference in the way the examiners approach the examination. Some do it a good deal better than others. But I suppose even if they do puzzle the candidates a bit, the candidates will never be failed by a weak examiner? That is impossible?—Yes, it is impossible.

163. The mere weakness of an examiner cannot fail a candidate?—No.

164. Do you think that is certain?—I am quite sure that is certain. Even if they are failed locally by picking out wrong wools, they always have the appeal, and that case comes before me. If there is the slightest doubt about the man, even if he has made a lot of wrong selections, then I always instruct the examiner to tell the man to come up on appeal and we will pay his expenses. In most cases they come up, but I am afraid that in some cases they do not really try to pass, because they will not come up to be specially examined.

165. Are there sometimes cases where they really do not want to succeed?—I think so, because we have offered to give them a free examination and to pay their expenses, and they have not come up.

166. You have had a good deal of experience with the fishing examination which has been recently instituted?—Yes.

167. Will you tell us something about that?—In two months and a half I think we had 1,023 men altogether, and they had never been up for an examination of any kind before. They ranged from 19 years of age up to 55. At one port we had 260 men and I had two examiners examining in colours at two different tables. I was there myself, and I supervised them. We had about 10 or 12 men round each table at a time and explained to them exactly what was required of them. When once shown, they could generally pick out the matches to the test skeins as quickly as I could myself, excepting in a few cases. We had 19 colour-blind men, and six men failed in form vision during these examinations. But most of them had very good sight. They could read the bottom line easily with both eyes.

168. I should like to ask you a question with regard to a point which arose with a candidate just now. Why do you insist upon each eye being right? That candidate could read the form vision with both eyes, but he failed with one eye?—We want full normal in one eye; we want to know he has good sight, at least with one eye. With the other eye only half normal is required. He is only required to have full normal vision in one eye; it does not matter which eye it is. Then he is allowed to have half normal vision in the other eye.

169. I am not quite sure what happened to the candidate just now: was he failed?—I think he passed the old test.

170. (Mr. Norman Hill.) As I understand it, he would not have passed in the year 1914. He passes now and he gets his certificate now?—Yes, and then he will always be able to take the lower test.

171. And his certificate cannot be taken away from him in 1914. But if in 1914 he went up to be examined as a master he would not pass for his master's certificate?—Yes, he could, because he would have his mate's certificate. But if he went up for his second mate's certificate as a youngster at the beginning, he would not pass.

172. (Chairman.) Because the test would become stricter?—Yes, the test would be stricter after 1914.

173. (Mr. Norman Hill.) And any man in the service now can go on in his profession and get his certificates if he is as good as this man to-day?—Yes, any man who has already passed for a certificate.

174. (Chairman.) If a candidate shows any indication of colour-blindness, you would let him see the other candidates tested, would you not?—Yes. If a man hesitates at all, we always put him back and let him see the other ones tested. Then he is shown the correct matches to each test skein. We mix them all up again, and if he makes mistakes again, we fail him.

175. Do you insist on that in every case?—Yes. We have so many examinations and examine in so many ports for the convenience of seamen that we must have it uniform. We cannot allow one examiner to do one thing and another examiner to do another thing. Therefore, we make it a rule that if a candidate makes any mistakes after being clearly shown what is required, he is to be failed, or the case submitted.

176. Am I right in thinking that before a candidate is failed you always show him the right colour?—Yes.

177. I suppose we had not got to that stage in the room just now. The test skein was a difficult pink colour and there were only about a couple of dark skeins resembling it. I noticed the candidate was hunting for them. He was not at all aware that there were only a couple?—That is so. It is in our regulations. The examiner should show every person. Only the other day I pointed that out specially to the examiner, that the men should be shown so as to save time.

178. It struck me there was a little waste of time?—Yes, it is pure waste of time and it is not good examination at that.

179. You mentioned to me privately something about the sight of these fishermen. You said the older men had better sight than the others?—They had far quicker sight. The men from 45 to 55 had a quicker colour perception too. We had far less trouble with the older men than with the younger men.

180. Did the older men read the small letters quicker than the younger ones?—Yes, as a rule.

181. (Chairman.) Does that correspond with any modern observations, Mr. Nettleship?

(Mr. Nettleship.) I think I should have to have the figures before I accepted that. Personally, I could not take a general statement like that. If it is true, I confess I cannot explain it?—There were 1,023 men in all examined, and of those who passed, 90.6 per cent. passed the new form vision test.

182. Do you mean of the older men?—No, that is of the whole.

183. (Chairman.) You have not any figures as regards old and young?—No, I have not. I think I could get them. I think I could work them out by getting the forms of application from the Registrar General.

184. (Mr. Nettleship.) I do not wish to doubt what you say, but I know that one gets impressions so easily?—That is so.

185. (Lord Rayleigh.) It may have been that many of the younger men were short-sighted?—It might have been so. I pointed out to them: "Here are men 'old enough to be your fathers or grandfathers, and they can do it easily, and you can barely do it with 'two eyes.'"

186. (Chairman.) Did that become very obvious to you?—Yes.

(Mr. Nettleship.) It may be, as Lord Rayleigh suggests, because of the short-sightedness of the younger generation.

187. (Lord Rayleigh.) The conclusion would be very different if you had given them a book with small print to read without glasses, would not it?—Probably.

188. (Chairman.) We had a point we thought we would like to ask you about, and that is as regards the increased speed of modern steamships. To what extent do you think that is a factor that ought to be taken into account in considering the strictness of the test?—There is less time between sighting a light and coming to the point of collision. I think it has a great deal to do with it, and especially when a fast ship is crossing a slow ship and the slow ship has to give way. If the fast vessel is crossing at right angles and coming along over 20 knots, perhaps the other would first see her when about 2 to 2½ points before the beam. This means that the slow vessel has to swing through a large arc to regain a safe course, and



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[Continued.]

if the officer in charge does not see the danger quickly, by the time he begins to act, he may quite possibly be too late.

189. Is it your view that the modern conditions make it necessary to be more careful in these tests?—I think so.

190. Can you give any illustrations?—I think it is important for sighting lights. A normal man is only expected to see a side light at two miles. I have been inquiring amongst doctors and others as regards half-normal sight, and I do not think that question has been gone into much, to see how far the half-normal man would see a side light.

191. Are there any other points in relation to that?—I think in hazy weather, when you have very little time to act, a man with good sight will pick up an object or light a great deal quicker than a man with only half-normal vision.

192. That of course has nothing to do with modern developments; that is a general statement?—Yes, that is a general statement, but of course the increased speed comes in.

193. Then there is another point about the use of spectacles and glasses. You do not recognise the use of spectacles or glasses at all?—No, I think they would be perfectly useless at sea.

194. What is the ground for that? I am only asking for the information of the Committee?—Well, there is the spray, and the rain, and so on. You always have to be taking them off and cleaning them. At such a time a collision might occur.

195. Is that the primary reason?—Yes, that is the primary reason. For the same reason binoculars are no good. The heat of the hands in certain atmospheric conditions causes condensation on the inner surfaces of the glasses, and puts them out of use until this moisture is removed; and in hazy weather they always magnify the haze.

196. Have you used binoculars under those conditions?—Yes, but I never used them much. Their chief use is for reading signals. If you see a light in fine weather you may be able to distinguish it better if you have binoculars. I mean in the case of a light which is dipping, or at a distance.

197. But under many circumstances they are a danger. I do not know that this is really relative to our inquiry, but you do not consider the use of binoculars desirable?—I do not. I do not think they are any help to one.

198. What we are concerned in is that they must not have glasses?—That is so.

199. Well, now, with reference to the steamships that you deal with, I believe there are certain coasting ships which have not any certificates, and for those you have no test?—We have no test for those.

200. As a matter of fact have most of those ships got certificated officers?—I should think they have. All the principal ones have. There are a lot of little brigs and schooners and some small steamers and vessels like that which have not got certificated officers. But I should say most of the big coasting boats would have certificated men aboard.

201. Now, with regard to the rapid manœuvring of modern ships, does that affect the question of danger?—I do not think so.

202. What do you say about that?—I do not think it affects it at all, because when you have a collision it is not as a rule in fine weather when you can see; it is in hazy and thick weather and you have not very much time when ships are approaching at the speed at which they do now. I agree that they have more power to go astern.

203. You do not think that may be brought in as an argument against the need of these stricter tests?—No, I do not think so. Then all men are not on the principal ships. There is a fast ship and a slow ship; and a slow ship takes a lot of time getting out of the way, especially if she is light and if there is a breeze on.

204. As I understand it, your tendency is to think that the various modern developments in ships do not in any way lessen the need for strictness with regard to the tests?—I do not think so. I think it is the other

way about. We ought to have the tests stricter if anything.

205. Of course, you must have come across a good deal of popular opinion that the tests are too severe?—I have heard very little of it. I do not think there is very much opinion that the tests are too severe.

206. Shall I rather put it that these scientific tests in laboratories and so forth are not the right kind of tests?—I have seen that opinion in the papers.

207. Do your examiners find that there is much grumbling about it?—No.

208. You have not come across it?—I have not heard anything really against the tests from candidates.

209. You know there are things said in newspapers?—I know there are, but personally I have never heard a candidate complain in any way about the test, or about the test being too severe either for form or colour.

210. (Lord Rayleigh.) I think I understood that the form test has been made more stringent recently?—Yes.

211. On whose advice was that done?—Well, it was first suggested that the form-vision test was not severe enough at the Colonial Conference. There were several men who were tested for short sight who could not comply with the old half normal, and we found that they could not see the lights, though their colour-vision was all right. You saw those dots of lights that Dr. Watson showed you? They could not see them at all, although they were quite plain to me and I was behind them, showing that they could not see ships' lights at a proper distance.

212. You think a stiffening of the form test is desirable?—I do.

213. (Professor Poynting.) What is the object of making the requirement of the other eye—the weaker eye—so high?—In case of anything happening to the good eye; so that a man would not be too bad altogether.

214. Is not the half-normal eye then practically useless?—You mean to say, when one eye is half normal, a man always uses his good eye?

215. I am a case in point. I should be failed utterly by the test. But as a matter of fact my eyes have always been very useful. I have normal vision with one eye and very much below half normal with the other eye. But I never have any difficulty in picking anything out?—I think the reason for only asking for half normal in the other eye is, that there are a great many men with one eye stronger than the other.

216. It seems to me that if you have got one good eye, you have got all that is really needed. Why make such a high requirement as half normal for the other eye?

(Mr. Nettleship.) I think the obvious reason is that something may happen to the good eye. You may be on the bridge and you may get something in it.

(Chairman.) It doubles the chances of accident.

217. (Professor Poynting.) Would the half-normal eye be any good then?

(Mr. Nettleship.) Yes, it would be better than nothing, at any rate. Of course, the ideal will be to have them both full normal. That is obvious.

(The Witness.) And the greater number are so. They have equal sight.

218. Or very nearly equal?—Yes, or very nearly equal.

219. (Mr. Norman Hill.) You say that every case comes before you when a man has failed. Does it come before you in the forms that were shown to us the other day—showing the wools that he has chosen compared to the wools given him?—Yes. They cut off bits from the skeins that he picks out, and they are sewn on to the form and sent up to me.

220. With regard to the increased risk by reason of the increased speed in the modern steamship, you have not found that the risk of collision has increased in daylight, have you? Year by year there are less collisions?—I do not think there are very many less collisions. The collisions keep about the same.

221. They have not increased in daylight?—Well, no. Speaking from memory I do not think they have, I am not quite sure of that without looking it up.

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[Continued.]

222. (Captain Golding.) In the evidence you have given us as to the necessity for seeing quickly the modern fast steamers, I take it you refer to the ordinary strong vision and not to the colour-vision?—I refer to both, ordinary strong vision in the day time and colour-vision in the night time.

223. Would the speed of the vessel make any difference as to colour-blindness at night? As the light gradually got nearer, do you mean that it would dawn on the man what the correct colour was?—Yes, that is form-vision.

224. But we are talking of colour-vision now?—Well, he would not see it.

225. I take it that the evidence you have given us as to the necessity of seeing quickly refers to form-vision and not to colour-vision. I am trying to get from you what you referred to in your evidence?—If he is short-sighted he cannot see the light, and so he cannot see the colour of it. It is form-vision.

226. (Chairman.) Then you agree with Captain Golding?—Yes.

227. (Mr. Parsons.) Do you find there is much difficulty in instructing the examiners in the wool test?—No. Those who pass as a rule take to it very quickly.

228. And after they have just passed, do you often get a lot of rejected candidates from them to begin with?—No.

229. In every rejected candidate, are the actual wools picked out and sent up to you?—Yes, they are sent direct to me. They all come direct to me.

230. And sometimes they will be passed?—Yes. If their mistakes are slight and of no consequence, they are passed. But if they make small mistakes with all the test skeins, then we have them up for special examination. We pay their expenses in that case.

231. (Chairman.) Do you think that any willing candidate is never improperly rejected?—No. If any man says he cannot afford to come up and the examiner on the spot finds that he cannot, we always have him up and pay his expenses.

232. And you see him yourself?—Yes.

233. (Mr. Nettleship.) Are they often kept a long while waiting before they come up?—No.

234. I was told that although their expenses were paid, they were kept about for a long time?—That has occurred once or twice, but not as a rule. They sometimes say they will not appeal at the time, but will wait for a time. Sometimes they have waited for six months. Sometimes they will say they will give their eyes a rest, and then try. We cannot force them to come up.

(Chairman.) I am sure we are very much obliged to you for coming to give evidence, Captain Harvey.

The witness withdrew.

Adjourned till the 14th October, at 3 p.m.

### THIRD DAY.

Friday, 14th October 1910.

PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).

Sir ARTHUR RÜCKER, F.R.S.  
Captain THOMAS GOLDING.  
Professor FRANCIS GOTCH, F.R.S.

Mr. NORMAN HILL.  
Mr. J. H. PARSONS, F.R.C.S.  
Professor J. H. POYNTING, F.R.S.

Dr. WILLIAM WATSON, F.R.S. } Secretaries.  
Mr. S. G. TALLENTS }

Captain CORKHILL, President of the Mercantile Marine Service Association, called and examined.

235. (Chairman.) We are much obliged to you for coming here. Will you kindly lay before us, in whatever way you think right, the views of yourself and your Council on the general question?—Yes. Do you wish me to go on straight, without you asking me any further questions?

236. I think that would be the best way, because then you would take the points that you think most important?—Of course, I may state at the beginning that I have had a certain amount of experience in testing the sight of people as an examiner in Calcutta. I was examiner there for masters, mates, and young pilots for about 12 years, and I have used the red glasses and the skeins, and know what there is to be known about the old vision test as far as I was concerned as an examiner. Besides that, amongst other things which I managed at Calcutta was a paint, colour, and varnish works, where, as you know, we have got to match a great many colours. People send colours for you to match and you have to give them an exact shade, or otherwise you do not get the order. I mention this as a preliminary, to let the gentlemen round the table know that I know a little about colours in an ordinary way. Now I speak as a shipmaster with sea experience, and I represent the conclusions which the members of our Council, after long experience at sea, have arrived at. I put it before them very plainly, when they elected me to give evidence before this Committee, as to what I proposed to do; and again, after your

secretary wrote to me, asking me to give him a little idea as briefly as possible of what I was going to say with regard to the form test and the colour test. I read that to them at their last meeting, and it was unanimously agreed that I should follow it up, and give you any other information you liked to ask me for. Looking at it from a practical point of view, I think that if a shipmaster or officer can read the commercial code flags, and flags of all nations, which adds considerably more colours to the colours of the commercial code, that is all that is necessary for a sailor.

237. Do you mean to read them with binoculars?—Yes, with binoculars, of course, or without; whichever you like. If it is a long distance off, a captain or officer has the privilege of using either binoculars or telescope. As marine superintendent, I supply all our ships out with both. Then we come to what is the proper thing for lights. With regard to lights, I think that a man ought to be tested in the dark, and by a light in a lantern in the same way that he does at sea. I have always held that that was absolutely necessary in order to find out whether a man knew the difference in the colour of lights at night time. I put a little more value on this than probably an outsider would do, because when I have been coming up the Red Sea, passing a P. & O., or any other boat coming down covered with lights, I have realised that it is absolutely necessary for a man to be able to see what



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[Continued.]

the lights are. That is to say, some of the lights, as you know, have a very yellowish appearance, especially if a light comes indirectly through a window from a cabin, because a good deal depends on the surroundings of that window, as to what it shows you. Of course, you know an electric light in a room is not on the window—it is somewhere on the side of the room, and close to the bed, where people can switch it on and switch it out. They also put curtains at those windows. I have stopped builders from fitting all green and red curtains, and put something in that is as near as possible neutral for curtains, just to avoid any mistake in lights at sea. But, all the same, I think the best test for a man on lights is to show him them in the dark, and, if possible, to have other lights around visible at the same time. That is my view about the lights, and that is my view about the colours, as far as a practical shipmaster is concerned. With regard to the form-vision, in my time as an examiner, and as a superintendent testing my own officers, I have always found the old form-vision test to be all that is necessary.

238. You think it is quite sufficient for all purposes?—Yes, for all practical purposes. I, as superintendent of a large shipping company, would never think of putting a man out of a berth if he could pass the old form. I look upon the new form, which I have taken the trouble to go through with some of my friends, the examiners in this country, as being really unnecessary. Why I venture to offer an opinion so decidedly on this point is, that I think we have had a practical experience of a number of years, which proves that to be more or less correct. Now I look upon that new sight test or form test, whichever you call it, as something which appears like disaster to our cloth, inasmuch as owners will select the men who can pass the proposed or new sight test that is coming in use after 1913. In one way you cannot blame the owners for it, because they want to get their premiums as low as possible. Therefore they will naturally want to employ only the men who have passed it.

239. What do you think will be the effect of that?—The effect of it would be that a number of men would be thrown out of employment, besides which there is another very serious thing which will arise. I might as well tell you, perhaps, as I go along, that I was a nautical assessor for the lower courts and the high courts of Calcutta, and, being the senior man, I have been on a great many cases, both in the high court and the lower courts, in addition to courts of inquiry. Judging from the different catspaws which the counsel always make use of, I feel in a court of inquiry or in any court, if one ship has only got men that have passed the old test, and the other ship that has been in collision has got men that have passed the new test, it will be trotted out as something to be taken into consideration on their side, although it may not interfere with the case. So that I look upon the new sight or vision test with grave suspicion as regards any future good, because it will put a lot of our very best captains with the most experience—I am talking about men past 45 years of age—out of employment; and it will only cause more bickering in the law courts when cases come up to be decided.

240. But you start by saying it is too severe?—I think it is too severe. What makes me say that is that our past 30 years' experience has proved that the old sight test is sufficient. That ought to be explained to you, sir, so that you will see it in another way. I went to get my sight tested the other day, just because I was coming up here. I paid my shilling like any other man. I held an extra master's certificate, and I knew they would not take it from me if I failed in the new test, as I could pass in the old form. I could not pass in the new form, because I could not read, I think, the sixth line. I could see the line all right, and I could see the figures, and I could see they were letters; but I could not distinguish the F from the E, or the V from the U, and that kind of thing.

241. Were you looking without glasses?—Yes, and sitting the usual 16 feet off according to the regulations. I could see the line there; and if I could see a line there, I could see a buoy. I could see there was something there just as plain as anybody could,

but I could not decipher the figures. I only mention this, to show you that it is not absolutely necessary to be able to read letters on board of a ship at a distance. Supposing there are two or three letters on light-houses, as there are at some places, you can always take your binoculars or your long telescope and see what the letters are. The same remark applies to the buoys. Of course, we work with red, green, and black buoys going up channel, so that we can see the colour. But when we want to read particular marks on a buoy we always have the advantage of taking a glass and looking at the letters to see what they are. I want to point out that, although a man cannot read small letters at a certain distance, he can see there is an object, which he wants to do as a shipmaster.

242. But that does not do away with the necessity for all tests. I mean, if it was sufficient for him simply to see with the binoculars, then the old test would be too severe?—Well, you must put a limit somewhere.

243. That is what I meant?—I put the limit on the old test, because you can get glasses of all strengths.

244. You think the old test is practically sufficient?—Yes, and that is my experience of officers and commanders at sea. When I fit out a new ship I always supply the chart room with a hand magnifying glass, which always lies on the chart, so that there cannot be any mistake in that way. I am not saying that the majority of men require this, but still, with a room that is not very well lighted, I think it is a safeguard for the navigation of a ship to assist the officers or commanders, because some of the figures on the chart are very difficult to see with the naked eye. I am 60 years of age, and the last command I had was "The Empress of India," a big passenger ship carrying about 1,400 passengers, in 1884 and 1885. At that time I felt at night time in the Red Sea that I wanted a glass with which to see my chart.

245. That is perfectly natural?—Yes. My eyes are all right. I have got the usual eye and a half, the same as most people, but I never trusted to my eyes in reading very small words on charts in 1884. I am only pointing this out to show you how serious a matter it will be for men, if they cannot pass the new test; that is, to have the two eyes, or to have the sight they are expected to have by the new test.

246. Do you discourage them from using glasses in the ordinary way?—No, I encourage it.

247. Because after 40, or some such age, the eyes of a great many people naturally change and they want glasses?—Yes, I rather encourage it. I encourage it, inasmuch that in all the outfits that I supply to new steamers, I always supply a hand glass as part of the chart room outfit.

248. Is that for the purpose of those who have not got spectacles?—Yes; a great many have not got those.

249. Your point is that, after a certain age, the application of the new test would knock out a very large number, owing to the ordinary process of what happens to the eyes of people at that age?—Yes, and I go further. Although I am the marine superintendent of a big company, I know it is natural for shipowners to get the very best men they can as officers and commanders.

250. At the present time there is no custom of re-testing in their later life?—No, it is not the custom; it is not a compulsory custom. But nearly all the managers of the large liners ask their commanders to have their eyes tested once in every year.

251. Do they put on a test of their own?—Very nearly all the large lines do that. I mean, they ask for periodical tests.

252. That is not the Board of Trade test?—They have got to pass the Board of Trade test, and they go to the Board of Trade Offices and they pay their shilling; or, if they do not do that, they go to a first-class oculist who gives the Board of Trade test.

253. But they do not start afresh every time; when they have got the certificate, they have got it?—That is the certificate only; but you cannot force a man to employ you, because you have got a Board of Trade master's certificate.

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254. We are only inquiring, after all, into the Board of Trade certificate?—Quite so.

255. Do I understand you to say, that they are periodically put through tests by the shipping companies?—Yes.

256. (Mr. Norman Hill.) I think, sir, the procedure is this: The man is a certificated officer. As a condition of his employment, his particular employer says, "We expect you to go down every year to go through the examination again." Of course it does not affect his certificate, but it does affect his employment. Some of them send their men to their own oculist, and some of them send the men down to the Board of Trade examiners?—That is so.

257. (Chairman.) And the test, as a rule, is the Board of Trade test?

(Mr. Norman Hill.) Yes, generally. There are instances where some lines prefer their own oculists, and tests which differ from the Board of Trade's.

258. (Chairman.) That is the point you are dealing with?—Yes. When we write to the oculist, asking him to kindly test the bearer, we generally say "by the Board of Trade test."

259. And that means by the new test?—Well, we have not put in the new test yet. We are quite satisfied with the old test, because the other one has not come far enough into fashion to have any disastrous effect.

260. But you are afraid of the new test?—Well, a great many of my Council are marine superintendents for employers; and they are of the same opinion as me; they think it will be disastrous to the present-day men who are going to sea. Some of our most experienced captains will sooner or later have to go out of it, if that new test is forced on to the community by the Board of Trade.

261. When you apply the test do you never allow a man to use glasses?—We carry the Board of Trade test out. There are no glasses. You are 16 feet away with your back to the wall. You toe the line, and you read the different lines down. If you cannot read them, you do not pass.

262. That is the main point, is it not, with regard to the form-vision test?—Yes.

263. Is there any other point that your Council urge with regard to either the colour-vision or the form-vision test?—Well, most of our men have great experience, and they ask me to point out that naturally sailors are long-sighted, because they are always used to looking out for something. Although I cannot explain it to you—but some of the doctors round me will be able to tell you—the ball of the eye seems to get elongated through continual searching in that way. Consequently my experience of shipmasters and officers is, that they can see things a long way off quicker than people who have got the normal sight for ordinary purposes. I think the continual searching of the horizon at night time with binoculars, to pick the objects up, is another thing which draws the eye out to a certain extent, and helps the man really to be what you call a long-sighted man. Now sometimes when I get a little seedy I go down to Queenstown on the White Star boats, and I go on the bridge just to test my own sight. In spite of my age—and I have been using glasses for reading for a long time—I can see a light with any officer on the bridge a distance away; but to read at my desk at the office, I have got to use glasses. But as far as picking up an object at sea is concerned, I can do it with anybody.

264. Including the colour?—Yes. I read flags with anyone.

265. Without using the glasses?—Well, it all depends on the distance.

266. But you are now speaking of using your natural eye?—Yes; I will read the colours with anybody, if they are close enough.

267. I understand you rather infer from that, that the sight of naval men is better than is commonly supposed?—Yes, for ordinary purposes. They can pick up a light, or anything in that way, quicker than an ordinary person would.

268. And that the tests do not altogether certify as to that?—They do not certify. They are not practical

enough. I do not think all the tests we get from the Board of Trade are practical enough. I do not think that they are tests equal to normal conditions, where a man has got to read colours, or read flags, I should say, and to see lights.

269. Have you seen the spectroscopic test in the dark—the one that is used in London when a man comes up here?—Perhaps, if you give it me in other words, I might be able to understand it.

270. I mean Sir William Abney's test. You would not have seen it unless you had been to his laboratory?—Then I have not seen it. But I have been put into a dark room with a small lantern through the wall, and seen different coloured glasses put in.

271. That is different. Do you think yourself that the old test was too severe?—The vision test?

272. Yes?—No. I think the old test has proved to be all that is necessary.

273. And not too severe?—No, and ample for the last 30 years. You see, you have got to work a good deal on practice in these matters, and we know by practice that the old test has suited us very well.

274. What is your view about the habitual wearing of glasses? I mean is a man, who wears glasses always, handicapped, if he has got to wear glasses in bad weather, and so on?—I know of only two or three captains who wear glasses. The owners apparently do not object to them. But to be perfectly candid about that—perhaps some of our Council would not agree—it is very awkward to wear glasses, because you are apt to get water on them, and you cannot see so well; but I doubt whether the man who used glasses would keep the glasses on with binoculars. I have had no experience of that.

275. One of your members, Commander Eagleton, says he has worn spectacles day and night?—I have met two or three men of that description. I am half inclined to think that, in looking through the glass, they just raise the spectacles and look through the binoculars without them.

276. But it is rather rare to find a man who wears them habitually, is it not?—That is so.

277. Do men try to avoid wearing them? I mean are they afraid of wearing them?—I do not think so. It has not come to that stage yet. When the old captains come to the office, you see the glasses hanging down on their waistcoats, and they are not afraid of them being seen; and if you ask them to sign something, they will put their glasses on in order to do so. They do not hide their glasses.

278. I mean at sea?—I have had officers who use them for reading at night time, but they do not do it about the deck or on the bridge.

279. Well, there must be a certain number who wear glasses in order to be better able to see objects afar off?—It is a question of how far they would require them. I am afraid they would be like a pair of bad binoculars if you tried to look a long distance with eyeglasses.

280. I can only say for myself, that if I put on a certain pair of eyeglasses, I can see a yacht and all it is doing at a reasonable distance; and if I do not put those glasses on, I cannot see what they are doing?—Well, I have not got that experience yet.

281. I do not say that I can see small figures?—I am the other way about. If I am driving, and I want to see the people that are passing me, I put the glasses on in order to see the people. But I have no occasion to put them on if the people are a good way off.

282. Do you think there are any other points, before I ask other members of the Committee to put questions to you? Do you think you have given us the main points?—I think I have given you the main points. I daresay something else will crop up in the questioning. If it does, I shall be very pleased to answer, if I can.

283. (Mr. Norman Hill.) You understand that under the new form-vision test, no man who holds a certificate will have to be examined again for a certificate?—I know that.

284. And although that is so, you think that if the standard is raised and the new test introduced, it will

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have a very serious effect on the men at present in the service?—Yes.

285. The shipowners will insist on enforcing the best standard, whatever it is?—Yes, naturally.

286. We have been told that the necessity for the strengthening of the form-vision test arises because of the greater speed of the modern steamer—the steamers approach one another more quickly?—Yes.

287. Now in your experience, are collisions increasing or diminishing in number of late years?—Well, we have got, as you know, captains on our Council who have been in the fast steamers. I have put that question to them. Now we have got two or three on the Council belonging to the Empress boats, which, you know, go fairly fast, 18 or 19 knots; and I have put it to them in this way: "I am afraid the Board of Trade think the fastest steamers will require it." But they say the difference is not perceptible, and I do not think it is perceptible. I will tell you what made me agree with this. When I am driving in a motor car, I do not feel, although my sight is what it is, a scrap more nervous than what I do when I am driving in an ordinary trap, as far as my sight goes. You really do not perceive it.

288. And, as a matter of fact, are the collisions that Liverpool ships meet with increasing or diminishing year by year?—Well, I should say they are diminishing, if you are alluding to a fine class of steamer.

289. And the Liverpool ships will be the fastest ships afloat?—They are the fastest ships afloat.

290. I mean, it is the fact that, although the pace has increased, the power of manoeuvring has increased enormously?—Yes.

291. I mean, even the speed increases the power of manoeuvring?—The speed, and the rudders, and the twin screws, and everything.

292. And the steam steering gear?—A ship will come round now in almost half the circle that was needed when I first took command, comparatively speaking.

293. You do not agree that the increase in speed has necessitated the strengthening of the form-vision test?—I do not agree. I have inquired specially on that point from the commanders who have commanded those fast liners out of Liverpool. A great many of them you know. They say they do not recognise it. It is years since I commanded the "Empress of India." But my experience on land is that with a motor car, or driving in a trap, I do not feel that the form-vision makes a scrap of difference, because I can see a certain distance at all times.

294. Now I should like to deal with a different point. As I understand it, you hold that the training of the eye at sea does a great deal to make up for any weakness in the range of the sight?—I am quite sure, from all the experience I have had, that the practice we get at sea of picking up objects goes more than to make up for any little weakness a man may have with his eyes, as far as the shore test goes.

295. (Captain Golding.) I should like to ask you this: can you suggest any more practical method of carrying out colour-vision and form-vision tests, than those at present used by the Board of Trade?—Are you now alluding to the skeins?

296. I am alluding to the skeins and the whole system now in vogue, both for colour- and form-vision. Can you suggest any more practical method of carrying out the tests?—Am I in order, sir, in going into detail about shades?

297. (Chairman.) Yes, certainly?—I have pointed out already that I think if a commander or an officer can read the colours of the bunting of the commercial code, and all the various flags which are displayed all over the world, I think that is all that is required from a seagoing man. Well, now, with regard to the skeins, I would like to give you a little experience which I have had as a colour tester, which bears on the question which you are asking now. The skeins at the present moment are of various tints. I would like to point out that the light of the atmosphere has a great deal to do with a man reading those tints properly. Now, in matching colours, I find frequently—and I am

matching colours very nearly every week—that a dull day does not give me the shades in the same way to the naked eye. A dull day does not give the shades out in the same way as a bright day does, and I do not think that a lot of the shades, which are in those skeins, are at all necessary for practical purposes. I know, as a matter of fact, that colours have not been standardised. We tried to standardise them some two or three years ago, and we sent coloured cards broadcast all over the kingdom, and asked people to write down under a shade what they called that shade. Strange to say—I suppose human nature was the cause of it—there were not six people out of a thousand who agreed about the exact shades. The same might almost be said of the paper you sent to me. In the first place, sailors would not call the shades by the same name as do the Board of Trade. But of course I know, as an examiner, a good deal of latitude is given to the man as long as the examiner sees he knows what it is. But still, coming back to your question again, and replying to it in brief, I do not think it is necessary to ask a man, what are all the shades that you have got in the skeins. I think the ordinary bunting, that is used by them at sea, is quite sufficient to test a man's sight for practical purposes.

298. (Captain Golding.) In other words, if a man could name the various coloured buntings which are used in the commercial code of signals, and any national colours, you consider that would be sufficient colour test?—Yes.

299. Would you match them? I think "distinguish" was the word you used?—Yes; distinguish the colours that are used in the code of signals and in the national flags.

300. But on the lines of what Mr. Norman Hill has just suggested, would you just simply make the man name the colours in the different flags, or would you ask him to match two colours?—I would ask him to match them. I mean if he is given two blues, and if you are going to test a man and you have got a lot of pieces of bunting here and there, and you take a piece of blue bunting out, if he matches the blue, it is all right. Of course, he must state that it is blue, because you will not be able to tell whether he is colour-blind if he does not.

301. With regard to the form vision, I take it, from what you have said, that all you would wish would be for the old test to be retained, and for the new test not to be brought into action?—That is the opinion of myself and my Council.

302. (Professor Poynting.) It is sometimes said that the present tests will pass people who are really colour-blind. Have you ever come across anyone?—No. I have never come across a man with a certificate whom I have found to be colour-blind. I have never come across a man in actual service who is colour-blind. I have asked our captains to let me know, if they ever doubt a man on the bridge; to let me put him through and test him. But I have never had a case. But I have had cases of this sort; I take a lot of the Conway boys who are in training to be officers. I have had boys who have passed the Board of Trade colour test, and when they have come to me to apply for an uncertificated officer's position, I have found that they were colour-blind, more or less. But invariably when I came to look at their fingers, I have come to the conclusion that their colour-blindness is caused by smoking cigarettes. The Secretary of the Conway has told me the same thing, and I have brought it to the attention of the Conway Committee. I have found that the boys are continuous smokers of cigarettes.

303. (Chairman.) Have you had several cases of that in your experience?—I have had about three cases in the last four years.

304. You put them through the ordinary test, and you find they do not come up to it?—Yes, and, when I find they do not pass the test, I send them to an oculist in Liverpool, and he has confirmed my opinion.

305. (Professor Gotch.) I understand you advocate a form of test for colour which should be conducted in the dark?—Yes, for coloured lights.

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306. On the ground that it really supplies the conditions under which you have to see lights at sea?—Yes.

307. Then have you any view at all as to what that test should be—a lantern test?—Well, if it was possible I would rather take a man down to the river side, and let him read the lights as they passed up and down the river, at different distances. I think that is a more practical way, if it were possible.

308. You advocate that rather on the ground that it is common sense that you should test in accordance with the conditions under which the recognition has to be made?—Yes, and there are other lights knocking about of a yellowish tint, and white tints, according to whether it is oil or electric; and it will be a better test of a man.

309. I should like to ask you one other question. Is there any increased difficulty, do you think, in recognising at sea at night coloured lights, if those coloured lights are surrounded by a whole series of other lights, as must be the case in a well-lit large liner?—Well, of course, you can see a red light or green light if it stands alone, much better than if it is surrounded by other tints. That is natural. But if a man can pick out a green or red light from amongst a number of other lights, you can take it that he is all right.

310. I take it that means, that with the modern large illumination of liners, to pick out a comparatively small green light necessitates what we should call great accuracy of visual form?—Well, that is one way of putting it.

311. It is like picking out a letter of a line. It is slightly against your other statement of increasing the severity of the form test?—I think my other answer covers the same question. That is to say, you can, of course, pick out a green or red light better if there are no other lights near it. It takes more trouble to search for them when there are a lot of other lights about.

312. (Mr. Parsons.) Do you think it is essential to have a test with actual lights? Would you be content, for instance, if a man passed the bunting test?—I would prefer to make him pass even a more moderate examination with lights than Professor Gotch has mentioned, rather than to give him bunting alone. That is to say, if you put him in a dark room and have a lantern at one end with a small light in it, and have different shades in it, I should like to see him sight the light, rather than make him look at bunting, and that sort of thing. I would rather try to lengthen the distance, the same as you do by looking up a tube and seeing the light at the end, and seeing the light itself. I think it would be better for the man to do it. I am only pointing out this way as one method of testing the man for seeing the light.

313. You would be content if he simply named the colours in the ordinary kind of way?—You are talking about the lights?

314. Yes?—Yes. As long as he told me one was a green, or a red, or a white I should be satisfied.

315. (Sir Arthur Rücker.) There is one point I should like to put to you with regard to the wools. Do you think there is anything important in the materials of which the different colours are made? Do you think a sailor would be less frightened, so to speak, of dealing with coloured pieces of bunting than with the coloured pieces of wool?—As an examiner, my experience of men passing a Board of Trade examination is that they can be fearfully nervous.

316. That is what I was thinking of?—Many a time I would ask a man what he was afraid of, and say, "Do you think I am going to eat you?" Then I have suggested that he had better go outside, and come back in a quarter of an hour. I mention that for this reason. I think a man would be more at home if you tested him with pieces of bunting than if you put before him a multitude of shades of colour in skeins, because the man has not been educated in shades. Take that list of colours which the Board of Trade sent me. I do not agree with half of those names they give to them, and the sailor does not agree. It is the

thought of not being educated to what the examiner might call those shades that makes him nervous; whereas if you give him bunting, such as he sees when he is using flags, he is more at home.

317. But is not the colour test carefully arranged so as to avoid that difficulty of naming—to match colours and not to name them?—Well, you have to match them. But the feeling is there all the same, that the man does not know half those shades, and he is afraid to say what they are.

318. He is not asked to say what they are, but to match them?—I am afraid that feeling as to the names comes in all the same, as far as the man's nerves are concerned.

319. One cannot account for nerves, of course; but if you never ask the names, how can that affect it?—Perhaps there is a good deal in what you say. But still, all the same, there is a great deal to act upon a man with all these shades being put before him. I have done it myself over and over again. A man picks a colour and says, "There you are, sir," and you sometimes ask him what the colour is. I am afraid you must ask him what the colour is.

320. But the colours are specially chosen, are they not?—Then I am afraid that as an examiner I have made a mistake, because, after he has matched them, I have asked him, "What colour do you call that?" The examiners asked me that question the other day.

321. (Chairman.) When the matching is over, if I am not mistaken, you may ask a man to pick up a green for the purpose of testing him for colour ignorance. Is that not right?—That is so.

322. That is rather a different point from the one put by Sir Arthur Rücker?—But it comes in all the same. You ask a man what the colour is, and he says, "I think it is a pea-green." If he says it is a green, I merely say, "Thank you," and I put it down.

323. (Sir Arthur Rücker.) That was rather my impression, that that was a secondary part of the examination, and the primary part was the matching. Now I will go to another point. Do you think new material is any real difficulty to a man? Supposing you had bunting instead of skeins of wool, do you think that would make any difference?—No, I do not think it would make any difference, providing there were not such a number of shades.

324. That is what I want to get at. It is the number of shades you feel a difficulty about?—Yes.

325. Regarding the lights surrounding the coloured lights, and dazzling a man, would it be possible to make an improvement on the existing arrangements on a ship, so as to have no other lights near the coloured lights?—No, because passengers are so exacting nowadays, that they will have lights all over the saloon deck.

326. Then you cannot do anything in that way?—No, you cannot run a ship on philanthropic lines nowadays. You have to cater for the public.

327. (Sir Arthur Rücker.) There is another point I should like to put before you. With regard to seeing the lights in more or less misty weather—not merely at great distances, but in misty weather—do you think it is important that that point should be taken into consideration, or do you think that is not important?—I do not think it is worth considering, inasmuch that if a man can see a light at the proper distance—that is on the old test in clear weather—it stands to reason he will see the light proportionately, according to the mist, in other weather; and I do not think that the action of the mist on the light—say it makes a white light look a little yellow—could be taken into consideration as far as colour-blindness is concerned, because I think it acts on everybody who sees a light. Take a green light at night time and a mist comes down; if it is grass green, for instance, it may alter the colour a shade; and if it is a white light, say an electric light, it may give a little yellowish shade, and that sort of thing. I do not think it is necessary to extend the colour-vision test to foggy or thick weather, for the simple reason that there are so many states of the atmosphere that it would be very difficult to get the atmosphere in all its moods in order to test a man.



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328. (Chairman.) We are very much obliged to you, Captain Corkhill. I think we have exhausted the subject now, unless there is anything else you feel has

been left out?—No, I think you have covered everything that is material.

(Chairman.) Thank you very much.

The witness withdrew.

Mr. N. R. LEWIS, Deputy Superintendent and Examiner in Colour-Vision at the Board of Trade Mercantile Marine Office, Tilbury, called and examined.

329. (Chairman.) Will you tell us whether at Tilbury the cases are very frequent that are coming before you every week?—Well, not regularly, but at times they are, because some of the companies examine their officers once a year, and then we get a bit of a rush.

330. Do they ask you to examine them?—Yes. That is one of their rules. The officers of the Atlantic Transport Company are examined every year.

331. Whatever their age is?—Yes, including the masters.

332. Then does the Board of Trade carry that out?—Yes, we examine and give a certificate. Of course, if they cannot pass the Board of Trade test, they are no longer required by the company.

333. But if he has once got a certificate from the Board of Trade, he has always got that certificate?—The company demand that they shall have a fresh certificate annually. I mean the colour-test certificate, and not the certificate of competency.

334. (Chairman.) The Board of Trade give a man a certificate once, and after that they are merely acting on behalf of other people?—(Mr. Norman Hill.) Yes, they give him a certificate of competency, and whenever you please you can pay a shilling and be examined.

335. (Chairman.) Have you any record of your experience of failures?—Yes, but not on the colours. I have recently had two on the form-vision.

336. I mean, you do not keep a definite record of the numbers that have been before you since you have done this work?—We can always find that by reference to our issue of certificates.

337. Have you, in your experience, had colour-vision failures?—No.

338. Have you had any appeals?—No. There have been two appeals at Tilbury. But I was not examining on those occasions.

339. Roughly speaking, what number of cases have you had in your experience; I mean colour-vision cases? Is it a matter of hundreds?—No, not as many as that. I have been examining now from the 1st September, 1908, till the present time. But then I have been away ill for six months during that period, so that I have missed that part of the time. Roughly speaking, I should say we would get an average of about two a week.

340. So that you may have had something between 100 and 200 cases altogether?—Yes, probably.

341. And out of those cases you have not had any colour-vision failures?—No.

342. And you have had two form-vision failures?—Yes.

343. Then, in your experience, the colour-vision test is fairly satisfactory. At any rate there have been no failures. Are you pretty well convinced in your own mind that the wool test is a good test?—No; I cannot say that I do approve of it thoroughly from my experience. It seems to me to be a little too intricate for the ordinary man. It is not quite simple enough for some of these mariners; they generally get very nervous over it, and it takes them a long time sometimes. Of course it depends on the intelligence of the individual.

344. Are you fairly convinced that when it is over you have got at the facts?—I mean you have not let a man through, who is in any sense colour-blind?—No; we are always very careful about that.

345. You mean, it may confuse them and make them nervous. But you have no doubt whatever it serves its purpose?—They have never actually selected the wrong skeins. They have made blunders sometimes. They have sometimes put a yellowish green with an ordinary green. I know I had that experience myself, when I first went up before Captain Harvey.

Perhaps I was a little nervous and did not grasp what was wanted. I had had no coaching at all. But directly I understood it, of course it seemed very simple to me.

346. With regard to form-vision, was there any appeal in those cases you spoke of?—Yes. We submitted them to the principal examiner.

347. Did they fail?—Yes. The first man was absolutely failed, but with regard to the second man, I had a letter down this morning, as a matter of fact, saying that he could be considered to be passed under the new system. Of course, he had really failed as far as I could see. I suppose the principal examiner took his age into consideration, and that he was a sailor and not an officer, and said he might be passed.

348. Under the old test?—He failed under the new, but passed under the old.

349. And now he has been allowed to pass?—Well, he is away at sea at present. I shall have to look him up and acquaint him with it. I suppose, as a matter of fact, we should alter his certificate to the new form which he has passed.

350. Has he been re-tested, then?—No, not as yet.

351. Not since you saw him?—No, he was seeking employment. I might say that the P. & O. Company always, when a man is joining their vessels for the first time, require a certificate for form-vision and colour; and then, once they have had that, they do not trouble as long as the man remains in the company. This man was seeking employment, and was sent up to get the certificate from us if he passed. Well, he failed in the new test and passed in the old test, for which I gave him a certificate, and they accepted him under that, and he has gone to sea now.

352. With the P. & O. Company?—Yes.

353. That really was all that he was concerned with? It was not a Board of Trade question?—That is so. He might go into another company and get employment. That certificate is enforced by the P. & O. Company with regard to all their quarter-masters. They sign on as able seamen, but they are really quarter-masters. There are only eight of them, because the rest of the crew are mostly lascars.

354. And the P. & O. Company do not bring them up every year?—No.

355. Which company is it who sends them to you?

—It is the Atlantic Transport Company only. The P. & O. Company examine all their own officers.

356. Do you know anything of their tests?—No. I think they are something similar to the Board of Trade tests.

357. How is it they came to send you this man?—They always send their deck hands, but none of their officers. They know that the officers, on getting their certificates, have passed the Board of Trade examination.

358. And then they do the re-testing themselves?—Yes.

359. This is a question of a deck hand coming for the first time?—Yes.

360. (Mr. Norman Hill.) I would like to ask you a question about the new test. Do most of the men submit themselves voluntarily to the new form-vision test now?—Well, most of them do not really know that it exists, but we always tell them. In fact we put them under the new test, first; and then, if they do not pass the new test, we put them under the old test; but we tell them the new test will be enforced on the 1st of January 1914.

361. Could you give us any idea of the percentage of men who would be failed on the new test, but passed on the old test?—You are speaking of the form-vision now, I take it?

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[Continued.]

362. Yes, the form-vision only?—A very small percentage. I have had two. Of course, the new test, as far as I remember, has only been in operation since last November.

363. It would be a small percentage?—Yes, a very small percentage.

364. Sir Walter Howell told us it would be about ten per cent. Your figure would be less than that? He thought the new test would throw out about ten per cent. of the men who would now pass the present test?—We have not had sufficient experience to form an opinion on that really. As far as I have seen up to the present it would not be as high as that.

365. (Professor Gotch.) What age were these people chiefly whom you examined? Were they all below 30 years of age?—Are you speaking of those who failed?

366. No; the whole of them that you examined. Do you get people over 40 years of age?—Yes.

367. Do you get many?—Yes. This man that I failed was 45 years of age.

368. (Chairman.) Captain Harvey offered the opinion that some of the older men are able to do it better than the younger men?—Yes; I think they really are. I dare say a lot of it is attributable to cigarette smoking in the case of the younger men.

369. You are now talking of form-vision, are you not?—Yes. I suppose some of the old ones have never taken to cigarettes, and the young generation are smoking them heavily. I think it has a great deal to do with it.

370. (Captain Golding.) You say you do not think the wool test is altogether satisfactory. Now the present system is, I believe, that you put all the skeins on the table, and you show the candidate one skein and say "Pick out colours resembling this"?—That is so.

371. Do you not think it would be simpler, and give the candidate more confidence, if you said "Pick out four or five colours most resembling this"; because he really goes hunting for dozens of colours?—Yes. But I think in our instructions we are allowed to help the candidates. That is to say, we place the skein on the table and tell him we require him to pick out lighter and darker shades of the same colour. I generally select all the skeins that are required, and lay them by the candidate's side, and show him them first. I let him have a look at them, and then throw them back on to the heap. Even if he only selects five, you can always tell, by the way a man picks out the colours, whether he has any knowledge.

372. Seeing a man examined the other day, it seemed to me that if you told a man a certain number, four or five, you would prevent him hunting for very distant shades?—I do that. Referring to No. 5, for example, I tell them there are only four to select: the others of course have more.

373. (Chairman.) It is the case that, with some of the five test colours, there are a great many fewer skeins that are correct matches than with others. I forget which it was, but I noticed one test-skein to which there were fewer matches than to the others?—Yes; it would probably be No. 5, the yellow.

374. It is very difficult to set out and pick out 15 colours either lighter or darker, is it not?—There are not as many as that.

375. I think I have seen them pick out nearly as many as 12 or 15, have I not?—Well, they may be going into different shades then.

376. Supposing the number is 10 or a dozen, and then a person comes to a colour where there are really only about four or five?—I see what you mean.

377. If he is really very intelligent, he will know?—I never demand that from them. If they pick out four or five fairly quickly, I can see in a minute.

378. Then you have finished with them?—Yes.

379. Some of the testing we have seen is different to that. A man picked up to a dozen, and then he came up to some other colour, and got into a bungle. However, that is not the way in which you do it?—No, I am afraid we should not have time to do it in that way.

380. If a man produces you two or three of each set, you are satisfied?—Yes. If he picked two or three yellows, and could not find the others, I should consider he had passed No. 5 test. Of course, in the pink, there are a good many more shades than in the yellow; and that is the same in regard to the reds, &c.; therefore, I should require more of the latter in proportion.

381. Have you anything you would like to say to us from your general experience in the matter, that would be of any use to us, beyond what you have been good enough to say to us?—If I may express my own thoughts, I have often thought that a different arrangement could be adopted. That is to say, supposing, speaking of the most simple way, you get a glass cube, and put different coloured electric lights into it and fill that with steam; that would give you almost the exact conditions which prevail at sea, if the proper distances and sizes of lights were given, so as to resemble port lights and starboard lights and white lights. Really I suppose all the man wants is to know the lights under any conditions of atmosphere, and if a man can pick out those lights under those conditions, I cannot see what else he would want at sea. He does not want all the different shades of red. I believe it is argued that a green light is very much different in a fog; it almost becomes a white light, I believe. Therefore, if a green light could be shown to a man under those conditions, he would get the same conditions which prevail at sea. In my opinion it would be a very easy arrangement to put a kettle of boiling water there, and have your lights inside this glass box or cube, turn on your different buttons, and get a red, green, or white, and intensify the fog by letting in more steam and getting any conditions you like. I do not suppose it would be much more expensive than the one I have seen of revolving lights—Sir William Abney's little test.

382. (Professor Gotch.) That is conducted in the dark?—Yes.

383. Do you attach importance to its being conducted in the dark?—I do, because you could get all degrees of light and shade in a darkened room so that it would really provide you with every condition prevailing at sea, from broad daylight right up to evening and twilight and intense darkness.

384. You said, with reference to your own examination, that you had received no coaching. It struck me in this way; do these people get any coaching?—I believe some of the candidates do.

385. What is the coaching?—Well, the coaching would be to put them all through these wool tests.

386. You mean to say, they go to people to be coached?—The different nautical schools, I believe, coach them in colours, in the same way as they do in navigation and everything else.

387. Do they coach them in the wool test? Do they show them the wool test and coach them in that?—Yes.

(Chairman.) Thank you very much.

The witness withdrew.

Adjourned till Friday, 21st October, at 11 a.m.



## FOURTH DAY.

Friday, 21st October 1910.

## PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).  
 The LORD RAYLEIGH, O.M., F.R.S.  
 Sir ARTHUR RÜCKER, F.R.S.  
 Mr. RAYMOND BECK.  
 Captain THOMAS GOLDING.  
 Professor FRANCIS GOTCH, F.R.S.

Mr. NORMAN HILL.  
 Mr. EDWARD NETTLESHIP, F.R.C.S.  
 Mr. J. H. PARSONS, F.R.C.S.  
 Professor J. H. POYNTING, F.R.S.  
 Dr. WILLIAM WATSON, F.R.S. } Secretaries.  
 Mr. S. G. TALLENTS }

Dr. EDRIDGE-GREEN called and examined.

388. (Chairman.) We are very much obliged to you for being good enough to come and give evidence. You gave evidence before Lord Rayleigh's Committee some years ago?—Yes.

389. I suppose since that time you have been following the matter up in a variety of ways, and really new information is to be put before us?—It is a confirmation of my previous evidence. I have not found it necessary to vary in the minutest detail, either theoretically or practically, from the evidence I gave then. It has been confirmed by others in the most emphatic manner.

390. And we should find that also in the new edition of your book?—Yes, in the appendix. The body of the book has been very little altered, and purposely, in order, to show how little it has been necessary to change. I have added an appendix. I am writing a new book now on the whole subject.

391. Then you have been good enough to-day to give us just a sort of outline of the most important points that you think we ought to have before us in this inquiry. I will start with the summary—classification of colour-deficient persons. Will you tell us what the classification should be that we should take into account?—Colour-perception is quite distinct from light-perception. If we regard as normal—which is perhaps a little supernormal—a man who sees definitely six colours in the spectrum, there are various grades from that to total colour-blindness in an absolutely complete series. If you have a spectrum and isolate portions of the spectrum which appear monochromatic, the normal person sees about 18, those with diminished colour-perception see a less number. The first two or three degrees I do not regard as colour-blind for practical purposes. For instance, the man I call tetrachromic sees four colours in the spectrum, red, yellow, green, and violet. That man does not regard violet and blue as distinct colours. That is to say, you can get him to match spectrum violet and spectrum blue. He only regards the violet as a superior kind of blue, not as a definite colour, as it is to a normal-sighted person. I have not got my latest spectrometer here, chiefly for the reason that I am working with it every day, and I want to have exactly similar conditions in a large series of cases. If the Committee would desire it, I could bring the old spectrometer, which shows all the effects and is the one I had 20 years ago. The only advantage of the new one is, that it gives exactly, in wave lengths, the size of the monochromatic patch, and so there is a great saving of time. If you have a man who sees only 15 or less patches in the spectrum, a normal-sighted person sees included, in the monochromatic patch, colours which are absolutely different. We have eminent men belonging to the trichromic class, and they regard the spectrum as simply red, red-green, green-violet, and violet. I consider myself entitled to call such men trichromic, because they themselves declare that there are only three definite colours in the spectrum. They have no yellow, and no blue. As an example of how completely the sensation of yellow is absent in these cases, I may say that 20 years ago

Sir William Ramsay, just after my first paper on colour-blindness, spent the evening with me, and I tested him with a lantern in the garden. He never failed with red and green, but when I showed him yellow, he was always in difficulty over it. If I showed him red first, and then yellow, he said the yellow was green. If I showed him green first and then yellow, he immediately said that the same yellow was red. If I showed him the yellow alone he would say, "I cannot say what that is; it is either red or green, or perhaps it is that horrid colour red-green." The trichromics have designated those colours, yellow and blue, with their own nomenclature. Sir William Ramsay declares, as also does Sir J. J. Thomson, that red-green is a much better name than yellow. Therefore a person of that kind will be obviously very unsafe at sea, because he will be continually mistaking the top light, or any white light that comes along, for red or green; and this would be particularly likely to occur if there were any red or green light against it. As a matter of fact, Professor Nagel has devised an apparatus which shows how these cases make this mistake. They are shown a red and white light together, and emphatically call the latter green.

392. As to our classification, you draw a line somewhere as to persons who see so many colours?—I have never yet been able to get a man who sees four colours to make dangerous mistakes. He regards violet and blue as the same colour, and simply sees four colours in the spectrum; and undoubtedly he is colour-blind to a certain extent with the spectrometer. I have never yet got such a man, even if he has been very fatigued, or in any circumstances, to confuse the red and green and white lights. Therefore I regard a man who sees four or five colours in the spectrum, for practical purposes, to be normal-sighted.

393. And therefore safe?—Yes, and therefore safe. As a matter of fact, there are very few trichromics, tetrachromics, or pentachromics who can be caught by the Holmgren test.

394. Now, then, you deem the colour-perception necessary—you have been really dealing with that—to be such, that a man will recognise red, green, and white lights?—Yes. I exclude those who see three colours, two colours, or one colour in the spectrum, and those who have a shortened red end of the spectrum.

395. (Professor Gotch.) Would those men be unsafe?—Yes, they would be unsafe.

396. (Chairman.) They must not only distinguish such lights, they must state whether such a light is present, and be able to tell its colour by inference?—That is very important, because many men will match with absolute accuracy. Professor von Kries examined a case of mine, an ordinary dichromic, exhaustively with various apparatus. Professor von Kries was first of opinion that he was not a dichromic because of the accuracy of his matches with Holmgren's wools and Helmholtz's apparatus. I told him that the man was a definite dichromic; he was a dichromic in the sense of colour but not in the sense of the old theories. He was absolutely dichromic as far as colour was concerned. I said, "Try him with a match of red and

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violet against blue and green." Then the man made a match with very great satisfaction with a purple and a blue green. Professor von Kries said to the man, "You do not think that is much of a match, do you?" He replied, "That is the best match I have made this morning." As a matter of fact that particular man holds the record for accuracy of matching with Lord Rayleigh's colour-mixing apparatus. No normal sighted person I have ever come across could match so accurately. Yet it is said that the ordinary dichromic cannot make a match with the apparatus at all. That statement is wrong.

397. That in your opinion is a dangerous man?—He is. Directly he was examined with my lantern, he called a green light, red. It is exactly the same with Sir William Ramsay. If he does not name the colours, he will get through, but directly you get him to name the colours he makes mistakes.

398. You mean he can get through a matching test?—Yes. But he fails absolutely when you ask him to name the colours.

399. (Lord Rayleigh.) Did you not say just this moment that he laid a blue green against a red and blue mixture?—Yes. That is the special one that I mentioned.

400. That showed he did not succeed in making a match?—Yes. That is not the match that is usually given. Professor von Kries had not used that match himself.

401. I thought that was the most characteristic test of the ordinary dichromic?—I have a letter on the case from Professor von Kries. He gave me a letter stating it was plainly a dichromic case and not a reduction form.

402. (Chairman.) Are they dangerous persons who see less than four colours in the spectrum?—Yes.

403. Have you anything to say with regard to those who have the red end of the spectrum so shortened as to be unable to see a red light at two miles distance?—Many of them will pass the Holmgren test. They are simply shortened, up to a certain point in wave lengths, at the red end of the spectrum for bright light or light of diminished intensity. After that you can reduce the red, which is a little higher up, to the faintest possible red which you can see yourself, and he will see it; and yet a blazing red light, of a wavelength, say, below 700, will not be seen at all. The point I am working at now is to ascertain exactly the degree of the defect of shortening at the red end which should be rejected. With the lantern I show the terminal red, and I show a bright red which only consists of waves about 700, and a man of that kind does not see the red light at all.

404. Do you take the two miles as a kind of average distance?—I took the two miles from the Board of Trade Regulations. As it was necessary for a man to recognise at two miles, I noted this fact and arranged my test accordingly.

405. Then the third class are those who are "unable to distinguish between red, green, and white lights at the normal distance, through a defect of the cerebro-retinal apparatus, when the image on the retina is diminished in size"?—With any big object those are cases that will not make any mistakes. They will match correctly with an elaborate series of wools. With a light, say, at a distance of 100 yards there is a difference. Dr. Mott belongs to that class of case. He has passed the Holmgren test with me with the greatest ease, without making any mistake, and yet he could not tell whether you had a red, green, or white light on a track at 100 yards, or see a red golf flag. He will not see the colour of the golf flag at all, and fails with the lights. When examined with the lantern in the room he fails absolutely.

406. (Professor Gotch.) With a small aperture?—Yes; or even with a big one at that distance.

407. (Chairman.) There is a question about the dark-adaptation of the eye which, I think, must be considered. I am afraid I have rather missed that point. How long should the eye be in the dark before it can perceive a green light at two miles distance?—It is not required to be in the dark at all. But the

dark-adaptation undoubtedly does have an effect. I am making a special research on that now. A red light, for instance, seen in a state in which the eye was partially dark-adapted might appear as a white light. But when the eye is further dark-adapted, the red definitely comes out as a colour. In addition to the physical effect that the red rays are the most transmitted, the dark-adaptation seems to increase the red very considerably. That is probably one of the reasons why the red light is seen better than any other coloured light at night. I have been comparing lights of different luminosities in order to study that point, apart from the fact of the red rays being the most penetrating.

408. As to the individuals whom you have mentioned—for instance, Dr. Mott, who was the most recent—has Dr. Mott got good form-vision?—Yes, I think he has very good form-vision.

409. You have no reason to think he has not?—No, I should think he has.

410. Shall we come to your lamp test now, which will meet some of the principal difficulties?—Just as you please.

411. Perhaps we had better follow on the outline of your criticism about the wool test, and then see the lamp test afterwards. Well, now I come to the criticism of the Board of Trade test with the wools. The first point you say is, that it is difficult to obtain the correct colours?—It is very difficult. Professor Nagel has written on that question. I had some trouble at first in getting a special Swedish set which was absolutely correct. But the majority of sets that are sold are very bad sets. Professor Nagel condemns every set, but points out that the imitations, as is naturally the case, are worse than the original set. The Swedish set is undoubtedly the best.

412. The next point is, that the colours are liable to fade, and some more rapidly than others?—Yes, that occurs, and alters the colour of the wools.

413. Then you say that the wools get dirty, and that alters the colour?—That enables many a man to get through the Holmgren test. If you are examining a number of men, they have a habit of running the wool through their fingers, and a number of the normal-sighted people do that. Several colour-blind people who have passed the test have told me that some wools, though apparently looking the same to the normal-sighted person, could be seen by them to have been distinctly used more than the others, and they picked them out quite easily on those grounds.

414. Why was that?—Because those wools had been handled so much more continually than the others, and they had got dirtier, and that gave them a clue which enabled them to get through. That is especially the case when they are watching. That is a thing I object to strongly. Holmgren said it aided the test to let colour-blind people look on whilst others were being tested. But they notice those little points in the wools, which they would not have noticed if they had been kept in another room. Even in using my classification test, which is absolutely different in every respect from Holmgren's, and has no resemblance except that it has wools in it, I never allow the colour-blind to watch for that very reason. A very clever colour-blind person notices those minute details, and will get through in an astonishing way.

415. Of course, in the ordinary test they are not allowed to finger the skeins. I mean if there is anything in the way of serious handling, it is reported. But your view is that they are so quick that in merely selecting, they can do it?—Yes. A number of men will take the wools out, and they get soiled, especially the light greens.

416. The next point is, that the colour-blind can distinguish the green from the brown skeins, quite apart from dirtiness and so on, by touch?—That I have found too, and that has been mentioned by others.

417. Do you know at all what that is scientifically?—I think it is a difference in the dye. Many dichromics will get a set of wools and know every one of them quite easily by just practising with them for a time.

418. When you yourself have tested people with the wools, have you put them through all the tests?

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Do you put them right through?—I put them through the three tests. That is one point to which I have drawn attention. Holmgren said that when anyone passed the green test he was normal-sighted. But from the very first I pointed out that there were many men who would pass the green test—for instance, those who have a considerable shortening of the red end of the spectrum—quite easily, and yet would put a bright blue and a rose together. In the records of the Board of Trade you will see many things of that kind, where the green test has been passed, and on the rose test they have failed. Therefore, they would be passed as normal in the ordinary way, if you followed strictly Holmgren's instructions.

419. When you say you have passed certain people in the wool test, have you put them right through?—What I have done has been this. When I started with the subject, I made the man classify every colour, so that I might see if he made any mistake with any colour. Then I noted the colours which he made mistakes with, particularly with the special colours to be used for the tests. For instance, if the dichromic always picked out a certain green and called it red, I regarded that green as being a useful test colour.

420. Should you say the pure green test skein is a useless colour? It is a green diluted with white; it is not pure green?—It is a whitish green.

421. That is the one you are alluding to when you say that is useless?—It is useless in the sense that many of the dichromics pass it, and fail on the rose test. I am told that in America they are adopting the rose skein right away.

422. Then if he passes in that, he will fail later on, if the wool test is carried right through?—That particular man would. He would fail with the rose test; but there are very many who will go right through.

423. And that is your objection to the wool test?—That is my objection. My objection to the Holmgren test is the number of colour-blind people who get through, and also the number of normal-sighted people who are rejected by it. If, for instance, you were to reject a man who hesitated or took up a confusion colour, you would reject far more normal-sighted men than is done now. Professor Nagel says, he found there were 2.75 per cent. of men who made dichromic mistakes and yet were not dichromics.

424. Do you think, as a matter of fact, that among those who failed and who are found to be colour-blind, a proportion are normal?—You find nearly 50 per cent. seem to get through on appeal, and obviously those men were rejected wrongly.

425. But I am saying those who have been finally rejected on appeal?—That I could not tell you without examining them. I should think it is very probable. I am perfectly certain in one case that passed on appeal that the man was colour-blind.

426. As to those who are rejected on appeal, I understand you think a great many of them are normal?—That I should not like to say.

427. I beg your pardon: I thought that was your view, that a good many of those who had been rejected were really normal?—But those who get through on appeal are about 50 per cent.

428. There are other tests besides the wool test on appeal?—Yes, a similar test to my method. I cannot tell, whether colour-blind persons are still passed on appeal, I have no evidence one way or the other, as the Board of Trade have left out the details in their reports. I am sorry to see that they have done so. I thought it was probably because I drew attention to the fact; for the next year I noticed they left them out. For instance, they mentioned that one man who called a pink, green, and a green, salmon, and the standard green, neutral and blue, was passed on appeal. How he could possibly be normal-sighted and make those mistakes in naming coloured lights, having been an officer at sea, I do not know. I drew attention to that in the "Lancet" (May 26th, 1900, p. 1512). The next year I noticed they did not give the errors, so I could not criticise such cases again. But that man I should say most emphatically was one passed on appeal who was undoubtedly dangerous.

429. Do you remember the name of the man?—No. You can find out quite easily by looking at the reports of the Board of Trade.

430. Was it last year or the year before?—No. It was just before the Board of Trade left off giving the details of rejected candidates who pass on appeal. For instance, that man made half-a-dozen mistakes of the most glaring description in naming the coloured lights, and called a red, green, and yet passed on appeal. I have never yet come across a normal-sighted person who called a red light, green.

431. (Professor Gotch.) When was that criticism published in the "Lancet"?—It was ten years ago. I know that the Board of Trade no longer give the details. I criticised a number of details which showed in the most emphatic manner that the test was not satisfactory.

432. Have you got a copy of that criticism?—Yes.

433. (Chairman.) I dare say we could obtain it or get the reference?—I can look it up quite easily in the Board of Trade reports.

434. Then the test does not define the degree of colour-blindness. You say that an educated person completely colour-blind will do better than an uneducated person incompletely colour-blind?—Not completely colour-blind, but a more dangerous degree. Varying absorption in the eye and yellow pigmentation in the eye will make a man make many mistakes in the Holmgren test. An examiner would be bound to reject him. He may have only a shortening of the violet end of the spectrum, which, to my mind, is of no consequence, and yet he will make these mistakes. I do not know whether Lord Rayleigh would mind my mentioning him.

435. (Lord Rayleigh.) Certainly not?—Lord Rayleigh has a shortening at the violet end of the spectrum, and there are many men who are exactly the same as Lord Rayleigh is and who have failed. In fact, it would rather interest me to see whether Lord Rayleigh would make any errors with the Holmgren test. The selections made by a person with shortening of the violet end of the spectrum appear correct to the normal-sighted when viewed through a yellow glass.

436. (Chairman.) Finally, you say, it does not detect central scotoma?—A man with central scotoma is quite able to recognise a coloured object when it is large; but when it is small he makes mistakes. When the object is diminished in size the man makes the mistakes. Such a defect emphasises a slight degree of shortening of the red end of the spectrum; any deficiency will emphasise that.

437. You say you have taught an uneducated colour-blind person to pass the wool test in five minutes?—I had one uneducated colour-blind man who made all the ordinary mistakes at first, and, as I have described in my précis of evidence, I taught him in five minutes to pass it. He was examined afterwards by one of the most expert ophthalmic surgeons in London, Mr. Adams Frost, who has written a good deal about colour-blindness, and he could not get the man to make the least mistake.

438. Would you infer from that, that you could take any ordinary uneducated colour-blind man and teach him?—No, I could not. You want a smart man; you want a clever man to do it.

439. You mean uneducated but cute?—He must be cute. Colour-blind people as a rule are far above the average in intelligence.

440. I mean, there is an office boy here, who is colour-blind. You would not undertake to teach him to pass a colour-test in five minutes?—No. Dichromics vary. That is one of the most important facts, not only from the theoretical but also from the practical point of view. The dichromics are not all the same. They are not all equally colour-blind. One dichromic is so colour-blind that any colour test, no matter how bad, would detect him. For instance, I published a series of cases in a paper which I read at the Royal Society about two months ago. One dichromic will divide the spectrum into two patches; another will divide it into three, four, five, six, seven, or eight. When you get to a man who is intelligent, and can divide the spectrum into eight patches, and yet who

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is a dichromic, he is a very difficult man indeed to detect by almost any test. Those are the men who go, perhaps, 12 years to sea, or are perhaps 20 years on the railway, and are examined repeatedly and cannot be detected.

441. Do you think they are dangerous?—Yes, they are dangerous. You can demonstrate easily with my lantern that they are dangerous. But many people could examine them for hours in different ways and not be able to find that there was anything wrong. They have eight distinct differences in the spectrum, and those eight distinct differences are sufficient to enable them to pass a test. A normal-sighted person could do the same with two colours, a blue and a green. We could, by making varying degrees of the amount of blue and green in the colours, designate, say, one as red, one as green, one as yellow, and so on. Such cases name colours and match colours in a similar manner.

442. Have you any such persons now under your supervision? Could we get at a person of that sort?—Yes, I think you could.

443. Who would, as you say, escape the ordinary test?—Yes.

444. And your lamp would catch him?—Yes, it would catch him instantly. It is simply this: with the lamp he cannot tell the different intensities of the light.

445. (Captain Golding.) You tell us how you deal with people with a shortened red end of the spectrum, and that your apparatus will detect a person who is dangerous. How does it tell the green-blind person?—There is really no such person as a green-blind person.

446. I am going by the book?—That is absolutely wrong.

447. Well, a person who cannot detect a green light?—He may have absolutely no defect of light perception. A person with shortening of the red end of the spectrum may not see the red light at all. When a dichromic sees a blue-green light he calls it white. I have had men who have been colour-blind, and yet have been able to see all the colours, as far as light was concerned, at twice the normal distance.

448. That is what I want. Would your apparatus be able to detect the person who would call the green light white?—Undoubtedly, it would do so at once.

449. Would it also show the extent to which such a mistake would be dangerous?—Any man who has such a defect that he calls a white light, green, and a green light, white, I think must be rejected.

450. But are there degrees of that?—There are degrees of dichromic vision.

451. (Chairman.) Would you have any objection, after we have done the lamp test, to taking two boys through the wool test?—No, I will do it with pleasure.

452. I do not mean our wool test?—No. My wool test is an absolutely distinct thing altogether. It is so distinct that there are practically no two points in which it agrees with the Holmgren test.

453. (Professor Gotch.) May I ask a question before we go to the lamp test? Is it advisable, in your lamp test, for your work to be done in a dark room?—It is not at all necessary. It can be done in a dark room or with a certain amount of light.

454. Would you regard it as being satisfactory in a room like this?—No. You should have this room darkened.

455. That is rather an important point?—Yes.

456. (Mr. Parsons.) Apparently you have a wool test as well, and before we go into the practical part, would it not be well, if you are going to show the wool test, that we should know how it gets over the difficulties of the Holmgren test?—It does not do so completely.

457. Then is it of any value at all?—Yes. It will detect a very large number of colour-blind people and does not reject the normal-sighted people in the same way as the Holmgren test. I have tried to meet the difficulties in all the ways I could. But I find it is quite impossible to make a wool test that is absolutely satisfactory. Even this pocket test which I have, which is one of the most difficult tests, is one that some men

will still get through. It is astounding to most persons that it should be so.

458. That is apparently a preliminary test. Do you place reliance on it?—I place reliance only on the spectrometer and the lantern.

459. (Professor Gotch.) Does your wool test limit the amount of the spectral image?—The colours in the pocket test are small.

460. You get over the limiting difficulty in the pocket test?—Yes. I have tried to get over all the difficulties I could. For instance, I have used the colours that the colour-blind people make most mistakes over, and I have excluded those that they do not usually confuse. Black and white are very important colours, and they are not in the Holmgren test. A man may call a white, green, and a black, red. They are very important colours in the test.

461. (Chairman.) Would you mind showing us the wool test first?—No; not at all.

*Two boys, A. T. Ruby and E. Sale, were then called and tested by the witness.*

*Ruby was first put through the classification test invented by the witness, and was asked to select skeins lighter or darker than the test-skein in each case, but of the same colour.*

*With the orange test-skein he placed five skeins varying from orange to yellow, and one of a degraded fawn colour.*

*With the purple test-skein, which he described as blue, he placed three blues, two mauves, and eight purples.*

*With the red test-skein he made a number of matches, which appeared to the Committee to be correct. But the witness stated that one of them was an orange.*

*With the green test-skein he placed one green and five brown skeins (three fairly dark and two light).*

*Tested with small circular glasses, he matched a yellow glass with red. He also described a pale yellow card as green, and a green silk as red.*

*The following examination took place during the test:—*

462. (Professor Gotch.) Do you use these fine silks on the ground of feeling?—No. I find some colour-blind people whom you could not detect if you only used wools with these methods. But by adding silks a man would detect them. It is the same with the lantern. For instance, if I show a light and he hesitates very much about it, the method I have adopted is to tell him to pick out a number of similar colours from the box.

463. (Mr. Parsons.) Are you satisfied with the second test of the wools?—No, they are wrong. The boy put dark yellows with the orange. When you see this colour is taken and this colour is overlooked altogether, it is obvious he is colour-blind. The boy calls this silk "red" (showing a green), and yet he has not put it with the red test-skein. That is exactly the answer I expected to get from him. That one answer is more important than any other part of the test, and demonstrates the value of colour names. Anyone who calls that red is obviously incompetent.

464. (Chairman.) Before we leave the wools shall we take the other tests?—Yes. This test (showing his wool-test) will detect many more colour-blind persons than the Holmgren test. This again (showing his pocket-test) will detect still more. But there are colour-blind people who can get through that test. Therefore one is obliged to have the lamp.

(Chairman.) Then we will have the other boy and go through his test.

465. (Captain Golding.) Just one moment, Sir. When you showed that boy a green he called it red?—Yes.

466. That does not agree with what you told me a moment ago?—I object strongly to the classification of red-blind and green-blind persons. First of all I object because it does not fit in with the facts, and it is based on a theory which is not correct. The point is that, as far as light is concerned, the light perception is in many of these cases the same, and the luminosity curve agrees with that for normal sight. But they cannot tell the difference between the two colours. With my



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spectrometer, they include the red, orange, yellow, and half of the green as one colour. The point is that he does not see much difference between them. He is judging by luminosity or some slight difference.

467. The question I put was with the object of finding out if your apparatus would detect that, with the person who called the green the wrong colour?—Anyone who called a green a red?

468. Yes?—Anyone who calls green, red, must be rejected. If, for instance, a man at sea looked at a green light and said to himself it was red, and if he did it from ignorance, he would be just as dangerous as if he were colour blind. I have never yet come across a man who through colour ignorance has called red, green, or green, red.

469. (Mr. Norman Hill.) They do not distinguish between the two?—No; they see no difference between the two. In fact, in many pseudo-isochromatic tables in which you have to read red letters printed on a green ground, the whole looks uniform to the red-green blind (dichromics); they cannot see any letters or reading on it at all. It is not that green is seen in one case or red in the other, but the whole appears to be absolutely uniform.

(Professor Gotch.) I think the difficulty you are putting is this, that, supposing you had a pure green in the spectrum for a colour-blind person, and had no other, and had a screen and put a book on that screen, the colour-blind person would be able to read that book. It still gives him that sensation of light.

(Captain Golding.) What was certainly conveyed to me was that a person who could not distinguish green could only see it as white.

(Witness.) Dichromics vary in this way. When they are shown the spectrum, some can only see a tinge of red at one end of the spectrum and a tinge of violet at the other, and the whole of the centre of the spectrum is white. These call orange, white; green, white; and blue, white. Then, with the ordinary dichromic, the colours meet in the centre of the spectrum, and there is only one little point they call white, and that is the neutral point. One colour includes the red, orange, yellow, and half of the green. They would not call the colour white (as distinct from yellow) unless you got an equal mixture of the two colours on either side.

(Lord Rayleigh.) But no one could possibly call that white. It would be much too dark.

470. (Captain Golding.) I am only dealing with the answer which the witness has given to me.

(E. Sale was then tested.)

(Witness.) Shall I try the boy with this card (showing his pocket test)? I will ask him to point out all those which have got any red in them, and go right through from the top to the bottom.

(Sale picked out the reds in the pocket test to the witness' satisfaction.)

(Witness.) Now point out those that have got green in them.

(Sale passed over several green wools.)

He says there is only one green there. That boy is rejected on that. I will now ask him to go all through them and point out any patches that have any green in them, and then point out those which have only one colour—all different shades of one colour.

(Sale correctly picked out the patches containing green, but failed to pick out a patch containing only one colour.)

(Witness.) This test is used with the cards all separate: they are set out on this card just to show the test.

(Sale was then put through the classification test, and chose correct matches in each case.)

471. (Lord Rayleigh.) I think we should have to pass that boy?—Yes, undoubtedly you would. I think the first slip was on the pocket test. He did not go through that.

(The room was then darkened, and the witness proceeded to test the two boys by means of the Edridge-Green colour perception lantern.)

(Ruby was shown a green and called it a yellow.)

(Witness.) You see, he is rejected straight away.

(Ruby called a green a yellow, and a red a yellow.)

(Witness.) You see, he is rejected at once, emphatically; he calls that yellow and the green yellow.

(Mr. Nettleship.) Will you put a much lighter one than the first one you showed, and then give these other lights afterwards? May we have those, and then see what he says they are?

(Ruby was shown a yellow, red, blue, and green, and called the green, red.)

(Witness.) That is perfectly clear. With this test he is detected much more emphatically and much more easily than by the other.

(Ruby was then shown a different-sized aperture, and named the yellow correctly, but called the green, red.)

(Professor Gotch.) Do you make a small aperture?

(Witness.) No, it is unnecessary. In the majority of cases you can generally detect nearly every dichromic with one turn of the wheel. You can get different apertures.

(Mr. Nettleship.) Would you give us colours with the small apertures?

(Witness.) Yes (doing as requested). These very small apertures are not suitable unless you have a dark-room.

(Mr. Nettleship.) May we have the next size above that?

(Witness.) Yes.

(Ruby called a red a yellow.)

(Mr. Norman Hill.) Will you repeat it, but much lighter at first.

(Ruby named the yellow and red correctly.)

(Sale was then brought in, and named red, white, yellow, green, blue, then red and blue again, correctly; later, he called a pale violet, a white, and a blue, a green (afterwards amending his answer on being shown the light again). He also called a yellow, a red.)

(On being requested, the witness put the colours on the largest disc.)

(Witness.) The blue and purple are not test colours. I mean, they are only for information, and a man is not rejected on them. Even with a comparatively slight shortening at the red end of the spectrum the observer cannot see that bright red at all. I had an example of this in a boy who went up for the Navy and was rejected with the lantern. Then he passed the Holmgren test several times outside, and I examined him and he passed the pocket-test. Then he looked at that light (showing a red), and said there was nothing there—he could see a circle and there was nothing there. His father was absolutely certain he was normal-sighted until he saw that, and then he recognised that the boy was not fit for the Navy.

(Professor Gotch.) That is the light which you speak of as using in the paper you wrote.

(Witness.) Yes. This is the actual light I use. The rays are nearly all below 700. If I wish to make it more certain still, I can add a blue. This light I am showing now is an extreme red.

(Professor Gotch.) Do you see that light?

(Sale.) Yes.

(Mr. Nettleship.) Might we have the other boy on this particular test?

(Witness.) Yes, certainly.

(Chairman.) We will send for him.

(Ruby was then recalled.)

(Chairman.) Is this the right distance to put him from the lantern?

(Witness.) It should be about 20 feet—from 15 to 20 feet.

(Mr. Nettleship.) Would you show him that very dull one?

(Witness.) Yes.

(Ruby was shown a red and named it correctly.)

(Mr. Nettleship.) You did that by grading. But will you let us have a light one first.

(Witness.) Yes.

(Ruby was shown a white and called it red; he was shown a red and called it green; he was shown a blue and called it red.)

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(Witness.) The boy says red is green and green is red.

(Professor Gotch.) Could you give us a large and a small disc?

(Witness.) Yes.

(Ruby was shown a green and called it red.)

(The boys then withdrew.)

472. (Lord Rayleigh.) You spoke several times of the numbers of the colours that different people can see in the spectrum. It would be desirable that we should have it on our Minutes what exactly you mean by that. I know what you mean, but I think it does not appear from the answers you have given hitherto, how you would decide what number of colours people would see in the spectrum?—I first of all would show a part of the spectrum—say orange, yellow, green, and a piece of red—and then the ordinary dichromic will say he simply sees one colour there.

473. It is a piece of the spectrum?—Yes. Obviously it does not do to start at the end of the spectrum, because everybody will try to go through the ordinary sequence of colours, viz., red, orange, yellow, green, and blue. Another man, who does not see orange, will say that he sees in that portion of the spectrum, red, yellow, and green. Then the trichromic will see red, red-green, and green, and no yellow. A man is obviously trichromic who only sees three colours.

474. Would you trust an ordinary observer to say that he saw no yellow in the spectrum, although he knows in ordinary parlance there is yellow in the spectrum that he does see?—They generally use some qualifying remark. I should see that a man hesitated over it. As a matter of fact, with any good observer, you are not on the look-out for trickery. You can easily guard against that. For instance, nearly everybody who comes to me wants to see seven colours in the spectrum, and it is quite easy to show that most normal-sighted people only see six colours. I rather encourage them to try to deceive me on that, in order to find them out with the spectrometer. A man who sees seven colours, just as Newton did, marks out the spectrum in a different way. His blue goes right into our green. The following is an important point. If we take his indigo and blue, and bisect each, and join the centres, we have the normal blue; showing that the blue has been split up into two colours by the process of differentiation in the course of evolution. A man who has five colours, has his yellow in the position of the orange-yellow of the normal-sighted. That is to say, the D-line is yellow to him. But when this colour splits up into two fresh colours, we have the orange and the yellow in quite a different position; and the monochromatic patches correspond.

475. You told us, I think, that you know of candidates who could pass the wool test as prescribed by the Board of Trade, and yet who ought to be disqualified. Do you mean that they would pass it by a trick, for instance, by noticing which wools had been handled, or judging by the feel. Do you mean that, if the Holmgren wool test were judiciously used, there would be some who would pass it, and who ought to be disqualified?—There are some people who may pass the wool test even if they are examined in an ultra-particular manner; that is to say, examined by a much more difficult method. I had two officers who belonged to the Navy who were like that. There was one whom Mr. Nettleship examined and passed.

476. (Mr. Nettleship.) I saw him, but under rather unfavourable conditions?—Well, I think there will be no difficulty in getting hold of him again, and having him examined. There is also the case of that boy I have just mentioned, who had shortening of the red end of the spectrum, and yet he could pass the pocket test.

477. (Chairman.) Could we have that boy up?—I have got his name and address, and I should be only too pleased to give it you in that case, or in any other cases. Dr. \_\_\_\_\_ is another who is quite unsuitable, and yet has passed the wool test.

478. (Lord Rayleigh.) Is that on the ground of a shortening?—No, he is a trichromic. Nearly all those get through.

479. So you would maintain that, although the red end of the spectrum was not shortened, the candidates might pass the wool test judiciously used, and yet ought to be disqualified?—Yes, and Professor Nagel has come to the same conclusion with regard to the trichromics. Nearly all the trichromics get through. Sir William Ramsay can get through the Holmgren test, so long as you do not ask him to name the colours. He will pass, however careful you are, and he did so before the Colour-Vision Committee of the Ophthalmological Society.

480. In the case of Sir William Ramsay, how did you test him afterwards for the trichromic failure?—With the spectrum and with the lantern. He failed absolutely with the lantern.

481. What are the colours he actually fails over?—Over the yellows and blues.

482. What does he call them?—The yellow he calls red or green as the case may be.

483. And you absolutely failed with the Holmgren test to find that?—Yes, and so did the Committee I have mentioned.

484. And nevertheless he succeeded in passing the Holmgren test?—Yes. But when he had to name the wools, he would call a yellow, red. I have found the following a very useful method with all trichromics. In the case of Sir William Ramsay, if you took a red and a green skein of wool, and put a yellow skein across from one to the other, he would say that one end of the yellow was red and the other end was green.

485. Have a great many people been tested alternately by this method and the Holmgren test side by side, or, rather, one after the other?—As may be seen from my book, I have tested a very large number of men with every method that I could obtain. In some instances I spent several weeks over one case. Then I made a careful note of each error that a particular class made; for instance, the particular shade of green which the colour-blind call red.

486. (Chairman.) You say in your book that Sir William Ramsay never confuses red and green?—Never. You get him to confuse yellow with either, but not red with green.

487. (Lord Rayleigh.) But why should Sir William Ramsay be disqualified?—Because he would be hopeless for the white light. Professor Nagel has been testing them, and finds that the trichromic cases must be excluded. I find the same thing; when shown one light, the man is absolutely uncertain. He may have seen a green light just before, and he will call the next top light he sees, red.

488. (Sir Arthur Rücker.) Have you in mind lights under practical conditions?—I have spent night after night on the bridge, watching the lights in order to study them from that point of view.

489. (Mr. Raymond Beck.) To distinguish the position?—You cannot tell the position at all. You simply see a light. I have also been on the engine in order to study the lights from that point of view.

490. On the railway?—Yes.

491. (Lord Rayleigh.) If a man never made a mistake on the railway about the red and green lights, might he not pass?—I should never like to pass a trichromic, because if a signal light for some reason got broken on the railway then there might be an accident. On a railway it is particularly dangerous, because they have a group of red lights and one green for the train to go through; a white opening in the centre would almost certainly be taken for a green light. I think trichromics must be definitely excluded. If I could test a few trichromics, or if you could see a few like Dr. \_\_\_\_\_ or some others tested, you would see with the lantern how dangerous they would be. Professor Nagel has now come to the same conclusion.

(Lord Rayleigh.) Then another point I should like to ask you about is this: You show coloured disks in your lantern, and Sir William Abney's lantern shows a coloured square.

(Dr. Watson.) First a square and then a dot.



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492. (*Lord Rayleigh.*) Has your way of exhibiting the colour any advantage over Sir William Abney's apparatus?—The method he has adopted is not the same as he recommended previously. I do not know the methods that he now uses, except from the reports I have seen. But they seem to me to be very similar to mine, showing spectral lights of varied intensity. They are not the methods recommended by the Royal Society Committee. Their method was to pick out the neutral point, and the trichromic has not got a neutral point. In fact, I took three cases of colour-blindness to Sir William Abney and he passed them all.

493. As far as you know of people who mix up red and green, do you think there is any advantage in using spectral colours rather than glasses?—I think there is no advantage in having a spectral light which is flickering. It is better to have a similar light to that used on the railway and at sea, and to have compound colours—you know exactly the spectral composition of the colours—and to have the green, which is the ordinary green which the sailors use. It is far better than using a spectral colour, with which, in order to be efficient, you will have to mix another amount of spectral colour.

494. Do you not use two glasses?—Yes. Or three or four.

495. Why is there a greater objection to mixing spectral colour than to mixing with glasses?—Because in the glasses you have exactly what you want, and you have the correct colours. You do not want a spectral light, and it is much more likely to confuse people when something which is quite foreign to them is used.

496. If you use a red do you think they could tell if it was produced by absorption through glasses?—No. A mixed spectral colour with a rim of one of the component colours round it is not satisfactory.

497. I do not see that it should confuse him in one case more than the other, if he does not know the source?—There seems to be no object in using a complicated apparatus when a simple one answers perfectly.

498. That is another question?—The lantern, for instance, could be very easily used out of doors. For instance, diminishing the light with a neutral glass is a much better method than with sectors, because many complicated phenomena occur with the eye with intermittent light.

499. (*Mr. Parsons.*) There is one point about this group of dangerous persons which I should like to put to you. One rather gathers that you have a class which do not belong to them?—Undoubtedly there are.

500. And if there is a large and important class of that kind, it will have to be taken into consideration?—Yes.

501. (*Mr. Nettleship.*) Do you think Sir William Ramsay would come here?—He came to me.

502. He allowed me to examine him by himself once, but that is not the same thing as coming before a Committee?—But you passed him.

(*Chairman.*) We can ascertain if he will come.

503. (*Mr. Nettleship.*) Then with regard to the boy with the shortened red end, whom you tested with the lantern, you will try to get him for us?—Yes, it would be perhaps better if I gave the name to you.

504. Going back to the three colours, I understand that Sir William Ramsay cannot be detected by a wool test, leaving out the strict methods?—Undoubtedly, when he does not name the colours. If you use names, you can detect many more colour-blind people.

505. I am rather concerned to make out clearly whether you think there is any wool test which is actually as good as a lantern. I rather gather that, if names are allowed to be used, there would be no difficulty even with trichromics?—I have told you what Sir William Ramsay said, when we put two skeins side by side and another one across them.

506. Therefore a wool test is quite practicable as a trustworthy test?—No. No wool test is as trustworthy as my lantern.

507. For dangerous persons, except for shortened red end ones?—One objection I have is, that a normal-sighted man may make a number of mistakes. I had

a case, only the other day, of a seaman who came to me after he had been rejected as green-blind. I examined him very carefully before I made up my mind. I found he was normal-sighted. He was a six-colour man. Then I told him he could pass the Holmgren test. He said "I was told I was green-blind, and I thought there was green in the colours which I could not see."

508. In your lantern test, you have no provision for simultaneous contrast?—No. Successive contrast is better.

509. Still, in actual practice at sea, a man has very often to see a great number of lights. Would it not be better to have something which would enable you to see two lights side by side?—If there were two lights side by side, this would enable certain colour-blind persons to pass.

510. You spoke of the yellow discolouration of the eye. Had you anything in mind when you did so?—Yes, yellow pigmentation of the lens.

511. Then you do not attach much importance to the wool test not detecting central scotoma? That is to say, do you think cases of that are common, in which the form-vision is not also defective?—Yes, they are. There are a number of cases where the form-vision is all right.

512. The form-vision is all right?—Yes.

513. In what sort of cases?—In the cases which Professor Nagel has called dichromatic fovea with trichromatic periphery, and in some cases of scotoma from disease.

514. (*Professor Poynting.*) Do you find that, with the change in intensity, the judgment as to the name of a light alters?—With the colour-blind, decidedly so.

515. You have got precisely the same glass in, and the light is brighter or darker?—What you find is, that if you have a monochromatic patch in the spectrum, which includes two colours, the name of the colour which is usually the brightest will be applied to the second colour, when it is made specially bright.

516. That is not quite my point. Supposing you double the brightness of the light, keeping the glass exactly the same, will the man name another colour?—Yes, very often, because, for instance, he will call a bright red, yellow, and a bright green, yellow.

517. (*Professor Gotch.*) Have you ever come across any cases that one might term borderland cases between the trichromic and the tetrachromic?—Yes.

518. Do you regard those as dangerous?—Yes, all cases that I should call trichromic.

519. But I mean borderland cases between trichromic and tetrachromic. Have you ever come across them?—Yes, there are many such cases.

520. What is a borderland case?—A man who has once seen yellow definitely will obviously belong to the tetrachromic. A man who says there are only three colours in a bright spectrum is a trichromic.

521. Then are the borderland cases, in your opinion, those in which the man is dependent on the size and intensity of the yellow illumination, so that when it is faint and small he is uncertain?—Yes, to a certain extent. But a man whom I should regard as a trichromic is the man who sees three colours only.

522. He makes no mistake with red and green?—That is so.

523. But will make a mistake in yellow. But a tetrachromic, a borderland case, will mistake yellows when those yellows are either very faint or small?—Yes.

524. Those are not mentioned here, and you regard those as dangerous?—Undoubtedly. They will be rejected immediately with my lantern. They are included in my third class.

525. I see you have been working on this question of dark-adaptation. Do you find that that makes any practical difference to your conclusions as to the dangerous character of trichromics and tetrachromics?—No, it only confirms them.

526. I do not quite understand what you mean by "only confirms them." Do you mean that the dark-adaptation in your later experiments makes no difference to the perception of dull reds?—No. The dark-adaptation makes the red brighter and brighter.

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527. Did you expect that?—That is mentioned by Burch. It is an important effect.

528. That is your experience?—Yes.

529. Does it make the green worse?—The green seems to remain very much the same. This is how I did it. I had a colourless spectrum, first of all, which I watched in the dark room and the green was the first colour to become visible—a miserable and dull sort of green I saw in the centre;—but as dark-adaptation went on, the red, which could not be seen at all before, began to spring out, and became stronger and stronger, until it was an infinitely superior colour to the green.

530. Have you done it with a restricted field?—No, only with an ordinary spectrum.

531. That was not quite my point. My point really was whether, with the restricted field, that is to say, with a restricted light and dark-adaptation, the appreciation of red became any better. I do not know if you have done the experiment?—No; I must do it.

532. With regard to your lamp, is it one which any ordinary person could work with ease?—I do not think anybody could test colour-blindness with ease.

533. Can your lamp be worked with ease or without special knowledge?—All tests of colour-blindness want special knowledge. But I think my lamp requires less than anything else. I think the examiner ought to thoroughly understand it.

534. We were told that one of the advantages of the wool test was, that the opinion of the examiner could practically be given by cutting the various matched wools off, as indicated there, and sending them up. How will you propose that such a result would come out of your lantern test so that it could be forwarded to the Board of Trade officers?—You have all the glasses numbered. You know what the slides are, and you would only have to record the combination of the colours.

535. You would make the candidate write on this each time what the colour was?—You could do that, or examine him in the presence of someone else. You could have a friend if necessary.

536. (*Captain Golding.*) I should like to ask you one practical question. Will you lend me your three skeins of wool—red, green, and yellow—so as to better illustrate my point? You said, if I understood you correctly, that with Sir William Ramsay, if you put a green and red skein some little distance apart from each other, and then put a yellow across from one to the other, he would call one end of the yellow skein red and the other green?—Yes.

537. Supposing it was a vessel's masthead and there were two side lights. He sees all the three lights, and they are all in view at once—two being side lights, and the masthead light. Would that tend to make him call the green red and the red green?—No, they never confuse the two.

538. You said with the yellow across like that, he would wrongly call one end of the yellow skein green and the other end red?—Yes. The point is that simultaneous contrast is increased in the colour-blind, as they have only certain colours. It was a fact I obtained through my theory.

539. In practice it would not affect the colour of the lights?—He would very likely say a yellow was a green if he saw it against a red.

540. But seeing all three, it would not confuse him?—No, it would not.

541. (*Mr. Norman Hill.*) Could you tell me, with regard to the first boy whom you examined to-day, if you would have failed him on the wool test?—Yes.

542. Would you have failed him on the orange test?—Yes. He did not pass the orange.

543. And would you have failed him on the red?—The red was the best he did.

544. And then the greens he mixed with the browns?—Yes, but he put a very different colour with the orange.

545. Would you have failed him for including that one?—Yes. I mean no normal-sighted person ought to have put that with the orange.

546. I think I should have put it there?—But that is the objection I have to the wool test. Normal-sighted people do do that.

547. It was quite clear with your lamp he could not tell red from green?—Yes.

548. But did the fact that he put a particular skein on the orange lead you to conclude that he would fail in that way?—Yes.

549. I could tell his mistakes from the lantern in a minute, but I think I should have put that skein along with the orange. Would you have passed the second boy on the wool test?—He passed the classification test but failed with the pocket test. Several points were not satisfactory, such as naming one green and leaving two other greens. But of course he was not like the other boy.

550. (*Chairman.*) Did the second boy break down in the lantern test?—Yes. That is the sort of boy whose case you have to go into very carefully. He called the yellow a red.

551. (*Mr. Norman Hill.*) That was the only mistake with the lamp, was it not?—No, he called the blue, green and the green, blue.

552. But he never confused the red and the green?—He made several mistakes. The green he called definitely blue.

553. (*Chairman.*) I should have done the same. I mean a good many of us said that the blue and red were extremely difficult?—That is very common. In a case like his, I should have got him to pick out a number of wools or coloured objects which matched the colour of the light. I would make absolutely certain of the idea he had in his mind as to the colour he was seeing, and would go on with him till I was satisfied whether he was normal-sighted. For instance, if he picked out reds, and began to pick out other colours with them, and make obvious mistakes of colour, then I should reject him. Undoubtedly those are border-line cases, especially when I allow a man who confuses blue and green to pass.

554. (*Lord Rayleigh.*) Does it come to this, that in some cases you can supplement the lantern test with a wool test or something similar?—The method I prefer is the spectrometer. I use the lantern in the first place, and then the spectrometer. I go at once to the spectrum when there is the least doubt.

555. (*Mr. Raymond Beck.*) Referring to the first boy in the wool test, I think I am right in saying that, as regards the red and green heaps, he made no mistake in putting a red wool with a green, and a green wool with a red?—That is so.

556. Therefore, from a rough and ready point of view, it would appear to me that, till you lifted up the green silk and asked him what the colour was, and he then said it was red, the boy was all right. That was the first boy. Were you prepared for that answer?—Yes.

557. That is quite a common thing? If you had said "Take this and put it on the right heap," you think he would have put it on the red heap?—He would have taken it over to the red heap, and then rejected it, and put it back here.

558. In both those tests you have had to-day, do you consider the subjects unsafe?—The case of the second boy I should have to go further into. For instance, in going through the pocket test he certainly failed right away. That is to say, he picked out one light green. He failed on that, and he failed on the lantern test. But he only had about half-a-dozen questions, and I like to ask at least twenty. What I should want to make out, and should make out absolutely in my own mind, would be that he was not making those mistakes either from nervousness, or as in a case I will give you. A mercantile marine officer came to me, and I examined him very carefully before I decided that he was normal-sighted. I heard that he went up soon afterwards and passed without difficulty. On the Holmgren test he had picked out nearly all the confusion colours, and yet he was normal-sighted.

559. (*Chairman.*) I suppose you can give us some reference to Professor Nagel's articles?—Yes, I will do so, with pleasure. I think he has written about twenty. I meant to mention those, when you were asking for cases. There was one surgeon on the Brighton Railway who told me he had had 13 or 14

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cases which passed the Holmgren test and failed with my lamp test. They had previously used the Holmgren method. Now they use both. Some of those cases might be interesting. There was a case only the day before yesterday. A surgeon told me that several persons had examined a man by the Holmgren method, and he passed, and then they tried him with my

lantern, and the first colour they showed him was the yellow, which he called green, and he was failed at once. Before that he had been considered normal.

560. Will you be able to leave us your lamp?—Yes, with pleasure.

(Chairman.) We are very much obliged to you for coming here to-day.

The witness withdrew.

After a short adjournment,

Mr. L. STROMBERG, R.N.R., Superintendent of the Mercantile Marine Office, and Examiner in Colour-Vision to the Board of Trade at Hull, called and examined.

561. (Chairman.) We are much obliged to you for coming. Would you mind putting a candidate through the test? Some of the Committee have not seen the ordinary process, and if you will kindly go through it in the ordinary way, we shall be very much obliged?—I will do as you wish.

Ruby was then called and put through the wool test. He was first asked to pick out all the colours to match a green. After he had endeavoured to do as requested, the witness showed him the green wools which he wished him to select, and put them back into the heap. Ruby then picked out two greens, a brown, a green, a dark brown, two greens, two browns, and a green.

(Captain Golding.) In the ordinary course of events, would you allow a candidate to take as much time over one colour?

(Witness.) In some cases we must do so. I have cases sometimes where they take two hours.

562. (Chairman.) With one colour?—No, with the whole test. In some cases one is compelled to give them plenty of time. In fact, in some cases one almost has to educate them in colours.

563. (Professor Gotch.) Do all the candidates handle the wools as much as this?—No; sometimes a man would pick them up readily.

564. Do you often get cases in the wools in which they are handled a good deal?—Not so much as in this case. The trouble is, they do not understand at first what you want. I would say that I wanted all that colour, lighter or darker, and that it did not matter how light or how dark. But, in spite of that, they think I want everything of the same degree of colour. Then I have to take up one skein and suggest, "Would you say that is the same colour?" The reply would be, "Oh, yes, but it is much darker." Then I say, "That is what I have been telling you."

565. (Chairman.) I think we may now take the batch of that colour, that he has taken out?—Yes. Now I will ask the boy to take a pink, and to pick out the wools nearest to that colour. [Ruby proceeded to do as requested.] This second and third test we have most difficulty with; it is easy to confuse the two. [Ruby chose two reds, three greens, and a red.]

566. (Captain Golding.) Do you often find a man making a hopeless muddle and mixing up all the colours of the rainbow?—Yes. Of course, in the case of this candidate, I do not know whether he is quite *bona fide*.

567. You do not think he is a *bona fide* candidate?—No, I think not. I will explain to the Committee the difficulties. These (showing the skeins chosen to match the pink test skeins) are somewhat characteristic mistakes of people who are colour-blind. They also get purples. But those are not the difficulties I experience in practice. If a man is colour-blind you can see it almost at once. But it is the other people whom we want to get the things correctly. For instance, for this particular one (showing the pink test-skein) he will take a salmon colour, and colours similar to that.

568. (Chairman.) I think we might be contented with his selections in the second test?—Yes. Now I will ask the boy to take the red.

569. (Captain Golding.) Do you think there is much coaching done by the navigation schools in this kind of work?—There is not much coaching done in the ordinary schools. I do not think it is possible to coach a colour-blind person.

570. I do not mean a colour-blind person: I mean, do they tell a candidate exactly what is expected by the examiners?—Yes, I think so. I am rather glad of it, myself.

571. It saves you a good deal of trouble in explaining?—Yes, a great deal of trouble. I do not think that anyone in the schools pretends to examine them, but only to teach them, so that they get through the examination more quickly. Ruby chose only one pink and the rest red.

572. (Chairman.) Perhaps that would be enough for the third colour, for our purpose?—Yes. The difficulty is that he took the pink colour. In fact they are always confusing the reds and pinks. I will now ask him to deal with the purples. [Ruby chose several blue skeins.] That is a fair sample of what an inexperienced person may pick. A man who is definitely colour-ignorant I find at first, calls anything like this (showing the purple test skein) blue. He has no idea of purple.

573. (Captain Golding.) Do you find there is any great amount of colour-ignorance amongst the candidates; that is, in designating the colours?—Yes. If you mention heliotrope or purple, many have never heard of them.

574. That is what I mean by colour-ignorance?—In the same way they would call that pink.

575. (Chairman.) What is it?—It is a light red. My principle is that if you have a dark wool, and imagine that you have got a tin of paint of the same colour, and you add white to it, you will never alter the colour. You may make it lighter; you will alter the shade but not the colour. Now I will take the boy on the yellow skeins. [Ruby picked a number of yellows and two greenish yellows.] That again is a fair sample.

Ruby then withdrew.

576. Well now, as a matter of fact, with that boy who wholly failed in the first two, would you put him right through, or would you have failed him?—He would go right through. I should take out the wools he had picked incorrectly, and take pieces of them, and put him right through the test.

577. But that boy you would consider to be a complete failure?—Yes.

578. I mean the first two were most marked of all?—Yes, and they are the usual things that colour-blind people do.

579. But you say that your very difficult cases are not with the ordinary colour-blind persons?—No. It is with the men who do not know what colours are by name at all. They can distinguish with the eye, but do not understand matching at all, until you show them there is a difference. It is with the paler tints that they are apt to get wrong, between pink and red. I ask them if they see any difference between the two, and they tell me they do. Then I take the paler ones, and let them see again what I want them to do. After that, I throw them all back and let them do it. If they do it correctly after that, they are clearly not colour-blind. But they do not do it at first, because they are unaccustomed to it.

580. But you very seldom fail one on mere questions of that sort? I mean you help them through?—We help them through by teaching, but not by helping the examination in any way.

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581. But you see that they thoroughly understand what they have to do?—Yes, and then, after that, they generally will get through and do the task correctly.

582. Do you think there is much nervousness?—Only a little. There is not a great deal. It depends mainly on the examiner.

583. Have you any record of the number of failures?—I have a record in my pocket of all the failures I have had in the past.

584. Could you give us the figures?—Well, I have not got all the figures. I have examined about 200 between 1901 and October 31st last, since when the new test has come into operation. I have a proper record of 83 cases only, and of that number I passed 81, failed one in form-vision and one in colours.

585. Was that all?—That was all. That is a total of 83. Since November 1st of last year and up to October 20th of this year, I have passed in the old form and colours, 15; passed in the new form and colours, 55; passed in the new form test, but failed in colours, 3; and one of them failed in the old form-vision and the new. There I have got three failures in 74 cases.

586. Have you applied the new form-vision test to these more recent candidates?—Yes, to practically all of them. They might have gone through the higher test if they could. But if they cannot, they can go through the old test.

587. You state that one had failed to pass the old form test?—Yes, and therefore he could not go any further.

588. But all the others passed the new test?—Only 55 passed the new test, and 15 the old test.

589. You say that 15 out of 74 failed to pass the new form-vision test?—Yes.

590. Those would not all be young men?—No; a number of them were men well on in life. Some firms now are sending up their captains once a year to be examined. I have had a number of them recently, who have passed the new test.

591. Are those voluntary?—Yes, they are quite voluntary.

592. Have you had a good many of that sort?—Yes, we have a large number of boys come in. The Trinity House Navigation School, which has about 250 scholars, send all the lads. They are examined now before they go into the school. Then, when we got this new form-vision test, all the boys of the school were examined over again, and a number of those were rejected. They could not pass the new form, and it was no use their going to sea and failing in four years' time.

593. Were they withdrawn from the school?—Yes.

594. Beyond those 15, how many would have passed the old test?—The old form-vision test is practically the same as it was before; I mean there is no alteration. Before the new test they would have passed without any question being raised.

595. I did not know whether later on in life they would not be able to pass the old form-vision test. You would not put them through that?—Yes.

596. They had passed for the old form-vision?—Yes. They have passed the old form-vision at the present time.

597. And were rejected for the new?—Yes.

598. I see what you mean; you had only one who had not passed the old form-vision test?—Yes.

599. And 15 did not pass the new, but passed the old?—That is so.

600. Of course, if that is the proportion in the future, the new form-vision test will cut out a great many?—I think so. I can give you my own figures at Hull. I have the record altogether, from last November, of those who have passed in the old form, and the colours. The number is 101. Those who have passed in the new form-vision and the colours number 465; nine have passed the new form and failed in colours; but it is rather odd that all those nine had passed the new form-vision test. They were men with a better sight for ordinary purposes.

601. Did any of those nine candidates appeal?—I am afraid I could not tell you. Certainly some of

them did, but I question whether they passed. I do not think that anyone I failed passed on appeal.

602. You say that out of that number nine failed?—Yes.

603. The biggest total is 465?—Yes; 465 passed the new form and colours, and 101 passed the old form and colours.

604. And all those 465 have gone through the colours?—Yes.

605. But out of those, nine failed?—No; there were 506 who passed the colours, and nine failed. They did not all pass the new form.

606. (Mr. Raymond Beck.) I think you told us that fifteen of your old candidates failed?—In the new form test.

607. And on the whole at Hull nine failed in colours?—Yes, three of which were my failures.

608. (Professor Poynting.) How many failed in the new form-vision test?—The total was 103. There were eight more who failed in the new form, who would not go any further.

609. (Chairman.) How many of the 550 would be boys? Would it be a considerable proportion?—Just about half of them.

610. (Professor Gotch.) How many do you think of the 101 were boys?—I think there would be very few of them.

611. (Chairman.) That is to say that the bulk of the boys got through the new form-vision test?—Yes, I think I might say that safely. I have not the figures of those.

612. But you say a number of them had failed?—Yes, a few of them.

613. And they were withdrawn from the school?—Yes, eight were withdrawn that I knew of. They were taken from the school.

614. Have you formed any opinion yourself as to the severity of the new form-vision test. I do not want to ask you for an opinion, but do you think it is too severe, or do you think it is reasonable. I do not want to press you?—Well, I do not know. It is a medical question almost. If a man has one good eye, it is almost as good as two; but there is a danger in having one eye that is not good and which may affect the sight of the other one eventually, and reduce its value by and by. There are many who go to sea with one eye, and I should be a case in point. If I did not wear glasses, I should go blind in time, although one eye is perfectly good; one of my glasses is a perfectly plain glass. Therefore I think the men who can see with one eye only are not so good as those who can see with both.

615. You think that a good many men can see in that condition?—Yes.

616. And they are sometimes brought before you by the shipping companies?—You may take it that in the last year we have had almost one out of five with one eye deficient.

617. Does that mean that they did not go to sea again?—No; they can go to sea at the present time, if they have got any certificate at all. But if a boy were like that, I should say, "Do not go to sea; give up the idea of going to sea," because in less than four years from now he would not be able to get a certificate, and would be barred from the profession. After 1914 they must pass the higher test. I have dissuaded boys from going to sea on that ground.

618. Do you think that the failure in the new test is more on the part of old people or young people?—Well, I find it more on the part of old people.

619. We have had it said that some of the old hands get through better than the others?—That is not my experience.

620. Do you find much complaint of the present method, broadly speaking?—I have heard people complain, but I do not think there is much occasion for it; and sometimes, when I have explained to them exactly, they say, "Well, if you do it like that, I see no difficulty." There is a lot of ignorance amongst people who make complaints. They say, "How can you expect a sailor to know the colours?" Well, he is not expected to know the colours in the sense that they think. They say it requires a lady to know them. I



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could not name many of those colours, but I could tell if they matched.

621. But you think when it is really understood by reasonable people the objections to the test disappear?—I think so. There were two new wools added to the test a year ago, and I have never seen a failure on those two.

622. Were those the last two in order?—Yes; the purple and the yellow.

623. Where do you get your principal failures?—I should say almost equally in the first, second, and third. I think the worst case I ever had was about a year ago. A boy put a red and green together and said they were the same colour. Then he reversed the process with a red and a light green.

624. Those came out in matching No. 1 and No. 3?—Yes. He was wrong with the second as well, but not so much.

625. But you have not found that Nos. 4 and 5 have added much to the test?—That is so. The only difficulty is, that with the last one they get a greenish yellow.

626. (Mr. Raymond Beck.) Are you the only inspector for the Hull district?—No, there is the examiner of masters and mates.

627. For the sight tests?—Yes.

628. There are therefore two persons qualified for Hull?—Yes.

629. In these cases that you have recited to us, are they mostly fishermen, or are they for ocean-going vessels?—No, they are not fishermen. As far as my experience is concerned, I do not think any of them are fishermen.

630. The Chairman mentioned that we were told as regards the fishermen, that their sight continued to be very good up till quite old age. Those whom you deal with are not fishermen?—I have not had so much to do with the fishermen.

631. (Captain Golding.) Is Grimsby included in Hull, or is there a separate examiner?—There is a separate examiner there.

632. Then the fishermen referred to would come under the Grimsby examiner?—Our examiner goes to Grimsby once a fortnight to examine the men for the certificates as skipper, or second hand; and then he has to pass them in these wool tests. But independently of that, at any other part of the fortnight the superintendent can examine them.

633. Therefore a large number may be examined by the superintendent and not by the examiner of masters and mates?—That is so.

634. (Mr. Nettleship.) I think I understood rightly when you said that you would have rejected this lad?—Yes.

The witness withdrew.

Mr. W. T. DUNLIN called and examined.

649. (Chairman.) We are very much obliged to you for coming, and especially for coming at such short notice. It is a great convenience to ourselves. I understand you are secretary of the Joint Arbitration Committee at Grimsby?—That is so.

650. What is the function of that committee?—To arbitrate on all the collisions, which are very numerous out of the port of Grimsby, between steam fishing vessels only.

651. Then you are chairman of the Navigation Board?—That is so.

652. Is that a laborious function too; is there a great deal to do?—No. We issue certificates to the candidates independently of the Board of Trade certificates, and it is also a tribunal for misdemeanours of captains and mates of vessels, apart from the law courts. We deal with them according to their certificates.

653. Does your Board meet pretty frequently?—The Navigation Committee meets on Wednesday and Friday evenings of each week.

654. And you generally have cases before you?—Yes, constantly.

635. (Professor Gotch.) Have you yourself experience of the sea; I presume you have?—Only as a passenger. But I have been connected with the sea and with seamen all my life. I have not much experience on the sea.

636. (Captain Golding.) Are you a superintendent of Mercantile Marine?—Yes, I am.

637. I thought perhaps you were the examiner for masters and mates?—No. The examiner we have has only been appointed for eight or nine months.

638. (Professor Gotch.) Have you, in your experience as an examiner, had any feeling expressed, not about this at all, but about the form-vision test?—No.

639. You have heard no feeling expressed by those whom you have had to deal with?—No.

640. (Chairman.) Of those who failed in colour, were some of them boys?—I think there were two, but certainly there was one.

641. And the others would be older?—Yes.

642. You do not remember about the actual question of appeal, as to whether they went further?—I am afraid one of them could not possibly have succeeded.

643. Can they appeal?—They can appeal in any case. But it would be foolishness to have appealed in one or two cases. I have not had anyone who has appealed and passed.

644. (Mr. Raymond Beck.) I should like to ask for a little more information. Who are the examiners for colour-blindness? At Hull you are the superintendent of the Mercantile Marine?—Yes.

645. And in those duties is comprised this examination?—Not of necessity; but I am specially qualified. I was examined by Sir William Abney some years ago. The reason for that was, that the examiner for masters and mates was away from the port at Grimsby, and there was no one in Hull to do it. Therefore it was considered desirable, that there should be one person there to do it, on any day in the week, and I was appointed for that purpose.

646. And the examiners of masters and mates must, of course, deal with the vision tests?—They must, because when they pass a man as qualified for his certificate, it includes his colour test.

647. Do you think the system you adopt of getting a qualified examiner is adopted in most seaports?—Yes; I should think it is.

648. Apart from the examiner of captains and mates, there is another person to examine?—Yes, I should think so.

(Chairman.) Thank you very much for coming here and giving us the benefit of your experience.

655. Then you help the examiners of skippers and second hands with regard to the candidates?—The Board of Trade?

656. Yes?—Yes. For 20 years I held that position in conjunction with Mr. Alward, who resigned two years ago; but I now do it along with Captain Ellery.

657. So you are perfectly familiar with these tests?—Yes. I have been a skipper for a number of years, and have been used to the lights there ever since they have been in existence.

658. Has your experience been chiefly confined to sailing trawlers?—My experience has been both with and without steam. I have also been a surveyor for the annual surveys of vessels and for the insurance, for a number of years, though I do not hold that position to-day.

659. Well, with your knowledge of the tests which are now applied according to the Board of Trade Regulations, will you give us your opinion of them? Will you tell us what you think about them?—Respecting the eye test or the lights test?

660. Well, shall we take the vision test first?—I have a statement here which I am desirous of reading,

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though it was made out in a hurry. But I will read it if you like.

661. Do just as you please. But will you take the vision or the colour first?—I will take the vision first. In dealing with this question of light tests it is necessary to arrive at a satisfactory understanding, and to dismiss from our minds the present methods employed for testing, and turn to the actual conditions which a seaman must be capable of interpreting in his calling whilst at sea. These in brief are, I take it, to distinguish the various white and coloured lights, and to distinguish the flags of the Commercial Code. I will deal with these in their order of importance. With regard to lights, the lights at present in use are white, red, and green. Now it must be admitted by all persons here, that in this regard the main test should be with illuminated glasses of white, red, and green, shown from a lantern in a darkened room. Next, the question as to the effect of atmospheric conditions on these lights should be provided for, that is, under conditions of fog, haze, mist, rain, falling snow, &c. I claim that these conditions should be simulated as far as practicable in the test room, and when a man has satisfactorily proved his ability in this respect, no further test would be necessary. At this point I would suggest that the Board of Trade take into serious consideration the advisability of defining those shades of red and green which prove of most value under all weather conditions, as at present there is no fixed shade of either colour, and any glass manufacturer is allowed to supply any shade of red and green that suits his particular fancy, as is evidenced by the numerous shades of side lights in vogue at present. To revert to weather conditions, I acknowledge the difficulty to be met with in simulating snow, hail, or sleet: these can be ignored. But fog, mist, and rain can be simulated at little expense by providing a simple apparatus, which would, by means of falling water or rising steam, reproduce the conditions and effect of fog, mist, or rain on the lights in question. This, in my opinion, should complete the test, and if carried out on these simple lines anything further would be quite unnecessary. With regard to flags, that is a minor consideration entirely; as, were a man to state correctly the coloured glasses, little fear need be entertained as to his ability to name the flags from a colour point of view, because the shape and arrangement of the colours in the flag practically decides its name. However, should it be considered advisable to include this in the examination, then let the Board of Trade provide a small book to each examiner, with the various coloured buntings inside, and let the candidate name the colour of each bunting, white, black, red, blue, yellow—five pieces in all—but by all means cut out from the examination the wool test, with its innumerable shades and matchings, which serves to little purpose apart from the discomfiture of the candidates concerned. I should like to add in conclusion, that in all my experience at sea on the various fishing grounds, where our boats are practically surrounded all the time by white, green, and red lights, I never found a man to make a mistake in the naming of a light. I should like to put it to the nautical gentlemen here present—did they at any time during their sea experience ever know a light to be misnamed? We have in Grimsby a model called the ruroscope for teaching our men the rule of the road at sea, which consists of a steamer electrically lighted and controlled by a steering wheel. (*Handing copies of booklet to members of the Committee.*) The various lights actually to be met with at sea are then switched on from a cabinet facing the man, simulating exactly the sea conditions. The red, green, and white lights in their correct relative positions tell him exactly what description of vessel is approaching. The steering wheel is in the man's hand, the steam whistle on his left, and the telegraph on his right, and he must act precisely as if he were at sea in charge of the bridge. This is a step in the right direction, and supersedes the old method of coloured balls which, to say the least, are a great strain on the imagination. I have known fishermen, who have finally failed as colour-

blind, when brought before this model, name every light or combination of lights correctly.

662. Is this in use in the Grimsby Technical Navigation School?—Yes; it is patented by J. Smith.

663. Do a certain number of employers insist on their passing this test?—That is a part of the test. We insist upon them passing that test. That is at the school. It is under the Board of Education at Grimsby now.

664. And are they put through that test in preference to the Board of Trade test?—Well, they have to go through that in their examination. That is, all students at school have to go through that, and they pass that before ever they go to the Board of Trade examiners.

665. They pass this when at school?—Yes.

666. Is this for lads?—Yes, and for skippers and mates too—skippers and mates principally.

667. Will a skipper go through this test every few years?—No.

668. Only once for all?—Yes, only once; and when he is graduating up for mate or skipper.

669. Then he goes through this, and he may have to go through the Board of Trade test afterwards?—Yes, he goes through the Board of Trade test afterwards.

670. Do you consider this ruroscope a better test?—Yes, by far. I do not know whether you saw the letter sent up to this Committee expressing my views on this wool test. I denounce it entirely.

671. I saw, in a general summary of your evidence, that you thought the skeins should be abolished and white, red, and green lights substituted?—Yes, screened lights in a room, and not to graduate from a simple light colour to the extreme red or green.

672. Does the ruroscope fulfil the conditions?—Yes, all we require. Everyone who sees it praises it.

673. What about the conditions of fog, and so on? Does it attempt to do that?—No, it does not. But we think we might do something towards it, by simulating steam and such like things, to see if it altered the man's opinion as to the light, when he saw it under those conditions.

674. You think something of that sort might be done?—Yes, and at a very small cost.

675. Then with regard to the flags, you think it might be reasonable to have bunting?—Yes.

676. You would not have any wool test?—No. I would have bunting, and they should name the colours of the bunting.

677. Would you have a considerable variety?—I should have all the colours that the different nations use.

678. And if a man could not name the colour fairly well, you would fail him?—I do not know that I should fail him as long as he knew the red, green, and white. But you will notice what I said in my statement respecting the shades of green and red. They differ terribly. We think a shade ought to be national, if not universal, because there are so many. The lamp makers, or glass manufacturers, put what shade of red or green they like. Some of them are nearly blue, and consequently they are not so easy to distinguish, as if they were a proper green or red.

679. There ought to be a standard?—Yes, I consider there should be.

680. When a captain is buying, does he order according to the fancy of the purchaser?—No, he does not fancy at all. He orders a set of lights for his vessel. He may glance at them. If they are green and red, he takes them as a matter of course. But the Board of Trade will pass them. The Board of Trade surveyors do not say anything about it. But we know there is a lot of difference in the shade of the green and red.

681. Do you think that is a source of danger—the variation of the colours?—Well, as far as a source of danger is concerned, I never found it to be one in my practical experience.

682. Why is it you lay such stress on it being a standard colour?—Because there is so much difference in the shade of red and green lights.



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[Continued.]

683. But why do you think it is so important we should have a standard colour?—Because we do not know what it may lead to. We do not know how far the imagination of the glass manufacturer will lead him to have a shade. There ought to be a standard shade.

684. You think it might become dangerous?—Yes.

685. That is the reason?—Yes, that is the reason.

686. Then you say that the wool test has led to the discomfiture of candidates who really were all right?—Yes; you will see that I have said in my paper that they have been failed by the Board of Trade. I do not put them through that test. That does not come under my ken. But with the examiner that examines them there, I have known them to fail; and we have taken them on the lights, and they have named the lights as they were.

687. On the ruroscope?—Yes. But I have also taken them to the lights. I have had them in a room, and the lights lighted; and when the sail has been moved, they have named the colours.

688. Do you think that is enough?—Yes, we think it is ample.

689. Do you think there is any general feeling of discontent as to the present methods?—Yes; they denounce this method entirely in our place.

690. But I suppose there are not a great many instances of men going about, who have been failed by the wool test, and are known generally to be all right, and not colour-blind?—No, I do not know of many. I have known it to be so, but not in many cases; it is very rare. I never knew a man name a light wrong at sea in my life.

691. Are you inclined to think that tests are unnecessary altogether?—No, they are not. When a light is put before them, we test them with a red, or a green, or a white. I am referring to a light, and not to skeins of wool.

692. Do you know men who are purely colour-blind from the point of view of ordinary glass?—I have never come across one yet that was colour-blind with a light.

693. That shows that in your experience it is extraordinarily rare?—Yes, it is very rare.

694. And yet you think there ought to be some test to cut out the possible man?—Yes.

695. There might be such men, although you have not known them?—Yes, that is so. I have been to sea from the time I was a boy, and I am dealing with men to-day more than when I went to sea. I might say, in my occupation as secretary to the Arbitration Committee—such a statement as I am going to make might seem extraordinary to a nautical man—that in one year we had 980 collisions. To take the evidence of that list would mean about three collisions a day. I take all the evidence, both at night-time and day-time, and I have a varied experience.

696. And you never knew a collision that you thought had anything to do with mistaking the colour of the lights?—No, not one.

697. And you never knew a man who had been failed with the light test?—Not with lanterns, but I have with the wools.

698. But the ruroscope has never failed a man?—No, not one.

699. And the wool test has?—Yes.

700. Have you anything to say about the pure question of eyesight, apart from colour altogether?—No. I am not an eye specialist in any way whatever.

701. You know what we call form-vision?—Yes.

702. (Professor Gotch.) You are aware that there is a new form test which is more severe than the old one?—I understand so, though I have not seen it yet.

703. And that it will cut out a good many candidates? I only want to know your opinion as to whether you consider that it is absolutely a bar to a seaman to have to depend on glasses, whether binocular or otherwise?—I do not hardly grasp what you mean.

704. Supposing you had a man who could not see properly without the use of glasses, spectacles, would you consider that to be enough to cut him out?—No. I consider myself fit to go and take charge of any vessel to-day. Of course, I should want my glasses

on. There are plenty of captains and mates, too, that have to use glasses.

705. (Chairman.) If you were using binoculars, would you use binoculars with your spectacles on?—No, I should take my spectacles off. I always do in that case.

706. (Captain Golding.) You stated that there is no standard, or, rather, that the standard colours for red or green lights are not observed, and that they vary in colour. Are you positive of that?—I am positive there is not a real standard.

(Captain Golding.) I should like to ask if we might put in as evidence the Board of Trade Regulations with regard to instructions to surveyors, because Sir Walter Howell said distinctly that all vessels had to conform to it.

(Mr. Raymond Beck.) Was it not in a very wide range?

(Captain Golding.) I asked Sir Walter Howell the question myself.

(Mr. Raymond Beck.) I understood him to say there was a range in the standard.

(Captain Golding.) I understood him most distinctly there was a standard. Except in the case of green lights with a yellow illuminant, you had light green; and if electricity was the illuminant, you had a darker green.

(Mr. Nettleship.) Was there not more than one shade of red? I have an impression there was a certain range.

(Dr. Watson.) I have had a set of these standard glasses. The surveyors are provided with two red glasses, and the ship's glass must lie somewhere between them. In the green glass there are two greens, and in the case of an oil lamp it must be somewhere between those; and there is a third green which has to be used in the case of an electric light. So that the surveyors are provided with standard colours, and all ships' colours are supposed to lie between those. Each standard has a certain range, and it is defined by the two glasses.

(Mr. Nettleship.) There is no absolute standard. There is a certain standard.

(Dr. Watson.) There is a limit.

(Captain Golding.) Might we not have a copy circulated to us.

(Dr. Watson.) It is printed in the appendix to Sir Walter Howell's evidence.

(Chairman.) Whatever it may be, you consider the limits are too wide?

(Witness.) Yes. I would like to say, in answer to Captain Golding, with respect to the surveyor, I know him well, and I knew his predecessor, and I have served continually with him as regards insurance. There is the red light and the green light. But if you go on another vessel, you would see another shade of red or green. There has been no complaint. I consider the range is too wide.

707. (Mr. Raymond Beck.) Have you personally taken part in the examination of this ruroscope?—I have not taken any part. I have seen the candidates before the ruroscope. I have been in the room, but have taken no part in it.

708. Is it your opinion that a candidate going through the instruction, or going through the course, would at once be detected, if he had any difficulty in distinguishing the red or green light?—Yes. If you will look at his position there, and the instructions in the book, you will see that must be so. The lights are put before him. He is at the wheel; there is a ship in front of him and there is a light shown, a red or green light, as it may be, or both, and he must alter his helm to clear those lights, either the port helm or the starboard, as the case may be. If he made a mistake, of course, he would know there would be confusion and collision, and he would fail over it every time. But this ruroscope is not in the examination room; it is in the school.

709. (Chairman.) Is there any other point, beyond what you have been good enough to represent to us, which you would like to bring before us?—No. If there is any question you would like to ask me, and I

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[Continued.]

am able to answer it, I shall be pleased to do so. But that is, in brief, all I have to say about the lights.

710. Does the introduction of steam trawlers affect the question at all, as compared with what the conditions used to be?—In what particular?

711. Does the rapidity of the movement of boats and ships affect it?—Yes. The old sailing vessels were not so quick on each other as are the steam boats to-day; and steam trawlers are very smart little craft, and they have to be very smart in handling them, especially amongst a fleet.

712. The requirements are, therefore, in this matter more necessary?—Yes, more necessary than they were before. Although we have no fleets out of Grimsby, there are four fleets out of Hull, and they are always at work fishing in the North Sea, and the fish is sent direct to London. I should say those fleets would number just over 100, or just under 100 each. They congregate together under an admiral, and they have to manoeuvre the vessels amongst each other by night as well as by day.

713. (Mr. Raymond Beck.) Do they still make use of rockets for the purpose of manoeuvring now?—Yes. The admirals do that, in order that the other vessels should be able to distinguish which way he is going to shoot his nets, whether it is to the east, or the west, or the north, or the south. The carriers also have the

rockets to send up, when they think they are in the vicinity of the fleet at night, so that the admiral may be able to answer them. Each has a particular rocket.

714. (Professor Gotch.) How many certificated officers are there on an ordinary fishing trawler?—We are issuing a third-hand certificate to-day. That is issued from the Joint Arbitration Committee. I proposed it, and it was carried. I issued 363 for servitude, and now the third-hand certificate is issued from the Navigation Committee.

715. How many would there be certificated on an ordinary fishing trawler?—There would be the third hand, the mate, and the captain. The captain and the mate have the Board of Trade certificates. With regard to the third hand, the Board of Trade have not done that yet.

716. But you propose to give it in your certificate?—Yes, or else they cannot take a vessel.

717. Does that mean some sort of colour-test?—Yes. He would not be allowed to take charge of the vessel, unless he could describe the lights.

718. (Chairman.) Do you put him through your own test?—Yes.

719. And give him a certificate accordingly?—Yes.

(Chairman.) We are very much obliged to you for your kindness in coming here.

The witness withdrew.

Adjourned till Friday, November 4th, at 11 o'clock.

## FIFTH DAY.

Friday, 4th November 1910.

PRESENT:

The Right Hon. ARTHUR H. DYKE ACLAND (Chairman).

Sir ARTHUR RÜCKER, F.R.S.

Mr. RAYMOND BECK.

Captain GOLDING.

Professor FRANCIS GOTCH, F.R.S.

Mr. NORMAN HILL.

Mr. EDWARD NETTLESHIP, F.R.C.S.

Mr. J. H. PARSONS, F.R.C.S.

Dr. WILLIAM WATSON, F.R.S.

Mr. S. G. TALLENTS } Secretaries.

Fleet-Surgeon G. WELCH, R.N., called and examined.

720. (Chairman.) We are very much obliged to you for coming here this morning?—Not at all, sir, I am very glad to come.

721. We have felt from the first that we ought to know what is the Admiralty test in order to help us in our investigations?—I hope you are going to help us.

722. Then we will try and help one another. Will you kindly treat us as being ignorant in the matter, and will you tell us what the general regulations are with reference to testing, under the heads of form-vision and colour-vision? Will you take the officers first?—Yes. Would you like me to read that out?

723. Just as you like?—If I do so, I shall not make any mistakes. I will deal with the regulations for vision for officers:—(1) For executive, engineer, and marine officers full normal vision for form and colour is required. (2) For officers of other branches full normal vision is not required, but any defect must be due to an error or errors of refraction, which can be corrected to 6/6 by means of glasses. The distant vision must, however, not be less than 6/60, and candidates must, for near vision, be able to read D = 0.6 at any distance chosen by the candidate, in both cases without the aid of glasses. The colour sense, except for chaplains, must be normal. Each eye must be separately tested. I may say that we use Snellen's types both for near and distant vision. Then (4) marine officers under the old scheme of entry must comply with Army Regulations regarding vision. That is because a marine officer under the old regulations

was simply a soldier. Now he is employed, or will be employed, under the new regulations as watch-keeper and also for signal duties, and so on, so that he must have acute vision under the new scheme.

724. You said "Army Regulations," did you not?—Yes.

725. This set of officers comply with the Army Regulations?—Yes. "Marine officers under the old scheme of entry must comply with Army Regulations regarding vision." I think they want something about one quarter. I am not quite sure about the Army Regulations with regard to that.

726. The new ones are more important?—Yes, much more important. They are coming in under the scheme at Osborne, where they are entering them under one heading. Those are the regulations of vision for officers.

727. Might we just ask you to make it quite clear at what age these officers are tested?—They are tested at between 12 and 13 years of age.

728. That is to say, that really, as soon as a boy is selected under the Admiralty selection scheme, he is examined before he enters?—He is examined in Whitehall. We examine him there physically, including the visual test.

729. Then does the term "executive officers" cover all the boys at Osborne?—No. Some are going to be engineers, and some marine officers.

730. They are under the same examination?—Yes, until you come to the dividing of the ways at a later

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[Continued.]

age, when they specialise. Some are going to be executives, and some marines, and some engineers.

731. Then at what stage do you have re-examination?—We do not have any re-examination.

732. All these boys have an examination at between 12 and 13 years of age?—Yes.

733. And there is no re-examination?—Well, there are exceptions which I will tell you of in a moment. As a rule there is no re-examination. But officers, who wish to specialise for navigation officers, are re-examined before they are allowed to specialise, and then, if they have not got 6/6 of each eye and normal colour-vision, they are not accepted.

734. At what age would that usually be?—It would run about 24 or 25.

735. Are they then going to College?—Yes, they go to the Navigation School at Portsmouth. They have a college for them at Portsmouth which they call the Navigation School.

736. That is a real re-examination?—It is a subjective examination. They have Snellen's types for form and they have our official test for colour down there, which, again, is not the same as we have up at the Admiralty. They are tested by means of Holmgren's wools for colour at this school.

737. Are there any statistics as to the failures in that examination?—I am sorry there are not; but there are going to be. The question was raised a couple of months ago. We have no statistics, but there are very few who are rejected. I know practically that very few indeed are rejected.

738. And, so far, that means that the examination at the early age has been effective?—Yes, so far. Of course, as regards the man who is going in for navigation, it is quite likely that he has a private examination before he comes in. Naturally he does not want to have any defect he has got published to the world at large. He probably has a private examination, either by medical officers of the navy, or by some ophthalmic surgeon.

739. And if he failed, he would not attempt to go to college?—That is so.

740. So it would be rather misleading to assume that to be a final test of the number who might become disqualified after that?—I think so, distinctly.

741. That is rather important?—Yes. Mind you, I cannot tell you officially that they are privately examined. I know they are, as a matter of fact.

742. A knowledge of human nature would lead you to suppose so?—I know they are; I mean I have seen some of them myself.

743. But the main point is, that there is no regulation of the Service requiring re-examination of all executive officers?—No, except in the case of navigating officers. That applies to warrant officers as well as commissioned officers. Some warrant officers qualify as navigators too, and they have small commands—gunboats and torpedo boats, and so on. They have to pass in navigation before they are allowed to take up those appointments, and so they go to the Navigation School and qualify, and they have to be tested as well.

744. It means this, that so far as those who are qualified for navigation after the college or school course are concerned, they have been re-tested?—Yes.

745. And I suppose those are the most responsible persons?—Yes, distinctly. I mean those are the people who get into trouble if a ship goes ashore.

746. Therefore, the second test is applied to the most responsible officers?—Yes, distinctly. That has not been very long so. It is only a few years since it came about.

747. I am not quite sure whether you indicated that the second test was in some ways more severe?—No, it is almost exactly the same. But it is not really quite so severe, because, at the Admiralty, for the colour test we use a lamp; at the Navigation School at present they do not use a lamp. But when your report comes out, we hope we are going to modify our colour-vision test on that, because what we want is to have exactly the same test for men-of-war as they have for merchant ships as regards colour.

748. At the Admiralty do you have the wool test?—We have the wool test and the lamp test. We use Buxton's telechrome at present. I do not think it is the best lamp there is. For instance, I do not think it is as good as Edridge-Green's lamp, so far as the lamp goes. But that is what we use. We use that and the wools. This afternoon, I believe, Fleet-Surgeon Pryn is going to show you how we use it at the Admiralty and Whitehall Place, the recruiting place for men. The Admiralty is for officers and Whitehall Place is for men. At both those places we use Buxton's telechrome and the wools. At all our other recruiting stations we only use the wools.

749. And that has been going on for some time?—Well, the wools, of course, were the original test, and then, at the Admiralty, in Whitehall, a few years ago, they took the telechrome as well.

750. But they have not had it at any of the other stations?—No, not yet.

751. Have you got printed instructions for examiners who conduct the wool test?—No, we have not; we take the general instructions. For instance, you get them in Swanzy's book pretty distinctly. It is in an appendix of Swanzy and Werner's book. There again, of course, you come into a difficulty. You get your colours. Swanzy, for instance, gives you what ought to be the three standard colours of the Holmgren wool test. Of course, that is all right. But then you get another book that is an equally good book—at least, I think so. I use two books which have been very useful to me. The other is a book by Mr. Parsons. Now, the green in Mr. Parsons' book and the green in Sir H. Swanzy's book, to my eyes, at all events—and Edridge-Green has tested me and says I am pretty good, and I suppose I ought to be fair—are absolutely and entirely different.

752. (Mr. Parsons.) I think I can explain. The explanation is that it is a lithographic point. I think in Swanzy's book they actually give the wools. In the original Holmgren it was a lithographed plate, and mine is a copy of the original Holmgren off the lithograph?—Then yours is really the better one of the two.

753. I am not sure about that; it ought to be. But they told me when they printed it that the colour changes on the stone. It sinks into the stone, and you get a different colour. There is an uncertainty about the colour?—Have you seen the two books?

754. Yes?—There is a great deal of difference.

755. Of course they are not intended to be the real colours—I mean not absolutely and necessarily so?—That is what we want. We want you to lay down, and we hope you are going to lay down, some standard green. I mean, at present it is confusion. I went to see a test the other day, where they had got a standard green. I should almost call it a buff; it had certainly got a very small amount of green in it.

(Mr. Parsons.) As a matter of fact the different plates that come off the same stone are different.

756. (Mr. Nettleship.) You do not use Edridge-Green wools?—No, we do not, and I will tell you why we do not; you cannot get any working directions for them. That is our point. I have spoken to him about that, and we want some definite working directions. I think that is what we want everywhere. I mean Edridge-Green refers you to "Nature" in certain volumes, and then he refers you to his book. But an examiner has not got time to do that if he has got 50 or 60 men to examine. He cannot do it.

757. (Chairman.) Of course you are aware that the Board of Trade has attempted to describe very carefully the way in which the Holmgren test should be used.

758. Do you think their instructions are fuller than some of the others you are acquainted with?—I should think so.

759. As a matter of fact those particular regulations are not in use with you?—No, they are not.

760. Might I just take the form-vision a little more in detail?—I think I have given you the form-vision that officers require. Certain officers require full normal vision, that is 6/6 with each eye, each eye being tested separately. That is for executive, engineer and

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[Continued.]

marine officers. For officers in other branches, medical officers, chaplains, paymasters, naval instructors, and so on, who have not got watch-keeping duties to do, not less than 6/60 that is one-tenth, is required.

761. At what ages are these given?—These are not all tested at 12 years of age?—No. For other branches, medical officers are examined between 21 and 28, and chaplains might be over 30. Accountant officers are examined about 17, and naval instructors may be the same as chaplains.

762. And in all these cases there is not any definite demand for re-examination?—No, they are never re-examined unless there is some complaint.

763. Form-vision is never re-examined except in the cases you have already mentioned to us under the head of colour-vision?—That is so—navigation officers.

764. Then up to what age may an officer be carrying out these responsible executive duties?—Well, he can go up to an admiral, because he has got to manoeuvre fleets. I mean he might go up to 65 years of age. But of course a navigating officer, a commander, would have to leave at 50. No one would be a navigating officer above the rank of commander. When they are promoted to post captain, they drop their speciality and become ordinary executive officers.

765. Is the use of spectacles discouraged in the Navy?—It is not allowed for executive, engineer, or marine officers. But that is a rule honoured more in the breach than in the observance, I believe. I am talking about distant vision, of course. Anybody over 40 may begin to wear them for his near vision.

766. But with regard to the distant vision, you say glasses may not be worn?—Officially, no.

767. But I suppose there are cases where distant vision would be improved by the use of glasses?—Yes, there are plenty of cases.

768. But officially the glasses are not supposed to be used?—No, and I think it is rather a pity.

769. There is a view, is there not, that fog and rain and things of that sort would affect them?—Yes, precisely. Then there is another very important reason now, and that is, supposing you are on a foreign station and you lose your glasses, you have got to be invalidated home, and it is a very heavy expense.

770. At the same time you recognise there are cases where the glass itself, apart from these other questions, is of use in improving the long vision?—Yes, distinctly.

[Mr. Acland then left and Sir Arthur Rücker took the Chair.]

771. (Sir Arthur Rücker.) You have told us about the officers, but I think you have not yet dealt with the men?—No. I will read you out the regulations for the vision for men: For candidates of the seaman class, including boys and youths, armourer ratings, engine-room artificers, electricians, and marines, full normal vision is required. That is to say, they have to have 6/6, and their colour-sense must be normal. For candidates for other artisan ratings, and for stokers, the vision must be 6/8, and their colour-vision must be normal. For all other ratings the vision must be not less than 6/12, and the only people who are not required to have normal colour-vision are writers, cooks, and officers' stewards. Marine bandmen are a special class; so long as they can read their music, that is the great point, and they are of course allowed to wear glasses. We also allow the people, whose vision is allowed to be 6/12, to wear glasses, because it does not interfere with them in any shape or form. That is for distant vision. Everybody must read D = 0.6 with each eye for near vision. We let them choose their own distance, because we find that a man who can read D = 0.6 can carry on his ordinary work, and he does not have to be invalidated if he should throw his glasses overboard, or lose them, or want to get out of the ship for that reason. I mean those cases do happen.

772. Perhaps you would kindly explain to us what half-normal vision means, and so on?—That is the number of the letter, 6/12 really, according to Snellen's type. You reduce it to one-half. We use the six-metre type. Then you have 6/60, which is one-tenth.

You use Snellen's type. You stand your candidate at a distance of six metres from that six-metre type, and then you test him, and you see what sized type he can read. If he can read only the type marked 60 at six metres, that would be 6/60, or one-tenth of full normal vision. If he can go down to 6/6, that is what they call full normal vision.

773. The nature of the test really depends on the angle?—Yes.

774. And a normal-sighted person would be able to read line 7 at a distance of 16 feet?—Yes, a normal sighted person can read them all down to 6/6.

775. That is line 7?—Yes.

776. At a distance of 16 feet?—No, at a distance of six metres; that is 20 feet. We use the six-metre type. We stand our people at six metres off. You are talking about a five-metre type.

777. Yes?—5/5 and 6/6 are the same. I should say the one you have just handed me is the five-metre one—the 16-foot one.

778. (Dr. Watson.) Yes?—We only use this when we have not got a room long enough.

779. (Sir Arthur Rücker.) What it practically means is, that you have got one line at that distance, which ought to be read by a normal-sighted person?—Yes, the point is it should be read easily.

780. Does that mean they should read all the letters?—Yes.

781. That you insist on?—Yes. My own experience is, if you pass a candidate who cannot read the letters easily, it is not a good test. He will develop some defect as he gets a little older, and you will find he has not got the vision he ought to have.

782. I believe some question has been raised as to whether the test in the seventh line is not too difficult. Do you find any difficulty?—Absolutely none.

783. In getting people who can read all the letters?—That is so. We have a number of people. We have a practically inexhaustible supply, certainly for officers, and for certain classes of men. We can get any number after January. They have increased the standard so much that we do not get many, because we do not want them. But after Christmas we shall want them, and down will come the standard a bit. Therefore we should only take very exceptional people just now, and we can get them, and so we take the best we can get.

784. Still, in your opinion, the reading of what we call the standard lines at the distance at which the man is prepared to read the whole of the letters is not too severe a test to impose?—It is not, in my opinion.

785. We have now done with what I may call the normal line?—Yes.

786. A person who cannot read that would read some other line?—Yes.

787. Line 7 is the normal line. Take line 5, for instance, in which case the angle subtended is ten minutes?—At that particular distance?

788. Yes, at that particular distance. Then what you practically do, in order to get a ratio of vision, is to divide the five minutes by the distance at which the line has to be read, say ten minutes?—Yes.

789. And the fraction so got reflects the vision of the person?—Yes.

790. (Dr. Watson.) We should be glad if you would explain the near vision test. We do not know anything about it at all?—We use the near vision test. It is Snellen's test. It is D = 0.6, and so the types ought to be held .6 of a metre distant from the eye. We do not insist on that, so long as the candidate can hold a paper up and read it at a reasonable distance. That is our test for near vision. We have that test because, if a man should lose his glasses, he will not have to be invalidated, or anything of that kind. I mean he can go on and do his work, until he can send and get more glasses. He can write and he can read.

791. (Sir Arthur Rücker.) That test is rather for what you may call office work?—Yes. You do it to test their accommodation, and so on.

792. That is quite a distinct thing?—Yes.

793. Then as to the tables which you have used for that, what relation have they to the tables which you use



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[Continued.]

for far distances?—They are all decided on the same system.

794. What is the distance?—It is 6 of a metre.

795. Is it a test of the same sort?—Yes, it is exactly the same test.

796. I think the next point is this. Do you know of any cases of persons who have been invalidated for defective colour-vision and who could pass the wool test but failed to pass the other tests?—I personally know of two. I do not propose to give you their names.

797. No, certainly not?—I know of two persons.

798. At the time they were invalidated, they could pass the wool test, but failed with the lamp test?—Yes; I examined them myself. They are people I know personally. They both passed the Holmgren test, and they both failed at the lamp test.

799. Have you known the converse case to occur, namely, a person who has failed with the wool test, but passed the lantern test?—No, I cannot say that I have.

800. Had the two persons who failed got good form-vision?—Yes, they had both got 6/6.

801. I do not know whether it is a fair question, but do you know of any case where a naval misfortune has occurred owing to defective colour-vision?—No, I do not.

802. You have told us you have known very few accidents to happen through defective colour-vision. Does the same remark apply to form-vision?—Exactly; because they are never examined.

803. There is no evidence at all?—There is absolutely no evidence.

804. May we take that as formal?—Yes, you may take that as formal. They are not examined. You can say that definitely.

805. (Professor Golch.) Is there any objection to that going down in the Minutes?—No; there is absolutely no objection to that going down in the Minutes. It is a matter of fact. I think Mr. Tallents applied to the Admiralty for information on that.

806. (Mr. Tallents.) I inquired whether they had any records with regard to accidents or mistakes at sea?—Precisely. This is referring to that.

807. (Sir A. Rücker.) May we take it from you that the records of accidents are really not adequate to show whether any of them have been due to defective sight?—No, they are not.

808. Then the next point is the reading of lights?—Of course, as a rule, I suppose they look at the light itself and recognise the colour from the light. But one of these officers who was invalidated told me—and that was the first intimation I had of it—that he did not try to read the colour from the light itself; it was from the reflection on the water, because it was a bigger area. Since then I have asked a lot of men about that, and they said, "Yes, as a rule that is the way we pick up our colour." I cannot say that is true; that is what they tell me.

809. A large area seems to help them?—Yes. Then I think there is another thing. I think that with the ordinary light—the ordinary bull's-eye—with a direct light behind, you get a centre where the colour is not anything like as complete as it is at the outside, simply from the glare of the light, and you notice that particularly in Buxton's telechrome. That is why I think the Edridge-Green lamp is very much better, where you have got a light below, and the light is reflected on to an open disc, and then on to the colour, so that you get no glare at all.

810. Then you think the reading of ordinary lights at sea is less certain than it would otherwise be on account of the glare of the lamp?—That is my impression. I think that is why the men say they pick up their colour better from the reflection on the water.

811. It is possible that we may make some experiments. Do you think it is important that we should make those experiments over water?—Yes, I think I should try them over water.

812. But you would not be altogether surprised if you got some different results?—I am simply telling you what was told me. I noticed it the other night

at Portsmouth, where coloured lights were reflected on the water, and you could plainly see them. Of course that was in smooth water.

813. Do they try it over rough water?—They did not tell me that.

814. It would be different there?—I think that is very likely.

815. Can you give us the benefit of your practical knowledge of these matters, as to where you think the best sort of place would be for carrying out experiments of this kind?—Of the colour tests?

816. Yes. Supposing we set up some lamps and arranged a series of experiments, partly over water and partly over land, what would you say?—I should say over water.

817. But supposing we decided to try both. I was rather thinking of the best situation. We would like you to suggest whether Shoeburyness or Portsmouth would be the best place, or what would be the best place?—Portsmouth would be a very good place.

818. Would it be affected by other lights very much?—I hardly think so.

819. A place could be chosen where these particular lights would be sufficiently isolated to be dealt with?—I think so, distinctly.

820. (Mr. Raymond Beck.) I think you said that the examination of these officers, the men who were going to be officers eventually, is taken when they are quite lads?—Yes, between 12 and 13 years of age.

821. Then, in your opinion, the examination or test which is given to them carries them through, or would you say it does not?—Do you mean carries them through their service?

822. Well up to the next examination?—There is no other examination, except for navigation. The large majority are never re-examined. I mean, the navigating class is a very small class, and the large majority of officers are never re-examined, unless there is some reason to do it.

823. The point is this; there is criticism that the tests, as at present used in the Mercantile Marine especially, enable a lad to engage in the service of the sea, and he is passed; but when it comes to the time for obtaining his captain's certificate, it is found that he has to give it up?—Exactly, and if you examined our people, you would have to do the same.

824. You think your experience would be that there would be a great percentage who would have to give up the service of the sea?—Yes, very considerable; I mean, if you are going to insist on the same tests.

825. Referring to the different colours of the wool in the two books which guided you, we have had that question before us, as to the desirability of an absolute standard red and an absolute standard green. I think I am right in saying that the present Board of Trade standard colour red is between two limits?—Yes.

826. Do you think there is any danger in not absolutely demanding one standard?—I think you want a standard. I think you want a standard badly—very badly indeed. I think you want a standard for the Navy and a standard for the Mercantile Marine; both to be the same, not only with regard to the question of lights at sea; but if we reject a candidate, for instance, an officer, for colour-vision or form-vision—but colour-vision in particular—he is certain to be taken to an ophthalmic surgeon. We want that ophthalmic surgeon to use exactly the same test we are using. We do not mind what the test is. If you will settle a standard test, we will accept it; but we want a test that will be universal, so that if you reject a candidate, he can go away and be examined by the same test that we have given him, which shall be the standard test.

827. That is very interesting. I am very glad to have elicited that answer. But what I meant to ask was, whether you think there is at the present time a variety in the reds and the greens?—I am sure there is.

828. And you would be in favour of a standard red for all port lights and green for all starboard lights?—Yes.

829. (Sir A. Rücker.) That is for the lights on the ships?—Yes.

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830. And you would have the same glass used?—Yes. If you are going to use a luminous test for your test I would have exactly the same. If you are going to have wool tests, you must have a standard red and a standard green, at least if you are going to use the Holmgren wool test. I think the pale pure green must be the same for all examiners. Then the next tests—the pink test and the red must be of the same shade.

(Mr. Parsons.) That is rather a severe criticism of the test.

831. (Sir A. Rücker.) If these glasses are bought in the open market it would mean they would have to be tested?—Do you mean the bulls-eyes?

832. Yes. That would mean they would all have to be tested by some authority?—Yes.

833. Now, then; two makers, acting perfectly independently, might fail to get precisely the right standard. There would have to be some amount of law left?—I suppose there would be. There would have to be a little, but not very much.

834. Does that not come very much towards saying that you would choose two glasses, one a little bit on one side of the standard, and one a little bit on the other side of the standard, and if it came between the two it would be all right?—Yes.

835. Is it better, in your opinion, to have an absolute standard, and to leave it to the authority to decide whether that standard has been reached within reasonable limits, or would you have two glasses?—I would rather have your first suggestion.

836. (Mr. Parsons.) Are not two things being rather mixed up here? I mean the question of the actual lights and the question of the standard colours of the test? You think the colours should be absolutely standard colours, so that everything would be absolutely the same. That was Holmgren's idea. And if the colours are not standard colours it simply means the test is not Holmgren's test?—I am personally in many ways in favour of Holmgren's test.

837. But it ought to be Holmgren's?—Yes, it ought to be Holmgren's test. If you are going to use Holmgren's test, it ought to be Holmgren's test with Holmgren's standard colours.

838. There is nothing new about that?—No, there is nothing new about that. There is your pale pure green (examining the green test skin). I think that is very like the one given in Swanzy's book. I have not got the book with me, but I should say it is a shade darker than that. I am not sure, but I think so. The only thing is, I mean, that you get controversies about it. Somebody quotes one book, and somebody quotes another. I saw that the other day.

839. (Sir A. Rücker.) I mean, when the wools are employed in the tests, they ought to be as nearly as possible the same in every case. But the question I was thinking of almost exclusively was as to the actual limits desirable in the colour of the glasses used, and whether you could get glasses used in different sets so absolutely right?—I think you would get them absolutely right, or so near that you would not be likely to make a mistake.

840. (Mr. Norman Hill.) I would just like to see if I can understand the terms you use, or that have been used. I am extremely ignorant on the point. We are told that a 9-foot buoy subtends an angle of 5 minutes at a distance of 2,063 yards. Am I right in understanding that a man whom you describe as having half-normal vision would pick up that buoy only at 1,000 yards?—I should say so probably.

841. That is the application of the test?—Yes, that is the application of the test.

842. Then we are told that, in the Mercantile Marine, the apprentice has no compulsory examination as to form or colour-vision?—I do not know.

843. We are told that. But he is tested when he comes up for his second mate's certificate. He is tested when he comes up to pass for his first mate's certificate. He is also tested again when he comes up to pass for his master's certificate. So in that respect, the tests in the Mercantile Marine are very much more severe than your tests?—Yes, much more severe. We have only one test, except for navigating officers; and

they have two, one on entry and one on trying to qualify.

844. Then as to the age of an officer, I understand from your evidence, you do not attach substantial importance to the shortening of his vision?—His near vision. I mean, his near point gets further away, and his accommodation fails, and he has to get glasses to bring his reading into within reasonable distance of his eyes.

845. And in testing for the near vision, as long as a man can read at any distance he pleases, you are satisfied?—Reading certain types.

846. You would be satisfied?—That is the near test.

847. Well, in your experience for the far vision, does the sea training of the man, the sea training of the eye, in any way take the place of the long vision, as you test it by those cards?—I think so, to some extent. I suppose the brain comes in to some extent, in the same way as you have it for gunnery.

848. Would it be reasonable to subject an officer to the same form-vision test, say at 45 or 50, for distant vision?—Yes, I think so, even at 45 or 50, for distant vision.

849. But so far as his near vision is concerned?—You do not worry about it. He can wear spectacles for his near vision. They all do, of course.

850. Then it is only the near vision that you allow to be corrected by the use of marine glasses?—No. By marine glasses do you mean telescopes?

851. Binoculars?—No. Not by binoculars or telescopes. I mean anybody is allowed to use a telescope or binocular, any executive officer. They use them constantly, and in fact you will never see an executive officer without one. He has to carry one.

852. (Captain Golding.) And telescopic gun sights?—Yes, and telescopic gun sights.

853. I should like to ask a question to clear the ground a little for the experiments which we may carry out. You have only given it as other people's opinion, not as your own, as to the reflection of lights on the water. In the case of a submarine, which is close to the water's edge, you may get a reflection. But how would that apply in the case of a battleship, or a large cruiser carrying her side lights 30 or 40 feet away from the water?—You get a reflection there, too.

854. But that is a long distance ahead of the vessel?—Well, it is some little way off. Mind you, I am only telling you what I have been told.

855. That does not square with your opinion?—I am not giving that as my opinion at all.

856. I started by saying that. There is one more question I should like to ask you. In your evidence you also speak of certain officers only requiring one tenth of the normal vision. Does that mean merely 10 per cent. of a normal-sighted person?—Well, that is what they call it.

857. It seems a very small amount?—Yes, but they are officers who are allowed to wear spectacles. Doctors and paymasters and chaplains and naval instructors can wear glasses. Provided that defective vision is due to error of refraction which can be corrected to 6/6 by glasses, we allow it.

858. (Professor Golch.) I am very ignorant about the conduct of affairs, so if it is an official question, please tell me. I want to know who examines the boys at 13 years of age?—Two medical officers.

859. Two Admiralty medical officers?—Yes.

860. Are they specially appointed?—Any Admiralty medical officer may be detailed for the examination, but as a rule they are there for three or four years.

861. Does more than one medical officer examine?—Yes.

862. How many?—Two examine, and in a case of doubt you call in the Director-General, so that you have three. Before you reject a candidate you have three medical officers.

863. The Director-General of the Medical Department of the Navy?—Yes.

864. And he is called in in case of doubt?—Yes.

865. Are there cases of doubt?—Oh, yes. I mean there are cases where perhaps one of the two medical officers who examine a candidate may not agree.

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866. Is this an examination at various stations, and does the medical officer examine at Whitehall, for instance?—The examinations for officers for entry always take place at Whitehall.

867. Of these boys?—Every officer who enters the Navy is examined at Whitehall.

868. Then as to the seamen?—That is done at Whitehall Place. You have a medical officer appointed for three years; he does nothing but recruiting.

869. Is that one medical officer?—That is one medical officer.

870. Only one?—Only one.

871. What happens if there is a doubt there?—He has to decide.

872. The one medical officer really decides the question of seamen?—Yes, that is so everywhere for seamen.

873. Of course there are different stations?—Yes, we have recruiting stations. I have got a list of the outside recruiting stations here.

874. Then in the case of seamen, the form test is exactly the same as it is conducted at Whitehall?—Yes, exactly.

875. But the colour test, I understand, is not?—No, except at Whitehall Place. The colour test at Whitehall Place is the lamp and wools.

876. The seamen are not examined with the lamp?—Not the seamen who are examined outside London.

877. The seamen who are examined in other stations, as far as you are aware, are not examined by the lamp?—I know they are not. They are not examined except by the Holmgren wools.

878. When you use the lamp test, is the examination carried out in a dark room, or in a partially dark room?—It is partially dark. The lamp is put in a dark place, and you look into the box. That is at Whitehall Place.

879. Would you think it important that a candidate should perhaps be kept in a dark room for 5 or 10 minutes before he is examined, since he has got to define these lights at night, or do you not attach much importance to that?—It is a point I have not considered. As a matter of fact we do not keep any of our candidates in the dark room.

880. I want to ask one question about the glasses and the lights on ships. I presume they are the colours which fall within the grades of colour of the Board of Trade?—Yes, exactly, I should say they are the same glasses. Do you mean the red and the green?

881. Yes?—Yes.

882. Do you think that there is any difficulty from your own experience in picking up a coloured light at sea, if it is intermixed with a number of white lights?—Well, of course, the farther your light is away, the more difficult it is to pick it up as regards colour.

883. I meant rather that large liners, and of course large cruisers, and so on, have a number of other white lights at a distance, which rather intermix with the coloured lights?—Yes.

884. Do you think that adds to the difficulty of picking up coloured lights?—Yes, I think so.

885. (Mr. Parsons.) What about the examiners? Do they have special instruction in colour-vision testing?—No, they do not.

886. Do they simply do it on their own?—Yes. They are supposed to know the test, and they are supposed to carry it out.

887. Do they ever take the opportunity of seeing how the people are examined first?—Yes. As a rule you appoint a man for a short time to pick up the recruiting work from the man who is already doing it. Perhaps you would have him there for a month or something like that. For instance, I have just given up an appointment, and my successor was sent out with me for a month to see how it is worked. I should explain that the junior medical officers who join are now instructed in colour-vision at Haslar.

888. Then the men are not re-examined at all?—Yes, they are. The men are re-examined for form but not for colour, whenever they go abroad. That is quite a new regulation. It has only just come out. But the men who are on draft for foreign service are

to have their vision examined by the Snellen's type test, and the result is put on their certificates for the information of the commanding officer of the ship to which they go, so that he can detail them for any of the duties he likes. But that is quite a new regulation; it has not been in use very long. Prior to that the men were never examined, unless there was some complaint, or unless they complained themselves. Of course they frequently do complain themselves. I mean, a man, who wants to get out of the service, knows that he is pretty safe if he has got defective vision.

889. Of course as far as entering the Navy is concerned, there is no appeal at all?—No.

890. Supposing a man is re-examined for any purpose and found to be defective, and he is invalided, he would have no appeal at all?—Well, he would have an appeal in this way; that, supposing he went to an ophthalmic surgeon afterwards and he produced a certificate as to the condition of his vision, and that ophthalmic surgeon was a reputable person, and he found that a mistake had been made; if that man applied for re-entry, as is often done, the Admiralty would order him to be re-examined, and if necessary re-entered. I have known plenty of those cases. But of course our great difficulty is that you get a man invalided for defective vision. He malingers. Although you may be pretty certain yourself that he has not got any defect, yet if that man says he cannot see, he goes down to G/60, and he will vow he cannot see anything else. Then he is invalided and goes out of the service, and he finds it is not all joy outside, and there is no piping to dinner every day at 12 o'clock, and he cannot get a job. He repents of the evil, and comes to the eye hospital, and he is examined, and they find he has got G/6 in each eye. Then he wants to come back. My rule has always been never to recommend a man like that for re-entering. But there are other cases where they do. I mean you must take every case on its merits.

891. In the case of a good many of the officers and the men, of course other than the navigating officers, I think there would be cases where colour-vision was important?—Yes, the watch officers and signalling officers.

892. It is very important, is it not?—My contention is, that is where we are wrong. That is what, I hope, we are going to try and alter.

893. Was there any special reason why that new regulation was introduced?—Yes. There were so many cases of men complaining after they had got abroad, because they did not like the ship or something of that kind. They said they had got defective vision, or something of that sort, and that they had got to come home.

894. (Mr. Norman Hill.) I think that is real evidence that this new test has been introduced to deal mainly with malingering. I think it should be on record that it has been found to be necessary for malingering and other reasons?—Malingering is one of the reasons.

895. (Sir Arthur Rücker.) I gather from you that one of the defects of the whole business is, that it lends itself to malingering?—It does.

896. (Professor Gotch.) That is the subjective nature of the tests?—Yes. But supposing we have a man who says he has got defective vision. Before he is invalided he has to go into hospital, and he has to have an ophthalmoscopic examination, and you have to see what the cause of the defective vision is before you are allowed to invalid him. But, even then, supposing you find that he is normal in every way, there still comes in the question of malingering. He will not go beyond perhaps G/36 or G/60, or something of that sort. Then what are you to do? If you take the responsibility of saying that man is fit, he is going to take the very first opportunity he has to prove he is not fit, and then the unfortunate medical officer is going to get into trouble.

897. (Mr. Parsons.) If I understand rightly, the tests used in the first place for the boys, and afterwards for the navigating officers are all subjective tests?—

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Yes, they are all subjective tests according to the present regulations.

898. So that, in the nature of things, there are a good many cases when they get to be 40 or 50 years of age?—The older they get, the worse their vision gets. As a matter of fact, a great many executive officers unofficially wear glasses. There is no question about that.

899. I take it that you would prefer, if you could, to have an objective test from the very beginning?—Well, I am not so sure about that, because I think if you carry out a subjective test fairly—that is to say, if at the distance the candidate can read all the letters without any hesitation at all—there is not very much to grumble about.

900. You mean at the age of, say, 25?—Yes. You see, I want to have a second examination. I think what nearly all we medical officers want is an examination on entry and an examination again, when they finish their sub-lieutenant's course.

901. (Mr. Norman Hill.) Would that satisfy you?—I think so.

902. That ought to be right for the rest of a man's life?—I think if the man is 25 years of age it is reasonable.

903. (Mr. Nettleship.) Supposing there is a moderate amount of hypermetropia which the navigating candidate at, say, 25, is able to cover, so that he can still read G/6 easily; how will he manage when he is 45 or 50 and unable to correct the optical defect?—By the time he was that age, he would probably no longer be a navigator.

904. So it practically does not matter?—That is so.

905. I suppose, in using the Holmgren test, you always use all three of the wools?—No; some do and some do not. I think the rule is that, if you use your first test, the pale pure green, and the candidate puts confusion colours with that green, you say he is colour-blind. We require normal colour-vision, and we have to reject him.

906. Take it the other way about. Supposing he passes the first test, do you always put him through

The witness withdrew.

Mr. W. GRIEVE called and examined.

916. (Sir A. Rücker.) I think you are the Headmaster of the Aberdeen Navigation School?—I am Headmaster of the Aberdeen Navigation School, and a certificated Master Mariner with some sea experience.

917. And you are an Associate Member of the Institute of Naval Architects?—Yes.

918. And Nautical Assessor to the Court of Session?—Yes.

919. And Chairman of the Directors of the Mutual Steamship and Trawlers' Insurance Club, Aberdeen?—Yes.

920. You have had long experience before going to Aberdeen?—I was assistant in the Leith Nautical College for two years after giving up the sea as an occupation.

921. And you have been chief officer of both steam and sailing vessels?—Yes.

922. I understand you have some views on the question of the reliability of wool tests?—Yes. Might I speak first of all on the form-vision test?

923. Just as you please?—I did not put that down in my précis of evidence, but I would like to make a few remarks upon it. Since the wool tests came into force, the average number of students whom I have examined in Aberdeen would be about 150 per year; and last year, when the fishermen had to go through these compulsory examinations, at the classes in the northern ports, I examined somewhere between 350 and 400 of the fishermen. With reference to the form-vision test, the present test in my opinion is, I think, good as far as the standard goes. But the proposed test, in my opinion, is an improvement upon it in this respect, that the proposed form test makes it compulsory for each eye to be examined separately. At the present time, as long as they can read five letters out of the eight in the fifth line with both eyes, that is good

the other two?—As a rule you put him through the rose-coloured one, and then, of course, as a rule—and it is a rule I have always carried out—after you have done the Holmgren test without naming the colours, you make him name the colours, to see whether he is colour-ignorant or not.

907. You drop the word "Holmgren" and adapt the wool test to circumstances?—Yes.

908. Then may we go back to these two people you found had passed the wool test, but did not pass the lantern test? Could you say you tried them fully with all the three tests?—Yes.

909. You do not use the Edridge-Green orange test, do you?—No, I do not.

910. In those two, as far as you remember, each mistook the lantern, and not the wools. Have you any difficulty from your experience, which is considerable? You could not coach them in the least on the wools?—I could not coach them. I do not know if anybody else could.

911. You had your suspicions?—Privately, I was a little in doubt about the *bona fides* of one of the two. The other was a very marked case indeed of an officer who completely broke down. He had a nervous breakdown in China, and was sent to hospital there, and was invalided home with functional heart disease. When I came to examine him, I could not find anything wrong with him. But, in talking to him, I asked him what was the matter with him, and I put it to him quite plainly. He said, "I am colour-blind, and it got on my nerves so."

912. How had he got into the Navy, do you know?—I do not know.

913-15. He failed with the lantern and was quite good with the wools?—Yes, he was quite good with the wools, and was distinctly bad with the lamp. He was also another case that was verified by Dr. Edridge-Green. At that time we were going into the question of colour a bit, and Edridge-Green was advocating his lantern. He was coming to us about his tests.

(Sir A. Rücker.) We are very much obliged to you, Dr. Welch.

enough. I think that each eye should be examined separately; and for this reason. Amongst the fishermen especially, I have found that many of them possess excellent eyesight in one eye, but, through accident or other causes, the second eye is a long way below the standard that would be required for the new test. Now I think that if each eye was examined and it was found that one eye was pretty bad, a special examination should be held of these men, to ascertain, if possible, whether the defect is due to accident or disease. It would be more satisfactory for the men themselves to know at once whether the bad eye was sufficiently bad to delar them from going forward for examination. In the meantime they have to wait three months, and then they present themselves for examination again, and of course they may be sent down a second time, and so on. That is the whole of the point on that head.

924. You approve of the new test?—I approve of the new test in so far as each eye should be examined separately. But I would go this length and say that, if it was found that a man had one good eye and one below normal, and he was specially examined, and it was found that the bad eye was due probably to accident, and there was no likelihood of the other eye being affected, then I think the present test is quite a high enough standard to put the man through. The new test, of course, is much higher than the present one.

925. You want, in these cases where one eye is distinctly made out to be bad, that there should be someone consulted as to whether that defect is likely to extend to the other eye or not?—Yes, whether it is a disease of the eye which is likely to go on spreading and affect the other eye, or whether it is due to accident. The men themselves tell me that the defect in



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[Continued.]

the one eye is due to accident, and of course I am not in a position to say whether that would affect the good one or not.

926. Is that all you have to say on that point?—That is all I have to say about form-vision.

927. Now what have you to say as to the wool test?—The present test has to be carried on after January 1914; and my experience of the wool test is that in well-defined cases of colour-blindness—that is where the candidate comes forward and matches a green with a brown—the wools are all right. But where you have cases in which the candidates appear to have a feeble sense of colour, it is impossible for the ordinary man to say whether that is due to ignorance or to feeble colour-sense. Personally I have not yet been able to decide what it is due to. All I can say on examining the men is that they fail to match the finer shades. Beyond that, of course, I cannot say anything. But in well-defined cases the wools are satisfactory. But we have to consider the examination from the seamen's point of view, I think. He is not asked to deal with all these different shades and different colours. In his occupation he has to deal with the three lights, white, red, and green. In all the cases I have had except one, where I have thought there was a feebleness in colour-sense, on testing them with the lights and the coloured glasses, I have never yet had them fail to distinguish between white, green, and red. The feeling of the men in Aberdeen is that the wool test should be entirely done away with. They realise, of course, that it is important that they should have good colour-sense, and they are of opinion that the wool test should be done away with altogether, as it is considered not satisfactory, and that the test should be made with lights.

928. Then how was it done in the cases where you tested them with lights?—Just in a dark room, with green and red glasses before a little bull's-eye lantern, which is the old type of test. I understand that now they have lamps made, where they can reduce the brilliancy of the light to a very feeble light, and probably that would be a more satisfactory test than the old one.

929. Then, I suppose, when you were testing them you did not put the glasses in regular order, but tried to puzzle them, as it were?—I put them in regular order, and then I mixed them up afterwards, just to see if they were able to distinguish between green and red. There was only one case where there was a mistake made; and that was a man whom I did not send forward for examination, because he made such a mess of the wools to begin with. He was mixing up reds and greens together, and greens and browns, and so on. Then I tested him on the coloured glasses and found him wrong there.

930. You mean that even in the cases which have been shown by the wools to be fairly pronounced cases of bad colour-vision, they have passed the light test?—Not where they have been well pronounced. I have only had the one well pronounced case through my hands. The others have had just a feeble sense of colour, or have been ignorant probably; and in those cases I have not yet found any fail to distinguish between the red and the green.

931. Out of how many?—Probably I should have well upon 1,000 candidates altogether. Of course, the percentage of failures is very low.

932. A thousand persons of feeble colour sense?—No; those of feeble colour-sense would be between 25 and 30 in number. In those cases we have put them through the lights and they have always been able to distinguish them.

933. Are there hardships on candidates?—The hardships I have to mention are in cases where candidates go before the local examiner, and fail to match the colours properly for him. Then they have to put in a special appeal. In London the candidates do not suffer much hardship, but in the north of Scotland there is a considerable delay. Appeal has to be sent through the local examiner to the headquarters here, and the candidates have to wait until such time as the examination is arranged. That, of course, entails loss of time; and seafaring men as a rule are

not too well off, and sometimes they have a difficulty with regard to money in waiting until such time. We had one case where the Christmas vacation came in, and the candidate was kept waiting about four weeks before he came to London.

934. The candidate has to come up to London?—Yes, he has to come up to London to go through this special examination. In other cases, if it is financial matters that are worrying them, when they fail before the local examiner, some of them have a feeling "What is the use of going up to London; I shall probably fail and I cannot afford to pay all my expenses for this." In two cases, I have had men who have been five or six years at sea giving up their profession altogether rather than face the examination in London. Probably they knew they were slightly deficient themselves. Then there is one very special case we have had. The Board of Trade know this case well. It is the case of a lad named Marshall, who was examined by the local examiner before he went to sea, and he got a certificate that he had passed the test. He put in his four years of apprenticeship, and then became a junior officer in the P. and O. Company. He came home to Aberdeen, and then prepared for his examination before the local examiner, but failed in the same test he had gone through before.

935. (Professor Golch.) Was that form or colour?—It was in colour-vision. He came up to London and went through the special examination, and they had some doubt, apparently, in London about him, because they gave him another three months to stay on shore or do anything he liked, and then come up to London again for that second examination. He was declared to have failed finally in the second examination. Of course that was a distinct hardship to that lad, because if the examination had been on other lines than what it was, when he passed the first examination, he probably might have been found to have been deficient at that time, and, of course, would have gone in for some other career. As it is, his 5 or 5½ years' sea experience is actually thrown away.

936. (Sir Arthur Rücker.) Are there many such cases of hardship?—No, that is the only one of that kind. But the people in the North feel it is a hardship to have to put in a special appeal, and then have to wait, probably, ten days or a fortnight, and come up to London for this special examination.

937. What would you suggest?—I am coming to that. I have nothing whatever to say against the local examiners as to the manner in which they carry out their instructions. I think they have shown every consideration to the candidates. But as this colour examination and form examination is so important to the candidates, my opinion is that the Board of Trade should appoint oculists to put the candidates through this examination. It should not be left to the local examiners at all; they should be entirely relieved of it. The oculist would then be able to say at once whether the candidate was fit to take up the profession or otherwise, whether he was likely to improve if he was found to be deficient, or whether he was to be debarred altogether.

938. In that case would you allow any appeal?—No. I think it would be quite possible in all the examining ports to have an oculist appointed by the Board of Trade, whose decision would be perfectly satisfactory. I think it would be satisfactory to the candidates themselves.

939. (Mr. Raymond Beck.) With regard to the case you mentioned of the boy Marshall, you said he entered the service of the P. and O. Company?—I understand he was a junior officer in the P. and O. Company.

940. That Company have a private test of their own, apart from the Board of Trade?—Yes.

941. Did he pass that test?—He must have passed that test I should say, or else he would not have got in. I understand they put all their junior officers through the test. When he came forward for examination in Aberdeen, he failed to match the wools before the local examiner, and then he put in this special appeal, and came up to London, and was examined here; and the examiners here would not say

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at the time that he was sufficiently bad to fail finally, and they gave him another three months and asked him then to appear.

942. And he failed?—And he failed then altogether, and has had to give up the sea.

943. (Mr. Norman Hill.) When you say you approve of the new form-vision test, I understand you mean, you approve of it so far as it requires each eye to be examined?—Yes, that is all I approve of. I think the test itself may be just a little bit severe for the fishermen. I would like it to be made perfectly clear, that I think it is right there should be a proper test made of all candidates. Each eye should be examined in form, and if it was done by an oculist, as I suggest, he would be able to say at once whether the deficiency in the one eye was due to disease or accident, and whether the man was a fit subject to be left in charge of a ship.

944. Then if there is one healthy eye which has the present range of vision, and the other eye is defective from accident, you would be content and you would pass the man?—Personally, I prefer two eyes to one. But I am not in a position to say that a man with one good eye would not be able to keep as good a look-out as myself with two eyes on board a ship. I would not debar a man, if he had one good eye, from going on to his examination.

945. You would not have thrown out Nelson, for instance?—No.

946. Have you had any case brought to your knowledge of accidents arising from deficient form-vision?—No, I have had no information given to me in regard to that.

947. (Captain Golding.) You suggest that oculists should carry out the examination. But I take it the standard of test should be laid down by the Board of Trade?—The test should be laid down, most certainly.

948. In that case, would the oculist's decision be final; or would there be an appeal to a higher authority?—That is really a matter for the Board of Trade. My own opinion is that an eye specialist is a man qualified to say definitely whether the candidate is good enough or otherwise, and I think the candidates themselves would accept his decision as being perfectly final.

949. If there is to be an appeal to a higher authority, you might as well go on as at present?—If you go on as at present, of course, there is the hardship to the men of having to wait, and so on. My point is this, that an oculist is a specialist on the subject, and he can say right away whether a candidate is an unfit candidate to possess a certificate or otherwise.

950. Then you would make his decision final?—Yes, I would make his decision final.

951. (Sir Arthur Rücker.) Would not the difficulty about fees come in?—No; I think the candidates would be very glad to pay a fee in order to cover the examination by the oculist, so as to get the decision at once rather than to wait on.

952. I can understand it with those about whom there is doubt, but how about the large number who pass without any doubt?—Well, they pay fees in the ordinary course for their examination, and I do not think the additional fee would debar them from going forward at all.

953. I should not like to ask what some oculists might charge?—Sailors are accustomed to paying their fees for school purposes and for examination purposes. If I have any doubt about a candidate myself, before he goes forward for examination, I send him up to the oculist in Aberdeen, and he charges them half a guinea. They have never complained about that.

954. Would the average fisherman be willing to pay half a guinea?—Yes.

955. (Professor Golch.) You are a member of the Trawlowners' Association. In your statements do you represent their views?—I represent the views of the people in Aberdeen—the fishermen and the seafaring people in Aberdeen.

956. Do we understand that you represent, apart from your own views, the other people?—Yes, I represent the views of the fishing people of Aberdeen.

957. Are they in this association?—The Trawlowners' Association asked me if I would come forward and give evidence here, and I have got their views. I have got also the views of many of the fishermen, who have gone through these examinations.

958. In these criticisms you are really giving us what the Trawlowners' Association think?—Yes, and what the men themselves have told me.

959. I rather gather that they, and you, representing them, attach great importance to the form-vision test?—Yes, to the form-vision test.

960. And you are inclined to think, as I understand it, that it is desirable it should be slightly increased in severity?—That each eye should be examined.

961. That is increasing it?—Yes, but to find out just exactly what the condition of each eye is. We are quite alive to the fact that it is necessary that these men should have fairly good eyesight.

962. I understand that. But I want to know whether the trawl people themselves attach importance to this?—Yes.

963. Then about colour-vision, is it your objection that it is not done under the sort of conditions in which a man has to see lights at sea? Would you object to the wools being wools of all these shades of colour?—All these different shades of colour confuse the candidate. From my own point of view, as having examined these men, I think it would be more desirable to substitute the light test for the wool test.

964. I quite understand your point of view. But I want to know if the trawl people themselves have been examined, and have raised this objection?—Yes, the men themselves complain always to me about these wools.

965. Do they say it is not the sort of thing they have to do at sea?—That is so. That is their point, that in their occupation they are called upon to distinguish between green, red, and white; and that this matching of skeins of wool is confusing to them, and they do not like it, when they go forward for examination.

966. I suppose what you want is some sort of Board in Scotland to which the appeal can be made?—No.

967. Instead of coming to London; is that the suggestion?—No; what I have suggested is that in each examining port an oculist should be appointed by the Board of Trade.

968. Supposing there was an appeal Board found necessary; would it at all ameliorate the condition of affairs, if such appeal could be made to some body in Scotland?—I think, if it was decided there should be an appeal to a higher tribunal, the present one in London would be the most satisfactory of all.

969. You do not want a separate one?—No.

970. (Mr. Nettleship.) There is just one more question about the wools. I do not know whether I am right, but I understood that, out of the total number you have tested, you have only found one who is very definitely colour-blind on the wools?—I had no difficulty myself, as a layman, in seeing that he was colour-blind.

971. But you found a fair number, 25 or 30, to have feeble colour-sense?—They failed to match properly.

972. And all of those, except one, passed the lantern test?—Yes, I gave them the lantern test. Of course, I had not a proper lamp. It was simply the old test, small square panes of glass, red and green, and they all distinguished clearly between green, red, and white.

973. So far as the body of men you are referring to is concerned, the wool test was very effective?—My point is, with the wools, I, as a layman, cannot say whether the man who goes wrong has a feeble sense, or whether it is due to ignorance. It certainly takes a great amount of training to make them perfect in the matching of the wools.

974. But you do not find any, who are doubtful with the wools, to fail at your lantern?—No.

975. So far as the testing went, the wools were effective?—Yes.

976. I can quite understand the men objecting to the wools, because they are different to what they need

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at sea?—In regard to the wools, of course, so much depends on the atmosphere; a good deal depends on the condition in which the wools are. They get dirty with handling, and so on, and they have a difficulty. I have no doubt that the physical condition of a man has a good deal to do with colour-sense. I know personally that some days I take longer to match wools myself than other days.

977. (Sir Arthur Rücker.) You know that specimens of wool, if a man fails to pass, are sent to London?—Yes.

978. I mean the question as to whether you interpret exactly his exact colour-vision is not so important, because it is settled by people doing a great deal of it in London?—Yes, I know. I quite agree that the final examination in London is the highest examination a candidate can be put through. My point is, to get over the hardship of delay, that it would be better to have the examination made in each port by the oculist.

979. (Mr. Norman Hill.) Could we have approximately the number of trawlers sailing out of Aberdeen, and the number of men?—Certificated men?

980. Yes?—I should think there would be about 300 steam trawlers, and each vessel has two certificated men. But, of course, many of these men got servitude certificates, and they were not put through a test.

981. About 600 is the total number of the certificated men involved?—Yes.

982. (Professor Gotch.) Are there not three certificated people on those boats?—No, only a skipper and a second hand. And the same thing applies now to the steam drifters.

983. (Mr. Nettleship.) With regard to the total number of men whom you examined, call it a thousand, they were not all fishermen?—No. There were foreign-going candidates and home-trade candidates, and also

fishermen. Of course we have had the most trouble amongst the fishermen; and during the last year I have been examining them in this new form-vision test, and I find that, when it comes into force, there will be very many more failures in the form-vision test than there have been in the past, due to the one eye being under normal.

984. (Mr. Norman Hill.) But it is not accident generally?—They say so. Every candidate whom I ask, "What is the cause of this eye being bad?" will reply, "Well, I got a blow," or, "It was due to an accident," or something.

985. (Mr. Nettleship.) I think we may take it that is not always the case. There are a good many who are defective?—That is so. I do not mean it is always caused by accident. But their statement has impressed me with this point, that it is desirable that each eye should be examined by some responsible person who would be able to answer the question: "Is this eye defective through disease or through accident?"

986. (Professor Gotch.) You say you have examined recently under the 1914 regulations. Why have you examined in form-vision?—Because they can take that just now if they like.

987. Why do they wish to do it?—Because I put them through that test myself when they enter the school. Every candidate who enters the school is put by me through the form-vision test.

988. You examine him on the new test, because it gives him a chance to come in in 1914?—No, I give him a chance just now to take the new test if he wants to. If he is not up to the standard of the new test, then I try him with the present test.

(Sir Arthur Rücker.) Thank you very much, Mr. Grieve. We are very much obliged to you.

The witness withdrew.

After a short adjournment.

Captain C. L. A. LECOUSTRE called and examined.

989. (Chairman.) You are one of the examiners at Liverpool, are you not?—Yes.

990. You are what they call a third examiner?—Yes.

991. Who is principal examiner?—The senior examiner is Commander F. M. Sergeant, R.N.R.

992. How do you arrange the work? Which of you take which set of candidates?—There is no division in regard to the different grades. We do the whole of the work, and examine masters and mates right through the colour and the navigation and the seamanship. We do it equally.

993. You divide it between you?—Yes.

994. Do you have a system?—The routine we have at Liverpool is, that one examiner will be at the desk and take all the navigation cases, and another examiner is dealing with seamanship and signalling and other parts of the examination; and then the next week the first examiner will go on to seamanship, and so on.

995. All these examiners are qualified to take these tests?—Yes, when we are appointed, we go through precisely the same examination and have the same qualifications.

996. Then you really arrange it from time to time?—Yes.

997. Do you, as a matter of fact, take a good share of the vision tests?—Yes, I take quite an equal share. In fact the second examiner and myself do, perhaps, a little more, because the senior examiner may be doing other work, checking the papers of the candidates, to see their service is in order.

998. What sort of number pass before you in a month?—Our numbers fluctuate so much. Sometimes in a year we have quite a good number, and at other times the numbers may drop off. I suppose, on an average, we have 60, 70, or 80 candidates a month for masters' and mates' certificates.

999. Do a considerable proportion present themselves voluntarily?—Do you mean just for the sight test alone?

1000. Yes?—Of course the numbers I refer to are confined to the examinations of masters and mates. Outside of that, we have a considerable number in Liverpool who come up just for the form and colour-vision test alone.

1001. And pay their shilling fee?—Yes, and pay their shilling fee.

1002. You have a separate time allotted to them?—Yes.

1003. A separate day?—Well, we take them at the same time that we take the masters and mates, and on Thursdays, Fridays, and Saturdays. Friday is the principal day, and then we have the bulk of examinations in colour.

1004. Then the numbers who come up in that way are outside the figures you mentioned just now?—Yes. They would, perhaps, average 500 or 600 a year.

1005. Have you got any statistics about them? Are they contained in the Board of Trade statistics?—Yes. The Board of Trade will take them from what we have in Liverpool. We have to record every examination.

1006. And they are coming to you for the voluntary purpose at all ages?—Yes. They come at (say) 12 or 13 years of age, before they go to sea, and then, perhaps, after they have been at sea for a voyage or two. Each time they come for a certificate they are examined. Then, after they have got their certificates, many of the steamship companies in Liverpool require the officers to be examined periodically, perhaps once a year or every second year. That refers to all their officers.

1007. And I suppose a certain number of failures arise in those cases with the older men. I mean these

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older men whom the companies insist on being examined?—Yes. Occasionally we have a failure in form-vision of men who are on in years.

1008. But not often in colour-vision?—Very rarely. In the six years I have been in Liverpool I do not know that we have had a case.

1009. Not an older candidate failing in colours?—No.

1010. What they fail in is form-vision?—Yes. I think I am right when I say I do not remember one.

1011. When you get your colour-vision failures is when they are starting for the first time?—Yes.

1012. Will you kindly take a boy we have here, and put him through the examination test in the ordinary way?—Yes, I will.

E. Sale was then called and tested by the witness.

(Witness.) Commencing with the wools, what I require you to do is to pick out from this heap of wools all the skeins you can see of that colour (pointing to the green), and you are not expected or required to match that exactly. What you are required to do is to pick out all the wools you can see of that colour, of a shade as near that as you can, and some lighter and some darker. Do not pick out any wools you are not sure of. They must be a distinct shade of that colour—but they can be darker or lighter.

(Sale picked out one green and was freely handling the skeins.)

(Witness.) Do not handle the wools; it will not assist you. It is better to keep your hands by your side. Look over the wools, and then just pick them out and throw them on one side, like that (illustrating). Pick out light and dark shades.

(Sale picked out seven green skeins of similar shade or darker.)

(Witness.) Have you ever been through a test like this before?

(Sale.) Yes, once before.

(Witness.) I will pick them out for you. You must confine yourself to that colour. There must be no other colour. The shade may be very pale or very dark. I will show you what is meant by the shades of that colour. It does not matter how dark they are, or how light they are. You see there is a very pale one (illustrating). You see the difference between those and these? (showing the light and dark greens).

(Sale.) Yes.

(Witness.) What colour would you call that, if you were asked to give it a name?

(Sale.) Green.

(Witness.) Is that like the colour?

(Sale.) That is a paler green.

(Witness.) Is it like this colour?

(Sale.) Yes.

(Witness.) Does it resemble that (the test skein)? Do these colours look alike?

(Sale.) No, they are not alike.

(Witness.) You see those colours? It does not matter how pale or how dark they are; confine yourself to the colour you see there (putting back the colours and mixing them in the heap).

(Sale picked out two dark greens.)

(Witness.) It is best not to handle them. Just look quietly round, and do not touch a wool until you see one you wish to pick out. Pick out one or two good deep shades of that colour (green). You are at liberty to withdraw a colour if you think, after you have put it there, it is not a good match. Is that the same colour?

(Sale.) Yes.

(Witness.) Well, pick one or two more out, quite distinct shades of that colour.

(Sale did as requested.)

(Witness.) Could you find me a paler shade like this (the test skein)? Is this like the test skein?

(Sale.) It is a darker shade.

(Witness.) Does it resemble it in colour? Never mind whether it is darker in shade. Do any of those you have picked out resemble this?

(Sale.) No.

(Witness.) Are those two at all alike?

(Sale.) The one is a bit darker than the other.

(Witness.) It is not a question of the shade, it is the colour. Do they resemble each other?

(Sale.) Yes.

(Witness.) If one is alike, the other must be alike. You want to confine yourself to that colour you see there. What colour do you call this?

(Sale.) A light green.

(Witness.) A pure green?

(Sale.) A light green.

(Witness.) Is it a pure green, or is there any other colour in it?

(Sale.) I cannot see any other colour in it.

(Witness.) Does it resemble that at all? (showing a yellow).

(Sale.) No.

(Witness.) Does it resemble this (another yellow)?

(Sale.) No.

(Witness.) Will you pick them out again? It must be a wool of that colour. It does not matter whether it is a lighter or a darker shade.

(Sale proceeded to pick out the greens again.)

(Professor Gotch.) Do I understand that you are showing now precisely the method you would adopt in Liverpool in examining a candidate?

(Witness.) Just exactly as I am doing all the time. If the candidate has any difficulty at all between the light and dark shades, I help him.

(Captain Golding.) May I be allowed to do that test, in order to see how far a normally-sighted person might go wrong?

(Chairman.) Yes, presently.

(Sale proceeded to take out the darker shades of green.)

(Witness.) Can you find one or two more? Will you find a pale shade of that colour? You have got sufficient dark ones. Would you call this the same colour (pointing to one of the shades of green)?

(Sale.) It is not the same colour.

(Witness.) Is it a shade of that colour?

(Sale.) Yes, it is a shade of that colour.

(Witness.) You are not expected to get an exact match. I may tell you that there are not two wools on this table precisely alike. The number of wools of that colour go right from the pale to the dark. Is that the same colour?

(Sale.) Yes.

(Witness.) Is that?

(Sale.) Yes.

(Witness.) Then will you pick me out one or two more? Do not waste time by looking for an exact match, as it does not matter how dark or how pale they are, as long as they are a distinct shade of that colour.

(Sale did as requested.)

(Witness.) You have picked out sufficient now. Can you see any wools there, that are not a very good match?

(The boy picked out two bluish greens.)

(Witness.) Is there another wool at all like that there?

(Sale.) Yes (picking one out).

(Witness.) Now we will take the next test (pink). What you have to do is to take out wools like that, and they may be lighter or darker (illustrating how it should be done). Those go from the very dark, and are graded down right along to a very pale one. That is what is meant by shades of a colour.

(Sale proceeded to pick similar skeins out.)

(Witness.) Is this the same colour?

(Sale.) That is dark, sir.

(Witness.) Yes; but I am requiring you to pick out lighter and darker shades.

(Sale.) That is red, Sir.



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(Witness.) Never mind the colour. Does it look like the test?

(Sale.) No.

(Witness.) Have you got a wool that resembles it there?

(Sale.) No.

(Witness.) Do all those wools you have picked out look like the test?

(Sale.) Yes.

(Witness.) Is there a wool that looks like that (red) there. It may be a little lighter or darker, but does it look like that?

(Sale.) Yes, this one (picking one a red one).

(Witness.) I will put them back again. Now pick out the light and the dark shades of that colour (the test skein).

(Sale did as requested, but picked out some red skeins.)

(Witness.) I will now put them back. Now pick them out once more. You must keep to this colour (separating the pink from the red).

(Sale.) Yes.

(Witness.) When did you go through this test before?

(Sale.) Last week.

(Witness.) I think you understand now. The shade may be pale or dark.

(Sale picked out some shades of pink.)

(Chairman.) I think we will not take any more now. Those are sufficient for our purpose.

(Witness.) Very well, sir.

(Chairman.) Now, Captain Golding, will you go through the test?

(Captain Golding.) If you please, sir. I want just to see how far a normal-sighted man can be wrong.

(Captain Golding picked out a lot of greens, some with a bluish tint.)

(Witness.) There is only one thing. If once you get at all away from the colour, and get a wool which has a little blue in it, you are apt to go wrong.

(Captain Golding.) I do not know how far the test extends.

(Witness.) There is nothing very wrong in what you have done. There is nothing there that I should reject on. I wanted to confine it to pure shades of that colour. All the first ones you picked out were a splendid match.

(Captain Golding.) My reason for picking out this enormous number was, that it strengthens my argument, that the candidates should be told the number of skeins there are, which they are required to pick out. That is my reason for picking out all those greens. A candidate should be told the number of skeins that he ought to pick out, which most nearly resemble the test skein.

(Chairman.) Would you mind just stating the number which you think a candidate should reasonably pick? Should it be about four or five?

(Witness.) It should be about five or six—one or two light ones and one or two dark ones.

1013. Would you mind picking them out?—Yes.

1014. Those are all rejected, because there is no blue in this (showing the test skein), and there is in this?—Yes.

1015. Is that the main point?—Yes, they are not a pure match to the green.

1016. And these are?—Yes.

1017. How many have you got there, about 8 or 10?—Those are what the candidate would pick out, and are good matches; there are about 9 of them.

1018. Would that be quite enough in your opinion?—May I ask if this is more than a full set of skeins?

(Mr. Tallents.) No, it is an ordinary set; it is one of the last new lot that came in.

1019. (Chairman.) I gather, from what you said, you would be satisfied with three or four on each side?—Yes, three or four on each side.

1020. That would meet the case?—Yes, five or six wools would be sufficient.

(Mr. Nettleship.) What I have done for years is to divide the whole lot into three. Number 1 is that

pale green. I have picked out all the colours approximately of that degree of darkness, but none very dark. Similarly, all the skeins likely to be confused with the rose or the scarlet respectively are kept separate.

(Chairman.) Did you keep the colour separate?

(Mr. Nettleship.) Yes, I have done that for many years.

(Chairman.) You have found that to be quite satisfactory?

(Mr. Nettleship.) Yes, I find it to be very much better than this plan.

(Captain Golding.) Those are two rejected skeins. How much do they differ?

(Witness.) They are rather bordering on the yellow. But that would not show that a candidate was going wrong.

1021. (Professor Gotch.) Supposing a candidate picked out that colour (blue), what would you do then?—If he did that and left it there, it would show he was not normal.

1022. Would you pass him?—No.

1023. Would you report him?—Of course, if that was the only one, it might be that the candidate might withdraw that at the next attempt.

1024. If he could not discriminate quite accurately between blue and green, would you reject him?—Yes.

1025. (Captain Golding.) Would that be a good match? (exhibiting two skeins of blue green tint).—No.

1026. Would it fail him?—No.

1027. Would you consider it a good match?—No.

1028. (Professor Gotch.) If he fails between blues and greens, in your practice is he rejected?—Yes, if they are distinct blues and he repeatedly puts them there.

(The Chairman then went through the test, saying he wished merely to be tested with the reds, and that he started with the idea that he had got to find about ten.)

(Chairman.) But you do not tell me how many there are?

(Witness.) No.

1029. But if you start without telling the number, the candidate gets an idea that eight or ten are required?—We ask them to pick out all they can find. If a candidate picks out only one or two, we ask him for more; but if he picks out four or five it will be sufficient, providing he picks out no incorrect skeins.

1030. If he has done that you leave him?—Yes. In a case like this, I would ask a candidate, who had got sufficient dark ones, to pick out one or two pale shades of that colour.

1031. (Professor Gotch.) Do you always start with the pale green?—Yes, we always follow the same order.

(Professor Gotch.) You start with the most difficult colour first?

(Chairman.) Which do you consider to be the most difficult?

(Dr. Watson.) That third test is practically useless.

(Chairman.) Why?

(Dr. Watson.) Because it does not give you much information.

(Chairman.) Do you consider the fourth and fifth are more difficult?

(Dr. Watson.) Yes, excepting the second.

(Chairman.) How far are those approximately right? Have I put in there anything I ought not to have done?

(Witness.) There are one or two pale ones not included.

(Chairman.) I should have been frightened to have chosen those.

(Witness.) We point them out to the candidates.

(Chairman.) I do not think I should pick that one (pointing to a very light red).

(Captain Golding.) I should never have matched that. I should class that with the pinks.

(Chairman.) I should never have dared to have picked it.

(Witness.) There is no other colour in that skein but the red.

(Chairman.) If you press a man to pick out lighter ones, I should think it would be difficult. I should

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[Continued.]

never dare to pick that one. Is there any other skein like that very light one, which you say is a good match?

(Witness.) There should be one.

(Chairman.) Dr. Watson says the pink is a better test. Shall I try one?

(Witness.) There is another lighter one here (picking out a light red).

1032. (Chairman.) It is difficult. There are hardly four which may be called lighter than the red test skein. Let me try the pink. The difficulty that bothers one, is the feeling that you must find them. (Choosing the pink skeins.) Now how much have I done wrong there?—Those two are not that colour. Of course, that in itself would not reject a candidate, if he picked out sufficient. It gives him an opportunity. If he was normal, he would say that it was not a good match.

1033. (Professor Gotch.) You would not report that?—No.

1034. (Chairman.) He would have got far enough?—Yes. You made an excellent choice there. These are about all there are.

1035. (Professor Gotch.) But you said you would report a blue green?—No, a pure blue.

(Chairman.) When one has seen six or eight or ten candidates tested over and over again, one is much more prepared to get them right, than if one sees it for the first time. That question of light and dark is very difficult. I feel I do not know the shade.

(Captain Golding.) I feel so too.

(Chairman.) There are a good many greens.

(Captain Golding.) After all, green is a mixture of blue and yellow, is it not?

(Chairman.) I do not suppose any of the failures we have made would fail a man.

(Professor Gotch.) I understand a blue-green would.

(Witness.) No, not a blue-green, but a decided blue. A blue-green would not show his colour-vision to be so defective.

1036. You would give him another chance?—Yes, and besides, even then, if there were not much blue, I think it would not condemn him at all. It would have to be a distinct blue. That is why we confine the candidates to the test-skein, because, once they get one with a little blue in it, they naturally get into the blues.

1037. (Chairman.) When you get a real colour-blind man, who mixes the green and the red, you have no

difficulty?—We have no difficulty with a colour-blind man.

1038. Supposing you have a real red-green blind man, what sort of colour would he put on the green batch?—He would put green and red together. Then, in the second test, he would put purple, blue, and red together. Then, if you have a light green, he will put colours like this with it (pointing to a brown).

1039. (Professor Gotch.) Those are the cases in which there would be no question? Would you reject a person who put those together?—Yes.

1040. What are the cases which you put down as doubtful?—Where a candidate does not make any bad mistakes, and yet I am not satisfied.

1041. Why are you not satisfied? Is it because he mixes the blues and greens?—Yes, doing the same thing—showing that his colour-vision is not really good. Then it might be that it was merely one colour. He might be good with one colour, and bad with the others. We would submit that case.

1042. (Captain Golding.) With regard to those oranges, or yellows, there is a greenish-yellow skein which you see there. Would that pass?—Yes. If that was the only one a man picked out, it would not fail him.

(Captain Golding.) How does yellow assist in testing colour-blindness?

(Dr. Watson.) A green-blind man, for instance, will put in a little yellowy green, and on some of the others he would go off on the red side. He would go chiefly off on the green.

(Witness.) They frequently put fawn with the yellow.

1043. (Professor Gotch.) Supposing a candidate did that sort of thing—there is not a tremendous difference, but it shows a certain amount of colour-blindness—would you submit that case?—That is worse than the greenish-yellow.

1044. I mean matching the yellow. What would you do with the candidate?—If he passed all the other tests successfully, and providing he picked all these good matches out, and that then he picked out some of the others, I would draw his attention to the fact that I wanted to confine him to that colour. If he repeatedly made that mistake and did the others right, I would not fail him outright. I would submit the case. I submit cases where I see the candidate does not come up to the standard.

(Chairman.) We are very much obliged to you indeed.

The witness withdrew.

The Committee then adjourned to No. 32, Abingdon Street, to witness Admiralty tests by Fleet-Surgeon W. W. Pryn.

(Fleet-Surgeon Pryn explained Buxton's Marine Telechrome.)

Two boys, A. T. Ruby and E. Sale, were then called and tested by the witness.

Ruby was tested in form-vision with each eye separately. Using the right eye, he passed without hesitation. Using the left eye, he made one mistake in the fourth line and two mistakes in the fifth line. With a second sheet, he made mistakes in the fourth and fifth lines.

The witness explained that they used three sheets, and they often used one with much smaller print.

A. T. Ruby was then tested with the lantern.

The witness explained that the candidate was first asked to name the light shown by the lantern, and then asked to pick out a woollen skein to match.

Ruby named the white light and the blue light, and picked out the wools to match. Then he called an orange, light red, and picked out a red wool. Then he called a yellow light, red, and picked out a yellow wool. Then he called a red light, red, and picked out a pink wool. Then he called a blue light, blue, and picked out a violet wool.

On being put through the test again with the modifying glass in position, he called a green light, yellow, and picked out a yellow wool. He called a green light, green, and picked out a violet wool. Then he called a red light, red, and picked out a red wool. He called a green light, green, and picked out a white wool. He called a greenish

light, yellow, and picked out a yellow wool. He called a blue light, blue, and picked out a violet wool. He called a yellow light, red, and picked out a red wool.

(Professor Gotch.) What would you do with him?

(Witness.) We should say he would be unfit for a cadet on account of imperfect perception of colours.

1045. You would not go any further?—I should go through the Holmgren test, although I should not regard it as necessary in this case. But we do that. We should put him through the Holmgren test afterwards.

1046. (Mr. Nettleship.) Why do you begin with the light and use the wools afterwards?—It seems to be like what he would have to do in practice.

1047. But I mean the colour of the light is very much less than that of the wool?—When they come up here they are always asked to name the lights, and match them with wools; and if there is any failure, they are put through the Holmgren test. Mr. Buxton recommends that they shall first of all name the light, and then they shall pick out from the heap of wools all colours which correspond with it.

(Mr. Nettleship.) You may just as well use the wools straight away if you do that.

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[Continued.]

1048. (*Mr. Parsons.*) Supposing they pass the light test, are they invariably put through the wool test?—No. If they pass the light test we are satisfied.

1049-50. (*Professor Gotch.*) Do you want that degree of accuracy? There would be very few that would not be sufficiently accurate for all practical purposes?—Yes, I should think so. The reason why the light is used first is because it is Mr. Buxton's recommendation. I saw he recommended that candidates should be asked to name the light and then to pick out all the corresponding wools from a Holmgren's set. That, as I say, is a very lengthy procedure, and we have to examine them not only for colour-vision, but for everything else, and we should not get through many candidates in a day in that way. Therefore we modify it in this way, that we require them to name the lights, and we require them to match the lights with the wools. If they name and match them correctly, we consider them to be fit.

1051. (*Mr. Nettleship.*) You do not put the whole of them through the Holmgren test?—We do not put the whole of the candidates through the Holmgren test.

1052. (*Professor Gotch.*) Do you ever take any of them through the Holmgren test?—Yes, if they fail with this test.

1053. (*Mr. Nettleship.*) What about this boy?—I should put him under the Holmgren test. But if he passed the Holmgren test I should fail him just the same.

1054. (*Professor Gotch.*) Then it is not much good putting him through it?—As a matter of fact I wanted to know how the Holmgren test would work out; and almost invariably, if a boy fails in this way, I see what he can do with that test.

1055. (*Mr. Nettleship.*) Have you ever found one fail at the light and afterwards pass on the wools?—

Adjourned till Friday, November 11, 1910.

## SIXTH DAY.

Friday, 11th November 1910.

PRESENT:

The Right Hon. ARTHUR H. DYKE ACLAND (Chairman).

Sir ARTHUR RÜCKER, F.R.S.  
Mr. RAYMOND BECK.  
Captain THOMAS GOLDING.  
Professor FRANCIS GOTCH, F.R.S.

Mr. NORMAN HILL.  
Mr. EDWARD NETTLESHIP, F.R.C.S.  
Mr. J. H. PARSONS, F.R.C.S.  
Professor J. H. POYNTING, F.R.S.  
Dr. WILLIAM WATSON, F.R.S. } Secretaries.  
Mr. S. G. TALLENTS }

Sir WILLIAM ABNEY, K.C.B., D.Sc., D.C.L., F.R.S., called and examined.

1061. (*Chairman.*) We are very much indebted to you, Sir William, for being so good as to come. You have devoted a great deal of research for many years to this question which is now occupying the Committee?—I have, a great many years.

1062. It was owing to your knowledge of the subject that you were appointed Secretary of the Royal Society's Committee of 1890-92?—Yes, I was member and secretary.

1063. You were member and secretary, and took a considerable part in drawing up that report?—I did.

1064. Since then you have continued to devote a great deal of constant attention to the subject?—That is so.

1065. During the period since that, you have acted as referee to the Board of Trade in all these cases of appeal?—Yes, except in cases where Dr. Watson has acted.

My experience is that if they fail in this way, they fail at the wools.

1056. If they call a yellow a red, or a green a red, or a red a green, do you ever find they pass the wool test?—No, I do not think so. I should say not.

1057. This boy called a yellow a red?—Yes.

*E. Sale was then tested with the lantern test.*

*Sale named the green, blue, yellow, red, dark red, green, and light green lights correctly, and the only mistake he made in matching the wools was, that he picked out a darker red when he named a pale red light, and he picked out a lighter red when he named the dark red light.*

*He was then put through the test again with the modifying glass in position. He named the lights correctly, and matched the wools correctly in regard to yellow, violet, red, green, and light green. But he called a yellow a pink, and picked out a pink wool to match.*

(*Witness.*) This is a boy I should put on the Holmgren test, after hesitating over them. I should use the Holmgren test for him, and if he passed it, he would be all right.

(*Mr. Nettleship.*) You counted him as hesitating?—Yes, I called it hesitating. I should use the Holmgren test, anyhow, in a case of that sort, and on the joint result I would make my decision.

1058. (*Professor Gotch.*) Supposing he passed the Holmgren test, would you re-examine him with the lantern?—Yes, we should afterwards. We frequently do that, and use the Edridge-Green lantern.

1059. I want to know which, in your opinion, you attach most importance to?—I think we attach most importance to the lantern.

1060. (*Mr. Parsons.*) Do not you think his mistakes were very likely due to their not being accurate matches as well?—They are not absolutely accurate.

*This concluded the test.*

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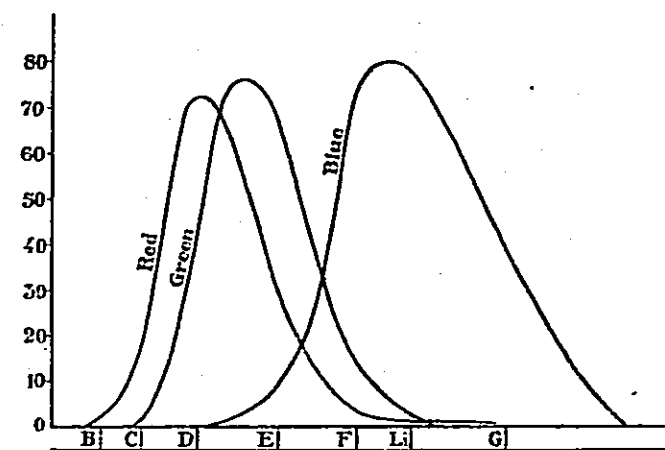
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[Continued.]

there is nobody who has put more questions to it than I have.

1069. The basis of it is that the normal human eye is capable of experiencing three distinct sensations, red, green, and blue?—Yes. That is the basis. There are three distinct—not colours but—sensations, the red sensation, the green sensation, and the blue sensation. I will take the red sensation first.

1070. That is where this card comes in, which Dr. Watson has prepared?—Yes. With regard to the red sensation, I may say that there is a part of the spectrum, where only one sensation is felt. We must distinguish very thoroughly the difference between sensations and colours. At the red end of the spectrum, nearly up to the C line of the spectrum, which is the red, we have only one sensation at all excited. Then, when we come as far as the D line, you will find between C and D (which also here looks red but really is an orange), two sensations excited, a green and a red. From that point onwards, right away, I might say, to the end of the spectrum, we have more than one sensation excited. We have two sensations excited at the very extreme violet end; that is to say, we have a red and a blue sensation existing in the violet end; and in the green and yellow and blue-green we have all three sensations excited, but, of course, to a different extent. Now those curves which you have before you are supposed to represent the sensations equally stimulated; that is to say, when equally stimulated they give you the sensation of white light. The areas of these curves, the red curve, the green curve, and the blue curve, are all the same; they are made so purposely to show the effect of equal stimulation in producing white light. Within those curves, at a point where the red and the blue cross, for example, those two ordinates of red and blue represent an equal stimulation of the two sensations. Above that we have a stimulation not only equal to those ordinates of green, but we have also a surplus of green, so that at that particular point we have white light stimulated plus an excess of green. Looking at the diagram from this point of view, it will be seen, by the overlapping of these three sensation curves, that white is perceived in a large part of the spectrum.



1071. If we draw a straight line up?—If we draw a straight line up.

1072. We come first to the blue and red?—When you go just above E, you will see where the blue and the red curves cut; we have green above that. Therefore, at that particular point, which is a very important point, I may say, as regards colour-blindness, we have white formed plus a surplus of green.

1073. And the green is dominating?—The green is dominating; the green colour which we see is actually composed of green plus the white sensation. You may do it at any other point. Take a point a little bit higher up, opposite 5,000; you will see the blue and the green curve cut. At that point the stimulations of the two sensations are equal, but the red sensation is not stimulated sufficiently to make white, and therefore there is a blue-green left behind. The white which is formed is equivalent to these two sensations I have mentioned, plus the red sensation as far as it goes. Were they all of the same height, all white would be present. These curves were measured by myself. I may say it was a labour of several years

to get out these three sensation curves as you see them there before you. I made not only one determination which was published, and which I have in a book here, but I made a second determination correcting it, when the apparatus which I have was made more accurate than it was before. There are some small corrections in the second paper, which are not to be found in the first. In that paper, from which the diagram before you was copied, I have drawn the curves to represent equal stimuli of sensations. I do not know who drew this diagram, but I expect Dr. Watson had it drawn from my figures. Do you wish me to go on with the question of colour-blindness?

1074. Have we completed that part?—I shall be very glad to answer any questions on points as far as I have gone. If it is not understood, I shall be very pleased to answer anything.

1075. So as to make it good up to this point?—Yes. As I say, I am perfectly satisfied in my own mind of the truth of the theory. It is not my theory; far bigger men promulgated the theory, although I have perhaps got out these curves in a way in which they were not got out before.

1076. If we produce the records of the mistakes which we have had made, could you show us from the theory why particular mistakes have been made?—Yes, I can.

1077. If you can do that, I think it would help to give us a practical illustration?—Yes. These are the wools before me.

1078. We have the glasses too. Would they be more convenient?—I should like to have the glasses.

1079. Will you kindly show us how you use the glasses to illustrate your theory. I think that would be very valuable?—It is not absolutely accurate, because there is a certain amount, not of white light, but of white sensation which always comes through the glasses. I think we must distinguish between white sensation and white light. There is a certain amount of white sensation comes through these glasses, and therefore you cannot be absolutely accurate in making a diagnosis. Supposing I wanted to find out whether a person was red-blind or green-blind from the wools which he took, I should have a glass of this description, which is a bluish-green glass, and as far as possible is composed of light representing the green curve and the blue curve, and none of the red curve at all. You see it is quite impossible to get it absolutely perfect, on account of the white which is generated in these glasses. (*The witness attempted to use the glasses.*) I am sorry to say it is impossible to see to examine the failures in the wool test in this light.

1080. And you do not want artificial light?—I do not want artificial light. I am afraid that would not do. The light is so very poor that I cannot examine them now. But anyhow, I may say this, that as far as colour-blindness is concerned, if you have complete colour-blindness of one sensation—I will put aside altogether for the moment the question of violet-blindness, because it is not important for the point you have to deal with—the red-blindness and the green-blindness both are very important. Now, if you look at the curves, you will see that, if you take away the red curve, you only have the blue and the green curves left behind. If you take the colour-blind person with no red sensation, those two sensations are all that he experiences. Now, following on from what I said before, we will suppose that the red curve is absent. Then he has only two sensations at all in the spectrum, one the green sensation and the other the blue. The light which he sees as white will be at that point where the blue curve of the spectrum and the green curve cut. At that particular point there will be a band of white. Suppose we have a person who is green-blind, then the green curve will no longer be present in his spectrum. If you take away the green curve at that particular point just a little above E in the spectrum, you have two curves cutting at that point, and the green-blind man will see white in the spectrum, that is to say, when there is complete green-blindness. You may ask if these positions are absolute. I may say that they are absolute. They do not vary, except so far as a variation in the blue sensation is caused by a greater or less



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yellow pigmentation of the centre of the retina. If you have a colour-blind man, particularly a green-blind man, white is shown on the spectrum by a narrowish band; and, if you have a red-blind man, his white is shown higher up in the spectrum towards the violet as indicated by these curves. That never fails. Take a person who is colour-blind—say, a red-blind man, whose red curve is missing. If he is asked to name the colours of the spectrum, he names two colours until he gets to the white. On another occasion, when there is a better light, I shall be able to show you real diagrams, illustrating how they have named the spectrum colours. The light is not good enough to-day. In a morning light, of course, it is very much easier to show those colours, and for me to take those glasses and use them.

1081. We understood you would like us to come to South Kensington next week?—Yes, and I should like you to come in the morning. It would be advisable, as then I can show you those particular diagrams, showing what different colour-blind people see in the spectrum. After all said and done, if you want to have any scientific idea of colour, you must go to the spectrum. It is no use fiddling about with glasses or pigments, or anything of that kind; they will tell you very little. Unless you know all about the glasses and pigments, glasses will tell you nothing.

1082. Do you mean in the popular sense?—They will indicate something, but they will not tell you what it means scientifically. For instance, I could show you a glass which is a yellow glass, which all normal people would take for yellow and match it in the spectrum; and yet, if you showed it to a colour-blind person, he would not match it as yellow at all, he would match it with something totally different; it might be green and it might be red. If you want scientific accuracy in regard to colour, it is no use placing all your reliance on glasses or pigments or wools. I will include wools. You cannot diagnose sufficiently well, unless you are perfectly prepared to know what the colours of all those wools are, and how they are composed. We will go on now to the incomplete colour-blindness.

1083. Now we come to the problem of the degree of blindness?—I am in your hands.

1084. Yes. We will take the form-vision question afterwards?—I am going to say a curious thing now, and that is, for the incomplete colour-blind those three curves would stand as they are. It seems almost absurd to say they would stand, and I do not believe it has been realised before that they would stand. It is for this reason: in order to form these curves, the determination of the absolute luminosity of the sensations in each colour of the spectrum has first to be made, and these luminosity curves have to be multiplied by a factor to make all those curves of the same area. You will see that, if a man is only half colour-blind, half red-blind, we will say, his luminosity curve would have to be multiplied by twice the amount required by normal vision in order to make the areas equal; and therefore these curves of equal stimulation do not apply properly to the incomplete colour-blind; they do not tell you very much. The only point is this, diagrammatically speaking: the curve of a half colour-blind person—red-blind person—would be half that curve really, although it would not be equally stimulated. But you will see, from what I mentioned just now, that these curves hold for the incomplete colour-blind person, to the extent that the stimulation of their particular sensations is the same. But there is one great feature which is different, and that is that the white, which they see, is totally different; the white, which is composed of their three sensations equally stimulated, is perfectly different from that which the normal-eyed person sees. For those who have studied the calculations of the matter, these curves will help them in certain matters regarding incomplete colour-blindness. But in the end you have always to reduce them back to luminosities. I think I might be able to show you what I mean. I have brought down a book containing my colour-vision papers.

1085. Are we now coming to the point which shows the means by which colour-blindness can be measured?—Not yet. I am only showing the curves of the

colour-blind. I will hand this in to you; it is only my rough book of bound papers, which I work on. (The book was handed to the Chairman.)

1086. It is one of the published papers?—Yes. You will see there we have the curves of luminosity in the spectrum for the normal-eyed person. There is the green sensation, the blue sensation, the red sensation; and also I have put in there the white sensation, so that you can see the amount of white that is seen in the spectrum itself. Now we will take the half red-blind. The red curve would be diminished by half, that is to say, half the ordinates. If he was half green-blind, then you would have to reduce that to half the ordinates, and the same for the blue also. Then from that, if you multiply all the necessary figures, whether they were half, or three-quarters, or a quarter, you would get them all exactly the same height with equal stimulation; but the stimulation would give different results, that is to say, it would give a different white light. The white light which would be given by a half red-blind person, for instance, would be a greenish blue. At the same time, if they had a neutral point—what we call a neutral point is that white point in the spectrum, that I pointed out before—that would be at this same point as it is in the case of complete colour-blindness. In nine cases out of ten, there is no neutral point for these incomplete colour-blind people. I do not know what further point you wish. I would like to be asked questions.

1087. May we take this point of the means of measuring colour-blindness? I understand that you have invented a means by which colour-blindness can be measured?—The amount of colour-blindness. Yes, I have.

1088. Have you already published your results?—No, I have not, but I have it in proof here.

1089. As we are dealing with the danger point, that would be extremely important to us?—Yes. A corrected proof has been sent in to the Royal Society. I think I may say, this is the first time that a way of measuring incomplete colour-blindness has been given.

1090. That shows the great importance of the investigation?—You can put down colour-blindness in decimals of 1, so that a person may be described as .1 red-blind; that is to say, he only has one-tenth of the normal red sensation, and so on with .2, .3, and so on, right up to .9. I do not know whether it would be interesting to the Committee, but, for curiosity's sake, I have tabulated the percentages of colour-blindness (of green-blind and red-blind), that I have lately measured.

1091. This is all worked out under the spectroscopic test?—All by the spectroscopic test. But in a very simple way. I may say that, for testing the amount of incomplete colour-blindness in any candidate, only one measure by myself and one measure by the candidate is necessary. That gives you a complete history of the colour-blindness. But, for safety's sake, you do not limit it to one set of measures but take two or three. As regards red-blindness, I will give you those that I have recently experimented with. There is one .82 of red-blindness.

1092. This is a definite instance?—This is a definite instance of measurements. It is rather interesting as showing the various amounts of incompleteness that are found in colour-blindness.

1093. (Professor Gotch.) Was this a case on appeal?—Yes. The first is .82, that is to say, he possessed  $\frac{82}{100}$  of the normal sensation. The next I have was .63; then .4, .35, .30, .25; then three cases at .17; then three .1, then .06, and another one, which is interesting from my point of view as a corrective of other evidence—.05. Those are all cases of red-blindness. All those are incompletely red-blind, and that list gives you the percentage of red sensation which they have.

1094. (Chairman.) Have those 14 or 15 cases come before you in the course of the last few months?—Yes.

1095. Quite recent cases?—Quite recent cases.

1096. All those lower cases would have been proved completely colour-blind in the ordinary way?—In the

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[Continued.]

ordinary way .1 and .06 would have been considered completely colour-blind.

1097. Would the others have been passed?—The others would not have been passed. The only one that passed was .82. I am going to give you my opinion as to what I think ought to pass. Now we come to green-blind. There may be some of the Committee here, who will object to the distinction between green-blind and red-blind. I am using the Helmholtz theory, because I believe in it. In the cases of green-blindness .7 was the first, and then there is a jump down to .33.

1098. (Professor Gotch.) That is 70 per cent. of sensation?—Yes. Then we come to .31, .14, .1, and .05. Then I come to two totally colour-blind.

1099. Nothing?—Nothing. I may say that yesterday I had one which filled up the gap of the green-blind. I cannot be quite sure, but it is somewhere between .4 and .5 green-blind. I have not worked it out. It is between .7 and .31.

1100. (Chairman.) These are all separate candidates, different from the red-blind?—Quite separate from the red-blind, yes. I may say, there is no mistaking when using the formula as to the category in which the candidate should be placed. If you put the unknown quantity in the wrong position, you get something which is impossible. From one observation you can tell whether it is red or green, because, if you put  $x$  in the wrong position, you get an impossibility, and with the other a practicability: but, of course, one does not rely on one observation only.

1101. Then these are all recent candidates too?—Yes.

1102. About half as many as the red, roughly?—There are 14 red and 7 green, or something of that kind?—That is, roughly, about the usual proportion of green-blind to red-blind.

1103. In your experience?—Yes.

1104. They are a very characteristic set?—Yes.

1105. (Professor Gotch.) Were these all rejected?—No, Number 1 was not rejected.

1106. (Chairman.) Have you any other statistics?—No.

1107. Now, would you like to tell us what you think should be the measure?—Yes, I think I could safely tell you.

1108. Could you tell us what kind of mistakes they made? Would that help us?—I can tell you that so much better next week, when I show you the cards.

1109. What is your view?—My view is that anybody over 70 per cent. of sensation, either red or green, might be passed; anybody below that ought to be failed. As a matter of fact, without having worked them out accurately, that is what I find in the cases I have rejected.

1110. Although it is only recently that you have arrived at, or invented, the numerical test, you think practically what you now recommend corresponds with what in practice you have been doing with the former tests?—Quite.

1111. And you think that what has been formerly the percentage of rejections is about what is reasonable?—Yes.

1112. And safe?—Yes. I think I will give you statistics with regard to the number of appeals now.

1113. We have the published figures?—As far as I can make out, there have been 345 cases of appeal, of which 214 failed and 131 passed; but of the 131, nearly every one was deficient in colour-sensation, but not sufficient to make them dangerous.

1114. Nearly every one?—Nearly every one was deficient, but not sufficiently so in my opinion to make them dangerous.

1115. (Mr. Raymond Beck.) They are all deficient, but all had more than 70 per cent.?—Yes.

1116. Which you describe as not dangerous?—That is so, not dangerous.

1117. (Chairman.) Would you like to explain to us further the method by which you arrive at this numerical test?—I shall be very pleased.

1118. The paper is not yet published, I understand?—No, I believe it is going to be read very shortly. I have sent the corrected proof in. I will

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explain it to you in popular language as far as I can. Supposing I have a person to examine, and I want to see whether he is completely colour-blind, or incompletely colour-blind, or not colour-blind at all, how should I proceed? Well, I take him in the dark room, and isolate one ray of the spectrum, it does not matter what colour it is, and make a colour patch of it alongside a white patch. You require to be diplomatic with your candidates; I must say that. It is no use being harsh with them, you must have plenty of patience. I have learnt in these last 24 years during which I have been examining, not for the Board of Trade only, but for other people and for myself for my own information, that by dint of coaxing, if you have patience with them, they will be able to tell you when that particular colour and the white look about the same brightness. If you repeat that observation four or five times you get a very good satisfactory mean observation of the reading, that is all the candidate need do really. That is absolutely enough for me, because I immediately follow on, using the same white light and the same colour, and make my measure of the brightness, when they appear to me to be the same. I read off from the instrument the amount of brightness which I use and the amount of brightness which he uses. Then I use the colour equations which are published and extant and make my calculations. I will give you an example. Supposing I took the luminosity of one man, say at 144.2 on my spectrum scale, that is to say, the red lithium line, which is where there is no sensation except red. Supposing I found that he measured that the luminosity was two to him and it was eight to me, of course the incompletely red-blind man would always see it much darker, I should use the following formula.

1119. (Sir A. Rücker.) Of course I know your apparatus, because I have seen it. You have two slits, through one of which you pass the white, and through the other pass the red?—No; it is the reflected beam, not white. It is always the same constancy which I put alongside as a colour patch. I can show you at the next meeting.

1120. (Professor Gotch.) You showed it to me some little time ago; and I think that every member would know immediately if you were to show it?—I could easily show it. The fact is this; if he measured 2 and I measured 8, the formula, by which I can tell how much red-blind he is, is a very simple one. If he measures 8, I multiply it by 10, and multiply it by  $x$ , the unknown quantity I want to find. If he makes it 2, I multiply  $7x + 3$  by that, and, equating, of course we get  $66x = 6$ . Divide the 6 by 66, and you get the amount of colour-blindness which he possesses in red. That happens to be red. In some cases it might be a green-blind man, in which case, if I were to try with the same formula, I should find it fail altogether. If I read lower than he did, I should know he was a green-blind man; if he read 10 and I read 8, I should know he was green-blind, although his reading was greater than mine. It is simply a question of the luminosities of the colour-blind white and my white which has to be determined. I can explain that very readily, I think, at the next meeting.

1121. (Chairman.) The luminosity test, which you start with, is quite final; you know exactly after that?—I know exactly what to expect.

1122. And then you only make your calculations?—And then I only make my calculations. In that paper it describes in full how the thing is done, because I thought it was rather an important point to lay down. I may say I have used what I call luminosity curves with dozens of people, which I made years ago. Working with them, I found that the three-colour theory works out absolutely, because there is no reason why a piece of apparatus in the eye should not always give a similar curve, whether it is incomplete or complete. The curves of sensation must always be the same, similar that is to say, not equal, but similar, mathematically similar, and in every case it has come out that that is so; the incomplete sensations of red and green are always similar to the one in the normal eye. Of course that is a very strong proof of the truth of the three-colour theory.

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1123. You use the word similar in the sense that you multiply all the ordinates by the same factor?—Yes, always by the same factor. That is one of the strongest proofs I know of the truth of the trichromatic theory. Some of the curves I took years and years ago. I must not mention names unless they are mentioned to me, but there is one curve of a gentleman whose name has been very much bandied about. I do not know whether it has been particularly bandied about to you. I have seen his name in the "Lancet" and everywhere else, and in a recent Royal Society paper I have seen that name mentioned. I may say I examined him years ago. He is .35 red blind.

1124. It appears to me that, when we are allowed to see this paper, if the Royal Society gives permission, and we see next time at South Kensington a demonstration of it, we shall be fairly well in possession of the numerical method which you have discovered?—Yes. Of course, it is only possible on the three-colour theory. I have never met a single instance in which it has failed.

1125. (Sir Arthur Rücker.) I have only one question. I wanted to see if I possibly had a misconception. You said these curves are all of the same area?—Yes.

1126. They are not of the same area in looking at them, and that is because the scale varies practically from place to place with the dispersal of the spectrum?—Yes.

1127. The lower scale is not uniform?—That is so.

1128. If it were uniform, it would be of equal area?—Yes.

1129. I understood you to say that a colour-blind person sees a white which is really a different white from what we see?—Yes, a different white altogether. I can show you on the screen what it is.

1130. The details we shall see when we get the demonstration?—Yes.

1131. (Professor Poynting.) If you select colours from different parts of the spectrum, what sort of green would you get? Would it be correct to two figures?—There are two methods in that paper, one dependent wholly on the candidate, in which he must take two observations, and one dependent on his observation and mine. They are two quite distinct methods. Although they are based on the same principle, one gives you the defect and the other gives you the presence of the sensation, and they both agree. I can read you some of the agreements. Here is quite a recent one, defect .9, .9. Then by the other method it gives .1. It is just the same, but different observations. Here is one, defect .86, .87, .81, .81, .8. Considering the people have never made an observation in their lives before, I do not think that speaks badly for it. That is the type. I may say the smaller the amount, the more accurately the luminosity has to be measured by the patient—I am calling him a patient. Here is an example of a not very good patient. The first determination made it nought, the next .04, the next .06, and one .66, all within a very small percentage of the mean, except the last, of course. That happened to be a bad measure. I am not saying they are within the second place of decimals, but within the first place of decimals they are correct.

1132. (Professor Gotch.) If you diminish a coloured light both in area and luminosity, I gather it gives no colour-sensation?—That is true.

1133. Then how, under those circumstances, can a sensation be entirely due to the red and green and violet reaction? This is the physiologists' objection to Helmholtz's colour theory?—I have not gone into the depths of the matter here, because it is a very difficult thing to do; but if you will take it from me, my point of view is that each of those three curves are founded on a sensation of white luminosity to begin with. Some people have said that colour is a varnish to those. I have no difficulty myself with the matter. Two sets of vibrations at right angles to one another set up in the receiving apparatus is another mode of attacking this rather intricate subject. I have seen other explanations, but I had rather not go into them. Nobody is better aware of the presence or absence of colour in a ray than I am; I may say I have written folios on it. I am only taking that three-colour

sensation theory and explaining it in the broadest sense; not when coming near extinction power, because that requires going deeper into the matter.

1134. Do you think it is fair for the Committee to take it, that this only applies when colours are really such as to produce, in normal eyes, a definite sensation?—Yes; not when you have a feeble spectrum.

1135. Nor when the light is very distant?—No, not at all; I quite agree with you there. I have only been talking about the spectrum in the ordinary sense of the word. If you want an accurate definition of it, I would say when the D light of the spectrum is one candle one foot off.

1136. It is a bright lumination?—Yes. When that is the lumination of the colour patch it is very easy to measure, because the D light and the candle light are the same—that is to say, they are not the same, but still they look the same.

1137. We have had evidence given us that, quite apart from what may be termed the weakening of the colour-sensation, there is such a thing as absolute failure of the eye to respond to the red end of the spectrum, a shortening of the red end. Do you find that is supported?—Always. In red colour-blindness, the red end is always shortened. The more complete it is, the more it is shortened.

1138. It cannot be shortened at the red end without there being any diminution in the size of the response?—No, I have never found that to be the case. I have heard it stated. It may be that I have been unfortunate not to find it, but I have not found it. If you ask me my opinion, I do not think I am ever likely to find it.

1139. You do not think it is possible?—No. From a mathematical point of view, it is impossible.

1140. May I point out that we are dealing with a physiological form of consciousness?—Yes, but even physiologists have to knock under to mathematics sometimes.

1141. I understand that all your results are carried out really in a dark room?—Yes.

1142. If there is any alteration in the eye, that alteration is present?—Yes.

1143. The alteration in the eye through darkness is present in your experiments?—Yes. I should like to put in a caveat here. In what I was going to talk about to the Committee, that is the case; but you must not run away with the idea that experiments have not been carried on with white lights of varying intensities with colours. That is a point which does not arise at the present time. I am perfectly familiar with the action that takes place when you are making an examination of colours—for instance, a colour patch in a white light. I know perfectly well what happens; but as a matter of fact all the measures that I make of the candidates in the appeal cases are always taken in a darkened room.

1144. (Mr. Parsons.) But you start the examination as soon as they come in, do you not? They are not deliberately dark-adapted?—No, not deliberately dark-adapted, but by the time they are finished they are.

1145. It is a mere accident of the examination more or less?—In the first things I do, it does not matter whether they are dark-adapted or not; in the second part, the luminosity, it does matter. As a matter of fact, after a good many elaborate experiments, I find that twelve minutes in an absolutely dark room is quite sufficient to give you the effect that you want.

1146. (Professor Gotch.) Am I correct in assuming that the percentage of sensation-value in colour-blindness, as obtained by your method, rests really upon the assumption that Helmholtz's three-colour theory is correct? Does it not rest on that assumption?—It is the fact, that is all.

1147. You regard the theory as a fact?—I personally regard it as a fact.

1148. Am I correct in thinking that this method rests on that?—The determination, yes.

1149. Then there is another point. Is the method one which always involves two simultaneous lights being compared?—No, the second method does not.

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1150. I do not know whether you can answer this question shortly. I do not understand what circumstances determine your fixing the dangerous point at 70 per cent.?—Simply that they would be able to distinguish the greens and the reds of single lights.

1151. You mean in practice?—In practice.

1152. You would show them the lantern and make them do it?—Yes.

1153. Or is that entirely calculated on the theory?—Not entirely calculated on the theory at all, but practically.

1154. Then you would practically show them the lantern test, to determine whether they were above or below this dangerous point?—I should say, where they recognise over .7, they will recognise the lights by the lantern tests.

1155. You would determine that dangerous point by a lantern test?—Yes, they always do have a lantern test.

1156. The Board of Trade does not have a lantern test?—Well, not an ordinary lantern, but a spectroscopic lantern test.

1157. Could this dangerous point be simply determined in your view by a simple lantern test suitably devised?—No, I do not think it could.

1158. (Captain Golding.) You say that for real scientific knowledge you must go to the spectroscopic; but if a candidate fails under the spectroscopic test and afterwards passes a practical test with coloured lights in the open, what conclusion would you draw?—It all depends on what you call "passing the test" in the open.

1159. If he distinguished the lights properly?—You must recollect that you may toss up a penny, head or tail, as to what the light is. Say head is red and tail green. When a light is shown, he knows that it is either green or red; and the chances are equal that he names them correctly, even if he is colour-blind. Therefore it does not do to take only one series of what we will call outside tests. You must have several of them, so as to get rid of the law of chances. You see what I mean. A light is shown; it is either red or green, and he knows that. He might as well pitch up a penny and, if it comes down a head, say "red."

1160. (Mr. Parsons.) Do you not think a practical test of that kind would be absolutely valueless?—A practical test of that kind only once employed would be perfectly valueless; it would require a long series of tests to combat the spectroscopic test. I hope I have made myself clear.

1161. (Captain Golding.) Quite?—I should say the candidate would eventually make a mistake, and if he makes one mistake out of a hundred, it is a fatal thing.

(Chairman.) I have been intending to ask your opinion as to the wool test, the spectroscopic test, and the lantern test all together at a later stage, but I do not wish in the least to interfere with the question being raised now. Still it makes it rather more difficult for you, I think. I rather wish that we should confine ourselves as far as possible to the scientific experiments you have been making up to now, dividing your evidence into compartments.

(Sir A. Rücker.) Sir William Abney says that .7 of the red and green sensations makes a man safe. Out of that obviously arises the question, how he decides the candidate is safe at that percentage. I think it is entirely a matter for you to say, Mr. Chairman, whether you wish that to be brought in at a later stage, when we are discussing lamps, or whether you think that, as it clearly arises out of the present evidence, it ought to come now.

(Chairman.) I thought it would be rather more convenient to bring it up when we come to the question of the lamps.

(Witness.) I do not mind which it is. All I can say is, I think very likely next time you will be able to see from charts why it is I selected .7.

1162. I think we will confine ourselves to a rather more limited scope for the moment?—Of course I have given my opinion; that is all. I am not laying down anything.

(Chairman.) We will come back to the relative value of the different tests.

1163. (Mr. Norman Hill.) There are two questions I should like to ask you. The theory you have put before us is based on the three colours, the red, the green, and the blue?—Yes.

1164. And all the other colours are combinations of those three?—Yes.

1165. And you draw your safety line at 70 per cent. of the maximum perception of any one of those colours?—Leave out the blue altogether, please.

1166. Seventy per cent. of the green or the red?—Yes. I do not think the blue has anything to do with it; it is only of scientific value; it has no practical value, that blue curve.

1167. Is it possible to express the 70 per cent. of the red sensation and the green sensation by reducing the number of colours? Supposing you have only 70 per cent. of red sensation, then you will see a less number of colours, will you not?—Yes.

1168. From B to G?—Yes.

1169. If you eliminate red, you would see a less number of colours?—Well, yes and no. That is a very safe answer to give. It depends upon the man. It depends upon the education of the man, really. I have met with some cases, in fact, I may say, a large majority of cases, by which no colours are named by the incomplete blind, except four—the red, green, yellow, and blue.

1170. Those are the four colours that are generally known?—Yes. It does not matter whether they are .4, or .5, or .1; they will always put in yellow somewhere, as well as a green, a blue, and a red. Those seem to be the only four colours which they see. When you come to what I should judge was .7, they might sometimes see an orange, but that is about all.

1171. And you do not think it would be possible, for instance, to reduce the skeins, so as to reproduce the 70 per cent. of colour-perception?—No, I do not think so. I do not know if I understand what you mean exactly.

1172. What I had in my mind was this, whether it was possible to diminish the number of colours which you put before the candidates, still putting them through a test which, if they responded to it, would give you your 70 per cent.?—I see your point. I would like to think over that.

1173. What I was trying to get into my own mind was how it would be possible in the ordinary working tests?—The spectroscopic tests?

1174. No, the wool tests, the practical everyday tests all round the coast—how it would be possible to bring those examinations up to your standard of safety, and not to put them above your standard of safety?—Do you mean above or below?

1175. Well, not to put them above?—That is to say above 70 per cent.—not to make them 80 per cent.

1176. Yes, if it would be possible to keep them at 70 per cent., and if the keeping them at 70 per cent. would diminish the number of colours that you had to put before your candidate?—No, it would not diminish them. That is a question of the wool test, I think.

(Chairman.) Yes, we are coming to that.

1177. (Mr. Raymond Beck.) There is only one question which may perhaps seem very obvious to the scientists, if I may be forgiven for asking it, and that is this: In those cases where a candidate has been found to have only .33 of red sensation, does it follow naturally that he has 100 per cent. of green and blue? We are speaking of the trichromatic theory?—Not necessarily. I should like to explain what I mean. With regard to the proportion of green sensation to blue sensation, I have a case in point in my paper. There was one case which Mr. Nettleship knows very well. I have a description of it here.

1178. (Mr. Nettleship.) Do you mean the nurse who could only see green?—Yes. That was a puzzle, I think, to Mr. Nettleship, and certainly was to myself, as to how it was that she only saw green. By this method which I brought out I have satisfactorily disposed of the difficulty that there was in the case of the nurse. I worked out, first of all, the blindness of the lady in the red; and then, plotting out her curve, I found she had an



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enormous quantity of blue sensation. As I have found that the red runs right away all through the spectrum into the blue, I was able to deduct the red sensation she had from the blue, and to leave the blue curve by itself. I found she had six times more blue sensation than normal people. If her blue sensation was the same as mine, we will say, then with regard to her red and green sensations, one would have to be reduced 24 times, and the other six times. That is a case which is published. It does not follow, because the proportion of red and green is different, that they always have the same as the normal. I think you can take it that, except for disease, one of the sensations will always be the same as the normal.

(Mr Raymond Beck.) That is what I wanted to know.

1179. (Chairman.) Now might we come to the wool test? Do you think that the wool test, which the Board of Trade uses, and which contains these two additional tests that you yourself suggested, is capable in the ordinary way of detecting the degree of colour-blindness?—In a rough way, yes.

1180. But not nearly so definitely as that which you have just been describing?—No, not so definitely as the spectroscopic test.

1181. We have been told of dangerous colour-blind people passing the wool test, but not being able to pass the lamp test: have you seen cases of that sort?—No, I cannot say I have. I have seen the wool test applied when the defect of matches was only a little bit wrong; and yet, when the light test has been applied to them in the dark room, it has been proved they were very much wrong.

1182. That is to say, the light test is stricter than the wool test?—The light test is stricter than the wool test.

1183. The spectroscopic light test?—The spectroscopic light test.

1184. (Mr. Nettleship.) Not the lantern test?—No, not the lantern test, but the spectrum test used as a lantern—not with glasses.

1185. (Chairman.) You said, with regard to your own tests, a good deal of judicious handling of the candidate is desirable. Do you say the effectiveness of the wool test also depends upon judicious action on the part of the examiners?—Oh, certainly, it depends a very great deal upon the tact of the examiner.

1186. Am I right in thinking that all examiners now, before they are permitted to be examiners, are brought to your laboratory to be tested?—To be tested for their colour-vision; they are not tested as to tact.

1187. You have not had opportunities of seeing them at work, after you have first seen them with a view to their vision tests?—No, I have not, but I have seen people who evidently were tactless, who wished to be appointed examiners, and I have recommended that they should not be.

1188. Would you hold the view that the mere qualification as regards colour-vision is not enough?—Oh, yes; it is not enough.

1189. To do it rightly, a good deal of tact and understanding of the nature of the candidate is really requisite?—Yes, you want a deal of patience. Patience is one of the main things.

1190. Now I want to come to this word "lantern" test. It is a very definite word. I observe you do not apply it to your own test; you use the word "light" tests?—Yes.

1191. Of course there was the old Board of Trade lantern test before Lord Rayleigh's Committee?—Yes.

1192. That we might call a lantern test?—Yes, that was a lantern test.

1193. You have put a certain number of your candidates through a test with coloured discs in your dark room?—Yes.

1194. You would not apply the popular lantern test to them?—No, it is not the popular one, but it is equivalent to that.

1195. (Mr. Nettleship.) Is that the dot test?—Yes.

1196. (Chairman.) I called it "disc"; you call it the dot test?—Yes, little circles.

1197. Could we find a definition for lantern test which would distinguish it from your dot test? Perhaps I should not put that question. You said that the lantern test, for instance such a lantern as Dr. Edridge-Green's, is a different thing altogether from your dot test?—Yes.

1198. Can you say in what the differences lies?—In the one you use glass and in the other you use pure light.

1199. That is most fundamental?—That is the fundamental thing in it.

1200. And therefore, I take it, your view is that no kind of lantern test, using it in the popular sense, could be a conclusive test of colour-blindness; is that your view?—That is my view, certainly.

1201. I suppose that is the reason why, as far as your advice went, or the advice of the Committee went, the spectroscopic test has been adopted in case of appeal? I only want to ascertain the facts?—I am not restricted by the Board of Trade to any particular tests.

1202. I did not want to imply that?—Of course, I do it independently; as a man of science, I do what I think best.

1203. When a case comes to you on appeal, you are not in the least compelled to take the candidates into the dark room?—No.

1204. You do exactly what you think best?—I do exactly what I think best. There is nothing cut and dried. I would not remain an officer of the Board of Trade for a minute if I was dictated to on a scientific matter.

1205. What I meant was that, scientifically, you look upon your spectroscopic light test as a much more conclusive and effective test than any so-called lantern test?—Yes, a great deal.

1206. Have you of recent years submitted lanterns of different sorts to inspection? Have there been any modern lanterns brought out of recent years which you have looked at?—No, I do not take much interest in them. It would have to be something very remarkable.

1207. Have you happened to come across the ordinary Admiralty test, as now applied to the young candidates, when they are first admitted into the Navy?—No.

1208. You have not actually seen it?—No.

1209. I think you have measured the colours of signal glasses?—I have.

1210. Perhaps we should see that better next Friday?—Perhaps you would, if you would leave that. There is one thing I should like to say about the wools. I do not think it is fully understood why it is that wools are effective in detecting colour-blindness.

1211. You would like to explain that a little further?—In a rough way. The ordinary normal-visioned man will allow 3 per cent. of green or 3 per cent. of red to be mixed with a colour without perceiving it. In taking colour equations, I may say, that has been a very great difficulty on both sides. We have to get the maximum and minimum and take the mean, in order to get the colour equations which I have here. Now, you can perfectly well see this. There is a yellow test skein: that is the fifth test skein. The fifth test skein is a yellow, and when you match that approximately with the spectrum, it is very close to the D light. At about the D light, the normal eye will never wander very far from the colour of the D light; but directly you get a person who is, say, half red-blind or half green-blind—it does not matter at all which—you will find that they wander away; they will make a match in the spectrum a good deal on one side of this particular D line, and a good deal on the other side, much further than the normal-eyed man will. In the one case it is greenish; in the other case it is reddish.

You can quite well see then, that with that yellow skein—I am only taking this as an example of some of the others—there is no reason why an incomplete colour-blind person should not pick out those skeins which are redder than the yellow, or those skeins which are greener than the yellow. That yellow skein is, as it were, on a balance with the red and green sensations. The sensations there are about the same to the normal eye; but directly you diminish one of

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those sensations, the balance tilts on to the other side, and you get them choosing the red or the green, as the case may be. Otherwise, if the sensation of hue was perfectly acute, everybody might name the spectrum colours absolutely, but as the normal-eyed people could mix 3 per cent. of red colour or green colour with the colour before them, and find no difference between them, then I say, with those who are half red-blind you can add 6 per cent. of their luminosity to the colour without altering it to them, although when you add that 6 per cent., the normal eye at once perceives that there is too much added. That is the reason why the wool tests are effective. Those tests which are just upon the border-line are those which are the most effective. Now, I can honestly say this, that since the introduction of that yellow and that purple test, for which I am responsible to a certain extent, I suppose, we have had more evidence backing up the first test, which is the green test, than we have ever had before.

1212. Therefore you attach great importance to Nos. 4 and 5?—I attach immense importance to Nos. 4 and 5. For what I call brutal colour-blindness, that is to say, when it is complete, or very nearly complete, it matters very little what test you use; you can find them out without being very elaborate about it.

1213. I gather you do not attach much importance to No. 3, the red?—No, I do not care about at all. I am sorry it was introduced, because it is what I always call the "gallery" test. If a man does happen to pick out a green to match red, people will cheer in an unpleasant way if you are showing it. In our cases we have not got a gallery, and therefore it does not matter if we do not have it at all.

1214. You would not care for your own purposes if No. 3 was eliminated?—No, I should not mind at all.

1215. But you would retain the other four?—I should retain the other four. And if I could replace it by another test, I should replace it by a brown colour.

1216. You think that would be of service?—That would be a further safeguard.

1217. Then what happened, I suppose, was that you did not feel in a position to recommend any disturbance of the first three tests?—No.

1218. When you recommended the fourth and fifth, I mean?—The fact is this. I suppose it will not be a breach of confidence if I say what the Board of Trade told me. As a matter of fact, I was told not to disturb the tests as it might create a disturbance in the country; so we left the three tests as they were, and added the other two. I wanted myself to arrange them afresh, but as a matter of fact I was told I had better leave them as they were.

1219. Those are the principal matters you wanted to say in addition about the wools?—Yes. You asked me if I was satisfied with it. I say, as far as a rough test goes, the wool test is the best that I know.

1220. Taking the tests as they are now applied in the different parts throughout the country, where, of course, your spectroscopic test could not be adopted?—That is so.

1221. You still consider that for this purpose the wool test is the best?—I do. In the epitome of the evidence I proposed to give, I mentioned that I thought the wool test would be more complete if, after it had been applied in the usual way, the candidate was shown a few of the pale confusion skeins and asked to name them; also that any case of failure to make right matches, through an apparently slight colour-vision defect, should be tested with the spectroscopic method to ascertain if the candidate was dangerous.

1222. I did not quite follow your outline of the lantern test. Was there anything further you would like to say about the lantern test to complete that bit of evidence? There are one or two points here. Would you turn to that part of your précis? You say, "The test with the lantern is of very little use unless the diameter of the hole is very small." You have given us the opinion that you do not think the lantern test, popularly so called, is of much value, have you not?—I have not much to add to the evidence here, I think.

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1223. You say, if a person fails with a lantern test even when the aperture is fairly large, he must be very colour-blind?—Yes, of course, if you could get glasses which are almost monochromatic—which I have never succeeded in doing yet; I wish I could—the lantern test might be used with very great effect. But all the glasses, that I have ever tested for lantern work, are so made up of mixed colours, that they cease to be of very much value except in cases of what I call brutal colour-blindness. For fine cases of incomplete colour-blindness, I do not know that they are of any use.

1224. For the more difficult questions of degree, it is not of much use?—That is so.

1225. One of the principal reasons, why you consider the lantern test is ineffective, is because the glasses used are so very defective scientifically?—Yes.

1226. You are going to tell us more about the colour of signal glasses next week?—Yes.

1227. (Mr. Nettleship.) I rather gather that, if a candidate fails with, say the pale green test, or the yellow test, you consider him as a rule to be disqualified. Supposing, before he comes to you, I examine someone, and he fails on the green or the yellow test, you would consider him disqualified?—I should fail him on those two tests.

1228. You would most likely find that he was disqualified?—Yes.

1229. That he was too bad to go on?—Yes.

1230. Therefore as a matter of fact you would say, if I understand rightly, that the great bulk of people who are failed on the first pale green test are rightly failed?—Yes.

1231. Nearly all of them are dangerous?—Yes, nearly all of them are dangerous.

1232. That is, putting it in your own terms, nearly all of those would be inside .7?—Yes.

1233. With less than .7 sensation?—Yes.

1234. (Professor Gotch.) I understand that your objection to the lantern test is, first, the difficulty of getting true colour of the glasses?—Yes.

1235. And I assume, secondly, because there is a flame behind?—Yes.

1236. I want to put it to you that that is what these people have to see—a lantern through a coloured glass with a flame behind—and that is what the Board of Trade has to test them for?—That does not tell me the degree of colour-blindness.

1237. I suggest to you that the lantern test is practical and, whatever may be its defects, they are defects which occur in the actual coloured lights which these people have to recognise at sea?—No, I do not quite agree.

1238. Let me ask you this: What do you consider the difference to be between the lantern test defects and the lights that are shown at sea, which come through coloured glasses with a flame behind?—You have to distinguish a light two miles off and you do not see the flame. You see the light, but you do not see the flame. If you reduce your lantern to .015 you will not get any light through at all. There is a difficulty close at hand in the reduction of the luminosity by diminishing the aperture.

1239. Do I understand that you do not think a lantern test can be made to simulate the lights on ships at sea?—I do not think it can, not absolutely.

1240. For practical purposes it can be made to simulate it? I suggest this is a very important matter so far as my view is concerned?—Of course, if you put the same glasses up and use them at 100 yards off, as I said in answer to another member of the Committee, it is a toss-up; you have only to pitch a penny up when one of the colours is shown, and the chances are equal that he will name it correctly.

1241. I do not think that is my question, if I may say so?—But it is my answer to it.

1242. I am afraid it is not an answer to my question, whether a lantern test can be made to simulate the coloured-light conditions which exist at sea?—Then that is not a lantern test. A lantern test consists of glasses of different colours. I know in most lanterns there is a yellow, there is a red, there is a green, and sometimes two greens. In the old Board of Trade one there was a neutral tint. The fact is, there are about

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[Continued.]

seven distinct glasses. Now, which of those glasses are you going to use for the lantern test?

1243. I gather you would not say that a lantern test cannot be made to simulate the conditions at sea?—With the red and the green you can simulate it exactly; but I say it is no test, because you have to change the conditions under which those are viewed. It is no test.

1244. You mean it is not a scientific test for the amount of colour-defect, but surely it is a test?—It is a test in so far as it was a test in the old Board of Trade days. It was a toss-up.

1245. That, surely, depends upon the construction of your lantern. I do not know whether you know the German lantern?—I cannot say I know anything about lanterns. From a scientific point of view the colours of glasses are unsatisfactory for any scientific test at all.

1246. (Chairman.) I gather your view is, that for the purpose of diagnosis the imitation of sea conditions is not satisfactory?—No, I do not think it is.

1247. That is what I understood your view to be?—I think the most satisfactory of all, if you want a practical lantern test, is to take your colour-blind people out on three or four nights, and let them see lights a mile off. That is the only practical way in which you can tell whether a person is colour-blind or not, unless you agree to the laboratory tests. I do not agree with the lantern test in the laboratory at all. But if you get your distance, you can get your atmospheric effect; if you get your diminution of light, due not only to distance but to fog and so on, then you will get something out of it.

1248. You hold that you cannot imitate in a room the conditions which you find at sea; and that being impossible, you consider some other form of diagnosis is necessary; is that your view?—Yes; I think it would be an impossible thing to diagnose properly, without taking about half a day to examine a man.

1249. Out of doors?—With a lantern.

The witness withdrew.

Adjourned to Friday next, the 18th November, at 11 o'clock.

## SEVENTH DAY.

Friday, 18th November 1910.

PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).

Sir ARTHUR RÜCKER, F.R.S.  
Captain THOMAS GOLDING.  
Professor FRANCIS GOTCH, F.R.S.  
Mr. NORMAN HILL.

Mr. EDWARD NETTLESHIP, F.R.C.S.  
Mr. J. H. PARSONS, F.R.C.S.  
Professor J. H. POYNTING, F.R.S.

Dr. WILLIAM WATSON, F.R.S. } Secretaries.  
Mr. S. G. TALLENTS }

Sir WILLIAM ABNEY, K.C.B., F.R.S., &c., was recalled.

He first showed the Committee in his laboratory, by means of photographs taken on the three-colour principle, which he threw upon a screen, the difference in tone which various landscapes would present to the red-blind or green-blind, as compared with the normal eye. He explained that the red and green-blindness represented by the pictures implied the presence of 50 per cent. red sensation and 20 per cent. green sensation respectively.

The Committee then adjourned to the lecture theatre, where Sir William Abney displayed the spectroscopic apparatus invented and employed by him for the detection and estimation of colour-blindness.

He threw upon a white square a patch of white light, obtained by a mixture of red, green and blue light. By shutting off first the green and then the red, he showed in turn a patch of light which the

1250. Out of doors?—No, in the laboratory; it would take half a day. You would have to have a turbid medium; pass a beam of light through turbid media, and have a variety of refinements, in order to imitate the signals at sea. It would be an endless job. The simplest way is to have a green and red light two miles off, and then make the colour-blind name them a certain number of times, and even if they pitch up a penny, they will be wrong sometimes.

(Professor Gotch.) My original question has never been answered. I do not want it to be answered to-day necessarily. But I suggest we ought to know on what grounds Sir William Abney fixes the danger point at a certain percentage of sensation, and the same percentage for both red and green, which I understand is the case.

1251. (Chairman.) Will you be able to give that?—I said I thought I should be able to exemplify that better, when you saw the diagrams which I have prepared.

1252. I thought so, too?—I am quite prepared to tell you, but it is much easier to explain with the diagrams.

(Chairman.) It is quite understood we shall get that.

1253. (Mr. Norman Hill.) You gave us about 14 recent cases of red failure and seven of green?—Yes.

1254. Would it be possible for us to see the records of those men as shown by their wool examination?—Yes.

1255. So that we could see how the 80 per cent. man goes on in his examination?—I think you can get that.

1256. (Captain Golding.) As to the reliability of the lantern tests in a room, I take it one of your chief objections is, that you cannot reproduce the atmospheric conditions which you would meet outside; that is, the conditions to an observer two miles off?—That is so; it is impracticable.

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appeared quite white and stood out more distinctly, if the eye was directed to one side of it or slightly above it.

The witness stated in reply to Sir Arthur Rücker that, though with a patch of the size shown the red light appeared red as long as it was visible at all, yet, if a small patch of a certain size were shown, the colour would disappear before the light; and the red patch, when considerably dimmed, would appear to be white; that is to say, in the case of a red light the absolute and the specific thresholds of sensation did not always coincide.

The witness then substituted coloured dots of red and green light for the patches, making the red four or five times brighter than the green, and showed that though the intensity of the red light was much greater than the green, the red dot was invisible at a distance at which the green could still be clearly perceived, though it might not be distinguishable from a white light. Incidentally he mentioned that, as long as the angular diameter of the patch was over four degrees, no alteration in brightness was seen. But beyond this, the brightness rapidly diminished according to a law which he had found out. Diminishing the angular diameter to quarter meant diminishing the brightness of the light ten times. In reply to Captain Golding, he stated that a yellow fog would have the same effect as the dimming of the spectral ray in making a green light appear white; and explained that a green light at sea was less visible than a red at short distances, because the green glass of a lantern would absorb more light than the red.

A. T. Ruby was then called and a spectrum was shown upon the screen. Ruby stated that he saw only two colours in it, yellow and blue. He marked the points at which the yellow ended and the blue began; and, in reply to Sir William Abney, described the part of the spectrum between them as grey. The witness pointed out that this grey patch was Ruby's neutral band.

Ruby was then shown patches of light of various colours, and asked to name them. He called all the reds, orange and yellow; also some of the green. When he came to the bluish-greens, he called them white, and the blues he called blue. These mistakes

he repeated, but on one occasion called a red, green, when a little white was mixed with it.

The witness next showed him, for the purpose of measuring his "luminosity curve," a patch of green beside a patch of white light; he called both green. Ruby was then asked to say when the patches appeared to him to be of equal brightness. He said the brightness was equal when the sector recorded 12½ degrees, while Sir William Abney's reading of the same was 21. (A subsequent calculation by the witness on the basis of these readings showed that Ruby was completely green-blind.) The witness explained, with reference to his evidence at the previous meeting, that the degree of colour-blindness could be estimated, by calculations on a definite formula, either from a comparison between the luminosities apparent to the colour-blind subject and to the normal eye at a given point of the spectrum; or by a comparison between the readings of the colour-blind candidate at two points in the spectrum.

Ruby was then asked to name the colour of dots of light of varying colours. In the course of a brief test he called red, red; dark red, green; red, yellow; green, white; red, red; dark red, white; yellow, yellow; green, white; and yellow, white.

He was then tested with simultaneous contrast colours. With a red stripe by the side of a white stripe, he called the former red and the latter green. He called another red, yellow; and a white, green. Subsequently he called a green and a white both green.

In reply to a question by Professor Gotch, the witness stated that it was easier for a colour-blind than for a normal-sighted person to judge when the luminosity of the two patches were equal, since the difference of colour would be much less appreciable to the former than to the latter.

By means of coloured glasses placed in front of a white arc light, so as to cut off in turn the red and the green rays, the Committee were then shown how the confusion colours in the Holmgren test appear to the colour-blind to be of the same colour as the various test-skeins. They also examined diagrams of the spectrum, prepared by Sir William Abney, to show the names given to its various portions by actual colour-blind candidates.

(After a short adjournment the Committee re-assembled in the Physics Library.)

Sir WILLIAM ABNEY was recalled and examined.

1257. (Chairman.) We will go direct to the form-vision test. The test consists in reading Snellen's test types at fixed distances. I understand that objection has sometimes been made that the test types are read too near, and that if they were further off and the size of type were increased proportionately, more men would pass. What do you say as to that?—I think that is a misapprehension. I do not say it is a mis-statement, but it is simply a misapprehension. If you have a lens of any focal length, I do not care what it is, you will find that the rays are practically and almost theoretically parallel when the object examined is 100 times the focal length of the lens. You have on the Committee gentlemen who know the focal length of the lens of the eye, and I think I am perfectly right in saying that 16 feet is a good deal more than 100 times its focal length.

1258. Therefore you think that any desire to have the size increased and put further off is wrong?—I do not think it would be any good.

1259. Then we come to the question of the necessity of the form-vision test as a test—the connection with the colour-perception test?—I think that is a very important point if you have anybody suffering from myopia, for instance, and not allowed to use glasses. Of course that goes without saying. I presume it is recognised that on board ship the use of glasses is impractical for various reasons, which I suppose the nautical witnesses will be able to explain to you.

1260. You assume that?—Yes, I assume that. Every point of light that is looked at, is really a small disc upon the retina. It is not a point. Since it obeys the

mathematical laws of optics, it must be a disc of a certain diameter. If you have myopia, of course, you do not bring the focus of the object to a sharp point or a sharp disc. The disc becomes diffused; and therefore the quantity of light, which is collected by the normal eye into a very minute disc, is distributed over a larger area; that is the same quantity of light has to be seen by one suffering from myopia distributed over a larger surface. As the colour of light will, to the normal eye, disappear as the angular character of the light becomes smaller (the diminution of the angular character being equivalent to reduction in intensity) it is evident that the light can be brought a great deal nearer and the colour will not be perceived by the myopic eye. The distance at which colour is recognised for the normal eye is much further off than for the myopic eye. That applies to every light—not only to the green, but the red as well. Therefore, if you have an eye which is only half-normal, I think I am right in saying, that the distance at which a half-normal eye will recognise colour in a light will be about half the distance at which the normal eye will do so. For this reason I think normal form-vision is a desideratum. At the present time, when we have very rapid steam vessels, it does not do for colour to be recognised only at a short distance; and therefore I think the Board of Trade have acted very wisely in requiring normal vision at all events for one eye of a candidate, and half-normal for the other eye. By that means they secure that the maximum perception of colour at a distance shall be attained. For instance, if the green light can be seen as green two miles off by the normal



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eye, the half-normal eye very likely would not see any colour at all, and would only see the same brightness of colour at about half the distance.

1261. You are fairly satisfied with the present test as established by the Board of Trade for form-vision?—I am satisfied with it for form-vision.

1262. You think there was good ground for that change?—I do. It was debated at considerable length at the former Colour-Vision Committee, and I think it was a sort of compromise that was arrived at. Some pressed for normal vision in both eyes, if I remember correctly, and others were for modifying that demand; and eventually, as a sort of compromise, it was agreed that half-normal vision would be sufficient.

1263. Do you think it is probable that under the old test a certain number of dangerous people got through?—Yes, I do; that is to say, somewhat dangerous people; but not dangerous with the old speeds of sailing. Of course, we have increased the velocity of our vessels so much during the last 20 years, that what was safe then would not be safe now; a vessel which formerly would take some considerable time to reach you, would be upon you quickly.

1264. You attach considerable importance to that change?—Yes, I do.

1265. I think you have something to say about astigmatism?—I was going to say that astigmatism was equally bad—that is to say, pronounced astigmatism—because it gives you a blurred image of a point, instead of a very minute disc.

1266. That is detected by this type test?—That is detected by the type test.

1267. Is there anything else with regard to form-vision which you would like to say?—I do not think at the present moment I can call anything to mind.

1268. You have covered the most important points?—I am not talking about the acuteness of sight for picking up vessels at a distance; that is another matter. I am simply speaking of the importance of having normal vision for colour work.

1269. And the importance of having a form-vision test?—Yes.

1270. Would you like to say anything about the acuteness of vision?—I think that is more for nautical witnesses to speak upon; I would rather not commit myself to that. Of course I have my own views, but they would be of no value. I think the experiments that one has made as to colour are quite conclusive upon the point that normal vision is a necessity. I have tested, with the dots and so on, different people whose vision was sub-normal, and I have come to the conclusion they are not safe at the present day.

1271. (Mr. Parsons.) Have you made any observations with regard to the colour-vision of people with eyes refracted?—Yes.

1272. It is rather a rough estimate, is it not?—Yes; it is only a rough estimate. I have carried out a good many experiments as regards extinction of colour. What I have said just now was, of course, only given in a rough way. But still, I feel that it is absolutely essential that there should be a greater acuteness of vision than was called for by the old Committee.

1273. (Mr. Nettleship.) With regard to the distance, I understand you thought 16 feet was quite enough?—Yes.

1274. You do not mean that a good deal less than 16 feet would be enough with correspondingly small types?—No, I do not. I say 100 times the focal length is the minimum.

1275. (Professor Poynting.) Have experiments been made to test the sufficiency of 16 feet? Has 32 feet been tried?—Yes.

1276. With precisely the same results?—With the same results. I think Mr. Nettleship will be able to give you a better answer regarding that than I could, because the efficacy of the test type at a long distance has been tried by him.

(Mr. Nettleship.) The chief thing I might say about that is, that it varies enormously with the illumination. The ordinary standard is 16 feet or 20 feet in an

ordinarily lighted room. If you take the same person or to the Thames Embankment at mid-day he will get very much more.

(Professor Poynting.) I meant, had experiments been made with the same light at 32 feet, or at any other distance, and was it found to give exactly the same results?

(Mr. Nettleship.) I cannot tell you that.

(Dr. Watson.) I can answer that. Professor Nagel gives 5 metres as the limit below which it is not safe to go.

1277. (Mr. Nettleship.) Accommodation comes in?—Yes, that is the reason why 16 feet was chosen.

1278. Twenty feet is the usual thing?—That is so. It was, I believe, owing to the fact that you could not readily get 20 feet distance at some centres that the minimum of 16 feet was chosen.

1279. You say that astigmatism can be detected by the type test. You do not mean that to be taken literally, I suppose?—No.

1280. (Professor Gotch.) Should an anomalous trichromic be tested at the same time for form-vision, to see if his form-vision may not compensate for his colour defect?—I should put it the other way. If he could pass the colour-test in the laboratory, then I should be inclined to test him for his normal form-vision, and to see if he ought not to be failed. I put it the other way, you understand.

1281. I realise that—that a person should fail, even though he has passed the colour-test, because he is below the normal in the form test?—Quite so.

1282. I put it precisely the other way round. May not a person on the border line of anomalous trichromic vision be safe for practical purposes by reason of having form-vision above the normal— $\frac{3}{4}$  instead of  $\frac{2}{3}$ ? He would have a distinct and bright retinal image?—Yes, a distinct and bright retinal image, that is perfectly true. If he comes just above or below .7, I should think it very likely he might pass; but if he has, say, .4 or .5, I should say there is no chance of any hyper-acuteness of vision making up for it.

1283. But there would be cases on the border line, in which especially good form-vision would probably render a person safe?—There might be. On the other hand, in justice to the travelling public, I would much sooner be too severe than too lenient. I look upon it as a duty to the public to see that a man is safe, and if there was a question about it, one way or the other, I should decide the matter against the man and in favour of the public.

1284. You have to draw the border line somewhere?—You have to draw the border line somewhere, that is perfectly true.

1285. Would you take form-vision into account at all from the colour point of view? At present the two are not taken together at all?—They are taken together.

1286. I mean they are not taken together for the determination of passing the colour-vision test?—When they come to me, they are tested in form-vision, and if they do not pass in that, they are not tested in colour.

1287. I mean, they are not taken together, in the sense of one possibly compensating shades of the other?—No; they are two separate examinations.

(Mr. Nettleship.) I think it would be dangerous to take the two together.

(Professor Gotch.) I only wanted to ask the question.

1288. (Mr. Parsons.) Do you say that any hyper-acuteness of form-vision would in any sense compensate for any real defect of colour-vision?—No, I do not think it could.

(Professor Gotch.) I was alluding to the borderland cases.

1289. (Mr. Parsons.) But still, if they have a defect of colour-vision, could any hyper-acuteness of vision compensate for that?—I think not, and even if there was a possibility that compensation could take place (I may say I have not met with such a case) I should give it against the man, on account of possible danger to the public.

The witness withdrew. (See Question 1307.)

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Captain J. CRAIG, M.P.

[Continued.]

Captain J. CRAIG, M.P., called and examined.

1290. Would you kindly say to us anything you think is important in your own experience, in relation to this very important matter of colour-vision?—I understand this is a Departmental Committee, but I do not know its scope.

1291. It is a Departmental Committee, appointed by the Board of Trade, to inquire particularly into the degree of colour-vision which should be found dangerous. I am putting it quite roughly, but that is one of the principal points?—I did not even know the scope of the Committee; but I have taken a great interest in navigation and such matters from a personal point of view, for so many years, that I was only too glad to do anything I could to assist the Committee. I went up for a master's certificate myself many years ago, and studied; and after I had completed the course, I went before the representative of the Board of Trade in Belfast, who did not know me. You will understand, of course, that before going in for the examination you have to pass a sight test. I had the wools put before me, and although I had a fairly good suspicion that I was colour-blind, I did not know that it would interfere to the extent that I afterwards discovered it would. I genuinely tried the Board of Trade test with the wools, with the result that the examiner there said, "You are colour-blind, and hopelessly so, and I could not possibly permit you to go up for examination." Then, simply out of curiosity, I appealed, in order to follow the course which any master of a ship would have to pursue in the ordinary case. I did so, because I had been three years' side by side with mariners of all sorts—first, second, and third mates, and masters who wanted extra-masters' certificates—and I wanted to follow them all through for my own personal experience. I came over here, and Sir William Abney confirmed the report of the local Board of Trade representative.

1292. He confirmed the report of the Belfast authority?—Yes, and although I was merely going for a yacht master's certificate for myself, I quite saw the justice of the decision in both cases. Although I felt that it was only a yacht master's certificate for my own yacht that I wanted, and, if I purchased a boat, I could take her anywhere; yet I saw it would involve the Board of Trade, if they granted me a yacht master's certificate; because, in the case of a collision, it would be said that they were in fault in having passed a master who was colour-blind. So I felt no grievance at all, although I was sorry not to be able to go in for the examination. Since then I have taken particular interest in the question of colour-blindness. The colour-blindness I suffer from is very genuine. My wife and family are always asking me: "What colour is that? For goodness sake, cannot you tell the difference between those colours?" That makes me look very small in the matter of colour, so it is a genuine case. I discovered, yachting in fogs and so on, that I could very frequently by deduction tell from the hull of a ship in the dark whether it was a port or starboard light I saw. It was more by deduction than by the light itself, which is rather dangerous.

1293. May I ask how the two lights appear to you—the red and the green?—The red and green I could, perhaps, distinguish accurately in a clear light, but I would not swear I could. I might, or might not, make a mistake. It would only be a guess; but my guess would probably be right. That is to say, it affects me in this way. I should say: "There is a green light," and I should probably be right. But I should not be quite satisfied that I had not guessed at it. But if there was a fog, and the green and red lights were coming straight towards me, although I could guess which was green and which was red, yet, according to the thickness of the fog, they would become more or less the same to me. I will admit that frankly.

1294. As long as you know the position of the two lights it is a guess?—Yes.

1295. But if the position is utterly obscure to you?—If the position is utterly obscure, I have said to myself frequently, "I am glad I do not command this ship." I am talking about travelling in other boats,

travelling down channel in a fog, and so on. I have been on battleships many times, and knocked about with them. I have said to myself, "I am glad I am not in command, because I could not tell which that light is."

1296. So that, from your own experience, you can confirm the real danger of a colour-blind officer?—Most decidedly. I say this, that although, on thinking the matter over and after careful study, I might pick out green and red, the very hesitation which would be necessary is in my opinion a great danger. Anyone, on board a ship especially, should be quick, and not even at the back of his own mind have the slightest suspicion that he may be wrong; because the damage is invariably done in the time it takes him to reconsider his decision. Perhaps, if there was a man on the bridge beside him, he might say: "Green or red?" or something to that effect. But if the fog-horn is going, or if there is a little bit of wind, he might not be heard, and the damage would be done. I have been on my own yacht in a fog, and have not known very much about the lights which have passed. My experience is, you want to be able to decide in a moment of time, or it is no use. If a man is confused, he will put his helm to starboard or to port too late.

1297. That is the principal evidence that you are willing to give?—That is my experience. Every time I have been at sea it has been my experience, that the chief safeguard is the rapidity and the certainty with which you can pick the colour,—not whether you can do it after consideration or not, but whether you can do it without doubt on the spot.

1298. Have you talked this over with officers who have regarded it as a grievance at all?—During the course of preparation for the examination I elicited the fact, as I believe, that they felt a hardship in this respect. I understand that in the case of a home-going captain, unless he applies for an extra-master's certificate, his colour-blindness is not discovered, although he may suspect it himself. But if he goes for an extra-master's certificate, then it is discovered, and he might even lose his home-master's certificate, if he were found to be colour-blind.

1299. And if he has to be tested under the rules of the company which employs him?—Yes. But I understand, by the Board of Trade rules, a second mate might be on board a ship as second mate, without it being detected that he was colour-blind, if he had once passed his test.

1300. You think they regard that as a grievance?—I am speaking from memory, but I always insisted on saying to them: "Well, after all, your grievance may be a genuine one in a way; but if you come to think of travelling on board one of these enormous liners, with thousands of people on board, and it all depends on you, and you alone, to be able to pick out in a moment of time a certain light, perhaps you will realise the enormous responsibility that rests on the Board of Trade in giving a certificate to a man about whom there is the slightest suspicion." That is the argument I used to them.

1301. In your experience, you have never come across any case of an accident which could be attributed definitely to colour-blindness?—Never. I never have that I can recollect—not personally.

1302. (Mr. Nettleship.) Does the distance of the lights from you make much difference to you?—No, because I have good distance sight. The only thing I have discovered was this. I had a cyst in the left eye about a fortnight ago, and owing to being laid up in bed through ptomaine poisoning for about a fortnight contemporaneously with the other, I got rather weak. The weight of the cyst closed the eye, and I noticed, when the left eye was closed, my colour-blindness took a different aspect. I do not know if cases of that sort have occurred before. I was only out of bed three days ago, so that I have not been tested since; but possibly the closing of one eye might alter the question of whether a man was colour-blind or not. That is the only thing I discovered in recent times. I discovered it by a number of coloured pictures that my children

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[Continued.]

had left on the bed. I was looking at them, and I got very tired with the weight of the cyst which closed the eye, and the colours seemed to me to assume a different aspect.

1303. It would be valuable if you could have your two eyes tested carefully?—Yes.

1304. It would be quite worth doing, if an opportunity occurred, but I was particularly referring to the distance at which you see the light. Does it make a difference to you?—No.

The witness withdrew.

Sir WILLIAM ABNEY recalled.

1307. (Chairman.) There was the point about the signal glasses, which we postponed. I think you have some evidence to give upon that point?—I can put in figures giving the luminosity of the different rays coming through the signal glasses. If the Committee desire it, I can put in the absolute figures of the measurements. This document gives the different luminosities of the different wave-lengths coming through. The curves will fit on to the spectrum, which, I think, everybody has got. (Documents were handed in.)

1308. There was one statement made by one of the witnesses which I thought I should mention to you. Dr. Edridge-Green was asked this question by Lord Rayleigh: (492.) "Has your way of exhibiting the colour any advantage over Sir William Abney's apparatus?" and he replied: "The method he has adopted is not the same as was recommended previously. I do not know the methods that he does use, except from the reports I have seen. But they seem to me to be very similar to mine, showing spectral lights and shutters inside. They are not the methods reported by the Royal Society Committee. Their method was to pick out the neutral point, and the trichromic has not got a neutral point. In fact, I took three cases of colour-blindness to Sir William Abney and he passed them all." I think it is only fair to lay that before you, and ask you, if you have any comment to make upon that statement?—I think there is a misapprehension on the part of Dr. Edridge-Green, because I happen to have chosen some of those patients for trials of my new method of giving a number to the colour-blindness.

1309. Do you know what the three cases alluded to are?—I happen to know two. It is not the first time that he had stated this. I was having a look through my old note-books. This one is dated 1891, nearly 20 years ago. I came across measures that I had totally forgotten and, among them, two cases which Dr. Edridge-Green brought to me. I suppose I must not give names. He referred me at the time to certain pages of his book. I will read the remarks that I made at the time regarding one: "Tried with Holmgren's test; picked out all greens correctly; took up a grey and called it red; took out all the pinks correctly. Tried him with the pellets; he called a brown and a dark green and a light green, green; a pale green, a pale grey; pale blue, a red; showing only the ends of the skeins, he called a green, grey; a bluish green, bluish green; and the red, red. Tried with the spectrum he named colours correctly, except that he faltered when white was mixed with the green; called greenish yellow, yellow; yellow correctly; scarlet, yellow; and red, red. Tried with the colour patch and white alongside: Said that all greens from 49.4 to 40.4 on my scale were the same colour as white, with a pinkish edge to the white." It is a funny thing about that pinkish edge to white, because this gentleman was perfectly unaware that it was a white patch. There could have been no pink edge, it was simply some fault in his retina, I suppose. "He called the white green when opposed to the reds, 33.4, a violet; he recognised blue in the colour. (He was astigmatic.) The main mistake made was to call orange, yellow, and a yellow-green, yellow; and green the same as white." I have here the luminosity curve. I do not think it is likely

1305. Would you have the same difficulty in going into a harbour almost at close quarters with the lights, if there are two lights there?—I have been in and out of harbour, and if it was clear I quite agree—the nearer the light was, the better chance I would have of discovering it; but if it was foggy I should not.

1306. You would not feel safe even with the light near at hand?—Not safe at all. I quite agree I am not at all safe.

that with a record such as that, I should have passed that gentleman as not colour-blind.

1310. Were you testing him for the Board of Trade then?—No, it was a private testing. This is an old note book of nearly 20 years ago.

1311. The statement is that he was passed?—He has forgotten. It is not correct. Also, as a matter of fact, from the new method of judging, he is 4 red blind. Then there is another case.

1312. We need hardly take the details?—No, but the second is equally glaring; if Dr. Edridge-Green says I passed those two cases, he is under a misapprehension. I cannot have done anything of the kind. The third case I cannot trace.

1313. I seem to have passed in review most of the matters which you were willing to bring before us. Of course nothing prevents us seeing you again at another time. Do you think there is anything else which occurs to you?—I should like to say one thing about the lantern test. It may have appeared, from my last examination, that I did not appreciate the lantern. Now I do appreciate the lantern test in a way, but I do not think it is trustworthy under a great variety of circumstances. The Board of Trade had originally a lantern test, and the number of people who passed through that lantern test was most remarkable. We had trials with the wool test against the lantern test, and those people who had passed the lantern test were failed by the wool test. I never found a person who was failed by the lantern test passed by the wool test. The wool test was by far the most accurate. A friend of mine has said to me: "If you were a doctor, and were examining a person for heart disease, you would not give him a heavy load to carry upstairs. You would take a stethoscope, and see what was amiss with his heart." In the same way, I think the diagnostic method by means of the wools is a very great deal better than, perhaps, the more direct method of the lantern. I have no objection to the lantern *per se*. I could imitate with the lantern the conditions of the atmosphere at a certain time, but I could not be sure that it would vary according to all conditions of the atmosphere. If you must have a lantern test, let it be a test which is used at a two-mile range, and then there will be something in it. But to take it in the laboratory, I think, is rather a snare. It is much better to have a good diagnosis of what the colour defect is, and then you can judge very readily the mistakes that will be made.

1314. The lantern tests that you were commenting upon were the ordinary lantern tests used in an ordinary room?—In an ordinary room.

1315. Or laboratory?—Or laboratory. Whatever additions are made to it, it must fail in certain conditions which are present in the atmosphere. By the wool test we are only diagnosing the failure in colour sensation, and from that diagnosis you can say very readily where the failure will take place in the actual examination of lights.

1316. (Mr. Norman Hill.) In the wool tests how many colours do you attach importance to—how many test skeins?—I attach the greatest importance to the first, fourth, and fifth.

1317. May I have the colours?—The pale green, the pale yellow or yellow, and the purple. The pink skein is the next in importance. Of course, the pink skein

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is very valuable where the colour-vision is very nearly complete.

1318. In your judgment would those four be sufficient to make a satisfactory diagnosis?—Yes. I think, as I said in my memorandum, if I had to choose another one, I should like a green-blue added as a test skein.

1319. Do you think it would be necessary to a correct diagnosis to add a fifth?—No, but I think it would give a spare wheel to the coach.

1320. If you had those five, it would be sufficient?—I should be quite content with those five. I do not want the third one at all—that is the red one.

1321. The red might go altogether?—The red might go overboard, as far as my opinion is concerned.

1322. Then amongst the skeins, how many skeins should there be for the man to handle, as against those five test skeins which you have given us?—I should think a hundred.

1323. Should every skein, that is put on the table, be either a lighter or darker shade of the same colour as one of the five?—No, slightly different colours; confusion colours, that is to say, slightly differing in tint. It is not very much use to have a large assortment of what I call blue confusion colours; the red and green confusion colours are by far the most effective, except in the case of the purple skein, where the blue confusion colours come in. In all the other test skeins, the blue confusion skeins are not of very great value.

1324. But suppose you are testing a man with normal colour-vision with your five test skeins, if you give him time enough, should he be able to group all the skeins, that are put on the table before him, under one or other of those five skeins?—No, I do not think that he would.

1325. Is it necessary to have colours and skeins which he cannot group?—Certainly. It is better to have them.

1326. I mean, is that valuable? Why I ask is this. In the men that I have seen tested, it seems to me that there is a great effort on their part to oblige the examiner, by finding as many as possible. I fancy sometimes their colour sense gives way to their politeness. They think he wants more skeins than they find?—Of course that is not quite as it should be. I think, when a man has picked out all that he thinks are like, he should be let alone.

1327. Is it necessary, for an effective test, that there should be skeins which do not fall under one or other of the groups?—Yes.

1328. That is necessary?—Yes, that is necessary.

1329. Then with regard to the 70 per cent. of perception being sufficient to get a pass. Is it possible to arrive at that point by reducing the number of colours you put before your candidate?—No, I do not think so. I think you must put them all before your candidate, before you can make a diagnosis at all. I go as far as to say that, when a candidate has failed by the wools at the ports, he should be tested on appeal. There are not so very many, and I think that those who have failed at the ports should always be tested on appeal.

1330. You mean they should not be failed, but they should be referred for re-examination?—Yes, they should be referred to somebody.

1331. Roughly speaking, do you arrive at your danger-point of 70 per cent. sensation, because you believe that a man who is 30 per cent. deficient in his green sensation, will never think that green is red?—He will never think that green is red.

1332. And if he is 30 per cent. deficient in his red sensation, he will never think that red is green?—No, never.

1333. But if you get less perception than that, there is danger of his confusing those colours?—Yes, there is danger of confusion.

1334. If the perception is less than 70 per cent.?—Yes, about 70 per cent. 50 per cent. is absolutely dangerous.

1335. I noticed among the cards there was one with 63 per cent.?—Yes, and he had been passed.

1336. Then there is another point. In 1914, the form-vision test is being stiffened?—Yes.

1337. In your opinion is that necessary?—I think so—decidedly necessary.

1338. On what ground?—On the ground of colour-vision.

1339. In your judgment, it is part and parcel of the colour-vision testing?—Yes.

1340. That is your only point?—That is my point. I leave the acuteness of the vision as regards picking up objects; I have not the same knowledge that gentlemen like yourself and Captain Golding possess. But for colour-vision certainly, I think that full normal vision is a necessity. I may say that correspondence has come for me to see from various Colonial Governments, in which they press for stiffening up.

1341. Like the Australian?—Yes, down South—Australia and New Zealand, too, I think.

1342. It was one of the New Zealand lines?—I may say their test is very much more stringent than any Board of Trade test.

1343. You mean this particular line?—Yes, that particular line.

1344. There are other lines in Great Britain which have their own tests?—I believe some have their own tests.

1345. Far more stringent than the Board of Trade?—Yes.

1346. And the particular New Zealand line is one of the few that has an over-sea trade?—I believe so. Therefore I do not think the Board of Trade are erring on the side of stiffness, but they are preserving a very happy mean.

1347. (Captain Golding.) I have one question about the coloured glasses. As to the curves of luminosity, does the luminosity govern the distance at which a light is visible?—Yes.

1348. Is luminosity the same thing as intensity?—Not as I employ these terms.

1349. That is what I thought?—You talk of the intensity of a ray of light, but you must take the luminosity of the whole of the spectrum as governing the brightness. Take the German green curve.

1350. It runs up to about 7?—As a matter of fact it only allows 6 per cent. of the whole light to go through. It is seen as a green light, but there is only 6 per cent. of the light going through the glass; all the rest of the 94 per cent. is wasted.

1351. But in the case of the red light, there is some 42 cent.?—Not going through.

1352. The curve runs up to 100 per cent.?—Yes, it is all taken to the scale of 42, 100 being the maximum of the naked white light.

1353. (Dr. Watson.) Twenty-seven, I think, is the percentage of red?—The percentage of the German red, yes; but, on the other hand, it is so mixed with white light, that I should consider it a dangerous light.

1354. (Captain Golding.) Do you think the present standard of coloured glass, as fixed by the Board of Trade, might be improved, both from the point of view of visibility and from the point of view of people partially colour-blind making mistakes? I do not know if you quite grasp my meaning?—Yes—whether any change in colour and luminosity would enable the lights to be more effective to the sailors?

1355. Yes, both from the point of view of visibility, and to avoid mistakes of people who are partially colour-blind?—You can make them safer, as far as the colour-blind people go, by robbing them of the white light transmitted, which involves dimming them. If you increase the light, more white is transmitted and you increase the danger with the colour-blind.

1356. By improving the colour you impair its visibility?—Yes.

1357. Would a difference in the nature of the glass make a difference? I believe there is what is known as pot metal and flash glass?—Yes, it makes no difference in the colour.

1358. (Professor Gotch.) There is a re-examination in form-vision, but not in colour-vision, as you are aware?—Yes.

1359. I want to know, supposing in the re-examination in form-vision there is a deficiency as compared



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with what it was before, whether that would not affect the colour-vision which has been previously passed?—My reply to that is that such a candidate cannot pass in colour-vision; he cannot be submitted to the colour-vision test, unless he has passed the form-vision first.

1360. But he is re-examined in form-vision and not in colour-vision?—If a man is deficient in form-vision, then he is allowed to come up again in three months to see if he is better, and if he passes he can go through the colour-vision; but until such time as he can pass the form-vision, he cannot be examined in colours.

1361. (Professor Gotch.) I understand. I do not understand still how it is you fix this 70 per cent.?—From experience.

1362. It is a personal impression from experience?—From experience, and the names which they give to the different parts of the spectrum when under examination.

1363. Another question I wanted to ask was, whether you considered the wool test, in the case of anomalous trichromics, as one that can be carried out, except by an experienced and skilful examiner. I am speaking of doubtful trichromics?—I think the wool

test can be carried out by people who have been trained to it, and are patient with the candidates and tactful. I think they can do it just as well as I or Captain Harvey can.

1364. Do you think the examiners now appointed by the Board of Trade, who have to examine a large number for certificates, are capable of carrying out the wool test accurately, in regard to these anomalous trichromics?—Some of them are, but, as I have said before, I think that, wherever there is a suspicion of colour-blindness, the case ought to be referred, and a re-examination insisted upon.

1365. You think there ought to be appeal in all cases?—Not for every man who is examined, but for all those in regard to whom there is the slightest doubt.

1366. All cases that are affected or doubtful?—Yes, all cases of possible rejection. I think that would make the thing perfectly safe.

1367. (Chairman.) We thank you very much for your evidence, Sir William?—If at any other time evidence on fresh points is desired I shall be very glad to give it, if I can.

The witness withdrew.

Adjourned to Friday next, November 25th, at 3 o'clock.

## EIGHTH DAY.

Friday, 25th November 1910.

## PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).

The LORD RAYLEIGH, O.M., F.R.S.  
Sir ARTHUR RÜCKER, F.R.S.  
Mr. RAYMOND BECK.  
Captain THOMAS GOLDING.

Professor FRANCIS GOTCH, F.R.S.  
Mr. NORMAN HILL.  
Mr. EDWARD NETTLESHIP, F.R.C.S.  
Mr. J. H. PARSONS, F.R.C.S.

Dr. WILLIAM WATSON, F.R.S. } Secretaries.  
Mr. S. G. TALLENTS }

Mr. ALEXANDER RUDOLF GALLOWAY, M.B., M.A., called and examined.

1368. (Chairman.) Do you hold the degree of Master of Arts, Bachelor of Medicine, and Master of Surgery, of Aberdeen University?—Yes.

1369. After you graduated, did you study ophthalmology at Moorfields under the late Mr. Marcus Gunn, and, since 1890, have you devoted special attention to eye work in Aberdeen?—That is so.

1370. In 1897, were you appointed ophthalmic surgeon to the Eye Institution of Aberdeen?—Yes.

1371. Since that time have you seen a large number of cases?—I have; about 4,000 annually.

1372. Now, I understand on several occasions you have examined cases of serious eye deficiency occurring among responsible employees on the marine and railway services?—I have.

1373. On one occasion you reported such a case to the employers?—I did.

1374. I gather that you never felt justified in continuing the practice of reporting men in that way?—No, I have not.

1375. On what ground was that?—Partly on professional grounds.

1376. You have seen other cases, but you have not reported them?—That is so.

1377. I think in some of your papers you may have alluded to particulars of such cases scientifically?—I have.\*

\* Paper I.—“Certain Aspects of Sight Testing.”—Scottish Medical and Surgical Journal.

† Paper II.—“Eight cases of serious visual deficiency affecting responsible employees in marine and railway services.”—Ophthalmoscope, March and May 1908.

‡ Paper III.—“The Board of Trade Sight Tests, with 12 illustrative cases.”—British Medical Journal, April 16, 1910.

1378. But that is a different question altogether?—Yes.

1379. You have described the cases?—Yes.

1380. Another reason, besides your relation to the managers or the employees, for adopting the course of not reporting is, that it is impossible to prove by examination after a certain accident has happened, that any one individual is responsible because of defective vision?—That is so; and also that reporting one case has no effect upon other cases. You, perhaps, simply remove the one case, but it does not draw attention to the fact that defective employees are being engaged at sea and in the railway service.

1381. You have sometimes attempted to follow up the examination in this way?—Yes, I have, quite recently.

1382. You find those willing to undergo examination have good vision?—That is so.

1383. And those about whom there might be some suspicion refuse to be examined?—I have several times, perhaps half a dozen times at least, failed to get consent to examination in those cases.

1384. So that at present, in cases of that sort, in cases of accident, there is not sufficient opportunity to follow the matter through scientifically?—That is so.

1385. Have you any suggestion to make as to any possible change of the law with regard to regulations dealing with cases of accident?—I think in cases of accident all responsible survivors should be compulsorily examined, if possible.

1386. It is evident that you have met with accidents where your own opinion has been that very probably defective vision had something to do with the accident?—That is so.

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[Continued.]

1387. Because we have had very few such cases brought before us. Have those been in the nature of railway accidents, or marine accidents?—Well, it is more with regard to cases I have seen described, than cases I have had in my own experience. There is one case mentioned of an accident to a trawler, where it went ashore, but no loss of life resulted. I think that was due to defective eyesight; it is mentioned among my papers.\* But I cannot say I have had any actual severe accident in my own experience, where I could say it was due to defective eyesight. Cases I have seen described are mentioned in my papers.†

1388. Then you put in several papers, which you have been good enough to forward to us; and I understand that, after reading one of those papers to the society at Aberdeen which is interested in these matters, a committee was appointed to inquire into the examination of employees in the railway and marine services?—That is so.

1389. You were a member of that committee?—I was.

1390. What was the result of that in relation to form-vision?—We decided that the standard of form-vision was too low.

1391. That was an experiment you made yourselves?—It was as the result of our inquiry as to what standard obtained. We made no experiments. It was simply that, in our own experience, we considered the standard then was too low for safety.

1392. Since then the standard has been raised?—That is so, but it is not compulsory till January 1st, 1914.

1393. And in your own opinion the new standard is not too high?—No, I do not think so.

1394. Are you satisfied with it?—Yes, I am satisfied with it to this extent, if the test is to be applied by medical men. I am not satisfied with it if the test is applied by laymen. Laymen could not exclude cases with a manifest hypermetropia of 2 D and over, which should be rejected.

1395. We are now speaking of form-vision only?—Yes.

1396. You think that the new form-vision test cannot be satisfactorily applied by non-medical men?—No; not as it stands at present.

1397. Was the old test capable of being applied? Is there any difference from that point of view between the new and the old?—It is much better than the old; but I do not consider it is sufficient in the hands of laymen. It is more difficult for laymen to apply than the old test.

1398. You concede that it is an easier thing for a layman to handle than the colour-vision test?—Yes, certainly.

1399. But still you are not satisfied with it if conducted by laymen?—No, I am not.

1400. Do you think mistakes are made?—Yes.

1401. Even in looking at the rows of letters, and so on?—That is so.

1402. Have you seen the Board of Trade test conducted by laymen yourself?—I have seen the apparatus and the room and the types for use in the test.

1403. And you have formed the opinion that an ordinary layman cannot do it satisfactorily?—That is so.

1404. With regard to the colour-vision and colour-ignorance tests, you reported that they were probably sufficient in the great majority of cases as tests?—Yes.

1405. And you state that their universal sufficiency was under the consideration of specialists?—Yes.

1406. Do you mean it was then under the consideration of specialists?—Yes.

1407. What specialists were you looking to?—Well, it was more in connection with the detection of defective red-vision, and also certain cases of colour-blindness which, when shown white lights, called them coloured instead of white.

\* Paper III., p. 10.

† Paper I., p. 11, Grantam and Shrewsbury; Paper II., Shrewsbury; British Medical Journal, April 4, 1908, Guisborough.

1408. Were there some specialists you had in your mind who were at that moment dealing with the problem?—Perhaps what called it to my mind more especially were the writings of Dr. Edridge-Green.

1409. With reference to colour-vision tests, your opinion is the same, I presume, and perhaps even stronger, that they ought not to be applied by laymen?—The present wool test, certainly; it is not satisfactory in the hands of laymen.

1410. Have you seen that wool test conducted by a Board of Trade official?—I have not seen it conducted. I am in the same position as with regard to the form-vision test. I have seen the manner in which it is used demonstrated by one of the Board of Trade surveyors. I have not seen an actual candidate being tested by him.

1411. Have you seen any candidates who have been dissatisfied with the tests? Have you come across people who do not think the wool test is well conducted?—I have had a number of patients myself who have been rejected by it, when they should not have been.\*

1412. They should not have been?—That is so.

1413. Do you mean they ought to have passed?—Yes.

1414. They were rejected as colour-blind, when they were not colour-blind?—That is so.

1415. It is generally rather the other way. Have they appealed?—On my advice they appealed, and passed in London afterwards.

1416. Then, to sum up on the points I have been dealing with, your opinion is, that all tests, if possible, should be applied by medical men?—That is so.

1417. Or that, at any rate in the more important centres, ophthalmic surgeons should be employed to supervise the tests?—That is so.

1418. If you did that, would you remove the central appeal? You would not abolish the ultimate appeal which now exists to London, would you?—I think I would. If a recognised ophthalmic surgeon was appointed in the various centres, I do not think there would be any reason for any further appeal.

1419. You would have a local court of appeal in that form?—Yes.

1420. If you could not have ophthalmic surgeons everywhere?—Yes.

1421. As regards a definite recommendation with regard to form-vision, you would like to make the new standard compulsory in the case of all candidates seeking higher certificates?—That is so.

1422. You have a criticism to offer as to the test itself, if it is applied by laymen—as to some improvement of the test. If the test is to be applied by laymen, you say the pellet test should be used?—Yes; that has reference to the form-vision test.

1423. And that is not demanded now?—No; not with that standard of vision.

1424. You would have that for each eye separately?—Yes.

(Mr. Nettleship.) Might we know what the pellet test is?

1425. (Chairman.) Will you describe the pellet test?—There are a number of marbles, little circular pellets of different colours, which are placed in a saucer on a table. There are two white saucers, and the candidate is shown, say, a green. (He is shown the same colours as with the wool test, and green is taken to commence with.) It is taken up and put in the other saucer, and he is asked to pick up those of a similar colour from the group of pellets, and place them beside the green.

1426. (Mr. Nettleship.) That is the central scotoma test?—Yes.

1427. Not the form-vision test?—No; it is to exclude a case with central scotoma where one eye is 6/6 and the other is 6/12. You may have that acuity of vision where there is central scotoma in one eye, if not in both. The recommendation is mainly intended to exclude cases of commencing toxic amblyopia.

1428. (Chairman.) With regard to colour-vision, your own experience in testing boys at Gordon's

\* Paper III., Cases 3, 4.

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[Continued.]

College gives you a definite percentage of colour-blind persons?—Yes.

1429. About 4 per cent.?—Yes.

1430. You would yourself supplement any wool test with a coloured-light test?—Yes. I may say, if I may add some information I have got within the last two days, that Holmgren himself recommended and used a lantern test in doubtful cases.

1431. You would like the lantern test to be applied locally, and not only on appeal?—Yes, locally.

1432. What kind of lantern test? Have you any particular kind of lantern test in your mind, which could be used in a room?—A simple asbestos chimney, with a movable diaphragm, and coloured glasses to put in front, is quite sufficient, if you have a sufficient number of them. If you have arrangements also for partially obscuring the lights, I think such a test is quite sufficient.

1433. And you think in that way you would catch a certain number who had got through the wool test?—Certainly.

1434. That is within your own experience?—That is so.

1435. That is to say, you have sometimes passed patients or other people through the wool tests, and failed them in the lantern test?—Yes; there is a case recorded among my papers.\*

1436. Supposing that it could not be used as a supplementary test everywhere, you would prefer, I understand, the lantern test rather than the wool test, if there was only one?—That is so.

1437. Because you think it is, on the whole, a safer test?—Yes, especially in the hands of laymen.

1438. You are not alluding to any specific lantern, like Dr. Edridge-Green's lantern?—No, I have seen that and used his glasses, but I am not referring to anything special.

1439. You advise a well-devised lantern test?—Yes.

1440. I think you have discussed that to some extent in the third paper which you have handed in to me?—Yes.

1441. You have an opinion with regard to the addition of the two skeins, the purple and yellow, in the last year; what do you think about that?—I think instead of being an improvement, it is so far the reverse.

1442. It has rather introduced confusion than otherwise?—Yes.

1443. Have you any opinion as to the relative value of the first three skeins?—The different coloured wools?

1444. Yes. Do you think one wool more valuable than another?—The first two are, of course, the important ones. I do not think there is any necessity for additional skeins of worsted, beyond those used by Holmgren.

1445. You do not think the addition of the purple and yellow has done any good?—No. I have gone into the figures, the percentages in the last paper issued for 1909, and the percentage of what I call normal rejections (*i.e.*, normals rejected) has really increased by it.

1446. The percentage of rejections?—The percentage of normal rejections.

1447. (Professor Gotch.) May we ask the meaning of the word "normal"?—I mean normal colour-vision candidates who have been rejected as colour-blind.

1448. You mean normal for the particular service?—With normal colour-vision.

1449. (Chairman.) Those who are not colour-blind?—Those who are not colour-blind have been pronounced colour-blind by it.

1450. Wrongly?—Yes.

1451. How are you able to prove that?—I have proved it from the figures that you have published.

1452. That have passed on appeal?—Yes. I have the figures here if you would care to see them.

(Professor Gotch.) They have all passed on appeal?

1453. (Chairman.) They have been decided not to be sufficiently dangerous to be rejected?—No, I mean

actual normal candidates, with normal colour-vision, who have been rejected.

1454. You do not prove them on appeal to be normal; they are simply passed?—The figures are here, perhaps I may read them. It states in the Report on Sight Tests in the Mercantile Marine for the year ending the 31st December 1909, that from January to October 1909 the number examined in colours was 5,146; the number rejected was 65. That is not by the appeal test but the first test. The number re-examined on appeal was 20, and the number passed on appeal was 10. The percentage in this class of what I call lay colour-vision failures from January to October 1909 is 1.26; the appeal colour-vision failures percentage was 1.06. These are the rejected after deduction of the successful appealers. The normal rejections are got by subtracting the 1.06 from 1.26, which gives .20. Then there is the same thing from November to December: number examined, 882; number rejected, 21; number re-examined on appeal, 11; number passed, 5. The two additional skeins were used and the same estimation which I have gone through gives the percentage of normal rejections there as .50, so that you arrive at an increase in the normal rejections, between the two periods when the three skeins were used and the five skeins were used, of .36 per cent. Those are from the figures published in the paper to which I referred.

1455. You use the word "normal" in that sense?—It is supposing that the appeal examination in London picks out the normal colour-vision candidates. It is a comparison of the one with the other.

1456. (Sir Arthur Rücker.) Is not this a possible interpretation: that the addition of the new wools has made the test more sensitive, and, in consequence of that, there is more doubt in the mind of the lay examiner, as to whether or no some of those people are colour-blind, than he would have had under the old system; therefore he sends up rather more than he would have done under the less sensitive system, and in consequence there is an increase in the number of so-called normal rejections?—It is partly that, and also from the fact that with the additional skeins, if a candidate is asked to match the purple skein and selects a blue skein, the layman has to reject him, according to instructions. Thus a candidate who mixes up a purple with a blue is rejected as colour-blind, when really he should not be. (The additional skeins have increased the appeals by 21.62 per cent.)

1457. That is the fault of the test?—That is the fault of the test.

1458. But you agree on the other point I put to you, that the more delicate the test, the more the number of cases with regard to which there might be some doubt?—Yes, and also that it is one of the most difficult tests for a layman to apply. You meet a number of candidates who are more or less stupid, and do not understand what is required of them, and the more you increase the number of tests, the more likely you are to reject for stupidity and not colour-blindness.

(Sir Arthur Rücker.) That is practically my view—increasing the complexity of the test sends more people up.

1459. (Chairman.) I understand that your general feeling about the wool test is one of the reasons, which make you say that light tests are preferable, if only one test is taken?—Quite so.

1460. Then you think that all responsible employees should be compulsorily examined periodically?—Yes.

1461. And you think some penalty should be instituted, and, where possible, enforced, for concealment of defective vision?—Yes.

1462. Concealing it on what occasions and in what way?—Well, I have met several cases which I reported, engine-drivers more especially, and also men in the marine; the captain of a cruiser is mentioned in one of my papers, and he was quite unfit for duty. It is difficult to believe, in a case of that kind, that the man does not know that he is defective; but he still goes on with his work, and I think in a considerable number of cases he really conceals the defect rather than lose his employment.

\* Paper III., Case 1.

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1463. It would be rather difficult to prove the exact extent to which he is aware of it?—It would.

1464. Then you think that in case of accident—I presume accident where colour-blindness had anything to do with it—all responsible survivors should be examined?—I do, and also where any form of defective vision was concerned.

1465. You think if that was done we should get really more information, than we have at present, as to the accidents arising from this cause?—That is so.

1466. Then you say that servitude certificates should be discontinued where and when possible. I am not sure that I understand the meaning of the word "servitude"?—Well, in Aberdeen, about the year 1907, a number of candidates were given certificates, not because they had passed any examination, but simply because they had served as master or mate for a period of 12 months; and it was reduced from 12 months to six months for a certain length of time.

1467. There will be no more?—No.

1468. As regards the future, it does not really apply?—No.

1469. That concludes the principal points you have to lay before us, I think?—Yes.

1470. (Mr. Nettleship.) With regard to Case 1 in your third paper, apparently he did not pass the wool test very comfortably?—No, there was a certain amount of suspicion from his slowness, but he made no mistake. I could not get him to make any definite mistake upon which I could make up my mind.

1471. Have you seen many whom you have passed with the wools and failed with the lantern?—No, I do not think I have seen very many. I have seen half a dozen or so, perhaps.

1472. Could you give particulars of them?—I might by looking them up.

1473. It is rather important?—Yes.

The following statement was subsequently furnished by the witness:—

On referring to my notes, I have no particulars of those cases, where I found it impossible to decide by the Holmgren test only, and had to use the lantern. The reason of this is, probably, that there was nothing to note, beyond the fact mentioned. In this connection it is necessary to emphasise the fact, that I consider the Holmgren test a good though not a perfect one in the hands of medical men, for whom it was originally devised; but a very unsafe and unreliable one in the hands of laymen. Cases are given in my papers, where colour-blind candidates have been more than once passed by it when applied by laymen, who also reject as colour-blind 45 to 50 per cent. who successfully appeal, and who would be regarded by a medical examiner as having normal colour vision in the generally accepted medical sense. It must also be remembered that about two-thirds of the candidates rejected by laymen as colour-blind in the first test do not appeal. It is legitimate to suppose that a considerable proportion of these have also been wrongly rejected.

1474. (Mr. Parsons.) Do you mean that ordinary laymen cannot do the ordinary form-vision test properly? Surely it is easy enough for any ordinary layman?—I do not know. There is a lot of dodging going on and that sort of thing. There was one engine-driver I mentioned in one of my papers, who said he had passed the layman's test in the following way. There was no trial frame. He was simply asked to hold a card in front of one eye, and by pushing the card partly in front of the other eye he managed to cut off some of the peripheral rays, and improved the sight of that eye. Then he was able to pass the test, which otherwise he could not have done. If it were conducted as a medical man would conduct it—carefully—it would be all right; but I am certain, in the case of laymen, they do not understand how to undertake work of that sort accurately, and they are apt to make mistakes which a medical man would not make. In short, it is medical work. (See answer 1394.)

1475. Supposing you had only a lantern test, do you think that would be absolutely efficient and sufficient without any appeal at all, even if conducted

by an ophthalmic surgeon?—My preference would be to have two tests, the wool test first and the lantern test afterwards. But I think if you had a lantern test with a sufficient number of coloured glasses and other glasses to tone down the light, it would be quite safe alone.

1476. And you would eliminate the appeal altogether?—If it were possible to have recognised ophthalmic surgeons in certain centres, yes.

1477. There are border-line cases, which are extremely difficult to find out, even with very accurate methods?—It was just those border-line cases in which Holmgren advised the use of the lantern.

1478. But even with the lantern and wool there might be some difficulty about them. Do you not think it would be much safer to have some court of appeal where a spectroscope might be used?—I do not fancy the spectroscope myself. I think it would be far better to have a practical thing—such a glass as is used at sea or on the railway. I think the spectroscope test is too complicated and puzzling for the ordinary individual to tackle.

1479. But it is not the ordinary individual who is tackled exactly?—I think an ordinary lamp, with, as nearly as possible, the same sort of colours and glasses as are used in practice, would be sufficient.

1480. You would eliminate the appeal altogether?—I think so.

1481. (Professor Gotch.) Supposing that your ophthalmic surgeon examined, would you give him a free hand as regards what tests he used?—I would.

1482. I imagined you would?—Yes, I would.

1483. Supposing that an ophthalmic surgeon does not examine, but the present examiners are employed, do you think a lantern test could be devised which would be safe and suitable as an initial test?—For the use of laymen?

1484. Yes?—I think it would be far more successful in the hands of laymen than the wool test.

1485. Have you devised a lantern test?—No, I have not.

1486. You have used the lantern?—Yes.

1487. May I ask what sort of lantern?—I have used mostly an asbestos chimney with Edridge-Green's glasses; and also another asbestos chimney with different coloured glasses put in; I think it goes by the name of the Kenneth-Scott.

1488. Has it the means of showing two lights at the same time?—No.

1489. (Mr. Raymond Beck.) With regard to the lantern you have referred to, does the one suggested use only red, green, and white lights, modified down as regards the dimness or the brightness of the light; or does it combine various colours which go from red to orange, and that sort of thing?—The one does, and the other does not. I think in the case of the Edridge-Green it does.

1490. I mean in the one you recommend. Would you recommend a test which simply used the Board of Trade red, green, and white?—If you had a sufficient number, and could vary the sequence of the numbers, altering the size of the aperture, and dimming or obscuring those lights, I should be quite satisfied.

1491. And you consider that would be an efficient test?—I do.

1492. In the wool test at present there are five colours?—Yes.

1493. You would suggest that five are too many, and you would like to revert to three?—I think three would be sufficient.

1494. Which three would you leave in?—The original Holmgren three—green, pink, and red.

1495. (Mr. Norman Hill.) You have told us you have had patients who have failed, when they should have passed. Have you had any case of your own in which a man, who should have failed, has been passed by the Board of Trade?—I have a number mentioned in those papers who have been passed several times, when they should have failed.\*

\* Paper II., March 1908, Case 2; May 1908, Case 4. Paper III., Cases 1, 2, 5, 7, 12.



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1496. Of your own patients?—Cases I have seen myself after such has taken place.

1497. With regard to the increasing of the severity of the form-vision test, you have told us you thought the existing test was too low for safety?—Not the present one; that was the old test. Most candidates at present take the new test, although not compulsory.

1498. I mean the one that is now in force; the one that is compulsory at the present moment?—It is insufficient.

1499. The new form-vision test does not become compulsory till 1914?—That is so.

1500. I am speaking of the one which is now compulsory; that is the old one. You have told us that you think that is too low for safety?—That is so.

1501. Have you, in your experience, known of cases bearing on that point?—There is the one mentioned of the trawler going ashore.

1502. We have the facts of that case. What did the man mistake?—That I cannot say. He was left in charge of a trawler lying off Aberdeen Harbour, and shortly after he was left in charge a snowstorm came on and the vessel drifted ashore. He evidently did not see what was taking place. I put that down, to a certain extent, to the bad vision that he had.

1503. He did not see he was dragging his anchor?—Well, I cannot say. I simply state the fact that that took place. He was left in charge with this defective eyesight, and shortly after the trawler went ashore in a snowstorm. After the accident took place, I examined the man and recorded the amount of his vision. That is all I can say about it.

1504. His vision might have stopped him detecting the fact that he was drifting ashore?—I think so.

Observe, the old test would allow a man with only one eye to pass.

1505. If the one eye was working, he would not see any less far than if he had both eyes?—I think he would; I think two eyes are better than one.

1506. Have you considered the effect on the older men in the service, if you adopt the new form of test? As I understand, you recommend periodical examination?—That is so.

1507. Have you considered what would be the probable effect of subjecting an officer who is over 45, say, to the new form-vision test?—I do not think that it would affect him. Unless that man of over 45 had started with defective vision, he would pass the test quite well. Age would have nothing to do with it.

1508. It would have nothing to do with it?—No.

1509. (Sir Arthur Rücker.) I think you said that in the case of the colour-vision test, even if it were conducted by a medical man, you would allow him to use his own method?—I would; that is to say, a medical man with ophthalmic knowledge.

1510. With ophthalmic experience?—Yes.

1511. In that case you would have no court of appeal?—I think I would not.

1512. Do you not think it possible that, after a time, you would get reports from different stations, that one man was passing a larger percentage, or a smaller percentage, than another?—If the ophthalmic surgeon is of sufficient standing and good knowledge, I do not think there would be the slightest risk of dangerous cases passing or of normal cases being rejected.

The witness withdrew.

Mr. HENRY ARCHER called and examined.

1513. (Chairman.) You are the manager and secretary of the Hull Steam Trawlers' Mutual Insurance and Protecting Company, Limited?—Yes.

1514. You are also the secretary of the Steam Fishing Vessel Owners' and Underwriters' Joint Arbitration and Navigation Committee?—Yes.

1515. You are also the secretary of the Steam Fishing Vessel Owners' and Underwriters' Joint Amalgamated Arbitration Committee for the Settlement of Salvage and Towage Awards?—Yes.

1516. You have held your present appointments for the last 12 years?—Yes. Previous to that time I held a command in Her late Majesty's Coastguard Cruiser Service, having joined the Royal Navy as a boy in 1872.

1517. You have been nominated by the National Sea Fisheries' Protection Association to give evidence before this Committee?—Yes.

1518. You state that that is the recognised organ of the fishing industry of the United Kingdom?—That is so.

1519. You yourself have had a very long experience among the crews of steam fishing vessels; you have examined numbers of their crews, and have investigated a great many cases under the Workmen's Compensation Acts, and have also dealt with salvage and collision questions?—That is so.

1520. Now, with regard to collisions, you have certain experience, which you mention in your précis. You have had something like 100 cases per annum through your hands?—Yes.

1521. For how many years would that be?—For a period of 12 years. That is the average.

1522. During those 12 years, not more than four cases have been found to have anything to do with defective vision?—That is so.

1523. How did you come to the opinion that, even in those four cases, there was defective vision?—For this reason, that, when we inquired into the cases, I found it was so. We always inquire into all cases of strandings or collisions, if there is a doubt in my mind as to whether the men are shortsighted or otherwise.

1524. You tested them?—I test them whenever the necessity arises. If I have reason to believe it is due to men having defective vision, I test them at once.

1525. Have you compulsory power to do that? Can you compel them to come and be tested?—Well, they never object.

1526-7. That is to say, if they would not come, it would be against them?—If there is a collision case, it is inquired into. The skipper, mate, and the people interested have to attend before this special committee. They must attend, before we will permit them to go to sea again.

1528. That is the hold you have upon them?—That is the hold we have upon them.

1529. If you choose to test them for sight, you do so?—Of course we do.

1530. And of those four cases two were elderly men?—That is so.

1531. And I presume were defective?—Yes.

1532. In the other two cases, which were defective, you were inclined to think it was excessive cigarette smoking which led to the defect?—I have every reason to believe so, because the men, when under examination before the committee, were very nervous. You can generally tell if a man is an excessive smoker by his fingers being stained, and so on. That is how I arrive at it.

1533. What test did you put them through in that case?—Snellen's for form; coloured cards, and sometimes wool.

1534. Perhaps I ought to ask you this: Would you put these men, in the case of collisions, through the same test as that which you put your boatswains through?—Just the same.

1535. With reference to these collision cases, did these men fail in form-vision?—No, in colour; they could not distinguish the colours. It was not form on which they failed.

1536. It was colour, not form?—Yes.

1537. In all the four cases?—Yes. Mark you, it was only in a measure attributable to defective vision, because in each case we found there was negligence on the part of the crew of the other ship. I could not

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[Continued.]

say it was solely due to defective vision, for that reason. We found them both to blame; but the defect was in existence.

1538. I understand you to say that the defect, where you found it, was a colour defect?—Yes.

1539. Not what we call a form-vision defect?—No; not a form-vision defect.

1540. You give us a reference to a number of steam trawlers and their crews, approximating something over 4,000 men, including the skippers and second hands?—Those are the only persons on board the steam fishing vessels who hold the special Board of Trade certificates.

1541. In order to ensure more efficiency with reference to the steam trawling vessels navigating from the port of Hull, your committee put all the boatswains through a test?—Yes.

1542. And your committee is solely responsible for that test?—That is so.

1543. Cannot they go to sea unless they pass your test?—They cannot go to sea as boatswains; they can go to sea in a subordinate capacity, but not as boatswains.

1544. You have power to prevent them?—Certainly. We insure the property, and we have the right to say who is to go in the ships.

1545. So that you can prevent it?—Yes.

1546. Then that is an additional test, over and above that of the Board of Trade?—I claim it is so, over and above the Board of Trade.

1547. It is additional?—It is. Moreover, on the recommendation of the Board of Trade (see Hand Bill, No. 182, 1900, bearing on the Navigation of Steam Fishing Vessels), and with the desire to improve the status of our men, I am of opinion that all men who have charge of a watch should pass an examination.

1548. You have issued in the course of the last 10 years something over 800 of these certificates?—Yes.

1549. And an increasing number during the last few months?—That is so.

1550. You are good enough to hand us in a specimen of the certificate?—Yes; this is the certificate issued by the committee (handing the same to the Chairman).

1551. When you test them, I presume you begin with the form-vision test?—Yes, the form.

1552. What standard do you require? You know the present Board of Trade standard?—Yes, I go by the Board of Trade.

1553. You follow that?—Yes, except as regards the Holmgren wools.

1554. Do you follow the regulations for that exactly?—Yes.

1555. You know, of course, that is going to be raised?—I was not aware of that, but I quite agree that all men and boys on first going to sea should be examined.

1556. After a certain time the test is to be more severe. You are taking it as it is in practice?—Yes, as it now stands as regards form-vision.

1557. Could you tell us what it is you require from them?—Unfortunately, I have not got Snellen's sheets here, but I follow them.

1558. You follow the Board of Trade regulations?—I have not in my mind exactly how far I do go. I require them to stand 16 feet away. (The type as used in the Board of Trade test was shown to the witness.) Yes. They have to read down to U, F, V, and then L, D, and so on.

1559. (Dr. Watson.) There must be no mistake in that line (showing the fifth)?—That is so.

1560. (Professor Gotch.) Both eyes separately?—Yes.

1561. (Chairman.) If one eye were weak, would you pass him on the other eye?—I think I should let him go. I do not remember any cases just now; but if one eye was a little weak, I should not bar him from going to sea.

1562. You do not insist on an equal standard for both eyes?—Well, of course, the other eye must not be bad.

1563. One eye must be thoroughly sound?—Yes.

1564. And the other must come up to a certain standard?—That is so.

1565. But not necessarily so good as the other?—That is so.

1566. Then with regard to the colour, you do not use the wool test?—We do not generally use the wool test.

1567. You use coloured cards?—Coloured cards, the flash light, and I also have these (showing a diagram).

1568. Have you the coloured cards here?—No.

1569. I dare say you could let us have a specimen; or have you only your own specimen which you use?—That is all. I also use these cards for examining the men (the cards were handed to the Chairman). Then lights as seen by a look-out man; then something similar to the date calendar on the mantelpiece there, with these colours in. Instead of having a date there, I should have these lights on a black ground. That is how I test them.

1570. (Mr. Nettleship.) You turn it round?—Yes.

1571. Do you mean lights?—No, the colours.

1572. (Dr. Watson.) They are dots painted on?—Yes.

1573. (Chairman.) In what way do you say you use the flags?—I have little hand flags.

1574. Is that only to test their knowledge of the colour?—With regard to colour, that is all.

1575. To see whether they can identify the colour?—Yes.

1576. Then, with regard to the lamp, what kind of lamp do you use?—Electric light—a small electric flashlight.

1577. Is it any particular lamp?—No, I use a white flash lamp with coloured glasses, and the tube extends about three feet from the light, so that the light is dark.

1578. Are the glasses any particular kind of glasses, or those which you yourself select?—The glasses I myself have furnished—of course different coloured glasses.

1579. You state green, white, red, and amber?—Yes.

1580. Are there more than four?—Yellow and purple—I forgot those.

1581. Not less than half a dozen?—That is so.

1582. And I suppose you take those in different rotations?—That is so.

1583. Can you expose two colours at the same time side by side?—No, only the one colour.

1584. And you consider that as good a test as the wool test? Perhaps you have not handled the wool test much?—Well, I do see this, that both with the wool test and the light test mistakes may arise; I do recognise that. I do see that a man may pass the wool test, and yet not be able to pass the light test.

1585. Do you think, on the other hand, a man might pass the light test and not pass the wool test?—Certainly; quite so.

1586. In your experience, do they try to coach themselves up for your light test, do you think?—I do not think so, because the greater part of the men are hurried up to me; there is no chance of being coached up.

1587. They have not time?—We oftentimes have a difficulty in regard to getting our ships to sea, in getting boatswains. A man may offer his services as boatswain, and he is rushed up before me before he knows where he is, as the saying is. There is no time to be coached in anything at all.

1588. If your candidate is unable to distinguish the colours, he has to report himself to the Mercantile Marine Office?—We recommend him to, but he does not always do it; that is the unfortunate part of the business.

1589. But if he does not pass your examination, he cannot proceed?—Not as a boatswain, but he can go in a subordinate capacity.

1590. I suppose that happens pretty often?—Of course it does; I cannot stop the people from earning their bread.

1591. If he reports himself, then he is recommended to consult an oculist?—Yes.

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[Continued.]

1592. But, as a matter of fact, that very rarely happens?—Very rarely. About three weeks ago I failed a man, and, strange to say, he passed the Board of Trade.

1593. Afterwards?—Yes.

1594. Have you any statistics of your failures?—Unfortunately, I think we have omitted them, except when they passed or failed. I have not kept the particulars, except that they have passed or failed. I have not kept any particulars as to what they failed upon.

1595. Could you give me a record of the actual number that have failed during your 10 years' experience? Have you any record you could give us?—No; but I think I should say that during the last year about seven or eight have failed.

1596. We do not want to trouble you, but if you could give us your experience, even of the last 12 months, it would be useful?—In the last 12 months, seven or eight have failed.

1597. Perhaps you would let us have any particulars you could give us of the numbers that have been before you?—I cannot go beyond that. I can say seven or eight have failed.

1598. Could you say whether those seven or eight have been colour failures?—Colour failures.

1599. All of them?—That is so.

1600. I suppose you could tell us how many you have examined in the last 12 months?—You have it here.

1601. You say 191 between May and November?—That is so.

1602. That is a much shorter period?—Before that we had very few.

1603. Could you say that between May and November there have been seven or eight failures?—Oh, no—during the year.

1604. During the year?—Yes; not between May and November, but during the year.

1605. Could you give us the number that have been before you during the year since last Christmas?—I have not got those particulars. I have not got the number of men I have examined during the past year.

1606. You see, my object would be to get the percentage?—Exactly.

1607. Could you tell us how many have failed since May?—That I have not got.

1608. Not at this moment, but could you get it?—I dare say I could provide you with the number.

1609. I do not know that it is worth troubling you about it, but about eight have failed during the past year?—Yes.

1610. And those are all colour cases?—All colour cases, yes.

1611. You have not found them fail in form-vision?—Not in form-vision. There is just another little point. My window overlooks the river, and I often take them there to the window to examine them as to what they can see—distant objects, and so on.

1612. Do you see boats passing by?—Oh, yes.

1613. Do you attach any importance to that test? They generally know which is the red?—They always know very bright colours.

1614. So that you do not attach very much importance to that?—No, very little, except as regards distance.

1615. What are you able to do out of the window that you consider useful?—Oftentimes you are able to see the companies' flags which are exhibited by the steamers and are able to get hold of the colours, and take sextant angles and so on.

1616. If you had a really defective man, he would not know the colour of the flags?—That is so.

1617. So that you find that a useful supplement to the other tests?—Certainly.

1618. In your view, the tests, which they are required to undergo, should be as nearly as possible subject to the conditions which are likely to prevail at sea?—Yes. But what that test is, of course, I cannot say. I mean, I should not like to lay down the line.

1619. But you would like to approximate to that as early as you can?—Exactly.

1620. In preference to what is now done?—That is so.

1621. Then you say a good deal of difficulty arises, because there is not a standard shade of red and green glass. That is with regard to the lamps actually in use?—Yes; the lamps actually in use at sea.

1622. And you think there ought to be a standard shade, which should be compulsory?—Certainly.

1623. For all sea-going vessels?—That is so.

1624. Why do you attach such great importance to that?—Because as secretary to a company, and going about and surveying ships, which we do every year, I do oftentimes come across very faulty lamps.

1625. In what sense are they faulty; what is the weakness of them?—The glass is not of a proper character.

1626. Do you mean that it would not be seen to be of the proper colour at certain distances?—That is so.

1627. And therefore it fails?—I may say this, that during the last five or six years I have had no cause for complaint.

1628. You think the standard of glass supplied by the makers is improving?—Yes, I do.

1629. But, for all that, you think, properly speaking, that there ought to be a universal standard?—I do.

1630. And all glasses which fall below that standard should be disqualified?—Yes, for this reason: to-day any tinsmith can turn to and make a sidelight for a ship, whereas a plate or a sternpost or a rudder post must be examined by Lloyd's, and must have Lloyd's stamp upon it. I think it is only right that lights, which are quite as important as plates, should also be tested by some competent authority. That is my view of it.

1631. There is a Board of Trade test when a boat is surveyed; there is a certain limit outside which a light cannot go already?—There is an approved pattern—I am aware of that—an approved pattern lodged with the Board of Trade.

1632. (Dr. Watson.) Do you know that the Board of Trade surveyor is provided with two green glasses, and the green glass on the ship has to lie between those? In the same way, they are provided with two red glasses, one a little darker than the other, and the ship's red has to be between those; so that the Board of Trade have a standard?—I am aware of that; but the Board of Trade officials cannot be on board every vessel which goes to sea. When a ship is new, true, they go on board and inspect the lights, and then they pass her as being correct; but in course of time other lamps are put there.

1633. (Chairman.) And they are not subject to any test?—That is so. As I said in my statement, if there was a standard laid down, and makers were authorised or registered, we could get over that difficulty.

1634. I notice you allude to a point which hardly comes within our reference, but you think the question of deafness is an important matter?—Certainly I do.

1635. You think seamen should all be submitted to tests for deafness?—I think it is a very serious matter.

1636. Have you come across cases where you have rejected a man for deafness?—Several. It is only a little while ago—perhaps about six months—that a skipper came to see me. I spoke to him, and he could not hear me. I heard he was deaf, and I had my electric bells rung in the office, and he could not hear them. I also had a fog-horn in the office, and I had that blown, and he could not hear that. Yet he begged me to let him go to sea.

1637. That, of course, is a matter which gets worse with increasing age?—That is so.

1638. You would require to have repeated tests for deafness?—Yes. I objected to that man going on any of our ships.

1639. About what age are these men who come to you for boatswains' certificates?—In the last two or three years I have had a number of young men, 22 to 25 years of age.

1640. Would most of the men who come to you now be under 30 years of age?—Most of them under 30.

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Mr. HENRY ARCHER.

[Continued.]

1641. You would not expect to find deafness so much with younger men as with older men?—No, with elderly men.

1642. That concludes the main matters which you have been good enough to lay before us. Is there any other point?—Yes; there is just one point. You may wonder how it is we have so many cases to investigate in the case of collisions. You will probably be aware that out of Hull we have four fleetings companies, with about 60 vessels in each company. They board their fish every morning with a carrier. Of course, oftentimes collisions do take place; but still, there is no doubt our men do handle their vessels in a very clever manner. The proof of that lies in the very few serious collision cases.

1643. And relatively the small amount of loss of life?—That is so. Of course you will be aware that we have boarding regulations approved by the Board of Trade laid down for their guidance.

1644. (Professor Gotch.) I wish to ask a question about that one case of a boatswain, who, you said, recently failed with you; and then you recommended him to report himself to the Mercantile Marine Office, and he passed the Board of Trade, which is a curious thing; you did not accept him?—Oh, yes, I did.

1645. You accepted him on the Board of Trade certificate?—Oh, certainly. I went down with the man. I was not satisfied, and I went down with him.

1646. I imagine that what you mean by bringing the question of deafness up is, that you attach importance to fitness from a medical point of view—normal sight and hearing?—That is so; I do.

1647. And you think that deafness should be really tested?—I do; I am serious about it.

1648. (Chairman.) I understand your main reliance for a colour test is not on this card (showing the compass diagram) but on your glasses?—It is on my other colours, not on this. This is what I put before the young lads. We must do something to bring them along. It is done by way of encouragement. I may mention that Mr. A. M. Jackson, one of our leading solicitors, offered a prize for the best method of getting out of the difficulty, supposing a ship were in the centre, with the wind in a certain direction, and those vessels steaming at a certain rate of speed.

(Captain Golding.) For that purpose it is most useful.

(Chairman.) We are much obliged to you for coming.

The witness withdrew.

Adjourned to Friday next at 11 o'clock.

## NINTH DAY.

Friday, 2nd December 1910.

PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).

Mr. RAYMOND BECK.  
Captain THOMAS GOLDING.  
Professor GOTCH, F.R.S.

Mr. NORMAN HILL.  
Mr. EDWARD NETTLESHIP, F.R.C.S.  
Mr. J. H. PARSONS, F.R.C.S.

Dr. WILLIAM WATSON, F.R.S. } Secretaries.  
Mr. S. G. TALLENTS }

Dr. F. W. MOTT, M.D., F.R.S., called and examined.

1649. (Chairman.) I will begin at once with the outline you have kindly laid before us. Perhaps you will say what you have to say on the point of your own colour-blindness?—Yes. Twenty-six years ago I discovered I was colour-blind by the fact that I failed to see tubercle bacilli, stained red, when the film was counter-stained with blue or green. The organisms were either missed or appeared black, unless they were present in large numbers, or I used a very high magnification and a very bright light. In fact, I had to adopt a new stain. I used a gentian violet on Bismarck brown instead of the usual stain. If I used a good condenser I could see them, but otherwise I could not. Since then, many facts have shown that I am slightly colour-blind; thus my children were often amused by the fact that I failed to see the cherries on the trees in our orchard, unless I was quite near. At golf I have always had difficulty in seeing the red flag in the distance, unless the light was very bright; either it appeared brownish-black, or it failed to attract my attention, owing to its not being a conspicuous object against the green. I have observed that I am unable to distinguish a green from a red lamp on the tram-cars, until they are within 150 to 200 yards; neither can I tell the colour of the railway signals at a distance of 200 to 250 yards approximately, but I have not measured accurately the distance. I do not know what the distance was, but that is what I thought it would be. I have made experiments on a long platform to test this incapacity while waiting for the trains, and I find, on approaching nearer to the signals, I can

decide quite well the colour of the signal, although just before I could not see a red lamp, and a bright green appeared to me only as a luminous point. It was really a yellow light. It appears to me to depend very much upon the size of the image on the retina and the intensity of the illumination. The following facts seem to show this: At Liverpool Street station, where I go very frequently, there is an indicator in glass on which is stated "Metropolitan Railway—Book Here—Baker Street, &c." There are two electric lamps rendering the red letters luminous; the letters just behind the lamps I can see red for a distance of about 100 yards. When I get close to them—I was trying it yesterday—owing to the yellow appearing through the red, it appears to turn more yellow than red, but, as I get away, it becomes red again. The other letters I see indistinctly, but I cannot see their colour.

1650. That is the letters which are on one side?—Yes, it is a long box really, with red letters on it. When I get within a certain distance of an intensely yellow lamp, it appears then more yellow than red. A French soldier's red trousers are a conspicuous object in the landscape; but last year in Brittany, when my wife pointed out to me the fact that there was a French soldier on a green hill, near by where we were standing, I failed to see him, which amused her very much. When he came much closer, I observed the fact to which she had called my attention. A knitted silk tie of two shades, light and dark green, I always thought was black and grey, until I discovered it was composed of two shades of green. I made this discovery when I



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[Continued.]

saw the tie in a very bright daylight. I have a similar tie in my pocket. It was like this (producing a tie), only it was dark green and very light green mixed. This fine check I could not tell. I was trying this upstairs. I notice in the light now at that distance (holding the tie about a yard away) it appears black and white to me. But when I get it near, I can see quite clearly that it is green. If the light falls in a certain way—if I just throw it back a little—then this appears green, but in daylight it appears black and white. It is curious, and is due, I think, to the mixture of the two things. Dr. Edridge-Green tested me with the wools about a year ago, and I had no difficulty, he informed me, of passing the test. I have not handled the wools since. I thought it would be much fairer for me not to try them.

1651. (Mr. Nettleship.) Had you ever been tested with wools before?—No, I had never been tested before. I failed, however, with his lantern test. He had a bright light behind a lightish green; I thought it was yellow, as I see it on the platforms. Also I failed with a dull red; I could not see it. But with the spectroscope I could distinguish all the primary colours, and I had no shortening at the red end. I believe he said I could pick out patches of red, orange, yellow, green, blue, and violet.

1652. (Chairman.) That was with the spectroscope?—Yes. It appears to me that my defect is due to the fact that, unless a sufficient number of retinal elements are stimulated with a sufficient intensity, the sense of colour is defective. I do not know whether that is an explanation, but that seemed to me a possible explanation. I am of opinion that I should be dangerous in any occupation where green and red signals are used, unless they were placed at relatively short distances from me.

1653. Now, will you be willing for Mr. Nettleship to pass you through the wool test?—Certainly.

1654. And then the lantern test?—Yes.

The witness was then tested by Mr. Nettleship with the wool test, which he ordinarily employs for the detection of colour-blindness.

With the pale green test skein he matched, among other skeins, one yellowish-green, and three blue-greens. With the pink test skein he placed one pale purple among a number of correct matches. In repeating this test he did the same, but remarked that the purple skein had blue in it. When asked to match the pink skein, he

stated that it clearly had no blue in it; but later, when it was placed beside the scarlet test skein, he said promptly that it differed very much from the latter in containing blue. From bundles of skeins placed before him, he correctly picked out, first all the blues, then all the greens. He matched the red skein without a mistake; with the yellow test skein he hesitated over greenish-yellow.

(The Witness.) On a long platform a green light looks a white light to me, especially if it is light green. If I see them on the engine, I think they are two white lights coming. A red light does not attract my attention at all; it is inconspicuous. Once when I was taking a tram, I asked my friend if it was our tram which was coming, and he said "Yes." I could only see three white lights, but he said there was a green, red, and white light. I said "They appear all the same to me." When they came close, I recognised the green and red distinctly.

1655. At what distance?—Within 100 yards I could see perfectly well. On another occasion I was on a platform, and a friend asked me if I could see the signals. I said I could not tell whether the green light was a white light or what. When I went up to the other end of the platform, I could see perfectly distinctly.

The witness was next tested by Professor Gotch with the Edridge-Green lamp. The general result of the test was that, when either the luminosity of the light was diminished or the size of the aperture was much reduced, the witness could not distinguish the colour either of the red or the green light, and in some cases could not see the light at all. (It was noticeable that, after his eyes had been exposed for a very short time to bright light, he was able to see a red point of light, which he had previously been unable to detect.)

1656. You do not tell us anything about your form-vision. Have you anything special about that?—No, my form-vision is perfect. I have perfect long sight. I do not know if you would like to test me on anything outside here.

1657. (Professor Gotch.) I have one question, namely, whether you have observed that the effect of small coloured areas is improved or not improved in the dark?—Well, I should have said myself that it was not improved—that it was worse.

1658. But you have not made any very definite tests?—No.

The witness withdrew.

Dr. GEORGE MACKAY, M.D., F.R.C.S.E., called and examined.

1659. (Chairman.) I think it would be better to follow the short outline of the evidence which you have sent, and then ask you to supplement it by anything you think germane?—Yes.

1660. With regard to the anatomy of the visual apparatus, the function of sight and the errors of refraction commonly met with, Mr. Parsons and Mr. Nettleship are on the committee, and we need hardly go into that in any detail?—It was only to help my argument. Perhaps a diagram showing the three conditions of refraction might be useful to other members. I have some copies here (handing same to the Committee).

1661. (Chairman.) Perhaps I had better go at once to Snellen's Test Type. Have you anything special to say on that?—I have a statement explanatory of that.

1662. That is chiefly on the line of explanation?—Yes. (The statement was handed to the Chairman.)

1663. Dealing with the standards of form-vision, both the present and the future proposed standard, I gather that your view is that the raising of the standard is commendable?—Certainly, if it can be secured.

1664. Now we will proceed to discuss that question: "Does the present or the proposed method of testing ensure what is intended?" Will you take those separately—the present first, and then the proposed method?—No. I think on the general question we might take those two together.

1665. Very well?—The point I wanted to urge, and have urged for a great many years (and Mr. Nettleship has supported me on a previous occasion), is that any method of sight testing by simply looking at type does not really and efficiently give you the value of the eye as a permanent condition, supposing the condition of health remain, because it leaves out of the question the refraction altogether. Now that is very essential indeed. If you look at the first little scheme I handed round, with regard to the refraction of the eye, you will see that there are a very large proportion of children and a considerable proportion of adults, perfectly well-made people in other respects, whose eyes follow that under-standard type. In looking at a distant object in youth, they secure sharp vision, if they have otherwise healthy nerves, and clear media, and so forth, but they focus quite unconsciously from their cradles, or shortly after, at the expense of accommodative effort. Now, if you look at the top figure, you will see I have thickened up the front of the true crystalline lens of the eye to show that eye looking at a distant object. Instead of having a sharp impression on the back of the eye, there has to be an effort to exercise accommodation in order to get it. It does it so long as youth and the elasticity of the lens and the condition of healthiness of the focussing muscle are present. The same individual, with equally capable nerves and equally capable perception, will be unable to make that effort as life advances. I give some illustrations here, which have

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come before me, of individuals who have been very hard hit through being accepted on a form-vision test without reference to refraction, and in subsequent years were incapable of doing it, and were then thrown out.

1666. Your point is not so much that people ought to be re-examined in order to discover these things, as that they ought to be examined in a more effective way to start with?—At the very outset, certainly. That would discover a great many of these cases which are quite discoverable in youth, and warn the candidate that if he enters the service he must be prepared to meet with this difficulty by and by.

1667. Then we come to the question of whether it is practicable to have a test such as you indicate?—Yes. There is no difficulty about it. It is the daily practice of every ophthalmic surgeon, and many medical men who have had any training at all in ophthalmology, to determine such a question frequently. There are simple methods by which it may be done in even young children quite independently of anything else. If they know their letters, one can determine the condition of the refraction of the eye. It is quite possible; certainly at the age of a youth coming up for a service such as the mercantile marine it should not be difficult.

1668. You take the case of boys entering the naval service?—Yes.

1669. It would be practicable in their case?—Yes. I have warned several myself of the difficulty that lies before them, if they ventured to go into the service in the condition they were in, and I have known those who have gone in and found trouble afterwards. Mr. Nettleship will support me with regard to the case of a naval lieutenant who was incapable. I have myself known a young bluejacket, and many others. If the Committee want a demonstration, I am a living example of hypermetropia. I could have passed the test, and got into the "Britannia" as a youngster. I had not the least idea that I had hypermetropia until I was studying ophthalmology in Vienna. Then it became a question of using the direct method of ophthalmoscopy, and I had to find out what my focus was.

1670. At what age?—The age of 22 or 23.

1671. Having discovered that, did you consider you were not in a satisfactory condition to conduct a ship?—Well, that depends on the amount of error. If it cannot be voluntarily corrected, the individual is at once in the difficulty of requiring some artificial aid—spectacles—to correct it. The actual acuteness of vision is as good as ever, but the focussing of the light on the back of the eye is not correctly attained without artificial assistance.

1672. Then your second point is: "Is it practicable to maintain the higher standard?" Do you wish to describe the method that you would apply? Of course you would have Snellen's test, and you would have something else?—Yes. The standard cannot be maintained, unless you have a correctly refracting eye. If you accept an individual whose eye is of the first type here, the liability is that, as life advances, he will be unable to do the focussing with unaided eyes.

1673. As to the method of testing, could that be applied in the ordinary local sea ports?—With facility, if you employ a properly trained examiner.

1674. When you say that, could one of the examiners who now applies the wool test do it?—Probably not, unless he has had a very decided optical training.

1675. That is to say, a man who could apply the Snellen's test could not apply this?—Any dominie can do the Snellen's test.

1676. What is exactly the method? There are a variety of methods. The chief instrument upon which we depend is the ophthalmoscope, by means of which a beam of light is reflected into the eye. That, again, may be applied in more than one way. One has to examine an individual in a darkened room, and, at a distance of four feet, to flash a beam of light into the eye, and to note the play of light within the eye—what is called the shadow test.

1677. Is that a simple test?—Yes, perfectly simple. One trains every medical student in it now. I have trained hundreds of students in it. It is not to be learned in a day; it takes several months of pretty

regular attendance. But every ophthalmic surgeon practises it daily.

1678. If it is to be applied in local sea ports, you would say that it must be applied by the medical men?—I would say it should.

1679. I think that is the point?—Undoubtedly.

1680. You know the nature of the examiners who do the work now for the Board of Trade?—Yes.

1681. As a rule they could not do it without very prolonged training?—I would not think of entrusting it to them. I do not think I should employ them.

1682. I quite understand?—I have no hesitation in saying that.

1683. And the difficulty which now arises in the effectiveness of the test from your point of view would not be met by frequent re-examinations?—It would be met, but it would be rather disastrous to the candidate, because it would simply defer his rejection until he was in a position when he could not turn to anything else. That is the hardship.

1684. You feel no doubt at all in your experience that, from the point of view of safety at sea, there does arrive a moment when a man ought to be rejected, if he is of the type you are describing?—Undoubtedly, that must be so. I am not saying where that line arrives. That is a very difficult question to answer, but it may come out later on. I took an illustration, out of others which I might have taken, of a lad who actually passed for the Navy with six diopters of hypermetropia in each eye. That was a gross illustration. By straining his focussing muscle he read his test type, and was in the service for two years. But he came to me when he found he could not perform the duty of look-out, and could not read the compass; he realised he was becoming steadily unfit. I am prepared to say that anyone who had that amount at any rate should certainly be disqualified. We want to discover where the real margin of safety is.

1685. That is rather an extreme case?—Admittedly.

1686. A boy who could not read the compass within a couple of years after reading Snellen's test?—Undoubtedly. The majority of these cases are cases in which the falling off is much later, I should think. But it is difficult to get the facts as regards the sea service, because the cause of failure is not intimated in the report. The question of refraction is not put in at all. The occurrence of opacity in the media of the eye is not stated. It may be a refractive error. It may be an error of hypermetropia, or it may be the opposite condition, of an eye which is lengthening in its axis and becoming near sighted. It is possible that may arise after adult life is attained. I know of cases of an admiral and a naval lieutenant, both of whom must have passed the primary test, but subsequently, in the course of the studies in which they have had to engage with a view to promotion, I suppose, or through some inherited tendency, they have undoubtedly developed near-sightedness.

1687. What is it they discovered?—That the type became blurred and indistinct to them.

1688. What is it they discover at sea which reveals to them that something has happened?—They cannot recognise, with the sharp definition which they previously enjoyed, semaphore signals, or the outline of sharply defined lights, whether coloured or white. It is just the kind of difficulty which the myope experiences on shore, in recognising his friends on the other side of the street, or reading the names on trams, and things of that sort. Hypermetropia is the same. Hypermetropia is often called long-sight in contrast to short-sight. We all know the myope, who half closes his eyes in order to get a distant outline, yet sees well near at hand. The hypermetrope is credited with having good vision at a long range, but his vision is as bad as that of the myope later in life, when he can no longer make the focus to get a definition.

1689. What is his position with regard to distant lights?—They are ill defined as he advances in life, or, if his error be high, even earlier in life.

1690. It is not discovered so soon?—It may not be discovered so soon.

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1691. Is his nerve value the same as the other?—The actual capacity of the retina to perceive may be as good. When he gets clear images, by artificial means or by the exercise of his natural power, in the case of the hypermetrope, purely by artificial means in the case of the myope, his nerve value is as good as the other.

1692. Both of these errors can be corrected by the use of glasses?—They should be rectified by the use of glasses, and when discovered at any time of life.

1693. Would you like to follow this further, before we come to the use of spectacles?—This is a little instrument, by means of which the light is reflected into the eye (*handing the same to the Chairman*). Some question arose which distracted me from that point. This is an ophthalmoscope. The mirror, which may be either slightly concave or flat, throws a beam of light into the eye from a certain distance. I am speaking of the practice in a darkened room with a fixed glow of light. The mirror is tilted, and the light, as it enters the eye, is more or less accurately focussed, depending upon the refraction of the eye. I need not go into the detail further, but that is the instrument.

1694. The point I put to you remains, that that could not be applied by an ordinary Board of Trade examiner?—No.

1695. Your next point is: "Is so high a standard essential?" You say it is. You consider the present method fallacious in the way you have described?—No. You have gone a little wrong. I have only said the present method of testing does not ensure what is intended if it leaves out the question of refraction. That is one way in which it does not ensure it. It does not ensure some other things, for the want of using this instrument or something of the sort to determine what is the real state of the eye.

1696. (*Mr. Parsons*.) May I ask what is intended?—That you shall have the security of efficiency.

1697. (*Chairman*.) Is there anything more on that point that you wish to say?—I do not think there is.

1698. Then we come to the next point: "Is it practicable to maintain the higher standard?"—Yes. That depends very much upon whether you have a sufficient number of fit persons coming forward with vision up to the standard which has been set. To arrive at that is a very difficult question at present, because so little has been done in the way of extended observation upon young men in the general population. I think my brethren here will bear me out, that we ophthalmic surgeons see mainly the defectives. We do not view them in relation to their percentage in the general population.

1699. And there are no statistics available?—Well, there are scattered statistics, but unfortunately even the school statistics, which are beginning now to supply us with some information as to the later years of school life, certainly have not all been done in a very uniform way, and the figures are a little difficult to compare.

1700. That is all rather in its early stages?—Well, in a sense. For this particular purpose it is in an early stage. The thing has been in operation, of course, ever since we have really known about these objective methods of examination at all. There has been plenty of opportunity if only the right methods had been applied.

1701. You mean the eyesight of children has been tested in one way or another in schools for a considerable number of years?—It is becoming much more sought after now. But, apart from that, what I rather wanted to urge was that had the authorities at the Admiralty insisted upon an efficient examination of refraction as well as the simple reading of type, and had the Army recruit been subjected to the same, we should have had an enormous number of statistics to go upon to tell us whether this standard could be maintained in the general condition of our population. It is largely a question of national physique from that point of view.

1702. (*Mr. Parsons*.) Is it not important to know what higher standard is intended? You do not refer to the Board of Trade future regulations, but you refer to some higher standard of your own, I think?—No, I

do not. I am simply taking the standard as it is here.

1703. (*Mr. Nettleship*.) 1914?—Yes.

1704. (*Professor Gotch*.) I understand you refer to the re-testing. It is essential in connection with your remarks that we should remember that the Board of Trade re-test for form-vision?—To a certain extent, and up to a certain age; but whether it can be maintained even for entrance is questionable.

1705. (*Mr. Nettleship*.) It is a question of supply?—Yes; of the supply of fit persons.

1706. Or rather of the demand, or both?—Yes.

1707. (*Chairman*.) You say "Supposing refractive error to be certified in a rejected candidate, and that it can be remedied by spectacles, are these altogether inadmissible?"—Yes, I raise the question.

1708. Now, what have you to say about that?—Well, I am not a practical mariner. That is a question for the practical mariner. As an ophthalmic surgeon, I find there is a great deal that can be done with spectacles, where the layman is inclined to think that the spectacles may be the cause of offence. Taking the ordinary experience of every workshop, it is always an obstacle, in the eyes of an employer, if a man has to have spectacles, and many men would have difficulty in finding employment. Any men on board ship with spectacles would have to submit to a good deal of chaff, I have no doubt. But the question arises is it practicable? It is a question for practical mariners to say. I have raised one or two suggestions here—the difficulty, which one obviously sees, of glasses being damaged. That it would benefit the vision in a large number of cases is undoubted, in actually giving sharpness of effect. Indeed, it is obvious that, in the reading of semaphore signals glasses of a sort, binoculars and telescopes, must be constantly employed, and are employed. It is a mere transition from that to a pair of spectacles on the bridge of the nose, which might be quite sufficient for the purpose for many people.

1709. I heard of a case the other day from a friend of mine who was coming home in a large liner. The captain was in the habit of never reading in the evening. He said others must read to him, and he would not read. The reason why he did not read or do anything of the sort with his shorter vision, was that he was intent on keeping his longer vision safe, which was so all important to him. Was he completely in error?—I think he was taking excessive precaution.

1710. It is rather an interesting case?—Yes. I presume he was a man of 45 or so, becoming presbyopic, the natural failure. He need not have been afraid of jeopardising his distant vision, because he assisted his vision near at hand. If his eyes were getting tired or strained, and he had not suitable glasses, he was wise to give his eyes a rest.

1711. You make an interesting suggestion with regard to comparison with the German Army or German Navy?—It seemed to me worthy of inquiry.

1712. I have understood that, in certain branches of the army, spectacles are looked upon, by a certain number of commanding officers at any rate, very much askance?—In this country.

1713. Yes?—Yes, but it is not so there.

1714. I presume that spectacles are more common in the German Army?—Much more. I think the explanation, perhaps, is this: that, in the first place, the number of men who have to serve in the army is very much larger than in this country. The conscript system demands that any man, who is not otherwise physically unfit, must give his services to the country. The prevalence of myopia in Germany is admittedly considerably higher than in this country. The German schoolboy spends a good many more hours over his education than the British schoolboy. I think that has been worked out quite definitely. Probably the same influence comes to bear there as we find among the Jewish children in the schools in Glasgow, who have to study their Hebrew outside their school hours. They present the largest number of myopes by far.

1715. And you think the myopia there is caused by study?—Yes. I think there is an intimate relation

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between myopia and school life—the education of school life.

1716. We do not know as regards Germany?—Spectacles, I have no doubt, are permitted in the same way. Once the principle is admitted of a piece of glass in front of the eye to correct the refraction, it would be folly to reject a healthy hypermetrope. Apropos of this question of glasses, I am informed that, in the construction of vessels by the United States now, quite a number are being made with covered-in bridges. That is a plan of shipbuilding which I believe has not yet found much favour in this country, but I am informed that a good many vessels across the Atlantic are being built in that way. I at once raised the question "What happens to the front view of the officer on the bridge?" The answer was, "Oh, there is a pane of glass." I said, "But surely that must get obscured." "Oh," was the reply, "you can easily wipe it now and then as it is wanted." If practical navigators think they can do that sort of thing with a sheet of glass, I should have thought an officer in a peaked cap and a pair of spectacles might protect himself even better.

(*Captain Golding*.) For years past the American coasting vessels have had the watch kept in the pilot house, they wipe the windows with paraffin to keep the rain drops from hanging.

1717. (*Chairman*.) Could you treat your glasses in the same way?—I cannot see why they should not be.

1718. (*Professor Gotch*.) There would be a question of losing the spectacles?—Undoubtedly.

1719. They would have to have more than one pair?—Yes, they cannot be replaced at sea. There should be some guarantee that they should be taken. It is purely a question for practical mariners, if they think they can do it; but it seems hard that a man should be thrown out for a purely refractive fault, when glasses would carry him through. There are many things which can be performed without accurate focussing, I am told.

1720. (*Mr. Norman Hill*.) Does he do all the accurate focussing required by the use of his binoculars, if he has not spectacles?—I should think he must, to read a semaphore signal. It must be as necessary to define that sharply, as to define Snellen's test type.

1721. With regard to your first case, where the navigator after increasing years has lost the keen edge of his vision, would he still see a semaphore, though he could not read the signals?—I should think he would be quite uncertain as to the position, and would probably see overlapping images of two, where only one should be.

1722. Is it probable, in the case of a man who had been passed and had read his test type correctly, that his sight should deteriorate, to the extent that he would not know there was a semaphore there?—It is quite possible.

1723. And probable?—It is bound to be less well defined, and it might be undecipherable by him. It all depends upon the amount of overlapping error.

1724. I think the practice would be that the man would always call in aid his binoculars to read his signal, or to read the number on his buoy?—I think he does; I do not see how men, who are developing any of this refractive difficulty of which I speak, can get on without.

1725. But it might come to the point at which he would not even know there was reason for his using his binoculars?—It might quite well. He certainly would not pick it up as quickly; he might not see the semaphore signal was given him at all. There may be a case when one ship wishes to signal to another, such as a merchant vessel wishing to converse with a man-of-war, or *vice versa*, and the officer on the bridge is not noticing that his services are required. I believe that such practice is encouraged between the two services.

1726. (*Chairman*.) I suppose there might be conditions under which a man who is always wearing spectacles would be more likely to pick up what was going on than if he was dependent on binoculars?—Yes; the field of vision with binoculars is much more limited; his field with spectacles is much better.

1727. (*Mr. Raymond Beck*.) Binoculars are quite excluded from men who are employed as signalmen for either semaphore or flag work, because their hands are being occupied at the same time as their eyes. It would eliminate all those men who go into the signalling part of the navy or mercantile marine?—Yes.

1728. (*Mr. Raymond Beck*.) I am speaking with regard to Mr. Norman Hill's reference to binoculars; they are quite eliminated for that purpose?—Yes. But a pair of spectacles would be still available.

1729. (*Mr. Norman Hill*.) Do you think it is probable that this degeneration of sight, after a man has passed his tests, will advance to the time when he does not know there is a necessity for determining what is in front of him?—I think it is quite possible.

1730. (*Mr. Nettleship*.) It would depend upon the amount of error?—Entirely on the amount of error. If the Committee would like a practical demonstration I can give it. If you, Mr. Norman Hill, would put this convex glass in front of your eye, and make yourself artificially near-sighted—with two or three dioptries—you would see at once what the blurring effect upon distance is. You require no glasses for distance, Mr. Hill?

(*Mr. Norman Hill*.) No.

(*Witness*.) With your unaided eye—say the right eye in case the other is different—what can you read of those letters? (*Snellen's types were held up at a distance of about 16 feet*.)

(*Mr. Norman Hill*.) I can go down, I think, to the last but one.

(*Witness*.) Now, will you kindly put that glass close up to the right eye?

(*Mr. Norman Hill*.) (*doing so*.) I can only see about the second down. I cannot see the existence of the line that I could read with the naked eye.

(*Witness*.) That is the effect of that glass, which has a convex lens of two dioptries. (*The same experiment was tried by the Chairman*.)

(*Chairman*.) It takes away two or three lines.

(*Witness*.) That would be the vision of a man who had two dioptries of refractive error; that is the experience of a distinguished admiral of my acquaintance.

1731. (*Captain Golding*.) (*after trying the experiment*.) I can see the type all blurred with this glass?—If you had to define a semaphore signal at half a mile, you would be in rather a difficulty.

1732. (*Captain Golding*.) A much more dangerous condition would be in navigating among unlighted islands in the dark?—That is another point. The sort of thing I mean is the purely refractive difficulty. The same is true, if your eye, with relaxed accommodation, was unable to make the focus. You would have that blurred vision that you got with this glass, and you would require to put up a glass in order to correct it.

1733. Is the artificial condition, which is produced by the glass, a bad condition of near-sight or long-sight?—No, it is only two dioptries—quite a low degree. It means a person who would read with the greatest comfort at 20 inches, but who would, if asked to tell the time by a clock at a distance, have a difficulty in catching his train, unless he had a friend to tell him the time. That is the state of an individual with two dioptries of myopia, or two dioptries of hypermetropia after a certain age.

1734. You say that is not an exaggerated condition?—No; it is a very mild condition.

(*Mr. Nettleship*.) It is very mild—an everyday condition.

(*Captain Golding*.) I am sorry for those who are bad.

1735. (*Chairman*.) Now we come to the question "Is so high a standard essential?"—Yes. Of course that is a very difficult question to answer. The Board of Trade, after employing a certain standard of vision for sixteen years, has now raised the standard. That is all the information I have as an outsider. Presumably, therefore, they have felt that the former standard was not high enough. In that opinion I agree, so far as the old test was made with both eyes open. I regard it as of the utmost importance that each eye should be tested separately. But I ask on what grounds



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has the Board of Trade raised its present standard? Is it based on exact calculation or experiments, with regard, for example, to the angle subtended by a semaphore or flag signal, or the visibility of certain standard lights at a known distance to the normal eye? I am not aware, and I venture to suggest that no such observation could be made in taking this standard. It has been taken more on a physiological basis of what ought to be the mean standard of vision, than upon an exact scientific basis; and I venture to express that opinion, because, on my asking the Principal Examiner of Masters and Mates if he could supply me with the actual dimensions of the semaphore signals, he informed me they are not laid down.

1736. That was Captain Harvey?—I do not know what the gentleman's name is. But there apparently was nothing to found on, if there was no standard. Every semaphore maker is a law to himself, as far as I can see. That is a question, of course, which the gentleman who is responsible for raising the standard will be able to answer. I do not pretend to know. A very interesting point follows upon that. One has to consider carefully what are the factors which go to make acute vision. I have stated here that the necessity is, sufficient illumination with sufficient contrast of figure on the background, perfect transparency of those lenses of the eye through which the light has to pass to reach the retina, and accurate focussing as the light passes through, so that the stimulus is applied sharply and definitely on the back of the eye, on the part which possesses the keenest perception. It depends on whether I get this lens at its true focus, whether I get a picture of the trees and objects outside this room (*the witness demonstrated his meaning*). If I hold it too far away, I am getting the condition of the near-sighted eye, which you artificially produced, sir, when you held the lens in front of your normal eye. When I get it here, I have the picture sharp and clear. If I go nearer, I again get want of definition. I am taking the outlines of the window bars of this room. The first essential is to have the focussing just at the right place. The eye is so proportioned and related that sharp vision is got, provided you have transparency, and provided that the light was strong enough as it left the object, in contrast with its background, to give a sharp image on the nerves at the back of the eye, and then that the nerves themselves are capable of perceiving the stimulus when they receive it. There are other and much finer physiological points, which one might detail, as regards the variation of the adaptation of the eye to light. These are very important factors in connection with the capacity of the eye. Now, roughly speaking, with an unaided eye, as was demonstrated a moment ago, if there is a little fault one way or the other, the apparent acuteness of vision falls off, it may be to the second row of type. From having been able to read the bottom row, if there is a little fault in the focus, then only the second line can be read. If there is a little more fault, then perhaps four rows from the bottom, and so on up the scale. I merely make a very rough statement here. One cannot make an absolute law of it, because people do differ so much in their perception, and some would make out a great deal more from a blurred image than others. That a defect can be introduced in that way is quite noticeable. But suppose the defect has been introduced; take the case of a coloured light; instead of having it sharply defined in the back of the eye, supposing the focus is not just where it should be, on the sensitive nerve plane, but that a diffused circle of overlapping images, either of light intercepted before it is focussed or perceived after it has come to that focus, is received; then the retina is still stimulated by an amount of light which will give quite a definite impression. It will not give a sharply-defined impression, but it will give a very conscious impression, and sufficient warning, so that you may have, despite of refractive error, men engaged in the actual conduct of traffic, who assure me that they have not the slightest difficulty, though they are only able to read two or three or four lines from the top, and are not able to come up to the standard which the Board of Trade has set down, and they are practical mariners.

1737. Ought we not to take here the question of the amount of refractive error which should disqualify?—I think it is a question for the physiologists and physicists on the Committee to consider. I could not venture to give an opinion.

1738. I did not know how far you wanted to offer an opinion?—I did not want to thrust any views upon you. There are a great number of questions which require a number of experiments to be made. I could not settle it in this chair.

1739. It is rather a question which you propounded; you do not give an answer?—It was for the consideration of the Committee. I would only go so far as to point out that, in one practical case certainly, where a man had one-sixth of normal vision, he found he was incapable. He had to resign from his duties, and told me so. He was a young fellow. Otherwise with glasses he could get quite acute vision. If a man with the naked eyes sees with blurred vision, and can with glasses get sharp definition, it shows that he has good nerve power. You may have another man coming forward failing at the same stage of the test, and no amount of correction with glasses will correct him. He owes his defect not to refractive power, it may be, but to defective nerve power. The Snellen's type test will never discover the difference between the one and the other. A man who with glasses is capable of getting a sharp-sighted vision is a much safer man than a man who has defective nerve power.

1740. (*Mr. Nettleship.*) Nerve power would be covered by the word "disease"?—Yes.

1741. Would you allow the word "disease" to be substituted for "nerve power"?—I should like to mention both, opacity in the media, and loss of nerve power. Without a competent examiner, you will never discriminate between the two, and it may be important as regards the light sense.

1742. (*Chairman.*) Have we covered most of the ground?—I only emphasise the point, that I have tried to gather, so far as a layman who is not a mariner can do so, some evidence on the point from those who are more practically concerned with these things; and I am assured that at any rate half-normal vision does not seem to interfere with the carrying on at sea of look-out duty. I do not say the reading of semaphore signals; that certainly requires a finer vision. But the look-out seems to be safely performed. The most practical case I know is that of an ophthalmic surgeon, a very keen yachtsman, who, with his unaided eye, sees only the third row of that test; and he assures me that he spends the greater part of his vacation—in fact I know he does—in yachting and cruising about the western islands off the Scottish coast, in and out of traffic; he navigates his own boat with perfect confidence, without glasses at all, with that amount of vision.

1743. Is the vision of both his eyes approximately the same?—I understand approximately the same, yes. Certainly his best vision without glasses is  $\frac{2}{3}$ , which is about one-fourth of the normal. With correcting glasses it is  $\frac{4}{5}$ ; he has a keen sight then. I think he is hypermetropic.

1744. Does he use glasses?—Yes, as occasion arises; and if he wants to see anything near at hand, he puts them on. But he does not require to use them for navigating. He is one of the instances which goes further, because he tells me that in a night light he sees better without his glasses, despite the fact that they assist his refraction and sharpen up his acuteness of vision. I have several friends who assure me that they require glasses when the light is bright, to get a sharp definition of some object, but do not require glasses at night. They can themselves determine the outlines and coast lines, and so on without glasses. This gentleman told me he was able to see the vague outline of a church, off which he wished to anchor at night, better without his glasses than with them.

1745. Have you a suggestion to make?—No. I merely wish to bring these points before the Committee, in case they have not occurred to them, as the observations of practical mariners. If the question of eyesight is to be brought to a thoroughly practical

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experimental investigation, information might be elicited in that direction.

1746. On the whole that covers the main ground under the head of Form-vision?—I think it does. There is a great deal to be said, but it would take me much too far, as to what we really mean by acuteness of vision, its dependence on certain functions of the retina, and its relation to the light-sense, which I believe is of the highest importance, so much so that I am not sure that there should not be a test of the light-sense as well as a test of the form-sense.

1747. (*Mr. Nettleship.*) You referred to "two suggestions towards a solution of the problem"?—I think those are in relation to the question whether an ordinary seaman might not be brought under the survey of the Board of Trade to some extent. I have not expanded that, because I did not wish to put too lengthy a paper before you. But I have made some notes, and I might give an illustration of the fact that it does seem desirable. I recall the case of a Scandinavian fisherman, who came to consult me on one occasion. He was obviously near-sighted. I suspected it from the way he walked about. He seemed a little uncertain about finding his chair, when he was asked to sit down for a moment. When we came to test him, we found he was so near-sighted that not only could he not read a single row of the test type at the ordinary distance, but he was in actual doubt whether a great-coat hanging on the wall on the opposite side of the room was a man or a woman. It was a gross illustration, which only shows the sort of man who may be admitted on board ship, and who may, without control, be sent to do look-out duty. I am quite aware that the responsibility of look-out rests with the officer on the bridge, and at the present moment it depends upon the officer on the bridge to determine whether the look-out is fit for his duty or not. If he is missing lights, the officer discovers the fact and he is excluded. But if a ship be undermanned, or if the officer has not had an opportunity of studying the man who is acting in the responsible position of look-out, he may land the vessel in disaster before his inefficiency is discovered.

[*The witness subsequently requested that the following note should be added to his answer:—*

In the first place, the extension to seamen in 1906 of the provisions of the Workmen's Compensation Act has thrust upon shipowners and insurers the necessity for knowing something more about the physical condition of those whom they employ than was previously the case, and the Committee, of course, knows that various large employers have now arranged for a medical inspection of their crews, either six-monthly or before each lengthened voyage. This practice, however, is by no means universal, and so far as I can ascertain, is in some instances quite superficial, if not entirely nominal. Still, the fact that a medical examination is recognised as practicable suggests that steps might be taken to enforce it more stringently.

In the second place, I am hopeful that the physical examination of school children, which has now been so wisely instituted, may so far as our "home grown" seamen are concerned, assist the same purpose.

Nearly 20 years ago (1891) I advocated in a public lecture, given under the auspices of the Edinburgh Health Society, that every scholar at the close of school life should receive a certificate stating his physical ability, and in giving evidence in September 1902 before the Royal Commission on Physical Training (Scotland) I again urged the adoption of this plan. Utopian though it may appear, I feel confident that the time will come when it will be adopted and extended so that every British citizen will have a life record of physical capacity which will be of the greatest service to the young in the selection of suitable careers, and a register to which appeal can be made in case of subsequent accident or disease involving claims for compensation.]

1748. Your yachting friend has to read signals at a long distance, I suppose. You talked of his yachting in and out of the islands?—Yes, that is the other side of the question. He could without glasses; I do not think he could read signals without them.

1749. I thought you said he had no difficulty in reading?—I do not think he will undertake to read semaphore signals.

1750. The lights at night?—Yes, lights at night, because you can pick them up from a blurred image.

1751. He would do so at full distance, as far as you understand?—He assures me he can. There you have two things to bear in mind. In one case, to read an arm signal you must have sharp definition; with lights you have overlapping circles, which are overlapping a part of the retina, which is just as acute as regards light sense as the central point itself. He referred to his capacity to steer in and out, and even in subdued light to take his bearings from headlands and so on without glasses +  $V = \frac{2}{3}$ .

1752. (*Mr. Parsons.*) I think it would be useful if you could give us some idea of what you regard as some level of refraction, because, after all, it has got to be a compromise; that is obvious, and what we want is assistance to form some idea as to the level. There are several points in view. One can very easily exaggerate the importance of hypermetropia. As a matter of actual fact these men very rarely do have look-out duty after they have reached a certain age?—The officer on the bridge does, and the pilot. The pilots go up to the age of 70.

1753. But in practice they have binoculars. Ordinary cases without astigmatism, cases which would have got in under the ordinary Snellen test, would be corrected by binoculars?—Yes. If binoculars are freely allowed for every part of the work, and at any moment.

1754. Apparently they are for a look-out man, who is the person responsible?—But they cannot be always glued to his eye; that is the difficulty.

1755. It would be useful if we could get some idea from you, as to what you regard as being a dangerous level from the point of view of refraction alone?—There are a great many factors to be considered, and I think really, at this stage of the inquiry, I might mislead the Committee, if I ventured to lay down anything. I am prepared to go so far as to say, that a refractive error, which would reduce the vision to one-sixth of the normal for Snellen's test-type, is dangerous. I know a case in which it was dangerous. That would represent about three dioptres of refractive power. If he has three dioptres of myopia, he will probably also have a difficulty. He will probably make out the top letters. My present feeling is that three dioptres of error in either direction should be inadmissible.

1756. It does not matter so much about myopia; they will all be cut out by the test as it stands; it is a pure question of hypermetropia?—It does in this way: Supposing a youth passes the earlier test of sufficient vision, and is not known to be myopic, and develops myopia, and is cut out at the later test; are you going to exclude him, because he has fallen below the standard, if, with refractive correction under three dioptres, he can reach it.

1757. You could not have cut him out at first, because on the first occasion he had not got it. No alteration in the test would do that, even if made by an ophthalmic surgeon?—No; I am speaking now of permitting candidates to use glasses at a later stage, if need be, instead of rejecting them.

1758. I was referring to the rejection of candidates. What degree of refractive power, whether myopic or hypermetropic, would you consider necessary, more particularly in regard to hypermetropia, because I think the myope would be cut out by Snellen's test as it stands?—If they have it then.

1759. If they have not got it, it will not make a difference?—They may get it later, and it would be a hardship to turn them out if a moderate amount of it could be permitted.

1760. (*Chairman.*) Mr. Parsons' question points to a definite matter, namely, what would you do with these youths at the moment when they are examined?—My present feeling is to exclude all those with known error.

1761. Of any kind?—At entrance. This is purely tentative. Really I am not going to commit myself to

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putting it down; I do not think it is right to do so. I have not the facts to go upon.

1762. (Mr. Parsons.) That would be making it even more severe than in the Royal Navy at the present time?—Yes, but the Royal Navy is landing men in difficulty by their present method.

1763. (Chairman.) We do not want to press you. I was only trying to indicate the nature of the point?—I think it would be wiser not to do this. There is a great deal to be done in this question. There is the whole question of the light-sense in relation to the form-sense, of how far the widening circles of diffusion will still serve a mariner for guidance. I should be quite prepared to do it, after I had carried out investigations, but I do not think I should be right now.

1764. (Mr. Parsons.) I am only asking for your impression?—It is not worth anything. A great many questions have arisen, since I began to write this paper. I can see that.

1765. (Professor Gotch.) I understand, what you advocate is, that there ought to be an addition to Snellen's test, in order to ascertain whether there is a certain degree of hypermetropia, without saying what that degree is?—Certainly.

1766. To be carried out by an ophthalmic surgeon?—Yes, I think it would be most desirable. I would go a little further. I think that to permit a youth to travel from the Hebrides to Glasgow, or Leeds to London, to find a clerk or an ex-captain of the mercantile marine established as a Government authority upon eyesight is not very creditable to the intelligence of the country.

1767. (Chairman.) Are you speaking of the appeal?—No, of the ordinary condition of affairs, because that is what it is at the present moment.

1768. (Professor Gotch.) What do you advocate?—A refractive examination.

1769. A refractive examination for the benefit of the people employed?—Undoubtedly.

1770. It is for their benefit to be rejected, or to be told at once that they will be in a condition in which they will be rejected later?—Yes.

1771. Do you think it is possible to have a re-testing on a less severe scale than the original test?—I think, when a man has had experience, considerable allowance may be made for his judgment in correcting.

1772. That is what I was coming to; whether it is not the case that, with real defective eyesight and a certain amount of experience, a man will do better than with normal eyesight without the experience?—I believe he undoubtedly does.

1773. There is one other point. You mentioned just now the fact that this gentleman with hypermetropia and probably astigmatism said that he could detect things better more or less in the dark than in the day?—Yes.

(Professor Gotch.) I wish to say that I am a hypermetrope of that type, and at night I never dream of walking down a difficult path with my glasses on; I always take them off.

1774. (Captain Golding.) What is the unit of refractive measurement?—The dioptré.

1775. You say that you consider three dioptrés dangerous?—I think about three dioptrés. I think it would result in such over-lapping of the images on the back of the eye, that sharp definition could not be secured.

1776. The glasses which you lent us a moment ago were only two dioptrés?—Yes.

1777. Is that the way in which objects would appear to a person with two dioptrés?—Yes.

1778. Then I should say two dioptrés were dangerous, very dangerous?—There is a great difference in perception of coloured light and a sharply defined thing like this largest type.

1779. I am referring to Snellen's test. If in your opinion those glasses are only two dioptrés, I should say it is very dangerous?—I am quite prepared to take a higher standard.

1780. As I understand it, the refractive error is of far greater importance in daylight than at night?—Yes, I think it undoubtedly is.

1781. On the question of its effect on the ability of a man to pick up lights at night, you do not express any confident opinion, how much error interferes with the power of picking up a light?—Unless it be of high degree, it interferes very little; it interferes very little, until it comes to be a high degree. I tried an experiment the other evening myself at a railway station. I looked at a green light with my glasses. I took them off, and relaxed my accommodation as much as possible, and I saw what was before a sharply-defined little lamp of green light spread itself out into a diffused circle, very considerably less in colour value, because I was getting a much weaker stimulus from the diffused circle. I could still tell it was green, and, on turning to a red light, I could distinguish between the two. I could locate their position and could have said: "That one is there, and that one is there"; but had I been asked to read it off, in the way one reads off the test-type, I should have been very badly placed.

1782. If a man had the high degree of error, which would be disastrous in regard to picking up lights, he would be cut out?—Oh yes, if he had that high degree.

1783. By the letter test?—Yes, he would be cut out, if he had it at the time you applied the test. If he passes the test before the age of 25, he may not develop it until he is nearer 40. If he is hypermetropic, which is the relaxing condition, he may be a much less efficient person than you thought he was when you gave him the certificate.

1784. You attach great importance to each eye being tested separately?—Yes.

1785. Is that to detect disease, or possible disease, or do you think for safety it is necessary to have two eyes?—I think it is very necessary for anyone, who is responsible for the conduct of traffic, that, if any slight accident happened to the one eye, he should have another eye which is enough to serve his purpose.

1786. So you never would pass a one-eyed man?—I do not think he should be passed, if you are going to lay down regulations. I think two eyes are better than one.

1787. If the man was passed, and lost the use of one eye from a pure accident, not affecting the sight of the other eye, would you disqualify him?—I think in the interests of public safety I should have to advise that he be disqualified. But I know one-eyed navigators at the present moment. In fact, I have a case of a seaman at this moment, whose eye I had to remove the other day with every confidence that he would get a job when he went back as A.B. on the bridge. There is nothing to prevent it.

1788. And the other eye will remain a good one?—Yes, it is a good eye. But if by any chance a smut from the engine or anything fell into it, God help the ship. He has to stand on the bridge with the compass before him, and take his word of command from the officer. If the officer is passing up and down, and in the meantime the man gets some chance smut from the funnel into his eye at a critical moment, there would be danger. If it was not at a critical moment, of course he would say: "I have something in my eye," and get somebody to take it out.

1789. (Mr. Raymond Beck.) Smuts might go into both eyes?—Yes. Still there is a 50 per cent. chance that it does not get into both.

1790. (Mr. Norman Hill.) A smut in the one eye might make him see out of the other?—He has not got another. If a man has one eye, he can navigate, and he will take the risks; I have no doubt they will occur comparatively seldom. But if you lay down regulations, I think men should be taken with two eyes by preference.

1791. (Mr. Raymond Beck.) With regard to the early part of your evidence and the recommendation for a higher test, is that purely on behalf of the candidate, or with a view to getting safety for the ships?—Not confining the question to the Navy, but to the ordinary maritime service, we ought to be able to catch these men at their future examinations?—Yes.

1792. So that your recommendation for a higher test at the start would be purely out of sympathy for the men who are going to sea?—Yes.

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1793. It would not affect the safety of the Mercantile Marine?—I think I may say, not until a certain stage.

1794. There is the very interesting case of the yachtsman; of course, he would have binoculars at night?—Yes, I have no doubt he has; he wants them.

1795. Then with regard to the test you were kind enough to permit us laymen to go through, it is affected very greatly by the suitable position of the light?—Yes, that is most important.

1796. I have recently been through the test myself in a room which, I presume, had been prepared for the purpose, and I could read quite easily all the lines; but when the Secretary held it up, where there is a light from the window, and a reflection coming down from the electric light, although I could read the last line, it was with difficulty; it was somewhat blurred. A suitable position of the light is very important?—It is of the highest importance.

1797. (Mr. Nettleship.) Yes, a suitable degree of luminosity?—I know, as a matter of fact, an examiner who examines at two different stations, and he quite

The witness withdrew.

Mr. TENNYSON LARGE, Clerk of Customs, Deputy Superintendent of the Mercantile Marine Office, and Sight Test Examiner to the Board of Trade at Great Yarmouth, called and examined.

1801. (Chairman.) What sort of number of candidates do you have through your hands in a year?—The numbers vary. About the beginning of this year there was a change in the regulation for skippers' and second-hands' certificates. The numbers, which we have had for the year 1910, are 28 skippers, 35 second-hands, and 9 for colour-vision only. Those nine would mainly be apprentices, not fishing candidates, but boys going up for training ships.

1802. Those are the numbers for this year up-to-date?—Yes. For the previous year we had only three second-hands and one for colour-vision. You will see there was an appreciable change.

1803. Does anyone share your duties with you?—I do the main portion of the duties myself, but during my absence the superintendent himself performs the work.

1804. The total number you have for colour-vision is not large?—No. That is apart from the ordinary skippers and second-hands.

1805. Would you mind showing us how you carry out the examination?—Certainly.

(A. T. Ruby was then called and put through the wool test by the witness.)

1806. (Chairman.) Of course we knew that he was a colour-blind boy?—You could see at once, from the very start, that he was colour-blind.

1807. Those skeins which he put into the yellow are in their way quite as bad as the others?—Quite.

1808. You do not notice the contrasts so much, but I suppose it is quite as bad as the others?—Yes.

1809. There are five skeins; in your experience which of the test skeins do you think the most important? If you were told to drop one or two, which would you drop?—I find, with fishing candidates especially, that this one is a very difficult one to match. (Pointing to No. 2.)

1810. What do you infer from that? Do you think it is a good test?—I think it is a good test. I find there is a distinct liability, when a man is even slightly colour-blind, to put down that colour (showing a purple). During my experience we have had only one candidate who had to be failed for colour-blindness.

1811. You have not had a large number?—No. Last year there were, I think, 72 altogether, and only one of those was failed. He was almost a remarkable case of colour-blindness; he matched every test skein incorrectly.

1812. You have not had a great opportunity of seeing which skeins are a good test and which are bad?—No.

1813. The bulk of your candidates have passed all right?—Yes, but I found the greatest weakness in the

appreciates the fact that there is a difference between the two, which he has often to guard against, by taking care that he only tests men when the light is good. In the one case he has an east window, and in the other a south window. He does not allow the sunlight to play directly on the type, but the room is very much better lighted. There is one point in relation to your question. Of course, to make a fair comparison between the test, which you said you passed in another place, and the test applied just now, it is not a question of illumination, but of the actual kind of type exposed.

1798. (Mr. Nettleship.) And the length of the room?—And the length of the room.

1799. (Mr. Raymond Beck.) I rather gather that wherever you went, the type would be adjusted to the room. I went to an ophthalmic surgeon?—Yes, it would be.

1800. This might not be the right distance for that type?—That is so. That is the point I wanted to bring out.

second skein. They find the greatest difficulty in seeing that there is any blue in that skein, and they confuse it with red.

1814. Have you noticed, amongst those who did pass, much in the way of nervousness?—Very great nervousness indeed.

1815. Very great?—Yes, they look forward to the colour-vision and the form-vision tests with much more nervousness than to the navigation tests.

1816. Do you find that they tend to fail because of nervousness in the colour-vision test?—We always do our best to reassure them.

1817. You have found the need of careful handling?—Yes, we always handle them most tenderly. We tell the men there is no need to be nervous.

1818. You feel that if you do not handle them carefully, you do not get proper results?—If we do not handle them carefully, I am afraid they: intelligence is such, that we would have to fail them.

1819. You feel that is a real difficulty?—Yes.

1820. Have you noticed any difficulty about matching the skeins, some skeins having a great many matches and others having only a few; does that puzzle the men?—No, I do not think that puzzles the men very much, except, perhaps, in the yellow. For example, there are a very few pure yellows in the bundle of wools, and they show a tendency to pick out light browns.

1821. They think you want rather more?—Yes.

1822. That would suggest that there should be a rather more equal number of good matches to the various test skeins provided?—Yes; I find also that they pick out yellow greens to a certain extent. Until it is explained to them that we simply want a pure green, they will wander away into the yellow greens and blue greens.

1823. (Mr. Raymond Beck.) Do you think it would be a reasonable thing to ask a fisher boy brought up on a smack to name the colour that you picked out there; the skein which you mentioned as being a difficult one to match? Do you think it would be a fair question to ask a fisher boy to say what colour it is?—No, I should think not.

1824. You would not?—No.

1825. It is an unusual colour?—It is rather unusual to him; they call it all sorts of names.

1826. Would you expect him to know whether or not that particular colour had any blue in it?—Only by the skeins he picks out to match this. Unless he picks out a skein which is of mixed colour, he will get into this (showing a red).

1827. Quite reasonably?—Yes, I should think so.

Of course, a person with normal colour-vision would see that that is a mixed colour, that there is a mixture of blue in it. When men do pick out colours like



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[Continued.]

that, they usually see almost at once, when they put it down, that it does not match exactly, that there is not a mixture of colours.

1828. (Chairman.) You would not think it fair to test whether he could tell you if there was blue in it or not?—No.

1829. (Mr. Raymond Beck.) You would not, therefore, reject him if he picked a blue?—If he picked a real blue.

1830. It is reasonable to suppose that if there is any blue at all in that, he may match it with blue?—I should always insist on getting the red.

(Mr. Raymond Beck.) If there is any blue in it, by a process of matching you would get to blue.

(Mr. Nettleship.) You might, if you could not see the red.

(Mr. Raymond Beck.) I am speaking of that particular skein. If I am right, if there is any blue in it, I am perfectly justified in getting to blue through the process of matching.

(Mr. Norman Hill.) Or the red?

(Mr. Raymond Beck.) Certainly, or the red.

(Chairman.) You would have to go a very long way, you would admit, before you got to blue.

(Mr. Raymond Beck.) An enormous way, but I should get there. I will put it in another way. If I have 10 colours marked 1 to 10, and No. 5 matches No. 1, and No. 10 matches No. 5, then No. 10 matches No. 1.

(Mr. Nettleship.) But the 10 are all different, they are not the same.

The witness withdrew.

Dr. KARL GROSSMANN called and examined.

1833. (Chairman.) I think I should begin with the outline which you kindly sent us?—I may modify that a little if you will allow me.

1834. You will do what you think right as you proceed. In the first place, you think that Holmgren wool skeins form a good preliminary test for ordinary congenital colour-blindness?—Yes.

1835. But even in that case you think there are exceptions?—For two reasons I consider Holmgren's tests very good. First, they are very cheap, which is an important thing, because they can be distributed everywhere. Secondly, they will certainly sift the great majority of colour-blindness. But they are neither perfect in the positive nor in the negative direction, I find. I mean in this way; that when you examine someone who puts together coloured wools which are not a real match, the same person may sometimes match the colours correctly with the lantern. I have come across such cases twice myself. On the other hand, many, comparatively speaking, are passed by the Holmgren test, who will not pass the lantern test. What I call a lantern test is matching the colours of two points of light. If I may give the reason, it is on account of small central colour scotomas.

1836. You hold that the principle underlying the Holmgren test is paramount?—In this way; I myself do not like to have colours named for this reason; that you have only two colours, or three if you like, at sea—I am referring to the signals—red, white, and green. The white is not white, but is yellow to start with. I have convinced myself, as you can do, on the river and at sea, that the yellow goes into orange and even into red under certain conditions. So that it is almost correct to say that you have only two colours, red and green. That is why I wanted them to be matched out of a larger number so as to avoid guessing. I am in disagreement with seafaring men on this point, but I cannot help that.

1837. The Holmgren test is apt to fail, especially with pathological defects?—I said pathological, and for this reason: I do not know whether such cases occur with congenital colour-blindness, because those individuals, whom I have seen myself, have all been adults, and have all been in the habit of either smoking or chewing tobacco. That may be a coincidence, but I have not seen it occurring in those who do not. In my experience I have not seen any case

(Mr. Raymond Beck.) They are gradually going down, until practically every other colour is eliminated—it might be 100.

(Mr. Nettleship.) I think you have to tell me what you mean by "match."

(Mr. Raymond Beck.) That is what I have wanted to get from every examiner we have had; what does it mean?

(Mr. Nettleship.) What I mean by "match" in this test is, that it should look to the person being examined identical, or as nearly as possible identical.

(Mr. Norman Hill.) But lighter or darker.

(Mr. Nettleship.) Well, you must say lighter or darker; but unless you say that, I say they must be exactly alike to him.

(Mr. Raymond Beck.) But you keep saying to the candidate "lighter or darker."

(Mr. Nettleship.) Then they must maintain the same constituent colours in relatively the same proportions—the same combination.

(Professor Gotch.) Have you examined with the type test?

(Witness.) Yes.

1831. You have only had one case of rejection for colour-blindness?—Yes, and one case only in form-vision.

1832. (Captain Golding.) Is there any tendency for the candidates to run off into these colours from the pink?—The only failure we had did take one from that skein and put it down against it in that way.

that was congenital in children. Therefore I am inclined to think it is acquired.

1838. The element there is practically an element of disease?—Toxic, yes; some consider it poison, some consider it disease. I call it disturbance. I will not go any further.

1839. But your general view, I take it, is that this daylight test—the Holmgren test—ought to be supplemented by a suitable lantern test?—Yes.

1840. Now, what is the ground for that view?—I think I hinted it just now. Because I have found that sometimes people can pass the Holmgren test on account of the way in which they handle the skeins; they hold them fairly near. The wools become, therefore, a larger mass of colour in their eye, rather than a very small point. A lantern test ought to go so far, that the point ought to be just on the limit of perceptibility—the smallest possible. When you go out to sea you have to pick up a light, and that light is very small, just upon the limit of visibility. The angle depends entirely on the brightness of the light, and whether it is scattered in the media; but the light may be so low in intensity that it is almost a mathematical point, if we can conceive that. With the skein of wool you get an angle of 10 degrees or 15 degrees or more, which takes in the whole area of the colour-perceiving field; you do not debar your examinee from handling the skeins.

1841. You know that candidates locally have a right to appeal to London?—I did not know that.

1842. And, if they appeal, they are examined not only by the wool test but also by Sir William Abney, or his representative, in a dark room, by his spectroscopic test, which includes the small light you speak of?—I myself should not mind where the colour comes from, whether it is given by a small spectrum or by a light.

1843. Your point is?—That a very small point of light ought to be seen; that is my point.

1844. A small point is a better final test than the wool?—Not only that, but it is practically the test which is required at sea.

1845. Which they require at sea?—Yes, no sailor can object to that.

1846. You also think the adaptability of the eye in the dark should be considered?—In a very limited degree. That is a difficult question, in so far as, with

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advancing age, the amount of adaptability to seeing a very small point becomes different; it takes a longer time than with a young eye. If you look at a very fine point of small intensity, unless your eye is adapted for some time to the dark, you do not see anything else at all. You have to find your point with eccentric vision. I believe astronomers know that very well.

1847. Does the adaptability alter with age?—From my own individual experience it gets a little slower. That is the only thing I can vouch for from my own individual experience. I remember about 20 or 30 years ago I noticed a little more quickly under normal conditions.

1848. You are speaking of the dark now?—Yes. When you have a very fine point—I will show you this on the lantern afterwards—especially when you are not adapted to the dark, you will not see what colour it is; and for this reason: you see a fine point and look at it, and then you do not see it. If you look at the side of it, you see some light but not the colour. Then afterwards you adapt yourself and see the colour.

1849. With regard to the present Board of Trade standard light, you say the green light, as used at sea, is not as easily recognised as the red light?—That is so.

1850. You have tested that?—I have tested that with some captains down the River Mersey, and it is not as easily seen.

1851. You think it is too dark?—I think it is too dark.

1852. It absorbs too much light?—If you take it through the ordinary spectrum you see it is much darker than the red, which you get from the red light.

1853. Proportionately?—Yes, but that can be easily altered. Just now Mr. Tallents was kind enough, as I had forgotten the specimens which I bought in Liverpool the other day (I have something very near to it here), to show me two glasses—light and dark green; the light green is much lighter than what I saw. I think you find with many steamers' lights the green is much lighter than others. The officers will tell you that some greens are more easily picked up; they are not all uniform.

(The witness afterwards sent, for the use of the Committee, a specimen of the "Board of Trade green" glass supplied in Liverpool for ships' starboard lights.)

1854. You think the same green light is recognised much better on railways than on steamers at the same distance?—Yes. I verified that for myself. I can only speak with certainty of what I found myself. I do not know whether it may be due to the steam, or the water, or to the atmosphere.

1855. Then again, you think that practice on the part of the individual improves the capacity to recognise green and red lights?—I feel inclined to think so, but not from my own experience. To me it remained pretty much the same. I am not accustomed to pick them up at all. I am never at sea if I can help it, and therefore I have only occasional experience, but several captains have told me so. They see them better, and, in fact, they tell me that the man who has served on a steamer is infinitely more ready and able to pick up lights than a man on a sailing vessel; he has to be more on the alert.

1856. And greater experience renders him more efficient?—Yes; whether it is simply that he picks up a light as such, and afterwards sees what colour it is, or whether he is really able to distinguish between the two, I cannot say.

1857. And that is the case with colour-sound individuals, as you call them?—Yes—individuals with normal vision.

1858. Then I gather your view is that, in a thoroughly effective system, testing for colour-vision should be repeated periodically throughout a man's brought in, I should certainly put in some insurance system. I should make that compulsory, after the style of the superannuation system. It is rough on the men.

1859. It is hard on them?—Very hard. I cannot think it would be fair otherwise. A man may fail a little in his keenness of vision. I come there to

another point with regard to form, which I will mention afterwards. A man may fail in sight a little, and just in those years when he is at his best mentally and has got his greatest experience; he is absolutely invaluable, and I do not think he can be dispensed with.

1860. He ought not to be turned out then?—No. I do not think so. I think he might be supplemented. But, in any case, the fact that he does not see things perfectly ought to be known. If the deficiency is known, the danger is half avoided.

1861. Do you think the effect of nicotine, and other dangers of that sort, are a frequent cause of possible danger?—An occasional cause. It is a cause, decidedly. With regard to its extent or frequency, I am not prepared to say. I have had little to do with the testing of seafaring men for the last 15 years. That matter is all now settled in fixed hands, so I speak more from my past experience. It is only very occasionally I now come across them, but I used to have a good deal of experience with them.

1862. I do not know whether we have covered the ground of colour-vision. If we have, perhaps you will take up the point of form-vision. If there is anything else on colour-vision, perhaps you will kindly mention it?—I was going to say, I can quite imagine a man getting a little bit muddled in the Holmgren test. He has a very pale green, a shade he hardly ever sees. He might easily put on a pale blue or something else, especially if it is very pale. I think it is quite possible those cases might occur; but I think a little sympathy and patience on the part of the examiner ought to be able to get him over that. You can muddle a man very easily by examining him rather roughly, and I find, the older we get, the more we are likely to bully our examinees and patients a little. Mr. Nettleship laughs, because he is out of that now. At the same time, it can be avoided, and I do not think it is really a danger. There is always an appeal, as you say.

1863. Then as to form-vision?—I do not know really what is the present quantity of vision that is required—I think  $\frac{2}{3}$ , roughly speaking.

1864. (Mr. Parsons.)  $\frac{1}{2}$ , with both eyes together?—That I consider very low.

1865. (Mr. Nettleship.) The new test is to be  $\frac{2}{3}$  with one eye, and  $\frac{1}{2}$  with the other?—If you consider that so-called full normal vision is only medium average, then  $\frac{1}{2}$  is a very low standard of vision. I have  $\frac{2}{3}$  easily—about  $1\frac{1}{2}$  to 2 myself. I do not think  $\frac{1}{2}$  is too high.

1866. (Chairman.) At any rate, it is not too severe a test?—No. As far as form-vision is concerned, I think there was a question what was the best sort of test. I do not think it matters. It may be letters. I test children with the fork or Landolt's ring or with dots; I do not think it matters much. You have always a ready means of comparison with your own vision, if you know your own vision. I do not think that  $\frac{1}{2}$  at least for one eye is too high, because, when you have much less than that, you will not find that your colour-vision for distant points of coloured light is too good either. You must have sufficient vision to be able to pick up any light at, say, two miles distance. Take the steamer that goes at the rate of 15 miles an hour; that is not a very tremendous rate, but it is an average speed nowadays. You have one boat going in one direction and the other in the opposite direction, and in two minutes they meet. We have not an ideal sky in these latitudes, and if you get conditions where it is not clear, you have not very much time; you can easily make a mistake.

1867. You are going to show us your lantern test afterwards?—Yes.

1868. (Mr. Nettleship.) You think re-examination is necessary chiefly from the point of view of tobacco scotoma, or largely from that point of view?—May I add also, from age?

1869. Would it not do nearly as well to re-examine for form-vision only, and if the form-vision at 45 years of age is still up to the standard, we may take it almost for granted that there is no scotoma, may we not?—I think we may.

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1870. It might simplify matters if the re-examination were limited as a rule to the re-examination in form-vision, unless the form-vision were found defective, and then there might be re-examination in colour too?—May I put in another point? When you have a man who is 45 years of age, and who has spent about 20 or 30 years of his life at sea, and he is a sober, steady man, with good vision, he is a very useful man; you would not like to lose him; he is not easily replaced by quite a youngster. That man, who has good vision at 45, is, almost in 9 cases out of 10, not what we call emmetropic, normal-sighted, but hypermetropic, oversighted. That man has full normal vision in daytime, but he has not got it at night, and for this reason, that at night his pupil dilates. He requires glasses, and I would like to put in a plea for glasses. I have tried to do that for 30 years in this country, and I have succeeded a little at the schools. I have heard this part of the world does not require glasses. I found 30 years ago that glasses were as much required for school children here as anywhere else. I find the human animal is the same, more or less, everywhere. That man will not be able to see at night so well without slightly convex glasses, but he is not allowed to have them now. If he were to wear them, and it became known, he would be dismissed on account of bad sight.

1871. Do you think wearing spectacles at sea would be practicable?—It is practicable; they wear binoculars.

1872. (Chairman.) You cannot wear them?—Well, he has them there, and they get wet with spray and steam. It is worse than his own glasses. I think it is not fair that a man should be debarred from having them ready in a case of emergency, which is at present the case. I do not think it is fair to the passengers who go with them.

1873. (Mr. Parsons.) Is it correct to say, as you do in your précis, "Holmgren's test is apt to fail where we have to deal with small colour defects in the vision field"? They can easily pass, can they not?—That is badly expressed. I meant the result of the test is apt to be wrong, to mislead.

1874. (Professor Gotch.) Do you mean a small area?—Yes, a very small area; that is what I mean.

1875. (Mr. Parsons.) If you had to devise tests, you would have a lantern test, and you would also retain the Holmgren test?—I think it is very desirable to have it; it does not do any harm either.

1876. You think the lantern test is more important?—Yes, for the reasons stated.

1877. By what type of examiner do you think those tests could be carried out?—I think the Holmgren test can be done practically by anybody.

1878. And the lantern test?—The lantern test is not so easily carried out. I should prefer to have a trained man.

1879. (Professor Gotch.) I do not know whether you will be able to answer me, but we have been told that glasses are used much more in the German Army and Navy and Maritime Service; do you happen to know anything about that?—I am informed they used to be allowed to wear them; I do not know anything about it at present.

1880. We were also told that there were possibly more cases in which glasses would be necessary in Germany than in England; you might have some view on that point. Do you think that is probable?—I can only judge from the school children. I found from the very beginning here an enormous number of children who ought to wear glasses. But they say—it occurred only the other day—"No, mother does not want me to wear glasses." The parents object to it. In this case the employer objects to it. I will give you one example of what one has to do sometimes. One is sometimes put in a very awkward position. Many years ago a seafaring gentleman came to me, who had a tumour in one eye. I was not allowed to excise it. I destroyed all my notes on the case, and I do not know what happened afterwards. I did not want to be asked before a court about it, if it came to inquiry. To my idea, in about two or three years, the eye must have come out in any case. He would not have it out, because he thought he would lose his status and his employment.

One sees these things, and one does not know what to do.

1881. I gather, at any rate, that you do not think that there is any really large difference between Germany and England on that point?—I do not think so.

1882. And you think that, if they were examined, there would probably be nearly the same percentage of defects in this country?—Certainly. I find it at school. The children in this country used not to be worked very hard 30 years ago; they paid more attention to games than to study.

1883. One question about the colour. I understand the lantern test is indispensable for detecting certain forms of colour-blindness—anomalous trichromics?—Yes.

1884. It can also detect the ordinary colour-blind dichromics?—Yes.

1885. Then, what is the advantage of the Holmgren test, because it can detect one of these, but the other only with difficulty?—The Holmgren test detects all the big congenital errors. I do not think it is absolutely necessary, but it is a preliminary test. You get them roughly sifted out.

1886. Do you think the lantern test only would be a reasonably effective test?—For the practical test of people who are subjected in practical life to the work of picking up these lights and knowing which is which, yes.

1887. (Dr. Watson.) I should like you to give me a little more information with regard to the colour of the glasses. I have made measurements of the quantity of light which is transmitted by the standard Board of Trade glasses?—The light or the dark?

1888. All of them. I have the curves here. I will show you the curves, and then you will understand what I am speaking of. (Handing document to the witness.) They are the Board of Trade and also some German glasses. The point I wish to draw attention to is, that the percentage of green light transmitted by the green glass is very nearly the same as the percentage of red light transmitted by the red glass. The reason the green looks so dull is because the lamp behind it contains such a very small proportion of green?—Yes.

1889. So that your objection is not so much to the colour green as to the colour of the lamp behind the glass?—In a way, you are right, and in a way I am right; I think I am more right for this reason, that you cannot get the light as you want it, but you can alter your glass more easily.

1890. You cannot add more green; and making the green light lighter will simply mean that you are diluting it with white?—You do not put so much green in, if you put it in that way.

1891. If you have a lighter green, it simply means you have a white tinge to the green?—Yes; but your Board of Trade green light contains practically everything blue that there is to be had.

1892. Blue is all to the good?—Yes. You have a bluish green, the blue of which helps you also. I dare say that is why sometimes people, who are on the borders of colour-blindness—I will not commit myself any further—see these things. It is the blue part of it which they see.

1893. Do you not think, if you used a very much lighter green, you would confuse that kind of people?—You mean by the "lighter green" that green which the Board of Trade has accepted?

1894. Or even lighter than that. I mean the one which, backed by a paraffin lamp, would look brighter?—We have at a landing stage at Liverpool greens without any blue—no noticeable blue. Those lights appear yellow at a distance under certain atmospheric conditions, and lose all their green appearance. If you choose a more bluish green—I prefer to call it peacock blue—then you have an additional safeguard, and you see this light as very different from the red and the yellow light.

1895. We may take it then that, when you recommend a lighter green, you would not recommend one which contains more white, or which looks more towards the yellow side of the green?—You take off

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a great deal of that by your blue admixture; you let the blue-green part through much more. You get more white light too.

1896. I take it you would not have a brighter green, if it were a more grass-coloured green; it must be a blue green?—It should be a bluish green. I may say this, that, as far as I have observed a very small point of real green light cannot be distinguished at a certain distance from a blue light.

1897. On the question of seeing a green on a railway, you stated you had not anything to say in extension on that point?—I can only tell you that the greater amount of vapour or steam or spray on the surface, the harder the green light is to distinguish from "white" or yellow.

1898. You do not think it might be because it had an electric light behind it?—Which one?

1899. In the case of the one on land?—I do not think they often have the electric light.

1900. In some they have?—In some they have, but not in all.

1901. You do not think that would be the reason?—No, I do not think so.

(Professor Gotch.) There is no evidence that the glass is the same.

(Dr. Watson.) No.

(Professor Gotch.) It is not the Board of Trade glass.

1902. (Dr. Watson.) Then there is a point about the red looking so much brighter than the other. Do you mean by that that when you are close up you are on the point of losing sight of either of them?—No. I saw the red much clearer than the green one at a distance.

Dr. ARNOLD CHAPLIN called and examined.

1909. (Chairman.) You are medical inspector to the Peninsular and Oriental Steam Navigation Company?—That is so.

1910. I understand, from the outline of the evidence you have kindly given us, that all candidates for the post of junior officer are medically examined?—Yes.

1911. And tested both for form-vision and colour-vision by yourself?—Yes.

1912. Previous to being accepted?—Yes.

1913. And that is quite apart from the Board of Trade inspection?—Quite apart. It is for the Company's purpose entirely.

1914. At what age usually does that take place in the first instance?—The age is from 19 to about 23.

1915. And then is it repeated?—Only if there is some special reason for doing so.

1916. Unless there was some special defect which was perceived, they would not come before you again?—No, except in the case of illness. They all come before me, in the case of illness, to obtain a certificate of fitness for service again; and then one generally asks them to go through a few of the sight tests.

1917. That is to say, if you have them before you for general health, you like to put them through a vision test?—I prefer to look at their eyes too.

1918. Do you find many defective?—My experience has been rather good in that respect. I have not often found any one defective. If I have, it has generally been due to ill health, rather than to any special defect of the eyes themselves.

1919. On their second visit to you, do you sometimes disqualify them?—I cannot say I have had to do that yet. I was looking up the subject. I have not had an instance of that yet.

1920. How long does your experience extend?—Ten years.

1921. The man, who passes you first, passes you again later on, broadly speaking?—Yes.

1922. Both for form-vision and colour-vision?—That is so.

1923. You have hardly any exception?—I have had very few exceptions—hardly any at all.

1924. Then if we may take the nature of the test, taking the form-vision test first, you take the ordinary

1903. We were conducting some experiments last Saturday, and we found it was the other way round. We actually measured the distance, and we could see the green after the red had disappeared with an ordinary ship's light. I wondered whether it was an impression. Of course one's impression comes from the fact that, when the red does come in, it is much brighter; but, if you are a distance away, you see the green after the red has disappeared?—I have found it to be absolutely the opposite. It may be that the lights I saw were not so bright in the lamps themselves or that the glasses were particularly dull. They vary.

1904. Your observations were made when casually going about?—No; I went to the estuary alone and also with some of the captains, one especially, and, although my sight is keener than his, he always saw the green lights first. But I am absolutely without practice in this respect.

1905. (Chairman.) Would you like to show us your lantern?—Yes.

1906. Will you practise on some of us?—Yes.

1907. (Professor Gotch.) Would you mind practising upon Mr. Tallents?—Certainly. I always use a mirror for testing. It gives me an opportunity of having the examinee on one side of the lantern, while I am on the other.

1908. (Chairman.) Where do you have your examinee?—By my side, he can turn his disc with coloured lights to match the one I give him on my disc, and I can vary the size and the intensity of light.

(Mr. Tallents then went through the test with the witness, who stated that he had passed the test, so far as it went. The witness afterwards produced and explained various apparatus to the Committee.)

well-known sheets of type?—Yes, the ordinary well-known sheets. I change them frequently, and I test in the usual manner by the ordinary sheets of types. In fact, precisely in the way laid down in the instructions of the Board of Trade, with the exception of the distance at which candidates have to stand from the type.

1925. That differs?—Yes.

1926. Is your distance longer?—Much longer.

1927. So that it is a severer test?—Much more severe.

1928. Do you have the same sheets as the Board of Trade?—No. I forget what the name is—Snellen's types, I think.

1929. (Dr. Watson.) The point is rather this, the Board of Trade use the type at a certain distance. If you use the Board of Trade sheets at a longer distance, it will be a harder test; but if you use somebody else's at a longer distance, it may be the same?—I do not know what the Board of Trade ones are. I have always had Snellen's types.

1930. You use them at six metres?—Yes.

(Dr. Watson.) That is the same as the Board of Trade.

1931. (Chairman.) Do you demand the same standard as the Board of Trade?—Yes, as near as possible.

1932. What standard is that?—The first form of test is with both eyes; after that one eye is shielded and then the other eye; and if the other eye is practically the same, it is all right; but if there is a grievous defect in one eye, that means rejection.

1933. Are you familiar with the new Board of Trade test?—The recent one you mean?

1934. Yes?—No. It was only the week before last I examined a candidate, who had his certificate marked with the higher form-vision test. That is the first experience I have had of it.

1935. Because that demands what may roughly be called full vision from one eye and half vision from the other eye?—Yes. In this case the man had full vision with both eyes.

1936. Is your test more severe than the Board of Trade test, as I described it?—I think I would require rather more in both eyes.



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Dr. ARNOLD CHAPLIN.

[Continued.]

1937. (Dr. Watson.) More than the new or the old?—More than the old.

1938. (Mr. Parsons.) Have you not any definite line?—No, I have not any definite line. Of course, if a man is quite unable with one eye to make out the types, without going very near, I look upon that as bad; but if it is only a small amount, I take no notice of it, provided he can read quite well with both eyes.

1939. (Chairman.) With regard to colour-vision, you use the wool test?—Yes, precisely as laid down in the Board of Trade regulations.

1940. You have five test skeins?—Yes.

1941. Do you consider that is a good test on the whole?—I think it is a very good test. I must say I think it is a difficult test to do also.

1942. But if properly carried out?—If properly carried out, and with proper time at disposal, I think it is a good test.

1943. But, as a matter of fact, you do also frequently test with a lamp?—Yes. That is, I might say, really complementary to the other test.

1944. Do you put them practically all through the wool test?—Every one, yes.

1945. And then you sometimes have the other in addition?—Yes. I may say the lamp tests were really devised to represent as far as possible the lights on a ship at sea—the white light, the green light, and the red light. They can be extinguished and lighted again rapidly, and altered by means of shades in front of the lamp. If a man could not pass the wool test, I should take no more trouble with him over the other test.

1946. You regard that as a kind of test which, I suppose, the candidate would rather like?—Oh, he would like it, yes.

1947. But, as I understand, you would regard the wool test as a much more stringent and effective test from your point of view?—I think it is a much more stringent test. There are only two particulars with regard to the wool test that I have to object to. It is quite a good test, I think, and my experience with it has been satisfactory; but there are two objections I have to it, which are not after all very important, but still they are objections.

1948. One is that you cannot keep the colours clean?—It is very difficult indeed.

1949. And the other is, the colours tend to fade?—Yes, even if kept carefully closed, I know they fade.

1950. But, apart from that, if a man fails in the wool test, you would not take the trouble to put him through the lamp test?—No, because, as I say, I do not think the lamp test, as I use it, is, strictly speaking, a good test for colour-vision; it is merely a test for his readiness in picking out a light quickly at sea, or something of that kind. He would have to be sound in colour-vision before I should put him to that test.

1951. Have you had cases of this sort, of men who have passed the wool test, and have failed markedly in the lamp test?—No, and I think, as I have said, it would be impossible for a man to do so—quite impossible to fail with the lamp test, if he passed the wool test properly. I do not see how he could.

1952. You have not come across cases?—No, I have never come across cases.

1953. Then I gather that you can recall only three cases, in which a candidate, who had passed the colour-vision test of the Board of Trade, failed to pass your test?—That has been so; only three cases of which I have a record.

1954. Practically all of them will have been before the Board of Trade, before they come to you?—Oh, yes; they have all of them passed the Board of Trade test, both for form-vision and for colour-vision. They cannot come into the Company, until they have their second mate's certificate.

1955. And this is an extra security on the part of the Company?—Simply on the part of the Company.

1956. One of these cases you had was a very bad one?—Yes, a very bad one; it was a very bad state of colour defect. I have often found the form-vision not up to the mark, but in regard to colour-vision, I think you will see on reference to my summary, I saw only three instances of colour-vision defect, after they had

passed the Board of Trade test. That would be dealing with some three or four hundred cases.

1957. Do you think it is at all possible that the bad case may have been due to some disease?—I do not think so, because I had the man before me on more than one occasion, and he was not ill in any shape or way.

1958. Do you think by some means or other he had flaked through the Board of Trade test?—I can only look at it as a fluke, because it was a very bad case. I do not know at all how it happened. It was quite an impossible case.

1959. In form-vision have you failed a certain number?—Yes, I have failed a certain number. I would like to qualify that by this statement, that a good many of those failures were due to the fact that the health was not quite good, but after a time the form-vision became quite all right again.

1960. I think you give them a second chance?—Yes, if I think there is some possibility of their getting all right again, I say, "Go away, and come up in a month's time, and I will have a look at you again." I have known men, who have not satisfied me in form-vision, go away and come back and do quite well.

1961. Have you any statistics of the number who, during the 10 years, have been finally failed in form-vision by yourself?—I have not any complete statistics, but I was looking up the causes of rejection, and whereas the colour-vision has amounted to three only, the others would be somewhere between 10 and 20; but not a large proportion in any case. I would like to say this, that when I have rejected a man for form-vision, and have told him he can come up again, sometimes he has not troubled to come up again; so that, of course, I do not know what has happened, or whether he would pass or not.

1962. You are obliged to call him a failure?—Yes; but judging by the men who have come up again, I think, possibly, he would have been able to pass. It is rather difficult to give you the percentage of rejections in form-vision, because, as I say, when there is some little defect, possibly the man goes to some other company and takes service there, so that I do not know what the final result is.

1963. Your general opinion is in favour of a pretty stringent test for form-vision?—Yes.

1964. I gather that you think that the more rapid rate at which ships travel makes it more imperative?—Yes, I think so.

1965. You feel clear about that?—Yes, I do feel very clear about that.

1966. You think it has made a real difference?—I do. I think it has made a difference.

1967. And do you think that is the general view on board ship?—Well, I have heard a good many people say, that they would like to be able to sight things rapidly a long way off—buoys, for instance, and various other objects.

1968. You think a man, who had only half form-vision, we will say, in both eyes, is not an effective person?—I should not say he was effective.

1969. I gather, from the last words in your outline, after the criticism which you have already given us of the wool test, that you would prefer the lamp test?—I have not made that quite clear. The reason I prefer the lamp test is, because I think possibly it might be more easily applied. I think the wool test requires an enormous amount of care, and I think possibly the work would be got through in a quicker way with an efficient lamp test.

1970. It is not because you do not think the wool test is perfectly sound at its best?—No. My experience with the wool test at its best, with time, is that it is quite a sound test. As to whether it is a very stringent test, I should like to say that I think it a very stringent test too.

1971. It wants to be conducted under the best conditions?—Under the best conditions; and I would like to say, I think it always requires a man with a certain amount of expert knowledge in conducting it.

1972. I see that. You think the lamp test is more easily conducted by an average man?—Yes.

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Dr. ARNOLD CHAPLIN.

[Continued.]

1973. The Holmgren test wants a good deal of tact and understanding, as to how to handle a candidate?—That is so. One has often thought, "Well, if I had not been quite so rapid, or had interfered a little more, the man would have done better, perhaps, with the wool test."

1974. The view of the company with regard to its own special method of re-examination is, I suppose, justified on the whole by your experience?—I think so, yes.

1975. I see you say you re-examine the officers as occasion arises?—Yes. That referred to the question of illness.

1976. The case you mentioned just now?—Yes. I should like to mention a point with regard to commanders. Supposing a commander is ill, I do not look at his eyes.

1977. You do not?—I do not look at a commander's eyes. I have never done so, unless it was a special question of eye disease.

1978. Have you any opinion as to the use of spectacles by officers?—I do not think glasses should be used.

1979. You do not?—No.

1980. What is your ground for thinking so?—Well, I use glasses myself for reading, and I know the difficulty, in the first place, of keeping the glasses in the proper position, and, in the second place, of keeping the glasses quite clean. I can well understand, there might be many conditions, where the damp and mist and fog, and so on, might very soon dim the glasses.

1981. Is the general view of the company against the use of glasses by officers?—Yes, against it.

1982. Are they prohibited?—They are prohibited. I believe. No officer on board ship, except a surgeon and purser, may wear glasses while on duty.

1983. Except the surgeon and purser?—Yes. That is on duty, of course.

1984. (Mr. Nettleship.) For long distance?—They are not allowed to use glasses, while on duty, for long distance.

1985. (Chairman.) Might they use glasses to look at the chart?—Oh, yes. I suppose many do. That is another point. I am speaking of when on the bridge—when on the bridge and on duty.

1986. Do you consider that prohibition is thoroughly justified?—I do.

1987. Because a certain number of your older officers would have their vision improved if they could use their glasses?—I quite admit that, but then I was not speaking so much of the older officer. My point was that we should very soon have a large number of young officers coming in straight away, with defects corrected by glasses.

1988. Trying to pass your tests?—Yes.

1989. You think that would be unsatisfactory?—I do. I think it would be most unsatisfactory.

1990. But the older officers might be put in a different class?—Yes. I expect that possibly the majority of our commanders, at the age of 50 or over 50, use glasses for reading and looking at charts; I have no doubt they do. I have never tested a commander's eyesight yet, unless I have been requested to do so.

1991. I understand the general prohibition holds with regard to them, that glasses should not be worn on the bridge?—Yes, I believe so.

1992. That is the rule of the service?—Yes, that is the rule of the service, that glasses should not be worn.

1993. (Mr. Norman Hill.) Can you give us any idea of the number of officers who pass through your

The witness withdrew.

Mr. C. DEVEREUX MARSHALL, F.R.C.S., called and examined.

2010. (Chairman.) I understand you have taken a good deal of interest in this matter?—Yes.

2011. You are a yachtsman, as well as a scientific man?—Yes; I have spent a good deal of time at sea in one way and another.

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hands in the course of a year?—Do you mean new candidates?

1994. How many examinations, roughly?—From 30 to 40, I should say.

1995. Of course, you always have a good many more applicants on your books for the position of officers than you have vacancies?—That is so; although it has not been so during the last two or three years, because there has been a dearth of junior officers.

1996. There has been a distinct falling off?—Oh, yes; there has been a dearth of junior officers for the last two or three years.

1997. But you are still able to keep up your own standard?—Oh, yes, quite able. There are enough. I will not say we ever have a long list of junior officers waiting to come into the service.

1998. There used to be a long list?—Yes, I believe there used to be a very long list.

1999. Now, there is always a list?—Yes, there is a list, but I think officers come into the service very quickly, possibly within a week or two or a month of the time they have passed.

2000. As I understand it, with regard to form-vision, you insist that a man should have full normal vision with both his eyes as shown by the lettering?—Yes.

2001. And if he has got that beyond question, your requirements for each individual eye are not so strict?—They are not so strict as for both eyes together.

2002. Nothing like so strict?—No. I would let go a defect in one eye, unless it was very grievous.

2003. Would you let a one-eyed man go?—No. I would not. I had one, but I rejected him.

2004. What would the one eye have to come up to?—The one eye would have to be very nearly first-class vision.

2005. It would have to be very near?—Yes, but I would not take a one-eyed man into the service.

2006. Have you had any cases brought before you, in which casualties have happened to the ship, where a question has been raised as to the eyesight of the officer or of the look-out man?—No, not one.

2007. Or ever heard of one?—I have heard of one. I think, before I had anything to do with the company, but I never had anything to do with it. In the last ten or twelve years I have had nothing of that sort brought to my notice. I might mention there was a case of a pilot in Australia, who was in charge of a ship called "The Australia," which went on the rocks at Point Nepean. I believe there was a question there about his sight, but, as a matter of fact, the reason of the ship going on the rocks, I believe, had nothing to do with that at all.

2008. (Captain Golding.) You say you do not examine a commander's eyesight; but there was one commander who retired on account of eyesight, I think. I will hand you his name; I would rather not mention it. He has retired. Was that disease? (The name was handed to the witness.)—I said except there is some special disease I do not examine them. In this case, which you are mentioning, the commander had a very severe attack of iritis. He was treated for some time, and it did not get well, and of course it was impossible for him to go to sea. His eyesight was so bad, that he could read no print of any kind, but I am glad to say that now he is very much better.

2009. It was disease in that case?—Yes. I said specially that in the case of disease I should have to do so, but in the ordinary course, if I see a commander on sick leave, I do not ask him to go through the test.

(Chairman.) We are very much obliged to you for your evidence.

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Mr. C. DEVEREUX MARSHALL, F.R.C.S.

[Continued.]

know that they have made a mistake, and for the next few minutes at least they will not make the same mistake again.

2013. Then also of course he must know the colour of any flag which may be hoisted?—Quite.

2014. And the test should be delicate enough to enable the examiner to reject a candidate, who makes one really bad mistake in the naming of a colour?—Yes, because it seems to me, if a person sees a light and gives a totally wrong name to it, his vision would be sufficiently bad to cause his rejection, and he would probably do the same thing again under serious conditions.

2015. From that point of view you think that what might be called the match test, matching colours or lights, is untrustworthy?—I do.

2016. And, from that point of view, you would condemn the Holmgren test?—Yes.

2017. I have no doubt you have put a good many people through the Holmgren test?—Yes, a good many.

2018. Have you found after they have been through that, that you were able to prove colour-blindness?—Yes, certainly.

2019. How is it they managed to get through it? What is your view of the method?—My view is that certain people, who have no very clear idea of what colours are, will be able to put two objects together, which are of the same colour, without really knowing what they are; they go by amount of shade. Take, for instance, the green wool. They know by the colour, and by the amount of light it reflects, that it is probably green; and although they may not see it as such, they may be quite capable of putting other colours together, which look very much like it, especially after they have had practice in it.

2020. You think, after they have been practised in it, even a skilled examiner may not be able to detect their faultiness?—I do, certainly.

2021. And you think the same people, who get through like that, when they are faced with lamps at night at a distance, would break down?—Yes, I am certain those people would.

2022. And it is from that point of view that you think the lantern test is really more certain and more effective?—Quite. Another thing is, of course, it is the correct naming of colours, which is always necessary in their particular work.

2023. When they get to sea, they have to see the light?—Yes; they have to see that it is a red light, or a green light, or a yellow light, and act accordingly.

2024. Then, as regards the lantern, have you examined a good many?—Yes, I have seen a great many lanterns which have been in use, and the fault which so many of them have is, that they have only a few slides, and those are very often not capable of being modified; that is to say, you can run up a red light, a green light, a yellow light, and a blue light perhaps, and then you cannot modify those lights, and very often a person who has seen that lantern before will know, by the amount of illumination, how much light is coming through, and in that way will probably be able to name the colours correctly.

2025. They may be passed through in the same order?—They may be passed through in the same order and the same amount of light. These people are sometimes very sharp in detecting the amount of light which comes through; they have seen it before, and know how much it is. Whereas in the ordinary avocation of a seaman he sees a light in an unknown or variable atmosphere; he does not know how strong it is; he does not know whether it is a weak light close to him or a strong light far away, and he has to judge that.

2026. And you think that a good lantern ought to regulate the amount of light passing through?—I do.

2027. And ought to be able to vary the colours as readily and easily as possible?—Yes. I think you ought to be able to put up dark shades, and dark-coloured glasses in front, so as to diminish the amount coming through, and modify it accordingly.

2028. And those conditions are fulfilled by Dr. Edridge Green's lantern?—Yes, quite.

2029. What do you think about the spectroscope test?—I think the spectroscope test—I refer, for example, to the spectrometer used by Dr. Edridge Green—is the most delicate that there is. As spectral light is the fundamental origin of colour, there we have them. By that means you can tell whether a person sees all the colours he ought in the spectroscope, and the relative positions which they occupy in that spectrum.

2030. Of course a test of that character could only be carried out in a laboratory?—Yes; it is decidedly complicated; it takes some time, and from a practical point of view I think it is seldom necessary.

2031. But you would approve the present arrangement, by which that is one of the final tests in all cases of appeal?—Oh, I should, certainly.

2032. You think that is satisfactory?—I think the spectroscope is distinctly satisfactory.

2033. I gather that the lantern test—I presume effectively carried out, as you have described it—is, in your opinion, a pretty effective bar to a dangerous colour-blind man?—I do.

2034. That is to say, you have not seen a colour-blind man who has passed a good lantern test?—Never.

2035. Does that mean that a good lantern test is fairly frequently used in your ordinary practice?—Yes, quite.

2036. You have put a good many through?—Yes, a great many.

2037. And those whom you have put through what you consider a proper test, you believe to be thoroughly safe?—I do.

2038. Whereas you think some of these people might have passed the wool test?—I do, certainly.

2039. Then, both for form-vision and colour-vision you want a specially skilled examiner; I presume you would say a medical man?—I should. I think it is decidedly important that that should be the case—a person who is used to examining eyes more particularly.

2040. Do you feel that specially about the form-vision test?—Not so much perhaps as the colour-test, because one has to draw a hard and fast line. The rules give you that a man must see at least so much, and it is fairly easy for anyone to arrive at a conclusion as to whether he sees it or whether he does not. In a delicate thing like colours, I do not think it is easy.

2041. You want more skill?—Certainly.

2042. Therefore, your view would be, if it were possible, that for the present examiners employed by the Board of Trade, there should be substituted people with more skill?—I should certainly say so.

2043. (Mr. Nettleship.) I suppose you really mean, that your experience would be, that every colour-blind person you have come across does make a mistake in the lantern test straight away?—Every dangerous colour-blind person would, certainly.

2044. And if he does not make a mistake in the lantern test straight away, he is not dangerous, that is the point?—Yes.

2045. That is your practical conclusion, I suppose?—Yes.

2046. How does that fit in with the fact that colour-blind persons are quite well known to name the colours rightly, although they are colour-blind—to make mistakes at times and not at other times? Why should it always happen that you should always hit him off the first time?—That is rather taking it the other way round.

2047. I want to look at it the other way round?—What I meant was that if a person made a gross error, I should not mind how many times he corrected that error; I should consider he was not a safe person.

2048. But supposing he did not make it the first time, are you contented?—Oh, no; I should give him a lengthy examination.

2049. If you go on long enough you will spot him?—Yes, I believe so.

2050. Without wools at all?—Yes.

2051. Have you seen a good many pass the wools and fail with the lantern?—Oh, yes.

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[Continued.]

2052. You could put your hands on a good many records, perhaps?—Well, a case occurred only last week at Moorfields. I have not his name, and I do not know that I could put my hands on any of them.

2053. There are very different statements made about that. Some say it is rare, and others say that it is very common, and it is difficult to get at the facts?—This particular individual I saw had been examined considerably. I knew absolutely nothing whatever about him. He had been examined by a member of the staff and various clinical assistants and they had spent a lot of time over him. One of the men came to me and said, "Will you look at a case of colour-blindness?" I said, "Yes. Where is the lantern?" He said, "Oh, I do not know." He went and got it. I put up an orange-coloured light and the man said it was green. That was the first I put up. That person had been passed as being correct by the Holmgren test.

2054. Then why did your clinical assistant say he was colour-blind?—I do not know what he originally came to the hospital for. I had not seen the patient before, but the reason why the assistant was suspicious was, because he had touched some other colour, I think, instead of blue. That made him not quite certain about him. However, the ultimate result was, that he was passed by the Holmgren test as being correct. The first light I happened to show him was an orange one, and he called it green.

2055. He had given some suspicion in the wool test, I suppose?—Presumably.

The witness withdrew.

Adjourned to Friday next at 3 o'clock.

## TENTH DAY.

Friday, 9th December 1910.

PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).

Sir ARTHUR RÜCKER.  
Mr. RAYMOND BECK.  
Captain THOMAS BOLDING.  
Professor GOTCH, F.R.S.

Mr. EDWARD NETTLESHIP, F.R.C.S.  
Mr. J. H. PARSONS, F.R.C.S.  
Professor J. H. POYNTING, F.R.S.

Dr. WILLIAM WATSON, F.R.S., } Secretaries.  
Mr. S. G. TALLENTS, }

A Gentleman called and examined.

2063. (Chairman.) We understand you have had a good deal of experience in going about on the sea, and that you are willing to tell us your own experience in connection with the question of colour blindness?—Yes.

2064. Perhaps you will kindly relate any experience which you think will be useful to us. You know the subject of our inquiry; will you take it in your own way?—As regards the visibility of lights at sea in relation to their colour, I have always found great difficulty in distinguishing between the green and the red lights at their limit of visibility, which, for bow lights, is supposed to be two miles. I have had no difficulty, or comparatively little difficulty, in distinguishing when I got to within a mile or something under; but whether that was due to distinguishing the colour, or distinguishing that one light was darker than the other, I should be sorry to say.

2065. That is to say, you cannot tell whether the luminosity of one is greater than the other, for certain?—Not for certain, no.

2066. You think that might be a reason which helped you to make the distinction?—That is so. When it is a case of a single light—and a single light is the one which worries people most at sea—I have no

2056. (Mr. Parsons.) Did you put him through the wool test?—No.

2057. Do you generally put them through the wool test?—Very often. This case did not belong to me.

2058. But as a general rule?—As a general rule, yes, I go through everything I can.

2059. Through the wool before the lantern, or vice versa?—Not necessarily the wool before the lantern.

2060. Supposing an ophthalmic surgeon had the testing, would you still retain an appeal?—There is no reason why they should not be appealed from. An appeal is always a good thing.

2061. How would you arrange the examination? Suppose they were ophthalmic surgeons, would you control their examination, or give them free scope to do what they liked?—I have no doubt there would have to be certain rules and regulations got out for them, but I think that a person skilled in the examination of the eye would be able to detect all cases of defective colour-vision. But I should not object to an appeal. I should not mind there being an appeal in a case which had passed or had not passed.

2062. (Mr. Nettleship.) Have you seen any cases of central scotoma for colours with full central form-vision?—No. I have heard of them, but I have never seen one.

(Chairman.) We are very much obliged to you for your evidence.

means of telling what that light is until I get it fairly close.

2067. When you see two lights approaching you have an opportunity?—When you see two lights approaching, when you see them coming straight at you, you naturally do not look at the colour, because you know that it must be a sailing ship coming on to you; but when you see a single light, which may be either side of a sailing ship, or a pilot vessel, or a fishing vessel, it may be almost anything.

2068. That relates to lightships, and so forth?—With regard to lighthouses and lightships, anything which you might be expecting to see on a certain fixed bearing at a certain time, by your dead reckoning or by your own observations, by means of binoculars, and looking out on that particular bearing you would pick out possibly before you would do so with the naked eye; but, in the ordinary course of events, I do not think you would pick up an ordinary light with binoculars or any other form of glass as well as with the naked eye. With regard to lighthouses, you are not worried with a colour, because nearly every lighthouse has a distinct signal, either occulting or revolving.

2069. You are able to discount the colour when you are looking at it?—Yes; in cases of that sort. Colour



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A GENTLEMAN.

[Continued.]

blindness worries me chiefly where it is a case of a single light.

2070. An unknown light?—Yes; I do not know what it is at all.

2071. Have you come to the conclusion from your experience that colour blindness may be for anybody in command of a ship a very grave danger?—Yes, most certainly.

2072. If you could emphasise that or give us the reasons for it, that would be a most important point?—I think the case I told you of just now is a case in point, that if a man cannot distinguish colours, he comes on a sailing ship possibly at very close quarters in thick weather; and if there is only one light showing, if he does not know which it is, he cannot tell which tack she is on, and he cannot tell how to alter his course to avoid her.

2073. Have you yourself as a matter of fact undergone any kind of test for vision?—I went through the usual test entering the Service in 1889. I think it is really different now; I do not know.

2074. But, as a matter of fact, you passed whatever test you had to deal with all right?—Yes.

2075. You do not suppose your vision has altered since that time?—No, I have no reason for supposing so.

2076. Are you all right with regard to form vision, as far as you know?—Yes.

2077. (*Mr. Nettleship.*) Do you remember what sort of test you went through?—As far as I remember they gave me a bundle of wools, not to match colours, but they asked me what colour a certain wool was. I suppose, if I called a purple a blue, it was near enough for their purpose. Then, as far as I remember, the examiner had a pocketful of small flags. He put one into his right hand parcel and asked me what colour it was. Meanwhile the next one was waiting, and one had a good chance to study it.

2078. Had you any difficulty in passing that test?—No, none at all.

2079. Would it be fair to ask, whether you have any anecdote, of your own difficulties at sea; I mean a specific instance which you can give us of having been in any difficulty, or having to get somebody else to read for you?—During my time as a watch-keeping officer, which was only for a year—and, of course, at various odd times since—I have never trusted myself about a light at all. If I have been on the bridge and seen a light I have usually seen it a good deal before anybody else; and when other people have picked it up, I have never trusted myself as to what it was.

2080. As to what its colour was?—No.

2081. (*Professor Gotch.*) Do you find it makes any difference if you use binoculars, when you cannot detect the colour of a light?—Yes; once I had found a light, if I could steady a pair of binoculars on it, it would make a difference to me, because I presume it is the same thing as bringing the light closer; but I have never tried to find a light with binoculars.

2082. Would it make a difference to your being able to distinguish the colour?—Yes, it would. It brings the light closer to me.

2083. As a matter of fact, have you found that? Have you been able to distinguish the colour through binoculars?—Yes. But the circumstances under which you can do that are very rare. When you think of a small light in a fishing vessel dancing about all over the place, and the ship itself dancing, you will see that you cannot steady binoculars on a light for a long time.

2084. Not long enough for decision?—Not long enough to determine what the light is. In the case of a lighthouse, or some big light like that, it is a different matter—where you have a beam.

2085. I imagine, from what you say, that even when a light comes nearer you do not make up your mind promptly as to the colour?—No.

2086. (*Captain Golding.*) Although you say you have a difficulty in distinguishing the colour of the light at two miles, have you not also a difficulty when you get to closer range?—No.

2087. You stated that, at a mile, you began to be more certain what it is; you say that at half a mile you would be absolutely certain what the colour was?—Well, after the experiences I have gone through recently, I should not; no.

2088. Your doubt would last till the last moment really?—Yes. But one associates a good many things with a distinguishing colour at sea. By the time the light had got within half a mile of me, I should know what the vessel was, and where she was going, whether she had a light or not. Therefore, whatever light she was showing, I should know what it was.

2089. You draw deductions from other things?—Yes.

2090. (*Mr. Raymond Beck.*) You told us that you passed the test in 1889?—December, 1889.

2091. Could you tell us when you first were aware of your difficulty in distinguishing lights: was it in the first year or two, or is it only just recently that it has come upon you?—Well, I think I might almost say at once; but I should not have had it brought home to me in the same way, until I became an officer responsible for the ship. As midshipman of the bridge, as I was for five years, I did not mind what a light was; the officer of the watch was looking out for that.

2092. You do not remember an instance of making a mistake?—No.

2093. If you see at sea one light, you know, probably, whether it is white, red, or green: do you think you would be more likely to make a mistake over the green or the red light, or are they all equally muddled up? I only wanted to know whether you have had any experience?—I think I should be most likely to make a mistake with the green light.

(*Chairman.*) We are very much obliged to you for your evidence.

The witness withdrew.

Captain GEORGE PEARL CUTTING called and examined.

2094. (*Chairman.*) I understand you have been appointed by the North of England Steamship Owners' Association to give evidence before us to-day?—That is so.

2095. You are a Member of the Committee of Management of that body?—Yes.

2096. What is the amount of tonnage that your Association represents?—About three-quarters of a million.

2097. You are also a Member of the Local Marine Board at South Shields?—Yes.

2098. And the Tyne Pilotage Commission?—Yes.

2099. You live in one of those ports?—I live at South Shields.

2100. You have been in commission about five years as an officer of various grades, and 20 years as a Commander?—Yes, in sail and steam.

2101. In what trades principally?—Mostly in the Baltic, the Mediterranean, and the Atlantic trade; very little south of the Line.

2102. For some years you yourself have been a managing shipowner?—About 20 years.

2103. You are well acquainted with the subject which we are deputed to deal with, by the Board of Trade?—Yes, I have taken an interest in it.

2104. And one of the first matters mentioned in your outline of evidence is the question, whether there are any instances within your knowledge of mistakes having been made in the reading of lights at sea, which have been due to defective form-vision or colour-vision?—None that I am aware of; none during my period, which have come under my observation at all. There was one particular case I might cite, of a young man being near-sighted. He was a sailor, and the others in

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the fore-castle seemed to find it out and advised me about it, and he was never allowed to go on the look-out.

2105. He was defective in form-vision?—Well, in distance.

2106. Had he passed any test?—No, he had no certificate.

2107. He was not one of the principal responsible persons on the ship?—No.

2108. Was he occasionally employed on the look-out?—He was, the first part of the voyage, but never after I got to know he was deficient in vision.

2109. I presume there is no doubt that that kind of defective form-vision is dangerous—a defect such as that young man had?—Oh, yes; it is dangerous, there is no doubt, if you get it with officers; but the officers are all tested.

2110. Yes; I was only making the point that there is an amount of defective form-vision, such as there was in that young man, which must be kept out from responsible persons?—Yes.

2111. Do you know of any cases in which a man suffering from defective vision, without making a mistake, has found difficulty in reading signals?—None to my knowledge.

2112. Are you aware of any tests which individual members require their officers to undergo, or individual companies require their officers to undergo, which are not imposed by the Board of Trade?—There are only two companies which I have heard of, that is, the Shaw, Savill and another one.

2113. You do not happen to be aware of any tests of that character which take place in South Shields?—None are applied by any shipowners in the North of England, that I am aware of.

2114. There are a certain number of companies at Liverpool and elsewhere which do so, but they have not come under your cognizance?—No.

2115. As a rule the Board of Trade tests are held to be sufficient, I suppose?—I do not think they go far enough.

2116. You do not think the Board of Trade tests go far enough?—I do not think they go far enough in practicability.

2117. You have seen them at work, and perhaps you would tell us really what you think about them, as to their efficiency?—I think a man might pass the tests that he goes through before the Board of Trade examiner; but if you put him upon the river or at sea on a hazy night, I think many men would not pass, when they came to the real test.

2118. Many would be defective in some way?—Defective in some way, yes.

2119. That is to say, the test would not catch those men?—I do not think it does. My own impression is, it is a bigger test to take a man on the river or on the sea, and let him see the colour of the lights there, and let him describe the colour of the lights.

2120. Are you thinking of both defective form-vision and of colour?—Of colour.

2121. You are thinking now principally of colour?—Yes, principally of colour.

2122. Would you say, as far as you know, that the test of ordinary sight, apart from colour, is fairly satisfactory?—Oh, yes.

2123. You are really thinking now of colour?—Yes.

2124. You think a man might pass through the wool test in a room?—Yes.

2125. And yet, when you take him out to sea or on the river, he might fail?—With a haze over a bright light, he might take it to be green.

2126. And you think that would be due to some defect of his own sight?—Yes. My own impression is it would be more satisfactory, if every man was tested either at sea or on the river.

2127. Do you think that would be practicable in each locality?—Oh, I think so.

2128. Could you do that at South Shields?—We could do it there; yes, most decidedly we could.

2129. Of course you must do it in some way, so that a man could not, by successful guessing and knowing pretty well where the lights ought to be and

so on, baffle the examiners?—The bulk of the men, who pass in the North of England, belong about there; but there are a good many who come from other places to pass in the North-East coast ports.

2130. Do you think you could apply a test in colour, say, at sea, which a man could not get round by his familiarity with the place?—Yes, most decidedly. There are vessels coming along, and you can ask a man: "What light is that vessel showing?" and he would say whether it was mast-head and green, or mast-head and red; or, if the mast-head light and both side lights were in view, he would say he saw the mast-head light and both side lights.

2131. And you think that, on any ordinary night, anybody coming to be tested could be taken out in that way?—Oh, yes, I think so. There would be a slight expense about it; you would have to hire a tug, if you had not got something of that sort, and take the man out.

2132. Can you tell me about the test employed in the examination of pilots?—On the River Tyne?

2133. Yes?—Yes, they are tested somewhat similarly to the way in which you test them for the Board of Trade.

2134. It is not more severe?—No, not more severe.

2135. Have there been any complaints made by any of those examined?—No, I think not; not that I am aware of. But in speaking to the Superintendent, before I came here, he mentioned the case of his brother-in-law, who had been rejected. He was trying for a certificate by the Board of Trade, and he had been rejected in the North; he was sent to London and was examined by Sir William Abney and passed.

2136. Does not that mean that he was sent up on appeal to London?—Yes, it might be so.

2137. And when he got before Sir William Abney in the final appeal, he was passed?—Yes, I believe that is so.

2138. That is not an exceptional case, you know?—No.

2139. Supposing there is any doubt in the mind of the local examiner, he sends him up to London?—Yes.

2140. And then if, on a fuller and more detailed examination, he is found on the whole, satisfactory, he will pass?—That is the only information I got from the Tyne Commission.

2141. With reference to collisions, of course a good many collisions have come under your notice in different forms: has any collision ever occurred, which you thought had anything to do with a mistake in the colour of the light?—No, none.

2142. (*Mr. Raymond Beck.*) I think you told us that, in your experience, you have not come across a man who, as far as you know, was defective in colour-vision, not even in being doubtful as to the colour when he has picked up a light?—Only this one particular case. It is a good many years ago, when I was on a sailing ship with this young man whom I mentioned.

2143. (*Captain Golding.*) You know that the form-vision test is to be strengthened up in 1914, and it will be compulsory for all candidates then to pass an increased test for form vision, full normal vision in one eye and half normal vision in the other?—Yes.

2144. Do you think, considering the increased speed of steam vessels, that that will be too stiff a test?—No.

2145. Do you think it is stiff enough?—That is what I have said all along.

2146. I am speaking of form-vision—distant vision. Consider the case of two vessels of twenty-two knot speed whose combined speed will cover nearly a mile a minute, do you think half-normal vision in one eye and full vision in the other is stiff enough?—I think it is stiff enough.

2147. But you do not think it is too stiff?—I do not think it is too stiff.

2148. (*Professor Gotch.*) Do you think officers should ever be allowed to use glasses to help their vision in searching for lights? I do not mean binoculars, but spectacles?—No, I would not allow them to use spectacles.

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2149. But you always allow them to use binoculars?—Yes.

2150. And you have binoculars for the purpose?—Yes, for that purpose.

2151. (Mr. Parsons.) You said that this practical test on the river would find out people, who had been passed by the Board of Trade. Do you think the opposite is true, that people who had failed the Board of Trade would pass that test?—I think that it would give a man a chance, who has not been in a draper's shop. You will excuse me putting it in that way. A young lad, who has not many sisters brought up with him, will not know the shades of green and red, that a young man will, who has been brought up with a family of sisters. He goes to sea, as I did when I was about twelve years of age, and he has not the opportunity of learning the different shades of wool. I think it would give him a chance to test him, whether he knew the colour of lights.

2152. (Sir Arthur Rücker.) With regard to the practical test that you have suggested, there would be real difficulties in carrying it out. You said you would have to take several men together on the tug. They would be all standing together and seeing the same light, and obviously one man would pass it on to another. Would it not be very difficult to make such a test a real one?—That could be easily avoided. You would keep so many men aft on the tug, and take one with you, and ask him what sort of a light it was. Of course you would not shout, so that the other men at the after end of the boat would hear you. When you got his reply, you would send him away and bring another man.

2153. You would go out for an hour or two. I suppose?—Yes.

2154. How many lights would you be likely to see. It would vary very much, I suppose?—In the evening you might see, perhaps, seven or eight steamers going out, and seven or eight coming in. In addition to that, there might be thirty or forty tug boats going about and a pilot cutter.

2155. If they were just going out or coming in, would he not, by seeing what they were doing, tell what the light was? If they were coming in, would not they be almost certain to show the opposite light to what they would in going out?—Yes, but they would not show them both at one time, probably. You could not tell at night-time which light it was.

2156. You could not make a good guess by the position merely, you mean?—That is so.

2157. (Chairman.) But the lights are always in the same order?—Yes, always in the same order. But the moment you go outside of the piers, you cannot tell. Inside the piers you could tell, because they are going up and down the channel; but the moment you get

outside the piers, then you could not tell, until you saw the light, which way the vessel was going at night-time. She might be going up North; she might be bound to Scotland; she might be going up to the Thames, away to the south, or going across to the Baltic.

2158. (Sir Arthur Rücker.) If a man saw the way the light travelled, would not that help him?—I think you would want him to pick it out, before he could tell that.

2159. Do you think there is any objection to having a similar test to that in a room, that is to say, showing lights which can be varied in intensity and size, and so on, having all these conditions imitated as closely as possible?—I do not think it would be quite the same thing. You could not get a mist, for example.

2160. Well, we could make an attempt to imitate that?—I have no doubt you could make an attempt.

2161. (Chairman.) With regard to the point about the fog and the mist, would you hold up your candidates, till you got a foggy night, and then take them out?—Oh, no; I think if we went at any time almost in the evening, for at least eight months in the year you would have a little mist.

2162. Enough for the purpose, you think?—Yes.

2163. (Captain Golding.) And smoke?—Yes.

2164. (Chairman.) If it happened to be a very clear night, the candidate you took out that night would have an advantage over others, who were taken out on a foggy night?—Yes, he would.

2165. One has to think of those things?—Yes, but, in a practical test, I really think we should give a man a chance, who has not been brought up in such a way as to have a draper's shop experience.

2166. You feel there is something about wools which is unfamiliar to men?—Yes, unfamiliar to seafaring men.

2167. Do you think that, supposing it was bits of hunting, you would feel in the same way? Is it the wool that you think they would be upset by? They are accustomed to look at things of different colours. Supposing there are a set of bits of hunting of various colours instead of wool, would you have the same objection?—I think there would be the same objection; there are so many different shades.

2168. You think it is confusing to them?—I think it is confusing to the men. I have seen some of them pick them out badly; and then, when they come back afterwards, when they have been a little more collected, they have picked them out far better.

2169. They get a bit nervous?—Yes.

2170. Your feeling is that some kind of outdoor test, if it can be managed, is desirable?—Yes, it would be desirable; that is my impression.

2171. I think I sum up your view very much in that; that is your principal point?—Yes.

The witness withdrew.

Dr. ANDREW FREELAND FERGUS called and examined.

2172. (Chairman.) I understand you have been in ophthalmic practice in the city of Glasgow for nearly 30 years, where you have been full surgeon to the Glasgow Eye Infirmary for 20 years?—Yes.

2173. And you are now the senior member of its staff?—Yes.

2174. For the last 15 years you have taught a very large number of the students passing through the University of Glasgow in the subject of ophthalmology?—Yes.

2175. And your class usually numbers about 50 students per annum?—Yes, on that subject.

2176. Amongst other things, as a young man you were for six months in Lord Kelvin's laboratory?—I was. As a young man I had a fairly good training in laboratory work. As an undergraduate, I was for six months in the laboratory of Lord Kelvin, and was for a year a class assistant to Professor John Gray McKendrick. After graduation I spent a considerable time in the physiological laboratory at Utrecht, and on my return to Glasgow I spent four years in the physical

laboratory of the Glasgow and West of Scotland Technical College. For a short period I gave courses of instruction on physics to medical students.

2177. I think you have had a good deal of experience in yachting at sea?—Yes, all my lifetime. I have for many years spent a great part of my leisure at sea, for the most part yachting in the Western Highlands. I have invariably been my own sailing-master, and I am acquainted with the ordinary navigational duties required for pilotage on the west coast of Scotland. From my earliest boyhood I have been in the habit of handling boats in the waters of the Firth of Clyde, but within the last 20 years have very frequently sailed the west coast of Scotland, going as far as Cape Wrath, Harris, and Stormoway. That has involved a great deal of night sailing in all conditions of weather and in all conditions of luminosity; and therefore I may claim to have some expert knowledge as a navigator, as well as some elementary training in physics and in the work of a physical laboratory. It seems to me there are at least four functions of vision,

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which are of importance to the navigator, namely:—(1) His power of distinguishing colours, (2) his visual acuteness, (3) his form-sense, (4) his light-sense.

2178. You distinguish between visual acuteness and the form-sense?—Yes, although these two terms are regarded as synonymous in all text books of ophthalmology, with which I am acquainted, and by all ophthalmic surgeons, with whom I have spoken on the subject. So far as it meets the views of the Committee, I should like to make a short statement on each of the four heads. About 15 years ago I published a paper in the Proceedings of the Philosophical Society of Glasgow, in which, I think, I conclusively proved that many colour-blind persons, as far as colour-sense is concerned, can navigate with safety. I have a copy of that paper here. I have never said, and I have never believed, that all colour-blind people are safe. I think, where there is a diminished light-sense, as well as a defective colour-sense, that probably the danger is great. I still adhere to the argument expressed in that paper, and have restated it in an article which appeared in the Glasgow Medical Journal for June of this year.

2179. When was your attention first drawn to colour-testing?—When I was in the laboratory of Donders, about the year 1882. Professor Donders was at that time engaged in an endeavour to prove the truth of the Young-Helmholtz theory of colour-vision, and a great part of my time was spent in working with him at this subject. One thing struck me very forcibly even at that time, and it was that a considerable number of people, who had passed quite satisfactorily the ordinary tests for colour-vision, came very badly to grief when they were tested with the differential spectroscope.

2180. (Professor Gotch.) What were the tests?—The tests were signal lights.

2181. What were they?—Ordinary railway red and green lights. That was before we had them in hand in the laboratory to pass those tests. By a mechanical arrangement, it was possible to make any portion of the lower spectrum of about the same luminosity as another portion of the upper one, so that the element of the difference of luminosity was largely eliminated. When this was done, a number of people, who had passed the ordinary tests, were pronounced to be colour-blind. These experiments convinced me even then, that the pigment is not the sole factor in estimating colour, for it was quite obvious that people, who had Daltonism, had been perfectly able to distinguish green, red and clear lights as used in everyday life. The question which seemed to be a pressing one was the limits of safety as regards Daltonism. The safety of the general public in travelling by sea or land is, of course, paramount; but on the other hand there was the very pressing question, more urgent in those days than it is now, as to injustice being done to men who had gone to sea in good faith, having passed the Board of Trade examination and received tickets of competency. All of a sudden the Board of Trade turned round and said, that their own examinations had not been sufficient, and that these men must retire from the profession. I could not help thinking that, if the amount of this defect which they possessed was not present to a dangerous degree, they were being very hardly dealt with, and in any case should be compensated.

2182. (Sir Arthur Rücker (in the chair).) You hold no theory of colour perception, I think?—That is so, and in my opinion a mistake was made in accepting the Young-Helmholtz theory. In the report of the Committee of the Royal Society, as well as Sir William Abney's monograph, we read of such things as red-blindness and green-blindness and violet-blindness. Now the plain fact is, that these are all supposititious conditions, about which no one living knows anything. One thing is pretty clear and that is, the experiments of Mr. Burch have tolerably well disproved the so-called theory of Hering, but they have not confirmed the Young-Helmholtz theory, in so far as he predicates the existence of four so-called primary colour sensations. For me, a colour is a mental condition, closely allied to a certain wave frequency. I predicate nothing more. I have Sir William Abney's book here.

2183. I think we are acquainted with his writings?—I will refer to that with your permission. One important reason why I do not accept Sir William Abney's book as authoritative, is that, if his diagrams represent fact, then colour-blind people are all but universally safe. There is the diagram to which I refer (*handing book to Sir Arthur Rücker*). The port light of a vessel is taken from about the C line of the spectrum, and the starboard light is taken from between E and F. In Captain Abney's diagrams for green-blindness and red-blindness and violet-blindness, these two portions of the several spectra differ absolutely from each other, and consequently, if they be true, a green-blind man, a red-blind man, and a violet-blind man are absolutely safe for purposes of navigation. I produce a copy of Sir William Abney's diagram to show the truth of what I mean. In addition to the case of Trattles, I have come across several persons who are colour-blind, and who have navigated or been on the look-out for many years.

2184. Are you able to give details in regard to this?—Yes. In my paper already referred to, one case is given in detail. I have found others. Indeed, the Board of Trade statistics, which were supplied to me for some years, confirm this statement. Again and again officers have been rejected at the higher examinations for their colour-sense; these gentlemen having navigated for many years and not a single accident having been attributed to them.

2185. Are there any statistics available?—So far as the statistics furnished by the papers to which I have access are concerned, they show a complete immunity from accident of many persons rejected for colour-blindness. To take one example: take the report issued on the 31st August 1894. It included a period of 15 months. From that report we learn that six men, who held Second Mate Certificates, were rejected, their average of sea service being eight years. Similarly, eight men who held First Mate certificates, having an average of 14 years' service, were rejected. Four Masters who came up for colour examination were rejected, and that with an average of 24 years' service. No mention was made in these reports of these officers ever having been in a collision, and I cannot help thinking that, if it had been possible to prove that any one of them had been in an accident as a consequence of his defective colour-sense, much capital would have been made out of it.

2186. What are your conclusions with regard to this?—So far as these statistics are concerned, they support my conclusion, that most colour-blind people are safe. One other line of evidence is also available. We have round the coasts of the United Kingdom many thousands of fishing boats, and, so far as I am aware, the colour-sense of the men on board these boats is not tested, nor indeed any of their other visual functions. Between 4 and 5 per cent. of the men are said to be colour-blind, which means that, out of every thousand boats, at least 40 are in the charge of colour-blind people, and therefore liable to accident, if colour-blindness is a very real danger at sea.

2187. Are there any records of accidents and loss of life consequent upon defective colour-sense?—There is no record of accident at all commensurate with this state of affairs. It is probably not wide of the mark to say, that there is scarcely such a thing as a well authenticated case of one life having been lost from a defective colour-sense; although I repeat that I have never said that all colour-blind people are free from danger. Three questions still remain to be discussed as regards colour:—they are (1) If it be admitted that a man suffering from Daltonism can distinguish colours, how does he manage to do it? (2) What tests are suitable to ensure the necessary safety of the public without doing injustice to the candidate? (3) What are the limits of safety? It has always appeared to me that in distinguishing lights differentially, what is called the intrinsic luminosity has a great deal to do with it. No one can see the lights as used at sea, without being aware that their intrinsic luminosities are very different. The intrinsic luminosity is mentioned by most writers on Light, such, for example,



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as Edser, page 17 of his book on Light for Students, and also by Heath.

2188. What would be your opinion, as to the power of colour-blind persons to distinguish between the lights of a ship?—I think it depends upon their having a very accurate perception of the differences of luminosity, at any rate from a qualitative point of view. It is possible, although I think improbable, that the different thermic effects may have something to do with the matter. As a matter of fact they do speak of the cold and the hot ends of the spectrum.

2189. How far are you satisfied with the existing tests?—The only tests which satisfy me are the practical tests. You never can test, from a navigation point of view, the colour-sense properly in a laboratory. The conditions there are never the same as at sea. Therefore the practical solution which I would give to this question is, that a candidate for a certificate of competency as an officer must produce from the various masters, with whom he has served during his apprenticeship, certificates to say that he has reported lights properly.

2190. How do you consider the laboratory tests compare with the actual weather conditions?—I think it is essential that an officer of the watch should be able to interpret lights in all conditions of weather thoroughly well; but it is not essential for this purpose, that he should be able to pass all the specially devised laboratory experiments for the examination of colour-vision. Probably the nearest approach which we have to sea conditions in laboratory testing is some such apparatus as the lamp devised by Dr. Grossman of Liverpool. If a man passes that, he is quite safe for sea work. In this lamp you have pieces of glass similar to those employed in the construction of the port and starboard lights.

2191. (*Sir Arthur Rücker*.) I do not think you need give us a description, because we have actually seen it?—Very well. Some such apparatus as that, is, in my opinion, the best means of testing candidates in a laboratory or examination hall, if you are going to test them there at all. The best test, however, is a record of the facts, as to whether he has or has not been able to recognise lights in all conditions of weather at sea. If satisfactory evidence is obtainable on this point, I would pass him. If there is no evidence, or if the evidence is unsatisfactory, I would test him with some such lamp as the one just described.

2192. I understand you regard Holmgren's wools as unsatisfactory?—Yes, because the specimens usually employed differ so much in saturation. So much is this the case that sometimes two skeins of wool, which have essentially the same pigment as the basis of their colour, may appear so different to the ordinary observer, that, if a candidate were selecting them as being the same colour, he would at once be rejected. I have repeatedly got artists with a highly educated sense of colour to make selections from these wools, and I have never found that one of these artists made a selection which would satisfy a Board of Trade examiner. A person with keen perception of colour may see tints in a skein of wool, which other people do not; and it is quite conceivable that, with such a crude test as Holmgren's wools, a candidate who had naturally a very perfectly developed colour-sense might come to grief.

2193. How many artists have you tested in that way?—Four or five, at any rate.

2194. And not one of them would have passed the test?—No; they would not have passed the Board of Trade examiner, unless the particular examiner had also an intimate knowledge of colour pigments.

2195. We have tried it ourselves, most of us, at one time or another?—Well, take Mr. G—H—, who is a distinguished artist. He made a selection many years ago, when I was working at the subject. Anyone looking at it would have said, it was a perfectly monstrous selection; yet he was satisfied that the same pigment ran through the whole of them.

2196. (*Professor Gotch*.) What you mean is, that the matching goes by shades from one to another, until you get in the matching the most extraordinary combinations?—Yes; different people see different pigments in the same skeins of wool.

2197. I understand what you mean is, that they have to match any shades which have that colour in them?—Which appear to them to be of the same colour.

2198. This question has already been before the Committee. You mean, you may go through shades, until you finally get to something which is different?—Yes; that is what I mean. I do not regard this test with the wools as at all satisfactory on that account. I do not think it is fair. Besides, when a man has been looking for long at the wools, he gets very much confused among them with different pigments and different shades. Spectroscopic testing is probably less open to objection; but I have not found the differences of luminosity so great in the spectrum, as they certainly are in practice at sea, and I, for one, would not reject a candidate on the spectroscope, if there was undoubted evidence that he had been able in practical work infallibly to distinguish the three lights, the port light, the starboard light, and the masthead light.

2199. You will agree it is essential that all officers, on whom the ultimate interpretation of a light depends, should be able to distinguish the three lights used in navigation?—Yes, and I think the Board of Trade have a right to demand this guarantee. At the same time it must be remembered, that a very large number of people are at sea in charge of boats, whose colour-sense has never been investigated. There is, to begin with, a whole army of fishermen, yachtsmen, men in charge of small coasting sailing vessels, men in charge of the smaller class of tramp steamers, who never have been tested at all, and yet who have never done any damage from defective colour-sense. It is no argument to say that these boats are so small, that there is no danger. A collision with a small coasting steamer, or even with a small sailing vessel, may sink an Atlantic liner. If there is danger in colour-blind people navigating, it will not do to say that the danger is averted by having the men in charge of all large passenger and cargo steamers tested; for even an extremely small and insignificant vessel may cause such damage in a collision to a steamer, as to sink her.

2200. (*Mr. Nettleship*.) I think you said something to the effect that a number of steamers had been under the charge of untested men, and nothing had ever happened in consequence of colour-blindness?—I am not aware of any authenticated cases.

2201. You made a definite statement?—Well, I will qualify it to that extent. I say I am not aware of a single authenticated case of a life being lost through colour-blindness. With such a large number of men at sea in charge of vessels, who have never been tested, and with no record at all of disasters due to colour-blindness, it is a little difficult to believe that the danger is very great.

2202. You are of opinion that one form of colour-blindness is especially dangerous?—Yes, acquired colour blindness. We see such cases in persons who are suffering from defective vision brought on by smoking. Not infrequently men come to the hospital to say, that their defective colour-sense does not admit of their continuing navigational duties with safety to themselves and to the public. Invariably I have found that these are cases, where we have disease of the optic nerves, for the most part due to excessive indulgence in smoking. During my whole career in an ophthalmic clinic in a seaport town, beginning with the year 1883 down to the present time, I have never known a man to come complaining of colour inability for navigation, and found that man suffering from congenital colour-blindness. Cases of such complaint are by no means infrequent, and so far as my observations have gone, they are entirely confined to persons, who are afflicted with diseased forms of colour-blindness. I do not remember to have seen any others. Several times a year, a man will come in and say he is no longer fit for the bridge, and invariably I find it is from disease.

2203. (*Professor Gotch*.) Do you know Nagel's test for colour-vision?—No. In teaching ophthalmology to students of medicine, I have, for a considerable number of years, carefully distinguished between Form-Sense and Visual Acuteness. The difference which I make between them is well illustrated by the following

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example:—I take a page of print and stare fixedly at a word about the centre of a page.

2204. What do you find as the result of that?—I find the area of distinct vision for letters is extremely limited; it includes only a few degrees of angular displacement, and forms what I have called the "Field of Visual Acuteness." Now, although I look steadfastly at one particular word, I am quite conscious of all the different objects in the room. For the most part, I can recognise their forms quite well. I take, for example, numerous objects out of my pocket, and put them to such a distance at the side, that a line drawn between the word of print, at which I am looking, and the first nodal point of my eye may have an inclination to each other of as many as 70 or 80 degrees. I still can recognise the objects perfectly. The power by which we read type I call Visual Acuteness, and it may be said to be limited to that part of the field of vision, which in space, corresponds with the macular area of the retina.

2205. (*Sir Arthur Rücker*.) You differentiate that from what you call the Form-Sense?—Yes. The other power which I have for distinguishing objects, the images of which are formed on those parts of the retina, where the visual acuteness is practically nil, I call the Form-Sense. That is how I have put the matter for many years to my students. It is obvious that for such parts of navigation, as require the reading of charts or of tide tables or the keeping of a log, or the reading of indicators of any kind, a certain degree of visual acuteness is necessary. Navigational duties on the bridge, for the most part, require a good form-sense. In view of certain cases, with which I am familiar, and of certain experiments, which I have made, I am not able to fix upon any standard of visual acuteness required for navigation. Certainly a man must have sufficient visual acuteness to be able to read charts easily, with or without a correction, but if he has that, in my opinion he is tolerably safe for the look-out on the bridge. Thus, at present I know a man who is nearly blind of one eye from cataract, and whose visual acuteness is not greater than  $\frac{1}{5}$  in the other eye; and yet that man has navigated for the past eight or nine years an express passenger steamer without any hitch. I have met several cases very similar to this.

2206. A year ago, you made an interesting experiment on yourself, I understand?—Yes, I happen to have a hypermetropic astigmatism against the rule of about 2 dioptres, and habitually wear a correction to that extent. I was standing on Wemyss Bay pier; and in front of the glasses, which correct my refraction error and give me approximately  $\frac{2}{3}$  visual acuteness, placed a pair of convex pince-nez of 3 dioptres, giving me thus a myopia of about 12 inches; yet, with that arrangement, I could perfectly clearly see the location of Innellan perch  $2\frac{1}{2}$  nautical miles away, and the pier at Craigmore, although its distance is something like  $5\frac{1}{2}$  nautical miles from Wemyss Bay. It was quite obvious that here the form-sense, and not the visual acuteness, came into play; yet I have no hesitation in saying, that I could, with that arrangement in front of my face, have navigated to any part of the United Kingdom. I could pick up the buoys on the patch situated at more than a mile from the quay with the utmost ease. In view of these facts, I am not prepared to fix any limit of visual acuteness, as being necessary for the duties of the look-out.

2207. A man who is going to navigate must have some visual acuteness?—Certainly a man who is going to navigate must have sufficient visual acuteness as to read and write; but, so far as my observations show anything, they prove that a man may have a fair amount of refraction error, and still be competent for work at sea. Probably a large majority of officers on the bridge who are over 40 years of age have not got anything like  $\frac{2}{3}$  of visual acuteness in either eye. Emmetropic eyes are in the minority. Most men on the bridge have a certain amount of hypermetropia which they can correct perfectly well by accommodation as long as they are young; but soon after 40, if not previously, the power of accommodation goes and we imagine that very few men who are over that time of

life will be found on the bridge who have got anything like  $\frac{2}{3}$  of visual acuteness.

2208. Do you personally have any trouble in picking up an object at sea?—Personally I have never had the slightest trouble at sea in picking up any object, and yet the visual acuteness of my right eye when uncorrected, is only two letters of  $\frac{1}{15}$ , and that of the left only one letter. The important point then in navigation seems to me to be not so much visual acuteness as the form sense which involves the sense of projection and, so long as a man has that form sense and sense of projection, he is perfectly safe. I have no hesitation in saying that when I am fitted with a glass which gives me two or even three dioptres of myopia I am quite capable of navigating nearly as freely as when my eyes have no correction. It is not a matter of visual acuteness; it is largely an affair of projection, and that very much depends upon what I call this form sense.

2209. Would you assign any degree of visual acuteness for candidates?—Under these circumstances I cannot assign any degree of visual acuteness which the candidate ought to possess. The whole question is as to his ability to recognise ordinary objects. Here too, the testimony of the officer, with whom he has served, would be most valuable; and if there be any doubt in the case, the Board of Trade should insist on his going to sea with some officer, in whom they have confidence, and that officer reporting as to whether the candidate's sight is sufficient to enable him properly to pick up objects at sea.

2210. What would you say in regard to this matter, respecting the persons already at sea and in charge of boats?—The same line of argument also holds, as in the case of colour, concerning the numbers of persons who are presently at sea and in charge of steamers, fishing boats and all kinds of smaller craft, who have never had their sight tested at all. Amongst these people there is probably the same average amount of refraction error, as exists amongst the same number of landsmen; and yet the record of disaster is by no means great. Even a fair amount of myopia will not in any way interfere with the sense of projection, and as long as the person has that, and a good light sense, he can perfectly well locate the position of any number of objects relatively to each other.

2211. You think that high degrees of refraction error are objectionable?—No doubt, especially if they are associated with disease of the eye such as disease of the choroid, or retina; but so long as a man can distinguish clearly objects at a certain distance, say, that he can pick up a buoy at the distance of a mile, or another vessel at a matter of 3 or 4 miles, I would hold that man to be safe for purposes of navigation. It is not a question of Snellen's scale at all; it is a question of the man being able infallibly and without hesitation to locate the position of certain objects, and to have a clear idea of what they are. I personally have navigated more or less for the last 20 years, with a visual acuteness which would not enable me to pass any of the Board of Trade's present tests. Further, it is to be remembered that on the bridge an officer has always beside him a pair of glasses, with which he can at any moment approximately correct his hypermetropia or myopia.

2212. There is no function of vision which you regard as of greater importance to the navigator than the light-sense?—That is so. Probably what I have called the form-sense depends on the light-sense; but, whether this supposition is true or not, the light-sense is of cardinal value in navigation, and in my opinion a good light-sense is one of the essentials of safety. I called attention to this subject in a paper which I read to the Philosophical Society of Glasgow in the year 1893, of which paper I have a copy with me; and further practical experience has shown me no cause, why I should alter the conclusions at which I then arrived.

2213. What would you mean particularly by the light-sense?—By the light-sense is meant that function of vision, by which we distinguish between different luminosities and different depths of shadows. Physiologists are in the habit of distinguishing between

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the light-difference-sense and the minimum light-sense. I am of opinion that both these functions should be tested. The light minimum sense may, perhaps, be conveniently defined, as the minimum stimulation of the retina by light, which will cause a mental perception. By the light-difference-sense is meant the smallest difference of illumination between two lights of the same nature, which will give rise to a consciousness in the person being examined, that there is a difference in luminosity.

2214. Can the minimum light-sense be tested?—The minimum light-sense can easily be tested by various pieces of apparatus. One of the best is that of Foerster, called the light-sense box. In testing the light difference sense, two lights of equal intensity are selected. One is gradually diminished and the other increased in brightness. The person being examined is asked to indicate the precise point at which he is aware of a difference of luminosity. Chibret's instrument is one of the best yet invented for the purpose of this examination. There is also a piece of apparatus devised by myself, a description of which can be obtained in the paper already referred to, which gives fairly good results. Probably some other form of apparatus is required, because these two pieces of apparatus are only of use for lights of considerable intensity. They are not suitable for testing the differences between two deep shadows, which is the thing required in testing the light-sense of men, who are to navigate in narrow waters. With a defective light-sense, a navigator will experience the greatest difficulty in many of the duties of the bridge. In dark weather he will be quite unable to make out a land fall, or on a dark night in narrow waters he will be quite unable to see the land sufficiently well to enable him to navigate.

2215. Have you known any instances of this?—The following incident well illustrates the importance of a good light-sense. Early last spring on a very dark night I was sailing along the east coast of the island of Bute. As the wind was rising from the north-west, I deemed it advisable to anchor before getting out of the lee of the land. I knew of an anchorage in five fathoms of water abreast of a church. The lead began to give me five fathoms of water, but, wearing my correction, which gives me  $\frac{1}{2}$  visual acuteness, I could not distinguish objects on shore. I asked a friend, who was with me, if he could make out any buildings; and before long he replied that he saw quite distinctly a building, which he took to be a church on the land. I took off my spectacles and at once saw the building indicated. The important fact of this test is, that with my natural eyes, which have scarcely  $\frac{1}{8}$  of visual acuteness, I could see the object at once; with my glasses on, which give me  $\frac{1}{2}$ , I could make absolutely nothing of it.

2216. You think the same sort of thing obtains when a person with a moderate degree of refraction error goes along a dark road at night?—Yes. If the person is in the habit of wearing his or her correction, the glasses are generally taken off; for the individual sees his or her way along the road better without them than with them. I have also met one or two gentlemen who have slight refraction errors, and who invariably, for night motoring, take off the glasses which correct them. A similar kind of thing is illustrated by the fact that, for night work, most chauffeurs take down the glass plate in front of them. The fact is, that a piece of glass in front of the eye reflects so much of the light, that, where the total incident amount is small, the deduction of the reflected portion much interferes with the possibility of vision. Invariably I take off my glasses on a dark night when looking out for land or for buoys or similar objects, and I have no great difficulty in such conditions in seeing them as well as a normally sighted man, although my visual acuteness is scarcely  $\frac{1}{8}$ .

2217. What conclusions do you draw?—From these practical experiences I have come to the conclusion, that visual acuteness is of comparatively small importance for navigation, and that the form-sense is all important. It is certainly not visual acuteness, but

form-sense, which enables a man to pick up buoys and all other marks used in navigation.

2218. With regard to your opinion, that the proper test is taking persons to be tested at sea, and keeping them there for some little time, and getting someone to report whether they have made mistakes, do you not think that would be a very troublesome method of testing the fitness of persons to enter the profession?—I think the Board of Trade ought to reserve the right to say, whether a certain master mariner was a man whose report they would take.

2219. There are certain men whom they would take?—I think the Board of Trade should have the right to make what regulations they like. Supposing a master mariner reports that an apprentice has been with him for four years at sea, and has reported all the lights and the colours properly; I would take that as being adequate.

2220. It is a lengthy process?—It might be a lengthy process.

2221. What would you say in the case of a boy who is found not to be satisfactory, but who has been, perhaps, a year in his profession, before a case has occurred where he has made an obvious mistake?—I think, if he has not done so in less than a month, he is not likely to make an obvious mistake. I insist that it should be a practical test, and not a laboratory one.

2222. You probably realise the great inconvenience of a practical test?—Yes, I see that. The Board of Trade might quite well take a lad like that to some harbour and test him. I know one or two cases. I had to pass several pilots. I know a man just now with 5 dioptries of myopia, who is piloting vessels up and down a river, as often as he is employed, and who has been at that work for many years; and up to this moment he has had absolutely no accident. I think it would be a perfectly fair arrangement to take the lad to some harbour or estuary or some place with the Board of Trade examiner, or with some suitable person, in whom that examiner had confidence, and for him to be asked to pick up buoys and marks of that kind. I think that would be perfectly fair.

2223. But if he knew where the buoy was beforehand?—I would take him where he did not know.

2224. That would mean a voyage?—It might in Glasgow involve going the length of the Firth of Forth, but not very far.

2225. (Mr. Nettleship.) In regard to the effect of spectacles in losing a light at night: you do not think it is partly due to looking too obliquely through the spectacles? It is often difficult in looking sideways, not to look obliquely through them, and that is much more troublesome at night, than in the day?—Really my spectacles cut the line of vision at approximately a right angle; but I know that at night I am perfectly useless with them. I only put them on, when I wish to look at the binnacle, the compass card; then I keep them on, or if I wish to look at an indicator, or something of that sort; but for all purposes on deck, I put them in my pocket at once.

2226. (Mr. Parsons.) Suppose a practical test were considered to be impossible, what method would you adopt for testing for colour-vision?—I think Grossman's lamp is the best. I have not seen the test mentioned by Professor Gotch, but of those I have seen, I prefer Grossman's test.

2227. The lantern test?—Yes, because that is much like the conditions in actual practice. With a good lantern test, you can diminish the size of the spot, till you get an object on the retina of nearly the same size, as the side light would give you at sea; and I think that is a perfectly fair test. I deprecate the laboratory test. Supposing the test was to distinguish between a high and a low note; you would not require that the man should have knowledge of tone, such as would be necessary to tune a piano or violin. A sailor, who could not tell whether a piano was in tune, could distinguish between high and low notes. Now, upon a matter of colour, I do not think it is necessary to have the degree of refinement which has hitherto been required.

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2228. You would regard it as essential, that the spot of light could be diminished?—Yes, emphatically so.

2229. And you would demand correct answers for a particular colour?—I would allow no man on the bridge of whom I had a suspicion; thus if I found a man break down with such an apparatus as Grossman's lantern, I would not let him take charge of a vessel.

2230. The method of conducting the examination varies very much?—Yes. I think Holmgren's wools are particularly objectionable.

2231. I am keeping to the lantern test for the moment. It is quite conceivable that the lantern test, supposing you do not diminish the aperture, might be a quite useless test?—Yes. There is no reason why it should not be fitted with a diaphragm, so that you could make what aperture you like, from zero to as far as the thing will stretch. That is the sort of apparatus I would employ.

2232. And if he made one mistake?—If he mistook what I myself could see, I certainly should be very chary about sending him to sea in charge of a vessel. I maintain my point that, if a man has for many years infallibly distinguished between the port, starboard, and masthead lights, he is undoubtedly safe.

2233. Even if he failed with the lantern?—I think so. But I do not think a man of that kind would. The reason the spectroscope test is objectionable is, because you have an artificial luminosity. It is not the same condition as distinguishing with lanterns.

2234. Are you quite accurate in what you have said with regard to the Board of Trade lights?—It is very nearly as I say. There is no such thing as a pure spectrum to be had from any of these side lights. In the lantern, which is employed, I would certainly have the standard Board of Trade glass introduced.

2235. But you would have a variety of other colours?—No, I would not.

2236. You would only have the standard colours?—Only the masthead and the port and starboard lights. If he made a mistake, and said it was a port light, when it was a starboard light, I would not have anything further to do with him.

2237. But supposing he did not, would you not have some means of altering the luminosity of the lights?—There is a standard luminosity by the Board of Trade regulations. The port light must show from dead ahead to two points abaft the port beam at a distance of two miles.

2238. I am talking of the lantern test?—Provided they will give you the two miles luminosity.

2239. You would not simulate fog at all?—No, I do not think so. I do not know what effect fog would have on the frequency. I would rather hear Professor Poynting on that, than speak of it myself.

2240. The frequency of what?—The frequency of vibration.

2241. Do you not think a great many colour-blind people would spot it invariably, if you did not diminish the luminosity?—As long as they did that, I would say they were safe.

2242. Even in fog?—Even in fog. I think that is a danger which has been much exaggerated. I do not think it will change what I would call a warm-end colour into a cold one. I have never seen anything like it, and I have been at sea in all weathers and in fogs too. Of course if there is a fog worth calling a fog, the lights are invisible, and you must then go by the code signals, which are given for the prevention of collisions at sea in fog. If there is a fog at all, it will put out the lights at once, and no one will see them, whether colour-blind or not.

2243. (Professor Poynting.) Do you connect the sensitiveness of form-vision with the greater sensitiveness of the central spot?—No. I think visual acuteness is particularly a function of the macular area, the yellow spot. The form-sense is a function of the entire retina. For example, I can tell quite well what object I have laid there; I know what it is quite well, though I am looking at my finger. There must be an angular distance there of 70 degrees or more.

2244. (Professor Gotch.) I suppose what you mean is a response which gives you the sensation of bright-

ness, without the necessary sensation of colour?—As regards the form-sense.

2245. Is that what you mean?—Yes.

2246. I suppose that that is increased by dark adaptation?—It will be; it must be.

2247. (Professor Poynting.) It is not form that you are aware of, is it?—Well, it is something. I say it is that part of the form-sense which depends upon the light-sense.

2248. It is change really?—Yes, but it is enough to attract your attention.

2249. You might say "a sensation of luminosity apart from colour"?—"Differences of luminosity apart from colour." But I prefer to call it form-sense.

2250. (Professor Gotch.) You are not alone in this, because it has been definitely shown by the greatest German authority, von Kries, that there is such a thing. May I ask another question? Supposing it to be impracticable, as Mr. Parsons said, to adopt any test, which is not fundamentally a test in a room, who do you think ought to examine?—I think a physicist or a physiologist, or a navigator. I would be quite content with one or other of those three.

2251. You are aware that the present examiners are people appointed by the Board of Trade to examine any number of other points connected with navigation?—Yes.

2252. Do you know these examiners from your experience?—No, I have not come across many of them. I sometimes examine for the Clyde Pilot Board.

2253. You do come across some there. Yes; I examine any candidate who is sent. For example, the Pilot Master on the Clyde, I understand, does the examinations for the pilots; he examines each pilot once a year there. If there is any doubt as to a man's vision he is sent to me.

2254. Do you think a navigator without experience is a suitable person to examine in these different things?—I think a navigator has more experience of the conditions at sea than most of us, if he has really been a navigator and not a school man. I mean, if he has been to sea himself for a matter of 20 years.

2255. Then you would not support the view, that there should be an objective examination of the eye, which must naturally be done by an ophthalmic surgeon?—No, I would not support that view. Even on your high authority I am not sure that I would abolish the phrase "form-sense," because, although I am looking there (demonstrating) I can tell quite well the form of that object, and so could any man who tries it. I am not quite prepared just at first to alter it.

2256. I understand what you mean by it, and what other people have called the light-sense?—It is a little difficult to define perhaps.

2257. (Mr. Raymond Beck.) I think you said, if a boy had been at sea for four years, and it had not been reported that he had made a mistake, you would be inclined to pass him as sound?—I would.

2258. But it is quite possible for him to have been on a ship for four years, and never had an opportunity of a test. Take the case of your own yacht; you may have a member of your crew with you for four summers, and at the end of that time, you may not know whether he is colour-blind or not?—Oh, I think I would know that; Oh, dear me, yes. For instance, I constantly say to the yachtsman I have just now, "What do you make out of that"; and we are in all sorts of weather by night and day; we are in the dark and so on, and he must report things to me. I should very soon find that out.

2259. But suppose you had a crew of 14 or 15?—It would be in the form of discharge, which the Master Mariner must give to an apprentice. The Board of Trade have every right to put in there an item, whether he has tested him in colour or not.

2260. My point is, he might perfectly well be one of a ship's company for a large number of years, and there might never be an opportunity of finding out, whether he was colour-blind or not; or at any rate there would be no opportunity of his shipmates finding it out, because he would not be put in a responsible position to report lights probably. However, you



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think he would?—I say that, where there is satisfactory evidence, he should be passed. I say, if there is no such evidence, or if the evidence is unsatisfactory, he ought to be tested by Grossman's lamp.

2261. (Mr. Nettleship.) I have had a case, in which a lad was at sea for 2½ years, without being put on the bridge, at any rate without being on the look-out; and on the first occasion he had the look-out, he reported the light wrongly?—That boy should have been rejected.

2262. (Mr. Raymond Beck.) In your personal experience, have you had no difficulty on a dark night as to a light? Is it always at once clear to you, whether it is a green or a white light? Have you never been doubtful for a moment?—I might have been, if it was very far away on the horizon.

2263. Or when there is a slight mist?—But I never would confuse red with green.

2264. Or green with white?—I might have a little difficulty there, especially if it were a poor light. The Board of Trade have laid down regulations, which are not properly observed, as to the distance at which these green lights shall be visible.

2265. Surely that depends on whether it is a clear or a dark night?—It depends very much on the kind of oil they burn, whether it is a good oil, and whether there is a good lamp behind it. I know one boat, which I consider a perfect scandal. I am not going to mention her name, but I cannot make out her green light till I am within less than a mile of her. Then I know it is this particular boat, because I do not see her green light.

The witness withdrew.

[The witness subsequently requested that the following note should be added to his evidence:—

With the permission of the Committee I should like to make a statement supplementary to that made by me on the 9th of December. This statement entirely concerns the questions which various gentlemen of the Committee addressed to me, and I think it right to send it, on the ground that a fuller consideration may sometimes alter the nature of an answer given very much on the spur of the moment. The two points on which I wish to make a further statement are, first, Holmgren's wools; second, Navigation in fogs.

One special objection which I have to Holmgren's wools is, that they do not eliminate the personal equation of the examiner; probably no two examiners would regard them from the same point of view, and therefore the standard, which they set up, is not an absolute standard, but is one only relative to a particular examiner.

A great deal has been said about the appearance of lights through fogs. I do not think the question is a very serious one, for, in the first place, if the fog is at all dense, dense enough to be dangerous, the lights will not be visible at all. I would remark in the second place, that I, personally, have never found thick weather interfere with my power of discriminating between the lights, so long as it was clear enough for me to see them. Further, the Board of Trade regulations for the prevention of collisions at sea are such as to give great assistance in a fog, independently of seeing

lights at all. Thus, were I in my sailing boat in a fog on the starboard tack, I would keep signalling that fact by means of the fog horn, and would hold on my way unless I heard another boat signalling also, that it was on the starboard tack. In the event of my doing so, the question of which was to give way would not be determined by lights, but by which was to windward of the other. If, while I was on the starboard tack, I heard another vessel indicating that it was on the port tack, I would hold on cautiously. The Board of Trade regulations for steam-boat traffic in fog are quite explicit and satisfactory, and steamers clear each other in thick weather not by seeing lights, for in serious degrees of fog, that is impossible, but by the code of signals laid down by the Board of Trade. If a light is visible through fog, I do not think that the slight amount of fog which renders this possible, will materially alter the wave frequency. Nor do I think it is at all a good way of simulating fog to devise a lamp which will turn down and thus weaken the source of light. If there is a difficulty in fog, which I personally have never experienced, it is not a question of weakening the source of light, but of alteration of the medium in which that light is propagated. The question seems to me to be, will the presence of a fog, which is not sufficient to obscure the light in the medium of propagation, materially alter the frequency? So far as my practical experience goes, it does not; but in a matter of this kind, I would regard the gentlemen on the Committee, who are physicists, as being in a very special manner authoritative.]

Adjourned till Friday, January 13th, 1911, at 11 o'clock.

## ELEVENTH DAY.

Friday, 13th January, 1911.

PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).

Sir ARTHUR RÜCKER, F.R.S.  
Mr. RAYMOND BECK.  
Captain THOMAS GOLDING.

Mr. NORMAN HILL.  
Mr. EDWARD NETTLESHIP, F.R.C.S.  
Mr. J. H. PARSONS, F.R.C.S.

Mr. S. G. TALLENTS, Secretary.

Commander MASSEY called and examined.

2266. (Chairman.) We have an extract from a letter which was kindly sent to us giving a summary of your evidence, and I gather from that that you have had 50 years' personal experience at sea in sailing ships and steamers?—I have.

2267. Of which 33 years were in the Pacific Steam Navigation Company's service?—They were.

2268. At the present time, among other things, you are the Chairman of the Advisory Board of the Liverpool Nautical College?—I am.

2269. That brings you in contact with a certain number of young people who are going to sea?—Yes, it does.

2270. With reference to these tests, I observe that you say, first of all, that you consider the colour-vision tests too scientific?—I do, because I think that it would require a knowledge of chemistry to distinguish between the different shades of the skeins.

2271. You are speaking of the wool tests?—Yes, I am speaking of the wool tests.

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Commander MASSEY.

[Continued.]

2272. You think that the ordinary man cannot be expected to make this distinction easily?—Hardly, I think.

2273. You have frequently watched the tests going on, of course?—Yes, I have seen them. I have been in communication with the Examining Officer of the Board of Trade, and he has shown me the tests, and we also have them at the Nautical College.

2274. Do you use them there?—We do. Of course the object of the Nautical College is to instruct people who are going up for their certificates, and therefore we like to have the latest appliances of that kind, so that when they go up to the Board of Trade for their examination they may not find something different to what they have been accustomed to.

2275. So that you prepare them to some extent for what they are going to have?—Yes.

2276. Do you sometimes in the course of preparation find a man is partially colour blind?—Yes, there are some cases of that kind.

2277. If he was quite bad, you would not advise him to go any further, would you?—Certainly not.

2278. Do you think any injustice is done by these colour tests as the Board of Trade applies them?—I think they are rather too scientific, that is the only thing.

2279. Perhaps you would go on to say what you think would be a better substitute?—I think if a man can readily and distinctly distinguish a white light, red light, green light, or yellow light, and flags or signals containing the same and similar colours, and buoys, forms and letters, and that sort of thing, that is all that is necessary for practical purposes, and I do not think any lives or property will be endangered if a man can do that.

2280. Would you take a man out on the river; would you prefer to do that?—That would be a very good idea. It is not always practicable to do so; but if it could be done, that certainly would give an idea as to whether a man was colour-blind or not.

2281. Could you in the same way manage that with regard to buoys or flags, without his being able to know beforehand? Of course, with buoys a man can very soon get to know their position?—Yes, it would depend where the buoys were, and so on. Speaking from my own practical experience—as I say, I was 33 years in the Pacific Company, and we called at a very great number of ports—with the exception of one or two ports, after I had become acquainted with them I never took pilots. For instance, I have entered La Rochelle, or rather La Pallice, without a pilot. We have to pay pilotage, but the pilots come off in small boats and stop the mail steamer, in order to take them up, which means very often a loss of time, and, of course, carrying mails, we wished to save every minute. After the first year I always went in there myself, even in bad fogs, because I could distinguish the marks and so on. In the same way, at Corunna we were obliged to take a pilot, but he only came aboard as we were dropping anchor. At Lisbon it was the same. That is a difficult port to make to people not accustomed to it; but if you once get hold of the marks and that sort of thing, there is little or no trouble. I never took a pilot, although we had to pay for a pilot. In the same way, in going through the Straits of Magellan, in the earlier part, 30 years ago, there were no lights at all.

2282. That, of course, proves your own complete faith in all that was necessary?—Yes. What I wish to say is this. For 40 years I have used glasses myself, but I should not be able, for instance, to read these marks or these lines at 16 feet distance myself, that is, with the test which is intended to be introduced in 1914.

2283. We are coming to that in a moment. Would you mind keeping colour distinct from form? If there is anything more to say about colour, will you please finish?—Of course, I am not colour-blind. I have had no difficulty in picking up lights myself, either red, white, or green, although I have sometimes had glasses to distinguish them at a distance.

2284. I gather you think there might be some difficulty in testing all these young fellows at sea and on the river, but would you rather have an out-of-

door than a wool test?—I think so; it would be more practical.

2285. Have you considered the question of the lantern test indoors as distinguished from the wool test?—Yes, I think that would be practicable.

2286. You do not quite like the wool test?—I do not like it because you are asked to distinguish "Is that red?" and you are asked to distinguish certain other colours which approach it. The examiner knows, of course, that that colour is not quite the same as you would call it. There is a slight distinction. As I say, you require a knowledge of chemistry to know that where two colours are combined they will produce a third colour, and I do not think it is necessary for the purpose for which, I take it, the examination is intended, that is, to see there is no danger to life or property.

2287. Of course, you are aware that the wool test is more a question of matching?—Yes.

2288. If a man knows a good match, he gets through quite well?—Yes, but some of the shades are so very fine, from what I saw when the examiner pointed them out to me, that it is rather difficult for the man to say, "That is so and so," and if the examiner finds in two or three he has made a mistake he does not pass him.

2289. But he has an appeal, of course?—Yes, he has an appeal.

2290. I quite understand you think it is a little too stringent?—Yes, it is a little too stringent for the purposes for which it is required.

2291. Now with regard to the form-vision, you were just following that up. You think that the new test would be rather too strict?—I think so.

2292. Even on entry into the service?—I think so, for the simple reason, as I say, that I understand now another line of letters has been introduced, and I think it is five out of the eight, or something like that, which must be accurately distinguished, or the examiner does not pass the candidate.

2293. Do you think it a hardship on a young man at the beginning to be rather stringent about his sight?—No, I do not think it is a hardship to be stringent, but I do think it is unnecessary in this case.

2294. You think the existing test is severe enough?—Yes, quite sufficient.

2295. Of course, what you were saying about yourself, of your use of glasses, is an interesting matter, but it is a different question as to what happens to the older men?—Yes; but, as I say, for 40 years I have been using them.

2296. But the Board of Trade does not forbid the use of glasses later on?—No, not later on.

2297. And it does not apply tests later on, unless there is a new certificate wanted?—No, it is not so much that, but it is this; that the underwriters will insist upon the masters and officers of all large steamship companies, and probably of the tramp steamers also, passing the test, so that their certificates may be endorsed that they have already passed; and many, especially when they arrive at the age of about 50, when their judgment and experience are matured, will not be able to pass that test. I have been in communication with several shipowners, and some of the leading shipowners of Liverpool tell me that will be so, because the underwriters will charge a higher premium if the certificate is not endorsed.

2298. (Mr. Raymond Beck.) You must take the reason the shipowners give you. I think they want to give some good reason for making such a statement. I feel quite sure that whatever the leading shipowners decided on the underwriters would agree to?—I will just give you an example. For instance, when I was out in the time of the Russian scare, my ship, the "Britannia," became an armed cruiser, and there was also one of the White Star ships, the "Coptic," taken up. The "Coptic" was in the New Zealand trade, and she came across under sealed orders. The captain of the "Coptic" thought he would like to come through the Straits of Magellan as being the shorter course, but he got a very severe wiggling from his owners, Imrie, Ismay, for having done so, because the insurance is much higher for ships coming through the Straits of Magellan instead of round Cape Horn from New Zealand and Australia. That is a case on the point.

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Commander MASSEY.

[Continued.]

2299. (Chairman.) We need not go further into that; but you are particularly anxious about the older men?—Yes.

2300. You think anything new put upon them would come rather hard?—If life and property were endangered I should be with the committee, but speaking from my own practice I do not think they are.

2301. And I suppose you would say that the great experience of some of these older men ought to counterbalance to some extent defects of sight, especially if they use their glasses?—I think so. I think it is necessary to use glasses.

2302. What do you think about the use of spectacles—I am not saying binoculars—as an ordinary rule by an officer?—As a rule there are very few officers who do use them.

2303. But do you think it is a disadvantage if they are used?—The only disadvantage would be in thick weather; they would have to constantly wipe them in thick rainy weather. I may just say that Sir Digby Murray, who was formerly the nautical adviser to the Board of Trade, used spectacles all his life.

2304. As a rule a man at that age will have somebody else who is practically responsible for look-out work besides himself?—I do not know. I always trusted myself; I did not trust anybody else.

2305. And you have used glasses habitually?—I have used glasses 40 years. In fact my sight is a little peculiar; I require a different glass for a distance to what I do for reading.

2306. Is there a prejudice against a young officer beginning to wear glasses?—I think they would probably prefer somebody who did not on that account, because, as I say, in thick and rainy weather he would have to wipe his glasses constantly in order to see clearly; that is the only thing.

2307. What do you say about the use of binoculars?—They are in constant use. We could not possibly do without them in these days.

2308. The day, too, may be affected by a fog?—Yes, but you have a better opportunity of wiping them with your handkerchief without taking them off your eyes. In fact, I think now officers in most of the leading companies are obliged to provide themselves with a sextant and binoculars.

2309. But I should gather from your experience you do not think the use of ordinary spectacles is either prohibited or should be prohibited?—No, I do not think so; but very few use them, because it is a peculiar sight that requires glasses at that early age.

2310. It is only in later life you would tolerate it?—Yes, it is only in later life.

2311. (Mr. Nettleship.) Do I understand that you have worn spectacles for looking at distant things for many years?—Yes.

2312. Did you habitually wear them?—No. For instance, if I wanted to see anything at a distance I used this glass which I have here; it is my distance glass; if I want to see the name of a street I use it. For reading I use spectacles or pince-nez.

2313. But on board ship?—I have used glasses for 40 years.

2314. You have kept them on?—No, I have only kept them on when I required to use them.

2315. That is a matter of course; but I mean looking ahead for signals and so on, did you habitually put on your distance glasses?—No, I did not.

2316. Your sight required it for perfect sight?—Yes.

2317. But you got on without?—Yes.

2318. (Mr. Hill.) It is only of recent years that the wool tests have been seriously challenged, is it not?—I believe so; they did not exist when I obtained my certificate.

2319. But they have been in operation now since 1894, and it is only within the last two years that they have been seriously challenged amongst seamen?—Possibly so. I am not able to speak very definitely upon that, because it is so long since I passed my examination, and of course I have not come greatly in contact with it.

2320. To put it in another way, can you give us any idea of the number of men who, to your own

knowledge, have been treated unjustly by the wool tests?—No, I could not do that, because I am not an examiner, and therefore do not come in contact with them. I am simply Chairman of the Advisory Board, where we try to keep up to date for the students who come up to prepare for their examination.

2321. But amongst the students, have you, from your own knowledge, known any man whom you think has been unfairly failed?—No, I could not say I have.

2322. It has not been brought to your own personal knowledge?—I was told the other day—I cannot divulge names—that, out of about 50 candidates who went through a sort of experimental trial, about 40 failed.

2323. They were not your pupils?—Some of them might have been, for all I know. I could not say.

2324. And with the great majority of the pupils in your school, when you put them through their testing examinations, is there any difficulty with the wool test?—There is with some of them, but, of course, it is only preparation; and if the headmaster sees that they are practically colour-blind, of course he advises them not to go up—if they are properly blind. Of course, if a man cannot distinguish a white light from a green light, he is colour-blind, and is not fit to take command of a ship.

2325. Has your college ever tried a man who has had difficulty in matching wools on the river?—No, I do not think so in our college.

2326. You have advised him that he had better not go on—that he would not pass the tests?—Yes, as far as the headmaster's information goes.

2327. There is only one other point with regard to the older men. As I understand it, your fear is this, that if this Committee, after hearing all the evidence, recommends periodical tests—form-vision tests—then the chances are the shipowners and underwriters will insist upon those being carried out?—That is so. I think that the underwriters will bring a certain amount of pressure to bear on the owners—in fact I know, from what some of the owners told me. Some owners insist upon their men going up every 12 months.

2328. Quite apart from the underwriters, if this Committee, after hearing all the evidence, recommends the periodical examination, the owners will accept the recommendation of the Committee?—I do not quite understand what you mean.

2329. As the Chairman has told you, it is not proposed to make compulsory any re-examination of officers who have now got certificates?—Yes, I understand that.

2330. But your fear is, is it not, that if this Committee should recommend for the future a more stringent examination, the owners will require their officers to present themselves again to pass it?—They will.

2331. That is your fear?—Yes, and I have had it from more than one that it will be so.

2332. Therefore you want us to be very careful before we recommend it?—Yes. What I mean is that it is not absolutely necessary, from what I understand from the statistics of the shipowners themselves, the Steamship Owners' Association, and so on. They cannot point to a single case where a ship or lives have been endangered through defective sight.

2333. (Mr. Raymond Beck.) Have you in the course of your career ever lost or broken your glasses at sea? Have you ever found yourself without a glass?—I always have a spare pair.

2334. So that you have never found yourself in difficulty owing to the loss?—No; I always have a spare pair, otherwise I might have done.

2335. Therefore, supposing it was allowable for men to wear glasses, that is to say, supposing they were allowed to pass the sight tests with the use of glasses, it would be almost necessary to provide that they had spare pairs?—I think so, the same as you would carry a spare compass in case of one being lost.

(Chairman.) We are very much obliged to you for coming here to-day.

The witness withdrew.

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Captain J. T. GARDINER.

[Continued.]

Captain J. T. GARDINER called and examined.

2336. (Chairman.) I understand that you have been nominated by the Chamber of Shipping at the request of the Liverpool Shipowners' Association?—That is so.

2337. For the last 20 years you have acted as marine superintendent to Messrs. MacVicar, Marshall & Co., of Liverpool?—Yes.

2338. For 24 years before that you were at sea, and the greater part of that you were in command?—That is so.

2339. You were in sailing ships for 23 years, and for one year in command of a steamer?—That is so.

2340. I understand, during all your experience, you have never come across any officer or seaman making a mistake by reason of his defective form-vision or colour-vision?—That is so.

2341. Nor have you come across a case of a man who has had difficulty in reading signals either by day or by night?—That is so.

2342. Do you think that the rules which have existed all these years with reference to tests have excluded any fit man?—I think there may have been one or two, but I have never come across any.

2343. You are not against there being some tests by the Board of Trade? You think there ought to be some tests?—I think that the present method is all that is desirable.

2344. You think they are sufficient as they are?—Yes, as they are.

2345. And you do not think they ought to be more elaborate?—No; I think if I elaborate too much we shall find almost every man with some defect.

2346. And you think you must not push this particular point about sight too far?—That is so.

2347. Then with regard to the wool test, I presume that is what you allude to when you speak of the five colours, is it not?—No, it is the colour that is in the book I was alluding more to. I went to the Board of Trade in Liverpool and saw the wool colours.

2348. Quite so—those five colours?—Those five colours, and the red in the wool is quite different to the red which is in that book. It is that I was alluding to. I have looked at it in some lights, and, of course, it is a red, but a man might call it a brown.

2349. You are alluding to this colour (indicating the red colour in the book)?—Yes.

2350. The colour in the book does not correspond to the colour of the skein?—No.

2351. Do you think five colours are too many?—Yes; I would prefer three only, but I think the present method all that is necessary.

2352. Of course you know these five skeins are in use at the present time?—Yes, the skeins are; but that red seems to me to be a little different colour to what is in the book; that is what I was alluding to.

2353. You are aware that a man's success or failure does not depend upon his naming the five skeins right. It is not a question of naming the colour that his success or failure depends on, as you know, having seen the examination. It is a question of matching. If he has a fair idea of matching other colours similar to it he gets through?—Yes; what I have said applies to the five colours in the book; but I think the matching as they do it with the wool could not be improved on.

2354. You think that is all right?—Yes.

2355. Your criticism is applied to the book?—Yes.

2356. I quite understand that. Then you say it has been suggested that the test for officers should be repeated every few years. I suppose you mean suggestions have been made?—Yes, that is what I have heard that the Board of Trade are likely to do.

2357. That is only in the nature of rumour?—Yes, that is all I have heard so far.

2358. Of course you are aware that some companies themselves do desire tests to be applied every few years?—Yes, I have heard that the Cunard, the White Star, and one or two others take the side lights down in the tween decks and put the hatches on, and the superintendent then takes the officer or the applicant down and asks him to give him the colour of different lights.

2359. I mean there are some companies which go beyond the Board of Trade, and have their own

additional tests and periodical tests?—Yes, that is what I have heard; I have never seen it myself.

2360. I did not know whether you took exception to that, or whether you thought that was reasonable?—No, I do not criticise that at all.

2361. Because it seems to us there are some responsible people who think a periodical test rather important?—I do not know whether they stand to that view or not; but I think it is just to satisfy themselves that the men do know a red light from a green light.

2362. But if it is done periodically to a man who has already gone through it?—I do not think it is done periodically. I have never heard that. It is only on the engaging of the men.

(Captain Gardiner.) Some do it annually.

(Mr. Hill.) Yes, there are a good many do it.

(Witness.) I was not aware of that.

(Chairman.) A good many companies do apply these tests periodically to ensure that, as a man gets older, he keeps up to a certain standard. That is quite correct, is it?

(Mr. Hill.) Certainly.

(Witness.) That I had not heard of.

2363. (Chairman.) I am not prejudging anything at all as to what this Committee may do, but I see there are a certain number of companies who do that?—I have not heard of it.

2364. But from your point of view you do not think a repeated test by the Board of Trade is necessary?—No.

2365. Especially as to colour-blindness?—Yes.

2366. You say a man is either colour-blind or not?—Yes.

2367. You are aware, of course, that colour-blindness due to disease sometimes comes on later in life, in a man who had passed and been normal in vision at an earlier date; there have been cases?—I have never come across one and I have never heard of one.

(Chairman.) There, again, I state it correctly, do I not?

(Mr. Nettleship.) Yes.

2368. (Chairman.) You have never come across one, you say?—No.

(Mr. Nettleship.) There are many of them.

2369. (Chairman.) You admit here quite frankly that as regards form-vision a man's sight does change?—Yes, it does change.

2370. But you do not think, considering the availability of binoculars, and so forth, that ought to prejudice him?—Quite so. I think that the seaman, in his occupation, becomes long-sighted, as the saying is, and, being accustomed to picking up objects, his sight is sharper than the younger man's, who, perhaps, has got much better sight at short distance.

2371. Have you any information yourself about the use of spectacles by an officer? Do you think he ought to be allowed to use spectacles if he wants them?—I think so, for reading the letters which are used in the form-vision test.

2372. I mean, supposing he happened to want them to help his distance sight?—I think the binoculars would do better for that.

2373. You think binoculars are better than spectacles?—Yes.

2374. And you think the use of binoculars really makes up for any deficiency of that sort?—Yes.

2375. I gather you think his all-round experience is of great use to a man, apart from the question of sight?—Yes, that I am sure of; on questioning passengers, on many occasions, I have found their distance sight is not so good as a seaman's.

2376. He has a knack of picking up things that stand him in very good stead?—Yes.

2377. You do not wish to put a man like that out, on what you think a technical thing, for defective vision?—No.

2378. Unless there is something serious, of course?—Yes; I think a man's eyesight must be right.

2379. I think I interpret your view very fairly, when I say you do not want any greater stringency?—Quite right; I think the present rules are sufficient for all requirements.



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Captain J. T. GARDINER.

[Continued.]

2380. And you think that is a widespread feeling among those you represent?—Yes. I think that a great number of men, when they are past 40, 45, or 50, would not be able to read the new sheets that the Board of Trade officers now have, that is, the last two lines. I do not think any of them would read them; there may be a few exceptions.

2381. And you do not think they ought to be disqualified in consequence?—No.

2382. (Mr. Norman Hill.) You know that the wool tests have been in operation now for 15 years?—Yes.

2383. From your own knowledge have you ever known a man thrown out by these tests whom you believed to be a capable officer of the watch?—No, I do not think so. Before coming up here, I went down and saw the tests with Captain Sergeant, and I am quite satisfied that a man who cannot name those colours put before him is somewhat defective in his sight.

2384. But apart from this inquiry, before the talk began about the wool tests, had you ever, from your own knowledge, come across a man whom you thought had been unjustly treated by the wool tests?—No, never. I heard, of course, of one case which could not pass, and then the man got through later on. That is the man named Trattles.

2385. (Sir Arthur Rücker.) Have you any experience of the use of tests made with a lantern in a dark room—different coloured lights?—When the first Board of

Trade examinations were passed, they were passed that way.

2386. Have you any strong feeling as to the wool tests being better than that, as a practical question?—I think the wool tests are all that are necessary. If a man can tell red from green with wool, I think he would be able to do so with the light.

2387. Do you think the sailors are at all puzzled by being examined in a way they are not accustomed to? Do not you think the lights to them are an easier matter?—Speaking for myself, I should not say so. The man who cannot name the lights which the Board of Trade have, and which I have seen, I should say was colour-blind.

2388. By the woools, I mean?—No, I do not think any man would be puzzled by the woools.

2389. We have had rather an alarming suggestion of a sailor feeling he is in a draper's shop, or something of that sort?—I cannot understand that argument, because the wool is there. It is better there than it used to be. When I first passed, one had to pick out small pieces, and now you have the skeins.

2390. (Chairman.) You think a man with any intelligence ought not to be confused when he is brought into the presence of skeins of wool. That is what Sir Arthur wants to know?—No, I should not think so.

(Chairman.) We are very much obliged to you for coming here to-day.

The witness withdrew.

Captain HENRY RUSSELL called and examined.

2391. (Chairman.) I understand that you have come here representing the British Shipmasters' and Officers' Protection Society?—That is so.

2392. You have had a very wide experience at sea, and I gather, from what you have kindly put into this précis of your evidence, that you began with five years' training in barges trading between the Thames and Medway; you then served an apprenticeship on the coast for three years, and then in foreign trade steamers, and you secured various certificates from 1877 to 1878; and then you had 18 years' experience in different steamers, all over the world, I suppose?—Yes. That was a continuous command in the one employ. It was after three years in command on the coast.

2393. Then you have acted on the committee of this body for eight years, and you have been chairman for two years?—Precisely.

2394. In your own personal experience you have not found men defective in vision, although some are more or less smart in picking up lights and objects than others?—That is so.

2395. You have never come across any colour-blindness?—I have never found one at sea—not from boy to man.

2396. But your feeling is that the proposed form-vision test for 1914 is too severe?—I think it is too stringent even for the beginners.

2397. You do not think that the demand for one eye with full sight, to speak roughly, and the other eye for half-sight, is needed; that it is too severe?—I think they should be privileged to use everything they are blessed with, so far as vision is concerned. At least I am given to understand—I have never experienced it myself—that there are very few men who are equal in both eyes.

2398. Not equal in both eyes; it does not ask that?—No, but they demand as good sight in the remaining eye in 1914. I understand, as prevails at present for their form-vision test, or nearly so.

2399. Yes, I quite understand what you mean. You think that is too severe?—I think that the original test—that is, the present test—is sufficiently severe and good.

2400. You have a general view as to the kind of test that is desirable. Would it be better to have an open-air test?—I would like to qualify that just a little. I have no objection, speaking for myself and the association I represent, to any of the tests prevailing at the moment. I am not referring to the 1914 test.

Trade examinations were passed, they were passed that way.

2386. Have you any strong feeling as to the wool tests being better than that, as a practical question?—I think the wool tests are all that are necessary. If a man can tell red from green with wool, I think he would be able to do so with the light.

2387. Do you think the sailors are at all puzzled by being examined in a way they are not accustomed to? Do not you think the lights to them are an easier matter?—Speaking for myself, I should not say so. The man who cannot name the lights which the Board of Trade have, and which I have seen, I should say was colour-blind.

2388. By the woools, I mean?—No, I do not think any man would be puzzled by the woools.

2389. We have had rather an alarming suggestion of a sailor feeling he is in a draper's shop, or something of that sort?—I cannot understand that argument, because the wool is there. It is better there than it used to be. When I first passed, one had to pick out small pieces, and now you have the skeins.

2390. (Chairman.) You think a man with any intelligence ought not to be confused when he is brought into the presence of skeins of wool. That is what Sir Arthur wants to know?—No, I should not think so.

(Chairman.) We are very much obliged to you for coming here to-day.

The witness withdrew.

Captain HENRY RUSSELL called and examined.

2401. You do not object to those?—I have no objection to them for the candidates that pass. There are very many of this kind come before the examiners. There is no question about them at all. They are so quick and so expert that either in the form-vision or in the wool test they find no trouble. They appear to have a gift that way. Some youngsters have, and they can match colours quickly, and let them pass; but where a doubt exists, those, I think, should have the privilege and the right to go into the open air and to be tested there. I do not say take them down rivers, or at sea, or anything of that class. It is very cumbersome; but take them to a flagstaff and display flags before them.

2402. And let them see lights at night?—And let them see lights at night.

2403. You think that would be a better way, where there is anything doubtful. Of course, you might meet occasionally a man who is so colour-blind that it is no good going on?—Then the thing is settled; he would be absolutely useless on board a ship.

2404. You are talking about the borderline man?—Yes, I am talking about the man who is not ignorant of colour, but slow and dubious in matching colours. It is a very severe test for some young people and for some older ones.

2405. Have you seen any lantern tests in a room, which you think not at all satisfactory—not in the open air?—No, I have not. I would say in the open myself; but I see no objection whatever, because if a man cannot recognise a red lamp, or a green lamp or even a blue lamp, in a room, I do not see how it is possible to ask him to recognise them from a ship's bridge; and, if it were a long room, and the colours were distinctive, I see no reason to object in any shape or form.

2406. If the wool test, which you think a little confusing to the sailor, were supplemented, so that he had a chance of seeing a lamp in a good-sized room, you think that would be satisfactory?—If he cannot pass the lantern test, I do not think he is any good at sea.

2407. I am only raising the point about the open air, because sometimes there might be difficulties there. I understand, if he could not get through a reasonable lantern test he ought not to pass?—If he cannot recognise distinct colours, whether it is in a room or in the open atmosphere, I cannot imagine him of very much service.

2408. The reasons you have already given as to the wool tests are the reasons that you are opposed to it as the only test for seamen; is that so? You say, "I am

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opposed to the Holmgren Wool Test?—I am opposed to it absolutely.

2409. As the only test. Do you want to exclude it altogether?—The elaborate method in use at the present time, I think, would be better excluded, or certainly curtailed in some way, in reference to the huge number of shades existing. I have been through it just latterly and I can easily understand that it is very, very confusing indeed to young men who are not well versed in colour matching, a wholly different accomplishment, I presume, to naming colours. The man may know red, green, blue, yellow, pink, and purple, or any of those colours, absolutely, but he does not know the shades of them; they go down to the ladies' shades, heliotrope, &c., and they get lost among them.

2410. He has not to do a lot of naming; he has only to show that he can compare one with the other?—That is the trouble. I have found it really very difficult to find where yellow and green finished and blue-green began in the shades. Put me to pick out reds, greens, blues, or fawns, and see how smart I am. I can pick them out fast enough, and so can most young men, at least those I have met at sea: but it is when they come to these delicate shades.

2411. That is why you like the lantern test better, is it not?—I want a clear distinct colour. I am not referring to a spectroscope, where you change your colours into a magic-lantern business. That is a difficult test, because it is almost as confusing. I am referring to young men, but I dare say it would be equally so as regards the elders. I do think when a young man is before an examiner he is not quite so calm, cool, and collected as he is when before his mother or sister, for instance.

2412. And you want to do him justice?—That is all.

2413. There is a point about the examination centres. You think that some are understaffed with examiners?—Yes, but that wants qualifying. That is rather general. We have certain examination centres in our country where I do think that applies. I can refer to one where in 1909 the examiners had before them something like 620 candidates. That is rather a large average per week.

2414. That is one centre?—Yes, at one centre. Last year they had a matter of 720 candidates before them, and I think I am correct—in fact, I know I am—in saying that they had 800 and odd for the colour test alone; that is including the 720, of course; but their candidates for certificates were 720, and, made up with fishermen and youngsters going to sea, there were others that made the number up to something like 800 odd. If that is averaged down per week, it averages somewhere about 14. However, there are some weeks when it must be certain that the examiners will have before them a matter of upwards of 20 candidates.

2415. On one day?—They are all on one day if they are passing through for second mate—no, I believe they work the Monday for the sight-testing; but, granting quite a number of young men out of the 20—we will take 20 on a big day of the year—I claim it is not possible for two examiners to do the work and do justice to themselves. I do not wish to insinuate for one single second that the examiners are not capable of doing every possible right towards the candidates; I do believe that.

2416. But you think they are a little over-pressed?—They are a little over-pressed. They have the whole of this work to get done in the current week. The documents must be sent forward to London at the termination of the week. I am presuming now, and it does strike me, that, where there are a few of these slow ones, there are quite a number who will shy at that wool business hard, and they are afraid of giving themselves away.

2417. They want a little more time?—The examiner, if he wants to do justice to the young men, says, "Take your time. There is no hurry. Get on one side and do not worry yourself. Just see how it is done by these other gentlemen." There is another gentleman comes up, and he is as quick as a linendraper's assistant, and he shies them out of the heap; but it puts the examiners back on their next day, if they have

to attend to this young man and cannot get them forward. I think it is very possible that it does occur where they may be overworked. That is where they have not time at their disposal to help themselves. It is clear here sometimes, but it is very rare; and it is very difficult for the examiner to conform to the rules existing at the Board of Trade, that is, to have a clear atmosphere and a nice white tablecloth, and go through the thing in a very methodical way.

2418. There is another point about the signal lamps?—Yes, I would like to say, and say it very urgently, and try to make an impression. It is the one thing which has brought me to London.

2419. We shall be very glad to hear what you have to say on it?—In the whole of my experience, and more especially when the electric light came into being about 15 years ago—it did not come in then, but it became more customary to use it on shipboard—many of the vessels not carrying electric light previously had an installation put on board, and their lamps were converted, with the little globes inside. I do not know whether it is scientifically a fact, but practically we found at that time that the intensity of the electric light made a great difference of colour, especially in the green light—not so much in the red. It seemed to absorb a certain amount of colour out of it, and show it very much lighter in colour than it did with the ordinary petroleum or colza.

2420. Green looked pale?—Very much paler. That is, perhaps, what called our attention to it as much as anything. I have noticed it very much up to now, although I have been on shore the last ten years. I am very often down on our pier in the evening, and I have noticed this. I heard it on very good authority—no less authority than our dock master's—that it is a fact that you seldom see two ships showing the same green light.

2421. The same colour?—Of course; the same degree of green; that is the point. What I think is absolutely necessary is this. If it is necessary (and we all admit it is) to have good sight to see an object, then I think the object to be seen should also have some consideration; and I think, in fact I am positive, that it is a very urgent thing that it should be made compulsory for the whole of a ship's side lights to be one shade, and pass that shade. It seems to me now that every manufacturer of lamps turns out his own idea of green or red. A good ruby red will stand the electric light behind it and still be red and not a pale pink, and green also a good honest green; so that a man as soon as he sees it says it is green and nothing else, and not a sort of pale shade of foggy smoked glass.

2422. You are aware that the Board of Trade have a standard?—Of degree of colour?

2423. Yes?—No, I am not. I have never heard of one.

2424. There is a certain range between which they expect you to conform?—I did not know it. I am rather surprised to hear it, because the range must be a large one.

2425. I presume the lanterns are inspected with the view of ascertaining whether they conform to the range?—I think the inspection more appertains to the degree of excellence of the lamp and its visibility of 10 points or 20 points, whichever the case may be.

2426. The essential point in your experience is that there is much too large a variation of colour, as things are at the present time?—Yes.

2427. And you are alluding principally to signal lamps?—Yes, signal lamps simply.

2428. And it affects green more than red?—Positively. I believe green is affected according to whether there is petroleum or colza being burned behind it, or electric light. The greater the degree of brilliancy behind the lamp—I do not know whether it absorbs or not, I suppose it cannot do that—seems to interfere with the degree of colour.

2429. (Sir Arthur Rücker.) I should say it certainly would be so?—We found it so by experience. Of course these things are passed when we come to the scientific part.

2430. (Mr. Norman Hill.) Have you known from your own experience any man fail at the wool tests

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who, to your knowledge, was a good officer of the watch?—No, it has not come in my experience.

2431. No case of injustice?—No, it has not come in my experience, except those cases we all know of. They are not in my own experience; they are merely by hearsay.

2432. (Mr. Raymond Beck.) I think you said you were in favour of not too severe a test—form test, not colour test—for even beginners?—Yes.

2433. Do you not think a rather slight test at the commencement of a career is hardly fair, because the lad's eyesight might be able to pass for the next few years, but later on he would lose it. Would you not rather be in favour of a somewhat severe test at the beginning which might, more or less, in all probability see him through his sea-going career?—If a youngster is going to take up the sea and is to be subject, sooner or later, to another severe test, most decidedly put him to it at the beginning. Perhaps I have explained myself somewhat badly, but what I am referring to is this. I have in my mind a youngster whom I know pretty well now. The other day he went up for passing. I may explain this, as probably it will illustrate my point. He went to the examiner. With his father's consent he was going to take up the sea service, and the youngster was very anxious indeed to go to sea. He is a strong, robust, healthy youngster, just the nipper to make a good sailor. He went down to the examiner to undergo the sight test before commencing the sea service. They thought it would be better if he was put through the form-vision test, the letter test for 1914. That is, you have to read quite a large number of the letters in the seventh line. Before that, the boy was placed the ordinary 16 feet from the cards, and he was told to read them; he read every one of the letters perfectly from top to bottom. The blinkers were then put on him, and his right eye was exposed and he read them just as easily as he could with both eyes. I would like to say that neither the boy's father nor his mother were aware that there was anything the matter with the youngster's sight. However, the right eye was obscured and the left eye was exposed, and he was told to read the letters. He said, "I cannot." He was asked why, and he said, "I can read the top ones." Then they said, "Walk up until you can read them," and he

The witness withdrew.

Mr. J. HAVELOCK WILSON called and examined.

2438. (Chairman.) You know the reference which has been made to us, do you not?—Yes.

2439. About what degree of colour-blindness or defective form-vision causes persons to be incompetent in the discharge of their duties, and the consideration of whether any alterations are desirable in the present tests?—Yes.

2440. You have been President of the Seamen's Union now for 22 years, and you have taken a considerable interest in this question?—I have.

2441. And, I understand, you have yourself examined a considerable number of seamen?—A very large number of able seamen.

2442. What sort of test have you applied?—We have the ordinary wools—the wool test; that is all. I have only tested them for colours, not for distance.

2443. The same kind of test as the Board of Trade test, as far as wool is concerned?—Exactly the same test.

2444. Then you have not found many, out of that large number you have tested, whom you could call absolutely colour-blind?—I do not think, out of 400 men I have tested in a good many years, that I have met two men I could say were really colour-blind.

2445. At what sort of age would you test these men?—From 18 up to about 40.

2446. Sometimes quite young men who had hardly started, so to speak?—Not younger than 18.

2447. And you have found them make mistakes, but you think that has been generally due to nervousness?—First of all many of them are very ignorant of colours. I mean if you were to ask them, "What is that colour?" they could not tell you.

2448. The names of colours?—Yes, they could not tell you; but I have noticed a good many of them are

walked up to about eight feet before he could make out the sixth line. My point is this, that the youngster is fit for the sea service.

2434. (Chairman.) In spite of the sight of his second eye?—In spite of that left eye. That is my point. As far as his two eyes were concerned, nobody belonging to his family knew about it. He has got perfect vision. He is a strong, healthy boy, and he is put before those cards, and with both eyes he could read famously. If he ever wants a telescope, I presume he will use his right eye. That is, possibly, why he has never found out that there is anything the matter. If he has done any gunning or telescope work, he has always used the right eye.

2435. Was he failed?—It was no use taking up the sea career with the 1914 test coming in view. He would not be able to possess himself of a certificate before 1914 was here, and hence, for his first certificate he would have to pass the 1914 test, and he cannot do it. He has given it up for the moment, unless there is some alteration. I wonder how many cases there are similar to that. There must be a great number.

(Captain Golding.) Is eight feet equal to half-normal vision, Mr. Nettleship?

(Mr. Nettleship.) No, accommodation comes in. Anything less than 15 or 16 feet ought not to be allowed.

2436. (Mr. Norman Hill.) If that had been your lad, would not you have sent him to an oculist to know if the defect in his left eye would be likely to have any influence on his right eye, before you let him go to sea?—No, I should be inclined to let the oculist find it out.

2437. But when you do find it out, if the oculist said, "Yes, that left eye has always been a bad one, and always will be, but it will not affect the right eye," I agree with you the boy is fit for sea, and should be sent to sea?—I think that is very possibly what they may do, but for the moment, so far as that youngster is concerned, I believe the father has decided to put him on the quay in some of the offices and make him a broker, or something of that kind; if he cannot sail ships he will have to charter them.

(Chairman.) We are very much obliged to you.

The witness withdrew.

very very nervous with regard to selecting colours and comparing them.

2449. The matching?—Yes, the matching of colours, and I found many of them made mistakes.

2450. But if you can gradually get rid of the nervousness, a man will find it more easy to do the matching than to do the naming?—Yes, much easier. They have no trouble, if you put them at ease, and say, "Now we only want you to match the colour. We do not want you to tell us what the colour is, but to find out other colours." That explained, it is not very difficult for them.

2451. Some people who are not so familiar with the test as you are, talk of it as if it were a test of naming. You are well aware they are not failed because they cannot name the colours, and it is only a question of matching?—Yes, it is only a question of matching. I do not think there is such a great difficulty in it, except what I have found in two cases. One was the case of the man Trattles, and the other one was a second officer who was failed by Sir William Abney at the same time. I forget his name at the moment.

2452. He came up on appeal?—Yes, in the case of both of those two men, when I was testing them in the colours, I found them in a highly nervous state. For instance, in the case of Trattles, I would give him a green and I would say, "Now I want you to pick out the greens to match that." He would pick up a green, and look at it for a minute or so, and then he would put it down and then pick the same green up and put it alongside the green I had put out, and I found just exactly the same way with the other man, whose name I cannot recall for the moment. I had a good deal to do with both those men. I spent quite a long time with them on different days and different occasions on

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the colours, and satisfied myself that as far as the colour test with the wools was concerned, had it not been due to nervousness they would have had very little difficulty. Then, apart from what I did with the wools, I tested them on the railways. I took them on the railways at night time, where all the signal lights were, and neither of them made any mistake with regard to the lights when I asked them to tell me what the colours were.

2453. In that case of the railway there was no way in which they could guess beforehand whether it was going to be green or red?—I do not think myself for a moment that a man could guess the colours if he were colour-blind.

2454. Of course, a man going on a river has a perfect knowledge in many cases on which side a certain colour is going to be?—It is not so on the Mersey. I would like to mention this.

2455. There may be cases when a ship is coming straight on, when a man could easily guess?—Yes; but I took the trouble of taking Trattles for five or six nights on the River Mersey, on the ferry boat going from Liverpool to New Brighton. On both sides of the river there are hundreds of lights, and they are not all red and green. I would ask Trattles to tell me the colour of a light that might be mixed with a large number of white lights and different lights, but he never made any mistake, and he could pick the lights out as quickly as I could.

2456. So that you formed the opinion that he was not colour-blind?—Not on my test. Then I was present when both of the men were tested by Sir William Abney. Of course I had a conversation with them before they went there, and I knew the highly nervous state both these men were in. In fact, I felt confident, before we went there, that they would not pass—they were so nervous. When they went before Sir William Abney, they made a fair show with the wools, in my opinion. I do not think they made any very serious mistakes; but when it came to the question of the dark room and the two lights that are turned on and changed, one of them failed hopelessly, and Trattles also failed on that very test.

2457. The two squares of light?—The two squares. They are so close together. In my opinion you never see at sea two lights so close together as the test that is submitted by Sir William Abney. They are always apart. You never see them up against each other.

2458. Do you think that makes it more unfair, that they should be both together?—I do. It is not what you call a normal test either, and I think it is very unfair, and a man in a highly nervous state is likely to make a mistake.

2459. I only wanted to understand exactly your objection to them. Why is it that you think two squares of light like that, put close together, are more difficult to distinguish as to whether one is white and one is green than if they were further apart?—I could not give a scientific explanation of it; but to me, as one whose eyesight is fairly good, it is rather puzzling.

2460. More confusing?—More confusing than if I had seen the ordinary lights that you would meet at sea or in a river.

2461. I have no doubt that, when you looked at the squares, you saw perfectly when it was white and when it was green?—No, I am not so sure that I was quite certain as to the colours. Where Trattles failed was this, I think. There was the red and the green, and then Sir William Abney commenced to change the colour of it, and it was then first that Trattles became more nervous and made the mistakes.

2462. Anyhow, in your opinion the fact that the two squares are side by side makes it more difficult than if they were apart?—Yes, and the smallness of the squares also. You know the squares. You have seen them?

2463. Yes. You think they are too small?—I think so. It is not an ordinary light.

2464. You would think something more resembling a lantern test, where the lights were larger, would be better?—I have an opinion that, where such a serious question as depriving a man of his livelihood is concerned, he should be tested afloat; he should be taken

on a tug-boat in the river on a dark night, and tested under the conditions which a man would naturally expect to find in connection with his employment at sea.

2465. Of course you are aware that there would be some difficulties in that?—I do not see that there should be a great difficulty. It might be more expense, of course; but when it comes to the question of depriving a man of his living—

2466. Yes, but I mean this sort of difficulty. You want to get the same weather for the different candidates. You do not want to take out one man on a foggy night and another on a clear night?—A foggy night would not be very good to anybody, whether his eyesight was defective or not. I mean an ordinary dark night.

2467. One of the criticisms of these indoor tests is that they do not imitate out-of-door conditions, when there is a fog?—That they do not imitate a fog?

2468. No?—In a fog it would be difficult for anybody to distinguish the colours.

2469. Might I put this to you? Do you think an outdoor test, without necessarily being always at sea, would be better than these indoor tests?—From what I have seen of the present test I think it is unfair, and what happened with regard to the man Trattles makes me more convinced of the unfairness of it, because when he was taken on the river and put to the test he successfully passed the test, and I think that goes to confirm my view. He could not have guessed the lights on that particular night, could he?

2470. I was not there?—I know, but Sir William Abney suggested to me that men who were defective in colour-vision might guess the colours. I do not think it is possible. I believe, if a man is colour-blind, he cannot distinguish one colour from another, and the guessing would not help him, because he might just guess the wrong light or the wrong colour. Then I was present at the Local Marine Board when both these men were tested. I consider that was a very very severe test, because there were six or seven members of the Board sitting at the table—that is the London Local Marine Board, of which I am a member—and then there were the Board of Trade solicitors and barristers and the expert advisers. I insisted that those men should be tested with the wools in our presence. That was a very severe test, because those men felt it was a life and death matter with them, and they were very very nervous, but they successfully passed the test in the wools. Then we had one of those long telescope glasses that you can turn on a different colour with, and the doctor representing Trattles and the other man submitted this telescope and asked them the colours, and they made no mistakes, and passed successfully; and the result was we returned Trattles his certificate.

2471. You think, under the present tests, injustice is likely to or may possibly arise?—That is my feeling.

2472. You do not want to abolish all the tests?—No, I think that, if a man is colour-blind, he ought not to have charge of the deck of a ship. I do not think any man with experience will say different to that.

2473. You think, from your own frequent use of it, on the whole the wool test is a fairly good one?—It is a fairly good test if properly applied, if a man has full instructions at the beginning. "Now you are not to name those colours, you are only to select colours to correspond with this particular colour as close as you can." I do not think that is a very severe test.

2474. Do you wish to have any other test besides that? Would you like to have some open-air test as well, or in the doubtful cases perhaps?—I have been in cases where men have been failed. They ought to have been tested in the open air under conditions which they were likely to meet with at sea.

2475. Yes, if a man has failed at the wool test you would give him another chance out in the open to be quite sure?—Yes, to be quite sure.

2476. You think that is a fair view?—I think that would be absolutely fair to the man.

2477. On the other point about the form-vision apart from colour altogether, have you any view about



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that?—Yes, I was one of the sub-committee of the advisory committee to the Board of Trade, which was appointed to examine the test, and I attended at Liverpool along with other gentlemen, and thought that what the Board required was rather too severe.

2478. The new test?—The new test.

2479. The 1914 test?—Yes. I thought it was a bit severe. There again I thought the explanation of what was required of the men was not quite what I would like to see.

2480. When they were testing?—Yes.

2481. You think perhaps it was not made quite clear to them?—I did not think it was. You see there are so many lines and letters. I do not think the examiner explained sufficiently to them exactly what they were expected to do with regard to the different lines, and it ought to have been made more clear. Then again I think the test itself was too severe.

2482. I suppose you think the present test fairly satisfactory?—I think so.

2483. And you do not think it need be made more stringent?—I do not think so. I think it is quite sufficient, and I have never heard in all my time of any case of a collision due to the want of good sight or mistake in colour. I do not say it has never happened, but I have not heard of it.

2484. You judge from that that, on the whole, men do not slip through who are inefficient from that point of view?—I do not think so.

2485. And you infer from that that the present tests, on the whole, are therefore satisfactory?—I think the present test is sufficiently stringent; and, as I have already explained, if, in the case of an appeal, a man had an opportunity of being tested under ordinary conditions in the open air, it would be much more satisfactory.

2486. (Mr. Raymond Beck.) As to the question of this test out of doors, which has had a good deal of consideration, I think you mentioned a tug-boat on the Thames?—Yes.

2487. Would you tell me this, not being a seafaring man, but having a certain amount of experience at sea. If I were taken out to sea, and I saw a steamer's head light and a coloured light, and the vessel was moving in this direction, I should know it was a red light?—Surely.

2488. If I saw in the same way the light on the opposite side, I should know it was a green?—Yes.

2489. Also when you take me down the river, although I would not be very learned, if I saw a vessel coming up on one side of the river or the other, I should know for certain, even if my eyes did not tell me which light it was, whether it was red or green?—Of course there is a certain rule of the road to be observed in river traffic that you meet.

2490. Because a vessel was on that side of the river, you would say that ought to be a green light?—Yes.

2491. Because it moved in that direction?—Yes; but I do not think for a moment that would appeal to that man.

2492. That is what I wanted?—They are not smart enough for that.

2493. Again, would not it eliminate that difficulty altogether, in the case of the man who was a very good seaman, if you took him, we will say, to a railway, where in the distance he sees first red and then green, would not that be a much better test than the one to which you submitted the man Trattles?—I do not know. I do not think so, because, you see, you have nothing moving there. Now in my opinion there is no better river in the whole of the country for testing a man for eyesight than the River Mersey, because the ships are not going all up one side or going all down one side. They are crossing and crossing diagonally, and that is where I had such a splendid opportunity of testing Trattles. The question, "That vessel is on the right side of the river, and you ought to see a certain light, and that fellow is on the left," would not come in there. They were vessels crossing different ways, going to Birkenhead and Seacombe. There he had a good test, probably a better test than he could get on any railway that I know of in the United

Kingdom, and I think Mr. Norman Hill would agree with me.

2494. You suggest that should be the test of those who were not easily detected to be good or bad in the preliminary test—what the Chairman calls the borderline class. You would give them the chance of being taken out to sea and undergoing a test of that sort?—Yes, I think that would make it very fair to the man.

2495. You have been in the habit of testing yourself?—Yes.

2496. Supposing it was left entirely to you to test eyesight according to what you think is right, would you continue to test with the wool test, or would you test with a lantern in a room?—I think it is necessary to test them with a light in addition to the wools.

2497. If it were entirely left to you to find out to your own satisfaction as a shipowner or master whether your men were right or not, apart from any Board of Trade regulations, you would take them to a lantern and show them red, green, and white alternately?—I would.

2498. (Mr. Norman Hill.) Take your own case even. You have tested about 400, I think, and two, you said, were hopelessly colour-blind?—Yes.

2499. Would you have bothered any more with those two if they had failed?—Of course, if they were men who already possessed certificates, and it was a question of depriving a man of his livelihood, I should.

2500. But if he was coming up for his first examination and wanted a chance. You know it is very hard lines to prevent a man following the occupation that he wants to, and I think he ought to be given every opportunity of satisfying himself. Of course these men who are colour-blind never will believe they are, and it does not matter what mistakes they make, they stick to it. Of course there is a great difference between the first examination, before a man has really given up his life to a profession, and the second, when he has been in it?—Yes. On that point I think that any boy commencing a sea life, either as a sailor or with a view to being an officer, ought to be properly tested in colours; and then, if they find he is defective, he ought to be told so:—"Bear in mind you can never expect to get any higher than a sailor, and then you may have trouble in getting employment, even as a sailor." I think he ought to be told that.

2501. That is, the severe test ought to be the preliminary test?—Yes.

2502. Of course it would be a misfortune if a boy just crept through on that test, only to be thrown out a little later in life?—Of course I am not a scientific man, and I do not know whether a man's eyesight changes with regard to colour or not.

2503. We are told it does?—I am not in a position to contradict that.

2504. From your own knowledge, apart from these two cases you have mentioned to us, have you known of any other case of a man thrown out by the wool tests who, to your knowledge, was a good officer or a good look-out man?—No.

2505. Those are the only two?—I have heard of others, but I have not myself examined them after they have been rejected.

2506. Is it that you have heard of several, or only occasionally?—I have heard of a good many. For instance, Trattles' brother. I was told by Trattles that, when he went and passed his examination first for second mate, the Board of Trade examiner, who had no right to examine him in the colour test, said to him, "Your name is Trattles?" He said, "Yes." The examiner said, "Did not you have a brother once, who was failed in the colour test?" So Trattles said, "Yes." Then the examiner said, "Would you mind me examining you?" Trattles, never thinking that it would be to his detriment, said, "No. I do not object." Then after that Trattles was failed. Now the impression left upon my mind was, that this Board of Trade examiner had been somewhat suspicious of Trattles, because he had failed his brother, and that was the beginning of Trattles' trouble.

2507. And was the impression left on your mind that Trattles was absolutely normal, and had as good

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[Continued.]

a colour-sense as you?—No, I would not like to say that.

2508. He was one of those difficult cases?—He was a difficult case.

2509. (Mr. Nettleship.) He was one, too?—Yes, but he never made a mistake in the colours. As I told you, if I said, "That is green, that might be a green," he would pick it up and look at it, and he would put it down and turn it over; then pick it up again and look at it, and then he would put it out. When a man acts in that way you begin to get suspicious. In my opinion it was due to the nervousness. When he came to me first, he had had a lot of trouble. He had had Sir Robert Ropner and a lot of other people writing to the Board of Trade, and the Board of Trade made one reply, "Nothing can be done for you," and I suppose he came to me as a last resort to see what I could do, and I am very proud to think I did help him through.

2510. (Mr. Beck.) You are satisfied that he deserved it?—I am satisfied that that man is no more colour-blind than I am, in spite of all the expert opinions.

2511. (Mr. Hill.) There is one other subject, the increasing severity of the form-vision test. We have been told that what really started that was the Colonial Merchant Shipping Conference of which you were a member?—Yes.

2512. Of course I was there also. In your view did that Conference express any opinion as to the necessity for increasing the severity of our form-vision test?—I do not think so. Of course I have not read the papers now for some time, but, in my opinion, it was only a general kind of discussion that came up on it.

2513. Our New Zealand friends suggested that the matter wanted looking into, and we said, "Certainly, have it looked into;" but there was nothing further than that?—No, there were no strong opinions expressed on it.

2514. And it was really never adopted or considered?—I do not think so—not in my recollection.

2515. That is mine too?—As I say, I have not read them for some time.

2516. (Captain Golding.) You have told us that in the event of the candidate failing at the wool test you would, as an appeal, test them afloat on the river?—Yes.

2517. Does that mean that you would like to see the appeal at the Imperial College abolished altogether—that is, the present system of appeal by Sir William Abney?—I would.

2518. Do you think that if a good and efficient lantern test could be devised, that is a lantern test in a room, that would be preferable to the wool test?—Do you mean that to be the only test?

2519. Yes, that to be the only test?—No, I would not agree with that. I do not think they would be very much better off under that test than they are now.

2520. Then would you still retain the wool test supplemented by the lantern test?—By the test afloat. Where a man has failed in the wools, as being a hopeless or a doubtful case, then I should have him tested afloat.

2521. But apart from failing in the wools, in addition to the wool test would you have a lantern test in a room, that is, for the initial test?—Well, to tell you the honest truth, I do not like this dark-room business, especially where a man has nerves on. It is like going into a death chamber, and if you could only have known Trattles and this other man as I knew them—I had this man Trattles on my neck for two years I tell you; wherever I turned I had Trattles, and I knew the nervous state the chap was in—when they went into that dark room it just about finished them. I did not like it.

2522. (Chairman.) If you have the lantern, you would like it out of doors?—I would like it out of doors. Then a fellow feels sure.

2523. (Mr. Nettleship.) I should like to ask you about that question of indoors. I understood you to say a while back that, if it were a foggy night, it was no good any way?—It would not be a good test.

2524. But surely there are many degrees between what you would call a foggy night and a misty night—I am not a seaman?—Yes, there may be a fog where

you could see lights 300 or 400 yards, and there might be a fog where you could not see 20 yards.

2525. Very well; take a case of quite a clear night, when you could see at whatever was the maximum distance required, and another night, when it is rather thick, and you could only see half the distance, do you think it would be a fair test to test one man on one of those nights and another man on the other?—No.

2526. How can you tell when you get a uniform atmosphere?—Clear of fog?

2527. How can you tell when you get a uniform atmosphere, testing different men on two nights?—Of course it would be very difficult to know when you had exactly the same conditions.

2528. Therefore, would it not be very much better to have an official lantern test in a long room?—No.

2529. I do not agree with a pitch-dark room because some people are rather frightened; but, say, looking down a dark tube like a shooting-gallery tube—have you any objection to that?—I can only say I took Trattles afloat on the Mersey for five nights and I had the same conditions practically every night. The fog did not interfere; so, if I could find five nights in which I could test a man under what I considered similar conditions—

2530. You are taking the single case of Trattles; but Trattles is not the only colour-blind man?—No.

(Chairman.) But Mr. Havelock Wilson means that he happened to find five nights running when he could do it.

(Witness.) Yes, I could do it.

2531. (Mr. Nettleship.) And he made no mistake?—No.

2532. Would those lights be moving or not?—A lot of them would be moving. Of course, on the Mersey there are hundreds of lights on both sides of the river. There are standing lights. Then, in addition to them, you have the ships going up, large and small, and then you have the ferry boats all the time crossing and re-crossing the river and continual traffic all the time.

2533. Speaking generally, did you try him with moving lights as well?—Yes. I was all the time saying, "What light is that?"

2534. Mr. Beck asked a question as to the direction in which the light is moving being of help to the candidate?—You see I disposed of that by saying on the Mersey it is different from the Thames. On the Thames, if a man was smart enough to think of that, he would say, "That ship is on that side of the river; the light I ought to see ought to be so and so"; but on the River Mersey you have different conditions altogether, because in addition to the ships coming up and going down you have the ships crossing.

2535. It is precisely the ships crossing that I wanted to know about. Does not the direction in which the crossing ship should move, say from New Brighton to Liverpool or the reverse, tell you what side of the ship you are looking at, and therefore which light?—It might help him a bit; but I do not think it would be the same as a ship going down one side of the river and going up the other.

2536. I quite agree; but do not you think it would be a serious thing in judging as to that man's vision?—I do not think so, judging from my experience of Trattles; and then I had a good test, because, you must remember, this man had been failed.

2537. Yes; my point is still that the direction in which the vessel will be moving, which you can see, must help a man who knows the sea lights in judging what colour it is?—I quite believe if any member of this Committee were to go afloat now, after all the talk you have had, he might be able to do that; but you must remember you are dealing with men who are seafaring men, and who have not been studying this subject very much, and I do not think they would be smart enough to judge that.

2538. Not if they see in which direction the ship is moving?—No, I do not think so.

(Mr. Nettleship.) If not, of course my questions have no meaning.

2539. (Sir Arthur Rücker.) On the same point, would there not spring up a class of coaches who

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would teach them the points themselves—a very useful thing—how to know which way a ship is going?—I do not know. Of course you can make all the rules and regulations you like, and somebody will find a way around them; but I do not think they would be clever enough for that.

2540. But we know there are schools and places where they do coach them for the colour test?—I have heard of it.

2541. There are really, and we have evidence on that?—If the man was colour-blind, like men I remember in my time, you could coach them for a thousand years and they would not know one colour from the other.

2542. (Chairman.) If you got him out of doors—I am not saying on board ship—and you could show him lanterns, not necessarily on a river or out at sea, and do it in a way which would not enable him to guess anything, would not that go rather near what you have told us about? You have used the word “afloat” several times. I do not want to press you in the least, but it might be possible to find tests, which would not involve being afloat, with a kind of lamp that a man is familiar with?—I do not think anything you can get out of doors—for instance, I understand your Committee has suggested testing men down off Shoebury—

The witness withdrew.

Adjourned *sine die*.

## TWELFTH DAY.

Friday, 5th May 1911.

PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).

The LORD RAYLEIGH, O.M., F.R.S.  
Sir ARTHUR RÜCKER, F.R.S.  
Mr. RAYMOND BECK.  
Captain THOMAS GOLDING.  
Professor FRANCIS GOTCH, F.R.S.

Mr. NORMAN HILL.  
Mr. EDWARD NETTLESHIP, F.R.C.S.  
Mr. J. H. PARSONS, F.R.C.S.  
Professor J. H. POYNING, F.R.S.  
Professor C. S. SHERRINGTON, F.R.S.  
Dr. WILLIAM WATSON, F.R.S. } Secretaries.  
Mr. T. LODGE

Mr. ARTHUR T. H. SCOTT, Principal Pilotage Clerk, Trinity House, called and examined.

2547. (Chairman.) The first point is the big and important point of the standard of vision which Trinity House require of those who apply for pilots' licences. Perhaps you will describe that to us?—The standard we require has been drawn up by our own medical man. I can put in a paper showing you exactly what that is; it is in rather technical terms. (Handing document.)

2548. I will read it: (1) “Form vision. A candidate must have no defect of sight, he must be able to read without glasses  $\frac{5}{6}$  by each eye separately at the required distance, and the near type at the distance for which it is marked. (2) Squint, or any defective action of the eye muscles or any disease of the eye disqualifies. (3) A candidate is disqualified by any imperfection of his colour sense. (4) A candidate must be also otherwise physically fit for the duties of a pilot.” Then there is a description of the method of examination in relation to form vision; and as regards colour vision, he is examined as to colour vision “by means of Holmgren's wools, and the method of conducting this part of the examination is the same as that laid down in the Board of Trade regulations.” You simply take the Board of Trade rules and apply them—your examiners follow those rules entirely?—Yes, our medical man has based his system of examination on the Board of Trade rules.

2543. What we are doing now is by way of experiment for ourselves?—That is what I meant. I do not think that is such a practical test as to take a man afloat on a ship which itself is moving.

2544. I see that?—Your own ship is moving and everything else is moving. Then you meet conditions which a man is expected to meet when he is following his ordinary employment, and the nearer you can get to that the safer you are.

2545. You see, do you not, that if that is the only test—you do not suggest that it shall be the only test—there are greater difficulties in making it equal for each candidate, when you have hundreds and hundreds of candidates, than in an official test, owing to conditions of weather. We could not take them all to the Mersey, for instance?—Yes, but I have not suggested that every candidate should be put to this test afloat. I only meant, in cases where a man has failed in the wool test, and you are suspicious of his vision not being perfect, then will come in the other test.

2546. Then if you can get him to a place like the Mersey, that is where you would take him?—That is where I would take him, and it would not cost the country anything, because I would take him on board the ferry boat and spend a few hours there going up and down the River Mersey.

(Chairman.) I think we understand your point of view, and we are very much obliged to you for coming.

2549. You use the same description of wools for colour vision?—Yes.

2550. And then for colour ignorance you have sheets of different coloured glass and he is required to name the colours. Then as to physical fitness, we need not go into that; it is fairly clear. I will not read all the details as to form vision; what you require is full normal vision in each eye  $\frac{5}{6}$ ?—Really the requirements are very sweeping; as stated there he must have no defect of sight, and he is disqualified by any imperfection of his colour sense.

2551. Yes. There is nothing here about the question of age, or when this examination is applied. Can you tell us about that?—The age is 35.

2552. They cannot come after 35?—No.

2553. They may come any time up to 35?—That is so.

2554. And apply for a licence?—Yes.

2555. At any age?—There is a preliminary qualification that they must have served seven years at sea.

2556. So that practically means that they will not come in before 25?—No; before about 22 or 23.

2557. So that it runs from about 22 up to 35?—Yes.

2558. As to the means you adopt to secure the continued competency of those who get a licence, do you re-examine them?—They are re-examined every

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[Continued.]

year by a member of the committee, or members of the committee, and the test by them is a practical test. The man is asked to distinguish objects, and in some cases he is taken down to the river, at the Tower Bridge, and asked to distinguish objects and so forth, and also colours.

2559. In what way is he shown the colours?—I fancy he is simply shown wools just as a sort of rough test, and if there is the slightest doubt in the minds of the examiners we immediately send him to our medical man to report.

2560. The first test is a stringent test before your medical man both for form vision and colour vision, and then afterwards each year every one of them comes before some member of your committee for a test of the kind that you describe?—Yes.

2561. If there is the slightest idea that he is failing in any way, he goes to the medical man?—Yes, and we have a firm report from him; it depends a great deal on his report whether the man is allowed to continue.

2562. Have you any statistics as to the numbers who have been failed?—Yes, I can give you that. This system was adopted in 1901. We have had 125 applications, and out of those we have licensed 119 men.

2563. That means that only six have failed?—Only six on account of eyesight.

2564. We are only dealing practically with eyesight?—Yes, we are only dealing with that point now.

2565. In what districts are they allowed to practise—I mean how far does the licence carry them?—The figures I have given you now only apply to the London district. Our regulations are not the same for the outports. I am giving you the London district only now.

2566. One hundred and nineteen passed during those years from 1901 up to date?—Up to the end of 1909; that is from 1901 to 1909.

2567. (Professor Poynting.) Are those all fresh entries?—Yes.

2568. (Chairman.) Not re-examination?—No.

2569. Can you tell us anything about those who came a second time during that period?—I understand you to mean those who are already licensed?

2570. Yes, those who are already licensed who have to pass the test again annually?—I see we had 14 doubtful cases during those years, that is to say, 14 doubtful cases that were tested by the committee and then sent for a report to our own medical officer, and in only two cases were they absolutely rejected; in one case the man was pensioned, and in the other case the man's licence was not renewed.

2571. Still, that is two out of 14?—Yes.

2572. An important proportion?—Yes, and in the cases of the other 12 the licences were renewed.

2573. There had been a little doubt, but the medical officer passed them?—Yes, he certified that they were all right.

2574. What is the total number of your licensed pilots in the London district?—The actual number in January 1911 was 330.

2575. We may take it that all those 330 have to come up for this informal test, if I may put it like that, every year?—Yes, every year.

2576. Do you know the ages of these two cases that were rejected? You say you gave one of them a pension, so perhaps he is an elderly man?—No, that man was quite a young man—I should not think over 40.

2577. I suppose you have power to pension?—Yes, where a man is disabled by a physical defect of that kind.

2578. Do you know whether that would be a case of disease, or accident, rather than what one may call failure of sight from ordinary causes?—I do not remember the details of that case, but if it would help the Committee I could refer to our medical man's report on that particular case.

2579. Yes, it would be interesting to know about the doubtful cases. At any rate, you thought it was a case deserving a pension?—Yes. The second case was a much older man. That was a case of colour blindness brought on by smoking. I remember the medical report was quite strong with regard to it. This man

was advised to give it up, but he would not follow the advice, and the consequence was his colour vision never improved and we were unable to renew his licence. I shall be very glad to give you further particulars of those two cases.

2580. Thank you. I suppose you have not had complaints about the stringency of your requirements. Have you good ground, do you think, for justifying what is a very stringent test?—I have heard one or two candidates say that our test is stronger than required by the Board of Trade, and therefore they think it is rather hard lines on them, but we have had no official complaints.

2581. The general view of Trinity House has been. I suppose, that under the circumstance; a pilot's work is so responsible that they think it desirable to have a really high standard?—Yes, and besides a pilot is placed on board vessels by compulsion of law, and therefore we hold it to be our duty to secure the very best men.

2582. You said that the rules are not quite the same outside the London district. Are they less stringent in other districts?—They are less stringent in this way that we have no medical man of our own who examines the candidates; we are satisfied if we receive the report of any qualified medical practitioner.

2583. But the standard is the same—I mean the standard that you indicate to the medical officer?—No, that is not so, because the conditions are not quite the same in the outports. In the outports the work is very small, and sometimes owing to the smallness of the earnings we have a difficulty in getting candidates at all and we have to take the best we can get, so that we have not drawn up very stringent regulations—or any regulations as regards the exact form of test with regard to eyesight. The form of certificate that we always have I can hand to you. That is the form of certificate given by our own medical officer. (Handing document.)

2584. This only uses the word that his sight is good, but you have defined that for the London district quite definitely in the way you have already described?—Yes, that means that the man has passed the test laid down by the medical officer, but in the outports we are not so strict. All we have from them is this: “A certificate under the hand of a duly qualified medical practitioner must be attached hereto stating that the candidate has been examined and found physically fit to enter the pilotage service, also that his sight is good and that he does not suffer from colour blindness.”

2585. You could not take a man who had not passed the Board of Trade certificate, could you?—

(Mr. Norman Hill.) Yes, the pilot need not be a certificated officer before he is appointed a pilot. Many of the pilots are non-certificated officers, and never have been certificated, and if you are not a certificated officer there is no obligation on you to pass the Board of Trade test.

2586. (Chairman.) Without a Board of Trade certificate he might become a pilot?—Yes.

2587. In the outports you could take a man and make him a licensed pilot even if he had not passed the Board of Trade certificate?—We could.

2588. (Captain Golding.) Not in a very large port like Southampton?—No, that would not apply to Southampton, but in any case we, of course, give preference to a man with the Board of Trade certificate.

2589. (Chairman.) In addition to the medical practitioner's report you prefer to have the Board of Trade certificate?—Yes, that would weigh with us if we had a preference, but in the case of London one of the qualifications is the possession of the Board of Trade certificate of competency as master of a foreign-going steam vessel; that implies that he has passed the Board of Trade vision test.

2590. I am asking in some ignorance. Is the whole character of the work in the London district so much more responsible?—Yes, much more. There is the length of the navigation to be considered, and the difficulty of it. We want a higher class of man than we should want for a small port like Aberdovey, where only very small vessels can enter.



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[Continued.]

2591. There is no other port that presents an analogy to London, I suppose?—Yes, you might take the Isle of Wight where our regulations are exactly similar as regards the Board of Trade certificate.

2592. (Lord Rayleigh.) How about Southampton and Liverpool?—Southampton is included in the Isle of Wight. I cannot tell you about Liverpool; that does not come under our jurisdiction.

2593. Do any other ports come under your jurisdiction?—Yes, ports on the east coast south of Hull; Scotland we have no jurisdiction over.

(Captain Golding.) The Tyne is under local jurisdiction.

2594. (Chairman.) So that London is really much the biggest thing you have to handle?—Yes.

2595. And next to that, what you call the Isle of Wight district?—Yes, that includes Southampton.

2596. Under the further headings you have been kind enough to note you have given us the general qualifications required. You have described to us by whom the certificate must be given. Your own Trinity House medical officer is a man selected and in your permanent pay—he receives a salary from Trinity House?—Yes.

2597. Do you have doubtful cases in the outports?—Yes. Our outports are under the control of a sub-committee appointed by us. That sub-committee is subject to our control. We issued a circular to them in 1891 when we extended the system to the outports. Perhaps I might read a little extract from that circular. We say: "Any physical defect which tends to render a man incapable of performing his duties efficiently is to be stated in the report, which will be treated by the Board as a confidential communication, and in all cases where a doubt arises as to the propriety of renewing a licence you will hold over the renewal until a report has been transmitted to this House, and a personal inspection or inquiry made by the Pilotage Committee, or as the Board may direct." So that in a case like that the Committee might, and probably would, see the man himself.

2598. (Captain Golding.) I rather think one of the pension cases referred to by Mr. Scott just now was that of a man named Bennett from Weymouth?—Yes, that is the case.

2599. He came under that exact heading of being reported on as defective and sent to the medical officer and reported on and pensioned?—Yes.

2600. (Chairman.) Under the instances of doubtful cases perhaps you could give us some particulars by way of example of a report given on a doubtful case?—Yes. I have a case that occurred last January. A man came up to have his eyesight tested by the committee, and it was not found to be satisfactory, so we sent him to our medical officer.

2601. Was this a first examination or a re-examination?—This is a re-examination. He was a man who had held a licence for 10 years. This is what the medical officer says: "I have examined the above as to the condition of his eyesight. He has myopia, short sight, for which he should use efficient spectacles; the myopia has increased since I saw him on January 11th, 1906. Without spectacles his distant vision is not good enough to allow him to continue to perform the duties of a pilot. With suitable spectacles he would be quite able to follow his occupation as a pilot. It is a case that I should advise permission being given to him to wear spectacles." This is the second time that this defect of eyesight was observed.

2602. What age was that man?—He was 46 in January 1911.

2603. While we are on the question of age, up to what sort of age do your oldest pilots go; have you any limit of age?—We have no limit of age.

2604. What would be the oldest pilot in the London district, roughly?—We have a man about 75, I think.

2605. Do they retire at their own option?—Yes; but, of course, a man is not retained unless he is physically fit.

2606. No; because you have this examination every year?—Yes.

2607. A man goes up and presents himself before your committee, and the committee say: "You must not go on any longer" if he is defective?—Yes, or they give him a warning: "Do not you think you are getting too old?"

2608. Yes, that takes place once or twice and then they are told that they must not go on?—Yes.

2609. Practically that is what takes place unless they retire voluntarily?—That is so.

2610. Are they entitled to a pension?—Yes.

2611. So that if they do retire voluntarily they get a pension?—Yes.

2612. The pension is only payable at a certain age, I suppose?—It only becomes due when they are physically unfit.

2613. Not at any particular age?—No.

2614. That rests really with your committee?—To a great extent. A man cannot retire voluntarily on a pension if he is still fit to perform his duties.

2615. The pension, of course, is a good deal less than anything he is likely to earn?—The pension in the London district is 11. per annum for each year of service and that is considerably less than he earns as a pilot.

2616. As a matter of fact, about what sort of age would the average man usually go?—I find that the average service is about 35 years. The average age at which we get them, I suppose, would be about a little over 30, so that the average age for retiring would be about 65 or 66. It is only, of course, in exceptional cases where we get hale and hearty men who are anxious and quite capable of staying on.

2617. And there are a certain number of cases where they break down before?—Yes.

2618. Roughly, they go about 65?—About 65.

2619. With regard to the test which is applied to these 350 men, is it all done at once or do the committee give two or three days to do it?—We give one month in every year to it, from the 1st January to the 31st.

2620. Certain members of the committee attend every day?—Yes, and some of these men come up every day. They can come up just as they like, but their licence must be renewed before the 31st January; it expires on the 31st January.

2621. Are they nearly all taken out on the river and tested?—No, that is only done in doubtful cases; that are put through a test of looking out of the window to distinguish various objects, and if there is a doubt they are then taken down to the river, and if there is still a doubt they must go to the medical officer.

2622. Are they put through some test with regard to colour?—Yes.

2623. That takes, I suppose, 10 minutes or so for each man?—Yes, I daresay it takes about that.

2624. It is a long routine?—Yes.

2625. They are all accustomed to it?—Yes. It involves a good deal of labour, and besides that test there is the question of their physical fitness and of their qualifications as regards the knowledge of their work, so that sometimes the examination of one man occupies a considerable time if there is a doubt about his other qualifications.

2626. Do you mean failing memory?—Knowledge of his work.

(Mr. Norman Hill.) The depth of water and the position of buoys.

2627. (Chairman.) Yes, but we are speaking entirely of re-examination. If he once knew that, would not he always know it?—No, not necessarily, because of changes in the district.

2628. The test proves whether he is capable and has been shrewd enough to keep his knowledge up to date?—Yes, some men get a bit slack and this examination rather tends to keep them up to the mark.

2629. There is one remaining point. You told us about this man in whose case the medical officer recommended the wearing of spectacles for myopia. What rule have you with regard to the wearing of spectacles?—I can read you what our practice is with regard to that: "As regards the wearing of spectacles a licence would not be granted to a candidate who required to use them when on duty."

2630. That means the first licence?—Yes.

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[Continued.]

2631. At the first test if it was thought that the applicant required to use spectacles when on duty he would not get his first licence?—That is so.

2632. Perhaps you would kindly read it once more?—As regards the wearing of spectacles a licence would not be granted to a candidate who required to use them when on duty, but if it should appear to the Elder Brethren that the sight of a licensed pilot, although not up to the standard required of applicants for licences, was reasonably good without the aid of spectacles, they would not object to the use of such, when on duty, to increase his powers of vision. In such cases the question of the renewal of the pilot's license is dealt with upon its merits." Of course, I imagine that the sight alters in certain cases.

2633. Does a man sometimes come before you and say he can see well enough if he is allowed to use spectacles?—Yes.

2634. And then that is considered on its merits?—Yes; as a rule we send nearly all those cases to the medical officer.

2635. What is the actual result in those cases? Do they generally get the renewal of the license?—Yes, subject to the condition of wearing spectacles when on duty and carrying a spare pair; we make that condition.

2636. And you say, that out of your 350 men there are a certain number among the older ones who do wear spectacles when on duty?—Yes, I should think about seven or eight.

2637. Not more?—Not more.

2638. The others really have not required it?—No.

2639. Those are not really presumed to be less efficient than the others?—No.

2640. That is to say it is not supposed, because they may have to wear spectacles, and always having a spare pair, that anything which happens with regard to weather and so on makes them less efficient?—I do not think so.

2641. Fog, and so on?—Not in the view of what our medical man says.

2642. He does not consider that it does?—No.

2643. He thinks it makes them more efficient in their work and does not really render them unfit to be pilots?—That is so.

2644. It is a very important point—the principle is important?—Yes, exactly.

2645. The principle is accepted that in these cases the man is not considered less efficient as a pilot by reason of his wearing glasses?—That is so.

2646. I suppose the point has been very carefully considered?—It has.

2647. You have not had complaints of these men who do resort to spectacles in their later life being bad pilots?—No—the proportion is small.

2648. Yes, but still the principle is the same. Trinity House does not consider that these men are less efficient pilots?—No.

2649. Although it knows that in consequence of certain defects of sight without spectacles he has to remedy them by the use of spectacles?—Exactly.

2650. You have considered that very carefully?—We have.

2651. (Lord Rayleigh.) Must there not be many more than seven or eight out of the total number who would see better with spectacles? It strikes me that the number you mentioned is very small considering the age to which your men go on. Is the high standard of sight insisted upon at the first licensing supposed to be maintained all through their career without having recourse to spectacles?—I do not think it is, because that, I think, would be almost impossible.

2652. (Chairman.) Do you think your men are a little unwilling to admit that the spectacles would improve their sight—or perhaps they do not know—a little afraid perhaps of losing something?—Yes, I think that is so, perhaps.

2653. (Sir Arthur Rücker.) I think Lord Rayleigh's question is the best I could form, but these seven or eight are men from among a great group who have been thoroughly sifted. A great many of these men who might otherwise have to wear spectacles have been

rejected as they get old. The seven or eight therefore remain out of a carefully selected number in the sense that everybody has gone through the annual test and a good many have not had permission to wear spectacles and therefore had to go?—No, we have had very few cases in which we have actually rejected a man on that account. I can only remember two cases of rejection in the last 10 years.

2654. Of course, these men were all very first-rate in the first instance, with full normal vision in both eyes?—Exactly.

2655. You test the eyes very accurately on the first occasion?—Yes, we give the eye a good test at starting.

2656. (Mr. Nettleship.) I do not think I can quite take Lord Rayleigh's view that men who had perfectly good vision between 25 and 35 would in a very large proportion fall below the standard at 65. In the case of a boy it is different, but in the case of men of 25 to 35 whose sight is good I do not know that there would be a large proportion. I suppose that the range of objects that a pilot in the Thames district has to look out for is very different from the range of objects that an ordinary seaman on the high seas has to look out for. Supposing a pilot whose sight had fallen off a little through age was allowed to wear spectacles—or supposing he does not even admit that his sight has fallen off, and does not wear spectacles, it is possible he might be able to distinguish the objects that he has to look out for on the river, whereas if he were on the high seas he might possibly have a difficulty?—Yes, I think there is something to be said for that point of view. The objects he has to see are not so far off.

2657. And they are more constant than he would meet with on the high seas?—Yes; he is accustomed to navigating the same waters and gets accustomed to seeing the same objects.

2658. And knows what to look out for?—Yes.

2659. He has, of course, also the assistance of the officers for that purpose, although, of course, it is the pilot's duty to look about and see things?—Yes.

2660. Then, again, he is guided not only by lights on the river but by buildings and marks, some of which are large objects, that he would be quite unable to expect to see if he were on the high sea?—Yes, in the upper reaches of the Thames that would certainly apply. (Mr. Norman Hill.) I am not quite sure if Mr. Nettleship understands that the pilot is in charge all up the English Channel right into the wide mouth of the Thames. The narrow district does not begin until he gets to the Nore.

(Mr. Nettleship.) It would apply in the Thames estuary itself?

(Chairman.) Yes, but there is a good deal of open sea before that. Certainly, I for one had not realised that.

(Mr. Nettleship.) Even so, I suppose the objects are always there and he knows what to look out for.

2661. (Chairman.) Does the compulsory region within which you apply these stringent tests extend from the Isle of Wight? No, the compulsory region on the south is from Dungeness, and from Orfordness on the north.

2662. You have an extension of the London district?—Yes, an extension of the London district, which is called the English Channel district, which extends to the Isle of Wight.

(Mr. Norman Hill.) If you take the waters from Dungeness right into the mouth of the Thames you have as much high sea as in any other part of the world and with far more moving objects on it.

2663. (Professor Poynting.) I think you said that there were 14 doubtful cases since 1901?—Yes.

2664. Were those out of the whole lot?—Yes, some of them were in respect of men who had not passed the Trinity examination which has been in force since 1901.

2665. (Captain Golding.) You said that men could enter at the age of 22, but I take it very few enter at that early age; it is nearer 30 when they enter the service as a rule, is it not?—I was rather thinking of the age at which they put their names on the list.

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[Continued.]

The age at which they enter the service must be later, because they have to go on the waiting list.

2666. They seldom come to the top of the list until very nearly 30?—Very seldom.

2667. There is a certain number of exempt pilots whose employment is voluntary by the shipowner?—Yes.

2668. They have to conform to the same standard as the compulsory pilots as far as form vision goes?—Yes, they only work between London Bridge and Gravesend.

2669. (Mr. Norman Hill.) Have you had to inquire into any cases in which one of your pilots who had to wear spectacles has got into trouble?—I do not remember one; I do not think so.

2670. You have had no complaints of the loss of spectacles?—No.

2671. Or of failure of sight through the loss of spectacles?—No.

2672. With regard to the test you tell us you do not apply your standard of  $\frac{2}{3}$  in the outports?—No.

2673. That is because the supply would not equal the demand if you did?—No, because our outports differ very largely in importance, and at many of the outports the pilots, as I said before, are merely of the fisherman class and if we imposed a strict standard we might have difficulty in getting any men at all.

2674. The man who is the best pilot from the point of view of experience and of handling a boat and such things might not come up to your standard?—No.

2675. And you would have to reject a better man on the ground that his eyesight was not quite perfect?—That is so.

2676. (Chairman.) Is it that the better prospect of wage earning produces a man physically better all round in sight and physique in London, and that in the out districts you cannot command so physically fit a type of man—because it is mainly a question of physical fitness? I do not see why the poorest fisherman who would care to earn what there is to be earned by pilotage should not be just as fit physically in body and in sight as your best London man?—Yes, but where the emoluments are on a larger scale, we have a wider selection.

2677. (Captain Golding.) I am not certain that we could not get so good a standard in the outports. We

have no absolute standard there, as Mr. Scott has told us, and for all we know they may comply with the  $\frac{2}{3}$ —we have no evidence that they do not?—That is so; we are satisfied with the certificate of a properly qualified medical man.

2678. (Chairman.) You do not know necessarily that they fall below?—No.

2679. You have not thought fit to put them to this severe test?—No; and they go every year before local sub-commissioners to have the licence renewed.

2680. So that you have a constant hold upon them if there is anything at all serious?—Yes.

2681. (Mr. Raymond Beck.) With regard to these pilots in the outports, which is a very important point, I should like to ask you whether you suggest that one of these pilots who came up to the present Board of Trade standard—not the 1914 one—would probably come under the word "good" as advised by your medical man?—I think it possible he would.

2682. You are of opinion that the entrusting of a valuable ship and cargo to a man of such qualifications for part of the voyage is perfectly safe, and that you are not endangering property?—I do not think so.

2683. With regard to the very high standard for London, I would there suggest that you get this very high standard, because the post being a lucrative one you get a great many applications?—Exactly.

2684. And also it is well known what the standard required is, and therefore the applicants only come forward when they know they have good sight vision?—That is so.

2685. It is not altogether because you think a man would be unsafe to take charge of a vessel in the Thames if he had not  $\frac{2}{3}$ —it is really that you are enabled to get a very high standard in the same way, if I may suggest it, as the man who applies to be a footman in Park Lane or Grosvenor Square knows it is no use his applying unless he is 6 feet high?—Yes, really the same argument applies. I suppose if for any reason the supply were to fall off we might have to lower our standard.

2686. Does the west coast of Ireland come under your jurisdiction?—No, none of the ports of Ireland come under our jurisdiction at all.

The witness withdrew.

The Committee adjourned.

## THIRTEENTH DAY.

Friday, 30th June, 1911.

PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).

The LORD RAYLEIGH, O.M., F.R.S.  
Sir NORMAN HILL.  
Sir ARTHUR RÜCKER, F.R.S.  
Professor FRANCIS GOTCH, F.R.S.

Mr. EDWARD NETTLESHIP, F.R.C.S.  
Mr. J. H. PARSONS, F.R.C.S.  
Professor J. H. POYNTING, F.R.S.  
Professor C. S. SHERRINGTON, F.R.S.

Dr. WILLIAM WATSON, F.R.S., } Secretaries.  
Mr. T. LODGE, }

Dr. H. LINDO FERGUSON, M.D., called and examined.

2687. (Chairman.) We are very much obliged to you for being good enough to come before us?—I am very glad to be of any use I can; it is a subject which interests me very much.

2688. I think I am right in supposing that it was on your advice that action was taken by the Union Company, or rather by the New Zealand representatives at the Colonial Merchant Shipping Conference?—Yes; I may say that is so.

2689. It arose out of you, I suppose?—Originally, I moved originally in the matter before the meeting

of the Inter-Colonial Medical Congress in 1896. I suggested this subject as an important subject for discussion and consideration by the oculists, and they passed a series of resolutions which were the basis on which the Union Company took action. I may also say that some of the State Governments took action with regard to their railway tests on the basis of the same resolutions.

2690. I presume that led to the matter being brought before the Colonial Merchant Shipping Conference in 1907?—Yes.

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[Continued.]

2691. We have a statement handed in by your chairman, Sir James Mills, which gives us the conditions which you apply to your officers?—Yes.

2692. Which we may take simply for granted?—Yes; there is nothing to go through in that.

2693. It shows the conditions which you in your company think desirable to have?—Yes.

2694. Then I think I may go to your outline and follow that in the best way I can. Take it in your own way. I will put an occasional question, but I think if you follow your own line it will be the best course, will it not?—Yes, I think so, and the quickest.

2695. Your view is that the present Board of Trade standard for form vision is too low for safety?—Far too low.

2696. Perhaps you would just follow that out a little on your own line?—As a matter of fact, nobody comes to see me in my study who is not prepared to pay a guinea to find out what is the matter with their eyes, and to get some relief. But out of 10,000 consecutive cases that came to me, I found that over 66 per cent. could pass the Board of Trade standard. That does not seem as if the Board of Trade standard were at all high, because those 10,000 cases included all the cases of cataract and chronic glaucoma, and even children born without eyes. There was not a single case counted out: every single case was counted in. From my records of vision I could say each case would, or would not, have passed the Board of Trade standard.

2697. And 34 per cent. would have failed?—The other 34 per cent. included all the cases of short sight, (except the very small degrees,) and all the cases of extensive defects, which would have failed. I do not know whether the members of the Committee quite understand what the Board of Trade vision test is. That seems an absurd thing to say, but unless you have your vision reduced to the standard you do not realise what a poor standard it really is. On the way down to-day I borrowed some convex lenses in order to see if I could reduce the vision of the members of the Committee to the standard in order to let them see what the standard is. May I do that?

2698. Yes; I should be very glad if you would show us anything.

(Mr. Nettleship.) I think we have had it before us.

2699. (Chairman.) I think it would be as well, with regard to the lay members at any rate?—I thought perhaps if some of the lay members were to have their vision reduced to the Board of Trade standard, it would give them an idea as to how very low the standard really is.

(Experiments were then made with the Chairman, Lord Rayleigh, and Sir Norman Hill.)

2700. (Chairman.) Going back to the outline of your evidence, there is an allusion to the French military service?—I find in the Ophthalmic Year Book of 1907 that the requirements for the French military service are that there must be half normal vision in one eye and one-twentieth in the other. The Board of Trade only requires rather less than half of the normal vision in one eye, and the other eye may be quite blind.

2701. So that their standard is higher?—Their standard is higher. That is with reference to the ordinary conscripts for the army. They are not good enough to be shot if they have not got that.

2702. The only assumption you would make is that for naval service you want a much higher standard than that?—Yes, I think so.

2703. Then shall we take the second point about re-examination?—Of course, the question of re-examination is one which is beset with difficulties, because when once you give a ticket the matter passes away from your observation, and the holder's sight may deteriorate seriously.

2704. But your main point, if I may make it quite clear for the purposes of your evidence, is that there is no guarantee now in the shape of periodical examination that this standard is maintained?—That is so.

2705. You say there are some difficulties besetting the question?—Difficulties beset the question because, if once the ticket is given, at present it, stands for life.

If you cannot get hold of your officer to re-examine him periodically it seems to be an absurd thing to demand a standard at all. As the Board of Trade test has been applied it is quite possible for a man to come in and pass his test, who, when he went on board his ship that night, could not see his way along the deck. That is quite conceivable. But the man could pass the Board of Trade test. I assure you I have led a man having a certificate along the deck which I could find my way along, and which he could not. He was stumbling about over things, and I helped the old gentleman along. He was going to pilot a boat down the coast. He was a man past work, but he had his Board of Trade ticket.

2706. Which he had got many years before?—I cannot say how many years before.

2707. But in your opinion he was quite unfit to do what he was undertaking?—He was not fit to find his way along the deck. That seems very absurd. There is one case in which I had to give a certificate to a man who had been operated on in London for cataract, and who came out in charge of a ship. With the eye which had been operated upon he had just enough vision to pass the Board of Trade standard with his cataract lens. The other eye failed at six-sixtieths. Of course, if the Board of Trade say that standard is sufficient with the glass, they ought to take the responsibility of any accident that might happen. I say that if that man had been turned out in the middle of the night to meet an emergency he would have been a danger to the ship. His third officer might have met the emergency all right, but as soon as the captain is on the bridge he is responsible.

2708. Your view is that whatever individual companies may do, the Board of Trade should hold itself responsible for the good condition of the eyes of officers during the length of the period for which they serve?—I think so.

2709. By periodical examinations?—I think that would be the best thing to do.

2710. Then what is your experience as to the changes which are likely to take place under ordinary circumstances in people's eyes? I mean, how often do you think the re-examination should take place?—In the case of young men there is not likely to be deterioration. Only by the time a man gets to 40 it is advisable he should be re-examined at intervals. Suppose the first examination were 25; his second should be at 40, his third at 45, and his fourth at 50.

2711. After 40 every five years?—I think every five years; and over 50 I would perhaps make the intervals shorter, because there is the chance of cataract coming up. Cataract becomes more probable after 50—or chronic glaucoma.

2712. Then I understand the re-examination should be principally from the point of view of what may normally happen to the human eye?—Yes.

2713. And not from the point of view of possible accidents that may occur to a young man?—So far as the accidents are concerned, if anything were definitely known as to an accident or an injury, I think the man ought to be tested again.

2714. Even before 40?—Even before 40.

2715. Would you say the same as to ill health which might have been suspected to have affected the eye?—In the case of hypermetropia it affects the eye very much. If a man is hypermetropic and has an illness, even an attack of influenza, his accommodation will fail and his vision deteriorate. For that reason I think it is essential before a man goes to sea, or at all events before he is given a ticket, he should be measured carefully, and should not be allowed to have a ticket if he has more than a certain amount of hypermetropia present.

2716. We are passing now to a slightly new point?—But I think it is pertinent.

2717. Yes; it is quite right that we should do it. Your point is with reference, at any rate, to the class of hypermetropics, which is a large class?—Yes.

2718. Quite apart from the question of re-examination, there should be a more efficient examination at first?—Certainly.



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[Continued.]

2719. Even of a different character to that which is proposed under the new test?—Yes, I think so.

2720. Perhaps you would elaborate that a little for us?—I have plenty of notes of patients who have high degrees of hypermetropia who have gone to sea. If a man has four or five diopters of hypermetropia, and his eyes are measured at the age of 16, 17, or 18, one can say for certain when that man gets to 40 that he must be below the standard which the Board of Trade asks. Therefore clearly it is the right thing to do to stop him going to sea at all, because he must be a source of danger at sea after a time.

2721. Very possibly, after 40?—He might be at 25 if he had an attack of typhoid, or even a bad attack of influenza.

2722. And you think that the facts can be quite effectively and scientifically obtained at an early age?—Certainly. We are safeguarding the man as well as the public, because it is a great hardship to him if you re-examine him at 40. He says, "You are stopping me now for a defect you might have seen when I was 15, and now I have a wife and family dependent on me."

2723. Then your suggestion on this particular point is, that whatever standard may be adopted there shall be a specific examination which has never yet taken place for the purpose of detecting that?—Yes, for the first examination.

2724. Apart from the question of standard?—Apart from the question of standard altogether. But I think the subsequent examinations as to the maintenance of the standard could perfectly well be carried out by laymen. It is not a difficult thing to decide whether a man can read so many letters on such a line; but what a layman cannot do is to measure the refraction, and he cannot see if there are any latent defects in the eye which are going to deteriorate the vision after a certain number of years have passed.

2725. But could a layman at 40 detect all that was necessary in a case of hypermetropia?—I think if once the eye has been carefully measured, that is a guarantee that there is no more than a certain amount of hypermetropia present.

2726. Provided only a certain type of officer were admitted, then the re-examination would be simple?—It becomes quite a formal thing.

2727. You have a certain number of statistics on the second page?—These statistics I have dug out of reports which were got together for me in a hurry just before I left New Zealand, of the officers who have been examined for the Union Company: those who have been rejected and those who have been accepted. From 1897 to the end of 1910, 18 officers were retired from the service afloat of the Union Steamship Company of New Zealand, for failure to reach the standard of vision required at their periodical re-examination. I may say, perhaps, that out of these 18 there were one or two instances possibly where they would have been retained in the service if they had been very exceptional officers. There have been other cases in which there have been men retained who did not come quite up to the standard, but who were particularly reliable officers, and had special knowledge of particular trades.

2728. I suppose the company always holds itself at liberty to balance one set of capacities against another in special cases?—Yes. There had been no examination in force prior to 1897, so that all the officers in the service at that date were unselected so far as vision was concerned. Of these, 18 officers retired, one had his vision seriously reduced by an inflammatory attack, and one was retired because his colour-vision was defective. I may say, with reference to that inflammatory attack, the man had a bad attack of interstitial keratitis, and his vision was reduced to six-sixtieths in one eye. He went on a trip to India, and while he was away he got an attack of interstitial keratitis in the other eye, and I think when he came back he only had six-sixtieths in that; so that he was far below the Board of Trade standard at the time when he retired. The Board of Trade ticket gives no guarantee against that.

2729. It was only your examination which detected it?—The man came to me to be treated, and I said to him, "You will not pass your next examination, and you had better look out for something else to do." That, of course, is a very difficult position for a surgeon. Sometimes a patient comes to one, and really one feels as if he had come to have his eyes examined to shut one's mouth, because you cannot say anything about your patients. There is one case I refer to here, where a man came to me to find out if there were anything wrong with his eyes because he could not keep awake on watch. I could not say anything to the company about him, and it was not until months after that the company said he had failed at his re-examination test, and asked me for a report about him.

2730. That rather complicates it?—My mouth was sealed all the time. Of course, he knew he could not keep awake on watch; he was astigmatic, and the strain of trying to see made his eyes so tired that he used to drop asleep.

2731. In his case would the use of spectacles put him right?—Yes.

2732. Do you consider the use of spectacles a bar to efficient service?—Certainly not. I do not see why in a ship of any size a man should not use spectacles; he is so high out of the water, and all these ships have charthouses with a glass front. I think in most cases he would not be much handicapped.

2733. This was a case of astigmatism?—It was a case of astigmatism.

2734. And spectacles would have put him right?—Spectacles would have put him right.

2735. Does your company forbid the use of spectacles?—Yes, and so does the Board of Trade.

2736. (Lord Rayleigh.) Forbid the use of spectacles at the examination, that is?—Yes.

2737. (Chairman.) But the Board of Trade does not forbid the use of spectacles in later life, which has nothing to do with that?—I do not know. I do not know whether that question has ever been raised.

2738. I do not think they do, but I am very anxious, if I may, to listen to your opinion?—I think in a small ship the use of spectacles would be a distinct bar, because a man might get covered with spray. If he is in one of these big liners 50 feet above the water, and where he has a glass-fronted screen in front of him, he might be very much better with spectacles on than without them.

2739. I think the rule of your company is that they shall not wear spectacles?—Yes.

2740. And they do not wear spectacles?—They do not wear spectacles.

2741. I do not ask you exactly to criticise that rule, but I would like to ask you whether you have had cases before you where, we will say, the officer was exceptionally efficient in other ways and the company were not anxious to part with him. In cases of that sort might it not have been desirable to say, "If this man is allowed to wear spectacles in a big ship it will certainly make him a safer man than if he does not?" I am putting the case of a man who does not come up to the standard, but whom you want to keep. In a case of that sort would it not be possible to say, "If you let this man wear spectacles he would be safe enough"?—There is one case of an officer who has had long experience in a particular trade who was stopped at his re-examination. The reports were not satisfactory; they were very contradictory. He was examined at two different ports, and he was finally brought down to Dunedin for me to examine him. I found what I fancied would be the case was really the case; he had a certain amount of astigmatism, and when he strained and squeezed with his lids he could correct the error of the shape of the eye to a certain extent and put up a good record. He would read about six-ninths, perhaps a letter or two of six-sixths, and then at other times his vision would go down to six-thirty-sixths or six-eightieths, or something like that. I found when I was testing him that by pressing on the globe a little he could bring his vision up to six-sixths. He said that most of his work was done with binoculars, and he rested his binoculars against the lower part of the globe. I think there is not the least

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doubt that his vision, when he was able to adjust it like that, was pretty well six-sixths. Of course, you can never be quite sure, unless you are looking at some accurately measured object, of the amount of the definition you really have. You find that out if you use an opera glass. Within a certain distance you are in doubt as to whether you are quite right in the focus. That man was kept.

2742. But might I ask you in a case of that sort are binoculars practically as satisfactory as spectacles?—No; in his case they certainly were not, because they did not correct his astigmatism, but he corrected his astigmatism by the pressure on the globe.

2743. Yes, I understand that is a somewhat exceptional case. There might be an astigmatic case where spectacles obviously would be of some use apart from the use of binoculars?—Certainly.

2744. I want to go back to what I said before. Might not there be cases where, if you have a perfectly clear field apart from any rules, you might say, "We want to keep this man. I advise the company to let him wear spectacles because I think he will be safer if he wears spectacles than if he does not"?—Certainly, there are plenty of cases like that where undoubtedly spectacles would correct it.

2745. He would be a more useful man?—He would be a more useful man.

2746. I assume he is deficient, but I assume he is going to be kept?—Of course, if he is very deficient the company do not keep him.

2747. I mean to a certain extent. There are cases where you would advise that, but the practice of the company does not permit it?—What I am particularly anxious about is, that the hardship should be saved to men like one of the officers who was rejected here. He started in life with one eye useless and the other eye with four diopters of hypermetropic astigmatism.

2748. You want to prevent men coming into the service at all who have these defects?—Yes, I would like to prevent them going to sea.

2749. But you understand the question I put to you is really of some importance apart from that, because supposing your idea could be carried out?—Then by all means put the men into spectacles.

2750. Therefore you would say a rule which forbids spectacles is, in certain cases of this sort, especially with men who are somewhat deficient, but who are efficient officers, liable to be a mistake?—Yes. I think if I had had the drafting of the rules I should have allowed spectacles under certain conditions, but there is a very strong prejudice against spectacles on the part of old seafaring men. I think the marine superintendent would have kicked very hard if he had thought spectacles were going to be allowed.

2751. Of course, we were not thinking for a moment of the use of spectacles on admission or re-examination. We are only taking particular cases, and it seems to me cases of that sort might arise in any form even on a preliminary examination?—Yes, but if you are going to admit spectacles at the preliminary examination—

2752. No, I do not mean that. I mean even with a strict preliminary examination such as you would advocate there might be a man of 50 pass that who might have some defects?—That depends very largely on the standard you set at the first examination; on the amount of hypermetropia or astigmatism that you pass.

2753. But take one further point; am I right that in big ships the conditions under which a man is made the use of spectacles more desirable, no doubt, than it used to be?—Certainly.

2754. Because he is much more protected?—Certainly. Of the remaining 16 officers retired, at least 10 would not have been admitted to the service had they been previously examined by an expert—the reports on the other six are either not available or are not clear on this point. I have a list of seven officers who had been examined by medical officers at different ports but who failed on re-examination, and who would not have been admitted to the service if their first examination had been conducted by an expert. Those are cases which all failed because their hypermetropia was

not measured at the time they entered the service. Three of these are counted in the previous list of officers retired from the service afloat, two of them were found employment ashore, and one left the service altogether. I may say in those cases where officers have been retired they have all, as far as possible, been found billets ashore. For instance, that old captain who was blind in one eye and had four diopters of astigmatism in the other was put on the wharf at Dunedin. They found billets for a considerable proportion of them.

2755. Quite so; we may take that?—The other four have been retained in the service under special conditions as to yearly re-examinations. That is, in cases where it was very undesirable to part with the officers or there were special circumstances—they were old servants—the company felt if, instead of examining them every five years, they were examined every year to make sure they were maintaining the standard they then had, they might safely keep them.

2756. You had adequate security?—Yes; but even in those cases the standard is higher than the Board of Trade standard. "During the three years 1908–9–10 99 officers passed out of the service by resignation or retirement, only four of whom were retired for defective vision." Of these four at least two would not have been admitted to the service if they had been examined in the first instance by an expert. I put that in because I wish to lay before you the point that if they are properly examined in the first case the risk of their vision leading to their retirement afterwards becomes very small. The percentage, you see, is quite small. The officers are all fearfully afraid, because it is a new thing, that when they are re-examined they will be passed out; but out of the men who have passed out of the service in the last three years only four per cent. have been passed out because of their failing vision. If, instead of vision, it had been something else, if it had been failing hearing, there would have been just the same hardship to the men; but the company would have had to do it for their own protection.

2757. You say some question was lately raised as to the stringency of your company's standard?—Yes, that question was raised, because out of 166 applicants for positions in the company's service 38, or nearly 23 per cent., were rejected at the vision tests. There were some of those in which the vision was very bad in one eye and who were perfectly rightly rejected; but the majority of them were rejected not because they could not pass the company's standard, but because of the amount of hypermetropia present.

2758. For which you examine now?—Yes; at each of the larger ports, at Melbourne, Sydney, Auckland, and so on, they have an expert examiner, and anyone who wants to enter the service has to go and have his refraction measured and has to have his eyes thoroughly tested for colour and form vision, and has to have an ophthalmoscopic examination, and he must have good muscle balance, and so on.

2759. And although he may have passed the Board of Trade standard he must not come into your company when once he has been rejected, and if he joins he has to be re-examined?—If he joins he is re-examined when he is promoted, and once he becomes a master he is re-examined every five years.

2760. You do not know of those 38 how many would have or had passed the Board of Trade standard?—They would all have already got Board of Trade tickets. I do not mean they had necessarily less than the Board of Trade standard when they were examined. Most of them were stopped because they were hypermetropic. Therefore, their vision must have failed as they got older. Here, for instance, is a man with just three diopters of hypermetropia and a little astigmatism, in each eye. When that man gets to 50 his accommodation must have failed to such an extent that he is below the Board of Trade standard, and the policy which the company has adopted is that they will not take any men they know are going to become incapable from their point of view. There is a point I have mentioned here of an officer who is reported as sleeping on watch. I have said here, "A condition such as his would interfere with his prompt recognition of a 'green light.'" That brings in a question as to whether

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green lights are advisable for signalling at night at sea at all. If there is any error in refraction it becomes exceedingly difficult to recognise a green light at more than a short distance. Coming home the other day I was very much struck with the difficulty of recognising green lights at the short range at which one saw the green lights of ships. It occurred to me it would be infinitely better if some scheme could be adopted by means of which a signal by position of lights gave the sign; have the red light for the port side, but have a triangle of white lights for the starboard side.

2761. You say that because you think that green is peculiarly unfit?—The green does not carry. I suppose that point has been before the Committee?

2762. Yes, we are investigating it?—It was merely a thing which occurred to me as I was drafting this.

2763. The question of the bearing of the defective form vision upon colour vision is a matter which is before us, and that is really the matter you are alluding to?—Yes, with errors of refraction. Therefore, if you use green lights, and if you pass a man with 2½ diopters or three diopters of hypermetropia and give him a ticket, he is passing with a defect which you are unaware of, but which must tell against him.

2764. I think we have now practically covered the ground of your outline. I would just like to ask you whether you have anything to say to us on the colour vision question?—No, I know that has been very thoroughly thrashed out here.

2765. You have no opinions to express on it?—No.

2766. (Lord Rayleigh.) I understand you hold strongly that a thorough preliminary examination should be made of any man before he goes to sea, in order that this defect of hypermetropia may be discovered at an early stage, which will ultimately develop into his not being able to see sufficiently well at a distance?—Yes.

2767. This hypermetropia which might be detected at that stage is consistent with his passing the full test of reading letters, is it not?—Yes.

2768. Will you explain to the Committee how you detect the hypermetropia which is latent under those circumstances?—You detect it by an ophthalmoscopic examination; you test it with the ophthalmoscope.

2769. But if he can put his eye by the exercise of accommodation in the same state in which it would be in if he had no hypermetropia, how is it detected?—With the ophthalmoscope. When a patient is in a dark room, accommodation relaxes to a great extent. The fact is we do make our measurements in this way and get them fairly accurate. With young people sometimes we do not get the total amount of hypermetropia unless we paralyse the accommodation with a mydriatic.

2770. That is what I want to get at. Would it be generally necessary to use that?—In making an examination of boys I should make it with an ophthalmoscope, and if there were more than two diopters of hypermetropia present I should stop the boys at once. If I found less than that I should use the mydriatic and make sure what the hypermetropia was.

2771. I suppose it is that which leads you to consider such an examination can only be made by a well-qualified expert?—Yes.

2772. Otherwise the ordinary use of the ophthalmoscope, I suppose, could be learned by almost any intelligent person?—It is a very difficult thing to get clinical clerks and house surgeons to make anything like accurate measurements of the refraction with the ophthalmoscope. I know one's private assistant has to be with one a good long time before he can be depended on altogether.

2773. (Dr. Parsons.) Do not you mean laymen?

2774. (Lord Rayleigh.) Yes?—I think I may say if I had assistants who had been working at these measurements that for six months or even twelve months, I should not depend upon the results of a tested case; I should check them myself and find very often they were wrong.

2775. So such an examination as you think is necessary really does require a well-qualified expert?—Yes.

2776. On the question of the Board of Trade ticket I understood you to say?—Before passing from your other question, do not imagine I want to create a series of well-paid positions for experts in this matter. You do not want a man who is at the very top of the tree to do this work. There are plenty of capable young men who could do it without necessarily putting the Board of Trade to a very serious expense.

2777. I do not intend to suggest that?—There is no difficulty in getting an examiner at each of the principal ports where examinations can be made without any very serious expense.

2778. I really want to be clear why it was held an expert was required at all?—That was touched upon to a certain extent when I said a certain number of men had got into the Union Company's service because they had not been examined by experts; they were examined by the ordinary medical men at the port. You cannot get measurements accurately made except by men who are constantly using the ophthalmoscope.

2779. I understand. Then on the question of the Board of Trade ticket, is it your view that that ticket should be given for a limited term of years only, or carry the age of the candidate at the time it was given and the date it was given? I suppose it does carry the date now?—I think it would be wiser if the first ticket were given for 15 years, and the second and third for 10 and 5. You would have an opportunity of making sure that the standard was being maintained.

2780. (Sir Arthur Rücker.) I understand that your approval of the use of spectacles is really conditioned by two things. In the first place they ought not to be used on a small ship. I think that was one?—Yes.

2781. The other was that the use of them should be permissible in the case of an experienced officer when he is getting older?—Yes.

2782. Neither of those points are points that any public examination can test. I mean you would not be able to tell what kind of a ship a man is going to serve on at the preliminary test?—The Chairman was asking me with reference to the question of retaining in the service valued officers.

2783. But the Board of Trade would not know much about the value of the officer; it is only the company employing him who would?—No; but the Board of Trade is dealing with young men in the first case, and glasses there would not be admissible at all.

2784. At the first examination they should not be admissible at all. That we are all agreed on?—You can quite understand that an admiral in command of a fleet might very well be able to get along with glasses for distant vision; but in the case of a lieutenant in charge of a torpedo boat it would be quite out of the question.

2785. Then, coming to the later case, which is more important, I think, that is to say, the man who has had long experience and whom the company might retain on that account, do you think any notice of that can be taken by public examination? The Board of Trade can only report?—I do not think so. I think that is a matter for the company.

2786. So that would ultimately have to be by private test?—Yes, I think so.

(Sir Arthur Rücker.) That is what I wanted to get at.

2787. (Mr. Nettleship.) Between what ages would these 166 be of whom you rejected 23 per cent.?—They would be all young men entering the service, who all wanted to come in. Those were all up for first examination.

2788. Under 25?—Some of them were 23, some of them 24. There was one 28. He was in the service. It was the first examination. He had two diopters of astigmatism and six-sixtieths in one eye.

2789. Have you any standard of hypermetropia for which you reject?—Yes, only one diopter, and that is a little small.

2790. You mean you would be inclined to allow a little more?—Yes; but if you get beyond a diopter and a half you will have to make up your mind that as soon as the accommodation fails the vision must fail with it. One diopter is what we came to the

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conclusion at the Congress in 1896 was a reasonable standard.

2791. Do not you think a great many men can cover one-and-a-half or two up to the time they are 45?—Perfectly well, up to the time they are 50 or more.

2792. So that up to 45 or 50 as much as two diopters of hypermetropia might be consistent with fairly good sight?—I think so. That would cover the principle I am contending for. Do not understand me to contend that the Union Company's standard is absolutely right.

2793. I was rather pleading for allowing a little more than one diopter to go through, because it seems to me if you only allow one diopter to go through you would reject a great many?—It is undoubtedly a stringent standard; but when the question was raised as to the stringency of the examination, the matter was referred to me, and I said to the company: "Do not take my opinion about it. Get other opinions." Write to Barrett in Melbourne, Pockley in Sydney, Lockhart Gibson in Brisbane, and T. K. Hamilton in Adelaide." They all four quite agreed that if they gave another half diopter it was the outside.

2794. You were speaking of the necessity of a great deal of experience in estimating hypermetropia amongst young men. How often do you use a mydriatic? I gathered you did not often use it?—I say I should not use it in every case in the first examination, because after I found more than two diopters present I should condemn the case at once, although there might be four diopters there; but in all cases that are admitted to the Union Company's service at their first examination, they are examined with mydriatics.

2795. All cases?—Yes.

2796. All these 160?—Some of them did not come up to the standard of vision. They would not be examined further.

2797. Those who did you would put under the mydriatic?—Yes.

2798. That is in reference to Lord Rayleigh's suggestion as to a man with great ophthalmic experience; but surely you would discount that a little?—Yes, but it is a question whether it is safe to put that in the hands of the marine superintendent.

2799. I did not mean anybody but a medical man?—You must have a competent man.

2800. A man must be a man of training, but not necessarily a great amount?—As I say, there are plenty of young men who can perfectly well do it.

2801. I rather wanted to lay stress on that?—Yes.

2802. (Professor Parsons.) With regard to the use of spectacles, that is only in exceptional cases towards the end of a man's career really?—Yes.

2803. That would not arise under a full preliminary examination, would it?—No, it would become almost negligible. If you only let in people who are not hypermetropic in the first place, the need for glasses would never arise except for reading.

2804. Then supposing other considerations come in which make it very difficult to make quite such a high standard, would you allow the use of glasses for examination? I mean, one would have to make the regulations more elastic in their construction as to the actual standard of vision allowed, in order to get a sufficient supply of men?—My own feeling about that is, that there would be no difficulty whatever about getting men with the vision if the pay is a sufficient inducement to come. It is a question of money.

2805. (Professor Poynting.) Do not you regard 23 per cent. as a very large percentage of rejection?—As I have said, that is because of the standard of hypermetropia. It is not so much because a man could not see at the time, but because the hypermetropia makes it probable he will not see later on.

2806. But do you regard that as a satisfactory percentage which seems to exclude such an enormous number?—I think what is unsatisfactory about it is that the Board of Trade should have given tickets to those men, and that 23 per cent. of the men who came up during that period with Board of Trade tickets had a defect in their eyes, which must reduce their vision dangerously later on in life.

2807. To those 23 per cent. you would have to add those who had been rejected by the Board of Trade, which would make it a still higher percentage?—My feeling is if over 66 per cent. of my patients can pass the Board of Trade standard they cannot reject very many officers. I think that is a reasonable inference.

2808. One or two per cent.?—That is a very small number.

2809. (Professor Gotch.) With regard to this preliminary examination, I understand you really would advocate that it should be done under a mydriatic in all cases, and you do it?—In some hypermetropic cases.

2810. Some mydriatic?—Yes.

2811. That only forms part of the medical examination on other points?—In my examination of these cases I test the vision.

2812. What else is done?—I run around the field of vision and make sure the field is not contracted in any way. I test the colour sense both with wools and with lights.

2813. Is there any other examination at all at the time; that is what I want to get at?—I do not examine them physically. I never examine them at all if I can help it. It is only when a man is sent to me on appeal who has not satisfied the usual examiner.

2814. My point is this: I understand that you advocate that the Board of Trade should institute such an examination?—I think at the beginning of a boy's career it ought to be done.

2815. But the Board of Trade examination is of a very different character, and comprises a large number of other subjects in which this is an important incident, but only an incident. At present, in your company you take this incident only, do you not, to examine on, not the other things at the same time. It is by itself?—Yes, it is entirely by itself.

2816. Do you think it is possible for the Board of Trade to institute an examination as to hypermetropia when they have an examination in a large number of other subjects which after all are more important, such as navigation, and so on, which would have to be conducted at the same time?—It is quite possible for an absolutely blind man to pass an examination in a mathematical subject. The eyesight is not absolutely essential.

2817. But it would have to be done at a different time?

(Chairman.) Could you put it at the end when all the rest of the examination was finished, then anything which has affected his eye would not matter?

2818. (Professor Gotch.) How long beforehand have you to put the mydriatic in? At present I understand that a candidate undergoes the sight tests at the same time as the rest of his examination by the Board of Trade?—I do not say that the examination need be all on one day.

2819. You would have to have a separate examination at different times; that is what it comes to?—But the examination of his vision is separate now. It is not carried out by the same examiner, is it?

2820. (Secretary.) The sight tests are often, though not necessarily, carried out by the same examiner; but except in the case of fishermen they do not usually take place on the same day as the rest of the examination?—There is no reason why the measurements in refraction should not come at the end of his examination; but there is this hardship, which has been felt before in examinations. If a fellow goes in for the Indian Civil Service and passes, if he does not pass his medical examination he is spun. It would be much kinder to examine him in the first case and say, "You are perfectly sound, if you can pass your examination."

2821. But my point is this: You are complaining of the necessity for two examinations at different times by different people. They must be done at different times. How long does your mydriatic paralyse it?—It would paralyse the accommodation for the afternoon. They are fit for their work the next morning.

2822. Then I want to ask about his re-examination?—We do not use a mydriatic then.

2823. You never use it?—No.



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2824. But you think it is desirable even there, I understand, that it should be done in some cases by an expert?—I do not think so. I think a lay examiner could perfectly well determine whether the standard of vision has been maintained, because it is merely a question of reading letters.

2825. (Sir Norman Hill.) Can you tell us the number of vessels in the fleet of the Union Company?—They have, roughly, 60 vessels. It is about 60.

2826. What is their total tonnage?—160,000 or 170,000, I daresay.

2827. That is gross tonnage, of course?—Yes, I think it is about that.

2828. And the number of officers?—They have somewhere about 250 officers afloat, I think.

2829. Then I gather from your returns that you pass in and out of the service somewhere between 20 and 30 officers a year?—Yes, somewhere about 30 officers a year.

2830. Of course, the fleet is the biggest and the fastest, and I suppose the most valuable of the vessels, belonging to New Zealand?—Yes, local.

2831. Belonging to New Zealand?—Yes, belonging to New Zealand, if you put it in that way.

2832. They are registered in New Zealand, are they not?—The majority of the boats are registered in New Zealand. Some still have "Glasgow" on the stern, I think, but the boats are registered in New Zealand; the company is there.

2833. And I suppose 160,000 tons gross is about one-third of the whole of the New Zealand tonnage afloat?—It is a great deal more than that.

2834. Your registered tonnage; of course, the Board of Trade only give net; but 150,000 tons is the total tonnage registered in New Zealand last year, and if you multiplied that by three you would get about the gross tonnage, roughly, so that there would be between 400,000 and 500,000 tons registered in New Zealand?—The Union Company has about 60 boats; the Huddart Parker Company are a Sydney company which trades in the inter-colonial trade, the Northern Company of New Zealand is quite a small company, and there are one or two small companies trading with coasters. I do not know, but I should say the Union Company represented more like two-thirds than one-third.

2835. About two-thirds?—I should think so, but really that is a question I cannot answer.

2836. But it is a very big proportion?—Yes.

2837. Your 250 officers would be a very big proportion of the officers serving in New Zealand waters?—Yes.

2838. You tell us that you attach the greatest importance to the sight of the officers?—Yes, I attach very great importance to it indeed.

2839. Have you had to investigate any casualties in which the question of the deficiency of the sight of the officer of the watch has been raised?—When any case arises where one probably would get on the track of it, the officer is got rid of and not sent for examination. That is what it comes to. I have a case in my mind which your question has brought up, of a captain who was very restless and could not settle down one night. At last he got up with an overpowering feeling that there was something wrong. He went up on the bridge and everything looked all right. He went to look at the compass and said to the officer of the watch, "What is your course?" The officer gave him the true course, and he said, "Go and look at the binnacle." The ship was two points off her course. That may have been carelessness, it may have been defective vision on the part of the quartermaster; it may have been defective vision on the part of the officer. If that ship had gone ashore, as she was doing as fast as she could, I should not have had the opportunity, because if the man were not drowned he would not have been sent to me for examination.

2840. Then when the line adopted this special form of examination in 1897, it was not because of casualties which they attributed to defective eyesight?—No, it was not.

2841. It was just on general grounds?—On general grounds.

2842. I do not know if it is a fair question to put to you; but since 1897 have there been far fewer casualties than before?—Of course some casualties are quite independent of eyesight. There was one boat which went down probably from her hatch being stove in by a heavy sea. A thing of that sort is quite independent of sight. There may have been an error of judgment on the part of the man in not seeking shelter in such heavy weather.

2843. I was not thinking of those cases, but I was thinking of collisions and strandings. Is there a marked improvement in the company's fortune of the last ten years as compared with the previous ten years?—We have been very free from accidents of that sort the last ten years.

2844. And before that?—We have had a fair number of losses, but I really cannot tell whether they were due to eyesight.

2845. Would it be possible, do you think, for the line to give us a return of the number of collisions and strandings say for ten years before and ten years after the adoption of the examination?—They could do that without the slightest trouble. I am sure Sir James Mills would let you have information of that kind.

(Sir Norman Hill.) I think it would be interesting, Sir, if we might have that?

(Chairman.) Yes.

(The witness.) I do not know that it necessarily will give you very much information. They lost a ship about two years ago. She struck on an uncharted rock. That is a thing which eyesight could not possibly affect.

2846. (Sir Norman Hill.) A submerged rock, it would not have had any effect at all. I was thinking perfectly broadly?—Then the class of ships has changed. I do not think there is the same risk with ships which average between 3,000 and 4,000 tons, say, as there is with ships that only average between 300 and 400. You are not so likely to lose your ship.

2847. Given an officer of the same degree of eyesight, I mean the evidence before us is that here in this country there are many lines which are in the position of the Union who do as your company does, apply special examinations. They do not depend on the Board of Trade. They have their own skilled advisers. We have had evidence from many of the lines that that has always been their practice. That is, lines that always have periodical examinations?—They all insist on periodical examinations.

2848. Many of the companies owning the kind of fleets that your company own?—I have no doubt Sir James Mills could tell you what the number of losses is for a period of ten years before and after.

2849. Then could you give us any information at all with regard to the supply of officers? Have you always men waiting on your books?—Sometimes the marine superintendent grumbles and says it is very difficult to get officers; but as a rule there is no difficulty I think.

2850. Can you pick and choose amongst the men who are offering their services in New Zealand?—You see we are able to pick and choose to this extent, that we are able to reject 23 per cent. of them because they are not up to the eyesight standard.

2851. And fully officer all your vessels?—Yes.

2852. There has been no difficulty of that kind?—No; their rate of pay is much better than your rate of pay here.

2853. Very much better?—Yes.

2854. Roughly speaking the population of New Zealand is what?—Just over a million.

2855. And the net tonnage owned in New Zealand is about 150,000 tons?—I cannot give you any accurate figures about that. You have that figure yourself, have you?

2856. Yes; perhaps it is not fair to put it to you?—It is outside my business altogether.

2857. I wanted to bring to your mind that in New Zealand you have about seven head to each ton of shipping, and in this country you have about four head of population to each ton of shipping. I mean, we make a very much greater demand on our population to man our ships than you do?—We man our

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ships always with white men; we have very few foreigners. That is not the case here. The ships here are very largely manned with coloured crews, Chinese and lascars.

2858. The ships trading to the East are?—You are counting those in.

2859. No, I am not; I am taking the population of the United Kingdom?—But those are owned in England.

2860. Yes; but we have only four head of population to provide for the manning of each ton of our shipping, and you have double that population?—There is another question comes in there. Your ships now are getting to be of an enormous size. You do not have the same number of hands per ton as we do with the smaller tonnage of ships. It costs no more in men to man a 10,000-ton tramp than it does to man a boat of 3,000 tons or less.

2861. Certainly; but your own experience is that there is no difficulty in getting your officers; there are always plenty of men to be had?—I have often heard the marine superintendent grumbling that there is difficulty in getting men, but I have never known them stuck.

2862. Then with regard to the re-examination at 40, again at 45, and again at 50, is it your idea that the men should be able to conform to the same standards as they had to conform to when first examined?—No. In the case of officers at 45 we ask for six-sixths with one eye and six-ninths with the other, and we let them have glasses for chart work and reading.

2863. That is at 40?—Yes, and 45.

2864. At 50 is it the same thing?—Six-ninths and six-sixths.

2865. (Chairman.) Just one point about the rate of pay. Is it a fact that the officers of your company have higher pay than the average English company pays of the same standing?—Yes, there is no doubt about that.

The witness withdrew.

## FOURTEENTH DAY.

Friday, October 6th, 1911.

PRESENT:

The Right Hon. A. H. D. ACLAND (Chairman).

Sir RAYMOND BECK.  
Sir NORMAN HILL.  
Sir ARTHUR RÜCKER, F.R.S.  
Captain THOMAS GOLDING.

Professor GOTCH, F.R.S.  
Mr. EDWARD NETTLESHIP, F.R.C.S.  
Mr. J. H. PARSONS, F.R.C.S.  
Professor SHERRINGTON, F.R.S.

Dr. WILLIAM WATSON, F.R.S., } Secretaries.  
Mr. T. LODGE, }

Mr. CLIFFORD C. PATERSON called.

2874. (Chairman.) It is very good of you to come here. We thought we had better see the experiments first before hearing anything from you?—I think it will be helpful, because after seeing the apparatus you will appreciate it better.

2875. I do not propose to go through all the long document\* you have been good enough to send us?—I want to make one or two notes on that.

2876. You must not assume that we have all quite got hold of the thing. Please just explain the experiments and then add anything you like; I think that would be the best way, would it not?—Yes.

(The room was then darkened and witness proceeded to demonstrate the use of the apparatus to the Committee.)

2877. (Chairman.) Was the general effect of spectacles unexpected by you?—Yes, quite. I found when

2866. Is that partly due to the fact that the rate of living is higher, would you suppose, or is it due to a matter of policy that the Union Company think it better to give more nowadays?—Rates of wages are higher all round. The rates of wages of our men are higher.

2867. (Sir Norman Hill.) Your rates of freights are very much higher too?—Yes.

2868. (Chairman.) Is the cost of living on board ship higher?—So far as the officers are concerned they are found on board ship, so that it does not make any difference to them. Their clothes of course are a bit dearer.

2869. Yes, to some extent; but it is affected by other considerations than that, I presume?—Beyond the fact that the general rate of wages is higher out there, I do not think there is anything else to affect it, but I think their policy always has been to pay their men well and get picked men.

2870. I gathered from what you said a little earlier, that you thought the fact of this high rate makes it much easier to get men?—Yes, undoubtedly.

2871. It has a very important bearing?—Of course to us out there it seems shocking to hear of the rate of pay which men in command of big ships here get.

2872. (Sir Norman Hill.) And in other employments too. You are just as surprised at the rates paid for all kinds of service in this country, are you not? Take your engineers, shipbuilders, and ship repairers?—Yes, of course the rates are very much higher there. I think perhaps we are more shocked at the rates we have to pay there than at the rates you pay here.

2873. (Chairman.) We are very much obliged indeed to you for having come?—I am much obliged to you for having listened to me so patiently. This subject has been rather a hobby of mine, and I am very glad to have had the opportunity of putting my views before you.

I tried to observe some of these green lights in the open. I could not see them as well with spectacles as I could without.

2878. But that is your general result?—That is the general result. Perhaps you would allow me now to say what further work I have done. That will explain it. Since the report of the 16th September some other experiments have been made which amplify the earlier ones described there, and serve to indicate a cause for the diminished visibility which I found when using spectacles. Unfortunately the new apparatus is only just completed and the work done with it has necessarily been very limited. In the first place, observations with the new apparatus, allowing of the use of the two eyes, confirm those shown on diagram 346. That is to say, any observer will find that the use of only a small amount of positive lens causes a great diminution of visibility, although the source observed still appears as a well-defined spot. On the

\* See Appendix F, page 153.

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other hand, the addition of a negative lens has little effect. In the second place, measurements have been made by various other observers with imperfect sight. They have made comparisons of the visibility of very faint sources of light with and without their spectacles in this apparatus. A point should be mentioned in the report which was not emphasised in the report. Owing to the difficulty of securing sufficient visibility for the starboard light a greater number of experiments had to be made with this, and nearly all the observations in the open, and upon which some of the conclusions of the report were founded, were thus made with a green light.

2879. Why was it you had to use a green light?—Because we are testing for the candle power which it is necessary to have in ships' lights in order to be seen at two miles, and as the starboard light is the most difficult one to see we made most of the observations with that. Of course this question of spectacles is only a by-product of what we were doing. The probable significance of this, that is to say, observing always with the green light, was not at first appreciated. This light was always dimmer to me when I used spectacles; but it appears likely to me now that, had I observed a white or red light, the effect would not have been so marked. This is borne out in a general way by the curves on sheet 345, in which the difference is seen to be the greatest in the case of the green light. That is what I pointed out a little while ago. Several short-sighted observers were tested, using their own negative spectacle lenses in the observation of a white source of light, and their measurements indicated that visibility to them was not increased by the disuse of spectacles. I then made comparisons with another observer whose sight is about equally astigmatic as my own, but corrected by negative cylindrical lenses, whilst my own are positive cylindrical lenses. One red and one green point source of light were viewed side by side in the apparatus. To me the increase of the green visibility as I lifted my spectacles was most marked, amounting to about 100 per cent. The red did not appear to change. The other observer, on the contrary, if he saw any difference with his spectacles, found the green light diminished when he lifted his spectacles. An exchange of spectacles caused him to see the effect which I had observed, whilst I saw, if anything, a brightening of the green when using his spectacles. At first sight the chromatic aberration of the eye would seem to be an explanation of this. The green rays come to a focus on the near side of my retina when I wear my positive spectacles. If I remove these the green comes to a focus nearer the retina, so that, when using my spectacles for green light, the combination is too positive, and causes the dimming of the light shown in the curves of figure 346. The reason for that dimming is rather obscure. I have no definite suggestion to offer at present. It does not seem to be an out-of-focus effect, since the image remains a point, showing that the eye is apparently accommodating beyond infinity. Nevertheless, the spot is very much dimmed, just as if the muscular relaxation which takes place when one accommodates beyond infinity causes diminished sensitiveness. If there was anything of that kind it would account for the effect observed. I do not, of course, say that there is, but a satisfactory explanation has yet to be found. In conclusion, I should like to give my opinion on the general question of the use of spectacles, based on the experiments which I have made up to the present. Although the various anomalous effects occur in the case of lenses, as described in this report, and result in the dimming down of lights, the only case I have met which has a practical bearing is that in which an observer, such as myself, observes a green light when he has positive spectacle lenses to correct his sight. I have tested several cases in which negative spectacles appear to have no disadvantageous effect, and I should deprecate any general action which would exclude men with spectacles from occupying posts where coloured lights had to be observed. My opinion is that a candidate should be required to distinguish the colours of point sources of light of nearly vanishing intensity in some such visibility apparatus

as I have designed, the different colours produced by the standard red and green glasses being presented to him at random. Such an apparatus very closely reproduces the practical conditions of night observations. The low visibility of the points of light will prove whether he is defective in the perception of a light, and his ability to distinguish its colour should prove all that is necessary for practical purposes regarding his colour vision. If he can distinguish with his spectacles the colour of points of light which to other people are on the limit of visibility, that should, I think, be sufficient proof that his sight is satisfactory for the observation of lights on sea or land.

2880. (Mr. Nettleship.) Do you think that the observation of visibility may depend at all on the loss of light due to reflection?—No. In all the results which I have given in the curves, I have allowed for the loss of light due to reflection from the surfaces of the spectacle glasses.

2881. (Sir Arthur Rücker.) There are two ways of attacking the question of a man's sight; one is, as you say, putting him as nearly as possible in the conditions in which he will have to use his eyes and seeing whether or no he can see; the other method is to find out where he is defective. This tells you whether he can do a particular thing, not why he can?—Yes.

2882. Do you see any objection in principle—I will not go into details—to what may be called the diagnostic method of approaching the matter?—No; none whatever, provided the results of the two methods are the same. You must understand I do not profess to test people's sight. I have no experience of the diagnostic method, so that I do not know that my opinion should be given.

2883. I only wanted to know whether you had considered it practically; you have not?—No; I have not considered it practically.

2884. (Professor Gotch.) I have already asked you a question which I think bears on what we were considering, namely, what you do with test types. I should like to ask you whether you have been really tested with the test type?—Yes, I have been tested twice; when I got my spectacles, the first time, by Dr. Fleming, whom you probably know.

2885. Yes. I understand you say you can only read the fifth line; that is half-normal vision?—I think it is the second line from the bottom I was able to appreciate, but I am speaking from memory entirely.

2886. (Professor Gotch.) I happen to know that you were tested. I understand that you with your apparatus can see a green light visible at two miles without glasses, and a mile and a half with glasses. Is that the case?—A mile and a half is an approximate figure, but it is just about what I should see.

2887. (Mr. Nettleship.) Was it some years ago?—No; I had my eyesight tested this year.

2888. Could you not get the figures?—Yes; I could get them at once.

(Professor Gotch.) We should like to have them.

2889. (Dr. Watson.) What candle-power light could you see two miles?—With a green glass and lens in front of it, the whole combination? The figure as far as I remember is about 2½ candles. I will ask my assistant.

(The Assistant.) The candle-power was 33 with a transmission of about 7 per cent. through green glasses.

2890. (Dr. Watson.) I wanted the real candle-power?—33.

2891. An ordinary ship's light is nothing like 33?—The combination of the lamp and the lens is 33.

2892. Is 33 the candle power of the source alone without the lens?—No; the source alone in the case of the lamp with the divergence I used was 10 candles, and the lens made the equivalent of it to 33 without any coloured glass.

2893. (Captain Golding.) Is it not usual to use 16-candle power in the electric side lights?—Yes, I believe it is, but only nominally 16, and the voltage

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on the boat is not, I think, as a rule, a very definite thing. As the candle-power varies as the sixth power of the voltage, you cannot say definitely what the candle-power is.

2894. I only asked because you said 10 candles?—This is a paraffin light.

(Chairman.) We are very much obliged to you for coming.

The witness withdrew.

Captain HENRY LOFTUS ALLEN called.

2895. (Chairman.) You are one of the commanders in the service of Messrs. Alfred Holt & Co., are you not?—Yes.

2896. Could you tell us in the first instance whether your company have any special arrangements for testing in relation to sight apart from the Board of Trade tests?—Yes.

2897. Perhaps you could tell us something about that; but before we come to the points of your own opinion on these matters, what is the practice of your company?—They test with spots on a card.

2898. First of all, whom do they test?—They test the officers every year, but the masters have not been tested, as a rule, after they get command, because I suppose men of 50 years of age would not be able to pass the tests they put the young men through.

2899. Have they a sort of systematic rule? Do they test a man when he comes into the service?—Yes, he has to pass a very severe test when he goes into the service.

2900. Supposing he has just passed the Board of Trade test, does that make any difference?—It does not make any difference.

2901. Do they sometimes reject a man who has just passed the Board of Trade test?—I believe they do if he is not up to the standard.

2902. Then the standard is definitely higher?—I suppose so.

2903. I suppose you are acquainted with them both?—I passed the Board of Trade over 30 years ago.

2904. In what way is this test of your company more difficult?—I think the test in the room is more difficult.

2905. Is it with a lamp?—We test with a lamp too.

2906. And the wools also?—Not the wools.

2907. It is a lamp test?—A lamp test. It is only recently we have had that, and when there is any doubt with the older men, the men who have been in the company any time, if they cannot pass that test, they would be taken on the river, and if they can pass the test on the river they are allowed to remain in the company as a rule.

2908. And do you consider the river test a good test?—I consider the river test the best. I was on the River Mersey several times this last week practising, and I think the river test is the best one for seafaring men; not for a boy going first.

2909. That should be a scientific test, I suppose? Have you tested many men yourself in that way?—Yes.

2910. You do not find the quantity of ships and the lights stand in your way at all?—No, I can always pick them out.

2911. And you do not find the man is familiar enough with ships to be able to guess right?—No, I have not found many colour-blind people.

2912. No, that is so; there are not many. But have you come across any?—I have not to my knowledge.

2913. I suppose the older men do not suffer from colour blindness; it is defective vision?—Yes, I think so. Of course we have to use glasses after 45 as a rule for reading, but my sight is as good to-day as it was when I was 30.

2914. At distant objects?—Yes.

2915. But there are a certain number of quite good men whose sight goes off a good deal, are there not?—There may be, of course.

2916. Do you discover that by your test?—There have been one or two men, I believe, rejected in the company who have found employment elsewhere that were really bad.

2917. Not many?—Not many.

2918. That would be on a test of vision, not of colours?—Yes, a test of vision.

2919. Some of your older men you said, did you not, have not good sight?—Some of the older masters. The mates must all pass the sight test. The older masters may not.

2920. But they are not tested because they are not the only persons responsible?—They have always got assistance on the bridge, but if their sight is really bad so that it would be a danger to navigation they would not be allowed to go; they would be very soon found out.

2921. I understood you to say that, as a rule, they are tested every year?—Officers are tested every year.

2922. Up to what age?—About 40.

2923. And after that?—They generally get a command by that time.

2924. As a rule, after they get command they are not tested?—As a rule, they are not unless there is reason to think their sight might be bad.

2925. They are not tested any more?—No.

2926. That is because the look-out is really in the hands of somebody else?—No, it is not altogether in the hands of somebody else. But I do not think masters could pass the severe tests they put the young men through, and they would lose the valuable services of an experienced man.

2927. That is another way of putting what I said; he is so important to the service because of his experience that the question of sight is not the first matter, as some younger man than he is responsible for the actual look-out?—There are always several on the look-out on the bridge.

2928. That is the real reason, is it not?—I would not say the master was not fit to be in charge of the bridge by himself.

2929. I did not mean that; but I meant you balance his experience against the possibility of his not being so acute as he was when a younger man?—Yes, his experience.

2930. I am putting it that way?—Yes.

2931. That is the way the company look at it?—Yes, he can pick up a light quicker too than a young man although his sight might not be so good, because he has had so much experience of doing so.

2932. At any rate the younger men up to the age of 40 are kept up to a much higher level than the Board of Trade level by this annual test?—I think so.

2933. And have a certain number of men fallen out in consequence of the test?—There have only been a couple the last few years that I know of.

2934. So that looks as if the Board of Trade test is fairly efficient?—Yes.

2935. I think it is only that the company want a little more security?—They want a little more. They want the very best men they can find.

2936. Now may we take your own opinion on this question about the distance at which men should be able to see? Have you your own outline?—I have.

2937. I thought perhaps you would follow that. What do you say about the distance at which buoys should be seen?—Buoys in the Mersey—that is what I quoted from—10 feet in diameter and 10 to 12 feet high should be seen in clear weather 3 to 4 miles. This I have got from pilots, and also from my own experience in taking ships up since I was put on this.

2938. And do you think that is quite sufficient?—I think that is a very good test; in fact, it is rather severe.

2939. How do you test them when you take them on the river?—We get our distances from them. We



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know the position of the ship and our distance off the buoy.

2940. Do you take them by day or by night?—By day. I take them going out of the Mersey; probably the lights might be seen a little farther; the lighted buoys might be seen a little farther in clear weather.

2941. But the day test is sufficient for you?—For colour blindness it is not.

2942. I mean for the other?—Yes. I think so.

2943. Then I see you say the red buoys should be distinguishable. That is to say, a man should know red when he sees it?—Yes. Some of these buoys are very often not kept brightly painted, and that makes a lot of difference, and it is rather hard to pick them up. If the buoys are constantly painted, then they are all right.

2944. Then about the ships' lights. You point out the varying power of those?—Yes.

2945. Are electric lights becoming more common now?—Yes, but the smaller vessels are the danger—the small sailing vessels we meet that have not good lights.

2946. Therefore it is very difficult to lay down any universal rule because the lights vary so much?—It is very difficult. I have been going up the Clyde within a few ships' lengths of a schooner before seeing his lights.

2947. But taking an electric light, you give an opinion there?—Yes; you can see electric side lights from 2 to 4 miles.

2948. A green side light?—Green side lights are not as a rule seen as far as the red.

2949. And not nearly as far as the white?—No, the masthead light is a much more powerful light.

2950. Then on the question of wearing spectacles—you say a man wearing spectacles would be quite useless in foggy weather?—Quite useless, I think.

2951. Do you know any cases where the older men, the commanders, do wear spectacles?—I have never seen any. To my knowledge I have never met a man.

2952. Do you wear spectacles for looking at a chart?—Yes.

2953. That is another point?—Yes; not on the bridge.

2954. You have never seen a man wearing spectacles?—No, never on the bridge.

2955. But there must be some of these elderly men who would see a buoy farther if they wore a particular kind?—They could use binoculars.

2956. A binocular comes in and rectifies the sight in that way?—Yes.

2957. Spectacles are not necessary?—No.

2958. To what extent can binoculars be used in foggy weather?—A very short distance. In some cases it is probably better without them. They magnify haze and they are no use.

2959. As to the test, you repeat here what you said just now, that a practical test in addition to one in a room would be a good thing?—I think so. I do not think the room is a very fair test at all to a man going to sea.

2960. When you say that, are you thinking of colour blindness or of both?—I am thinking of both.

2961. Have you tested any man for colour blindness on the Mersey?—I am always watching my officers to see if they are colour blind. I keep a pretty sharp look over them when I get new officers.

2962. Do you think you could give such an effective test that a man would not be able to mislead you?—I think after he has been a voyage with me or a few months with me I should know.

2963. But the Board of Trade could not take all their candidates out for that length of time?—I do not see why it should not be done on a river, the Thames or the Mersey, as well as the test in the room.

2964. Of course, one of the difficulties is obviously to get that same condition of weather for all the different candidates. You cannot take them all out at the same time. You appreciate what I mean. It is very important that the tests should be exactly equal for all candidates. There is a difficulty there, do not you think; that the conditions of one river differ from those of another, and if you are to have an out-of-doors

test it ought to be equal to all or they would complain at once?—You can always take a clear night for it—a clear atmosphere.

2965. And if possible, the same place, because there is a great variety of different rivers and different conditions. You think that could be met?—I think that could be met. I think the river test is the fairest test you can give a man.

2966. You would not abolish the room test?—I do not think so.

2967. But you would like to have the practical test also?—I would like to have the practical test also.

2968. Now about colours. You say a man ought not to be disqualified for hesitating over his shade. Do you think sometimes the wool test has been rather too severe on a man?—I do not think it is a fair test very often. So long as he can discriminate without any hesitation between red and white and black and green, I do not think he should be disqualified.

2969. Have you any knowledge of men who have been failed on a wool test?—The colour test?

2970. The wool skeins?—No.

2971. You have not any case in your mind where you think a man has been unfairly failed?—Not to my knowledge.

2972. But when you say they ought not to be disqualified for hesitating over a shade, it is not that you mean that the present Board of Trade test is too severe?—No, I do not mean that.

2973. I did not know whether you thought perhaps it might be?—No.

2974. But you think it must not be made too strict any way?—I think if you make it too strict you will cripple the mercantile marine.

2975. If you make it too strict you may knock men out who otherwise would be quite satisfactory. Have you seen the wool test being applied to men—the skeins?—I passed that when I was passing as an officer. I have never seen it since.

2976. But you have no particular reason to be dissatisfied with it?—I do not think so.

2977. Only you have this feeling, that an outdoor test would be a good additional thing?—Yes, as well.

2978. Now about boys starting at sea. I see you think their test should be pretty strict?—Yes.

2979. Why do you say that?—There are so many men that I have heard of that have had to give up the sea through bad eyesight, and if that is seen to in the first place before they go to sea those men would never follow the sea as a profession.

2980. Have you come across cases like that yourself personally?—I have read of them.

2981. And you think there are a certain number of cases?—I think there are.

2982. Cases where, if they had been sufficiently tested at first, they never would have entered?—Exactly.

2983. That is not a question of colour; that is a question of direct vision, is it not?—Yes—any defect in vision at all.

2984. Do you think the defect was probably there only it was not ascertained?—Not ascertained until afterwards as years passed.

2985. I suppose it would be impossible to get any statistics about that with regard to any particular company; it is more a question of what you have heard than of any actual cases?—That is all; only what I have heard and read.

2986. Do you think cases have occurred in your own company?—We do not take them in in the first place in our company.

2987. Because your own test is so strict?—Yes, and we only take in men with masters' certificates; they cannot join our company without masters' certificates.

2988. But do you disqualify a certain number of young men when they come up for the first time?—Yes, I think so. I think quite a number of men have been put back.

2989. Men who have already passed the Board of Trade test?—Yes.

2990. You have not any figures about that, have you?—No, I have not been told, but I have heard.

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2991. Do you think the company could give us any figures?—Possibly they could. Dr. Jones could have given you that.

2992. Because it is very important?—He is the man who puts them through the test—Dr. Avory Jones, our doctor.

2993. If we knew the company had rejected a certain number of men who passed the Board of Trade test and had figures to that effect it would be useful.\*

(Sir Norman Hill.) I am not sure if you will get the records kept. You appreciate, however, what Captain Allen has said, that the men they have rejected are the men who have applied for service in the company as officers, and each one of those men before he can apply for a junior officership has to hold a master's certificate from the Board of Trade; so that man has been passed as second officer, as chief officer, and as master by the Board of Trade, and the requirements of the company, if they reject men, must be very substantially higher than the Board of Trade.

2994. (Chairman.) But you test all your young officers?—Yes.

2995. (Sir Norman Hill.) Yes, but they take no officers unless they hold masters' certificates?—No.

2996. (Chairman.) Not even the youngest?—No. No man enters our service unless he holds a master's certificate.

(Sir Norman Hill.) It is a very high standard indeed. A junior officer must hold a master's certificate.

2997. (Mr. Nettleship.) With regard to the boys, it is rather a council of perfection, and, as I understand, it is not applied by your line?—No.

2998. (Chairman.) It is what you think ought to be done?—I think it is what ought to be done.

2999. (Sir Raymond Beck.) I should like to ask a question about taking these people on the river. You say you know more or less the distance from the buoys which you think they ought to be able to pick up?—Yes.

3000. They would be very much more difficult to pick up when there was a rough or choppy sea than when it was a flat calm?—I was speaking of fine weather when I gave this report.

3001. Therefore, if it were left to you to examine a certain number or one candidate you would wait until the day was calm and the buoy was visible, because I am right in saying, am I not, that it is very much harder to pick up a buoy in a rough, choppy sea?—If the weather were clear it would not make any difference.

3002. (Sir Norman Hill.) May we have the number of ships in the company now?—I think we have close on 70.

3003. At what tonnage about?—About 350,000, I think.

3004. What number of officers, roughly?—We have three officers for every ship, and probably a standby of about a dozen.

3005. So that would be over 200 officers?—Yes.

3006. And every officer holds a master's certificate?—Every officer holds a master's certificate, and a good many of them extra master's.

3007. Then am I right that you yourself know of no accident arising from defective form vision or colour-vision?—Not in our company.

3008. You have never known of one?—No.

3009. And during the last two years there are two officers who have not come up to your own test?—I think so.

3010. Not more than two?—It is probably more than two years. I would not be quite certain on that point, but I know there have been two within the last two years.

3011. Only two within your memory. May I put it in that way?—That is all I know of.

3012. Who have been asked to resign because you were not quite satisfied with their eyesight?—Yes.

\* Messrs. Alfred Holt & Co. subsequently informed the Committee that during the past five years about 3 per cent. of the applicants for posts as officers in their line had been rejected on account of defective vision.

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3013. Then do I understand that your experience with regard to the river test is that that is the best test for the experienced man?—Yes.

3014. You said experienced man?—Yes, an experienced man.

3015. Do you draw a distinction between the experienced man and the boy who presents himself?—Yes, I would have a scientific test of the boy.

3016. The boy might be confused by the river test?—Yes, it would be no use.

3017. He would be more likely to be confused by the river test than by the wool test?—Yes.

3018. So that when you advise the river test, that is, in the case of a man who already holds his certificate and comes up for the higher grade?—Yes.

3019. And you do not think that that man who already holds his certificate should be rejected until he has been tried practically outside on the river?—I do not think so.

3020. (Captain Golding.) With regard to the men you take on the river to test, is that for colour blindness or for distance vision?—To report?

3021. Yes, for both; both for form and colour vision?—Both.

3022. On the question of spectacles, I take it you are opposed to any man, either as a look-out man or an officer, wearing spectacles?—I would not have it.

3023. (Sir Norman Hill.) But you would not object to spectacles for reading his charts or anything of that kind?—No. I am afraid a number of us require them for that.

3024. (Professor Gotch.) I understand that the form-vision test of the company is a much more severe one than the Board of Trade one?—I think it is.

3025. Do you happen to know what it is?—No. I could not say what it is because I have not passed our company's test. I was in command before.

(Professor Gotch.) Have we data?

(Captain Golding.) Yes, we have it: "Messrs. Alfred Holt & Co., 62 steamers, 350,852 gross tons. We have our own private tests in addition to that used by the Board of Trade, and we consider them rather more stringent." That is what they say.

(Mr. Nettleship.) Could we have the test of spots so as to form our own opinion.

(Sir Norman Hill.) Yes, I am sure we could get them.

(Chairman.) Yes.

3026. (Sir Arthur Rücker.) I should like to ask a question or two about the river test. The Board of Trade has to deal every year with between 5,000 and 6,000 applicants. I want to know whether you think it is a difficult thing to apply the river test in the case of a miscellaneous lot. You have all the men directly under your command, and each ship is a testing station. Each captain can test, and therefore you have, comparatively speaking, a smaller number of men and a larger number of skilled persons to apply the river test, and a greater number of opportunities to apply it. But you said just now you thought a boy would be confused by the river. Surely, to a certain extent, that would hold good with a man who has been chiefly concerned in navigating down the Thames, say, or down the Mersey. Is it not a certain amount of advantage to a man to be tested in waters he knows?—I do not think it makes any difference.

3027. You do not?—No.

3028. If that is so, on the question of time would it not be very difficult to arrange for taking 5,000

\* Messrs. Alfred Holt & Co. subsequently furnished the following description of the test applied by their medical superintendent:—

"The candidate standing opposite at an interval of 15 feet is required to count the number of black dots on a white card with shaded electric light. These dots have a diameter of  $\frac{1}{16}$  inch,  $\frac{1}{8}$  inch, and  $\frac{1}{4}$  inch. An ordinary normal sighted man has no difficulty in seeing the  $\frac{1}{16}$  inch at 15 feet, and should he have acute vision, the  $\frac{1}{8}$  inch and  $\frac{1}{4}$  inch, but for these latter a reasonable shortening of the distance is allowed. Each eye is also tested with  $\frac{1}{16}$  inch.

"Swollen's letter type is used in doubtful cases in addition, and the officer should be able to read V=4.5 M., or at any rate V=6 M. (that is, the letters marked for 20 feet should be read at 15 feet without mistake.)"

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[Continued.]

candidates to sea? You say perhaps several could go together; but to prevent talking together, if there is a lot sent you would have to isolate between the different experiments so that they would not tell each other it was red, say?—Yes, I suppose it would entail a lot of work.

3029. It would mean a lot of work?—Undoubtedly.

3030. One of the main arguments about a room test showing them exactly the same thing—I am taking the lantern test in which you see the red, green, and white sighted alternatively very much as you do at sea

Captain J. W. HARRIS, a Marine Superintendent of the Booth Steamship Company, Ltd., called.

3032. (Chairman.) Would you kindly tell us if your company has any special regulations as to testing officers in the matter of sight for themselves?—Yes. We test the officers at intervals of not more than two years, and the masters three years.

3033. Do you test an officer when he first comes to you?—Yes, always.

3034. At whatever age?—At whatever age; but we do not take officers until they have their master's certificate.

3035. What would be the youngest age at which a man would come to you?—About 23 years of age.

3036. Then even if he had passed the Board of Trade test just before, you would test him again?—Yes, we would put him through our first test.

3037. Under that test, when he first comes during a course of years—say during the last four or five years—have any men been declined because they could not pass it?—Two officers and one man who had been some years in our service failed to pass the test, but in the case of the younger men, the two officers, we took them outside, attended by the medical superintendent and one of the marine superintendents, and gave them an outdoor examination, from the pier head in the daytime and again at night. We allowed the examination to be a comparison between the superintendent's sight and the officer's sight, and in both cases the officers quite satisfied the superintendent that they were safe for the purposes of navigation.

3038. And they were both passed by the company?—They were both allowed to remain in the company's service. One of them is now sailing as master. They had no difficulty whatever and no hesitation in stating what the lights were, particularly with the red and green side lights.

3039. Although they had failed indoors?—They had not actually failed, but they had just about got our minimum—barely our minimum in one case.

3040. So that you gave them the other in addition?—We gave them the outdoor test, and they seemed to be more at home—less nervous.

3041. And you were satisfied?—Quite satisfied.

3042. Could you describe to us what your indoor test is?—The indoor test, so far as colour is concerned, consists of a lamp. We have a lamp with the various shades of green and red, and also the white light. Take for example the green light. We put on a pure green light and show that, and then show a yellow-green light and a blue-green light. After that we put on certain densities of fog and see what they can make of those, but we never fail so long as he can distinguish the colours with a very light fog or in clear weather. That is disregarding the dense-fog glasses—so long as he can distinguish the red, the green, and the white. We bring in no other colours at all. Really there is very little difficulty. We have one case, but it is not of an officer in the company, it is an employee of the company on shore, who showed us that a man could mistake a yellow-green light for a red light in fog, and I think that is really the only fault we found with any man.

3043. Of course all these officers who have come to you have already passed the colour-vision test of the Board of Trade?—Yes, and because of that we get very few doubtful cases.

3044. Then in reference to the other kind of vision, form vision?—As to form vision, our system is very much the same as that used by the Board of Trade at present, but we have our own letters. Our medical

—is that the advantage you there get is that you can have any number of men together. One man does not see what the other is seeing at the moment, and the thing could be done very much more quickly?—If the man hesitates over a shade in a room you should take him to sea.

3031. You only regard it as a sort of last test to be used in a doubtful case?—Yes.

(Chairman.) We are very much obliged to you for coming.

superintendent takes a great interest in this kind of thing, and he has designed his own letters, and the distance for standing away.

3045. It is not necessarily more difficult?—It is a little more difficult than the Board of Trade.

3046. But have you failed any men on that?—We have not failed any men, that is, officers. Of course, we apply these tests also to our look-out men in the company, and we fail them if they cannot do it.

3047. But those men come for the first time because they have not been under the Board of Trade?—No; they have not been under the Board of Trade.

3048. With regard to these, do you make them all come before you?—Any man who is going to be employed as an able seaman with a chance of being put on the look-out has to pass these tests.

3049. Colour and form?—Colour and form vision.

3050. Those men are being examined for the first time?—A great many of them.

3051. Have any of those men in your experience been failed in colour?—Yes, quite a number.

3052. And also on form vision?—Yes, more on the form vision than on the colour. We very often get a man stand up before the letters, or, as we used some years ago, the dots—a system of various-sized dots—who is quite blind.

3053. He does not leave your service; he simply is not qualified to become a look-out man?—He is not qualified for that, and if we cannot give him employment he has to go. They are just casual employees, you may say.

3054. Do you suppose there are any statistics about that which would show how many of these men who wished to be look-outs had failed? Have your company any figures?—I do not know if they have kept a record for any number of years. But the present medical superintendent has been on I should say at least four years, and I think he could give you statistics.

3055. That would be rather interesting to us because it is an independent and separate test altogether?—Yes.

3056. You say these men have never been tested before?—No. They have never been tested before—quite a number of them, anyway.

3057. And to your knowledge a definite number—it cannot be a large number—have been rejected?—Yes. At the time I was sailing as chief officer in the company one of my duties was to put my own crew before the medical superintendent and see them examined. Often in the case of a somewhat doubtful man the doctor would ask me if I cared to take him or not.

3058. Then you think there always are a certain number of hands whose form vision unfits them to be look-out men?—Yes, I am quite certain of that. I have seen that proved. But the trouble seems to be that they go on being able seamen with six or seven years' experience before they come to a company that adopts the system we adopt, and they find out then, perhaps for the first time in their career, that they are either colour blind or somewhat short-sighted. But now we have a system in the company of working up boys, these Navy League boys. We take them in as youngsters, and their sight is tested before they make their first voyage, so that there can be no mistake. The boy is passed before he goes away in a ship for his first voyage, and I do not know of any case where he has had to be rejected afterwards.

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3059. There, again, your medical superintendent would, perhaps, have some figures as to the number of boys he has rejected?—Yes, I should think he would.

3060. He would have rejected some?—We have had the system of boys about the time this medical superintendent has been in the firm.

(Sir Norman Hill.) You might get the numbers from the school. They test the boys at the Liscard school; they have the arrangement of lamps there.

3061. (Chairman.) Are you in favour of a pretty severe test for boys to start with? Do you think that is the fairest thing?—Yes. I think if a severe test were given to the boy it would be hardly requisite to apply it later on.

3062. With reference to your re-examination, how does that work out? I was trying to put questions as to your first examination just now. You re-examine every three or four years, do you not?—Every three years the masters and every two years the officers, and they must come up to the medical superintendent's minimum.

3063. Have there been cases in the last four years of officers rejected?—None whatever. We have had two just on the minimum; but, as I say, they quite satisfied us out of doors.

3064. Were those men who were coming for the first time, or who had already been in your service?—They had been years in our service.

3065. I did not understand. You have had two slightly doubtful, but when they went out they came all right?—Yes.

3066. So that your test is kept up, not because you think there are many who would fail, but simply as a matter of precaution?—As a matter of precaution.

3067. Up to what age do you carry it on?—We carry it on as long as they are in the service. The senior masters to-day undergo this test, and we do this because a great many masters use spectacles for, say, chart work and reading small print. But if you put them on the ship's bridge they would probably be the first men to pick up a buoy at a distance or pick up a light; they have no difficulty at all in picking up distant objects.

3068. Do you find that none of your older officers have any difficulty about their long sight?—We have had none as yet.

(Chairman.) That is rather remarkable, is it not, Mr. Nettleship?

(Mr. Nettleship.) Yes, I think it is. I do not know what the number is.

(Witness.) We have 37 ships in the company, and four officers and a master to each ship.

3069. (Professor Gotch.) The test is on the river and not with dots or type, is it?—No, the test is in the first place with letters.

3070. The re-examination test?—The re-examination test is with the letters and a lamp. It is only if they get down to the minimum that we apply the outdoor test.

3071. (Chairman.) Will a man be tested up to 60?—Up to 65. We have one master sailing to-day who is 65 years of age.

3072. And they would have been tested every three years?—This has only been instituted the last four or five years.

3073. But these older men will be subject to the test every three years?—Every three years.

3074. And up to the present they have not been disqualified on the examination of the letters?—No, they have not been disqualified.

3075. (Mr. Nettleship.) I suppose it might happen now and again that a man might resign before his re-examination came on because he found himself getting bad?—I do not know of any such case. They know we give them a very fair show. That is if they cannot satisfy the examiner in the room, they know they will be taken outside where they are more accustomed.

3076. (Chairman.) But you have only had two cases?—We have only had two cases; one is a master and one is an officer.

(Mr. Nettleship.) It seems to show that good distance vision is not so rare in elderly people as some people think.

3077. (Chairman.) No; it is very interesting, because you are aware that a good many elderly people do need a certain kind of distance spectacles to help them out. Their distance vision is not very good without them?—My own experience in the company, and I have sailed with several of the very senior masters, was that they were quite equal to me in picking up a buoy or a light, and I have very good eyesight myself.

3078. Yes; that is very interesting. About the conditions, generally speaking, we wanted to know what your view was at about what distance you thought a man should be able to pick up a buoy or a light. Could you give us your opinion about that?—I think it is too difficult to fix any distance, because there are so many things to be taken into consideration. You might get two clear days, apparently the one as clear as the other, and see a buoy two miles one day and four on the next. The light affects it a great deal—a cloudy sky or a clear sky.

3079. You think to lay down a general rule out of doors would be almost impossible?—Yes, it would; but generally to pick up, say, an ordinary channel buoy or fairway buoy on a clear day about two miles. Very often you will see it farther, but that is quite a safe distance.

3080. You think that is a reasonable distance?—Quite a reasonable distance.

3081. With regard to this question of spectacles which we have just been discussing, what do you say about that?—I am quite opposed to that, and my colleagues in the company are quite opposed to it.

3082. Would you let a man wear spectacles for his chart work?—Yes, he can do that as much as he likes; but on the bridge we all have the feeling that if we happen to be on that particular ship we would not feel very comfortable in knowing the man in charge on the bridge was having to rely on the aid of spectacles. In the first place we like the officer of the watch to pick up whatever he is looking for or whatever happens to come within range with the naked eye, even if he only sees it dimly. Then it is quite instinctive for the watch officer to lift the binoculars and put them up, and it is better than spectacles, I should think, for bringing the object nearer. But for a man to wear spectacles on a dirty night with driving rain, snow, or sleet, when they must require wiping frequently, I do not think is right.

3083. You think they should require binoculars in every case?—I think so.

3084. You do not expect in your experience old officers always to be quite as quick in picking up a light as your best look-out man?—We expect our experienced officer to be quicker in picking up a light than an inexperienced officer or a look-out man. His sight must be good, and then he has the very great advantage of his experience. He knows what he is looking for and what he may expect to see.

3085. You think that balances the younger man?—More than. I have known a junior officer frequently to be outdone by a captain over 60 years of age.

3086. You have already told us, I think, all we need to hear as to the advantages, and you do think them advantages, of giving a doubtful candidate a practical examination?—Yes.

3087. In the cases you have mentioned you think it is a good thing?—I think it is an excellent thing. I think we have proved it ourselves.

(Mr. Nettleship.) Might we again, if possible, have the standard of form vision which the company adopts?

3088. (Chairman.) I understood you to say with regard to form vision it was very nearly the same as the Board of Trade?—A little more severe according to our medical superintendent.

(Captain Golding.) In the case of new men entering the company, it is full normal vision in one and half normal vision in the other, and in the case of men old in the service, not in years, 50 per cent. decrease in both eyes, so that your test is full normal vision



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in one eye and half normal in the other, and the Board of Trade is half normal vision in one; it is full in one and half in the other.

(Mr. Nettleship.) It would be a very good thing if we could have what letters he actually uses so that we can compare it.

3089. (Chairman.) Yes; I think the medical superintendent would let us have it?—I am quite sure he would be pleased to.

3090. (Captain Golding.) I was going to ask a question as to the tests, because they appear to be very much in excess of the Board of Trade tests?—Yes. We think the Board of Trade tests are very fair to the candidate with one exception; we do not approve of the wool being used. We think that the man who has to look for lights should be tested for lights.

3091. You prefer indoors, the lantern test, rather than any wool test?—Yes.

3092. That is what you use yourselves?—Yes. We did away with the wools some years ago.

3093. (Professor Gotch.) By the Board of Trade test you mean the present Board of Trade test, not the future one?—No, the future.

3094. Do you mean 1914?—1914. I was put through it myself a day or two ago.

3095. (Captain Golding.) But that is the colour test?—No, the whole thing right through.

3096. The form vision?—The form vision. I do not think the form vision is at all severe.

3097. What is proposed in 1914 is the same as your company has at the present moment?—Is it?

3098. Yes. You say that when you are testing with your lantern you introduce various conditions of fog. What is it you use, smoked glass?—I do not know how the glass is prepared; it is glass; it has an astonishing effect; it has a yellow-green light. I am not at all colour blind, but the green that I saw before the fogged glass was certainly reddish in appearance.

3099. But you do not think that the form-vision test which is to be introduced in 1914, and which is practically the same as your own company's test, is too severe?—No, I do not think so.

3100. (Sir Norman Hill.) How long have you been at sea?—Seventeen years.

3101. Have you ever known a case of a catastrophe arising from defective form vision or colour vision?—Never.

3102. With regard to the new form-vision test of the Board of Trade, as Captain Golding has told you, that brings the old test up to your standard?—Yes.

3103. Before it was lower than your standard?—Yes, it was lower.

3104. We have been told that the effect of applying the new test will be to disqualify about 10 per cent. of the men who now pass?—Yes, if the new test stands as it is. But we propose that no candidate should be definitely failed on the outdoor test but should have the right of appeal or offer from the examiner of the outdoor test as final, and that the test should be not a fixed distance of any object but a comparison with an examiner, a normal sighted man, and who is known to be normal sighted.

3105. I follow that; but the present Board of Trade test, not the new one, has been in operation 16 years?—Yes.

3106. And you have never known a case of a single casualty occurring through defective form-vision?—Never.

3107. Do you think it would be right to throw out 10 per cent. of the men who have been passing during the last 16 years?—No, certainly not.

3108. The effect of increasing the test will be to do that?—Do you mean that there are men—

3109. We are told that one man out of every ten who have been in the habit of passing in the future could not pass. From your own knowledge do you know of any circumstances connected with sea casualties which have happened that would warrant that?—No; I do not know of any casualties.

3110. Of course, as you have told us, you have maintained a very high standard for your officers?—Yes.

3111. Everybody must be a master?—Everybody must be a master; and then, when they come to us as masters, they have been at least three times before the Board of Trade.

3112. (Captain Golding.) And still you do not consider it is good enough?—It is good enough, but our standard really depends on the medical superintendent who happens to hold the position.

(Captain Golding.) It does not fulfil the requirements of your company, anyhow.

3113. (Professor Gotch.) I do not quite understand the situation. You examine people who have already passed the Board of Trade in direct form vision?—Yes.

3114. Your company demands a much higher test?—Yes, a severer test.

3115. I think you told the Chairman that you have never rejected one of these people you have examined?—Speaking of the officers. When I say that I am not referring to the look-out men.

3116. No; they have not passed the Board of Trade. You have never rejected people who have passed the Board of Trade?—No.

3117. Although you have a higher test?—Well, this gentleman says it is equal to the new one. I am told by the medical superintendent it is distinctly higher.

3118. But you have had some doubtful cases?—Yes.

3119. And am I right in assuming you have not rejected them because you have taken them on another test which is not a letter test—namely, a river test—and, as a result, you have passed them?—Yes, that is what we have done. We do not consider it fair to reject men on the indoor test.

3120. (Captain Golding.) Were the two doubtful cases young men, or men of long service in the company?—One man is about 45 years of age; and the other perhaps five years older.

3121. They are both men of middle age, anyhow?—Yes.

(Chairman.) We are very much obliged to you for coming.

The witness withdrew.

Captain JOSEPH HENRY WILLS, Marine Superintendent of the General Steam Navigation Company, Ltd., called.

3122. (Chairman.) What number of ships has the General Steam Navigation Company, roughly?—Fifty.

3123. Where is the trading chiefly, in what direction?—They are nearly all short-trading vessels, Continental and Mediterranean.

3124. Chiefly from the Thames?—Yes, all from the Thames, you might say.

3125. I understand that your own experience is pretty wide. You have been in command of vessels trading for 17 years, and your experience often takes you to sea, and your general experience extends over 42 years?—That is right.

3126. Does your company have any tests of its own with regard to this question of eyesight?—No, nothing beyond the Board of Trade test.

3127. Are you fairly satisfied with that as far as you know?—Yes.

3128. You have no reason to think that anything more severe is required?—No, nothing whatever.

3129. Have you come across any cases in your experience of accidents happening owing to any defects of sight?—No, not one.

3130. Do you think any of your older officers, because they are old, are weakening in their eyesight at long sight? I am not speaking of colour blindness?—Slightly, but nothing to interfere with their capacity as commanders of vessels.

3131. It does not affect their general efficiency?—No.

3132. Or even their capacity to pick up lights?—No, that is true.

3132. Have you known any cases of men retiring because of defective eyesight?—Not voluntarily.

3134. But have you known any cases of an officer having to leave?—Yes, one of them.

3135. That is to say, those responsible for the company found his eyesight was not what it ought to be, and I suppose they asked him to retire?—As a matter of fact he was chief officer, and the master of the ship reported to me that he thought the eyesight of the chief officer was not quite what it should be. I sent him up to the Board of Trade at once, and they failed him, and he had to leave in consequence, of course.

3136. Do you think that, as a rule, cases of that sort are found out? It must happen from time to time, of course, that a man's sight does fail, but he does not want to go unless he is made to go?—I should hear at once.

3137. You are almost sure to hear?—Yes, I am sure to hear.

3138. Because it is dangerous?—Yes.

3139. And, one way or another, you will find out?—Yes, one way or other on board ship one is sure to find it out if there is any defective eyesight.

3140. But, as a matter of fact, you have only had one case?—Only one case in the whole of my experience I can remember.

3141. And, of course, that was quite a marked case. The man was bound to go?—Yes.

3142. He was not fit to carry on?—No, I think so without a doubt.

3143. You thought the best way of ascertaining that was to send him through the Board of Trade test?—Yes.

3144. And that settled it?—Yes. He wears glasses now and says he can see very plainly.

3145. You would not let him wear glasses?—I should not care about it. I am not in favour of that.

3146. Of course he has failed the test, but does he go to sea?—No.

3147. He could not now?—No.

3148. But, in his own opinion, if he were allowed to go to sea, would his glasses keep him right?—He says so.

3149. He says he can see the objects all right with his spectacles?—Yes, he says so.

3150. I suppose your reply to that is, in foggy weather his spectacles would disqualify him?—Yes. Foggy weather or the least little salt spray would put his glasses out, and he would not be able to see through them.

3151. That is your main objection, I suppose, to spectacles?—Yes.

3152. With reference to the distance at which in the ordinary way a buoy should be picked up, would you tell us your own opinion?—My own opinion is that anybody ought to be able to pick out either a light or a buoy at a distance of one mile.

3153. That is to say in any case they ought to see even the most difficult light at a mile?—Yes.

3154. He would see the green light at a mile?—Yes.

3155. And the others of course he would see farther off?—Farther off. If he sees the green a mile, the chances are he will see the bright light two miles at any rate.

3156. That is the way you put it, that he ought to see the green light at a mile?—Yes.

3157. And you think that is fairly satisfactory?—I think so.

3158. I see you say yourself that you could distinguish the black and white rings of the West Ouzé Buoy at two miles off?—Yes, that was with ease without straining at all.

3159. Do you think any young officer should be able to do that also?—Yes, and I think the majority of them could.

3160. Do you find some of your older officers have quicker sight than some of your younger ones?—Yes, up to a point. For instance, a man trading across to the Continent knows where to see a light. Naturally

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his experience teaches him that that light ought to come there. He is watching for it where perhaps an outsider who perhaps does not know might be looking a little farther off, and might not catch it.

3161. That is where experience comes in?—That is where experience comes in.

3162. I suppose in a trade like yours it is very important?—Very important.

3163. It is not wholly a question of eyesight, but a question of experience?—Experience. But if you do not have good eyesight you cannot get the experience.

3164. Have you heard any complaints of the present Board of Trade test?—No, not from any of my officers. We sometimes hear that the wool test is not satisfactory to some people.

3165. I did not know whether you had heard anything of that?—No; in my own experience I have heard officers from other firms say they do not like the wool test and do not think it is one which should be put before them.

3166. There is a preference for a lantern test or outdoor test of some sort?—Yes; for what I should term a practical test. Of course if you are going to be a draper, being able to pick out the skeins of wool might do?

3167. Yes, we are very familiar with that objection?—But I must say my own officers have not complained to me.

3168. They are satisfied?—They are satisfied.

3169. Some people think it would be possible to have tests for all these candidates entering out of doors on the Thames or the Mersey. Do you think an outdoor test and no other indoor test would be possible?—No other indoor test?

3170. Yes?—I think an outdoor test would be a more practical one.

3171. But as a matter of fact would it not be very difficult if you have many hundreds or thousands of candidates to apply one which would be equal? Take the different nights; it is so difficult to find nights which are all equally clear?—Yes, it is, more particularly near London in the winter time. In the summer time you might get it.

3172. Because every test must be one which is quite impartial, otherwise we should have hundreds of complaints, should we not?—Yes.

3173. One would say, "You took so and so out on a clear night, and mine was not." That is the difficulty?—Yes.

3174. In your own experience, quite apart from that, do you think you could pick a clever candidate out and be able to test him severely enough so as to really ascertain whether he was colour blind? I am thinking of colour blindness now. I mean a clever man will pick up a good deal about red and green by knowing where they ought to be. Supposing you had to take a man out whom you thought was colour-blind, do you think you could test him adequately in the Thames?—Yes.

3175. You do not think he could deceive you?—I do not think so. He could not do it twice if he did it once. You see we have so many opportunities. There are barges all over the place, and you never know where a barge is going to turn up, so that the man could not have the experience and think, "I am going to see a green light directly."

3176. (Captain Golding.) Would not the wind be rather a guide to him as to which tack it is on?—It might be on the river.

3177. (Chairman.) I meant a test in the river?—Yes, if the green light were in sight he would know very well "That chap will have to go about directly and he will show me his red," but one could easily see that.

3178. You think after a little while you would soon find out if he did not know green from red?—Yes.

3179. (Sir Norman Hill.) Your vessels are constantly in and out of port, are they not?—Yes.

3180. I mean the whole of your trade is in narrow waters?—Yes.

3181. Therefore perhaps you are more liable to collisions than any other company afloat?—I think so.

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[Continued.]

We are always in narrow waters, and that is where collisions occur.

3182. In all your experience you have told the Chairman you have never known of a case of a casualty arising from defective vision?—No.

3183. (Captain *Golding*.) Do you have any re-examination? Do you examine your people annually?—No.

3184. And you are quite satisfied with the Board of Trade tests?—The only thing I do is with regard to second officers; they all have to pass the Board of Trade examination, and if I promote a second officer, before he is promoted he has to go to the Board of Trade and have his eyesight retested.

3185. But you are satisfied with the Board of Trade test?—Yes.

3186. (Professor *Gotch*.) When you say you are satisfied with the Board of Trade test, do you mean the present Board of Trade test or the one that is coming into existence in 1914?—The present Board of Trade test.

3187. You are aware that there is a much more severe one which is coming into force in 1914?—Yes.

3188. Have you any opinion to offer upon that?—No. Most of my officers have passed this new test.

3189. How have they passed the new test?—On their certificate it is stated that it is passed.

3190. (Mr. *Nettleship*.) It is voluntary at present?—Yes.

3191. A good many do it?—Yes.

3192. (Captain *Golding*.) Do you know of any who have failed to pass it?—No, I have heard of none who have failed.

3193. (Sir *Norman Hill*.) It is only those who have passed it who bring their certificates?—They must bring me their certificate and I should see it.

3194. Has any man been up for re-examination since the new test came in?—Yes, I had two candidates up last week. They are just commencing, and they have passed the new test.

(Mr. *Nettleship*.) It might be this: a man might just pass the existing test, and if he only just passed it he would know and would probably not take the new test and say nothing about it.

(Sir *Norman Hill*.) You remember, sir, we saw them.

(The *Witness*.) Is the new test much more severe than the old one?

(Sir *Norman Hill*.) About 10 per cent.

(Chairman.) A good bit more severe.

(Dr. *Watson*.) Yes.

(Sir *Norman Hill*.) It will cut out 1 in 10 we are told.

(Mr. *Nettleship*.) We really do not know.

(Sir *Norman Hill*.) It is only the evidence given before us.

(Mr. *Nettleship*.) Yes, to the best of our knowledge it is 1 in 10, but no one has material to go upon.

3195. (Chairman.) With regard to collisions, in your long experience have you heard a good many cases of collisions within your own knowledge?—Yes.

3196. In reference to those collisions, as to the actual cause of the collision, is there always certain knowledge as to what the cause really was?—Pretty well.

3197. You have known what the cause really is?—The evidence is sifted so that you really get at the bottom of the cause of the collision.

3198. You think you do?—I think we do.

3199. Of course defective look-out is not an infrequent cause?—I do not think defective look-out from the bridge, but possibly defective look-out from the fore-castle. In narrow waters you very often have three pairs of eyes and always you may say two. There are nearly always two people on the bridge, and if you have a pilot, there is the pilot, the master, and the officer.

3200. (Sir *Raymond Beck*.) We can assume the "Hawke" saw the "Olympic"?—I think so.

3201. (Chairman.) What should you say, speaking roughly, has been the most common cause of collisions? Perhaps that is not a fair question to put to you?—I do not like to answer the question.

3202. I ought not to put it like that; but among the more common causes of collision what would you mention?—One man not knowing quite what the other one is going to do.

3203. Just at the critical moment?—Just at the critical moment.

3204. (Mr. *Nettleship*.) What proportion of these vessels is in the hands of pilots, because a pilot certificate is generally higher than the master's certificate?—For sight test?

(Mr. *Nettleship*.) Yes.

3205. (Chairman.) In the case of collisions would a good many of these boats be in charge of pilots?—I must say we have been particularly free from collisions the last seven or eight years.

3206. (Captain *Golding*.) But a large number of your masters hold pilots' certificates?—Yes, they do.

3207. (Mr. *Nettleship*.) Pilots come in in guiding your vessels in difficult places?—The only pilots we have are from Gravesend to London. All the masters have to do the pilotage below Gravesend, both up and down.

3208. And elsewhere?—No, not in foreign ports.

(Mr. *Nettleship*.) Of course not.

3209. (Professor *Gotch*.) Do you adopt any precautions at all about look-out seamen? I do not mean such a thing as the Board of Trade tests, but any precautions about their sight?—No, we do not.

3210. (Chairman.) I suppose there is a sort of knowledge as to which seaman is the best or has good sight, I mean?—You soon gain that. If a man is on the look-out and he reports a bright light on the star-board bow, and it is a green one, you would be on the top of him at once to know what was the reason of it.

3211. So that the good men are sifted out by the knowledge of the commander, which is a practical knowledge of their sight?—Yes, they are.

3212. A quick-sighted man?—He very soon comes to the front, and you know who is on the look-out.

3213. Even although he has not passed a formal examination?—Yes.

3214. And the weak man is also soon found?—The weak man is also soon found.

3215. And is not employed on that sort of job?—If they found that the man really could not see, they would not allow him on the look-out.

3216. I mean he would not be employed on that; he might have some other employment?—I think he would very soon be sifted out of it altogether when he gets as bad as that.

3217. (Sir *Raymond Beck*.) His mates would not like it?—No.

3218. (Chairman.) You do not like having a man on board whose sight is seriously defective?—No.

3219. And do a certain number of elderly men pass out in that way; they must, I suppose?—It does not come under my notice. The master or officer would weed him out without giving a reason.

3220. Quite so. But there must be cases like that from time to time?—Yes, there would be.

3221. And they just drop out?—They just drop out.

3222. (Captain *Golding*.) A large proportion of your crews are practically permanent men, are they not?—Yes, steady married men, with their homes in London, because all the ships come to London, and they get steady employment.

3223. (Professor *Gotch*.) Would you object to a one-eyed seaman? I do not know whether you have had such a thing?—Yes. I remember many years ago we had one; in fact we used to call him Nelson.

3224. Was he an able seaman?—Yes. He lost his eye in the company's service. I do not know what became of him at last. But he could see. Of course he could not see as much with the one as with the two, but he sent his one eye all round.

(Chairman.) We are very much obliged to you for coming.

The witness withdrew.

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