

AN ESSAY,

&c. &c. &c.

THE SEWERS.

IN the days of Sir Christopher Wren, and before the great fire of London, the pavements, it is presumed, were as public and offensive a nuisance as exists in the present days in Paris: they were then a public evil. The sewers are unquestionably now the cause of a private grievance. The commissioners, whose jurisdiction is so extremely great, are nevertheless at all times ready to attend to every reasonable complaint, which must reflect the highest credit on their boards. But great as their powers are, it is perhaps limited in having no provisions for preventing those noxious exhalations, that arise through the gratings or gulley-holes contiguous to soap manufactories, and other processes; offending houses and foot passengers, at a moderate distance. But this is a trifling consideration, when compared to the whole extent of drains, sewers, and cesspools, &c., making one surface, that, if united, may be

estimated at about one thousand acres, in the district of the metropolis; discharging the most noxious vapours, that can infect the health of mankind, and which are agitated and increased by every change of the weather.

So pestilential has these exhalations from corrupted waters been considered, and agreed upon by the scientific in all ages, that for me to point out any of its pernicious consequences would avail little. Amongst the many who have treated on this subject, Virgil has mentioned it more than once. In speaking of the offensive exhalations arising from the pestilential Acheron, he proceeds thus:—

*Spelunca alta fuit, vastoque immanis hiatu
Scrupea, tuta laeu nigro, nemorumque tenebris,
Quam super haud ullæ poterant impune volantes
Tendere iter pennis, talis sese halitus atris
Faucibus effundens supera ad convexa ferebat.*

VIRGIL.

Deep was the cave; and downward as it went
From the wide mouth, a rocky rough descent;
And here th' access a gloomy grove defends;
And here th' innavigable lake extends,
O'er whose unhappy waters, void of light,
No bird presumes to steer his airy flight;
*Such deadly stench from the depths arise,
And steaming sulphur, that infects the skies.*

DRYDEN.

Granting that allowance due to poetic licence,

the vast sewers of this metropolis cannot be more accurately described. Various other authorities might have been quoted—superior to that of the poet—from men who had devoted their whole life to the study of the causes of disorders, whose remarks are not here necessary, as it is a point that must be agreed upon by all.

We may then ask, not how many houses are subject to these noxious exhalations, but how many are free from their effects? and unfortunately we shall find it to pervade too many even of our best mansions; but most particularly the houses of the lower orders of society, and those manufactories where the proprietors feel no interest in adopting the most common and necessary precautions; though some, of a more liberal mind, have held out an example that ought to be followed by all. A new building act could not have a better clause than one regulating the drains, and providing against their smells, by enacting the insertion of a cast iron air trap, of a sufficient capacity, in the mouth of every drain leading to the common sewer. Each house could not then be infected by its neighbour, or by the sewers; and farther precautions in preventing the smells from their own drains might be optional.

I have heard an objection to these my opinions by stating, that the scavengers and night-

men are in general most healthy and hardy: that may be granted; but contrast them with those menial and other servants, mechanics and work-people of a more sedentary life, who have neither that air nor exercise which they have, and are confined to apartments, houses, or manufactories subject to these offensive exhalations, and the comparison falls to the ground. As it is not every seed sown that immediately produces fruit, so it is not every constitution that can withstand the baneful effects of these exhalations. The arguments in favour of a good ventilation, or circulation of the common air, must be still more powerful, when used to oppose the respiration of air so deleterious in its consequences. The King's Bench prison has become recorded in the acts of the legislature, as subject to these offensive smells; one step, we should hope, towards preventing them.

FOGS AND MISTS.

HAVING pointed out the sewers as the cause of a very general and private grievance, I might add, they are a great cause of a public inconvenience; I mean the fogs of London, that are so notorious. To those sceptically inclined, an examination of the different gulley-holes, at these

times, will show the great and constant discharge of vapours in the form of steam. To increase these fogs, it is only necessary that there should be two causes in opposition to each other, which will suspend the vapour in solution in the atmosphere. Thus the sewers, or any other moist or watery source, must be of a sufficient warmth to evaporate, and cause the aqueous vapours to ascend; and the atmosphere must be sufficiently cold to chill, but not to condense them. In such a case, we should have one continued fog; but the heat, the cold, the winds, the pressure and temperature of the atmosphere, so frequently varying, these fogs are seldom of very long continuance. It is impossible to prevent them, but the sewers in all large towns must very much increase them. I am, however, inclined to think they may be ameliorated, by forming air traps at each gulley hole; which will have the advantage of preventing those offensive smells, offending the foot passengers as already mentioned. It is considered, that the climate of this country has materially altered, within the last fifty years, by the cutting of canals, &c.; and that we can only calculate one third of the time to be moderately dry, the atmosphere in the remaining two thirds of the year being greatly charged with moisture. The importance of this fact, if such it is, will

be sufficiently obvious in the two following considerations.

DAMP WALLS.

WHERE these arise from the ground, by the force of capillary attraction in the basement, they endanger the whole building, independent of it being more easily undermined by those destructive vermin, land and water rats. Nothing is more essential to the lasting soundness of a building than keeping the walls perfectly dry while building, and, by good drainage, afterwards. Instead of the drainage being the first thing ascertained, it is too often neglected until the building is complete. Where the incumbent ground is saturated with moisture, the greatest precautions should be taken to insulate the house, in the construction of good air and water drains. The areas, in the metropolis, tend greatly to the dryness of the buildings, which, considering the materials frequently used, would otherwise be too often attended with serious consequences.

Various saline substances, not duly prepared, both of old and new materials, are used in the interior, and those parts of buildings considered out of the influence of the weather; but, as these are greatly attractive of moisture, with which

the atmosphere is always more or less charged, they should be invariably rejected; for, as one evil begets another, damp walls are not only attended with great expense in repairs of papering, painting, &c., but too often produce the dry rot. The construction of the gutters, parapet walls, and water pipes, demand, therefore, particular attention, for the safety of the roof and walls. Cottage roofs, with eaves, are the best for keeping the walls dry; but, in populous towns, extremely dangerous in high winds, by the falling of bricks, chimney-pots, &c. The advantages of a temporary covering during the construction of large buildings is not less requisite to insure sound and dry walls, than to prevent the dry rot.

DRY ROT.

As in damp walls, so that premature decay in timber, commonly called the dry rot, may be said to proceed from two causes:—first, the quality of the timber itself; and, secondly, the situation in which it is placed. To remedy this evil, different plans have been adopted, and patents obtained; but until a method is found that shall, in the first place, effectually dry and season the timber, and in the next, make it impervious to

the action of heat, air, and moisture, any other certain preventive must be out of the question. While we cannot fully accomplish these ends in the timber itself, we must be more particular in directing our attention to the situation in which it may be during the performance of any piece of work, and where it is to be ultimately fixed: in houses, the upper and lower timbers are most liable to be attacked; the latter from the damp exhalations arising from the ground, the former from the breaking in of the weather, gutters, or pipes; while all will depend on the general construction of the building, and each again on its peculiar situation. So great has been the extent of this evil, that it is now become of national importance, particularly in that great bulwark of our defence, the Royal Navy.

The following Report, made in consequence of the Queen Charlotte being infected, is now first published amongst these observations, by the permission of the Lords of the Admiralty, and of the Navy Board; and, with the slightest variation, becomes circumstantially applicable to civil architecture. I here beg leave to state, that, previous to this survey, I had not been on board of a ship in the state of building, for more than twelve years before.

“ *Report of a Survey taken on Board His Majesty's Ship the Stag, building in Deptford Yard, December 30th, 1811.*

“ Wishing to see the disposition of the timbers in a ship, before I gave my opinions as to the cause of the dry rot in the Royal Navy, on the above survey, I found them to coincide with my own ideas and recollection.

“ 1st. The framing of the ship, extending from the keel upwards to the top, and leaving a space between each timber; the air contained in that space accumulates that moisture and heat, greatly productive of the dry rot, to avoid which, air holes have been generally left at the top of each space. But this, instead of counteracting, only promotes the rot, by feeding it with the nitrogen of the atmosphere, necessary for the decomposition of the wood.

“ 2d. The timbers are found the most decayed between the streaks and skinning, or footwaling of the ship, and the middle framing, where they touch and cross each other; this must be the case, for the compression of the timbers, by the driving of the tree nails, *and working of the vessel**,

* The plans now adopted for the prevention of *Arching* will possibly remove this effect.

will not only produce heat, but make the timbers give out their vegetable sap or moisture; this in some cases being of different qualities, one pine and the other oak, will cause the fermentation to go on much quicker than where it might be more exposed.

“ 3d. Whatever may be the advantages for timber, after it is properly flaved, to be exposed to the weather, when it is sawn and cut up more precaution is then requisite; but this is at present wholly unregarded, for *the timbers are framed together without the least possibility of discharging the accumulated moisture of rain, snow, or dews; the soundness of a ship may be then said to depend, NOT ON THE LENGTH OF TIME, BUT ON THE WEATHER WHILE BUILDING. After the framing of the ship is put together, I can see no objection to a temporary awning over the whole, until the outside and deck shall be cased in.*

“ 4th. To the prevailing custom of felling oak for the bark, when the sap is most in it, and which, I think, was not formerly done*, may be attributed the quantity of green timber now in use; and it is with vessels as it is with houses,

* At one period “heart of oak” only was allowed to be used, and all the sap or alburnum cut away. Hence, perhaps, the reason of the old song—“Hearts of Oak are our Ships.”

more a matter of good fortune than precaution, that they are not all infected with the rot.

“ The necessary precautions for the timbers, after they are sawn and framed, should not be omitted in keeping them from the rain, snow, and dews. In preventing the mixing of different saps, in causing a proper circulation of air through the interior and framing of the ship (particularly necessary in transport vessels), with the chemical and other preparations, where necessary, will be found means highly beneficial for the prevention of the dry rot.

(Signed) “ JOSEPH GREGSON.

Charles Street, Grosvenor Square,
DECEMBER 31, 1811.

The lamentable failure of some experiments, that were adopted for the quicker seasoning of timber, must be regretted by all scientific persons; as, from the specimens, that were exhibited, they had the appearance of answering all that could be wished for that purpose. In adopting, however, a medium and more general course, it is extremely gratifying to find, that the plans and sentiments, contained in the preceding Report, have so fully coincided with the opinions of those, who, in naval affairs, were so much more competent to judge of the propriety of the measures; these plans being now carried on in the Royal Dock Yards, with a preciseness well wor-

thy of attention: the erecting of temporary awnings, or housing, even over the largest ships; the speedily covering in the quarter decks; the preventing the mixing of different saps by the use of tar, oil, or paint; with the comfort with which the men now work under cover, and the time thus saved, will fully compensate for the expense incurred. Indeed, the whole improvements, that are now going forward in the different water ways and framings of the vessels, may be considered as a new æra in the annals of ship building.

These observations, with respect to ships in the progress of building, are equally requisite to be attended to afterwards. Whether they are employed in long voyages, and hot climates, or laid up in ordinary, still the caulking, painting, and keeping the framing and *upper timbers* of the ship weather tight, is indispensably necessary to prevent a premature decay, though every precaution may have been taken in the building of it.

What has been here pointed out as of importance in the Royal Navy, cannot be less so to all merchants, ship owners, builders, and captains in private traders; considering, that, as the different vessels are well known and rated at Lloyd's according to their sea worthiness, the importance of these considerations, and the necessity of not only adopting the best plans in

building, but preserving them afterwards, cannot require many additional comments.

Nor will it be necessary to enter much farther into the application of these remarks, as respects the framing and preparing of roofs, floors, partitions, and all principal timbers for the interior of houses, which is always done in the open air, and in almost all seasons. These timbers are afterwards inserted in the walls, and often closed in "without the least possibility of discharging the accumulated moisture of rain, snow, or dews." The soundness of a house must, in this case, likewise depend on the precautions taken, in keeping the timbers from the weather while framing; and in preparing and keeping the situation of their fixed place afterwards perfectly dry.

It must be here evident, that, as we cannot generally, in the large way, dry and prepare timber equal to what was intended by the above mentioned unfortunate experiment, no dependance is to be placed upon external preparations. One or two sides of a square piece of timber may be prepared, but not the whole of it covered; the unprepared sides cannot be in too dry a place, or in too great a circulation of air. On this last point, there is generally a failure; the elasticity of the air is such, that it will not pass freely through small apertures, nor will it circulate, however rarefied, where the ingress and egress are on the equilibrium.

WET ROT.

To accommodate the opinions of those, who may conceive there are two different causes of that rot, which may be considered a premature decay, I have made a separate head for these few remarks. What I understand, and, I believe, is generally understood, by the dry rot, is a *premature*, and not a natural decay of the timber; and the same is likewise understood by the wet rot. It is not necessary, in these general observations, to enter into a scientific disquisition, of the products, and the decompositions produced by this decay; our attention is more to be directed to the physical causes of it, which we shall find to be heat, air, and moisture: and, without the united action of these three, no premature decay will take place. The abstracting of either, but more particularly that of the sap, or moisture, is the only method to be depended upon as a preventive in building.

In the dry rot, there will always be present with heat and air a *partial* degree of moisture, for *the capacity of air to retain moisture increases with its heat*; and, in the wet rot, there will be an *excess* of moisture, though the immersion of timbers in water, by which the air may be totally excluded, will, with most woods, have the con-

trary effect; *viz.*, that of preserving it: so, in others, where all moisture is excluded, the same effects precisely take place.

To assign, therefore, the limits between the dry and the wet rot is as impossible as to fix the degrees of absolute cold, in the privation of all heat, or the extreme of dryness in the total absence of all moisture.

There is a common saying, only deserving notice to refute itself, *viz.* "that the dry rot is one of the best friends the carpenter has got." Upon the same principles then we might be able to find advocates for disease, for famine, and for contentions, to fill the pockets of the doctor, the farmer, and the lawyer; an insinuation, that I have no doubt, every trade or profession would repel with the utmost indignation: casualties will arise, and, "it is an ill wind that blows no person good." The evils of life are sufficiently numerous for the purpose of exciting our vigilance in adopting the best means in our power of reducing them, by doing the most good, and the least harm. Wherefore, we must agree with Pope in the following lines:—

All nature is but art, unknown to thee;
All chance, direction, which thou canst not see;
All discord, harmony not understood;
All partial evil, universal good.

I have never heard, or seen, any good accounts respecting the worm in different timbers. Experiments to ascertain the cause, or prevention of it, would, no doubt, require a long series of years; but would, nevertheless, be attended with great advantage to the community.

SMOKY CHIMNIES.

THESE may be considered under two heads, public nuisances, and private grievances. In the architectural observations already published, one chimney has been mentioned as offending Royalty, by its not being carried to a much greater height: others, equally notorious, have tended greatly to depreciate the value of most respectable property at the west end of the town, with the addition of many, too numerous to mention, the ill effects of which are deeply felt by the neighbouring inhabitants. It becomes therefore necessary to inquire into the right and consistency of these public nuisances, and how far an act regulating the height of the chimney by the size of the furnace would be desirable. This nuisance is almost daily increasing in the metropolis; but in Manchester and in the Staffordshire potteries it is, to strangers, intole-

rable. From the last place I had a few years since sent me, for my opinion, a small tract, being "*Observations on the Dangerous Consequences of the present Public Nuisances in the Staffordshire Potteries, by the building of Low Chimnies,*" in which it is stated, in page 7, "We have living instances now, both of manufacturers and others, who are absolutely obliged to retire from this cloudy scene of sulphur and smoke, as the only means of preserving life, by breathing a purer air." And again:—"We see youth of both sexes, whose constitutions are tender and delicate, and not able to stand the repeated attacks of this bane of the human race, carried away early off the stage of life, to the great distress of their disconsolate parents." And farther:—"It is not only the precious health of mankind that suffers by this most pernicious effluvia, but even plantations, fruit gardens, and all kinds of vegetation within its reach." Such, then, being the case in the open and extended plains of the Staffordshire potteries, what must be the fatal consequences in this populous metropolis, or other large towns?

The present method of feeding fires periodically at the hopper hole might, I think, be altered for one that can be worked by the steam engine; and have not only a more regular and intense heat, but avoid those voluminous clouds of smoke and

coal, that issue from the chimney-top, which, being consumed in the furnace, will remunerate the expense; thus making a considerable saving to the consumer, and a much less nuisance to the public*.

From the effects of smoke, in the open air and out of the building, we have now to consider it in the interior; and we must admit, that every public building, whose chimnies are so constructed as to smoke, or prevent the possibility of having fires in the respective rooms, must be considered little less than public nuisances. In one department of government, where I was called upon, I found, on making the estimate, it would not cost so much to erect a steam apparatus to warm the whole fabric, principally occupied by clerks, as it would to remedy the chimnies, with any degree of success. And in this metropolis, to public buildings may be added whole streets of the first, second, and third rate houses, in which there is not a single dwelling free from so intolerable a nuisance; and for proof, let a person only observe the numerous devices set on the tops of the different chimnies, to counteract the effects of the wind, and then

* Since this went to the press, I have been called upon to lay down the plans for its execution; as the inflaming of smoke, by the admission of cold air, has, in large concerns, disadvantages beyond its benefit.

consider how often they have known that very element, travelling in all the greatness of majesty, dealing destruction in the most terrible form in every direction, on land and at sea! And how vain, how futile, must these inventions be too often found in resisting its progress? Until, therefore, the powers of the wind, and the nature of smoke, shall be so generally understood, as to produce an entire change, not only in the principle, but in the construction, in this department of building, the present evils and nuisances are likely to continue.

The remedy of those chimnies known to draw down both the smells and smoke of other chimnies, when there is no fire in the grate, depends entirely upon the same principle as if it smoked when there was a fire. Smoky chimnies, depending on so nice a balance as that which shall adjust the difference of the weights, forces, and powers of air, we may readily grant that it will be the last that will arrive at any fixed and definite system, for its prevention. As the following question has been too long asked to admit of the most favourable conclusion, *viz.*—“Does any architect know how to build a chimney that shall never smoke? If he does, he knows how to cure every one.”—*Vide Gent. Mag.* vol. lxxiv, p. 399.

The great discoveries in pneumatic chemistry, if

sedulously applied to the remedy of these defects, will no doubt ultimately lead to the desired conclusion. As far as may relate to chimnies, some alterations in the building act would be desirable; particularly if it was enacted, that the with (or mid-feather, as it is called in the country) instead of being half a brick, was a whole brick thick. It could then be sufficiently bonded to resist the pressure used by the sweeps, in cleaning them. A good foundation should be made to the stacks, where they are considerable, to prevent their settlements: or otherwise, instead of, or in addition to pargetting, it should be enacted, that *Every course of the chimney-work should be fully flushed with mortar, and all the return joints, and cross joints, should be filled home with mortar, the breadth of the brick; and no four courses of bricks, with their mortar, should be allowed to measure more than eleven inches and a quarter in height.* We should then have sound constructed chimnies, not liable to settlement in the foundation, or crack by the heat of the flues, or the pressure of the sweeps; and, without sound chimnies, it is almost impossible to remedy their smoking by any plans that can, or may be invented. In too many of those houses that are built **ONLY FOR SALE**, this alone is a most serious public grievance.

In no part is there greater necessity for sound-

ness of construction, than in the chimnies and in the drains, and in general there is nothing more neglected; perhaps, because they are out of sight, and beneath attention: but to those, who know the expense of perfecting them, or the inconvenience of living with them, they find it worthy of their greatest attention and consideration.

Altitude in height, soundness in construction, adequate warmth, and sufficient supply of air, are four grand requisites for every chimney.

WARMING OF ROOMS.

A DISSERTATION on the principal merits of any plan would be here improper; but, as far as the public are concerned in public buildings, the warming of rooms by open fires, as in common practice in private houses, is, and will be found at all times the most healthy; though being frequently attended with smoky chimnies, extreme drafts, and great consumption of fuel, it is not the most economical for public purposes. However, I am inclined to think much greater improvements, in the manner of warming by open fires, may yet be adopted, as we obtain a more correct knowledge of the nature of heat; and in this I am supported, by knowing, that a certain quan-

tity of heat can only be evolved from the consumption of a certain quantity of fuel. The same quantity of fuel ought, therefore, to warm the same space, whether by direct radiation, by induction with rarefied air, or by abduction through the medium of steam; that is, if our economy in the management of heat, in all these points, were sufficiently equal. Next to open fires, warming by steam has the advantage, not being attended with any consequences prejudicial to health, where well conducted. Next to steam is the warming by retorts and rarefied air, providing it is not burnt in its passage; then German and French stoves, coakles, flues, &c. &c. These are all, more or less, not only prejudicial to health, on account of emitting the most noxious vapours, from the dust and substances ever floating in the air coming in contact with their surfaces; but more especially hazardous on account of their danger, that has been so frequently experienced, not only in private, but also in many public buildings.

Warming by brasiers, or coke fires, in close rooms, is, above all, the most improper, as the carbon of the fuel uniting with the oxygen of the atmosphere, and forming carbonic acid gas, has too often, in confined apartments, been the cause of instantaneous death.

VENTILATING APARTMENTS.

THE following is an extract from a paper, that was presented to the Honourable the Supervisors, appointed by act of parliament, for the erection of a Penitentiary House.

“ Observations on the present State of Ventilating Public Buildings, Prisons, Houses, &c. &c.

“ I had not many years entered upon the study, and made experiments, for the purpose of promoting greater improvements in the ventilation and interior comfort of houses, when Mr. Nield's Reports of the state of Prisons, in 1802 and 1803, were published, which fully showed the necessity of persevering in them. My attention became alternately engaged to public and private buildings. The more that was disclosed to my examination, the more I found the importance of a greater inquiry, and the more I excused those, whose situations, as superintendants of prisons, could not have been accountable for the deficiencies of a better circulation of air. The theory, and almost the practice, I found confined entirely to philosophical lectures and experiments, or, at the farthest, subservient only to the education of the gentlemen of the faculty,

whose studies being directed to our bodies, prevented their greater improvements in our dwellings.

“ I continued progressively in the pursuit, until I had arranged the whole in a competent system for public practice; and, for the final completion in making my calculations for ventilations, according to the number of persons and size of rooms, I am indebted to those gentlemen of the faculty, who have, with pleasure, forwarded so desirable an end. My intention was, however, scarce known, of publicly carrying them into execution, before I was called upon in cases far more intricate than what I had at the first intended to adopt; I mean the preventing the offensive smells, or exhalations, from the drains and sewers, &c. &c.

“ Fortunately, my studies were adequate to the purpose; for I had only then to direct my attention to the situation of those subterraneous conduits, when the effectual remedy presented itself. In different conferences with the surveyors of the sewers, I found it was no part of the business of the commissioners to attend to their exhalations, farther than their present practice; and whatever precaution the inhabitants took was optional, *and has too often been ineffectual.* Nearly three fourths, then, of the inhabitants of this extensive metropolis are inhaling the exha-

lations of the common sewers, *in itself* actually as offensive and as poisonous as the air of the most confined dungeon. The effects of this, in dry or hazy seasons, or during any epidemical disease, will be greater than is at present imagined; but that, with the necessary preventives, both public and private, will form a sufficient subject for a more important paper. I have only mentioned it here to shew how far the late discoveries in pneumatics have been practised, even in our own mansions, and from which *we could not expect our prisons to be, then, in a better state.* Rejoiced, indeed, must every person of humanity be to think, that they have hitherto had such great improvements, and which are daily advancing; though we may regret, that the study of that vital principle, air, has been so little cultivated, and still less practised, in the present age, amongst all our other improving arts and sciences. For, in the honour that I had in making a survey on the cause of the dry rot in the Royal Navy, I found, that pneumatic chemistry was not more studied in the naval, though so much more wanted, than in civil architecture. And, for the last, out of seven and twenty plans, delivered in lately for building a new church, not one treated on the warming, or ventilating of so necessary a building. I had, however, the honour of humbly suggesting to the committee the

necessity of some specific plan being adopted, to which they have assented."

April, 1812.

J. G.

Chester Castle,

Though greatly admired in every respect, yet, in point of ventilation in the fever wards, ought not to be taken as an infallible copy. The perfect powers of ventilation depend on the difference of altitude between the entrance of the fresh, and discharge of the contaminated air, and the size of the apertures, in proportion to the number of inhabitants the room will contain.

The House of Lords

Has undergone some experiments, for the improvement of its interior comfort; but so long as their lordships shall continue to sit, *on the same plane*, in a crowded room, they can never enjoy the best effects of ventilation.

The Theatres.

In the treatise on one of the theatres, lately published, a few remarks on ventilation or warming, as well as on sound and sight, would, I conceive, have been a great acquisition. These, however, have been omitted, though a better

ventilation is acknowledged to have been wanted by all.

Churches, Chapels, and various Public Lecture Rooms, &c. &c.

Are generally complained against; and principally the lower parts, more than the galleries, because they are more crowded, and being on the same ground, or plane, as mentioned in the House of Lords.

Public and Private Assembly Rooms,

On the same account, have equal inconveniences. One general observation would be of service to all; that is, if the upper sashes of windows were made to open inwards, from the top, with enclosed sides, the same as is generally adopted in the French windows in Paris.

The greatest evil will, however, be found in that want of ventilation that exists in the houses of the lower classes of the community. The upper sashes of the windows, so far from opening inwards, will be too often found *not to open at all*. Hence, with the want of CLEANLINESS and VENTILATION, arise those epidemic fevers, that might (excepting for the exertions of the Fever Institution) be too often the scourge of the metropolis. The upper sashes, or panes, of

every window should be made to open, whether the lower ones were or not.

It may not be improper here to observe, in the "Reports of the Institution for the Cure and Prevention of Contagious Fevers, in the Metropolis, from its Establishment in 1802 to the present Time," lately published, the only effectual preventives against contagious fevers were found to be CLEANLINESS and VENTILATION, without which medicine is of little or no use.

Houses, built in courts or passages, or let in separate apartments for the accommodation of the poor, ought to be under certain regulations, externally, as to the entrance and width of the courts; and, internally, as to lime whitening the ceilings or walls, &c. once a year: an enactment to that effect might be held up by some as trespassing on the liberty of the subject; but, let the Reports of the Fever Institution only be seriously considered, and such unhealthy tenements cannot but be deemed public nuisances, and, therefore, I should think, removable by indictment at common law.

In most cases, great popular objections arise against improvements in streets, on account of the many poor families that are turned out of home and living; and, perhaps, none where it would meet with greater objection, than by continuing a street parallel with Fleet Ditch; but

such an improvement would, no doubt, be one of the greatest blessings to the metropolis, and to those very individuals; for, in that neighbourhood may be found, almost at all times and seasons, germs of the most contagious fevers.

King's Bench Prison.

The Report made to the House of Commons, by the committee appointed to inquire into the state of the King's Bench, Fleet, and Marshalsea prisons, &c. &c. has been lately published. It appears, the committee were sitting in the King's Bench Prison, about the time the greatest part of these observations were penned. The Report states,—“The prison is ill lighted, extremely dirty, *smells*, not only *from the sewers* but from the piles of dirt heaped up behind the prison, and suffered to accumulate for the profit of the scavengers, who also collect the urine in tubs, for sale; the smell of which is generally complained of; and, at present, no attention is paid to cleanliness in the prison,” &c. These remarks are sufficiently applicable to the purport of this Essay. For farther particulars I must beg leave to refer to the Report itself.

The tract lately published, on the gaol of the city of Bristol, compared with what a gaol ought to be, is worthy of much attention.

Beds and Bed Rooms.

Perhaps no trade has a greater opportunity of knowing the comforts and the conveniences, or even inconveniencies, of the higher classes of society, than the upholsterer: he is consulted on the splendour of the drawing-room, and on the comfort of the bed-room. There are few, then, who have been in the habit of entering bed-rooms, the first thing in the morning, but what are fully sensible of the great difference and unpleasant sensation they feel, on entering so close a chamber; nay, the commonest brick-layer employed on the house top can discover, by the smell, a bed-room from other chimnies. Nor is it to be wondered at, when we reflect, that, upon an average, of the better orders of society, those, who have lived to thirty years of age, may be allowed to have spent *ten years* in bed; a period of time, most probably, not occupied in any other particular place. The health, then, of such a room, ought to be the most important consideration; instead of that, we too often find it sacrificed for external parade, by giving to the drawing-rooms a greater degree of space, in proportion as the bed-rooms are confined: both require space, and both require ventilation.

Currents of air may be as improper as a close

confined room; but, considering the use of bed-rooms, they ought to be kept always dry and temperately warm, which can only be done by uniting the warming, by common fires, with a suitable ventilation, that can be regulated at pleasure: the bedsteads might also participate of the ventilation, without being inconvenienced by the currents of air or light from the windows; such an arrangement would be extremely advantageous in all cases of indisposition.

Uninhabited Houses.

The furniture, interior decorations, and fittings up of houses, in town or country, receive more injury, during the absence of the family, than when the whole is in full use; part from being neglected, and part from being confined in close, damp, and dark rooms.

A perfect system of ventilation would prevent many of the injuries arising from the moisture; tarnishing the silver and gilt work, condensing on the walls, destroying the paper, and swelling the furniture, doors, window-shutters, &c.: to remedy which, fires are too often instantly lighted, the room, perhaps, warmed to an excess, and an opposite effect, but not less injurious, produced; *viz.* the sudden contraction of the doors, window-shutters, and furniture, by starting cracks and vents, and bringing the paper from the

walls, &c. &c. : whereas, a perfect system of ventilation, that would constantly be changing the air in the rooms, whether open or closed up, would not only prevent these effects, but much less fire would, at all times, warm it.

Moist, damp rooms, always feel much colder than dry ones of the same temperature; aqueous vapour, abstracting the heat from the body or the fire, with very great powers; hence we find, that *it takes nearly six times as much fire to evaporate or boil away a gallon of water, in the form of steam, as it does to bring that gallon of water, ice cold, to the boiling point*; the less, therefore, that the walls, furniture, and the air, in the interior of a house, have absorbed moisture, the less firing will be required to warm it: a consideration of some importance in the metropolis, and not to be overlooked in all public buildings, as churches, chapels, &c., that are long closed up.

Possibly, the most damp air, that could be admitted, by ventilation, from the atmosphere, would not be so injurious as that to be found in a confined apartment; the one only being for a day, the other for a season.

COMPOUND VENTILATION.

UNTIL we are sufficiently acquainted with the natural causes and effects of simple ventilation, and its application in different situations and buildings, we cannot expect to be very successful in the adoption of machinery, or other artificial aids.

The *frigorific* science has not yet been sufficiently developed to ascertain how far it may be successfully applied to the cooling of crowded rooms; nevertheless, I conceive, great advantages may be ultimately expected, from its application to that purpose.

VENTILATING OF SHIPS.

THE celebrated Doctor Stephen Hales, who made so many experiments on the nature and properties of air, and exerted himself so much in the construction and use of ventilators, in his treatise on them, states, amongst numerous facts, the following. Nor will it be here improper to remark, that, though his labours considerably preceded the great discoveries that have since been made in pneumatic chemistry, so far

from refuting, they have only tended to confirm, and prove correct, the justness of his opinions. Indeed, it is generally regretted, that the doctor did not follow up his experiments with a chemical view; but, as practical experiments, they are still worthy of attention and consideration. I beg leave to refer to the 343d section, and following parts, in which he states, that—

“ The sappy vapour which arises from ships built with green timber, makes these ships so very unhealthy, that they continue so to the last of their duration; this, together with the putrescent vapour, which arises from many human bodies, and from the stinking bilge-water, must needs be very noxious. And as those great evils are, by happy experience, *remedied* by the good and salutary effects of ventilators, the following instances, as they are strong proofs of the great benefit and usefulness of them in ships, so they also fully prove, that they can most commodiously be fixed and worked in them.

“ Captain Thomson, of the Success frigate, in his letter to me, dated London, Sept. 29th, 1749, says, ‘ That, during the ventilation, the lower deck hatches were commonly kept close shut, by which means the air was drawn down into the hold, from between decks, through the seams of the ceiling, amongst the timbers of the

ship, by which means we found the foul air soon drawn off from between decks. Our rule for ventilating was, for half an hour every four hours; but, when the ventilating was sometimes neglected for eight hours together, then we could perceive, especially in hot weather, a very considerable difference, by that short neglect of it, for it would then take a longer time to draw off the foul air. Our general rule was to work the ventilators till we found the air from them sweet. We all agreed, that they were of great service; the men being so sensible of the benefit of them, that they required no *driving*, to work that which they received so much benefit by. We found this good effect from ventilation, that, though there were near 200 men on board, for almost a year, yet I landed them all well at Georgia, notwithstanding they were pressed men, and delivered me out of gaols, with distempers upon them. This is what, I believe, but few transports, or any other ships can brag of; nor did I ever meet the like good luck before, which, next to Providence, I impute to the benefit received by ventilators. It is to be remarked, that we, who lay *wind-bound for four months*, with our expedition fleet, which soon after invaded France, were healthy all the time, when they were sickly in all the ships of that expedition. This ventilation certainly occasioned all kind of grain provisions to

keep better and longer from weevils, than otherwise they would have done. And other kinds of provisions received benefit from the *coolness* and freshness of the air in the ship.' ”

The following is another letter to Dr. Hales from Captain Ellis, *viz.* :—

“ ‘ SIR,—Could any thing increase the pleasure I have in literary intercourse with you, it would be to find, that it answered your end, in promoting the public good. The *vis inertia* of mankind is not the only difficulty you have had to encounter ; but their ignorance and prejudices, which are almost insuperable. It is to your perseverance and resolution, that the little progress you have made is due. Indeed, I ought not to say little, for it is a great step to have found the few, that have hearts good enough to relish your plan, and heads sufficiently clear to discern the most effectual method of advancing it. It does honour to those noble, and other personages, that join you in acts of such extensive humanity, as the introduction of ventilators to hospitals, prisons, ships of war, transports, &c., as they must needs render the miseries of the first more supportable, and the close and constant confinement of others less prejudicial and fatal to their health and life. It is to be lamented,

that they are not more generally made use of ; for, notwithstanding their advantage is apparent and incontestable, it is scarce credible how few make use of ventilators, among the vast numbers of ships daily employed in carrying passengers, slaves, cattle, and other perishable commodities. Those of your invention, which I had, were of singular service to us; they kept the inside of the ship *cool, sweet, dry, and healthy*. The number of slaves I buried was only six, and not one white man of our crew, which was thirty-four, during a voyage of fifteen months, an instance very uncommon. The 340 negroes were very sensible of the benefits of a constant ventilation, and were always displeas'd when it was omitted: even the exercise had advantages not to be despised among people so much confined.

I am, &c.

HENRY ELLIS.'

Bristol, Dec. 26th, 1753.

“ And, by the like good conduct, in his next voyage, in the year 1755, not one of 312 slaves died; and all his sailors arrived alive and well at Bristol.

“ The Earl of Halifax has often informed me of the great benefit they found by the use of ventilators in several Nova Scotia transport-ships, *twelve to one* more having been found to die in

unventilated, than in ventilated ships. And there are many more instances of their salutary and good effects for the benefit of the *soundness* of the ship, as well as the health of the crew. It is, indeed, a self-evident thing, that the changing the foul air frequently in ships, in which there are many persons, will be a means of keeping them in better health, than not doing it; which makes it the more astonishing, that effectual proposals to remedy so great an evil, should for so many years be received with so much coldness and indifference by mankind.

“ In the beginning of the year 1756, the Lords Commissioners of the Admiralty ordered them to be put on board the Royal George, our largest ship: in which the honourable Admiral Boscawen, taking care to have them properly worked, they were found to have the desired good effect, so to refresh the whole air in the ship, as to preserve in good health 850 people; which happy event occasioned their being ordered to be put into the whole fleet.”

Such are a few of the remarks from the doctor. I must, however, acknowledge that, in the course of my own small acquaintance with the shipping interest, I have not seen, or heard of any of those ventilators, until his treatise lately came into my hands. If their use has been exploded, I con-

ceive, that it may have been from their occupying too much room; and, if that has been the case, I can only be surprised, that the stoves, and coppers, are suffered to remain; for, warm victuals cannot be of one half the consequence to the health of the crew as good, pure, and wholesome air. But, perhaps, they have given way to the easy and simple methods adopted, by the use of windsails, which, I think, must be an after invention, as the doctor has not once mentioned them.

A great defect in the fire-pipes then in use, arose from the deficiency of their capacity, not being more than $2\frac{1}{2}$ inches diameter; and also from the impossibility of their rendering any service, when there was no fire in the grates, or during a storm.

An equal deficiency must even now hold good with respect to the use of windsails; particularly when they are becalmed or wind-bound, as mentioned in captain Thomson's letter. The object I had in view, with respect to a better “ *circulation of air through the interior and framing of a ship (particularly necessary in transport vessels)*,” was the adoption of fire-pipes of a sufficient capacity to the ash grates of the stoves, or by making an air-pump, or gasometer, in the well of the ship, to be worked by the machinery of the pumps, or even overboard at the yard-arm.

I allude to the pump in the 28th volume and 219th page of the Transactions of the Society of Arts, which was used to ventilate the tunnel of the Tavistock Canal, near half a mile in length. Its advantages I shall state in the engineer's (Mr. Taylor's) own words, and the certificate of the committee:—

“ ‘The end of the tunnel of the Tavistock Canal, which it was my object to ventilate, was driven into the hill to a distance of near three hundred yards, from any opening to the surface, and, being at a depth of one hundred and twenty yards, and all in hard schistus rock, air-shafts would have been attended with an enormous expense; so that, the tunnel being a long one, it was most desirable to sink as few as possible, and, of course, at considerable distances from each other. Thus a ventilating machine was required, which should act with sufficient force through a length of near half a mile.

“ ‘Within a very short time after the engine began to work, the superiority of its action over those formerly employed was abundantly evident. The whole extent of the tunnel, which had been uninterruptedly clouded with smoke for some months before, and which the air that was forced in never could drive out, now became speedily so clear, that the day-light, and even objects at

its mouth were distinctly seen from its farthest end. After blowing up the rock, the miners could instantly return to the place where they were employed, unimpeded by the smoke, of which no appearance would remain under ground in a very few minutes, while it might be seen to be discharged in gusts from the valve at the top of the shaft. The constant current into the pipe at the same time effectually prevented the accumulation of air unfit for respiration.’

“ *Certificate.*

“ An extract from the Report of the Committee of management of the Tavistock Canal, to the General Meeting of Proprietors, held in August, 1808, stating, that great impediments had arisen from the want of good air in the tunnel, when distant from a shaft, then adds

“ ‘For the purpose of rendering the ventilation in the tunnel completely good, and of doing it in a manner that may be applied to very considerable lengths, in driving, the engineer has erected machines, *acting upon the simplest principle, and without friction*, which exhaust, from the very place in which the men are working, a continued volume of vitiated air, the place of which, of course, is as constantly supplied with fresh air, by the pressure of the atmosphere, and thus all difficulty on this head completely ceases.’ ”

It has been stated, that all the sails sent to the American lakes in the late contest, had so contracted the mildew in the king's store-houses and on their passage, as to be entirely defective on arrival at their destination; if such was the case, it only shews the imperious necessity of adopting a more perfect system of ventilation, by these or other machines in the interior of ships, store-houses, &c., and which will be not less beneficial in many other situations; as manufactories, hospitals, and workhouses.

SAFETY OF BUILDINGS.

To these remarks on the interior health and comfort of houses, a few observations on their safety may possibly be expected. Indeed, the lamentable and destructive conflagrations with which the present year was opened and continued cannot have escaped the notice of the most superficial observer. These conflagrations depend on two points: *first*, the great combustibility of the materials used, causing their extremely rapid destruction; and, *secondly*, the delay too often experienced in adopting means for extinguishing them. The prevention of the first, depending on the nature of air, has only claim to a place here; nor can I enter farther on the subject than by

reference to those, who have made it a peculiar study; amongst whom we shall find the Right Honourable Lord Viscount Mahon, now Earl Stanhope, Mr. Hartley, &c. His lordship's plans are to be found in the Philosophical Transactions of the Royal Society for 1778, and specimens may be seen at the Society of Arts, &c., Adelphi. The system has been reduced to this axiom, *viz.* that "*A combustible body, in contact with an incombustible, becomes itself incombustible.*" That it is so has been sufficiently proved, though I am not prepared to state whether it is caused by the absorption of heat by the incombustible body, or preventing, by that *contact*, the dissipation of the moisture contained in the combustible; in each, or either case, the effect would be the same. The contact, however, here alluded to, is not the placing of wood aside of iron, or plaster, but such an adhesion or cohesion of parts as to prevent *the intervention of the smallest portion of air*; a circumstance not a little difficult to be accomplished in large buildings. To those, that wish to counteract the effects of settlements and air vents by the using of iron plates, painting and wealting them together will be indispensable.

Building in groins, and using no combustible substances, can alone be depended upon; but, as this cannot generally take place, while the plans

that have been recommended by Earl Stanhope and others can be universally adopted, and that at a trifling expense, though they should not be found at all times to make the building incombustible (and which would often more depend on the skill of the workman than the deficiency of the means), yet, in even arresting the progress of the flames, and giving greater time to save that property, that cannot be replaced by insurance, or, still more, saving the invaluable lives of the community, cannot but be a consideration of the last importance.

J. G.

March, 1815.

POSTSCRIPT.

AFTER the preceding observations were written and sent to the publisher's, the change of affairs on the continent, the apprehended suspension of improvements at home, uniting with other causes, delayed the putting it to press. Since then, two books have been published, valuable in their contents, and not irrelative to these considerations: I have availed myself of an attentive perusal of them. The first was Mr. Accum's Treatise on the Gas Lights. It contains some excellent remarks on the general management of our ordinary fires in open grates, with respect to the wasteful use that is made of both large and small coal; and the still greater loss the poor sustain by it, as well as the inconvenience, and want of comfort the rich feel in a cold room, and a smoky chimney, from the "*wasteful and slovenly*" manner in which the fires are managed. But my attention was more particularly directed to the processes necessary for the obtaining of the gas lights, and to endeavour, if possible, to find a data for calculating the quantity of atmospheric air requisite

to be introduced into a close room, for the combustion of a certain quantity of coal, and of the quantity of heat that would be evolved from it; but definite calculations on these points are not yet accurately ascertained. As far, however, as they are to be deduced from calculation and induction, from the combustion of the carburetted hydrogen, or the gas lights, it will be as follows:—

One measure of carburetted hydrogen gas takes $2\frac{1}{2}$ measures of oxygen gas for its combustion, or destroys nearly 9 measures of the atmospheric air; taking, therefore, the capacity of the hydrogen gas for caloric to be about 8.7754, the oxygen at 4.7490, $2\frac{1}{2}$ measures will be 10.4478

Total capacity of the gases before combustion . 19.2232

Their products are

Carbonic acid gas, one measure, the capacity for caloric will be	}	1.6454
Aqueous vapour about one measure		1.5500
		3.1954
Caloric evolved		16.0278

We find, therefore, that the heat evolved by the combustion of the hydrogen gas will be 16 parts out of the 19, that the gases held in a latent state, prior to the change; hence the great warmth produced by the burning of gas lights, owing to the great consumption of oxygen, the little produce of carbonic acid gas, and the great capacity of the hydrogen for caloric.

I shall endeavour, if possible, to follow up the calculation, by way of theory, as far as it may be applicable to the entire combustion of the coal itself, as observed in our common fires, furnaces, &c.

The coal, upon an average, loses about 1-6th part of its contents for the production of the gas lights; and, being reduced into that state, it takes above twice its quantity of oxygen for combustion. Presuming, therefore, that the quantity of oxygen wanted will increase in a geometrical progression, as the decomposition proceeds, we shall find, that it takes near 40,000 times its bulk of oxygen gas for its entire combustion; nor is this far from the result of my own experiments, in supplying the fires of closed and confined rooms.

The capacity of pit coal for caloric is	}	0.2777
To consume which, it will require 40,000 measures of oxygen gas, at 4.7490		189960.0000
		189960.2777
Total capacity		189960.2777

The products will be,

50,000 measures of carbonic acid gas, at 1.6454	}	82270.0000
1 measure of cinders		0.1923
		82270.1923
Caloric evolved		107690.0654

So that, in the complete combustion of pit

coal, the heat evolved will be more than one-half of the latent caloric contained in the oxygen gas; and the intensity of that heat will be in proportion to the greatest quantity consumed in the least time. I apprehend, this will be approximating nearly to the truth of the principle, as exemplified in our forges, wind furnaces, &c. In the common and ordinary fires of houses, there must be some, and, perhaps, considerable deductions, as a complete combustion seldom takes place. Until, however, that these points can be fully ascertained we shall remain ignorant of the best remedy for smoking chimnies, or the best method of warming rooms. The capacities abovementioned are from the authority of Crawford, except that of carburetted hydrogen, which is relatively presumed. I trust, that some of our practical and experimental chemists will soon favour the public with certain data on these points. A consideration of the above naturally leads to a contemplation of the great produce of carbon in furnaces, and the alterations produced by it in the temper and qualities of steel and iron. Nor does it less account for the wonderful production of animal heat, and the consequences we are to expect in close rooms, or crowded assemblies: hence the necessity of a greater development of the frigorific science, for the absorption of this heat, as

mentioned under the head of compound ventilation.

The other book to which I allude is Mr. Bowden's Treatise on the Dry Rot. When I reflect, that the Survey and Report on that subject, in the preceding pages, was made in the course of twenty-four hours, and that a period of near four years has not produced any thing to alter that opinion, I cannot but be much pleased, in perusing the Treatise of a gentleman, connected with the navy, whose studies, for a great part of that time, has been devoted to the subject, to find, that there is not any other difference between our sentiments on that head, than would naturally arise from a condensed report, and a scientific disquisition; or between a chemical inquiry into the component parts of animals and vegetables, and a superficial, though microscopic examination of them. Those, who wish to be particularly informed of the incipient cause of the rot in timber, will here find an ample elucidation. The only remark I have to make is, that of giving a greater latitude to the powers of *external causes*, and that for the following reasons: if a person dies through the decay of old age, or in youth through a decline or consumption, we consider the death natural, and from an *internal cause*. But, if a person in full habit and strength of body receives a wound, or

fracture, from which mortification and death follows; or is inoculated by touch or incision with pestilential virus, and death ensues, though, in these cases, we cannot but admit of the predisposing internal agency, ever tending to decay, yet the deaths are certainly premature, and that arising from an *external cause*; at least, such have always been my opinions with respect to the different states in which the rot of timber is to be found, and which has been sufficiently proved by the late injudicious adoption of the bonding system in the different warehouses in Liverpool.

It is stated, in the Treatise, that the building ships under the protection of a roof is an old method revived; but when, where, or how it was done I must confess myself still ignorant: nor does the Treatise substantiate the facts. Awnings over the hatchways, or some other particular parts, I have been informed, were occasionally adopted where the vessels have been long on the stocks, or under repair; but "*the necessary precautions for the timber, after it is sawn and framed, in keeping it from the rain, snow, and dews,*" by "*a temporary awning over the whole, until the outside and deck shall be cased in,*" and "*in preventing the mixing of different saps,*" are, I believe, methods that have never been generally adopted, until the present period, in the British Navy.

The opinion of Mr. Snodgrass, Surveyor to the Honourable East India Company, given in 1771 to the Committee of the House of Commons, I never had the pleasure of before seeing, or even hearing of it, nor do I suppose it was ever acted upon. The great coincidence of our opinions, upon that subject, induce me to conclude with the observation that I made at the beginning, that the more extended our knowledge, in practice and theory, the nearer shall we all come to the same definite conclusions; the operations of nature being unchangeable, though many circuitous routes are often taken to ascertain them.

The annexed circular is most respectfully addressed to the consideration of the nobility and gentry of landed property.

August, 1815.

(Circular.)

ON THE DRY ROT.

To, and the Nobility and Gentry
of great Landed Property.

THE dry rot having become now a most important national evil, not only in causing a premature decay in many of the first private and public buildings, palaces, &c., but also rapidly increasing the destruction of that great bulwark of our strength and greatness, the Royal Navy, it becomes the duty of every person, whose scientific knowledge, or opportunities, or possessions, enable him to advance any measures, that shall tend to prevent or remedy so great an evil, to make experiments and promulgate his opinions for the benefit of the public service.

Having had the honour of reporting to the Lords of the Admiralty my humble opinions thereon, and the plans that were suggested being now adopted in all the Royal Dock Yards, as far as the precautions necessary to be taken in the building of ships were requisite; nevertheless, all that art or science can do, in preparing unseasoned and badly grown timber, can never be

equal to those effects, that may be produced by attending to the well growing, planting, training, felling, and barking, previous to it being sent into the Dock Yards. The following observations, united with the practical skill of the gardeners and planters, will, I trust, be found worthy of consideration; and, if attended to on the extensive estates of, and other noblemen and gentlemen of great landed property, will, in the course of time, produce greater effects, in extirpating the dry rot, than any measures that can afterwards be taken; *viz.*

1st. All oaks should be raised, if possible, on the spot they are intended to grow.

2d. The southern and most open parts of the estate will be the best.

3d. They should not be raised in forests, or where they cannot be fully exposed to the weather after they have passed the infant state.

4th. If blasted, or shaken during any gale of wind or storm, or other casual accidents, no longer to be depended upon for building.

5th. They should be allowed to arrive at a full state of maturity, and in a sound condition, before they are felled or barked, and the crooked ones taken equally as much care of as the straight ones for ship building.

6th. They should be felled in the winter, from

or about the first of November to the fifteenth of January; and, when flawed or barked, immersed in water until they can be removed into some shade, out of the influence of the sun, to prevent all vents and starts, and to weaken and dissolve the strength of the sap; or they may be barked standing, in the preceding spring, if this plan is found correct.

Oak timbers, carefully raised and managed on the above principles, will not only be a great national benefit, but form *a considerable increase in the patrimonial estate*: for, if every hedge throughout these kingdoms raised, in the course of fifty years, two good building oaks, I apprehend there would neither be the scarcity nor the decay that now prevails.

The above observations are not theoretical, but founded on the practical experience of those who have stated, that the oaks in the bold shores of the Adriatic, and of the county of Sussex, are the best in the world; while, in those from the forests of America and Germany, the greatest precautions hitherto taken have scarcely prevented them having the dry rot; which may be considered as founded on this principle, that *an open and exposed oak has the accumulated wood dried every year, while that enclosed in a damp forest, or under shelter, retains it's moisture to the last.*

The interest, which every person of landed property would receive by an attention to the above, will, I trust, be a sufficient inducement for the adoption of the plans.

JOSEPH GREGSON.

March, 1815.

T H E E N D.

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