

CHAPTER III.

THE NATURE AND MEASUREMENT OF THE
NUISANCE.

A NUISANCE is anything which annoys, is offensive, or is injurious, and the coal smoke nuisance may be said to be all three.

The nuisance is the result of the incomplete combustion of coal—that is to say, by reason of badly designed apparatus, carelessness in control of air, or improper stoking, the largest possible amount of fuel is not converted into heat, but instead much of it is allowed to pass up and out of the chimney, partly in a gaseous and partly in a solid but finely divided state.

As explained elsewhere, should too high a pressure be used with forced draught, small particles of the fuel will be expelled from the chimney, and the "grit" thus entering the atmosphere becomes a very real nuisance.

The action of soot and gases on buildings and vegetation is also discussed elsewhere.

It will be obvious that such emanations must pollute the atmosphere, and as the latter must be breathed by man, whether he will or no, the matter becomes of vital interest to the individual and the State.

For the purpose of estimating the suspended impurities of the atmosphere, an automatic instrument has been devised by Dr. J. S. Owens, M.D., A.M.I.C.E., Secretary of the Meteorological Office Advisory Committee on Atmospheric Pollution, and by his courtesy it is possible to illustrate and describe it here. It must be understood that this instrument measures only the *solid* impurities.

Automatic Instrument for Measuring Suspended Impurity.—The instrument is designed to measure the

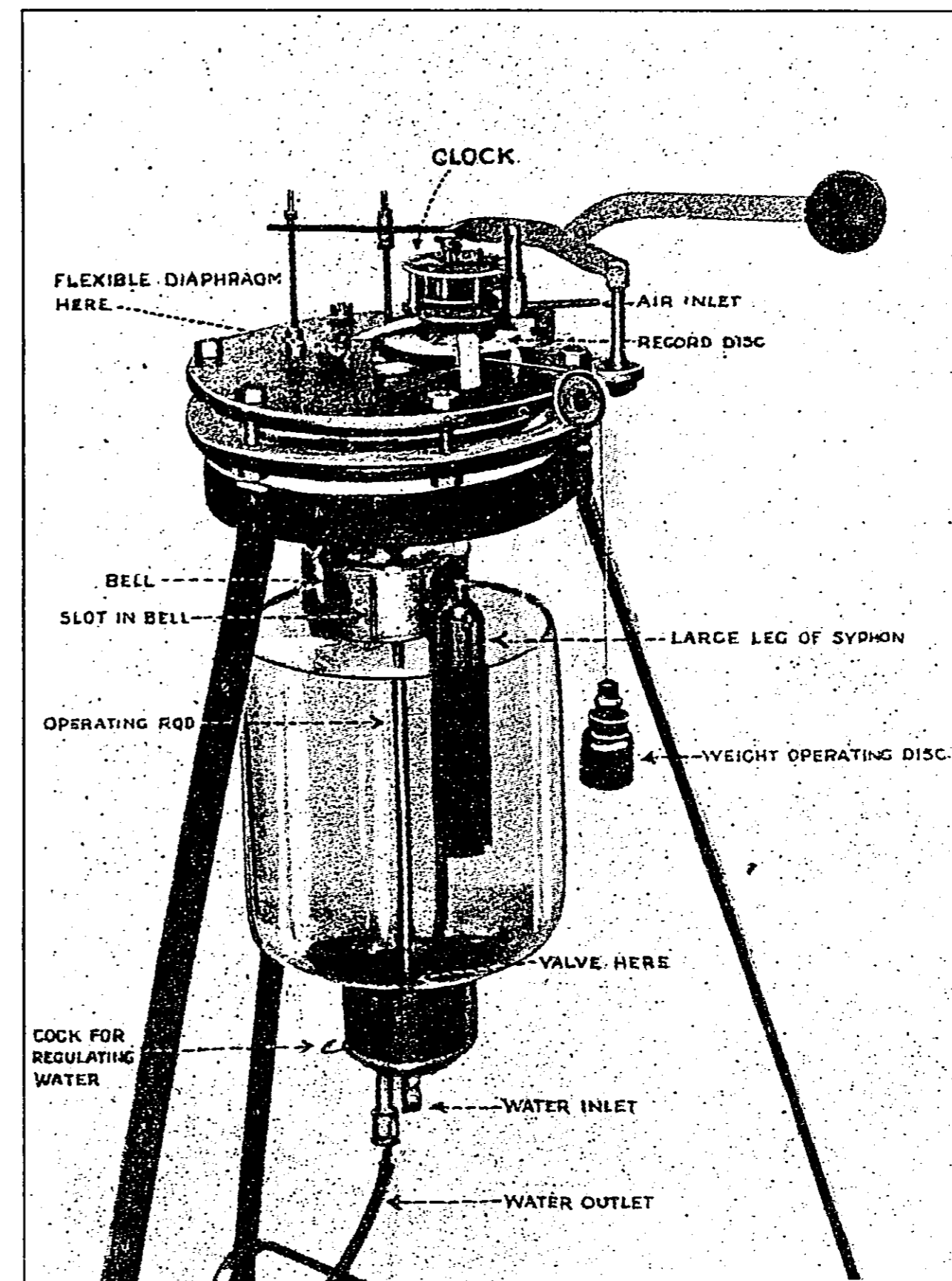


Fig. 1.—For Measuring Air Impurities. A Filter Designed for an Advisory Committee of the Meteorological Office.

density of city fogs by an automatic arrangement which causes two litres of air to be filtered, at regular intervals, through an inch disc of white filter paper. The records

obtained consist of dark spots, $\frac{1}{8}$ th inch diameter, round the edge of a large paper disc, 7 inches in diameter, which latter is divided into 24 hours, similarly to a clock face. The density is read by comparing the records with a calibrated scale of shades from white to nearly black in ten steps, the shades being numbered 1, 2, 3, 4, 6, 8, 10, 12, 15, 20, which numbers represent quantity of impurity (Fig. 2). The value of 1 on this scale being ascertained by calibration to be 0.32 mg. per cm.

Description of Instrument.—The instrument consists of the main vessel, into which water is admitted through an inlet at the bottom. A syphon is fixed inside the vessel, which causes the water to rise and fall between two fixed levels, thus alternately driving air out of the vessel and drawing it in through the air inlet plug.

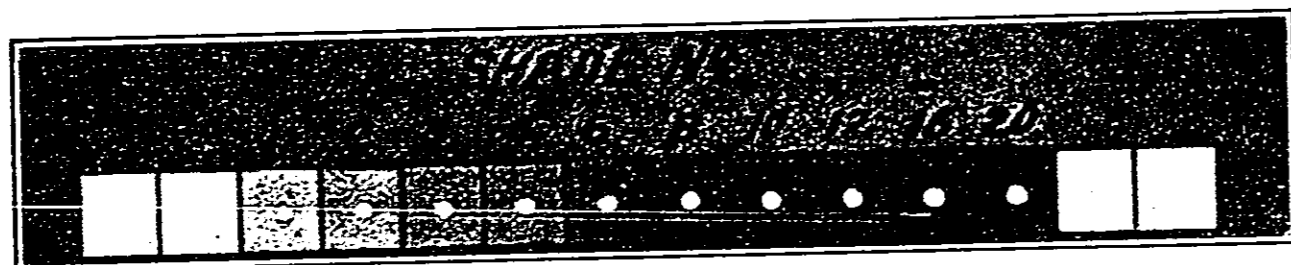


Fig. 2.—With numbers Representing Varying Quantities of Air Impurity, a Scale of Shades used for Reading the Recorder.

This air inlet plug is hollow, and slides up and down in an air inlet sleeve, which has a horizontal slot in which the edge of the filter paper disc is placed. When air is drawn in the air inlet plug is automatically brought down on the filter paper disc, so as to make an air-tight joint, and all air drawn into the main vessel must pass through the filter paper; the impurities are left behind on it, and a small black disc or spot is made. When the syphon has finished working and the water rises again the pressure on the air inlet plug is automatically released, the counterbalance weight lifts it, and the disc is free to move.

The air inlet plug is made to bear on the filter paper in the following way:—Inside the main vessel is a bell

with its mouth downwards; this is mounted on a central rod, which has at its bottom the valve sleeve. When the water is at the higher level the bell is full of water, and when the syphon acts, and the water level falls, it cannot fall inside the bell, because the air cannot enter. The weight of water inside the bell pulls it down, and the central rod with it, closing the water valve, pulling down the control arm, and thus forcing the air inlet plug down on the filter paper. Then, since air can only enter through the filter paper, the pressure in the main vessel falls as the syphon draws the water out, there is then a pressure of air on the top of the flexible diaphragm, which also presses down the central rod. When the level has fallen sufficiently, air can enter the bell and the water falls out, but the diaphragm keeps the plug pressed on to the filter paper.

The water level continues to fall till the syphon breaks, and the air in the main vessel returns to atmospheric pressure, when the counterbalance weight lifts the central rod and the air inlet plug; it also opens the water valve by lifting the water valve sleeve, which admits water, and the level again rises. The air in the main vessel is now free to pass out through the air inlet sleeve. The bell has a small float valve, which lets out the air as the water rises, and allows the bell to fill with water; the float valve, however, will not allow air to enter the bell when the water falls.

After each record has been taken the filter paper disc moves through a small angle, and the next record comes at a different place. In order that the disc may move in this way, it is mounted on a turntable revolving on a central pivot, and operated by a cord passing over a pulley with a weight attached. The turntable is controlled by a clock, which has a boss with an arm on it engaging one of the studs on the turntable; this arm makes one revolution in 24 hours. The weight keeps the stud on the turntable pressing against the arm on the

clock boss, except when a record is being taken, during which the disc is held by the air inlet plug, and the turntable cannot turn, the arm on the clock boss moves on until the air inlet plug is lifted, and the turntable is again free to move, and its stud can follow up the arm. Thus each record is placed automatically on the filter paper disc opposite the time when it was taken.

In this way two litres of air are drawn through the filter paper disc at regular intervals, leaving records of the impurities present in the air.

Instructions for Working.—To put the filter in working order, the nuts on the central rod should be slackened back from the stop bracket, and care should be taken that the nuts at the top end of the central rod do not grip the central arm, but allow it to move freely while transmitting movement to the central rod.

Adjust the balance weight so that the central rod is just lifted by the control arm; when the central rod is in its highest position the water valve sleeve should just uncover the hole in the water valve; this can be tested by blowing through the tube connected to the water inlet cock.

The water inlet cock is connected to a suitable water supply by means of rubber tubing; and a rubber tube is fixed to the water outlet to allow the water to run to waste. By reducing or increasing the water supply, the time between each record may be made greater or less, but care should be taken not to have a greater flow of water than the syphon can carry off, or the filter will not work. If it is seen that the water in the gauge glass falls slowly when the syphon begins to work, then the flow at the water inlet is not too great. The rubber tube fixed to the water outlet should be at least 4 feet long, its end should hang free, and should not be allowed to dip into the water.

When the syphon is first started or when it has not been used for some time, the inside will be quite dry;

this will greatly influence the working of the syphon owing to capillarity; therefore, it should be started the first time by sucking the end of the rubber connection on the water outlet. When once the syphon has become wet it will continue to work regularly.

To Fit the Filter Disc.—The filter disc is fitted by lifting the clock, and by removing the top plate of the turntable, the three holes in the disc fit over the central pivot for the turntable, and over the two studs on the turntable. The edge of the disc must be placed in the slot in the air inlet sleeve. The top plate is replaced, and keeps the disc in position, a piece of cord 12 inches long is threaded through the hole under the turntable, and is passed over the pulley and attached to the weight. Then wind the clock and set it going, see that the disc is quite free to turn. Turn the disc round in a clockwise direction, so as to wind up the cord, and lower the clock on to the turntable, so that the arm on the clock boss engages with one of the studs on the turntable. The disc is set with the correct hour opposite the air inlet plug by turning the knob on top of the clock. The water is then turned on, and the filter may be left for 24 hours, when a new disc must be fitted. When fitting or removing a disc, care must be taken not to touch the edge, or it will be soiled by the fingers or the records will be smudged. The clock must be wound once a week.

Immediately the disc, with the records, has been removed, the date, place and nature of the weather should be entered on the face in pencil.