SANITARY SCIENCE AND PRACTICE.*

(See page 22.)

Abstract treatises innumerable have appeared on the laws of health, and public attention is now becoming aroused to the necessity of fresh air and a pure water supply, with the innocuous removal of the waste matters of a population. Still, practice and theory, somehow or other, have hitherto not been coincident; and those who talk and write freely about sanitary matters have sometimes been, unconsciously perhaps, themselves offenders against the laws of health, in their own houses.

A little work has been brought before our notice which professes to deal, in a common-sense and practical manner, with the sanitary condition of our houses; and, as the company who publish it undertake to carry out practically the reforms they advocate, we will, instead of reviewing the book in the ordinary way, endeavour to extract and condense as much of its contents as is possible in the space at our disposal, making use of some of the woodcuts which illustrate its pages.

A sufficient quantity of pure air is a vital necessity; and those who are shut up all day in offices or workshops are apt to blame the long hours of work for the depression they feel, whereas it may really be the vitiated air breathed which chiefly affects them. It is said that air containing more than one-thousandth part of its bulk of carbonic-acid gas is injurious to health; but in bed or sitting-rooms, where the doors and windows have been kept close for some time, the air often contains two or three times the quantity named of this poisonous gas. If a fire and light are burning at the same time, the oxygen of the air is also consumed very rapidly; it is said that an ordinary gas-burner requires as much air as four or five people, while the products of its combustion are known to be exceedingly deleterious. The air in the chamber should therefore be constantly renewed—not by means of a draught under the door, keeping the feet at an icy temperature—but by a constant, equable and regular supply of sufficient volume, without appreciable current. The method recommended for securing this desideratum is the system of vertical tubes, which we have before described and illustrated.† We will remark, however, that in addition to the system of water trays, on which the fresh air is deflected, for depriving it of impurities, another and cheaper method of filtration has been devised for offices, and wherever the keeping of the trays regularly supplied with water is at all likely to be neglected. A pyramidal frame of tinned iron wire, covered with fine canvas, is inserted in the tube for arresting the particles of carbon, &c., and has been found to answer admirably. The canvas can be taken off and washed, from time to time, as required. Owing, however, to the filtering area obtained by this arrangement being about 500 square inches, it only requires cleaning occasionally; whereas, with a layer of cotton wool or canvas stretched across the tube, the filtering area is limited to the section of the tube, and would very soon be clogged.

As it has been determined that disease in its simple, as well as in some of its more dangerous forms, is introduced into the system by the agency of water, the importance of securing purity in this necessary fluid cannot be too strongly insisted upon. It is also ascertained that water readily absorbs impure gases, and that it also both decomposes and dissolves various substances injurious to health, which are held either in solution or suspension. With proper care, however, these may, in a great measure, be got rid of, or their injurious effect neutralised. In London and other large towns, where the supply is not derived from a pure source, it is impossible for the water companies to remove all the impurities by means of their filtering beds; and when the supply is intermittent, there is the further danger of the water becoming contaminated in cisterns—not cleaned out, perhaps, for years together. It is recommended, therefore, that the house cistern be so placed as to be readily accessible for cleaning and examination; and that a separate tank be provided for the water-closets, perfectly unconnected with the cistern for general household purposes. The interior of the latter, if not lined with zinc, or constructed of galvanized iron, should be lime-washed about once a year. The company have devised a special self-cleansing cistern, shown in vertical section at fig. 1. The waste-pipe (perforated with holes near the top to serve for this purpose) acts also as a plug, and, on this being raised by means of the handle, A, whatever sediment has collected is carried freely away. A self-cleansing and aerating filter, shown both in vertical and horizontal section in the same figure, is also added. As the water enters the tank, being led by means of the pipe, E, to an opening in the annular space, B, it rushes entirely round the surface of the filtering ring, C, which is composed of fine mineral carbon in a compressed state, and so keeps it free from deposit, the accumulation of one day being washed away the next. The pipe, D, serves for aerating the filtering medium, and, by attaching an indiarubber tube to this pipe, and reversing the flow of water, the granular material in the body of the filter may be cleansed when necessary. As this filter is being continually cleansed, and the cylindrical surface affords a large filtering area, the quantity of water which can be passed through it is considerable.

If some such arrangement as the above be not adopted for the general household supply, at any rate the water used for drinking should be filtered; and the selection of a filter is an important matter. Eminent authorities have stated that the old-fashioned appliances for this purpose, provided with vegetable charcoal, sand and sponge, are not only useless for the proper purification of water, but worse than useless. Vegetable charcoal possesses very limited purifying qualities; and sand and sponge only act as strainers to arrest the grosser particles. Animal charcoal is now being largely used as a filtering medium; but although this substance, when fresh, exerts great power in arresting and absorbing impurities of all kinds, it has been authoritatively determined to become a source of danger when remaining in use for too long a period, owing to the property, which it is said to possess in a high degree, of favouring the growth of low forms of organic life. What was required to ensure perfect filtration was a substance possessing powerful oxidising and purifying properties without these drawbacks, and this has been found in a mineral carbon of peculiar nature, and prepared in a special manner. The oxygenation of the water, or of the filtering medium through which the water passes, is another point which must not be neglected. Filters should be so arranged that, as water is drawn off, air is drawn in through the filtering substance; in fact, the filter should *breathe*, and thus continually renew its chemically purifying properties. The company have had a filter specially constructed on this principle, and so arranged that the whole of the filtering medium may be cleaned or replaced. This is shown in vertical section at fig. 2, and consists of an earthenware receptacle, a movable pan having a cake of mineral carbon for preliminary filtration, and a perforated plate below, on which rests a deep layer of granular mineral carbon for the second filtration. When water is drawn, it runs more rapidly out of the tap than through the carbon block, consequently, air and water are together drawn through the filtering medium, and this aeration and revivification are constantly going on. All other filters of this class have an air-tube at the side; but in this case the air is made to pass through the filtering substance itself, in the direction shown by the arrows. The object of making the perforated plate of the form shown is to afford a portion of the area in which the column of water shall exert a less pressure than on the rest, and thus give way to the air displaced by the water as it descends into the lower receptacle.

Although the heating of rooms by hot-water pipes and stoves may be a convenient and advantageous arrangement under certain conditions and in special cases, the open fireplace, besides being preferred in this country on account of its cheerful appearance, has the great advantage of assisting ventilation by effecting or encouraging the rapid changing of air in a room. The company advocate the principle adopted in what are termed slow-combustion stoves, and to which we referred in a recent article, viz., the use of firebrick for the sides, back and bottom of the grate; but the latter is, in their case, provided with perforations capable of being closed by a damper. This grate is shown in elevation and vertical section at fig. 3, in which will be seen the mechanism for closing and opening the damper. The register may also be regulated from the outside, as shown. The combustion is not so irregular as in iron grates, because, with so large a body of heated firebrick the fuel is kept in a constant glow; and when fresh coal is put on, the heated bricks at once assist combustion. Not only is the amount of heat thrown out while the fire is burning very great, but heat is also radiated from the hot bricks for a long time after the fire is extinguished. A saving of about 30 per cent. of fuel has been ascertained to have been effected, owing to the more perfect combustion. The object of making the bottom with interstices capable of being closed, is that the draught may be adjusted to suit the description of coal burnt; and, besides, a draught at the bottom greatly assists the lighting of the fire. Another improvement consists in inclining inwards the front bars, which are flat in section, thus allowing more of the fire to be seen, and preventing the fall of coal or cinders on the hearth.

The constant variation in the pressure of gas acts prejudi-

* "Health and Healthy Homes." London: Published by the Sanitary Engineering and Ventilation Company, 115 Victoria Street, Westminster.

† See *Iron*, of 19th August, 1876, vol. viii., p. 229.