example of which by Frew of Perth is shown in fig. 15. The basin is kept partly full of water by a ground gun-metal valve tightly pressed up

against a conical seat at the basin’s foot.

The chamber below is only large enough to allow the valve to turn down ; it cannot collect much foul mat­ter and may be venti­lated by a separate pipe. A trapped over­flow prevents the basin from being overfilled.

The whole closet is trapped by an ordinary bend on the soil-pipe, which is not shown in the figure. The volume of water in the basin is much greater than in pan closets, where the height is limited by the overflow which occurs round the lip of the pan. In some closets of this kind the valve is placed at the side, and, when closed, lies nearly vertical. In another type of valve closet (Jennings’s) the valve is a conical plug, pressed vertically down on a seat at the side.

Valve closets can be made fairly effective and satisfactory from a sanitary point of view ; but a much cheaper and certainly not less excellent type of closet is the “washout,” an example of which (the “National”) is shown in fig. 16. (Another wash­out closet, by Doulton, appears in fig. 6.) These are now made in a great variety of good forms, sometimes of a single piece of white stoneware. They combine cheapness and simplicity with a degree of sanitary perfection that is probably not reached by the most expensive closets of the kinds already named. They have no working parts ; the closet is cleansed after use simply by the flush of water, which sweeps everything before it. The flush must of course be good : a l 1/2-inch service pipe from a cistern not less than 5 feet above the closet will do well. In some recent designs the cistern is a box at the back of the seat with a wide

oval mouth leading from it to the flushing rim of the pan : this gives a good flush although the cistern is low. A feature of con­struction which may be strongly recommended is to leave the closet entirely open for inspection and cleaning, instead of con­cealing it in a wooden case. The seat then generally rests on iron brackets projecting from the wall, and can be raised on hinges at the back, so that the pan may be used as a urinal or slop-sink without the risk of fouling. Another good type of closet, sharing with the washout the advantage of having no mechanical parts, is the “hopper,” illustrated in fig. 17 (Dodd’s Hopper). In all these closets the horn marked V is for attaching a ventilating pipe.

For the supply of water to a closet a separate cistern is desirable, especially when water for dietetic purposes is liable to be drawn from the main cistern (instead of being taken direct from the water service pipe, which is better). It would seem needless to add, were it not that such faults are

common, that no cistern—unless it be exclusively used for water- closet supply—should be placed in the same room with or just under a water-closet, and that the room itself should be well lighted, well ventilated, and well shut off from bedrooms. To prevent flushing of closets from being imperfect through carelessness, many plans have been devised for ensuring that once the flow of water is started it will continue until a given volume has been discharged. One of the best of these is the arrangement of siphon flush sketched in fig. 18 : when the valve *a* is opened the downrush of water starts the siphon *b* into action, and even should *a* be then closed the flow continues until the water-level falls to c, when air is admitted

and the siphon ceases to act. The air-pipe c is cut to give the desired volume.

As regards house-drainage generally, the points of chief importance may be briefly summed up as follows :—(1) the use of one or more disconnecting traps to shut off sewer gas from the whole system of house-drains and pipes; (2) the thorough ventilation of house-drains, soil-pipes, and branches, by providing openings through which air can enter at the foot and escape at the top ; (3) the dis­charge of all sinks, basins, &c., other than water-closet fittings, and especially of fixed bedroom basins, into open traps in the open air ; (4) the direct discharge of cistern overflows and safe-trays into the open air ; (5) the use of cleanly and well-designed closets, basins, &c., each sealed by an ordinary bent trap ; (6) the use of separate service cisterns for water-closets.

It may seem superfluous to add that the system of pipes must provide a rapid and effective carriage of all sewage to the sewer, and must be water-tight and air­tight. During the last five years, however, it has been proved, by examination of the best houses in London, that it is no uncommon case for a house to be so completely without effective connexion with the sewer that all its own sewage sinks into the soil under the basement; and about 75 per cent. of the houses inspected have failed to pass the “ smoke test.”

In this connexion mention should be made of the system of co-operative house-inspection originated by the late Prof. Fleeming Jenkin. The Edinburgh Sanitary Protection Association was founded by him in 1878 to carry out the idea that the sanitary fittings of a house should be periodically submitted to examination by an expert, and that householders should combine to secure for this purpose the continuous service of an engineer able to detect flaws, to advise improvements, and to superintend alterations. The Edinburgh association soon justified its existence by discovering, in the houses of its members, a state of things even worse than students of sanitary science had imagined possible. Similar associa­tions are now doing excellent work in London, Glasgow, and many other large towns.

Space admits of only a very brief mention of those systems of sewerage in which excreta are not removed by the aid of water. The dry-earth system, introduced by the Rev. H. Moule, takes advan­tage of the oxidizing effect which a porous substance such as dry earth exerts by bringing any sewage with which it is mixed into intimate contact with the air contained in its pores. A discharge of urine and fæces is quickly and completely deodorized and absorbed when covered with a small quantity of dry earth ; and the same soil, if exposed to the air and allowed to dry, may be used over and over again for the same purpose. Even after soil has been several times used, however, its value as manure is not so great as to pay for its transport to any considerable distance ; and for this reason, as well as from the fact that it leaves other constituents of sewage to be dealt with by other means, the system is of rather limited application. So far as it goes it is excellent, and where there is no general system of water-carriage sewerage, or where the water- supply is small or uncertain, an earth-closet will, in careful hands, give perfect satisfaction. Numerous forms of earth-closet are sold in which a suitable quantity of earth is automatically thrown into the pan at each time of use. Arrangements of this kind are, however, not necessary to the success of the system ; a box filled with dry

earth and a hand scoop will answer the purpose not less effectively. Ashes are sometimes substituted for or mixed with the dry earth, and powdered charcoal is also used.

The most primitive method of dealing systematically with excreta is to collect the discharges directly in a vessel which is either itself carried to the country, and its contents applied to the land, or is emptied into a more portable vessel for that purpose. In Japan, for example, in spite of the difficulty of transport over bad roads and by human labour, the latter plan is universally followed : the land and the people have in fact performed for centuries what may be called a complete cycle of operations. The agricultural return is so good that farmers pay for leave to remove excrement, and householders look to their discharges as a source of income. The plan, although carried out in the roughest manner, appears to involve fewer sanitary drawbacks than might be expected ; but