the seal of the trap. The long hopper pan is a most objectionable type of closet which should be rigorously avoidedas it easily becomes foul and is most insanitary. In most districts its use is prohibited.

A water-waste preventer is a small tank fixed usually 4 or 5 ft. above a closet or urinal and connected therewith by a flushing pipe of 1¼ in. or greater internal diameter. This tank usually contains a siphon, and the flush is actuated by pulling a chain which admits water to the siphon; the contents are then discharged with some force down the flushing pipe into the pan of the closet, clearing out its contents and replacing the fouled water with clean. The flushing tank is automatically refilled with water by a valve fitted with a copper ball which rising on the surface of the incoming water shuts off the flow when the tank is full. Fig. 20 is a sectional drawing of one of the latest patterns and clearly shows its construction. The water-supply is shown near the top with the regulating ball valve attached. An overflow is provided and a pipe is led from this to an external outlet. The capacity of the ordinary domestic flushing cistern is two gallons, which is the maximum quantity allowed by most water companies. A three gallon flush is much better, however, and where this larger quantity is allowed should be adopted. Larger tanks for ranges of closets or urinals are often made to flush automatically when full, and for these the rate of water supply may be

fast or very slow as desired, for the siphons are so constructed that even a drop-by-drop supply will start a full flush.

The by-laws of the London County Council contain very full regulations respecting the construction and fitting up of water- closets. These may be summarized as follows:—A water- closet or urinal must be furnished with an adequate flushing cistern distinct from any cistern used for drinking water. The service pipe shall lead to the flushing cistern and not to any other part of the closet. The pipe connecting the cistern with the pan shall have a diameter of not less than 1¼ in. in any part. The apparatus for the application of water to the ap­paratus must provide for the effectual flushing and cleansing of the pan, and the prompt and effectual removal therefrom, and from the trap connected therewith of all solid and liquid filth. The pan or basin shall be of non-absorbent material, of such shape, capacity and construction as to contain a sufficient quantity of water and to allow all filth to fall free of the sides directly into the water. No "con­tainer” or similar fitting shall be fixed under the pan. There shall be fixed immediately beneath or in connexion with the pan an efficient siphon trap constructed to maintain a sufficient water seal between the pan and the drain or soil pipe. No D trap or other similar trap is to be connected with the apparatus. If more than •one water-closet is connected with a soil-pipe the trap of each closet shall be ventilated into the open air at a point as high as the top of the soil-pipe, or into a soil-pipe above the highest closet. This ventilating (or anti-shiphonage) pipe shall be not less than 2 in. in diameter, and connected at a point not less than 3 and not more than

12 in. from the highest part of the trap (fig. 12).

Baths may be made of many different materials; copper, cast- iron, zinc and porcelain are those most generally employed. Metal baths have the great advantage of becoming hot with the water, while baths of porcelain, stoneware and marble, which are bad conductors of heat, impart to the user a sense of chilli­ness even though the water in the bath be hot. Copper baths are best; they may be finished on the inside by tinning, enamelling or nickel plating. Iron baths, usually tapering in shape, are very popular and are usually finished in enamel, but sometimes tinned. Fig. 21 illustrates a good type of cast-iron bath with standing waste. A good feature of this bath lies in the fact that all parts are accessible and easily cleaned. Porcelain baths are cumbersome and take a long time to heat, but they are often used for public baths. The practice of enclosing the bath with a wood casing is fast dying out; it is insanitary in that it harbours dust and vermin. Baths are now usually elevated upon short legs, so that every part of them and of

the adjacent floor and wall is accessible for cleaning.

Fig. 22 is a section of a good type of scullery sink, and shows the waste and trap with brass clearing cap. The fitting is supported

upon galvanized iron cantilever brackets which are built into the wall.

Like closets, urinals have undergone much improvement in design and manufacture. The best types are of glazed ware, and have vertical curved backs and sides about 4 ft. high with a flushing rim round the top and terminating in a base discharging into an open glazed channel waste, which, in the case of a range of urinals, collects the discharge from all and conveys it into

a trapped gulley at one end of the range. This is the type usually fixed in street conveniences and similar positions. Plate and iron urinals are often fixed, but there is more difficulty in keeping them clean on account of the sharp angle and the unsuitability of the material. Urinals are seldom fixed in private houses or offices, an ordinary washdown pedestal closet with hinged “ tip-up” seat serving every purpose. Such seats are often fitted with balance weights to cause them to lift automatically when not in use as a closet. Unless kept very clean and well flushed with water, urinals are liable to become a nuisance.

In London among other towns the system of drainage is a “ combined” one, that is, the storm water and the domestic sewage and waste is all collected in one sewer. For many reasons it is more satisfactory to have the two drains quite separate. In many districts this is done, but it entails the provision of a double system of drainage for each house, one drain being provided for rain-water, the other for sewage. Where combined

drainage is installed an ex­

cess of water poured into

the sewers during a storm

often results in back flow

and the flooding of basements and cellars with

sewage. Such an occurrence might take place

where there is a separate

sewer for the storm water,

but in this case the flooding

would be with compara­

tively harmless rain-water

instead of sewage and filth.

Figs. 23 and 24 show two

ground plans of the same

house, a semi-detached suburban residence, one with combined drainage and the other with separate drains for storm water and sewage. In both figures the rain-water drains are shown in a dotted line, and other drains in a full line.

In fig. 23, A is a 4 in. cast-iron rain-water down-pipe. B is a 4 in. ventilating-pipe taken up to a point above the building. C is a trapped gulley such as is shown in fig. 13. D is a gulley with channel head (fig. 14) into which are taken the discharges from the scullery sink on the ground floor, and from the bath and lavatory on the first floor. E is an untrapped manhole, with open channel bends and sealed cast-iron cover, from which any branch of the drains can easily be cleared by the use of drain-rods. F is a soil-pipe from a water-closet on the first floor, and is carried up above the roof to serve as a ventilator. G is a trapped gulley as fig. 13, taking the discharge from the rain-water pipe over it and serving also to drain the yard; H and J are similar gulleys. K is a manhole with trap for intercepting the foul gases from the sewer and preventing them from entering the house drains. The manhole is fitted with a seated cast-iron cover and has an inlet at L with mica flap valve to admit fresh air to the drains; in construction it is similar to the one shown in fig. 9, but has only two branches entering it instead of five, in fig. 24, A is a rain-water pipe discharging to the gulley B, which is untrapped to allow of the ventilation of the branch C-B. C is a length of piping brought up to the surface of the ground and finished with a cap, which is removed when it is found necessary to clear away any obstruction. A special shaped junction here allows the rods to be pushed up either branch as required. D and E are trapped gulleys as already described. F is an untrapped gulley serving to ventilate the drain. G, H and J the same as for fig. 23. K is a pair of man- holes built side by side, one for storm water and the other for sewage. Both are fitted with intercepting traps, and the sewage chamber is ventilated by an air inlet at L as in fig. 23.. The cover of the storm water manhole need not be sealed, and if necessary could be fitted with a grating and be used to drain the forecourt.