to serve as ventilating continuations of soil-pipes and waste-pipes. The practice is open to serious objection, for it discharges the drain air just under the eaves, at a place where air is generally being drawn into the house. The ventilating end of a soil-pipe should be carried to a higher level, as in fig. 6, clear of the lower edge of the roof. It is better to restrict rain-pipes to their legitimate function of taking surface water from the roof, or at most to allow them to receive slop-water from sinks and basins, and to make them terminate in or over open traps from which a connexion is taken to the house-drain or sewer (fig. 9).

In figs. 10 and 11 the sanitary fittings of a small house are shown by diagrams, which should be carefully studied as exemplifying a well-arranged system. Two closets, and a bath and basin in the closet apart­ment, discharge into a soil-pipe on the right, and the branches (except that of the basin) are venti­lated by pipes leading to a sepa­

rate air pipe, which, like the soil-pipe, is carried above the roof. The overflow of a cistern which supplies bath, basin, and boiler is carried out to the open air, and so are the waste-pipes of the leaden safe-trays. A sepa­rate cistern supplies each water- closet, and its overflow opens into the closet basin. A rain- pipe (in the middle of the figure)

receives a bedroom basin waste, and leads by a 4-inch drain to a venti­lated grease-box, into which the scullery sink

and wash- tubs and an­other rain-pipe also discharge.

Finally, the whole system is protected by

a Buchan trap in a built manhole, which is covered with a grating.

House-drains, that is to say, those parts of the domestic system of drainage which extend from the soil-pipes and waste-pipes to the sewer, are made of glazed fireclay pipes, generally 6 inches but sometimes only *4* inches in diameter. A larger size than 6 inches is rarely if ever desirable. The pipes are spigot-and-faucet- jointed, and the joints should be made with cement in the manner already described for sewers. When, as is often unavoidable, the house-drain has to pass under a part of the house, or to come from back to front, iron pipes jointed with lead and coated with an anti-corrosive compound are preferred to fireclay pipes, as giving a better security against the production of leaks by the settling of the soil and other causes. Soil-pipes, when carried down inside the house, are of either lead or iron ; when outside the house they are usually of iron. Au outside soil-pipe is obviously preferable to an inside one ; if the arrangement of the building makes an inside soil-pipe necessary, care must be taken that it shall be easily accessible for inspection at all parts of its length. The usual diameter is 4 inches. For the sake of good ventilation it is desirable to continue the soil-pipe to a point above the roof without reduction of diameter rather than apply a smaller ventilating pipe. Amongst reasons for ventilation one remains to be mentioned,— that, owing to the corrosive action of sewer gas, the life of the soil- pipe is greatly shortened if provision for the free circulation of air be wanting or insufficient. A closed soil-pipe becomes in time pitted with holes, especially in the upper parts of its length.

Defective joints in soil-pipes and waste-pipes, particularly where they connect with drains, closet-basins, sinks, &c., are another frequent cause of leakage. Any want of air-tightness in drains or soil-pipes within a dwelling leads to the pollution of the air, not

merely by diffusion, but by an actual in-draught, for generally the air of the house has its pressure reduced by chimney draughts to a value slightly lower than that of the air outside. The house, in fact, ventilates itself by drawing in air from the pipe at any hole, a fact which may easily be demonstrated by holding the flame of a taper near the hole.

Various experimental methods are used of detecting such leaks as would admit foul air to the dwelling. Of these the best is the “smoke test.” It consists of filling the house-drain, soil-pipes, and waste-pipes with a dense and pungent smoke, any escape of which into the house is readily observed by eye and nose. A quantity of cotton-waste soaked in oil is lighted, and its fumes are blown into the house-drain by a revolving fan, at the ventilat­ing cover of the disconnecting trap, or at any other convenient opening. Smoke soon fills the pipes, and begins to escape at the roof. The upper ends of the pipes are then closed, and the house is searched for smoke. @@1 Another test, especially applicable to those parts of drains that are laid under houses, is the hydraulic test, which consists in stopping up the lower end of the pipe, filling it with water so as to produce a moderate pressure, and then observing whether the level of the water falls. This test, however, is too severe for any but new and very well constructed drains.

Every basin, sink, or other fitting should bo separately trapped by a bend on the waste- pipe or some other form of trap. A brass cap, screwed on a ferule which is let into the pipe on the bend, facilitates cleaning (fig. 5). The warm waste- water from pantry and scullery sinks contains much grease, and should be discharged into a grease box (fig. 12) where the water becomes cool and deposits its grease before overflowing into the drain. To collect surface water from laundry floors, areas, court-yards, &c., an open trap or gully is used. Fig. 9 shows a simple and good form of open trap; but if the water is liable to carry down sand or earth a gully (fig. 13) is more suit­able. Even in this simple fitting a remarkable ingenuity of error has been displayed.

Many of the forms favoured by builders are bad either because of an insecure seal, a narrow outlet, or a tendency to gather filth. One in particular, the well-known “ Bell ” trap, is an example of nearly everything a trap should not be.

Water-closets used to be almost invariably of the “ pan ” type, but

wherever sanitary reform has been

preached to any purpose the pan closet is giving place to cleaner and wholesomer patterns. The evils of the pan closet will be evi­dent from an inspection of fig.

14. At each use of the closet the hinged pan *a* is tilted down so that it discharges its contents into the container *b.* The sides of the container are inaccessible for cleaning, and their upper portions are out of reach of the flushing action of the pan. They gradually become coated with a foul deposit. A gust of tainted air escapes at every use of the closet ; and it rarely happens that the container is air-tight, and that the filth it has gathered does not cause a smell even in intervals of disuse. To make matters worse, many of the older pan closets are provided with the kind of trap shown in

the sketch, called the D trap, which is

also liable to become a gathering place for filth. Even with an ordinary trap, however, the pan closet remains so bad that its use is to be strongly condemned.

A much better closet is the valve or Bramah closet, an excellent

@@@1 A novel plan of making the smoke test has lately been introduced, in which smoke is given off by a “smoke rocket” or cake of slowly combustible compound which is lighted and placed in the drain.