those parts of the domestic system of drainage which extend from the soil-pipes and waste-pipes to the sewer, are generally made of glazed stoneware pipes having a diameter of 4 in., 6 in., or sometimes 9 or 12 in., according to the estimated amount of waste to be removed. In ordinary domestic dwellings there is rarely any occasion to use pipes of a greater diameter than 6 in., and this only for the main drain, the branches and single lines of piping being 4 in. in dia- meter. It is a good rule to make the pipes and other fittings, such as channels and bends, as small in diameter as possible, having due regard to efficient capacity. Such a drain is more cleanly than one too large for its purpose, in that it is more thoroughly flushed when in use, the sewage running at a much faster speed through a full pipe than through one only partially full. For this reason a pipe having too great a capacity for the work it has to do is liable to become corroded by sediment deposited from slowly

moving waste.

The pipes are made in 2 ft.

lengths and are formed with a socket at one end into which the straight end of the next pipe fits loosely. This is wedged in position with a little gasket and the remaining space then carefully filled with neat Portland cement (fig. 1). Pipes are made also with a bituminous substance in the socket and around the spigot end, and by merely pushing the one into the other the joint is made. The bitumen is curved to allow self-adjustment to any slight settlement, so that damage to the joint is avoided (fig. 2). A composite joint may be used having the bitumen lining reinforced with the ordinary Portland cement filling (fig. 3). This type is some­what more expensive than the ordinary jointing, but it makes a powerful and effective connexion. The method of connecting two lead pipes by a wiped solder joint ” is shown in fig. 4. Fig. 5 shows the method of connecting a lead pipe into the socket of a stoneware one, a brass sleeve piece or ferrule being used to give the necessary stiffness to the end of the lead pipe. This arrangement is frequently used, for example, at the base of a soil-pipe at its junction with the drain. In the next figure (fig. 6) the lead pipe has a brass socket attached to it to take the plain end of a stoneware pipe. This form of connexion is used between a water-closet and a lead trap. The joint shown in figs. 5 and 6 is similarly made when an iron pipe is substituted for a stoneware one, but instead of the Portland cement filling, molten lead is used and carefully caulked to form a water-

tight joint.

In the water-carriage system of drainage each house has its own network of drain-pipes laid under the ground, into which are taken the waste-pipes which lead from the closets, urinals, sinks, lavatory basins, and rain-water and other gulleys within and about the house. The many branches are gathered into one or more manholes, and connexion is finally made by means of a single pipe with the common public sewer. Gas from the sewer is prevented from entering the house drains by a disconnecting trap fixed in the manhole nearest the entrance to the sewer. The fundamental maxims of house sanitation are first, that there shall be complete disconnexion between the pipes within and without the house, and second, that the drainage shall be so constructed as to allow for the free admission of air in order to secure the thorough ventilation of all parts of the system

and avoid the possibility of the accumulation of gas in any of the waste- or drain-pipes. The drains must be planned to conduct the waste material from the premises as quickly as possible without leakage or deposit by the way. The pipes should be laid in straight lines from point to point to true gradients of between 2 to 4 in. in 10 ft. Junctions with branch pipes and any bends necessary should be gathered, as far as practicable, in inspection chambers

fitted with open channels

instead of closed pipes.

This allows of easy in­spection and testing, and

provides means of access

for the drain-rods in

cases of blockage. Some-

times it is desired, for

reasons of economy or otherwise, to avoid the use of a manhole at a change of direction in the drain. A branch pipe which may have a specially shaped junction for cleaning the pipes in both directions is taken up with a slope to the ground or floor level and there finished with an air-tight cover which may be removed to allow the introduction of drain-rods should the pipes become blocked. Junctions of one pipe with another should be made

obliquely in the direction

of the floor. Stoneware

pipes should be laid upon

a bed of concrete not less

than 6 in. thick and

benched up at the sides

with concrete to prevent

any movement. When such

pipes pass under a building they should be entirely surrounded by a concrete casing at least 6 in. in thickness. No drain should lie under a building if it is possible to avoid it, for injury is very liable to occur through some slight settlement of the build- ing, and in a position such that the smells escaping from the damaged pipe would rise up through the floor into the building this would be an especially serious matter. The expense and annoyance of having the

ground opened up for the

repair of defects in the pipes

beneath is another strong

argument against drains

being placed under a house.

Where this is really neces­

sary, however, pipes of cast-

iron are recommended

instead of the ordinary stoneware pipes, as being stronger; being made in lengths of 6 and 9 ft., they have a great advantage over the 2 ft. long stoneware tubes, for the joints of the latter are frequently a source of weakness. The joints, fewer in number, are made with molten lead (fig. 7), or flanged pipes are used and the joints packed with rubber and bolted (fig. 8).

The principle of disconnexion adopted between the indoor and outdoor pipes should

be retained between the

latter and the sewer, and

the domestic system should

be cut off from the public

drain by means of a dis-

connecting trap. This appliance

is usually placed in a

small chamber or manhole,

easy of access for inspection, built close to the boundary of the premises, and as near as possible to the sewer into which the house drain discharges.

Fig. 9 shows a section and plan of such a manhole built in accord­ance with the London drainage by-laws. There are five inlets from branch drains discharging by specially-shaped glazed channels into the main channel in the centre. It will be seen that in case of blockage it would be a simple matter to clear any of the pipes with