the drain-rods. The cap to the clearing arm has a chain attached by which it can be removed in case of flooding. The channels are benched up at the sides with cement, and the manhole is rendered on the inside with a cement lining. A fresh air inlet is taken out near the top of the chamber and is fitted with a mica flap inlet valve. The cover is of cast-iron in a cast-iron frame shaped with grooves to afford a double seal, the grooves being filled with a composition of tallow and fine sand. Where there is a danger of a backflow from the sewer due to its becoming flooded, a hinged flap should be placed at the junction of drain and sewer to prevent sewage from entering the house drain. A ball trap designed for this purpose may be used in place of a flap, and is more satisfactory, for the latter is liable to become corroded and work stiffly. In the ball-trap appliance the flowing back of the sewage forces a copper ball to fit tightly against the drain outlet, the ball dropping out of the way of the flow directly the pressure is relaxed.

The water-carriage system of drainage is undoubtedly the most nearly perfect yet devised. At the same time it is a very costly system to install with its network of sewers, pumping stations, and arrangements for depositing the sewage either in the sea or river, or upon the land or “ sewage farm.” In country districts and small towns and villages, however, excreta are often collected in small vessels

and removed in tank carts and deposited upon the land. The dry-earth system introduced by the Rev. Henry Moule (1801- 1880), and patented in 1860, 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. The system is of rather limited application from the fact that it leaves other constituents of sewage to be dealt with by other means. But so far as it goes it is excellent, and where there is no general system of water- carriage sewerage 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 (fig. 10), but a box filled with dry earth and a hand scoop will answer the purpose nearly as well. A plan much used in towns on the continent of Europe

is to collect excrement in air-tight vaults which are emptied at intervals into a tank cart by a suction pump. Another pneumatic system adopted on the continent has the cesspools at individual houses per­manently connected with

a central reservoir by

pipes through which the

contents of the former

are sucked by exhausting

air from the reservoir at

the central station.

Newly laid drains should be carefully tested before the trenches are

filled into detect

any defects in the pipes or joints. These should be made good and the test again applied until the whole system is in perfect order. Cement joints should be allowed to set for at least forty- eight hours before the test is made. There are several methods of testing. For the stone- ware drains laid under the ground the *water test* is generally adopted. After the lower end of the length of drain to be tested has been securely stopped (fig. 11) the drain is filled with water from its upper end until the desired pressure is obtained. To obtain the required head of water extra lengths of pipe are sometimes taken up tempor­arily at the upper end of the drain or, as an alternative, both ends of the pipe may be plugged and water introduced under pressure by a force pump through a small aperture provided in the plug. The exact pressure may then be ascertained by a water pressure gauge. An escape of water through some defective portion of the drain is indicated by the subsidence of the level of the water in the upper part of the drain or by a diminution of the pressure shown by the gauge. Then the defect must be located and remedied and the drain re-tested until all weak points are eliminated. This process must be repeated in each section of the drainage system until the whole is found to be sound and tight. It is not necessary to test drains laid with ordinary socket joints made in cement with a greater pressure than is obtained with a 5 ft. or 6 ft. head of water. A foot head of water gives at its base a pressure of ∙433 lb per square inch, so that a head of 6 ft. would result in a pres­sure of just over 2½ lb per square inch. Cast-iron drain-pipes with caulked lead joints will withstand a pressure of nearly 90 lb per square inch of internal surface, but in actual practice it is sufficient if they are tested with a pressure of 10 lb or say a head of 20 to 24 ft.

The *atmospheric* or *air* *test* is sometimes applied instead of the water test. The drain is plugged, as in the latter, and air is then pumped into the pipes until the desired pressure is registered by the gauge attached to the apparatus. This pressure should be maintained without appreciable diminution for a stipulated period before the drains are passed as sound.

The *smoke test* is generally used for testing vertical shafts such as soil-pipes and ventilators to which the water test cannot be con­veniently applied owing to the excessive pressure produced at the lower portion of the pipe by the head of water. It is applied by stopping the ends of the pipes and introducing smoke by a drain rocket or by a smoke-producing machine which forces volumes of thick smoke through an aperture in the stopper. The pipes and joints are then carefully inspected for any evidence of leakage.

The *scent test* is occasionally employed for testing soil and ventilating pipes, but the apparatus must be carefully handled to avoid the material being spilt in the building and thus misleading the operator. The test is made by introducing into the drain some substance possessing a powerful odour such as oil of peppermint, calcium carbide or other suitable material, and tracing any defect by means of the escaping odour. This is not so effective a method as the smoke test, as there is more difficulty in locating leakages. Gulleys, traps and other similar fittings should be tested by pouring in water and ob­serving whether siphonage or unsealing occurs. This of course will not happen if the appliances are of good design and properly ventilated. A section of a drain plug or stopper is shown in fig. 11. It has a band of india-rubber which expands when the screw is turned and presses tightly against the inside of the drain-pipe. In the centre of the plug is a capped aperture which allows for smoke