is allowed to settle. The process gives a remarkably clear effluent ; practically the whole of the insoluble constituents of the sewage and a portion of the dissolved impurities are carried down in the precipitate, which, when dried and ground along with some sulphate of magnesia, is sold under the name of native guano. The ABC process has been in successful use for nine years at Aylesbury, where the “guano” finds a sale at 70s. per ton. In 1870 the Rivers Pollution Commissioners reported unfavourably on the pro­cess, a fact which may have prevented its adoption by other towns, but it has since then received the approval of many specialists. A recent protracted investigation by Dr C. M. Tidy and Prof. Dewar showed that the percentage of oxidizable organic matter removed by the process ranges from 75 to 86—a result, in their judgment, satisfactory. At Leeds, where the process was tried for a time, it was given up because the effluent was purer than the river into which it ran, and the simple lime-process, which costs less but gives a less clear effluent, was adopted in its place.

Much difference of opinion still exists as to the relative merits of broad irrigation, filtration through land, and chemical treat­ment, as means of disposing of sewage. That either of the two first plans or a combination of them both can be made to yield a satisfactory solution of the sewage problem, from a hygienic point of view, seems unquestionable. That chemical treatment, espe­cially if supplemented by filtration through land, will also purify well, is generally admitted. No process of effective purification is now expected to yield a profit ; but the question of cost, on which the choice of a system principally turns, is too extensive to be touched in this article.

II. The Conveyance of Sewage.—For small sewers, circular pipes of glazed earthenware or fire-clay or of moulded cement are used, from 6 inches to 18 inches and even 20 inches in diameter. The pipes are made in short lengths, and are usually jointed by passing the end or spigot of one into the socket or faucet of the next. Into the space between the spigot and faucet a ring of gasket or tarred hemp should be forced, and the rest of the space filled up with cement, not clay. The gasket prevents the cement from entering the pipe, and so obstructing the flow ; at the same time it forms an elastic packing which serves to keep the successive lengths of pipe concentric, even if the cement should fail. The pipes are laid with the spigot ends pointing in the direction of the flow, with a uniform gradient, and, where practi­cable, in straight lines. In special positions, such as under the bed of a stream, cast-iron pipes are used for the conveyance of sewage. Where the capacity of an 18-inch circular pipe would be insufficient, built sewers are used in place of earthenware pipes. These are some­times circular or oval, but more commonly of an egg- shaped section, the invert or lower side of the sewer being a curve of shorter radius than the arch or upper side. The advantage of this form lies in the fact that great variations in the volume of flow must be expected, and the egg-section presents for the small or dry-weather flow a narrower channel than would be presented by a circular sewer of the same total capacity. Figs. 1 and 2 show

two common forms of egg-sections, with dimensions ex­pressed in terms of the diameter of the arch. Fig. 2 is the more modern form, and has the advantage of a sharper invert. The ratio of width to height is 2 to 3.

Built sewers are most commonly made of bricks, moulded to suit the curved structure of which they are to form part. Separate invert blocks of glazed earthenware, terra-cotta, or fire-clay are often used in combination with

brickwork. The bricks are laid over a templet made to the section of the sewer, and are grouted with cement. An egg-shaped sewer, made with two thicknesses of brick, an invert block, and

a concrete setting, is illustrated in fig.

3. Concrete is now very largely used in the construction of sewers, either in combination with brickwork or alone.

For this purpose the concrete con­sists of from 5 to 7 parts of sand and gravel or broken stone to 1 of Port­land cement. It may be used as a cradle for or as a backing to a brick ring, or as the sole material of construction by running it into position round a mould which is removed when the concrete is sufficiently set, the inner surface of the sewer being in this case coated with a thin layer of cement.

In determining the dimensions of sewers, the amount of sewage proper may be taken as equal to the water supply (generally about 30 gallons per head per diem), and to this must be added an allow­ance for the surface water due to rainfall. The latter, which is generally by far the larger constituent, is to be estimated from the maximum rate of rainfall for the district and from the area and character of the surface. In the sewerage of Berlin, for example, (one of the most recent instances of the combined water-carriage system applied on a large scale), the maximum rainfall allowed for is ⅞ of an inch per hour, of which one-third is supposed to enter the sewers. In any estimate of the size of sewers based on rainfall account must of course be taken of the relief provided by storm-overflows, and also of the capacity of the sewers to become simply charged with water during the short time to which very heavy showers are invariably limited. Rainfall at the rate of 5 or 6 inches per hour has been known to occur for a few minutes, but it is altogether unnecessary to provide (even above storm-overflows) sewers capable of discharging any such amount as this ; the time taken by sewers of more moderate size to fill would of itself prevent the discharge from them from reaching a condition of steady flow ; and, apart from this, the risk of damage by such an exceptional fall would not warrant so great an initial expenditure. Engineers differ widely in their estimates of the allowance to be made for the discharge of surface water, and no rule can be laid down which would be of general application.

In order that sewers should be self-cleansing, the mean velocity of flow should be not less than 2 ½ feet per second. The gradient I necessary to secure this is calculated on principles which have been stated in the article Hydkomechanics (q.v.). The velocity of flow,

V, is V— *c√im,*

where *i* is the inclination, or ratio of vertical to horizontal distance ; *m* is the “hydraulic mean depth,” or the ratio of area of section of the stream to the wetted perimeter ; and c is a coefficient depend­ing on the dimensions and the roughness of the channel and the depth of the stream. A table of values of *c* will be found in § 90 of the article referred to. This velocity multiplied by the area of the stream gives the rate of discharge. Tables to facilitate the determination of velocity and discharge in sewers of various dimensions, forms, and gradients will be found in Mr Latham’s an∣l other practical treatises.

Where the contour of the ground does not admit of a sufficient gradient from the gathering ground to the place of destination, the sewage must be pumped to a higher level at one or more points in its course. To minimize this necessity, and also for other reasons, it is frequently desirable not to gather sewage from the whole area into a single main, but to collect the sewage of higher portions of the town by a separate high-level or interception sewer.

Sewer gas is a term applied to the air, fouled by mixture with gases which are formed by the decomposition of sewage, and by the organic germs which it carries in suspension, that fills the sewer in the variable space above the liquid stream. It is uni­versally recognized that sewer gas is a medium for the conveyance