THE PROPORTIONS OF SEWERS.

At a recent meeting of the Society of Engineers, London, Mr. John Phillips read an interesting paper on the forms and construction of channels for the conveyance of sewage, in which he said:

"The water carriage system consists of a series of drains and sewers laid to various inclinations for the purpose of receiving and carrying away the water we use and the filth we produce in our houses and towns. The efficiency of this system depends, as its name implies, upon the gravitating power of the water to remove not only itself, but the organic and inorganic matters which it receives. And as the water derives the requisite power to do this from the form, the fall, the size, and the construction of the channels in which it runs, it is imperative that by no defect in either of these respects should any of this power be wasted or lost; for the more power the water has the better it raises and holds the matters in suspension and propels them forward, the quicker it carries them with it to the outfalls, the cleaner it keeps the drains and sewers, the freer these are from noxious gases, and the purer is the atmosphere and the healthier are the inhabitants of houses and towns. At different periods various forms have been used for drains and sewers, such as the square, the rectangle, the triangle, the circle, the semicircle, the oval, the semi-oval, and parts of these combined. But the best form is that of an egg, broad at the large end and narrow at the small end, and this end placed downwards. For by this form the channel imparts to the same quantity of sewage greater velocity and scouring power, the sides and crown offer greater resistance to the pressure of the ground, and the amount of excavation required for its execution is less than any other form. The egg shape and the circle are now employed for large sewers constructed of bricks, and the circle for stoneware pipe sewers and drains."

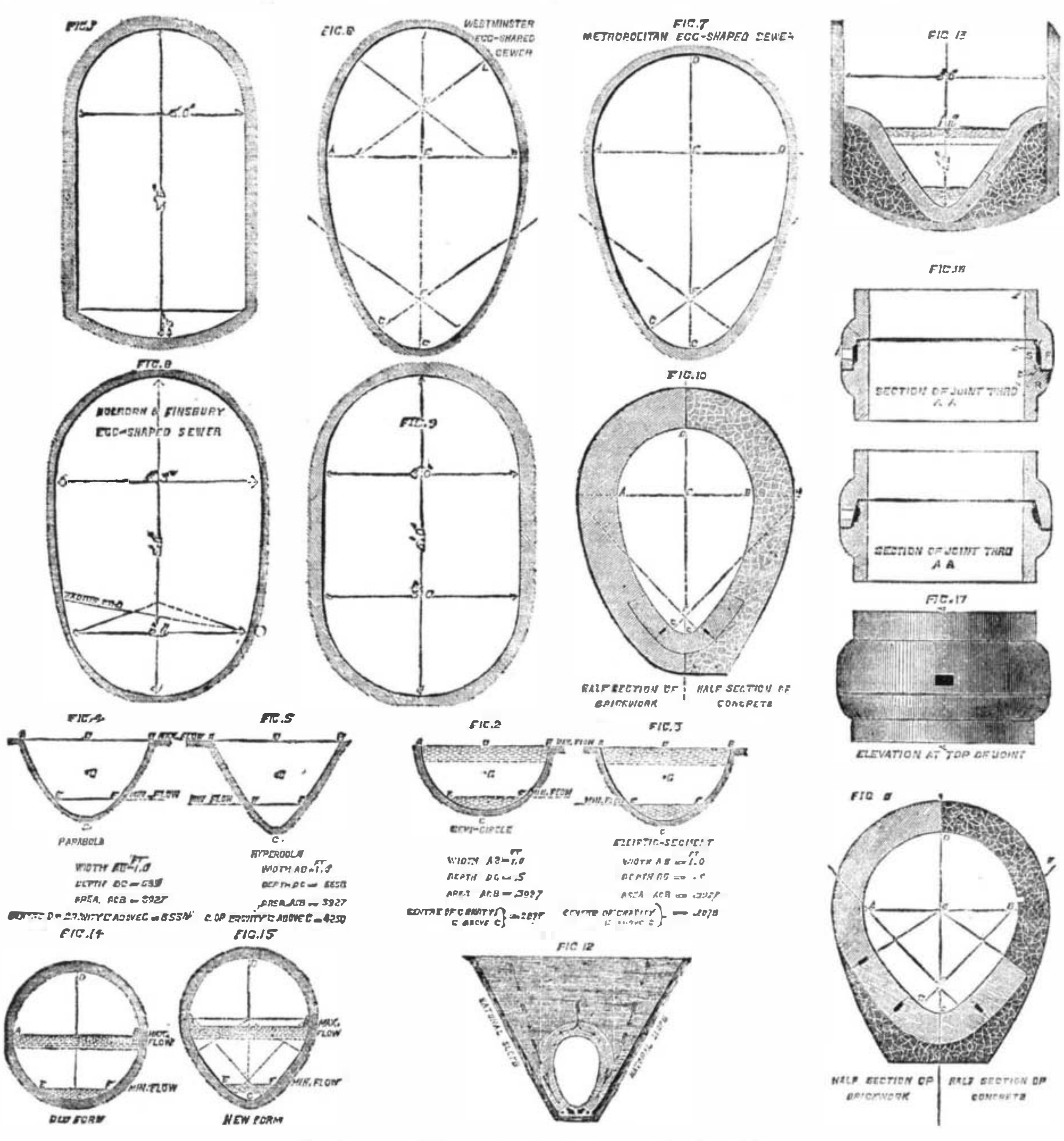
In the course of the paper, Mr. Phillips described the various sections of sewers in common use, of which we give illustrations, the following being the particulars of each:

Fig. 1 is a section of two large sized sewers, constructed in Westminster 80 years ago. Little care was bestowed on the masonry of sewers in those days, bricks, mortar, and labor being economized to the utmost extent; and the width and flatness of the bottom of the sewer diffused the flow and destroyed its "scour," from which the carrying power is derived. This led to accumulations of detritus in the sewer, and consequent failure of the gully or branch sewers; and it became necessary to ascertain which form of sewer would best give the required velocity to the liquid, and carry the whole of it to the outfalls. Mr. Phillips, therefore, made experimental channels along the sewers, as shown in A C B, Figs. 2, 3, 4, and 5—Fig. 2 being a semicircle, Fig. 3 an elliptical segment, Fig. 4 a parabola, and Fig. 5 a hyperbola; and he computed the areas, perimeters, and velocities of flow of all of them, the experiments extending over several months. Fig. 5 gave the least tendency to deposit; next in degree came Fig. 4, Fig. 3, and Fig. 2, in the order named. This result was caused by the contraction of the bottom of the channels, deepening the flow, and so giving the stream greater gravitating energy.

As a result of these and other considerations, the author designed an egg-shaped sewer, shown in Fig. 6, to take the place of that in Fig. 1. Twenty miles of this sewer were laid down in 1846 and 1847; it proved to be completely self-cleansing, and a saving of $7,500 per mile over the cost of the Fig. 1 sewer was effected, the total showing an economy of $150,000. Its proportions are: $CI = 1\frac{2}{3}$ AB, $CE = AB$, $CF = \frac{1}{4}$ AB, $GH = 1\frac{1}{2}$ AB, $AJ = \frac{1}{6}$ AB, $EK = \frac{1}{4}$ AB, $JL = \frac{5}{6}$ AB, $KL = \frac{5}{12}$ AB. The one shown in Fig. 7 is considered to be a still further improvement, and is now generally adopted in Great Britain; its proportions are: $CD = 1\frac{1}{2}$ AB, $CE = AB$, $CF = \frac{1}{4}$ AB, $GH = 1\frac{1}{2}$ AB.

Fig. 8 shows a modified form of Fig. 1, and is superior to it for cleansing, strength, and economy; but in all these points it is surpassed by Figs. 6 and 7. It was designed to replace Fig. 9, the defects of which are apparent in consideration of the abovementioned experiments. Fig. 10 was proposed by Mr. Phillips as an improvement on Fig. 7, which latter, however, may still be used where the flow is large; but elsewhere, Fig. 10 must be considered to show many advantages. Fig. 11 is a modification of Fig. 10, of which the proportions are ascertained as follows: Divide AB into 11 equal parts; then $EC = 7\frac{1}{2}$, $CD = 13$, $FC = 2$, and $GH = 21\frac{2}{3}$ such parts.

Fig. 12 shows the manner in which the weight of superincumbent earth bears on a sewer, and demonstrates the necessity of great strength in the crown of the work. Fig. 13 shows a method of improving flat-bottomed sewers by narrowing the channels. Figs. 14 and 15 are old and new forms of auxiliary or branch sewers, the latter having all the advantages aimed at by Mr. Phillips in designing the sewers shown in Figs. 7, 10, etc. Figs. 16 and 17 show methods of making joints in pipe sewers. "Where, from inadequate inclination or body of sewage," says Mr. Phillips, "the velocity of the flow is insufficient to carry away the silt, sand, and other solid substances which are washed into sewers from sculleries, areas, yards, streets, and other places, these materials become embedded and entangled with the excreta, fat, hair, paper, and other matters, and form hard compact masses along the bottom. Wide, flat, and extremely rough surfaces are thus produced, which diffuse the flow, weaken its force, and no flush of water is strong enough to tear it up and remove the accumulation. Hence it is of the first importance to keep detrital substances out of the sewers as much as possible. This may be done by forming catch pits under the sinks and gulleys, and emptying them directly after every rainfall. Where no such appliances are provided or the emptying of them is neglected, detritus gets into the sewers, causing putrifying matters to deposit, and foul gases to generate and escape into the houses and streets where the drains are improperly trapped and are unventilated."



CROSS SECTIONS OF LONDON SEWERS.

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Bohemian Glass Bad for Chemical Analysis.

M. P. Truchot states that glass vessels in which various liquids, and even pure water, are boiled give up by degrees a small quantity of their substance, silica, potash, soda, and lime. The analysis is the more erroneous the longer the boiling is kept up. This, at least, is what results from the use of glasses brought from Germany, and sold at Nancy in 1873 and 1874. This fact may be shown by boiling in a flask pure water mixed with a tincture of red cabbage or sirup of violets, slightly reddened by an acid. After boiling for a few minutes, the liquid turns green. French glasses, with a base of soda, are not sensibly attacked, and therefore do not offer this inconvenience.

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A PHYSIOLOGICAL THERMOMETER.—Dr. Edward Seguin proposes a centigrade thermometer in which the zero point shall be marked at +37°, equal to +98° Fah., the nominal temperature of the body. Deviation of the mercury from this point would be understood at once as indicating irregularity in the system, by persons who might not be aware of the temperature as above mentioned

A Brilliant Light.

Professor John Spiller communicates to the London Photographic Society the following method for a temporary light of great power, useful for photo and other purposes:

"When common saltpeter (nitrate of potassium) is heated to a temperature somewhat beyond the point of fusion, in a hard glass tube or porcelain capsule mounted over a spirit lamp, and small pieces of sulphur are then successively introduced, a deflagration ensues, accompanied by the emission of an exceedingly brilliant white light, which is maintained as long as any of the sulphur remains floating as a molten globule in the fluid nitrate.

"The cost of this light is very trifling, both ingredients being remarkably cheap. One ounce of niter melted, and fed with sulphur at the rate of eight or ten grains at a time will keep up a brilliant light for about ten minutes, at the cost for materials of one cent; but it must be confessed that the wear and tear of apparatus, from the intensity of the heat, adds to the cost of production.

"To guard against fracture or actual perforation of the glass during the course of the experiment, it is necessary to provide a tin tray into which the fluid contents of the flask may drop in case of accident. An ordinary spirit lamp is found to give sufficient heat to melt the niter and start the reaction; when once the light is produced, the spirit lamp may be removed, or the holder supporting the flask turned aside. Short lengths of stout 'combustion tubing,' closed at one end, serve exceedingly well for making the experiment, this kind of glass being so difficultly fusible. If iron capsules be employed, it is only possible to work with the top light, which may, however, be reflected to any required angle; and with porcelain crucibles much of the effect is lost by the partial opacity of the material. In the event of the niter-sulphur light being required to be maintained for a lengthened period, it would, of course, be desirable to provide some kind of chimney to carry off the gaseous products of combustion, or absorb the sulphurous acid with peroxide of manganese.

"With respect to the actinic value of the light, I find that from three to five seconds' exposure, according to the density of the negative, is sufficient to give a collodion transparency at a distance of a foot from the source of light, when produced on a small scale. The maintenance of a constant degree of intensity is, perhaps, one of the points open to future improvement.

"I have tried the use of nitrate of sodium in place of the ordinary saltpeter, and experimented with various metallic sulphides and finely divided metals; but none of these answered so well as the simple attack of sulphur, in the form of roll brimstone, by melted niter. Their spectra also appeared to be more limited. With the chlorate of potassium and sulphur a light of dazzling brilliancy is emitted; but the deflagration is very violent, and white fumes are given off by reason of the greater volatility of the chloride of potassium —a by-product in this reaction.

"In conclusion: I have only to state that no claim of novelty is set up for anything beyond the photographic use of the nitro-sulphur light, the light itself having been shown as a lecture experiment certainly as far back as the year 1847"

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A Great Ice Slide.

A correspondent of the SCIENTIFIC AMERICAN, who resides in Norway, states that, in the eastern part of that country, large quantities of ice are gathered and stored in the ordinary manner during winter, for shipment abroad. Last summer a company tried to make the vast glaciers near Bergen supply the ice; to that effect a shoot made of spars was built, starting at an altitude of 2,200 feet, running down to the fjord, the whole length being 8,000 feet; the incline varies from 1 in 3 to 1 in 4 feet. At the lower end, the shoot runs level for a short distance and terminates in a shed, at which the vessels are loaded. The blocks of ice make the run in 4 minutes, although the speed is checked at several places. The average velocity of the ice blocks is 24 miles an hour. The ice is of a fine quality, and the supply is, of course, next to inexhaustible.

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By rubbing metallic surfaces with soda amalgam, and pouring on a solution of chloride of gold, gold is taken up by the amalgam; and it is only necessary to drive off the mercury by heat, to obtain a gilded surface that will bear polishing