expected to occupy the district in question. For convenience in sewer calculation, this is reduced to cubic feet per second per acre of total area.

Gaugings of sewage flow from typical areas were made from time to time in different parts of the city to assist in determining the factors to use in calculations of this kind. In making these sewer gaugings, various appliances were used, including floats, pitot tubes, current meter and one or two others. The writer, who had charge of the work, decided that the float method, properly checked by pitot readings, was probably the most practical for gauging sewage flow under conditions found in Manhattan Borough. Difficulty was experienced in carrying on the work because of the presence in some sewers of great quantities of gasoline vapors, illuminating gas and steam; also, occasionally, great depth of mud near the outlets, obstructions from pipes, back-water from tides, excessive velocities, poor light, and last but not least, the influence of large house connections.

Having decided upon the point for making a gauging, the sewer was cleaned for a distance 100 feet each way from the section by the cleaning gang of the department. The distance between the centres of two manholes was accurately measured, an extension-leg level and short rod were used for running a line of levels on the sewer invert with readings at 10-foot intervals, and the cross-section of the sewer at a point near each of the two manholes was measured. The party usually consisted of five men when engaged in putting floats through and six men when taking pitot readings. In the former case, one man remained on top at the up-stream manhole and two men at the bottom of this manhole, one to start the floats and the other to keep the time. At the down-stream manhole there was one man on top guarding the hole and one on the bottom to receive the floats and call out the time. While sending the floats through, the height of the sewage is taken at regular intervals, being measured down from a plank set horizontal and whose elevation is taken accurately. The surface floats used at first consisted of wooden strips 4 inches by 8 inches by ½ inch, but it was finally decided that better results were obtained by using a float to the bottom of which were nailed two tin vanes at right angles to each other and extending 3 or 4 inches at right angles to the board; the object of the vanes being to catch the maximum velocity, which was about one-fourth of the depth below the surface.

The mean velocity used in calculating volumes of flow was obtained by multiplying the float velocity by a coefficient varying from 0.75 to 0.80. To check the coefficient, a pitot tube was used, consisting of a glass tube two feet long and ½ inch in diameter, bent 45° at one end and tapered off as a cone which terminates in a small cylinder about 1/32 of an inch in diameter. The tube is set so that the lower end is horizontal and the main part of the tube makes an angle of 45° with the vertical. This position serves the purpose of exaggerating the velocity head to facilitate the accurate measurement. The combined virtues of the nozzle and standard short tube are found in the shape of the cone and tip, giving a very high coefficient of 0.98. In spite of the fact that the tip was continually clogging when immersed in the flow, this appliance gave very good results. In using the pitot tube, a frame was employed to which the tube was fastened, this frame being so constructed that it could be slid along a horizontal board set in the sewer, and the tube slid up or down along the 45° bed of the frame so that the pitot end could be brought to any part of the cross-section. The cross-section was then divided into a number of small imaginary sections of equal area and a reading taken at the centre of each section. The difference between the static elevation and velocity head was measured directly from the tube.

In rating the floats, these were put through the sewer at the same time the pitot readings were being taken and for as short a distance above and below the pitot station as it was practicable to use and obtained precise velocity readings.

One of the greatest sources of error encountered in measuring sewage flow arose from the influence of house connections, especially the larger sizes. If the house connection entered above the surface of the sewage, or if the sewer section was narrow or the velocity flow more than 3 feet per second, the effect was not so marked. But when the house connections were near the flow line, the sewer section wide, and the velocity below 3 feet per second, the effect on float velocities might be considerable. In making a velocity determination, five floats were put through, one after the other. From a considerable number of observations it was decided that if the five floats did not vary more than 2 per cent. or 3 per cent., probably no house connections were operating and the arithmetical mean was used. If one float varied 3 per cent. to 6 per cent. from the mean of the other four, the length of route covered by the float was assumed to be greater than the straight length of sewer by eight-thirds of the extreme variation caused by the float swinging first as far as possible to one side and then the same distance to the other side of the centre line of the sewer. If the tardy float was 6 per cent. to 10 per cent. behind the others, sixteen-thirds of the extreme variation was added. If the tardy float was more than 10 per cent. behind the others, it was discarded as an observation.

In one case a standard sharp-edge weir with a stilling-box arrangement was used and gave very accurate results; but it was concluded that placing weirs in sewers is seldom practicable, since the weir must be made water-tight and yet so constructed that it can be removed readily in case of storms in order to prevent the flooding of cellars; and it was found almost impossible to satisfy both conditions. In addition to this, the presence of the weir causes the precipitation of great quantities of solid matter behind it which tends to back up the sewage into the house connections. Attempts made to measure the sewage flow by means of a current meter were unsatisfactory, owing to the fact that suspended matter clogged the mechanism.

At the time of writing this paper, a few weeks ago, the writer was experimenting with what is known as the Sanborn automatic gauge, utilizing pneumatic pressure, which had up to that time given better results than others which had been tested, although it required more or less constant attention.

The Vancouver Gas Co., Ltd., have installed new gas retorts which considerably enlarge their output of coal gas. Ammonia liquor—formerly wasted—is now being made in the new plant, and is used by the Victoria Chemical Co., Ltd., Victoria, in the manufacture of their product.

A plant for the construction of concrete ships is to be erected at Cleveland, Ohio, by the Cleveland Builders' Supply Company. Construction will be limited exclusively to concrete ships and barges. The plant will be the first of its kind on the lakes. The size of the vessels will permit their passage through the Welland Canal. Ships of 2,000 tons capacity and barges of 1,200 tons capacity will be built. They will be more than 200 feet long and 38 feet wide. The plant's output is expected to be about four ships per month.