

## MUNICIPAL ENGINEERS, CONTRACTORS, AND MATERIALS.

first that the largest sewers should have the shortest route. This seems self-evident. Another principle to be borne in mind is that economy is reached by concentrating sewers as much as possible. This is easily seen from the fact that to build a sewer of a times a certain capacity does not cost  $n$  times as much money.

Keep in mind that the sewage should be gotten as quickly as possible into the large mains. The size of the different sewers is the next point to consider. The underlying principle governing size is that the quantity of sewage is equal to the water supply of the city. It is sometimes more, but unless specified can be considered as being the same. We should also assume that the quantity varies during the day just as the consumption of water varies—being greatest in the forenoon and least at night. One-half the daily quantity flows in from six to eight hours, and we should always, for safety, assume that this quantity will fill the sewer only half full.

We must now consider the ground water. In America there is kept out of the sewers; it will leak in. When necessary to allow for ground water make careful investigations of its maximum amount from existing records. In some places its amount is as high as 1,000,000 gallons per square mile per day. To keep it out of the sewers concrete or lead should be constructed around them. This was done in many cases in Berlin.

We must next ascertain the greatest quantity of rain-water to be removed. To do this, consider the greatest intensity of rain fall in the vicinity and design the system to carry it. A certain fall per day was formerly all the information that was recorded, but this is of no practical value since the entire quantity may have fallen in a single hour. Automatic registers now in use show graphically the fall for every minute during the day. We find that this maximum varies considerably in different sections. In New York City, as a striking example, it has been as much as 6 inches per hour. At that rate it actually fell 1 inch in 10 minutes. It has been observed that these phenomenal falls do not last very long, and in fact are generally over by the time the water has reached the sewer, so they need not be considered. The presence of snow, which would melt during a rain, might be supposed to increase the amount of water to be allowed for, but it has been observed that heavy rainfalls seldom take place when snow is upon the ground.

(To be Continued.)

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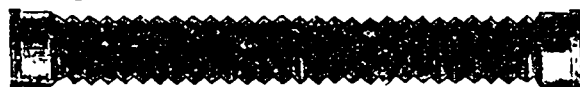
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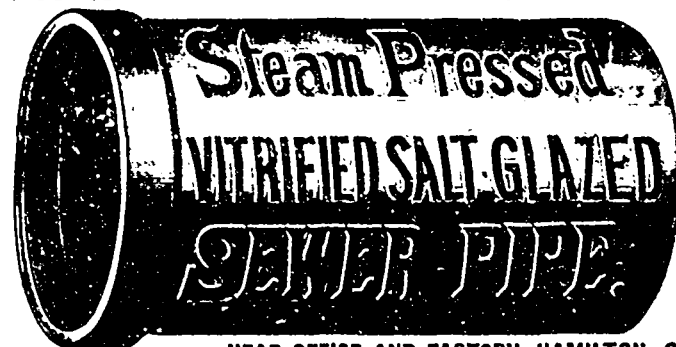
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