signal box, and the chart will thus be made readily accessible. The only criticism of such a method of installation lies in the necessity of providing some method of accurately checking the chart record with the depth of flow.

Particular care should be taken in connecting the gauging chamber or float chamber with the sewer, to see that the connecting pipe is normal to the direction of flow, and does not project into the sewer. If this precaution is not observed, the recorded heights will be in error—too high if the connecting pipe is directed upstream or against the current, and too low if in the reverse direction. The precautions taken should be the same as in installing a piezometer connection to a water pipe.

It is highly necessary that recording devices be regularly inspected in order that they may be sure to be in operation when most needed, and the more accessible and convenient it is possible to make their location, the more careful attention will they receive. Maximum rates of precipitation and the attendant depth of flow in the sewer are of infrequent occurrence, and it is very essential that the recording device be in operation whenever such a discharge takes place.

Maximum Flow Gauges.—Practically the only information to be obtained from a maximum flow gauge is the greatest height reached by the flood wave at the point of observation since the last recorded measurement. Ordinarily the records thus obtained are of little value, but they may occasionally serve as a valuable check upon the records of an automatic gauge which may be out of order and fail to indicate the highest point reached by the flood. It is, therefore, advisable to install such maximum flow gauges at all points where automatic water level recorders are installed.

In the earlier observations of run-off in sewers, the maximum gauges consisted merely of whitewashed laths set firmly in position in manholes, the expectation being that the highest point reached by the sewage would be clearly indicated on the whitewash. In some cases this simple type of gauge has proven satisfactory, although in many cases the whitewash has peeled off about the height to which the sewage reached, and in other cases, for some unexplained reason, the maximum height could not be distinguished upon the gauge. The most satisfactory type thus far devised consists of a rod to which are firmly fastened a number of small vials having their mouths set at uniform distances apart, usually one-tenth or two-tenths of a foot, the whole being properly protected from the flowing current by a shield or perforated tube. On examining this rod, it is evident that the sewage must have been as high as the highest vial which is found to be filled with water. Inverting the rod and emptying the vials is all that is necessary to prepare the gauge for use. This type of gauge is best located in a manhole, with the bottom of the gauge slightly above the normal dry-weather flow. In some cases, gauges of this type have not proved satisfactory where high velocities have obtained—such as 8 ft. per second.

Actual Measurements of Storm-water Flow.—The report contains, in tabular form, all available records of storm-water flows in sewers, including not only those which have been made in co-operation with the committee and submitted to it for publication, but all other published records of storm sewer gaugings which have come to its attention. It gives also a detailed description of apparatus and methods used in a study of rainfall and run-off at Pawtucket, R.I.

Rate of Precipitation Causing Maximum Flow.—It is of the greatest importance in arriving at a correct conclusion that the maximum rate of flow in the sewer be compared with the rainfall which actually caused this run-off. It is, therefore, particularly important that the time required for concentration of run-off at the gauging point, under the conditions existing at the time when the gauging was made, be accurately known.

It is evident that if the time required for the concentration of the run-off at the gauging point is thirty minutes, the run-off factor obtained by comparing the maximum rate of run-off with the rate of rainfall which obtained for a period of five minutes, or with the average rate which obtained for a period of sixty minutes, would be considerably in error, unless the rate were uniform in the latter case. In such comparisons it is evident that the actual time of concentration existing for the particular gauging is the figure desired—not the computed time of concentration for maximum velocities of flow, which may be widely different from those existing. If the sewers are but partly filled and the velocity of flow is less than the maximum velocity, it is evident that the time of concentration will be considerably greater than the time computed upon the basis of maximum velocities.

Another point requiring careful consideration is the interpretation of the run-off from storms of less total duration, or having a downpour of less total duration, than the time of concentration for the drainage system gauged. This is particularly true in the case of large areas for which the time of concentration is considerable. It is not often that storms occur of sufficient uniform intensity to produce a noticeable "flood wave," and lasting from thirty to sixty or ninety minutes. Accordingly, storms which give significant information relating to drainage areas for which the time of concentration exceeds thirty minutes are of rare occurrence, and records of value for such systems are obtainable only after a number of years of observation. Much valuable information could be obtained in shorter periods of time if subdistricts, for which the time of concentration would be short, were gauged. The committee spent a large amount of time in endeavoring to obtain significant information from storms in which the period of downpour was of less duration than the time of concentration of the district gauged, but had been forced to the conclusion that, with present knowledge, no information of value can be obtained from such records. It seems impossible to estimate the area actually yielding storm water from a shower of less duration than the time of concentration. Take, for instance, the case of a heavy downpour lasting ten minutes upon a drainage area for which the time of concentration is thirty minutes. If the entire rainstorm lasts but ten minutes, it is evident that the maximum rate of run-off represents the discharge from but a portion of the drainage area. Whether this is the portion lying nearest the outlet or some other part of the drainage area, it would be impossible to tell without a very large amount of information. If the storm included a heavy downpour of ten minutes' duration, followed by a drizzle of indefinite duration, the maximum run-off would probably occur when a section of the drainage area at a distance from the gauging point was contributing at the maximum rate, while portions nearer the gauging point were contributing the run-off corresponding to the lighter rainfall which followed the downpour. It is therefore impossible to say what the true contributing drainage area to the maximum run-off amounted to, or what is the proper rate of precipitation with which that run-off should be compared.