8½ in. by 11 in., so as to facilitate filing in standard letter files. It would be desirable to have the sheets made up in the form of pads, so that the operator by placing carbon paper beneath the top sheet could obtain a copy.

The record sheets should be signed by the operator and mailed at monthly intervals to the office of the Board of Health.

It is again desired to call attention to the importance of recording essential data. In the majority of sewage treatment works no provision is made to obtain a record of the rate of flow to the plant, even though such information is vital to proper operation. The committee strongly recommends that engineers in designing new works provide means for easy measurement of the flow, and that measuring devices be installed in existing works not now so equipped.

When the record forms are printed, blank spaces should be left at convenient places where it may be desired to put figures resulting from computations by the state authorities.

For example, if the operator reports that sludge was placed on drying bed "D" to a depth of 7 in., the state official, knowing from the records the area of the bed, can compute the number of cubic yards of sludge, which he would enter in the blank space mentioned.

If this system of obtaining data were to be put in force, in a short time the state officials would be in possession of a fund of information which could be used in advising operators of sewage works, and this would not only aid the local communities, but also the commonwealth.

When sewage works are operated without producing nuisance, and at a reasonable expense, the objection on the part of communities to being compelled to instal works will diminish, for the fear of failure will be lessened.

It would be of further advantage if the Boards of Health would use the information so gathered to prepare pamphlets, written in clear, popular style, to call to the attention of town officials the need for and value of sewage treatment not only as a local matter, but in its broader effect upon the commonwealth.

NEW ULTRA-VIOLET RAY DEVICE.

A novel addition to existing apparatus for the ultra-violet ray sterilization of drinking water was recently described by Mr. Billon-Daguerre before the Académie des Sciences, Paris. By his arrangement the water is made to flow in a thin sheet across a cone of intense radiation just before it is drawn off for use. The outlet pipe is T-shaped and of transparent quartz. It is provided with a slot adjacent to a mercury vapor lamp, and the thin film of water flowing through the slot gets full benefit of the ultra-violet action. In larger apparatus there are two slots in the outlet pipe and two corresponding lamps. This equipment can sterilize 2,500 gallons per hour.

As a test of its efficiency, the apparatus was supplied with water containing cultures of bacillus coli, cholera and tuberculosis germs. It was perfectly sterilized at the rate of 2,200 gallons per hour, with a power consumption of 440 watts. It is stated that after 3,000 hours' continuous operation there was no appreciable reduction in the germicidal efficiency of the lamps, and no calcareous or other deposits had formed on either the lamps or the outlet pipe, no doubt owing to the scouring effect of the rapid water flow.

THE HYDRAULIC JUMP, IN OPEN-CHANNEL FLOW AT HIGH VELOCITY.

A PAPER to be read by Karl R. Kennison, before the American Society of Civil Engineers on November 3rd, presents an analysis of the hydraulics of the turbulent discharge below a spillway dam, where the so-called "jump" frequently occurs. A knowledge of the hydraulic principles involved should enable destructive high velocities and turbulence to be avoided, or intelligently provided for, in the design of flumes, dam foundations, etc.

The interesting feature of the paper is that in every open channel, except at controlling sections where the discharge is a maximum, there is, in addition to the existing water level, another level at which the same quantity of water might be flowing, under the same head. These two alternative stages should be recognized in the design of all structures for controlling the flow of water. The hydraulic jump is merely the turbulent passing between these two stages.

We quote from Mr. Kennison's paper as follows:—

When water is discharged into a flume through a contracted gateway and under a considerable head, it sometimes continues to move in a thin sheet at a high velocity along the bottom of the flume for several hundred feet. Then it suddenly becomes turbulent and forms what is called a "hydraulic jump," the surface level down stream from this point being much higher than that of the approaching high-velocity discharge; or, when water flows over an ogee dam and out on a smooth apron it sometimes continues in a thin sheet, having a surface level far below the normal level of the river a little farther down stream, until it suddenly changes into a tumbling mass, rising to the normal river level by this back roll or hydraulic jump.

This phenomenon sometimes becomes of great practical importance, and has been investigated mathematically by the writer because of its interest in connection with the design of two important dams under widely different conditions and different parts of the country. In one of these cases it was desirable that the back roll or hydraulic jump should not be pushed far down stream from the foot of the ogee, off from a concrete apron which protected a clay river bed from scour; in the other case it was desirable that the back roll or hydraulic jump, with its violent surges, should not be pushed down stream so far as to interfere with the draft-tube exits of the power house.

The problem does not appear to have received proper attention in the textbooks. No exhaustive mathematical analysis is attempted here, but merely an explanation of the peculiar conditions of flow which make the jump possible. The conclusions are as follows:

In the case of water flowing in an open channel on a steep gradient there are certain controlling sections which throttle the flow and determine the quantity of the discharge, that is, certain points where, for the given head and channel depth, the discharge is a maximum. If the contraction which causes this throttling of the flow is sufficiently gradual—for example, a submerged dam with smooth gradual approach and get-away—it can be shown that the depth of water at this point is theoretically two-thirds of the total head measured from the channel bottom or dam crest up to the hydraulic gradient, and the discharge per foot of length, therefore, should be 3.09 $H^{3/2}$.

At other points than at the controlling sections, however, the depth of water is not necessarily determined by