

be brought into balance by making small adjustments in the areas of the web members. If some of these latter cannot be made to carry the full working stress, the loss will usually be slight since their forces are relatively small as a rule.

While the carry the load be used for compression a table of struts.

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## A Portable Electric Water-Depth Gage

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TO meet the growing need for a portable instrument capable of accurately indicating water depths in wells and channels over a considerable range, the point gage illustrated in Figs. 1 and 2 was designed. As in other electric point gages, the distance of the water surface from a reference point is measured with a plumb-bob suspended on a graduated steel tape. Contact of the bob with the water surface closes an electric circuit which activates the needle of a milliammeter.

As shown in Fig. 2, the instrument is compact and very simple in construction, with no complicated wiring or small parts. The reference point is provided by a plug-in socket which

is fastened with screws to any level support above the water. From a binding-post in the bottom of the socket, a ground wire is carried in-to the water. Duplicate sockets make the gage usable at any number of gaging points, each with a reference socket of known elevation. When the instrument is plugged into the socket its base rests on a ring-shaped shoulder, while the ground (negative) portion of the circuit is carried through the base to the lowest battery by means of a male plug element.

Passing through a series of three standard  $1\frac{1}{2}$ -v flashlight batteries, the circuit enters the top element of the gage, consisting of a spring contact, a 5,000-ohm fixed-resistance unit, and a milliammeter registering up to 1 ma. This combination of voltage, sensitivity, and resistance makes it possible to obtain readings in practically pure water; at the same time there is no danger of burning out the milliammeter by a direct short-circuit. The second pole of the milliammeter is grounded by a spring contact to the metal case and measuring tape, which carries the circuit back to the water surface.

The measuring tape is of  $\frac{1}{4}$ -in. steel ribbon, 25 ft long, graduated in feet, tenths, and hundredths. A special

housing and three set-screws hold the standard tape in place and permit easy removal of both tape and case for repair or replacement. A metal guide bracketed to the side of the battery case insures free movement of the tape at all times and provides a suitable measuring plane for reading the tape. When not in use, the tape is rolled in its case and the plumb-bob is held solidly in a cylindrical metal sheath affixed to the lower end of the metal guide.

Without switches and without any wiring except that directly connected to the milliammeter, the instrument can be completely disassembled by unscrewing the female socket and the top ring. A disk shield protects the milliammeter face from damage. The assembled point gage is very little heavier or bulkier than an ordinary three-cell flashlight and is sufficiently sturdy to give service for an unlimited period of time under normal field usage. All the instrument parts that are subject to wear or breakage are standard manufactured equipment.

This gage, for which a public patent has been applied for, was developed by the U.S. Forest Service and has been used successfully on several experimental watersheds in the West. In the field the gage has proved a particularly efficient means of determining instantaneous water stages in flumes, weirs, ground-water wells, and runoff collector tanks. It was possible under field conditions to obtain vernier readings with the instrument to the nearest 0.001 ft, and with care to duplicate such readings within 0.001 ft above or below the average of several measurements. This degree of consistency, together with the instrument's portability, has made it an effective low-cost device for setting and checking a series of automatic, water-stage recorders. In general, it should be helpful wherever there is an engineering problem calling for accurate and efficient determination of the level of fluids (electric conductors) in wells, channels, tanks, or reservoirs.

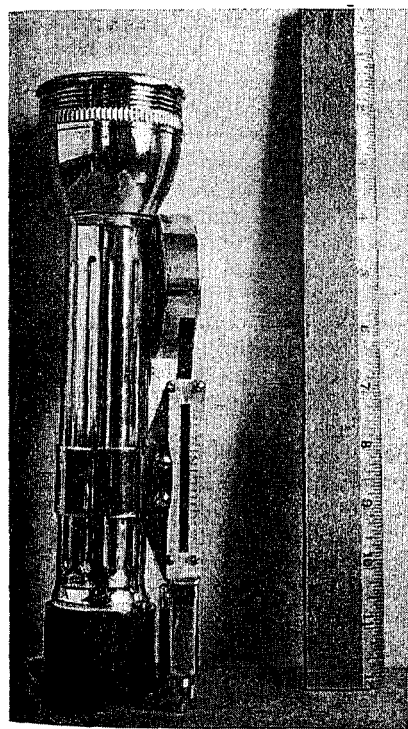


Photo by U.S. Forest Service

FIG. 1. POINT GAGE ASSEMBLED AND MOUNTED IN SOCKET

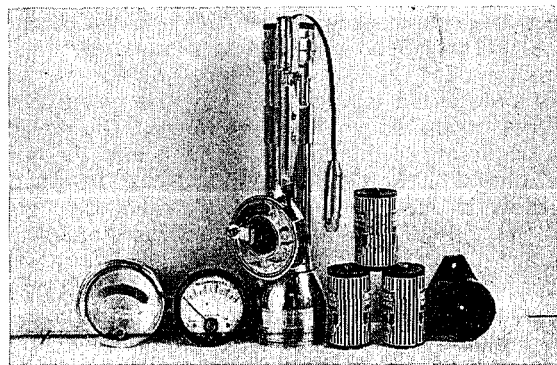


Photo by U.S. Forest Service

FIG. 2. POINT GAGE DISMOUNTED AND UNASSEMBLED  
Left to Right Are Threaded Top Ring and Shield; Milliammeter; Battery Case, Tape, Vernier, Plumb-Bob Sheath and Bob; Batteries; and Socket Showing Male Plug