



Graphic Pressure Sounder -- Sondeur à pression à enregistrement graphique



*Barr & Stroud
Prismatic Binocular*

*Jumelle à prismes
Barr & Stroud*

GRAPHIC PRESSURE SOUNDER

by

HAROLD E. LIBBY, ENGINEER, U. S. ENGINEER DEPARTMENT.

(Extract from *The Military Engineer*, Washington D.C., Sept.-Oct. 1931, p. 456)

For many years there has been evident need for an improved method of securing and recording soundings over comparatively large areas in relatively short periods of time. Mention is made below of two machines, developed to fit the special needs in the Rock Island and Detroit Engineer Districts, as a preface to the description of a more generally useful apparatus, devised by the Survey Section of the First New York District.

In 1902, Mr. Montgomery MEIGS, United States Civil Engineer (Retired), at the instance of Colonel C. McD. TOWNSEND, Corps of Engineers (Retired), constructed a sounding machine for profiling river channels, which was successfully used in the Rock Island District until 1928. The outfit was mounted on a barge and continuously recorded the varying depths of water over the course followed, through the medium of a pivoted, angled, sounding pole, connected to a recording instrument by means of suitable reduction-of-movement apparatus. It was intended to be used only at the lower stages of the river when depths of 7 feet or less were to be expected on the bars, but was capable of recording depths up to a maximum of 28 feet. This machine is described in detail in the July-August, 1922, issue of *The Military Engineer*.

A sounding machine, termed the *bathometer*, patented by Assistant Engineer E. S. WHEELER, was bought by the United States Engineer Office, Detroit, Michigan, in June, 1908. This device determined and recorded depths of water by measuring the equivalent pressure of air in a flexible tube, extending from the pilot house of a vessel to the bottom of the waterway. There was a slow escape of air from the submerged end of the tube, requiring various adjustments to insure correct readings. The results obtained from this outfit were not considered sufficiently precise to warrant its continued use.

The apparatus herein described has been in operation about three years around New-York Harbour, and its use has recently been extended to the Albany sub-district. An outfit has also been obtained for the Wilmington District, after an investigation and a demonstration that proved satisfactory. This instrument, designated as a Graphic Pressure Sounder, rapidly, accurately, and inexpensively records depths and gives promise of displacing in large measure the use of lead lines on hydrographic surveys. Up to the present, it has been used for investigations of minor importance, standard methods still being followed on surveys involving contract quantities or where otherwise a more or less experimental method might prove objectionable. Marked expedition and economy have been obtained in cases such as surveys of reported shoals, progress of dredging, preliminary investigations, etc. Having a chart of depths immediately available has proved of very great value to the engineer-in-charge as compared with lead soundings entered in a notebook.

Field tests of sufficient scope have now been made to substantiate the assertion that the improved method of securing soundings has future possibilities for river and harbour work far exceeding the original expectations of those responsible for its development. There is presented in the following paragraphs a description of the equipment, in its present stage of development, and the method of operation, with the expectation that the particular type of instrument, best fitted for their own needs, will be further evolved by other groups of engineers.

The underlying principle involved is that of transmitting the bottom water pressure to a trapped body of air, connecting with a recording instrument, which makes a continuous record graphically in depths of water in feet.

The device, complete, consists of a sounding lead, a recording instrument, and an air pump. It has been customary, in this District, to use about 100 feet of 1/4-inch hose to form the connecting link between the sounding chamber and the recording instrument. The weight of the sounding chamber is 29 pounds.

For field operations, the device is mounted on a launch or row boat which is placed on the selected range, after which the successive positions of the boat are located by instrument men in the usual manner. The crew of the boat consists of a chief of party,

one observer, and one leadsman. The leadsman, using the air hose as a line, lowers the sounding chamber until it reaches the bottom, when he immediately raises it from 3 to 5 feet and again drops it for the next sounding. This procedure is continued until the range has been traversed. The depths reached by the sounding chamber are marked automatically, and in correct relation to the time intervals, by the recording instrument which is in the boat, under the observer's care, preferably in a sheltered position. The observer is responsible for all duties in connection with the recording instrument, such as changing charts each revolution (thirty minutes), the insertion of all pertinent data on charts, renewing the air column, and keeping the chief of party advised of changing conditions as indicated by the chart. The chief of party is charged with general supervision of the efforts of the party and coordination of the activities of its members.

The alternate raising and lowering of the sounding lead must be done smartly and without any excessive dragging, in order that the record on the chart may assure accurate plotting of locations. The accuracy to which the fractions of a foot can be interpolated from the chart depends upon the size of its division. For this reason, the two-open chart is used; so that two separate charts ranging from 0 to 25 feet and 0 to 50 feet can be used. For depths between 25 and 50 feet, readings within 0.5 of a foot should be satisfactory and can be secured easily from the 50-foot chart. For shoaler depths, greater accuracy is generally essential. For this purpose the 25-foot chart has been found satisfactory.

It has been found advisable completely to free the sounding lead of all water periodically, during operations. This is accomplished by increasing the air pressure by means of the air pump, until the presence of rising air bubbles indicates the expulsion of all water.

Repeated tests of the accuracy of this apparatus have demonstrated, by means of check soundings with a lead line, that frequent calibration of the instrument is not required. All variations from the check soundings have been found to be well within the permissible limit of error.

For the purpose intended, more satisfactory results, at a decreased cost, can be secured with this equipment than by present standard methods. The outstanding advantages of the above described method may be summarized as follows:

(a) The pressure of the head of water is directly recorded in feet on the chart, without being affected by the drag of the lead line. This permits the use of a launch or boat with outboard motor attached, which can move at a slow speed, with or across the current.

(b) A power boat can be controlled more effectively during rough water conditions.

(c) The time interval between soundings, automatically recorded, fixes the location of the sounding. From fifteen to twenty-five soundings per minute can be secured readily. Much closer and more accurate spacing of soundings is obtained and more rapid progress is made than with the methods in vogue at present.

(d) The possibility of errors, due to inaccurate readings by the leadsman, is removed. Hence the tendency towards more accurate observations.

(e) The condition of the waterway can be shown graphically by drawing a line on the chart itself to represent the corrected project plane. This may be done while the work is in progress, without the reduction of many pages of soundings.

