this case it is found best where the same section is to be sounded a great many times and where it is desirable to obtain the successive soundings at close juxtaposition, to fix range posts on both sides of the river, and then one or more series of intersecting ranges at points some distance below or above the section on one or both sides of the river. The soundings can be made at the same points continuously without having to observe any angles. Such a system is shown in Fig. 4. AA and BB are range poles on the section line across the river. O and O′ are poles set at convenient points on opposite sides of the river, both above as well as below the section when found necessary. The poles OO′ should be distinguishable by small flags. Shorter posts are set near the bank at points 1, 2, 3, etc., in such positions that the intersections of the lines O-1, O-2, O-3, etc., with the section range BB will locate the soundings at the various points of the cross-section line AA, BB. This method is very simple and effective. It is plain that by changing the position of the poles OO′ several cross-sections can be taken at different points on the river without changing the position of the posts, 1, 2, 3, 4, 5, 6, 7, 8, or the base AB.

Making the Soundings.—The weight of a sounding lead will depend largely on the tide or current. A lead of 5 lbs. answers for still or shallow water, though for deep running stream, or very strong tides, a weight of 20 lbs. may be required. The line should be of a size suited to the weight, and may be composed of ordinary hemp or manilla. The line should first be well stretched for a couple of days, so as to be freed from all kinks. It is quite possible to stretch a line too much, as they are apt to shorten by use when over-stretched. Soundings at sea are always taken in fathoms (6 feet). On the United States lake surveys it is the general practice to indicate all depths over 24 feet in fathoms, and depths under that in feet. The depths here shown are all in fathoms, as was the old custom in hydrographic work. "½" and "¼" shown in this map meaning one-half and one-fourth fathoms, or 3 feet and 1½ feet respectively. If the line is graduated in fathoms and fractions of fathoms, leather tags are fastened in the strands of the line at the fathom points, and the fractional fathoms, as ¼, ½, are indicated by cotton or woolen strips. The line should be frequently tested.

Sounding poles are found most convenient and necessary. They should be used when the depth is less than 12 feet. A pole 15 feet long will answer for obtaining 2-fathom soundings and under. The pole may simply be graduated to feet, or, where great accuracy is required, to tenths.

In tidal water the elevation of the mean tide is the plane of reference for both the topographical and hydrographical surveys, and the state of the tide must be known with reference to the mean. The elevation of the zero being determined, with reference to mean tide water, all soundings must then be reduced before they are plotted to what they would have been if made at mean tide. This can be done graphically by Bourcher's method, as shown in Fig. 1, if necessary. This is seldom necessary, as practically all soundings are now reduced to mean tide.

Lines of Equal Depth.—These lines correspond to the ordinary contour line on land, as shown in all topographical surveys in rough and mountainous countries. To draw lines of equal depth with certainty the elevations of many more points are necessary than are needed for drawing contour lines on a railway map, for example, because the bottom cannot be viewed directly, while the ground can. Where the ground is seen to be nearly level no elevations need be taken, while for a similar region of bottom a great many soundings are required to prove that it was not irregular.

River slope is a very important part of a survey where a river is involved. Sometimes it may be desirable to determine it for a given stretch of river. In ascertaining the discharge of streams it is often found necessary to set gauges simultaneously every few minutes for several hours. But such an object was not required in this case under consideration, where, as for ordinary purposes, the river slope was determined with sufficient accuracy by simply reading the level or stadia rod at the water-surface as the survey proceeded. In all natural channels the slope is quite variable. For short distances it is frequently negligible, as the water is still and almost level, then follows for a short distance a sudden fall or rapid. Streams, particularly those emptying into the sea, are subject to material changes in local conditions. This applies also to streams flowing in friable, sandy beds. Great caution must be exercised in introducing the function of river slope into any hydraulic formulæ for natural channels.

NEW TYPE OF EMBANKMENT WALL.

THE Dominion Government has awarded a contract for four thousand square yards of a new system of armour for the protection of the dyke at Laprairie, Que., against damage from water and ice of Lake St. Louis. This contract was placed with C. Gardaix and A. C. Attendu, C.E., of the Decauville Flexible Armour of Canada, Montreal, who are the owners of the Canadian patents on the Decauville flexible armour.

This armour, which was patented in France seven years ago, is intended to take the place of concrete retaining walls for the protection of river and other embankments. The armour consists of a network of cement bricks. These bricks are held together by vertical wires, which pass through corresponding holes in the bricks. The bricks are absolutely equal in size, and measure about 10 in. in length by 3 in. in width by 5 in. in height. Each brick has two holes through which the wires pass. These wires are attached to a strong horizontal steel cable running along the bottom of the embankment, and forming the base line of the whole wall.

Each brick is curved at the ends in such a manner as to form hinges with the next bricks, so as to permit of flexibility. The wires, about one-fifth of an inch in diameter, are heavily galvanized—180 grams to the square meter. Eight wires are used per running yard of brick, thus allowing a tension of about seven thousand pounds per yard of brick. The wall is held in place by its own weight and by large stone or iron anchors which are sunk into the earth at the top of the embankment, the ends of the vertical wires having been twisted together in strands, and the strands bound around the anchor.

The bricks are made of cement and sand by presses driven by hand or motor power. A pressure of about twenty-three tons per brick is obtained. Mr. Attendu states that the resistance of the bricks against crushing is about nineteen hundred pounds per square inch. Staircases of any width desired can be placed in the wall by a special arrangement of the bricks. It is stated that the cost of the Decauville armour is from thirty to fifty per cent. less than a concrete wall of the same height, length and resistance.