

up to 1893, when the writer was appointed to organize a survey to carry on the work systematically.

*Tides.*—Under the circumstances, there was practically a clear field to work upon. The tides themselves were known to be very complex in character, as they ranged from almost nothing in the middle of the Gulf of St. Lawrence to the highest in the world in the Bay of Fundy. The general method adopted from the outset was to establish principal stations at strategic points, to which the harbours in the surrounding regions could be referred. It was the intention from the beginning that the principal stations should be adequately equipped to obtain tidal record which could be reduced by the modern method of Harmonic Analysis. For this purpose it is essential to have continuous record day and night throughout the year. There were thus many practical difficulties to be overcome; such as the heating of the tide gauges in winter by a method devised for the earliest stations, construction problems in the establishment of gauges where no artificial structures existed and the exposure was severe, and the design of an unfailing recording instrument for situations where no repair could be obtained. In such matters little help could be found in anything previously done in other countries.

The two essentials for tidal observations are correct time and some datum or plane of reference from which the height can be measured. At some of the tidal stations the time can be readily ascertained, but at others it has to be specially obtained either by telegraphic signals or by meridian instruments which determine the time directly from the sun. At almost all the tidal stations it has been necessary to originate a datum level for height, and to establish a bench mark. A tide scale is set with reference to this bench mark, to maintain a uniform datum throughout the years of observation. As an open scale becomes useless in the winter season, on account of the accumulation of ice, it was necessary to devise special apparatus which can be enclosed and protected.

With regard to the limits of accuracy, it is sufficient to have the time correct within one minute, as this is as close as individual readings can be taken on the tide diagrams. The limit of accuracy for height is in general 0.01 foot.

The equipment of the tidal stations to secure a continuous record, summer and winter, for harmonic analysis, and to obtain time and height for the observations under conditions of isolation and winter ice, are described in a Paper communicated to the Institution of Civil Engineers of London (2).

*Currents.*—In the investigation of the currents the advantage of current meters registering electrically was very evident; but at that