

determined datum, then firmly attach the carriage *G* to the wire by means of the set screw *O*.

To change the recording sheet, the pen *H* is thrown back, the cylinder including friction gear *P* placed upon a table, the old sheet taken off by raising two special spring clips at either end of the cylinder, and a new sheet substituted and held firmly in place by means of these clips. After the cylinder is again in proper position, it is easily set to the correct clock time by turning until the point of the pen agrees with this time as shown upon the sheet. This can be accomplished without injuring the clock, for, when properly adjusted, the socket *P* so fits over the end of the shaft as to permit of the cylinder being easily moved by hand, but binds sufficiently to prevent slipping during the normal movement generated by the clock. A set or clamp screw has, however, been added, so that a perfect connection between clock and cylinder may be readily ensured at all times.

The traces from this hydrograph not only furnish a continuous record of the hydraulic variations of the Great Lakes, which is of primary importance to your Department, but also will prove of great scientific value by demonstrating the existence of numerous rapid secondary fluctuations in the water level on these lakes, or short undulations of various forms similar to those which have been studied upon the Swiss Lakes, where they have been termed "Seiches." The writer has made a careful study of these undulations, as derived from records afforded by a combined lake level and barometric registering instrument termed a hydro-aerograph, which was set up at the mouth of the Humber River last July for the Canadian Meteorological Service,* from which he has deduced the existence of:—

1. A longitudinal and a transverse "Seiche" of about 4 hours plus 45 minutes and 45 minutes duration, respectively, due to abnormal differences in the atmospheric pressures which obtain at the extremities and on opposite shores of the lake.

2. Shorter undulations after the passage of a wave of considerable amplitude, due to the direct action upon the surface of the water by atmospheric waves, which are known to exist before and during the passage of severe storms, including thunderstorms.

3. A measurable lunar and solar tide.

Although the instrument above described has only been in operation since last May, many interesting types of undulations have been obtained. On Illustration II, appended hereto, three varieties of such undulations or oscillations registered during different weather conditions, are shown.

The record of the 19th of May illustrates the very great and rapid oscillations set up by the passage of a thunderstorm. Upon the extreme left a phenomenal rise of 1.06 feet in less than 5 minutes, is registered, which is followed 20 minutes later by a fall of 1.08 feet in 4 minutes. The notched and complex appearance of the latter portion of the trace appears to be due to interferences of the larger undulations

* Fully described in a paper read before the Toronto meeting of the British Association, entitled "The Great Lakes as a Sensitive Barometer," by the writer.