HOPKINS "BAND ELECTRO-CHRONOGRAPH," CAPABLE OF DIVIDING A SECOND OF TIME INTO ONE HUNDRED THOUSAND AND ONE MILLION PARTS.

The following description and illustrations are taken from the fifth practical article on "Experimental Electrochemistry," by Prof. N. Monroe Hopkins, of the George Washington University, Washington, D. C., published in SCIENTIFIC AMERICAN SUPPLEMENT No. 1517. The article in question is one of a series now running in the SUPPLEMENT. As this new form of high-speed chronograph undoubtedly has other applications than that for which it was designed, namely the study of electrolytic conduction, we deem it of sufficient interest to reproduce a description of this piece of apparatus here.

Figs. 1 and 2 represent the rear and side view of such a band chronograph respectively, which, as will be seen, is direct-driven by a high-speed electric motor. A paper band passes over the chronograph cylinder, and extends over a distance of about ten feet to a loose-running drum-wheel. Were it not for this novel feature, a momentary contact of the pencils carried by the armatures of the two electromagnets shown, would result in a line drawn completely around the chronograph cylinder at the enormous speeds the instrument is designed for, and it would be impossible to tell where the contact was first made. In order to produce a clear record of the times of actually making contacts by the two electro-magnets, Prof. Hopkins introduces a long band of paper, some twenty feet in length, which prevents a line being drawn upon itself even when the cylinder is revolving from 2,000 to 20,000 revolutions per minute, the contact of course being only momentary. With such an arrangement the times of striking of the two electro-magnets, which are upon different circuits, may be studied. Fig. 3 illustrates a chronograph for the highest speeds. Here at the left an electric motor of two horse-power is shown belted up for multiplication of speed to a countershaft, also belted for speed to the chronograph cylinder. In the foreground fifty feet of electrolyte is represented in glass tubes arranged like a hot-water radiator. The diagram in Fig. 4 will make the plan of connections and operation clear. For example, *A* and *B* stand for an electrolyte and wire respectively, arranged for studying their electrical conductivity. *D* is a sensitive ammeter for reading the current flow through the electrolyte with which it is in series and the electro-magnet *E* of the chronograph and the source of electricity, which is reached through the switch *H*. *C* is a rheostat of the non-inductive variety, for bringing the circuit including the wire *B* to the same resistance as the circuit containing the electrolyte *A*; and *F* represents in dotted lines the same delicate ammeter shifted in series with the wire and the electro-magnet *G* of the chronograph, and the source of electricity through the same switch *H*. Having "balanced" the two circuits perfectly, by making them of exactly the same resistance, the chronograph cylinder is speeded up, and when the desired speed has been reached the switch is thrown, and the two electro-magnets allowed to strike their records upon the flying band. Any differences in time of conductivity between the two classes of conductors may be calculated from the differences in length of the two record lines, or rather their points of contact. In the article in SUPPLEMENT No. 1515, electrolytes of different constitutions are studied, compared with each other as well as to wires. Interesting evidence in support of the electrolytic dissociation theory is also advanced, and methods of determining the absolute velocities of ions are given.

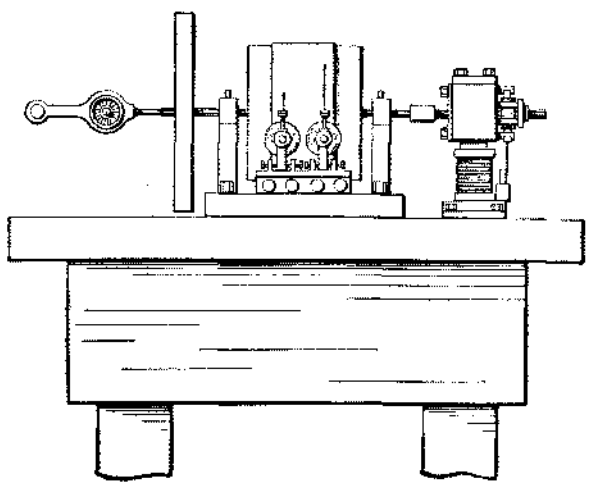

Fig. 1.—REAR VIEW OF HOPKINS HIGH-SPEED BAND ELECTRO-CHRONOGRAPH.

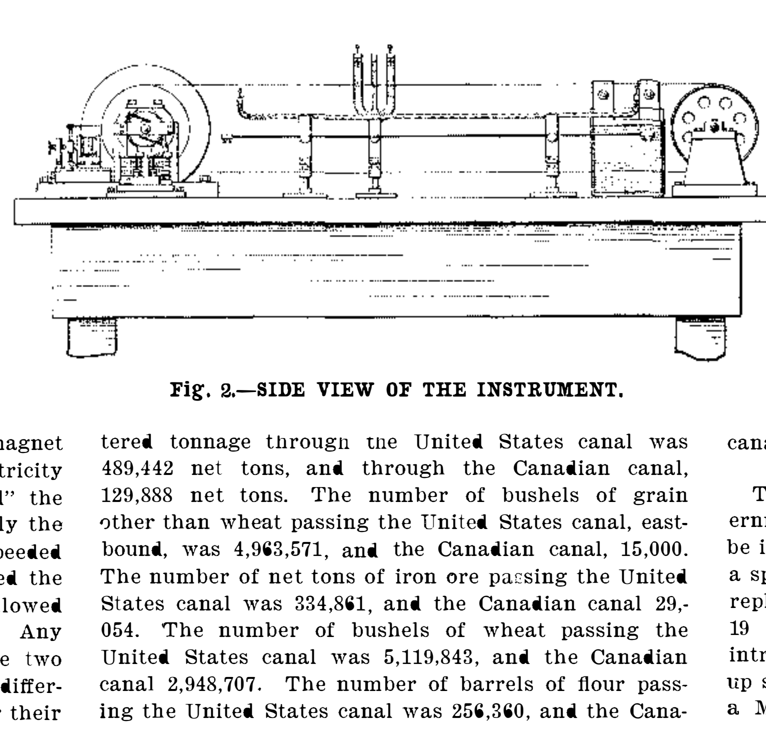

Fig. 2.—SIDE VIEW OF THE INSTRUMENT.

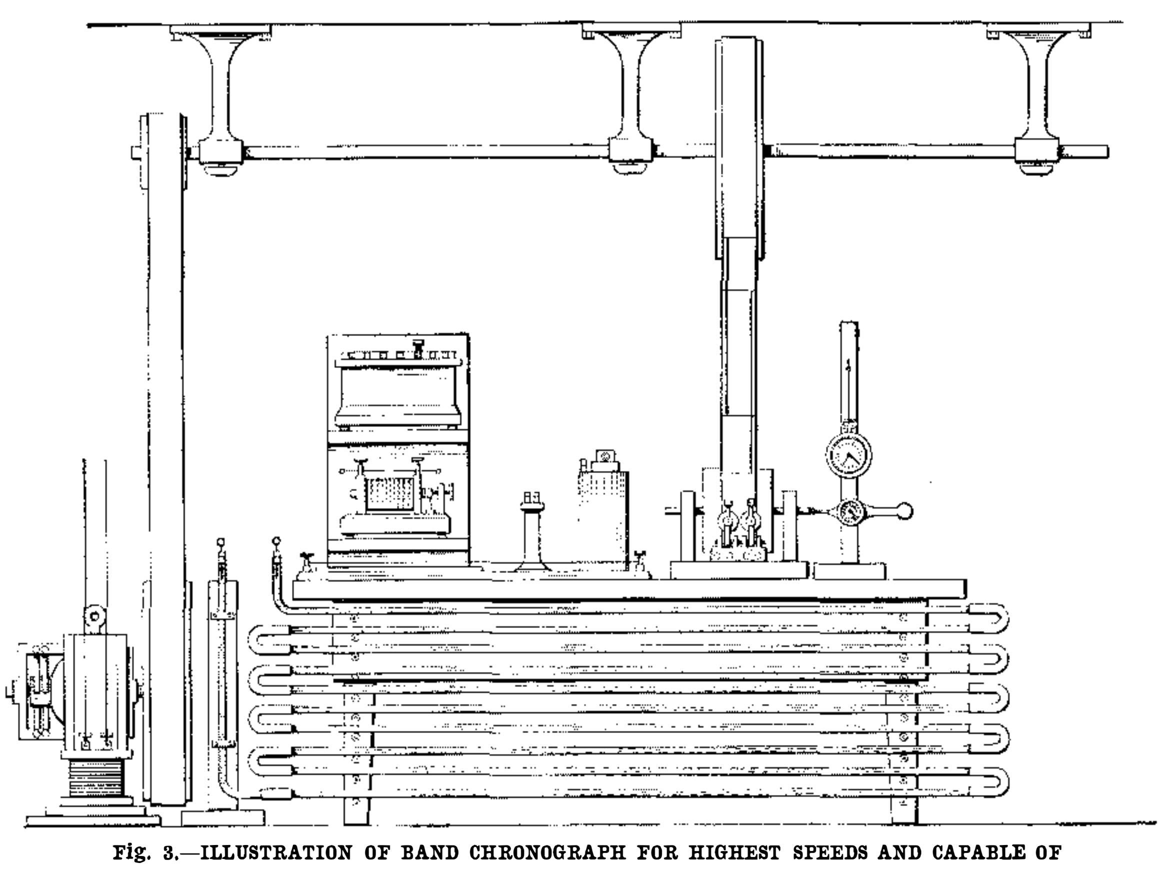

Fig. 3.—ILLUSTRATION OF BAND CHRONOGRAPH FOR HIGHEST SPEEDS AND CAPABLE OF DIVIDING A SECOND INTO ONE MILLION PARTS.

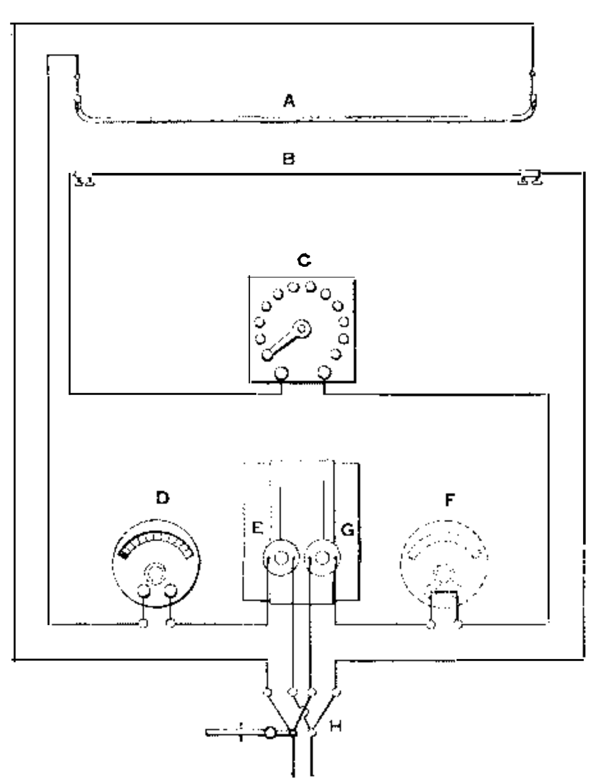

Fig. 4.—DIAGRAM OF CONNECTIONS OF BAND ELECTRO-CHRONOGRAPH.

Lake Traffic Passing the "Soo."

The United States engineering office at Sault Ste. Marie, Mich., reports the following information regarding lake commerce through the American and Canadian canals at Sault Ste. Marie, Mich., and Ontario, for the month of December, 1904: Number of net tons east-bound freight, 816,973; west-bound freight, 153,892 net tons. The total number of vessels passing through the United States canal was 242, and through the Canadian canal, 144. The total registered tonnage through the United States canal was 489,442 net tons, and through the Canadian canal, 129,888 net tons. The number of bushels of grain other than wheat passing the United States canal, east-bound, was 4,963,571, and the Canadian canal, 15,000. The number of net tons of iron ore passing the United States canal was 334,861, and the Canadian canal 29,-054. The number of bushels of wheat passing the United States canal was 5,119,843, and the Canadian canal 2,948,707. The number of barrels of flour passing the United States canal was 256,360, and the Canadian canal 146,724. The quantity of lumber passing the United States canal was 15,389 M. feet B. M., and the Canadian canal 223 M. feet B. M. The shipments of general merchandise passing the United States canal amounted to 1,193 net tons, and through the Canadian canal 182.5 net tons. In west-bound traffic there was 19,300 net tons of hard coal passing through the United States canal, and not any through the Canadian canal; 87,520 net tons of soft coal passing through the United States canal, and 26,302 net tons passing through the Canadian canal; 5,611 net tons of general merchandise passing through the United States canal, and 6,728 net tons passing through the Canadian canal. There were no passengers through the United States canal, west-bound and 35 through the Canadian canal; 18 passengers east-bound through the United States canal, and 90 through the Canadian canal.

The United States canal was opened May 5 and closed December 13, 1904; season, 223 days. The Canadian canal was opened April 30 and closed December 25, 1904; season, 240 days. The following is a statement of the traffic for the season of 1904; Number of net tons east-bound freight, 24,213,902; west-bound freight, 7,332,204 net tons. The total number of vessels passing through the United States canal was 12,153, and through the Canadian canal, 3,967. The total registered tonnage through the United States canal was 20,160,042 net tons, and through the Canadian canal 4,204,096 net tons. The number of bushels of grain other than wheat passing the United States canal, east-bound, was 27,877,071, and the Canadian canal, 5,148,372. The number of net tons of iron ore passing the United States canal was 17,207,260, and the Canadian canal 2,428,537. The number of bushels of wheat passing the United States canal was 20,248,-392, and the Canadian canal 29,684,477. The number of barrels of flour passing the United States canal was 2,774,863, and the Canadian canal 1,935,325. The quantity of lumber passing the United States canal was 894,324 M. feet B. M., and the Canadian canal 28,956 M. feet B. M. The shipments of general merchandise passing the United States canal amounted to 57,038 net tons, and through the Canadian canal 38,336 net tons. In west-bound traffic there was 880,417 net tons of hard coal passing through the United States canal, and 110,-811 net tons passing through the Canadian canal; 4,589,501 net tons of soft coal passing through the United States canal, and 874,140 net tons passing through the Canadian canal; 419,390 net tons of general merchandise passing the United States canal, and 217,245 net tons passing the Canadian canal. The number of passengers through the United States canal, west-bound, was 12,029, and through the Canadian canal 5,789; passengers east-bound through the United States canal 9,577, and through the Canadian canal 10,300.

The fleet of nine steamers which the Belgian government maintains for the cross-Channel service is to be increased by the addition of a turbine steamer with a speed of 23 knots. It is said that Belgium intends to replace gradually all the old steamers of a speed of 19 knots by turbine steamers similar to that to be introduced shortly. The new steamer is to be fitted up splendidly. Among other conveniences it will carry a Marconi apparatus and a searchlight.