No. 881,479. PATENTED MAR. 10, 1908.

E. B. MERRIAM.

CHRONOGRAPH.

APPLICATION FILED JULY 22, 1904.

Fig. 1.

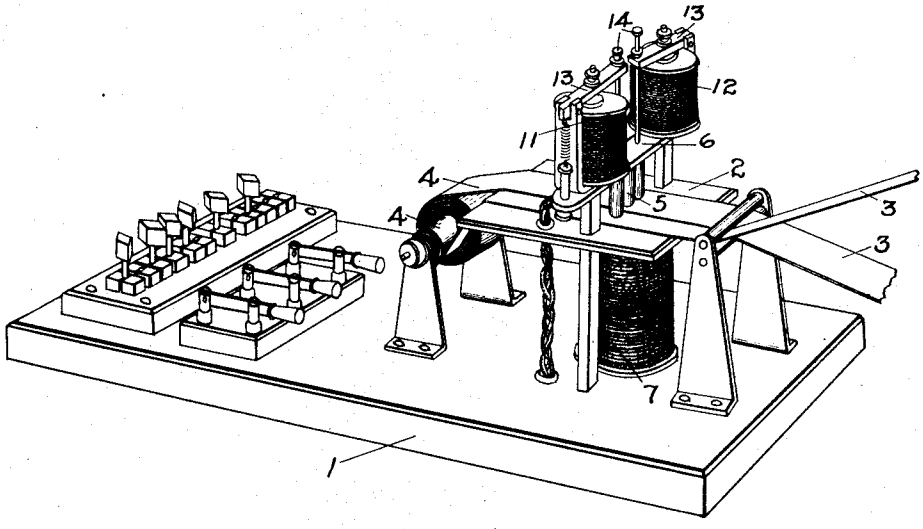



Fig. 2.

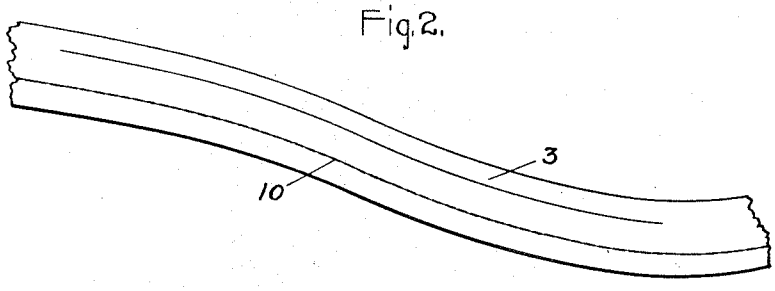



Fig. 3.

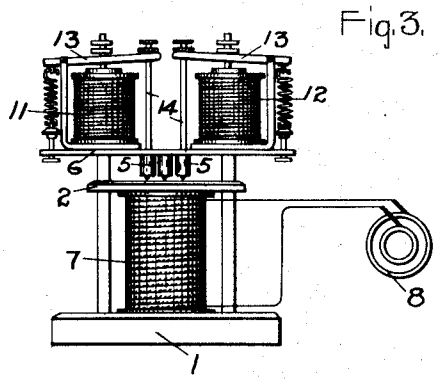
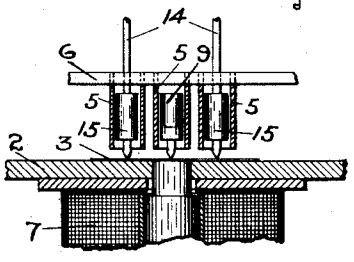



Fig. 4.




WITNESSES:

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# UNITED STATES PATENT OFFICE.

EZRA B. MERRIAM, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## CHRONOGRAPH.

No. 881,479. Specification of Letters Patent. Patented March 10, 1908.

Application filed July 22, 1904. Serial No. 217,639.

*To all whom it may concern:*

Be it known that I, EZRA B. MERRIAM, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Chronographs, of which the following is a specification.

This invention relates to apparatus for making simultaneous records, on one or more traveling surfaces, of the expiration of time intervals and other data which it is desired to compare.

Heretofore in nearly all chronographic apparatus of which I am aware, the measurement of the time has been done by a clock, whose operation has been recorded either mechanically or electrically on the record element. It has also been proposed to photographically record the vibrations of a tuning-fork whose number of vibrations per second for a given musical note are known. My invention differs from both of these modes of getting an accurate time record, and is in many ways far simpler. Inasmuch as the modern alternating-current generator supplies a current whose frequency is very constant, I take advantage of this fact by using such a current to energize an electromagnet whose armature carries a recording element, such as a marking point resting on a traveling record element. The point will trace a continuous line, but at every alternation of the current the armature is attracted and consequently the pressure it exerts on the point is alternately heavy and light. This causes said point to produce a line which is composed of a series of alternately heavy and light portions corresponding exactly with the frequency of the current, and since this is known, it is easy to read the elapsed time down to fractions of a second corresponding with the frequency.

In the accompanying drawing, Figure 1 is a perspective view of an apparatus embodying my invention; Fig. 2 illustrates a portion of a record; Fig. 3 is an end elevation; and Fig. 4 is a section of a portion of the electromagnet and its armature.

On a suitable base 1 is erected a table 2 over which the record strip or strips 3 can be drawn by suitable mechanism from rolls 4. Above each strip is located one or more upright guides 5, preferably tubes of non-magnetic material such as brass, depending from a transverse bridge 6.

In each tube is a weight of soft iron carrying on its bottom a marking point resting on the record strip. The lower end of the tube does not touch the strip, there being sufficient space between the tube and the table to permit the strip to travel freely. Immediately below one of said tubes, with its axis in line with that of the tube, is an upright electromagnet 7, whose coil is in circuit with an alternating-current generator 8 of known frequency. At every alternation of the current, the armature or weight 9 in line with the core of said electromagnet is attracted strongly by said magnet, so that the marking point bears more heavily on the record strip. The result is that a line 10 is drawn which is made of alternate light and heavy portions equally spaced and corresponding exactly with the frequency of the current. If this is a 60 cycle current, there will be 120 dots or short dashes made every second on the strip. It is evident that these will be independent of the speed of the strip, so that any irregularity in the feed of said strip is immaterial. Other records may be made on said strip, or on parallel strips simultaneously with the time record. These additional records may be made mechanically or electrically. In the drawing, I have shown two electromagnets, 11 12, mounted on the bridge 6 and provided with pivoted armatures 13 carrying rods 14 connected with weighted marking points 15 in the guide-tubes 5. Each electromagnet may be in circuit with some apparatus whose performance during a given time it is desired to record, such for example, as the speed of stroke on an oil switch, the time when the parts of a motor-starting switch start, the time it takes a spring to compress, the duration of a short-circuit on a given machine, the time necessary for a motor or other piece of apparatus to obtain a known speed, the calibration of the time limit relays of an electric system, the acceleration of vehicles, time required for various metals to fuse under the action of electric current, etc., and so on.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the appa-

ratus shown is merely illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,

1. Means for recording the frequency of an alternating current, comprising an electromagnet connected to be energized by said current, a table above the same, a bridge over said table, a guide depending from said bridge in line with said electromagnet, and a loose weight in said guide carrying a marking point.

2. Means for making records, comprising a traveling record carrier, a main recording device coöperating therewith, a time recording device having a movable part, a source of alternating current of known frequency, and means for actuating said movable part in unison with the alternations of said current.

3. Means for making records, comprising a traveling record carrier, adjacent recording devices coöperating therewith, a source of alternating current of known frequency and a marking device connected to be actuated by said current for producing alternating light and heavy marks corresponding with the cycles of said alternating current of known frequency.

In witness whereof, I have hereunto set my hand this 20th day of July, 1904.

EZRA B. MERRIAM.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.