A. H. RUSSELL.

ELECTRO CHRONOGRAPH.

No. 174,444. Patented March 7, 1876.

Fig. 1

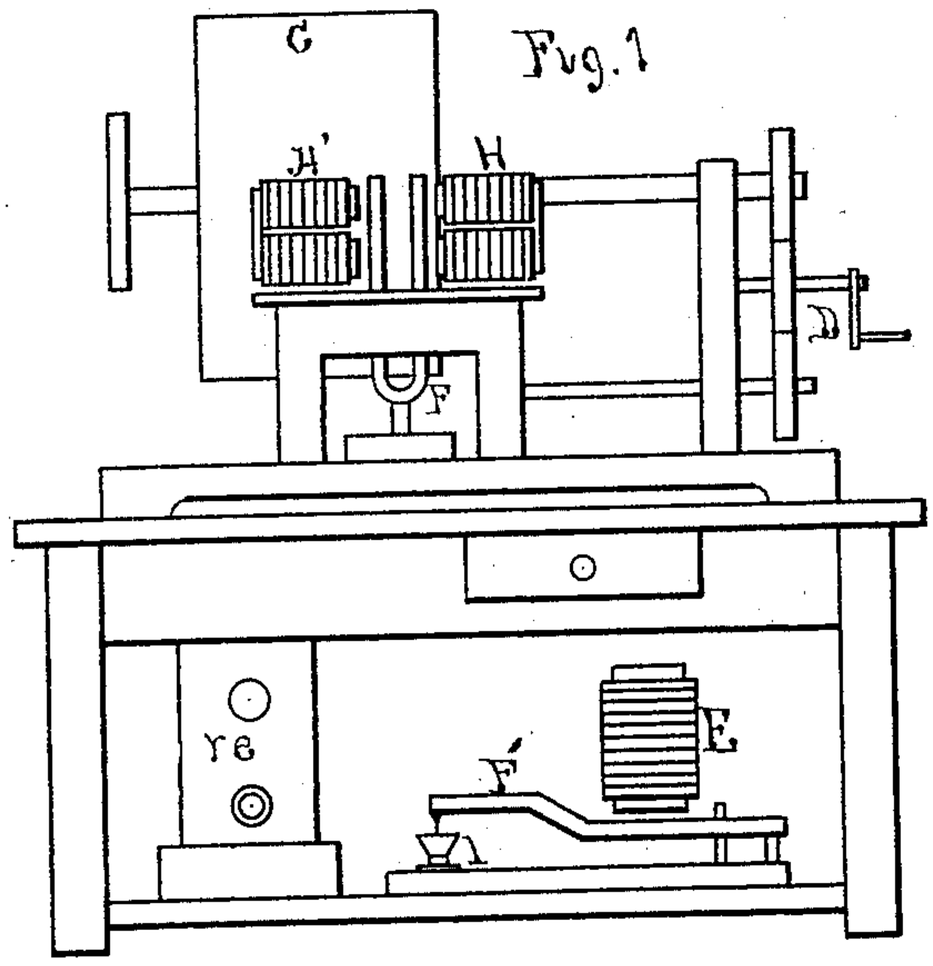


Fig. 4

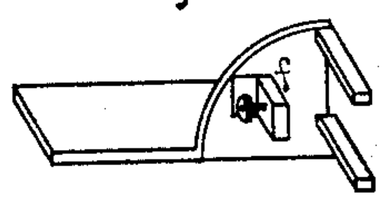


Fig. 2

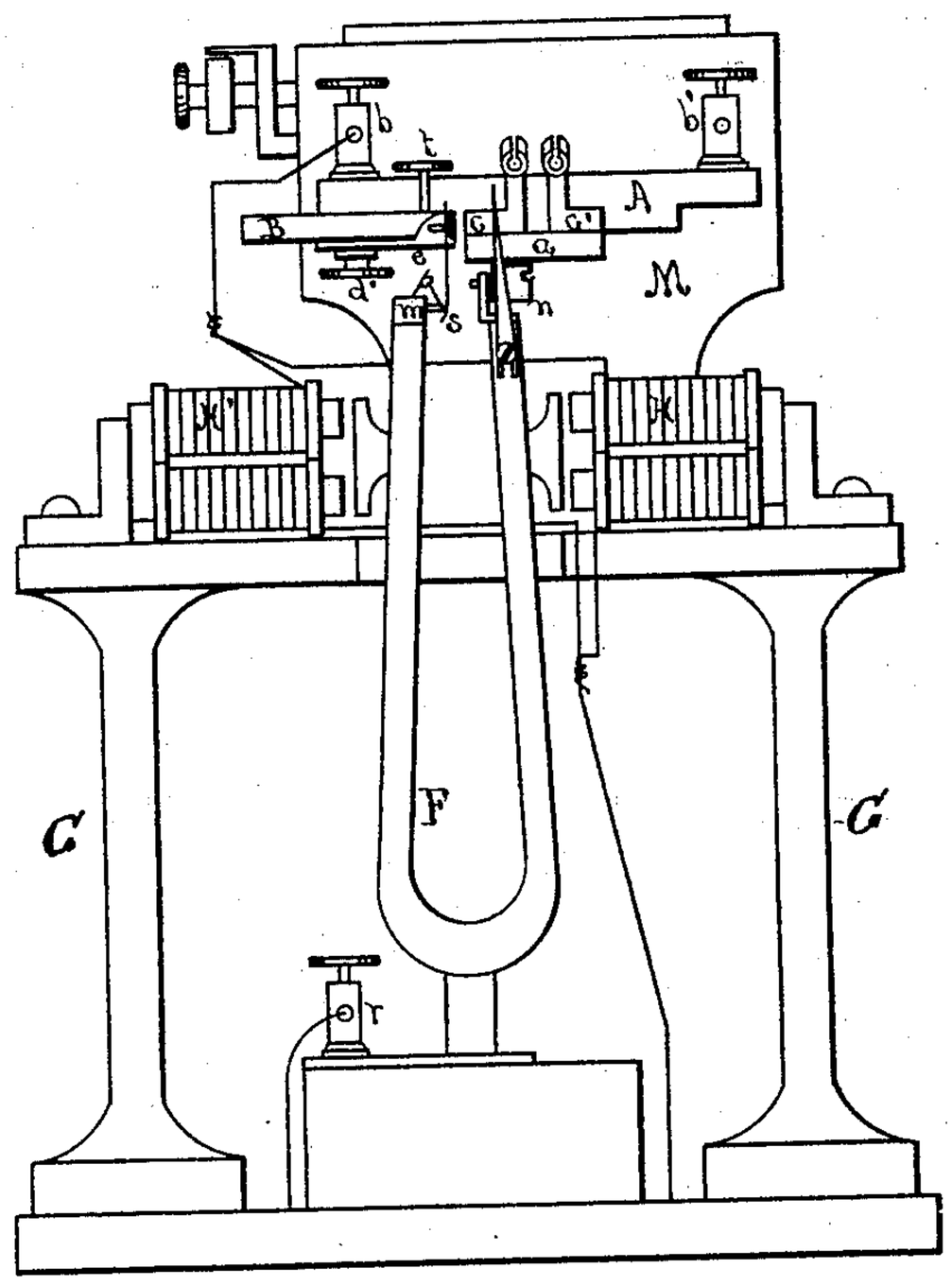
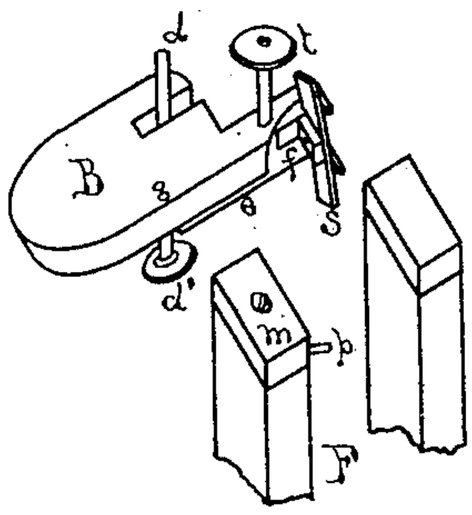


Fig. 3



Witnesses.

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UNITED STATES PATENT OFFICE.

ANDREW H. RUSSELL, OF UNITED STATES ARMY.

IMPROVEMENT IN ELECTRO-CHRONOGRAPHS.

Specification forming part of Letters Patent No. 174,444, dated March 7, 1876; application filed February 3, 1876.

To all whom it may concern:

Be it known that I, Lieut. ANDREW H. RUSSELL, of the United States Army, have invented a new and useful Improvement in Electro-Chronographs, of which the following is a full, clear, and exact description, reference being had to the drawings accompanying and forming part of this specification.

This invention is an improvement upon the Schultz electro-chronograph, in which small intervals of time are measured by means of a sinuous line traced by the extremity of a tuning-fork, vibrating an ascertained number of times per second, upon the surface of a rotating cylinder, which form of chronograph is well known.

The tuning-fork stands in a vertical position in front of the rotating cylinder, and its vibrations are originated and sustained by means of electro-magnets on each side of it, in the manner well known in certain forms of acoustic apparatus.

Means are provided for making a mark upon the cylinder at any desired moment of time; but this is not necessary to describe, as my improvement relates to other parts of the apparatus.

The necessary alternate magnetization and demagnetization of the magnets which sustain the vibrations of the tuning-fork is caused by the breaking and closing of the circuit by means of an interrupter automatically operated in such a manner that the succession of currents is produced in unison with the vibrations of the tuning-fork, which will always make the same number of vibrations in each second. This interrupter consists of a steel beam, one end of which is fixed to a suitable support, and the other, extending beneath an electro-magnet and over a small cup containing mercury, has a piece of platinum attached, which touches the surface of the mercury, unless the beam is drawn up by the attraction of the magnet.

One pole of the battery is connected with the mercury in the cup by a platinum wire, and the other pole to the beam by a wire which forms a part of the circuit through the electro-magnet above the beam, and those on each side of the tuning-fork.

On making connection with the battery, all the magnets will become excited, the prongs of the tuning-fork will be drawn apart, and the beam will be attracted and the platinum point raised from contact with the mercury. This will break the circuit, the magnets will all be demagnetized, the tuning-fork will commence to vibrate, and the beam will be released and complete the circuit, as before, and thus a succession of currents will be automatically produced.

These interruptions must be in unison with the vibrations of the fork, in order that the latter may continue; for, if not in unison, the vibrations of the fork would be arrested, or retarded, rather than sustained, and consequently the beam must vibrate in unison with the fork. This is difficult to maintain, owing to the changes in the temperature of the atmosphere and other causes, unless means of adjustment are provided, which consist of a sliding weight placed on the beam, which, when raised, changes the time of its rise and fall, or a means for moving the mercury-cup up and down, which accomplishes the same result.

These adjustments, which are indispensable to the successful use of the apparatus, are nevertheless exceedingly delicate and difficult to make, and it is found very troublesome and difficult to maintain the interruptions of the circuit exactly in unison with the vibrations of the tuning-fork for any length of time, a very slight difference being sufficient to retard the movement of the fork and render precision and accuracy in working with the apparatus impossible.

To avoid the necessity for these adjustments and dispense with the use of the mercurial circuit-closer is the object of my invention, which consists in so arranging a spring in connection with the tuning-fork that the latter acts as its own interrupter, whereby the construction of the apparatus is much simplified.

This improvement, by dispensing with the extra electro-magnet for the beam, enables the chronograph to be operated with less battery-power than when the mercurial circuit-closer is used.

In the drawings referred to, Figure 1 is a diagram showing sufficient of the working parts of a Schultz chronograph of the usual form

to understand my improvement. Fig. 2 is a view in elevation of my improvement, showing the tuning-fork and spring-interrupter in position, and the connections complete. Fig. 3 is a view showing the form in which I construct the spring-interrupter more fully, and Fig. 4 is another form of the spring-interrupter.

In these figures similar letters refer to similar parts.

Referring to Fig. 1, G is the cylinder of the chronograph, and D is the train by means of which it is rotated. F is the tuning-fork, and H H′ are the magnets which originate and sustain its vibrations. F′ is the interrupter, and E is the magnet which operates it, and I is the mercurial circuit-closer. The magnets E H H′ are in the same circuit which is interrupted at I. In Fig. 2, F is the tuning-fork. H H′ are the magnets on each side, properly supported on the frame G. M is a vertical frame attached to the frame G, and A is a table fastened to the frame M. Upon the table A are the binding-screws by which connection is established with the battery and induction-coil used with the apparatus, the function of which it is not necessary to describe. B is a brass plate, which is fastened underneath the table by the screw *d*, which works through the slot *g* in the plate into the base of the thumb-screw *b*. This screw *d* has a milled head at *d′*. *e* is a strip of brass, which, at one end, is riveted or screwed to the brass plate B underneath, and at the other end has projections, which serve to hold the steel spring S, which is at a right angle to the strip *e*. This steel spring S may be a small piece of watch-spring. I is a screw, which works through the plate B, against the strip *e*, so that the strip can thereby be raised or lowered, thus moving the end of the spring S horizontally. By this means the end of the spring S is made to bear against a platinum point, *p*, fixed on the inner side of one end of the tuning-fork. The fork and spring are connected with the opposite poles of a battery, and the current is closed and broken at *p* by the vibrations of the fork. The connections are shown in Fig. 2. *r* is a thumb-screw attached to the base of the fork, for receiving one wire from the battery, and the other wire passes around the electro-magnets to the thumb-screw *b*, and thence to the spring S. The connection with the battery having been adjusted, the circuit is completed at *p* by a turn of the screw *t*, and the electro-magnets, becoming excited, draw the prongs of the tuning-fork apart. This causes an interruption of the circuit at *p*, the fork flies back, and the circuit is again closed; and thus, by this automatic breaking and closing of the circuit, the vibrations are maintained as long as connection is established with the battery. The steel spring S may be attached to the strip *e* by a screw, as shown in Fig. 4, or any other suitable form of attachment may be used.

The adjustments necessary for maintaining the vibrations of the fork are readily and easily effected at the spring-interrupter, as will be readily seen.

I am aware that it is not new to make a tuning-fork act as its own interrupter, such a device being found in certain forms of acoustic apparatus; but in these apparatus mercurial circuit-closers have been used. These interrupters are not suitable for use in chronographs in which the tuning-fork acts as its own interrupter, for the reason that they necessitate placing the tuning-fork horizontally, which is a very inconvenient position, and therefore a spring-interrupter is the only form that can be used.

The form of spring-interrupter which I have described is that which I have found most suitable; but I do not confine myself to the use of this particular form, but any other form which will answer the purpose can be used, and it may be arranged in connection with the fork in any other way besides that which I have described which will accomplish the desired result.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an electro-chronograph, the combination, with the tuning-fork which marks the rotating cylinder, of a spring-interrupter, substantially as and for the purpose set forth.

2. The combination of the tuning-fork F, having the platinum point *p*, the spring-interrupter, consisting of the strip *e* and spring S, the plate B, table A, adjusting-screws *t d*, and electrical connections, substantially as and for the purpose set forth.

ANDREW HOWLAND RUSSELL.

Witnesses:

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