(No Model.) 2 Sheets—Sheet 1.

E. WESTON.

TELEGRAPHIC RELAY.

No. 511,005. Patented Dec. 19, 1893.

Fig. 1.

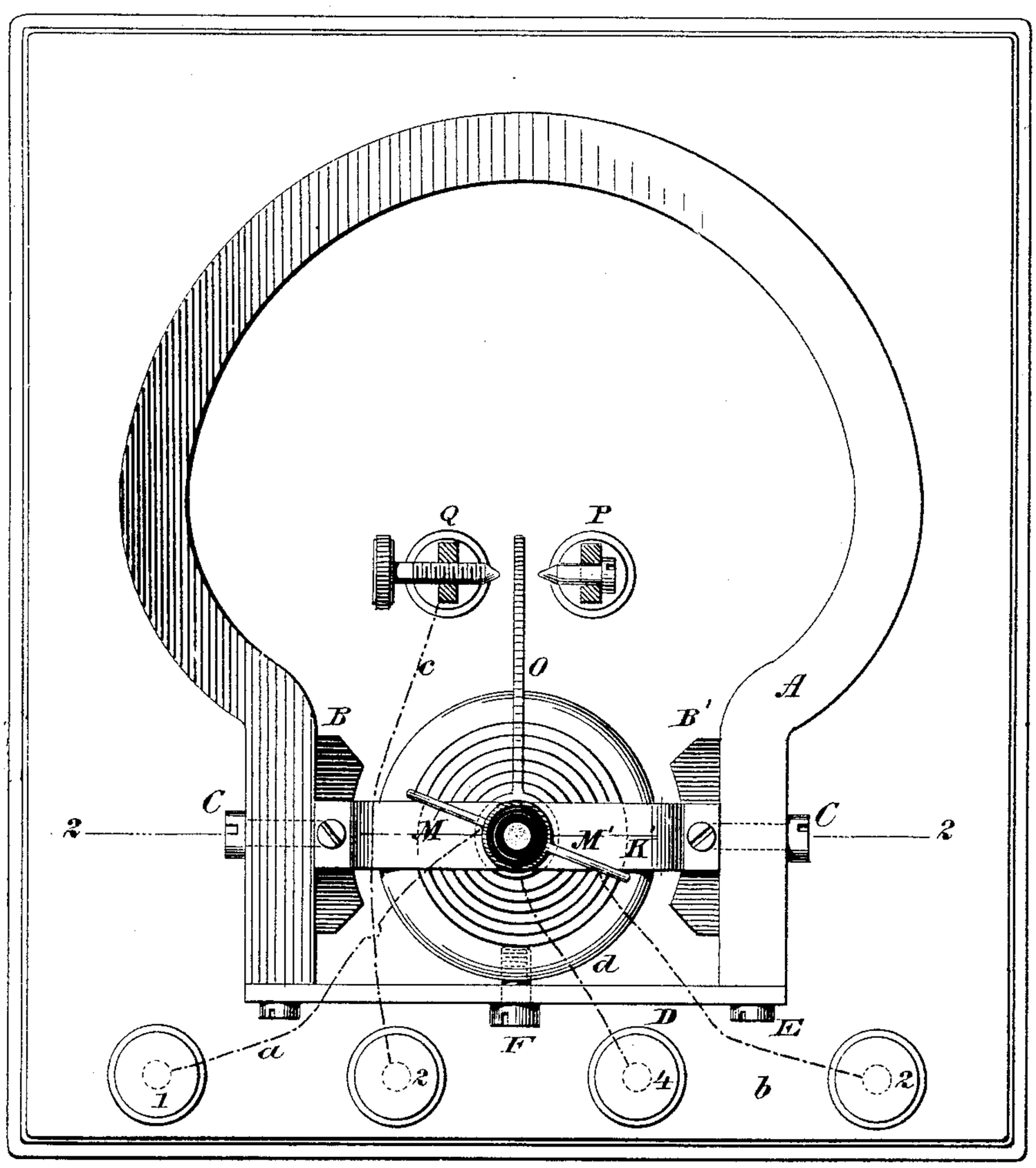
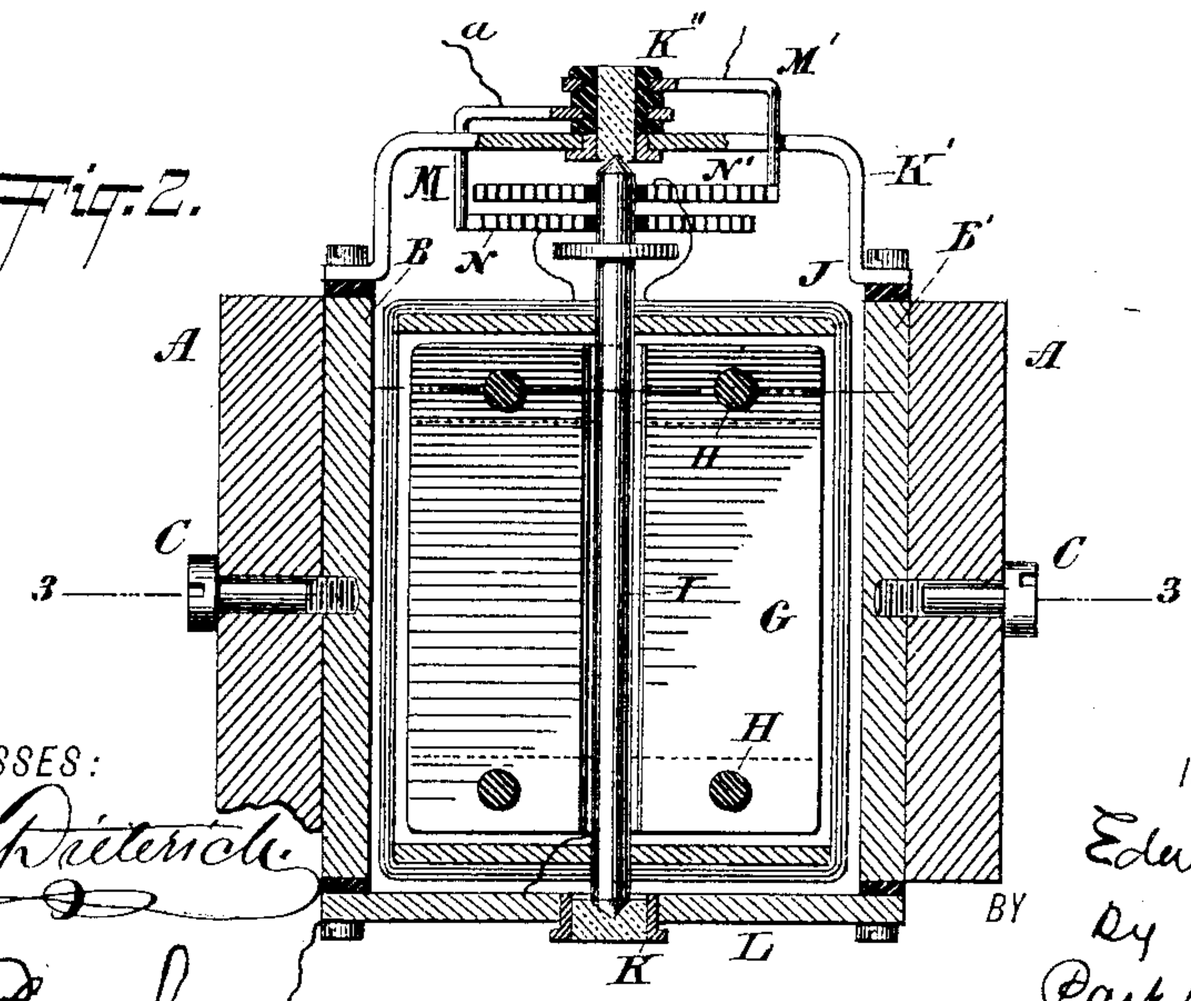


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

E. WESTON.

TELEGRAPHIC RELAY.

No. 511,005. Patented Dec. 19, 1893.

Fig. 3.

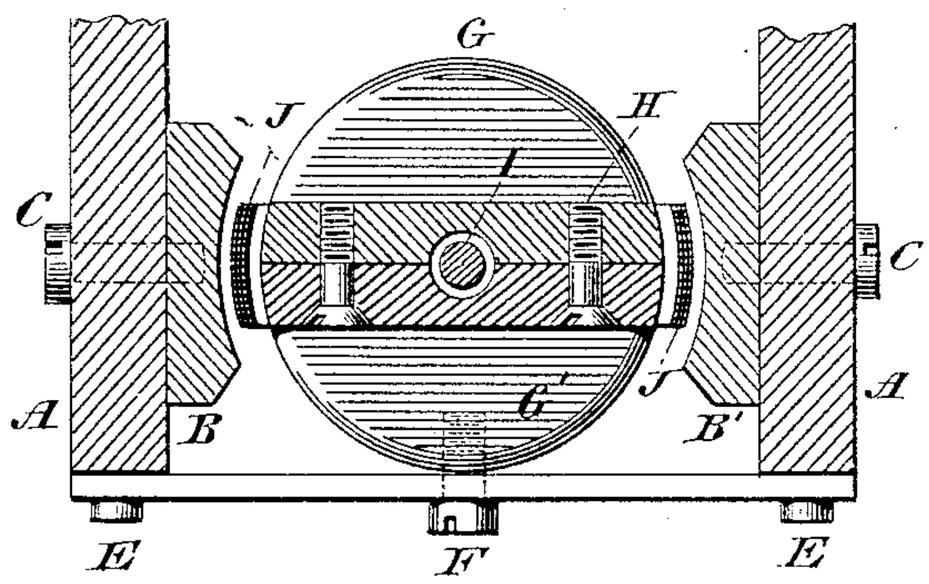


Fig. 4.

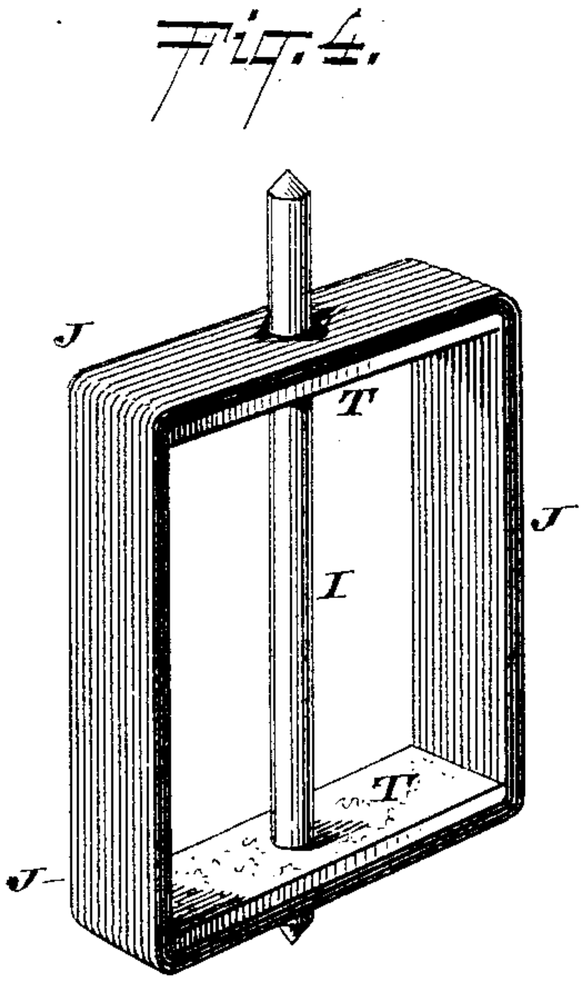
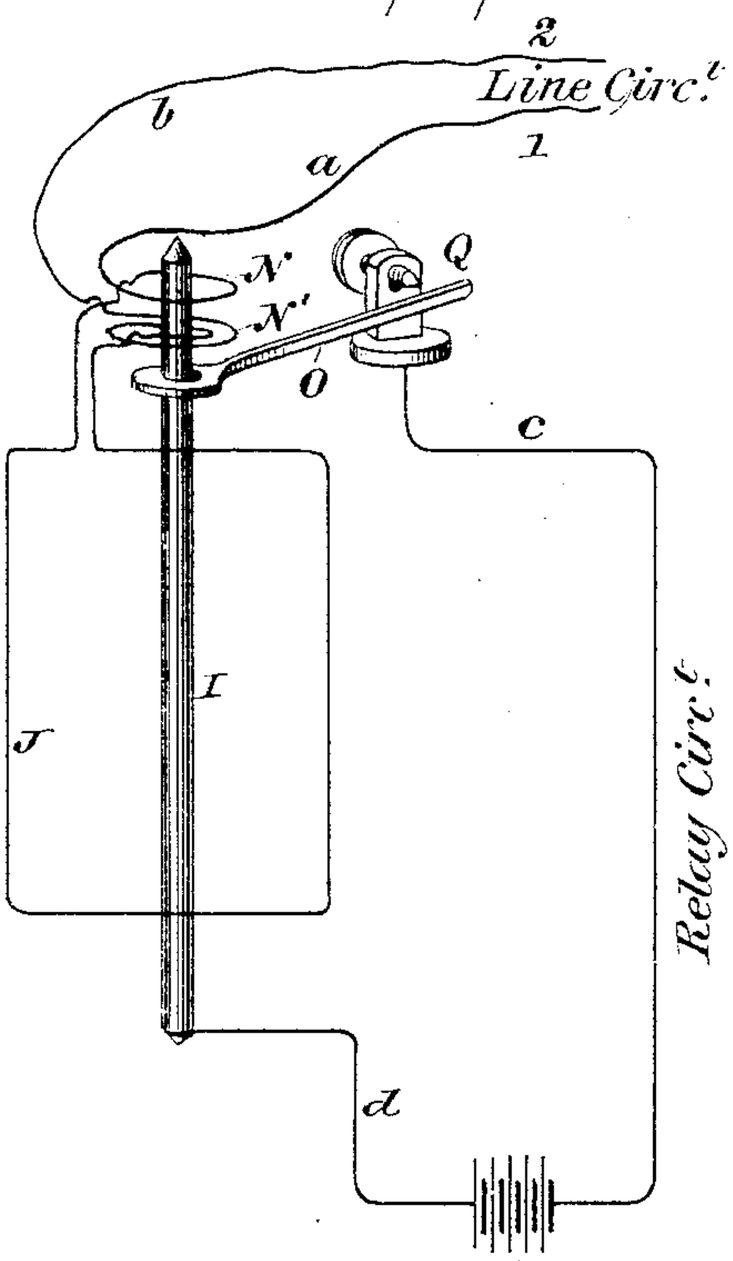


Fig. 5.



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EDWARD WESTON, OF NEWARK, NEW JERSEY.

TELEGRAPHIC RELAY.

SPECIFICATION forming part of Letters Patent No. 511,005, dated December 19, 1893.

Application filed June 4, 1891. Serial No. 395,133. (No model.)

To all whom it may concern:

Be it known that I, EDWARD WESTON, of Newark, Essex county, New Jersey, have invented a new and useful Improvement in Telegraphic Relays, of which the following is a specification.

The principle of my invention is as follows:—to organize an apparatus embodying a conductor in coil or loop form supported in a field of force, which conductor, on being traversed by a current coming over the main line, will vibrate, and in so vibrating will cause, a local circuit to be established, or broken, or the current thereon to be varied.

My invention consists in the construction and arrangement of the apparatus substantially as hereinafter set forth.

In the accompanying drawings, Figure 1 is a plan view of my improved relay. Fig. 2 is a sectional view on the line 2, 2 of Fig. 1. Fig. 3 is a sectional view on the line 3, 3 of Fig. 2. Fig. 4 shows the movable coil separately, and Fig. 5 is a skeleton diagram of the circuit in the instrument.

Similar letters and figures of reference indicate like parts.

The general construction of my apparatus is substantially similar to that for which Letters Patent have already been granted to me on November 6, 1888, No. 392,387. There are, however, certain important differences which adapt the instrument for use as a telegraphic relay as well as for a variety of other purposes, which differences I will particularly point out in the course of the following specification.

A is a permanent magnet, the polar extremities of which have their inner faces relatively flat and parallel. To said inner faces are attached pole pieces B B′, by means of screws C. The opposing faces of the pole pieces B B′ are concave, as shown. Extending across the ends of magnet A is a bar D of brass or other non-magnetic material, which is secured in place by screws E. Attached to the middle bar D, by means of the screw F, is a cylinder G of soft iron or other magnetic material. This cylinder is made in two parts, G G′, Fig. 3, secured together by screws H, and a central opening extends longitudinally through it. This opening receives the shaft I of a coil J of insulated wire. The coil J surrounds the cylinder G, and extends through the annular space between said cylinder and the pole pieces B B′. The shaft I, at one end, is pivoted in a jeweled bearing K, which is supported in a bar L fastened by screws to the lower side of the pole pieces B B′, as shown in Fig. 2. The upper end of the shaft is stepped in a similar jeweled bearing K″, which is received in a bent bar K′, which is secured by screws to the upper sides of the pole pieces B B′. The bearing K″ has a sleeve of insulating material upon which freely turn the two bent arms M M′. The end of the arm M is connected to the outer extremity of a spring N. The inner extremity of the spring N is fastened to a collar of insulating material, which is fast on the shaft I. The bent end of the arm M′ is fastened to the outer end of a spiral spring N′, the inner end of which is secured to a collar of insulating material, also fast upon the shaft I. The springs N N′ are watch springs and may be wound in relatively opposite directions. By rotating either arm M or M′ on the sleeve K″, the initial tension of either spring may be adjusted at will. The shaft I carries a light contact arm O, which moves between the fixed stop P and the adjustable stop Q.

When the instrument is used as a telegraphic relay, the circuits proceed as follows. (See Fig. 5.) The line circuit connects with binding post 1, and thence proceeds by wire *a* to arm M, to spring N, to and through coil J, to spring N′, to bar M′, and by wire *b* to binding post 2. The local or relay circuit proceeds from binding post 3, by wire *c* to adjustable stop Q, and thence, when the bar O is brought into contact with said stop, through the shaft I, to fixed bar L, to wire *d*, and thence to binding post 4.

In operation, when the current comes over the line circuit, the coil J tends to set itself in a position transverse the lines of force of the magnet A, and it therefore rotates on its pivots, and so moves the contact arm O into contact with the adjustable contact stop Q, thus establishing local or relay circuit whenever an impulse comes over the line.

I will now point out the new and distinctive features of the present apparatus. The instrument shown in my prior patent, No. 392,387, is a measuring apparatus, the extent of movement of the coil depending upon difference of potential in the circuit being indicated, and said potential difference or current strength, thereon depending, being measured. In my present device, while the movement of the coil depends as before upon potential difference, the extent of movement is not measured, nor is it material so long as it be sufficient to move the circuit-closing arm of the relay circuit into and out of contact with its stop. Again, in my said prior Patent No. 392,387, the movable coil is connected with a mass of copper, or other diamagnetic material, which, as is well known, finds a resistance in the field of force, which resistance, when said mass is moved, tends to bring it speedily to rest. In my prior instrument I utilize that principle in order to make the index needle "dead beat." In my present device, the main thing needed is great sensitiveness of the coil, so that it will respond instantly and quickly to any current, however small, which may pass through it. It, therefore, becomes important not to provide the coil with any means tending to retard or check its motion. And in fact it is desirable to make the coil as light as possible, so that the retarding effect of its own inertia will be reduced. With this object, I prefer to construct the coil as represented in Fig. 4, making it a helix wound upon two transverse bars or supports T of paper or light metal, which are secured to the pivot shaft I. The vertical portions of the coil, therefore, which enter the field, are merely parallel strands of fine wire. The resistance of the coil to its impressed motion due to the current is, in this way, reduced to a minimum.

Instead of making the soft iron cylinder as a single solid block, I here make it in halves united together by the screws H. This is for convenience in introducing the shaft I. In lieu of placing the pair of springs N and N′ on opposite ends of the shaft I, as in my aforesaid prior patent, I here dispose them near the same end. By this arrangement, access to them for purposes of adjustment may be had without making it necessary to go to the back of the instrument, or to turn the instrument over. The contact arm O is preferably to be made of aluminium or other light metal.

The great advantage of this instrument over all other forms of relay with which I am acquainted, is the exceedingly small amount of current required for its operation. The embodiment of the same principle in an instrument such as I have illustrated in my prior patent before referred to, has resulted in a measuring apparatus of extreme sensibility and accuracy, a fact which has been abundantly demonstrated by the construction of large numbers of such instruments and by their use for several years under the most varied, difficult and exacting conditions. It is safe to say that this apparatus will work under a current strength of much less than one ten-thousandth of an ampère.

Any one skilled in the art of telegraphy will readily appreciate the resulting advantages which include all the possibilities flowing from longer main lines, less battery power, and line conductors of smaller cross section, coupled with a certainty and accuracy of operation both, so far as I am aware, theoretically and practically beyond that of any similar apparatus now known.

I desire here to give notice that I do not limit my invention to an instrument having a movable coil J composed of a single loop conductor. I may make said coil of two conductors differentially wound, or otherwise construct it in analogous manner to adapt the instrument for use in multiplex telegraphic systems. So also I do not limit myself to a single pair of springs arranged at one end of the pivot shaft, because I may add a second pair of springs in the same way at the other end of said shaft. This arrangement would be advantageous in using two coils as above set forth, one pair of springs leading the current into and out of one coil, and the other pair of springs leading the current into and out of the other coil. The winding of the springs, whether in the same or reverse directions will depend entirely upon the adjustments of the coil found desirable.

I claim—

1. The combination in an electrical apparatus of a magnet, a fixed body of magnetic material disposed in the field of force of said magnet, and a coil of conducting material surrounding said fixed body and supported on a pivoted shaft passing through said body.

2. The combination in an electrical apparatus of a magnet, a coil rotary on a diametral axis in the field of force of said magnet, a pivot shaft supporting said coil and two springs both applied to the said shaft near one end thereof.

3. The combination in an electrical apparatus of a magnet, a coil rotary on a diametral axis in the field of force thereof, a pivot shaft supporting said coil, two springs applied to said shaft near one end thereof, and means for varying the strength of said springs.

4. The combination in an electrical apparatus embodying a means of producing a field of force, and a loop conductor rotary in said field, of a pivot shaft and a support of insulating material for said loop conductor upon said shaft.

5. The combination in a telegraphic relay of a permanent magnet A, a coil J supported and rotary between the poles of said magnet, pivoted shaft I of said coil, contact arm O carried by said shaft, and contact stop Q in the path of said arm; the said coil J being disposed in main, and the said shaft I, contact arm O

and stop Q being disposed in relay or local circuit.

6. The combination in an electrical apparatus with a magnet A, coil J in the field of force of said magnet, and coil pivot shaft I, and the reversely-wound spiral springs N N′, each having one end secured to said shaft I, and their opposite ends secured to suitable abutments, and both disposed at or near the extremity of said shaft I.

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