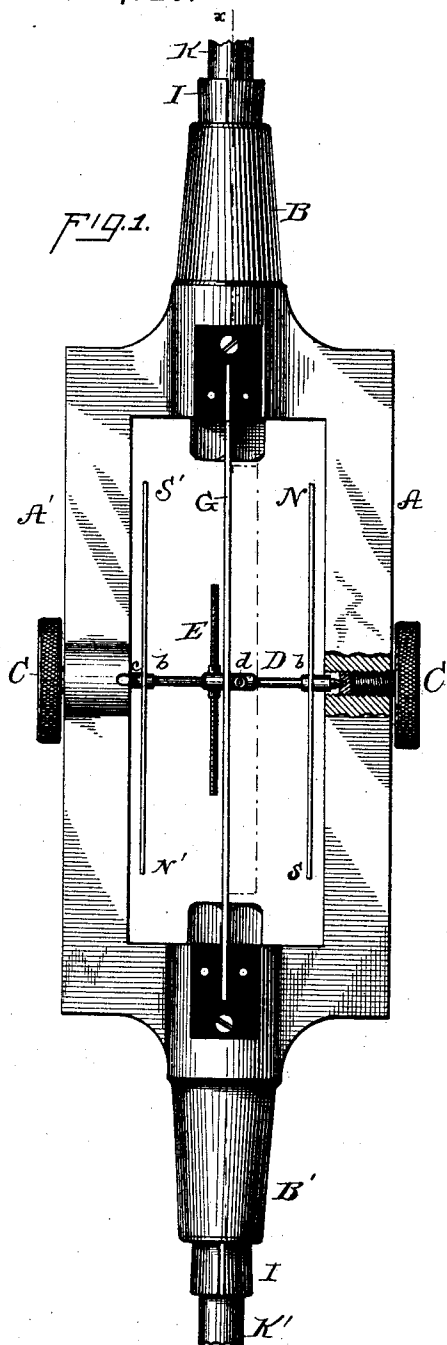


(No Model.)

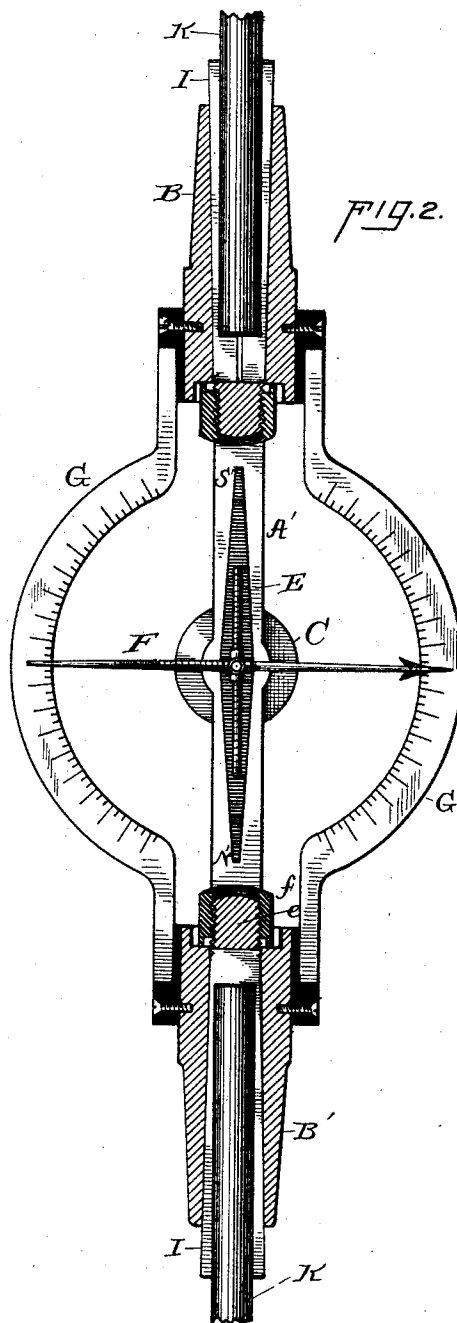
M. WADDELL.
ELECTRICAL INDICATOR.

No. 371,720.

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ATTEST:
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UNITED STATES PATENT OFFICE.

MONTGOMERY WADDELL, OF NEW YORK, N. Y.

ELECTRICAL INDICATOR.

SPECIFICATION forming part of Letters Patent No. 371,720, dated October 18, 1887.

Application filed March 19, 1887. Serial No. 231,555. (No model.)

To all whom it may concern:

Be it known that I, MONTGOMERY WADDELL, of the city of New York, in the county and State of New York, have invented a certain new and useful Improvement in Electrical Indicators, of which the following is a specification.

My invention relates to an indicator of amount and direction of current, designed especially for use in the circuits of electric-lighting systems, and my object is to provide an indicator which shall be accurate and delicate in operation, not liable to get out of adjustment, and not affected by the earth's magnetism, or by that of dynamo-electric machines near which it may be placed, and which shall not interpose any extra resistance in the circuit. My indicator, also, is of simple and cheap construction and of compact form and neat appearance.

The main feature of my invention consists in the providing of a split or divided conductor, forming part of the circuit whose current is to be indicated, between the divisions of which are pivoted two oppositely-magnetized needles turning together on the same pivoted spindle, and each placed as closely as possible to one division of the conductor. The current passing in the same direction through the two divisions of the conductor causes the two oppositely-magnetized needles to tend to turn in the same direction, their tendency being to place themselves at right angles to the conductor, and the reversal of the current causes them both to turn in the opposite direction.

My invention further consists in various novel devices and combinations of devices employed by me in accomplishing the above-named objects, as hereinafter set forth and claimed.

My invention is illustrated in the annexed drawings, in which—

Figure 1 is a front elevation of an indicator embodying my invention, and Fig. 2 a vertical section of the instrument on the line $x x$ of Fig. 1.

A and A' are two straight conducting-bars joined at their ends, so that they form side pieces of an oblong frame, from the ends of which extend tapered sleeved extensions B B',

for making connections to the instrument. This frame is preferably cast of copper. Each of the side bars has a screw-threaded perforation at its middle, and in these perforations are set the screws C C, which form bearings for a shaft or spindle, D, extending across the middle of the frame. The ends of the screws C C preferably have jeweled recesses, and the spindle D has pointed ends stepped therein, whereby the minimum of friction is produced.

Near each end of the spindle is placed thereon, upon a squared portion between a shoulder, b, and a nut, c, a permanently-magnetic needle, N S or N' S', the two needles being oppositely magnetized, as indicated by the positions of these letters.

The middle portion of the shaft is enlarged, and this enlarged part d has two screw-threaded holes extending through it at right angles to each other, through one of which passes the screw-threaded rod E and through the other the pointer F, which is screw-threaded at its middle part.

Secured in any desired way to the ends of the frame are the arcs G G, which are graduated to form a scale, along which the pointer or index plays on one side or the other. The scale, as shown, is a thin curved metal bar set into blocks H H, of hard rubber or other insulating material, secured to the ends of the frame. I prefer to so insulate the scale, though it is not absolutely necessary, since the current which will pass through it, if not insulated, is usually immaterial. Moreover, the scale may itself be made of insulating material and secured directly to the metal of the frame. The instrument thus constructed is interpolated in the conductor the current on which is designed to be measured or indicated. The means which I have shown for this purpose form an additional feature of my invention.

In the tubular extension B is inserted a tapering split sleeve, I, having a screw-threaded end, e. In this sleeve is placed the end of the conductor K, and then upon the inner end of the sleeve, which extends inside the frame, is screwed a nut, f, which draws the parts of the sleeve together upon the conductor and draws the whole tightly together. At the other end of the instrument the other part of the severed conductor K K' is connected in the same way,

and the two sides A A' of the instrument thus form a split or divided conductor, through the two divisions of which the current of course passes in the same direction.

5 The connecting device just described may evidently be used in other situations for the purpose of making connections to other forms of electrical apparatus or instruments. After the indicator is thus connected in the circuit, 10 the needles are so adjusted as to set themselves parallel with the conductors when there is no current therein. This is done by screwing the rod E into or out of the spindle, so that the weight of its downwardly-extending 15 part will hold the needles in the position desired. By this adjustment the needles can be brought usually to the right position; but a more delicate adjustment is provided by also screwing the pointer F into or out of 20 the shaft, so as to bring more or less of its weight on one side or the other. Thus, if the position of the instrument is not absolutely true the needles can still be adjusted to bring them parallel with the conductor. Then, since 25 the tendency of a magnetized needle is to set itself at right angles to a conductor in proximity to which it is placed, when current flows in the circuit the needle N S will turn so as to move the pointer in the direction of the 30 current, and since the needle N' S' is oppositely magnetized and is on the opposite side of a conductor whose current is in the same direction, this needle will turn in the same direction as N S, and the two needles will move 35 together against the weight of the rod E, and the direction and amount of the current will be indicated upon the scale by the pointer. As the current increases or decreases the needles turn to a greater or less distance from their 40 normal position, since they are retracted by the weight of rod E, and these variations are shown by the pointer. By the use of the two needles a double effect is produced, so that the smallest variations of current produce a considerable change in the position of the pointer. 45 A reversal of the current causes the needles to move back so that the pointer passes across the zero-point of the scale and still points in the direction of the current, and the amount of 50 the reversed current and any variations thereof will be indicated.

Since the effect on the needles of the current varies inversely with the square of the distance, the effect on each needle of the opposite 55 side of the conductor will be so small as to be inappreciable, for, as stated, each needle is placed as close as possible to its own conductor. The magnetism of the earth or that of dynamo-electric machines or other magnetic bodies in 60 the vicinity will have no effect upon the instrument, since it will affect the two needles equally and oppositely.

While indicators such as above described are adapted for use in any desired situation, 65 they are especially adapted to be placed in the circuits leading from the several dynamo-electric machines of a system of electrical distri-

bution, since in such systems it sometimes occurs that one machine will take current from the others and run as a motor. My indicator, 70 however, shows instantly the reversal of the current, no matter how slight the current may be, and the machine can be at once regulated to obviate this. Also, when a machine is to be disconnected from the circuit and its current 75 is reduced, as usual, before breaking the circuit, until it begins to receive current from the line, the indicator shows the gradual reduction of current, and shows also the instant when the current is reversed, so that the machine can instantly be thrown off. The instrument is also especially adapted to be placed 80 in the neutral wire of a feeder of a three-wire system.

The instrument shown is intended to be 85 placed in an upright or vertical position, or substantially so. Such an instrument can, however, be used in a horizontal position if the rod E is put through the shaft in the other direction, so that it will hang downwardly and 90 oppose the tendency to movement of the needles.

What I claim is—

1. In an electrical indicator, the combination of a split or divided conductor and two 95 oppositely-magnetized needles pivoted together between the divisions thereof, substantially as set forth.

2. In an electrical indicator, the combination of a split or divided conductor, two oppositely-magnetized needles pivoted together 100 between the divisions of said conductor, and a retracting device for said needles, substantially as set forth.

3. In an electrical indicator, the combination of a split or divided conductor, two oppositely-magnetized needles pivoted together 105 between the divisions of said conductor, and an adjustable retracting device for said needles, substantially as set forth.

4. In an electrical indicator, the combination of a split or divided conductor, a turning spindle extending across between the divisions 110 of said conductor, two oppositely-magnetized needles on said spindle, each situated close to one of said divisions, and an adjustable retracting-weight on said spindle, substantially as set forth.

5. In an electrical indicator, the combination of a split or divided conductor, a spindle 120 extending across between the divisions of said conductor, two oppositely-magnetized needles on said spindle, each situated close to one of said divisions, and a rod passing adjustably through said spindle, substantially as set forth. 125

6. In an electrical indicator, the combination of a split or divided conductor, a turning spindle extending across between the divisions 130 of said conductor, two oppositely-magnetized needles on said spindle, each situated close to one of said divisions, and a rod and a pointer both passing adjustably through said spindle, substantially as set forth.

7. In an electrical indicator, the combina-

tion of a frame consisting of two straight metal sides joined at their ends and provided with means for connecting said frame into a circuit, a turning spindle extending across between
5 the sides of said frame, two oppositely-magnetized needles on said spindle, and an adjustable retracting-weight and a pointer on said spindle, substantially as set forth.

8. The combination, with the frame, of the
10 tapered sleeved extensions, the tapered split sleeves adapted to enter said extensions and to receive the ends of electrical conductors, and the nuts adapted to be placed upon the ends of said split sleeves, substantially as set
15 forth.

9. In an electrical indicator, the combination of the split or divided conductor, the two magnetized needles pivoted together between the divisions of said conductor, the adjustable retracting device for said needles, the pointer
20 turning with said needles, and the scale over which said pointer moves, substantially as set forth.

This specification signed and witnessed this 18th day of March, 1887.

MONTGOMERY WADDELL.

Witnesses:

WM. PELZER,
E. C. ROWLAND.