H. G. WEBSTER.

ELECTROMAGNET.

APPLICATION FILED SEPT. 28, 1907.

1,128,562.

Patented Feb. 16, 1915.

2 SHEETS—SHEET 1.

Fig. 1

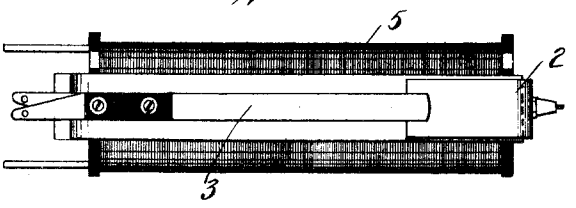


Fig. 2

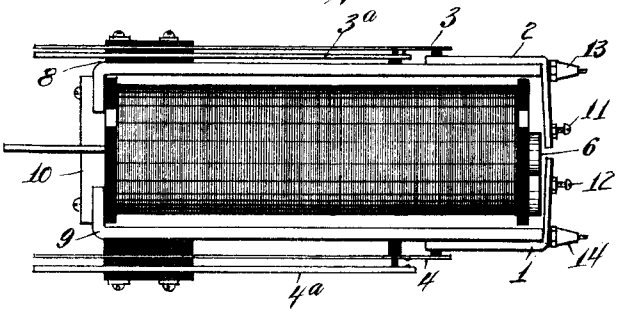


Fig. 3

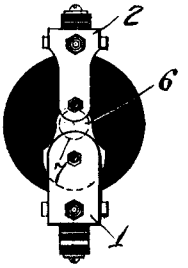
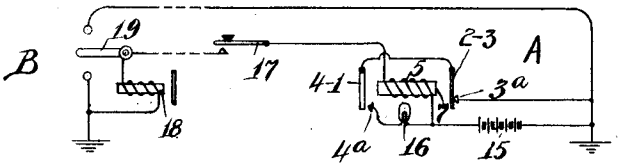


Fig. 4



Witnesses

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2 SHEETS—SHEET 2.

Fig. 5

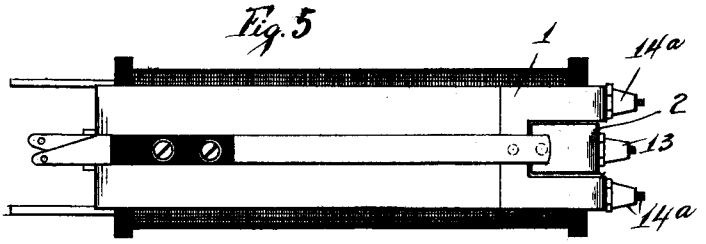


Fig. 6

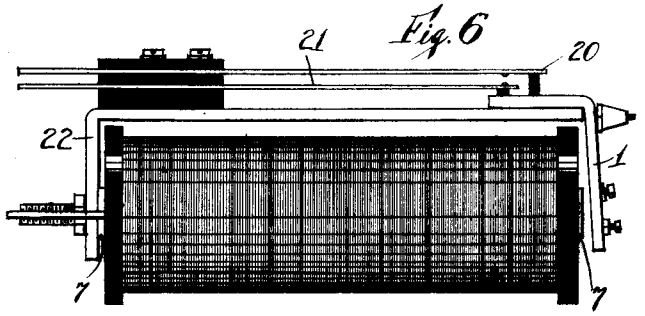


Fig. 7

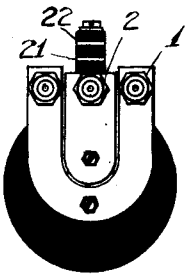


Fig. 8

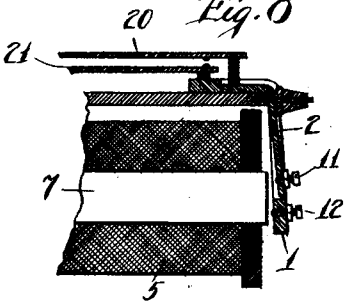
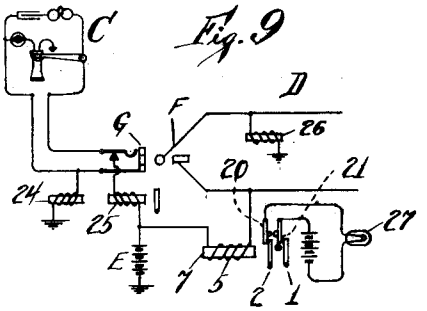


Fig. 9



Witnesses
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UNITED STATES PATENT OFFICE.

HARRY G. WEBSTER, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, A CORPORATION OF ILLINOIS.

ELECTROMAGNET.

1,128,562. Specification of Letters Patent. Patented Feb. 16, 1915.

Application filed September 28, 1907. Serial No. 395,025.

To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, residing in Chicago, county of Cook, and State of Illinois, have invented new and useful Improvements in Electromagnets, of which the following is a specification.

My invention relates more specifically to an electromagnet or relay for differential operation responsive to varying current values; that is one in whose use a relatively small current flow will produce one circuit change and a greater current flow will alter the circuit condition produced by the first flow.

The relay of my invention is well adapted for use in connection with telephone work. It may for instance be employed for supervisory service in connection with an operator's connection circuit, in which case the relay initially operated over a local circuit to display a supervisory signal will be further operated to end the display when the subscriber removes his receiver, a circuit of lower resistance being thereby established. For such service the relay must not only be responsive to current changes in an ascending ratio, but when the subscriber replaces his receiver producing a current flow of the former lesser value, the relay must operate to again display the signal. This is an exacting service to put such a relay to and the relay of my invention is well calculated to meet the requirements indicated.

I am aware that various double-acting relays are known in the art, for instance, relays depending on mechanical adjustments of their armatures as by spring tension or weights to render them more or less readily operable.

My present invention realizes its object, to produce a simple and reliable structure of the indicated character, primarily by the employment of two armatures which may be independently mounted, one of which exposes a relatively greater area than the other to the electromagnetic action of the core of the relay.

Another feature of the invention is found in a peculiar return magnetic circuit employed which will be hereinafter fully explained.

Referring to the drawings, Figures 1, 2 and 3 show respectively top, side and end views of a relay embodying my invention. Fig. 4 illustrates diagrammatically a circuit environment suitable for the relay of the preceding figures. Figs. 5, 6 and 7 are respectively side, top and end views of another embodiment of my invention, whereof Fig. 8 is a sectional view. Fig. 9 shows a circuit environment suitable for the relay of Figs. 6 to 8.

Referring first to Figs. 1 to 4, the relay consists of a winding 5 disposed about a core 7 which may have, as indicated in Fig. 3, a pole piece 6 of magnetic material narrow above and broader below, the upper part being opposite the narrow angular armature 2, while the lower part is opposite the broader angular armature 1, although I am not limited to this specific arrangement. Said armatures are mounted, being secured by suitable pins and nuts 13, 14, upon knife edges of the pieces 8—9, respectively, of magnetic material which extend rearwardly to positions adjacent to, but not contacting with, the distant end of the core, the T shaped block 10 of non-magnetic material being screwed to pieces 8—9 to support them out of actual contact with the core. A suitable screw and nut (11—12) is provided for each armature, the screws being preferably of brass and arranged for adjustable extension through the armatures 1, 2 to limit the degree of proximity to which they may be attracted to pole piece 6. They are preferably adjusted so that neither armature when attracted actually touches pieces 6, as in such case there would be a distinct tendency for the first attracted armature to magnetically shirt-circuit the one to be attracted last and prevent its actuation. It is owing to the above consideration that I regard it in certain respects preferable that the customary heel irons 8, 9 should not contact with the distant end of the core, there being preferably two gaps of low permeability in the magnetic circuit of each armature. I prefer, however, to employ the magnetic pieces 8, 9 for portions of the magnetic circuits from armature to distant end of core, as to entirely omit them would produce an electromagnet of low efficiency. Contact spring 3, with its contact 3^a, and 4,

with its contact 4ª, are insulated and mounted in the usual way for actuation by their respective armatures 2, 1 in an obvious and well known manner.

In Fig. 4, station A wishing to signal station B, depresses key 17 current flowing from grounded battery 15 through winding 5 about core 7, through magnet 18 to ground. Armature 1 of greater area is attracted on the energization of winding 5, limited by the resistance of magnet 18, and closes circuit through lamp 16, contact 4ª and contact 3ª, since armature 2 of less area is not sufficiently magnetized to be attracted and open contact 3ª. Lamp 16 is now lighted and the armature of magnet 18 attracted, this attraction constituting the signal at station B. The attendant at B throws switch 19 to engage its upper or lower contact, magnet 18 being in either case short-circuited and a circuit of lower resistance for winding 5 produced, whose energizing effect upon core 7 is increased, which then magnetizes armature 2 of small area sufficiently to attract it, whereon lamp 16 is extinguished and station A knows station B has received the signal. Station B restores key 19 whereon armature 2 releases because of the reintroduction of resistance 18 in the circuit, and lamp 16 is again lighted because of the closure of contact 3ª, the current being now too slight to hold armature 2 attracted. Station A then knowing the apparatus at B to be in normal condition, releases key 17 and the circuit is ready for further work.

In Figs. 5 to 8, the armature 1, of greater exposure area is stirrup shaped and bent, the armature 2 fitting within the armature 1. In this embodiment of my invention both armatures are mounted upon heel iron 22 which is in magnetic contact with the distant end of the core 7, armature 1 being held in place by the pins and nuts 14ª. When the relay is partially energized, armature 1 only is attracted, closing contact 21, 20 by actuating spring 21 in an obvious manner. When the relay is more fully energized, armature 2 is attracted and opens contact 21, 20 by actuating spring 20. Armatures 1—2 have the adjustable stops 12—11 as described for Figs. 1 to 3.

Fig. 9 shows a telephone line circuit C and enough of an operator's cord circuit D to illustrate an application of my invention. On the subscriber removing his receiver, the resulting elevation of the hook lever completes a conductive bridge of the line limbs and line signal 25 is energized from battery E in the usual manner. The operator inserts plug F in jack G, the respective tip and sleeve contacts registering and the tip contact of the jack being raised to disconnect line signal 25. Current now flows from battery E through winding 5, sleeve, plug and jack contact and over a branch to ground through resistance 24, another branch path controlled by the subscriber's switch-hook, extending over the line limbs through the tip plug and jack contact and to ground through resistance 26. While both branches are closed, both armatures 1 and 2 will be attracted and contact 21—20 open, the supervisory lamp 27 being then unlighted. When, however, the subscriber replaces his receiver, the hook switch opens the conductive bridge of the line limbs, current ceases over the branch through resistance 26, and the current then flowing through winding 5 is only sufficient to hold armature 1 attracted, the armature 2 being retracted, contact 20—21 closed and lamp 27 lighted, the display of the latter signaling the operator to withdraw plug F. Were the operator to insert plug F before the subscriber removes his receiver, the flow from battery E through coils 5 and 24 would be suffcient to cause attraction of armature 1 only displaying lamp 27.

It is apparent that the relay of Figs. 1 to 3 and the local lamp circuit of Fig. 4 may be used in the structure of Fig. 9.

Various changes of mechanical arrangement and circuit environment, not departing from the substance of my invention, will be obvious to those skilled, and I do not limit what I claim to the specific apparatus of the drawings but

What I do claim is:

1. A relay comprising a core and means for energizing the same, a pair of armatures mounted adjacent to said core, one of said armatures presenting to said core a magnetizable area of greater extent than the other, and switch springs controllable by said armatures.

2. A relay comprising a core and means for energizing the same, a pole piece, an armature adjustably mounted adjacent to said core having a relatively great air-gap area with respect thereto, a second armature similarly mounted and having a relatively small air-gap area with respect to said core, said armatures being supported by said pole piece and switch springs controllable by said armatures.

3. An electromagnet comprising a core, a winding therefor, a pole piece, and a pair of armatures adjustably mounted adjacent to said core, one of said armatures having a relatively greater air-gap area with respect to said core than the other, said armatures being supported by said pole piece.

4. A relay comprising a core, an electromagnetic winding for energizing said core, a pole piece, a pair of armatures pivotally supported upon a single alined axis by said pole piece and adapted to be attracted by said core, and switching contacts controlled by said armatures.

5. An electromagnet comprising a coil, a return pole-piece for said coil, two angular shaped armatures pivotally supported by said pole-piece upon a single alined axis, and a contact controlled by each of said armatures.

6. An electromagnet comprising a coil, a return pole-piece for said coil, an angular shaped armature supported by said pole piece, a second armature mounted on said pole-piece within said first armature, and contacts controlled by said armatures.

In witness whereof, I have hereunto subscribed my name this 26th day of September, 1907.

HARRY G. WEBSTER.

Witnesses:
G. E. MUELLER,
CAROLYN WEBER.