No. 646,598. Patented Apr. 3, 1900.

L. CEREBOTANI.

RELAY.

(Application filed Oct. 14, 1899.)

(No Model.)

FIG. 1.

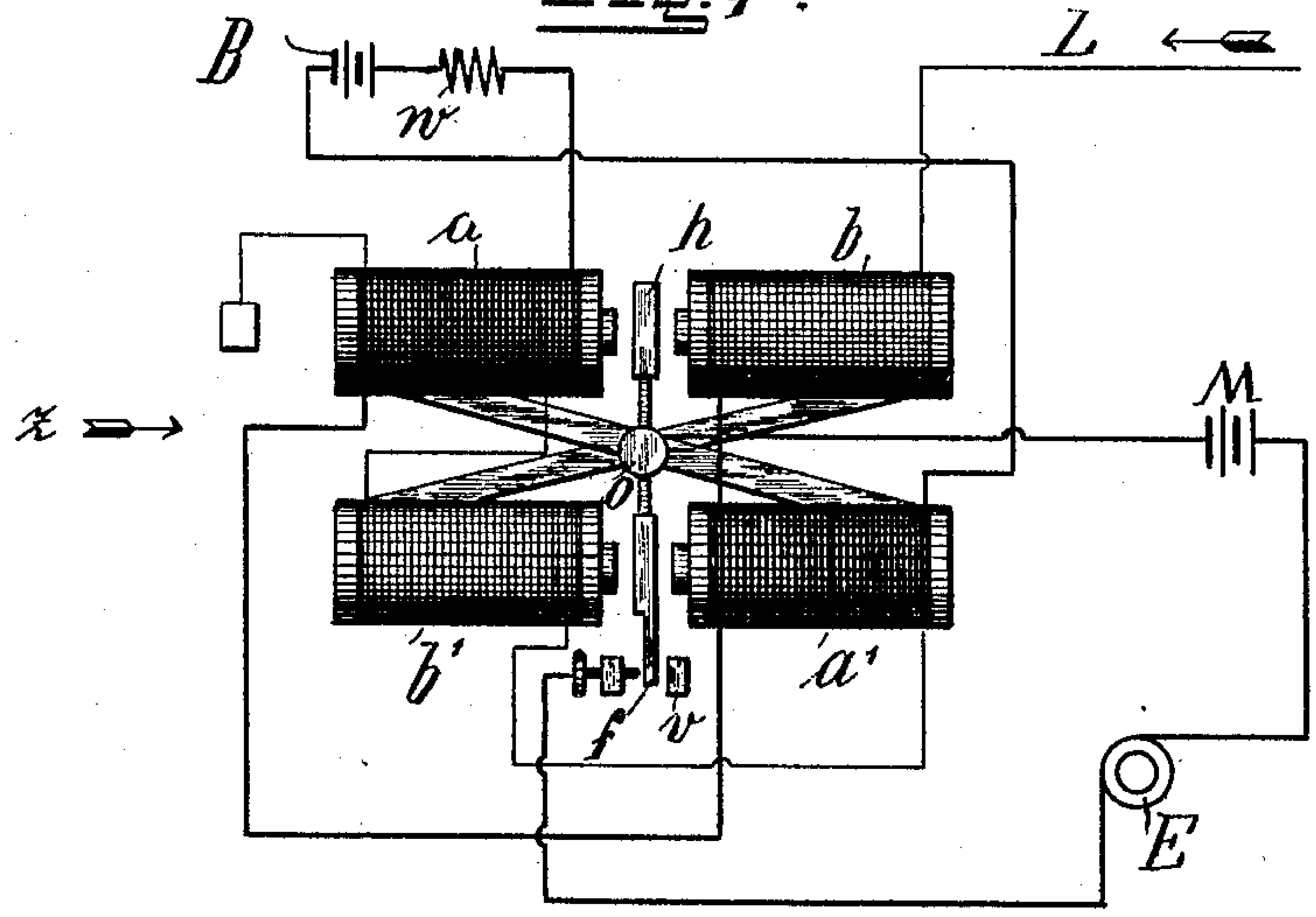


FIG. 2.

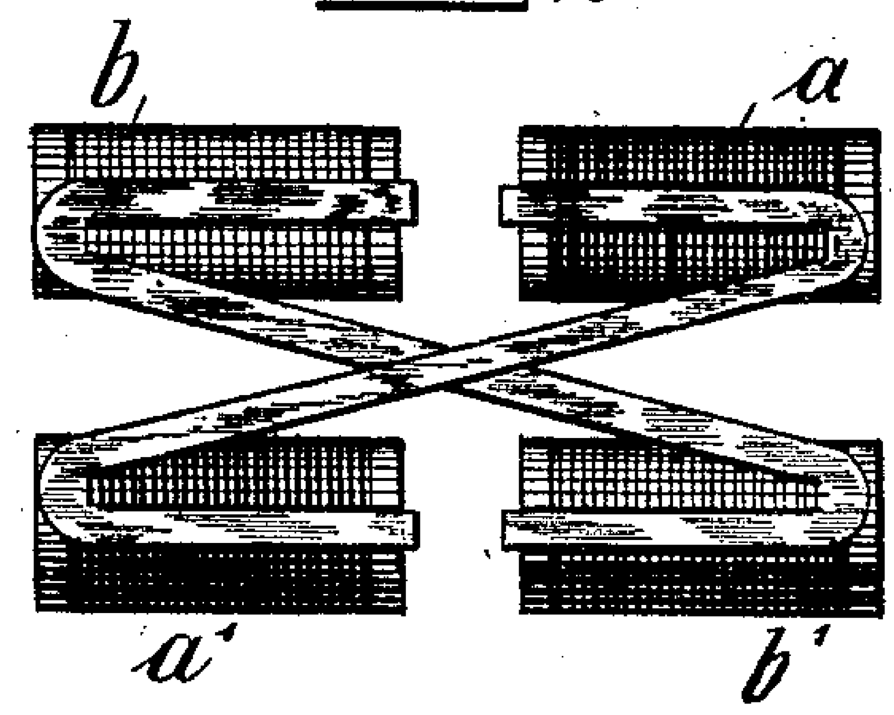
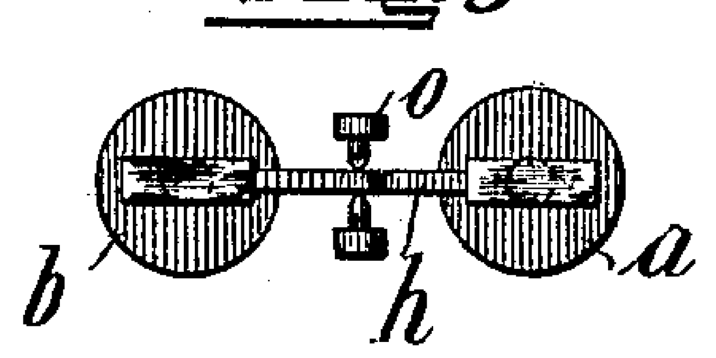


FIG. 3



Witnesses:
H. Schloss.
A. Marx

Inventor
Luigi Cerebotani
By his Attorneys
Alfred Wilhelm [illegible]

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

LUIGI CEREBOTANI, OF MUNICH, GERMANY, ASSIGNOR OF ONE-HALF TO ALBERT SILBERMANN, OF BERLIN, GERMANY.

RELAY.

SPECIFICATION forming part of Letters Patent No. 646,598, dated April 3, 1900.

Application filed October 14, 1899. Serial No. 733,637. (No model.)

To all whom it may concern:

Be it known that I, LUIGI CEREBOTANI, a subject of the King of Bavaria, residing at Munich, in the Kingdom of Bavaria and German Empire, have invented new and useful Improvements in Relays, of which the following is a specification.

The essential features which must characterize a relay which shall be really effective in its operation are as follows; sensibility—*i. e.*, that it responds at once to even the weakest current; obedience—*i. e.*, that all the impulses of current, even the most rapid, are reproduced through the relay; uniformity of the stroke of the armature—*i. e.*, that the energy of the armature-stroke remains the same, even though there should be many variations in the line-current; reliability and permanency of the polarization—*i. e.*, that if the relay is a polarized one its polarization will not undergo any change through alteration in the current; limitation—*i. e.*, that the relay may respond only to currents the strength of which is within certain limits. These features are all united in the relay forming the subject of the present invention.

Figure 1 is a plan view of the relay, showing also the course of the currents. Fig. 2 is an under side view of a part of the apparatus; and Fig. 3 is a vertical section seen in the direction of the arrow, Fig. 1.

The relay consists of two pairs of electromagnets *a a′ b b′*. The arrangement of each of the magnetic pairs is such that one part lies on the right and the other on the left of the armature. The connection of the iron cores is shown in Fig. 2. The lever *h*, turning about the point *o*, forms the common armature *c p*, Fig. 3. It is so constructed that if no force is exerted upon it it remains in any position in perfectly-stable equilibrium. *o* is a set-screw for adjusting the point of suspension.

If the one pair of magnets—for instance, *a a′*—is excited by the current, the lever *h* turns, moving toward the left at *a* and toward the right at *a′*. If, on the other hand, the magnetic force acts at *b b′*, the action will be the reverse.

The magnets are arranged in a particular manner. The line L first passes through the coil *b* and then through *a′*, *b′*, and *a*, finally going to earth; but while the magnet pair *b b′* is only wound with the line-wire the magnet-pair *a a′* is wound also with a second wire, (indicated on the drawings by a thicker line.) This second winding is included in the circuit of a local battery B and consists of only comparatively-few turns, but of relatively-thick wire.

To regulate the local current, a resistance *w* is inserted in the circuit. The coils of the line L are very numerous and the wire very fine. A second local-battery circuit M is arranged for the purpose of operating the receiving apparatus E. This local-battery circuit, however, is only made when the armature *h* is attracted by the electromagnets *b b′*—*i. e.*, when the nose *f* of the said armature strikes the contact *s*. The latter is adjustable, as also is the counter-block *v*. As mentioned, the armature *h* only leaves its position of rest if one or the other magnet pair exerts a force. If, however, the battery B is constantly in action and there is no line-current, the contact *f* naturally bears against the stop *v* and can only be drawn in the contrary direction by a greater force exerted by the magnet pair *b b′*. Such force is only exerted, first, when the line-current runs in an opposite direction to the local current, and, second, when its strength is greater than half the strength of the local current, for if the line-current is in the same direction as the local current the magnetic influence exerted by the coils of the magnet *a a′* is obviously greater, since here the two currents (the line and the local current) supplement each other. If the direction of the line-current is a contrary one, however, the resultant effect of the magnet pair *a a′* is equal to the difference between the effect of the local current and that of the line-current. If, then, this difference is smaller than the effect of the line-current alone, the armature will turn.

Supposing now that the magnetic effect caused by the current from the local battery B is a very small one, (and any, even an exceedingly-small force, suffices to attract the lever *h*, which turns with extreme readiness,) the line-current will still, with the greatest certainty, exert its force, no matter how considerable the decrease in the line may be, for, as already stated, the smallest force, such as that of the local current is, is sufficient to cause the force of the magnet pair *b b'* to predominate over that of the pair *a a'*. As is clear, the effect of the line-current with this arrangement is twofold—viz., firstly, the resistance is overcome, and, secondly, the whole of the magnetic force resulting from the current is exerted.

It need scarcely be remarked that the resistance of the coils is very small compared with the great resistance of the line.

From what has been said it is clear that the relay possesses the first of the features mentioned at the commencement of this specification—*i. e.*, sensibility. The second feature follows from the first.

The reason why the relays ordinarily in use do not always respond to the frequency of the current impulses is that the current has to overcome a resistance—viz., the contact-spring, which cannot be a strong one on account, first, of the diminution in the line, and, secondly, on account of the current strength only being very slightly expressed when the impulses of current are very short. If, however, the spring is a very weak one, it does not promptly enough react when the impulse is of extremely-short duration. With the above-described relay, on the contrary, the spring is replaced by the local current, which exercises a constant effect. The latter, as already explained, does not have to be overcome, but remains quite out of action, so that the line-current operates with its full strength without experiencing resistance.

A second reason why the ordinary relays do not respond to short impulses is the so-called "residual magnetism." With the present arrangement, however, there is no residual magnetism or it exercises no effect.

The uniformity of the stroke of the armature depends upon the magnetic effect which expresses itself, as also the energy of attraction, always remaining the same. This feature also is possessed by the improved relay when the line-current exercises a like or somewhat greater effect than the local current. If, for instance, the magnetic effect of the local current is 5 and that of the line-current 12, the resulting effect of *a a'* is 7. The effect of *b b'*, on the other hand, is 12, consequently 5 more than of *a a'*. If, however, the magnetic effect of the line-current becomes weaker or stronger—for instance, 36—the resulting effect of the magnetic pair *a a'* equals 31 and, on the contrary, of *b b'* equals 36. Consequently the latter is again 5 greater than the former. From this the lemma follows: The attractive effect both at the electromagnet *a a'* and *b b'* is always equal—that is, that resulting from the local current B—notwithstanding the variations and changes which may take place in the intensity of the line-current.

That the polarization of the present relay (the fourth of the requirements referred to and one not fulfilled, as is well known, by steel-magnet relays) is very reliable and constant need not here be pointed out, being nothing but a result of the above.

Most remarkable is the fifth requirement referred to—*i. e.*, the limitation of the exercising of the magnetic effect. There are many strong current-relays in use; but polarized relays which either only operate with a weak current or which only operate in response to currents within certain definite intensities do not, so far as I am aware, up till now exist. This requirement is fulfilled by the present invention, inasmuch as there can be fewer coils wound around the magnet pair *b b'* than around the pair *a a'*. In this case (where the effect resulting from the line-current is smaller than at *a a'*) there is a limit to the increase of the line-current intensity, the magnetic effect of the pair *a a'* being also predominant in consequence of the subtraction.

Having now fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

A polarized relay consisting of two magnet pairs *a a'*, *b b'*, the cores of which cross each other, having a common armature *h* oscillating on a fulcrum between suitable contact-pieces, said magnet pairs being contained in the line-circuit and one pair also in a local-battery circuit in the manner substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

LUIGI CEREBOTANI.

Witnesses:

DAVID LOEWENBERGER,

BENJAMIN NUSBAUM.