(No Model.)

F. E. CHAPMAN.
RELAY.

No. 558,672. Patented Apr. 21, 1896.

FIG. 1.

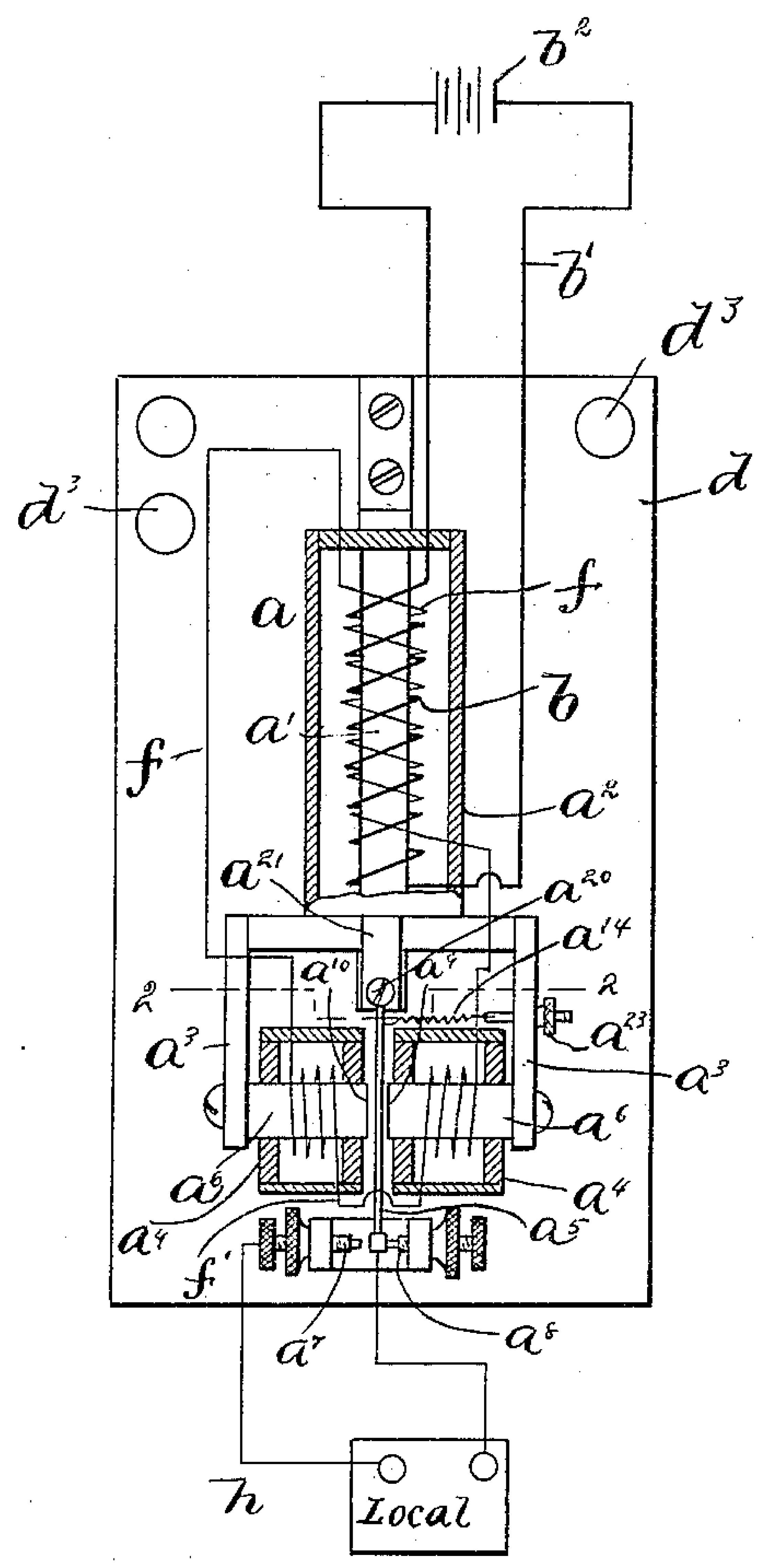
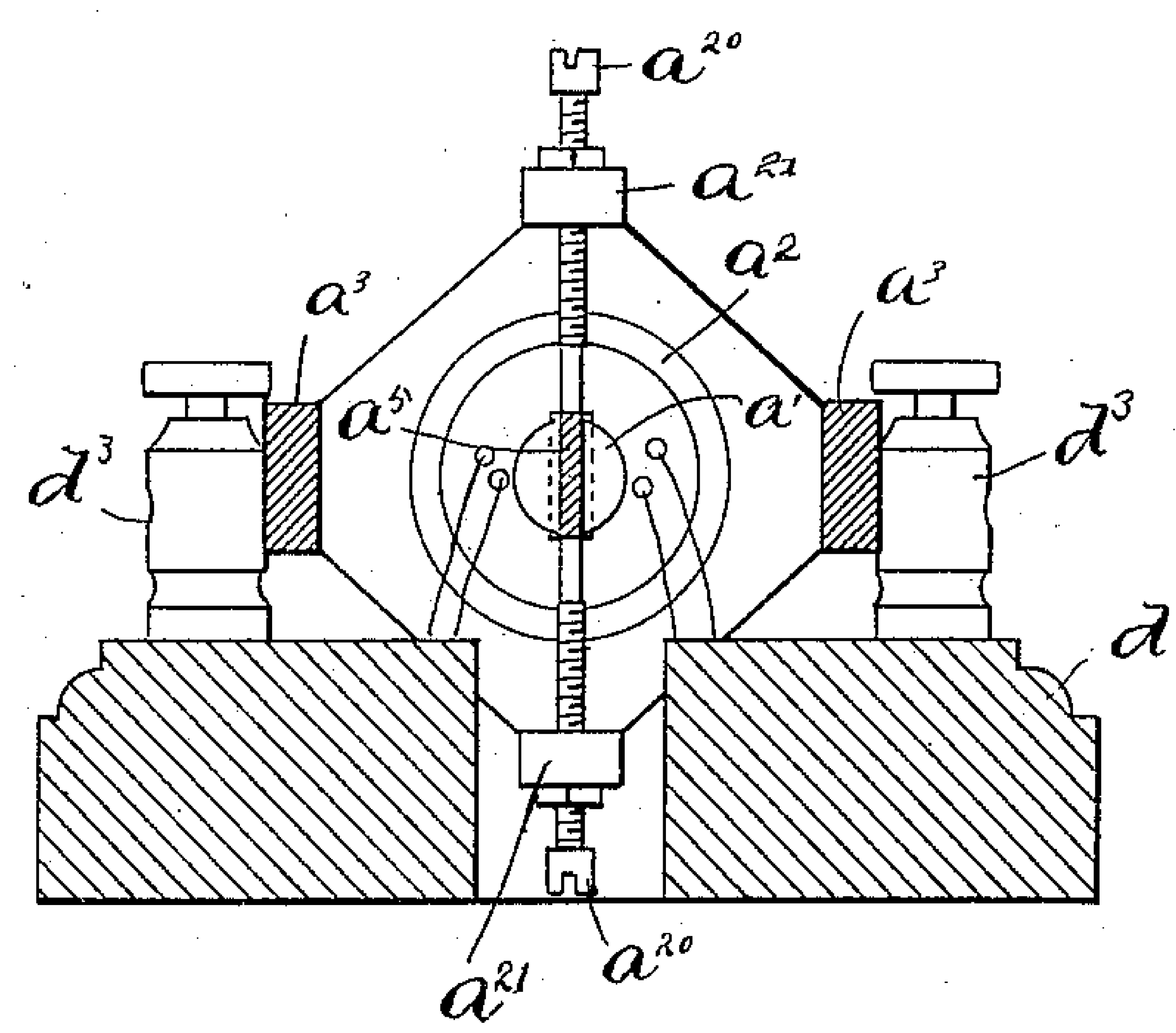


FIG. 2.



WITNESSES:
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UNITED STATES PATENT OFFICE.

FRANK E. CHAPMAN, OF MEDFORD, MASSACHUSETTS.

RELAY.

SPECIFICATION forming part of Letters Patent No. 558,672, dated April 21, 1896.

Application filed January 27, 1896. Serial No. 576,958. (No model.)

To all whom it may concern:

Be it known that I, FRANK E. CHAPMAN, of Medford, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Relays, of which the following is a specification.

This invention has for its object the production of a novel and useful relay; and it consists in the novel features of construction and relative arrangement of parts hereinafter fully described in the specification, clearly illustrated in the drawings, and particularly pointed out in the claims.

Reference is to be had to the accompanying one sheet of drawings, forming a part of this application, in which like characters are used to indicate like parts wherever they occur.

Figure 1 represents in top plan view a relay constructed in accordance with my invention. Fig. 2 represents an end view thereof, the arms being shown in section on the line 2 2 of Fig. 1, the electromagnets being removed.

The several elements of my relay may be variously arranged. I employ the current in one winding of the induction-coil to magnetize the armature and the induced current of the secondary winding of the coil to move or operate said armature.

Referring to the drawings, in the embodiment of my invention therein shown and selected by me for the purpose of illustrating my invention, a represents an induction-coil, composed of a shell a^2, made of soft iron, having a soft-iron head or end piece at one end. Secured to the closed end of this shell is a soft-iron core a'. Electromagnets a^4 are connected to one end of the core a' of the induction-coil. As here shown, these electromagnets a^4 are secured to arms a^3 that project from the shell a^2, and are thus connected to one end of the core a' by means of said shell. An armature a^5 is pivoted to the free end of said core by means of the screws a^{20} passing through the ears a^{21}, Fig. 2, extending from the top and bottom of said shell. The free end of said armature vibrates between the open poles a^9 and a^{10} of the electromagnets a^4, making contact with the screws a^7 and a^8, the local circuit h being connected to the armature and one screw a^7, so as to be closed when the armature makes contact with said screw, screw a^8 serving merely to regulate the play of said armature.

a^{14} represents a spring connected at one end to the armature and at the other end to the adjusting-screw a^{23}, carried by the arm a^3, Fig. 1. This spring serves to keep the armature to one side, opening the local circuit h in the arrangement here shown, when no current is passing through the instrument or when not in operation.

b' represents the main or line circuit, of which b^2 is the battery.

b represents the primary winding of the induction-coil, being connected in circuit with the line b'. The binding-posts d^3 may be used, if desired, for connecting the primary winding b with the line-wire b' in the usual way.

f represents the secondary winding of the induction-coil. This winding is connected in circuit with the electromagnets a^4, the coils of said electromagnets being wound and connected in such manner that a current passing through them would make the adjacent ends a^9 and a^{10} of opposite polarity.

If now the main circuit b' be closed, as ordinarily, by means of a key (not shown) located in said circuit, a current will be caused to flow through the primary winding b. The direction of the flow of said current will be dependent upon the polarity of the battery connected to the line. In this case, assuming it to be of the right polarity and passing through the primary winding b around the core a' in such direction as to make the armature end of said core a north pole and the end connected to the shell a^2 a south pole, the magnetism will continue through the closed end of said shell, through the shell itself to the open end, through the arms a^3 and cores a^6 of the electromagnets, tending to make the adjacent ends a^9 and a^{10} of said cores of like polarity, in this case two south poles. The armature a^5 connected to the core a', and practically a continuation of said core, will likewise be magnetized, the free end of said armature becoming a north pole.

The main current passing through the primary coil b, in addition to the magnetization just mentioned, will induce a momentary current in the secondary winding f. This current passing through the coils of the electromagnets a^4 in a certain direction, as hereinbefore described, in this case tends to make the end a^9 of said electromagnet a^4 a north pole, momentarily counteracting the magnetism from the primary coil before described, and thus decreasing the polarity at this point. Said secondary current also tends to make the end a^{10} of the electromagnet a^4 a south pole. This magnetism, acting in conjunction with the magnetism from the primary coil hereinbefore described, momentarily makes said end a^{10} a south pole of increased strength. The armature a^5, being north pole, is therefore drawn to the latter side, making contact with the screw a^7, closing the local circuit. The impulse of the secondary current now having passed, the ends a^9 and a^{10} of the electromagnets a^4 return to the primary magnetism equal strength south poles. The armature, however, being nearer the pole a^{10}, more force is exerted on it from that side, where it will remain, keeping the local circuit h closed, since the spring a^{14}, as stated below, has only sufficient tension to move the armature when there is no magnetism in the cores a^6. Now if the key on the main line be opened, it stops the current flowing through the primary winding b, induces a current of opposite polarity to the first in the secondary winding f. This current, passing around the cores of the electromagnets a^4 in the opposite direction, reverses in them the effect of the first current, now increasing the strength of the magnetism at the pole a^9, and counteracting the magnetism at the pole a^{10}, the armature, not having had time to wholly demagnetize, will be drawn away from the contact-screw a^7, opening the local circuit h. The spring a^{14}, having only sufficient tension to hold the armature when there is no magnetism in the cores a^6, will now hold the armature against the stop a^8, leaving the local circuit h open until the main line is closed again. If now the main-line current be reversed, and passing through the primary winding b of the relay in such direction as to make the armature end of the core a' a south pole and the ends a^9 and a^{10} of the electromagnets a^4 a north pole, the current induced by closing the key will be in the opposite direction from the current induced by closing the key in the case just mentioned, and will, therefore, have the reverse effect upon the cores of the electromagnets a^4. Now the magnetism at the pole a^{10} will momentarily become strengthened and the primary magnetism at a^9 will be counteracted. The armature consequently will be drawn toward the pole a^{10}, making the contact with the screw a^7 and closing the local circuit h, the same as in the previous case. Now, by opening the key in the main circuit, the induced current becomes reversed again, and reverses the effect at a^9 and a^{10}, as before described, the armature will be drawn to the stop a^8 and held there by the spring a^{14} or by the residual magnetism remaining in the armature or core a^6.

As from the nature of the induction-coils it is not necessary to absolutely open and close the primary circuit, but simply increase or decrease the current, to set up induced currents in the secondary circuit, it will be seen that simply increasing and decreasing the current on the main line, as on a leaky wire when a distant station is transmitting, will operate my relay, and, being once adjusted for a minimum, it will be operated by any heavier current that the wires with which its coils are wound are capable of carrying, the heavier currents being only able to perform the same duty as the smaller by inducing a secondary current first in one direction when started or increased and in the opposite direction when stopped or decreased, throwing the armature from side to side in exactly the same manner as the smaller current.

Having thus explained the nature of my invention and described a way of constructing and using the same, though without attempting to set forth all of the forms in which it may be made or all of the modes of its use, what I claim, and desire to secure by Letters Patent, is—

1. A relay comprising in its construction, an induction-coil having windings in inductive relation, an armature, means whereby said armature is magnetized by one of the windings of said coil, and means whereby said armature is operated by the other winding of said coil.

2. A relay, comprising in its construction, an induction-coil, two electromagnets connected to one end of the core of said coil, and in circuit with one winding of said coil, an armature connected to the other end of said core and arranged to be operated by said electromagnets, and to be magnetized by the other winding of said coil, as set forth.

3. An automatic relay, comprising in its construction, an induction-coil, a shell connected to the core of said coil, two electromagnets connected to the shell of said coil, an armature pivoted to the core of said coil, the main circuit connected to one winding of said coil, the other winding of said coil being continued to form the winding of said electromagnets, and a local circuit controlled by said armature, as set forth.

4. An automatic relay, comprising in its construction, an induction-coil, a shell connected to the core of said coil, two electromagnets connected to the shell of said coil, an armature pivoted to the core of said coil, the main circuit connected to the primary winding of said coil, the secondary winding of said coil being continued to form the winding of said electromagnets, a local circuit controlled by said armature, and a spring for holding said armature to one side when there is no current in the primary winding, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 22d day of January, A. D. 1896.

FRANK E. CHAPMAN.

Witnesses:
A. D. HARRISON,
A. D. ADAMS.