No. 636,116. Patented Oct. 31, 1899.

# F. E. CHAPMAN.

## AUTOMATIC RELAY.

(Application filed Aug. 27, 1896. Renewed Mar. 6, 1899.)

(No Model.)

FIG. 1.

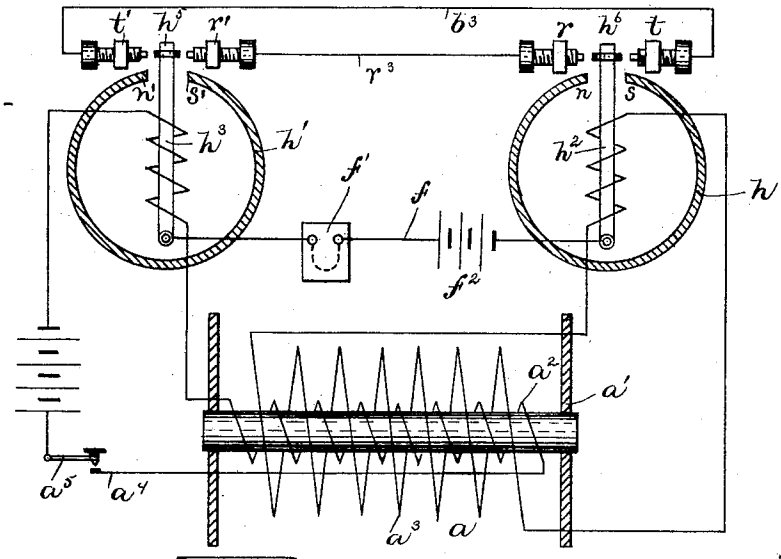



FIG. 2.

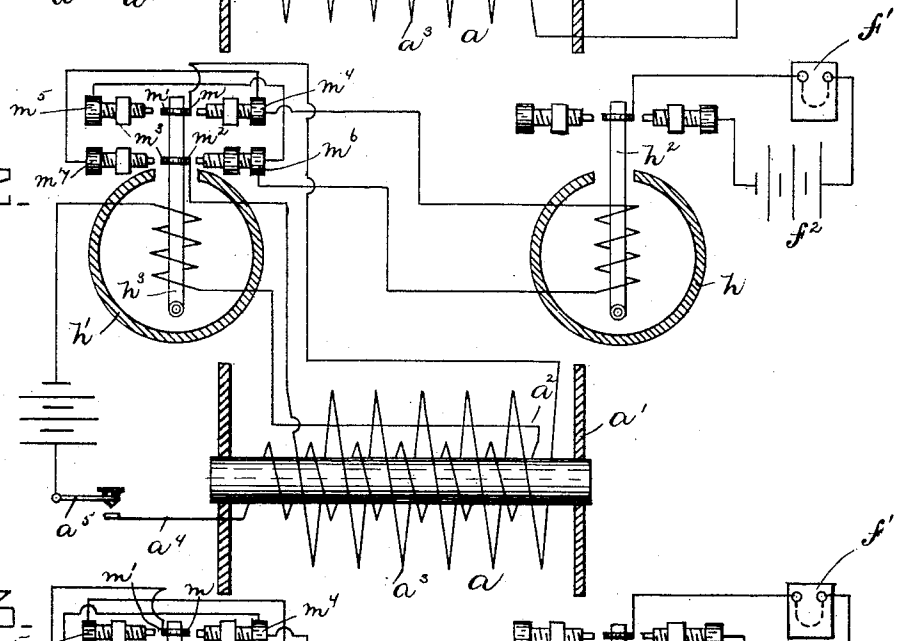
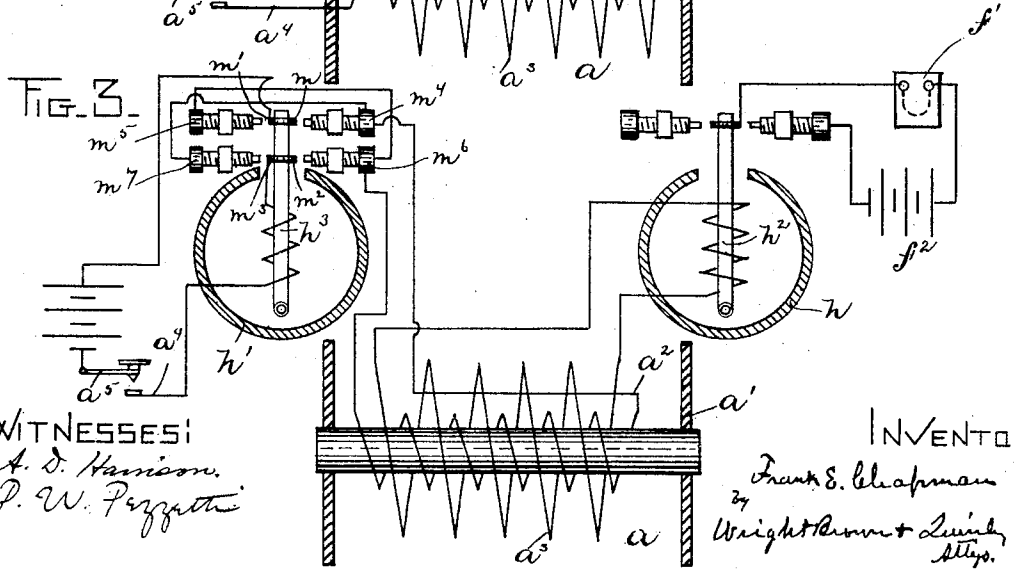



FIG. 3.




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# UNITED STATES PATENT OFFICE.

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## AUTOMATIC RELAY.

SPECIFICATION forming part of Letters Patent No. 636,116, dated October 31, 1899.

Application filed August 27, 1896. Renewed March 6, 1899. Serial No. 708,041. (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 Automatic Relays, of which the following is a specification.

This invention has for its object the production of a new automatic 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 sheet of drawings, forming a part of this application, in which like characters indicate like parts wherever they occur.

Figure 1 represents a diagrammatic view of a relay constructed in accordance with my invention. Figs. 2 and 3 represent modifications thereof.

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 of any preferred construction, consisting of a spool $a'$, upon which are arranged in inductive relation a primary winding $a^2$ and a secondary winding $a^3$, the former connected to the main circuit $a^4$ in any preferred way.

$f$ represents a local circuit.

$h\,h'$ represent two permanent magnets, here shown as arranged in a circular form, with their poles or ends slightly spaced.

$h^2$ $h^3$ represent armatures pivoted to any desired object and arranged to vibrate between the poles of the magnets $h$ $h'$. The winding $a^2$ is connected in series with the winding of the armature $h^3$, while the winding $a^3$ is connected in series in like manner with the winding of the armature $h^2$, so that the armature $h^3$ is operated by the primary circuit, while the armature $h^2$ is operated by the secondary circuit of the induction-coil.

$n'$ $s'$ and $n$ $s$ represent, respectively, the poles of the magnets $h'$ $h$.

$r$ $r'$ represent two contacts connected by a wire or conductor $r^3$.

$t$ $t'$ represent two contacts connected by a wire $b^3$.

The ends of the armatures $h^2$ $h^3$ are adapted to vibrate between the contacts $r$ $t$ $r'$ $t'$ in order to close the local circuit. In the form shown in Fig. 1 the armature $h^3$ must be in contact with $r'$ whenever the armature $h^2$ closes the circuit by contact with $r$, and, conversely, the armature $h^3$ must be in contact with $t'$ whenever the armature $h^2$ closes the local circuit through $t$.

$a^5$ represents a key arranged to open and close the primary circuit, thereby stopping and starting the primary current.

$f'$ represents the sounder of the local circuit, and $f^2$ the battery thereof.

The operation will be explained as follows: The key $a^5$ being closed starts the primary current, which magnetizes the armature $h^3$, making the free end, for example, a south pole. The former is attracted thereto by the north pole $n'$ of the permanent magnet $h'$, and the end $h^5$ of the said armature makes contact with the point $t'$. The primary current passing through the winding $a^2$ of the coil $a$ induces a momentary current in the secondary winding $a^3$. Said secondary current passing around the armature $h^2$ magnetizes it, making the free end of said armature, for example, a north pole. This armature will therefore be attracted by the south pole $s$ of the permanent magnet $h$, the end $h^6$ of the armature $h^2$ making contact with the point $t$. In this position of the parts the local circuit is closed through the points $t$ $t'$, and thus the sounder $f'$ is operated. If now the key be open, the primary current stops flowing, inducing another momentary current in the secondary winding $a^3$ of the induction-coil. This induced current will be in the opposite direction to that caused by the closing of the primary circuit. The said current passing around the armature $h^2$ in the opposite direction from the first current now magnetizes the free end to a south polarity, and the latter $h^6$, being repelled by the pole $s$ and attracted by the pole $n$, is drawn to the stop or contact $r$, opening the local circuit, the armature $h^3$ remaining in contact with the stop $t'$, leaving the circuit open at the point $r'$. It will thus be seen that the armature $h^2$ is here operated each time that there is a reversal in the direction of the induced current, which occurs each time that the main circuit is

closed or opened or each time that there is any increase or decrease of the primary circuit. The armature $h^3$ is operated likewise each time and only when there is a change in the direction of the polarity of the operating-current in the primary winding. If this polarity remains constant, there will be only one movement of the armature $h^3$; but if for any reason the polarity of the operating-current of the induction-coil should be reversed the armature $h^3$ would be operated, being thrown to one pole or the other, as in the case of the armature $h^2$. If the primary current be reversed, the end $h^5$ of the armature $h^3$ will become a north polarity, causing it to be repelled by the pole $n'$ and attracted by the south pole $s'$ and its free end $h^5$ made to contact with the point $r'$, leaving the point $t'$ open. Now had the closing of the key $a^5$ induced a current in the winding $a^2$ in the same direction as the current that was induced by the opening of the key just described this current makes the end $h^6$ of the armature $h^2$ a south pole, causing it to be repelled by the south pole $s$ of the permanent magnet $h$ and attracted by the north pole $n$ of said magnet and its free end made to contact with the stop $r$, the point $t$ being open, thus closing the local circuit through the points $r\,r'$. If the key now be open, the polarity in the secondary winding $a^3$ will be changed again, as before, throwing the armature $h^2$ to the stop $t$ and opening the local circuit. It will thus be seen that as the functions of the contact-points $r$ and $t$ are reversed by a reversal of the primary current (in one instance the point $t$ being the closing or "marking" point and the point $r$ the open point, while in the other instance the point $t$ becoming the open and the point $r$ the marking point) it makes no difference what the polarity of the primary current may be the closing of the key will close the local circuit and the opening of the key will open the local circuit in the same manner as in the ordinary relay; but as the induction-coil operates on great or small currents or on any increase or decrease of the primary current, the small induced currents polarizing the armature $h^2$ and throwing it from one side to the other in the same manner as the greater currents, the object of the invention is easily accomplished. It is understood that the armatures $h^2$ $h^3$ are so arranged in regard to the poles of the magnets $h$ $h'$ that said armatures remain on the side placed after the manner of the ordinary polarized relay. It will thus be seen that the armature $h^2$ operates to close the local circuit, while the armature $h^3$ operates to prevent any reverse signals in the local circuit due to changes in the polarity of the operating-current passing through the relay. Heretofore all relays operated in this manner by induction-coils have been connected for a particular polarity. If this polarity for any cause is reversed, then the opening of the primary current will close the local current, and vice versa, whereas by my invention I am enabled to prevent this reversal of signals in the secondary current occasioned by the reversal of polarity of the operating-current in the induction-coil.

Instead of the form shown in Fig. 1 I may embody my invention in the forms shown in Figs. 2 and 3. In the embodiment shown in Fig. 2 I arrange the armature $h^3$ to open and close the circuit of the secondary winding instead of the local circuit, as in Fig. 1. The armature is provided with two pairs of stops $m$ $m'$ $m^2$ $m^3$, adapted to make contact with the stops $m^4$ $m^6$ and $m^5$ $m^7$ to close the circuit of the secondary winding of the coil. The stop $m^6$ is connected to the stop $m^5$, while the stop $m^7$ is connected to the stop $m^4$. From this construction and arrangement it will be evident that the movement of the armature $h^3$ to one side or the other will change the path of the current traveling through the secondary winding and reverse the direction of said current around the armature $h^2$—that is to say, the contacts $m$ $m^2$ being in engagement with the stops $m^4$ $m^6$ the current will travel in one direction. If now the armature be moved so that the contacts $m'$ $m^3$ engage the contacts $m^5$ $m^7$, the current through the secondary winding $a^3$ will be reversed, and consequently if the contacts are in the position first stated and the polarity in the operating-current $a^2$ is changed the armature $h^3$ will be moved and its contacts made to engage the stops $m^5$ $m^7$, the result being that the current is changed so that its direction through the secondary winding $a^3$ is the same as before, and the signals made by opening and closing the key $a^5$ will be correctly repeated by the sounder $f'$ and not reversed, as would be the case but for my invention. In the form shown in Fig. 2 the primary armature $h^3$ and its contacts serve to reverse the direction of the current of the secondary winding of the induction-coil and the secondary armature-coil. In the form shown in Fig. 3 instead of arranging the armature $h^3$ to open and close the local circuit, as in Fig. 1, or the circuit of the secondary winding, as in Fig. 2, I arrange it to open and close the circuit of the primary winding of the induction-coil in such way as to prevent reverse signals, the armature $h^3$ being provided with contacts and making contacts as in Fig. 2, the only difference being that these contact-points are mounted in the primary winding of the induction-coil instead of the secondary, the result being the same in all cases, that whenever the polarity of the operating-current of the relay is changed the path of the currents in one of the circuits of the relay is changed in order to prevent reverse signals.

Instead of the automatic primary armature switches or other like devices may be employed to perform the same functions, the object being in all cases, as already stated, to prevent the reversals of the signals on the local circuit caused by the reversal of the

primary current through the relay due to change of polarity.

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 embodying in its construction an induction-coil, an armature, a coil for said armature connected with and operated by the secondary circuit of said coil, an independent or local circuit including the armature, and means for preventing reverse signals in the said independent circuit due to changes of polarity of the primary circuit, said means comprising contact-points and a switch included in one of said circuits.

2. A relay embodying in its construction, an induction-coil, an armature, a coil for said armature connected with and operated by the secondary circuit of said coil, an independent or local circuit including the armature, and means for automatically preventing reverse signals in the said independent circuit, said means comprising an armature operated by the primary circuit, and contact-points, included in one of said circuits.

3. A relay embodying in its construction, an induction-coil, an armature, a coil for said armature connected with and operated by the secondary circuit of said coil, an independent or local circuit including the armature, "open" and "marking" contact-points connected with said armature, and means for reversing the functions of said contact-points, said means including a switch operated by the primary circuit of the induction-coil.

4. A relay, comprising in its construction, an induction-coil, having windings arranged in inductive relation, a circuit, an armature arranged to open and close said circuit and to be operated by a secondary winding of said coil, and a switch for changing the path of the current of one of the circuits to prevent a reversal of signals in the instrument.

5. A relay, comprising in its construction, an induction-coil, having windings arranged in inductive relation, a circuit, an armature arranged to open and close said circuit and to be operated by a secondary winding of said coil, and a switch for automatically changing the path of the current in one of the circuits to prevent a reversal of signals in the instrument.

6. A relay, comprising in its construction, an induction-coil, having windings arranged in inductive relation, a circuit, an armature arranged to open and close said circuit and to be operated by a secondary winding of said coil, and a switch operated by the primary current for changing the path of the current in one of the circuits to prevent a reversal of signals in the instrument.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 7th day of August, A. D. 1896.

FRANK E. CHAPMAN.

Witnesses:
A. D. HARRISON,
P. W. PEZZETTI.