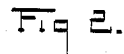
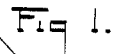


APPLICATION FILED JAN. 17, 1916.

2 SHEETS--SHEET 1.

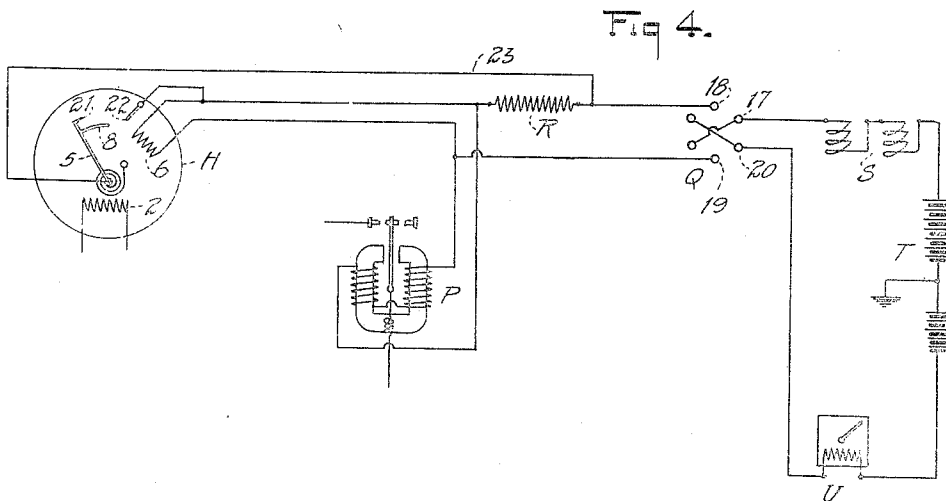
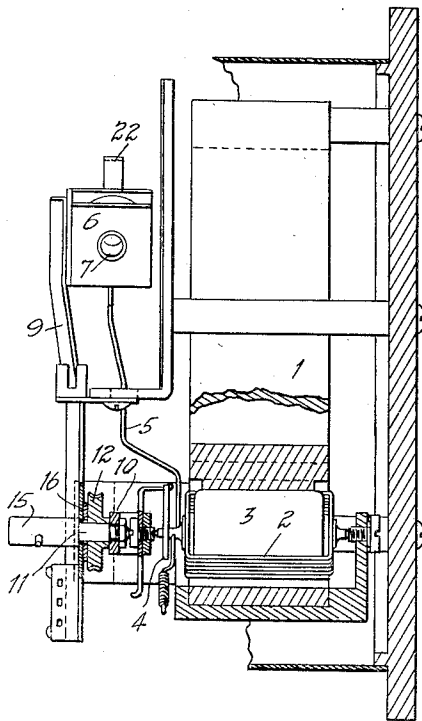


Inventors
Richard M. Waples
Joseph F. D. Hays
By their Attorney
H. M. Marshall

RELAY.

1,246,430.

2 SHEETS—SHEET 2.



J. Massing
Paul R. Frank

By their Attorney
Richard W. Hopkins
Joseph F. C. Hoyle
for the Defendants

UNITED STATES PATENT OFFICE.

RICHARD M. HOPKINS AND JOSEPH F. D. HOGE, OF NEW YORK, N. Y., ASSIGNORS TO
AMERICAN DISTRICT TELEGRAPH COMPANY, OF JERSEY CITY, NEW JERSEY, A
CORPORATION OF NEW JERSEY.

RELAY.

1,246,430.

Specification of Letters Patent.

Patented Nov. 13, 1917.

Original application filed December 6, 1915, Serial No. 65,194. Divided and this application filed January 17, 1916. Serial No. 72,387.

To all whom it may concern:

Be it known that we, RICHARD M. HOPKINS and JOSEPH F. D. HOGE, citizens of the United States of America, and residents of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Relays, of which the following is a specification.

Our invention relates to improvements in relays, and particularly in relays intended to be actuated by very small currents. The improved relay herein described is particularly intended for use in the alarm or detection system set forth in our application filed December 6, 1915, Sr. No. 65,194, wherein a relay such as herein described is caused to be actuated primarily by feeble currents themselves produced through the actuation of delicate telephone transmitters themselves actuated by sounds which may be produced in the immediate vicinity of such telephone transmitters. The currents which actuate the relay in that system are so feeble that, to insure closing of a contact and maintenance thereof for the desired period, the relay is provided with a so-called "holding coil", usually of the nature of a solenoid, and arranged to be energized by current derived from a battery or other generator, and controlled by a suitable switch located at a convenient point; and the armature of the relay is provided with a core adapted to enter this solenoid magnet and to be "sucked into" that solenoid magnet, when, by one of the feeble currents mentioned, that core is brought into proximity to the solenoid magnet. While the relay forming the subject matter of the present application is disclosed in said prior application Serial No. 65,194, it is not claimed therein, except as it enters into the combinations of the system of said application Serial No. 65,194. Hence the present application. In general structure, our improved relay is an instrument of the general nature of a D'Arsonval galvanometer, the hand or pointer of that galvanometer being provided with a core or plunger adapted to enter the solenoid holding magnet above referred to; said hand or pointer being also provided with a contact point adapted to make contact with another contact point, stationary

except as to its adjustability; whereby by motion of such hand or pointer a circuit may be closed. The said solenoid holding magnet, and the stationary contact point, are mounted so as to be adjustable toward or from the normal or rest position of the said hand or pointer; whereby the action of the relay may be regulated.

The main object of our invention is to provide a relay of extreme sensitiveness and which, notwithstanding such extreme sensitiveness, shall be capable of closing contact firmly and retaining such contact closed so long as desired. Other objects of our invention are, to make the relay simple and relatively rugged in construction, notwithstanding its inherent delicacy; and to provide for ready and easy adjustment of the relay, and preferably from the outside of the inclosing case of the relay.

We will now proceed to describe our invention with reference to the accompanying drawings, and will then point out the novel features in claims. In the drawings:

Figure 1 shows a top view of the relay, the inclosing case having been sectioned horizontally.

Fig. 2 shows a vertical section of the relay on the irregular section line $x-x$ of Fig. 1.

Fig. 3 shows a side elevation and partial vertical section of the relay.

Fig. 4 is a fragmentary diagram, being a fragment of one of the diagrams of our said application Serial No. 65,194, and showing particularly the circuit in which the said holding coil or solenoid magnet is located.

As above stated, our relay is similar in general construction to a D'Arsonval galvanometer, and therefore comprises a field magnet 1, a light pivoted armature coil 2, mounted in the field of force of such magnet 1, and a stationary core 3 located within coil 2 and within the field of force, and which tends to strengthen the action of the instrument. The coil 2 is provided with a light retractile spring 4 of the general nature of a clock hair spring. The armature coil 2 carries a delicate pointer 5. Suitable and customary provisions are made for including the coil 2 in an electric circuit.

6 designates the holding or solenoid magnet or coil above referred to, said coil having an interior space 7 for the reception of

a core or plunger 8 carried by the pointer 5; and 9 designates a support for the coil 6 (see particularly Fig. 3) said support being mounted substantially concentrically with respect to the armature coil 2.

10 designates a bridge piece, preferably of non-magnetic material, supported from the field magnet 1 and carrying a shaft 11 capable of some oscillatory movement to which shaft 11 the support 9 is secured. Upon this shaft 11 is mounted freely a worm wheel 12, arranged to be engaged by worm 13. The shaft of the worm 13 has a head 14 with which a suitable key or wrench may be engaged, for the purpose of adjusting the position of the coil 6. The shaft 11 has a similar head 15, for the same purpose. The support 9 is mounted so as to be capable of motion with respect to the shaft 11, and between this support 9 and the worm wheel 12 there is a friction washer 16, permitting shaft 11 to be turned, by a suitable key or wrench engaging head 15, while worm wheel 12 is held stationary by its worm 13; such motion of the shaft 11 of course moving the support 9. The friction washer 16 interposed between worm wheel 12 and support 9, causes that support to turn when the worm wheel is turned by means of its worm 13.

In Fig. 4 we have shown circuits of an alarm system in which this relay is well adapted for use; the figure being a fragment of one of the diagrams of our said application Sr. No. 65,194. In this figure, H designates the relay, such parts of such relay as it is necessary to illustrate in this diagram having applied to them the same reference numerals as in the preceding figures. S designates a double-balanced relay drop, usually located at a central station, Q designates a double pole double throw switch, U a galvanometer or other indicating instrument, and T a divided grounded battery. P designates a polar relay, the function and operation of which may be neglected for present purposes.

Current from the central station battery T, flows normally through the coils of the drop relay S, to contact 17 of switch Q and then through contact 18 of the switch and resistance R to the holding coil 6 of relay H, and thence back to contact point 19 of the switch, the contact point 20 of the switch, and the indicating instrument U to battery T. It will be apparent that if for any reason the coil 2 of the relay is energized, deflecting the armature 5 of that relay to the right, the plunger 8 of the relay will be brought within the influence of the holding coil 6, whereupon that plunger will be "sucked into" that holding coil, and thus contact will be made between the contact point 21 carried by the armature arm 5 and a contact spring 22 carried by the support

9. In the particular circuit arrangement shown in Fig. 4, closing of the contact between 21 and 22 completes a circuit through a conductor 23 and holding coil 6 back to battery, the resistance R being shunted out, and as a result the line current being increased to such an extent as to actuate the drop S and also the indicating instrument U; an alarm being thus given. The armature 5 of the relay H may be restored subsequently by hand or (and particularly when the circuits and instruments are being tested) the armature of the relay may be released by throwing the switch Q to the open position indicated in Fig. 4, whereupon the holding coil 6 is deenergized and the retractile spring 4 of the relay retracts the armature, so breaking contact between 21 and 22. This occurs after deenergization of the coil 2, or while that coil is not energized.

Various other uses for the relay will occur to those skilled in the art. Owing to the extreme delicacy of mounting of the armature, the relays respond to very small currents flowing through the coil 2; currents so small that the coil 2 in itself does not create sufficient pressure between contact points 21 and 22 to make a good electrical contact; and, indeed, it may happen that the current energizing the coil 2 is too weak to swing the armature, against the influence of the retractile spring, far enough to bring contact points 21 and 22 into contact; the normally energized holding coil 6 nevertheless exerting sufficient pull upon the plunger 8 when that plunger nears such coil, to draw the plunger over and thus bring points 21 and 22 into contact and hold them together with sufficient pressure to insure a good electrical contact.

What we claim is:—

1. A relay comprising in combination a delicately mounted armature coil, means affording a field of force in which such coil is mounted, an arm movable with said coil, contact pieces arranged to be moved into and out of contact by movement of such arm, a solenoid holding magnet independent of the means producing such field of force, and a plunger armature carried by said arm and adapted to be attracted by said solenoid holding magnet, when moved by said arm into proximity to said holding magnet, whereby making of firm contact between said contact pieces is assured.

2. A relay comprising in combination a delicately mounted armature coil, means affording a field of force in which such coil is mounted, an arm movable with said coil, contact pieces arranged to be moved into and out of contact by movement of such arm, a solenoid magnet, and a plunger for that solenoid carried by said arm and adapted to be drawn into said solenoid when moved

by said arm into proximity to said solenoid, whereby making of firm contact between said contact pieces is assured.

3. A relay comprising in combination a
5 movable arm, electro-magnetic means for
moving said arm, contact pieces arranged to
be moved into and out of contact by move-
ment of such arm, a solenoid magnet inde-
pendent of the electro-magnetic means for
10 moving such arm, and a plunger for said so-
lensoid carried by said arm and normally clear
of said solenoid and adapted to be drawn into
said solenoid when moved into proximity
to such solenoid, whereby making of firm
15 contact between said contact pieces is as-
sured.

4. A relay comprising in combination a
delicately mounted armature coil, means af-
fording a field of force in which such coil
20 is mounted, an arm movable with said coil, a
holding magnet independent of the means
producing such field of force, armature
means carried by said arm and adapted to
be attracted by said holding magnet, a sup-
25 port for said holding magnet and means

for adjusting said holding magnet to va-
rious positions generally in the path of
movement of said armature means.

5. A relay comprising in combination a
delicately mounted armature coil, means af- 30
fording a field of force in which such coil
is mounted, a pivoted arm movable with
said coil, a holding magnet independent of
the means producing such field of force, ar-
mature means, carried by said arm and 35
adapted to be attracted by said holding
magnet, and a support for said holding
magnet pivoted substantially concentrically
with said arm and adapted to be moved to
adjust the position of said holding magnet 40
toward or from the said arm.

In testimony whereof we have signed this
specification in the presence of two subscrib-
ing witnesses.

RICHARD M. HOPKINS.
JOSEPH F. D. HOGE.

Witnesses:

DAVID A. BERLIN,
FRANCIS X. BLAKE.