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H. B. TAYLOR.

RELAY.

APPLICATION FILED DEC. 4, 1903.

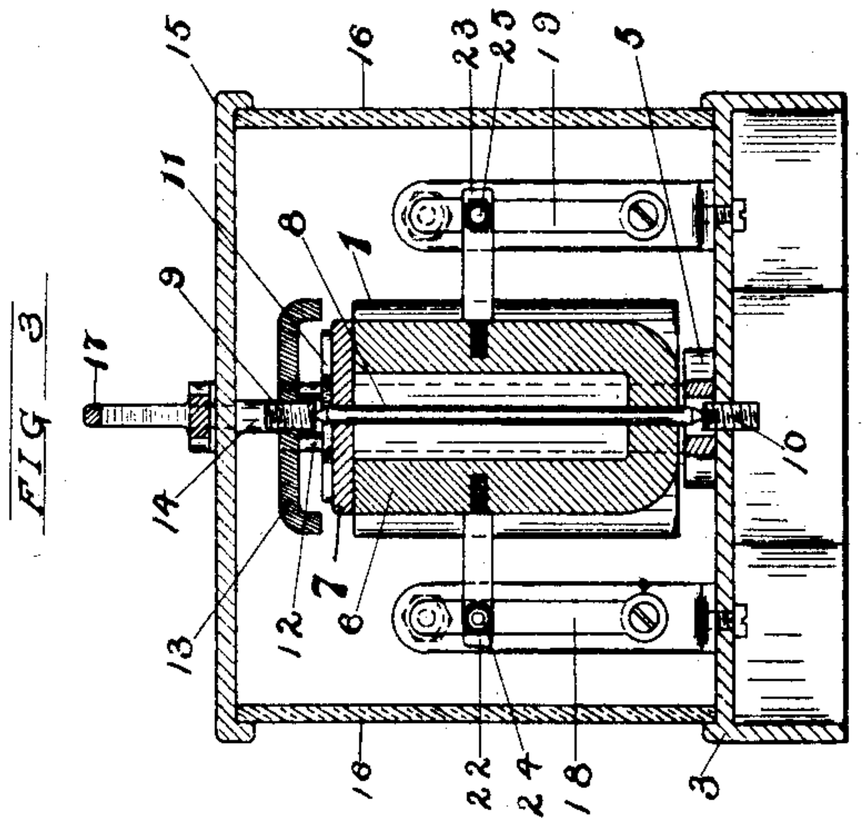

FIG 3

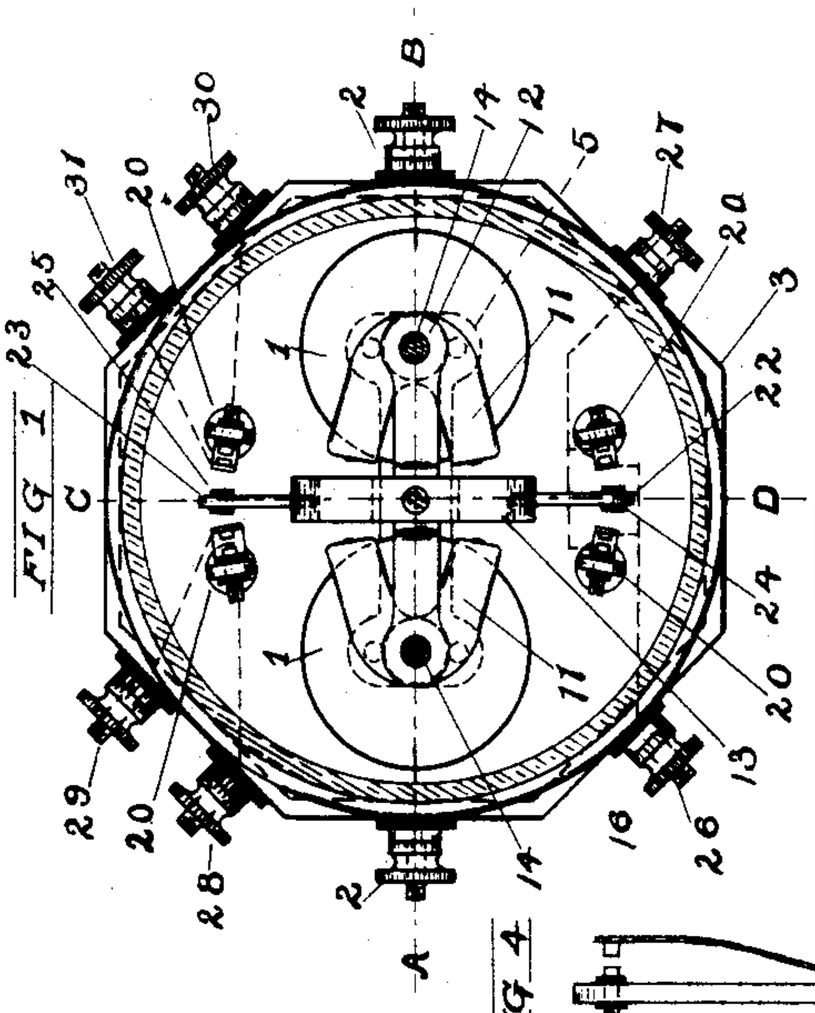

FIG 1

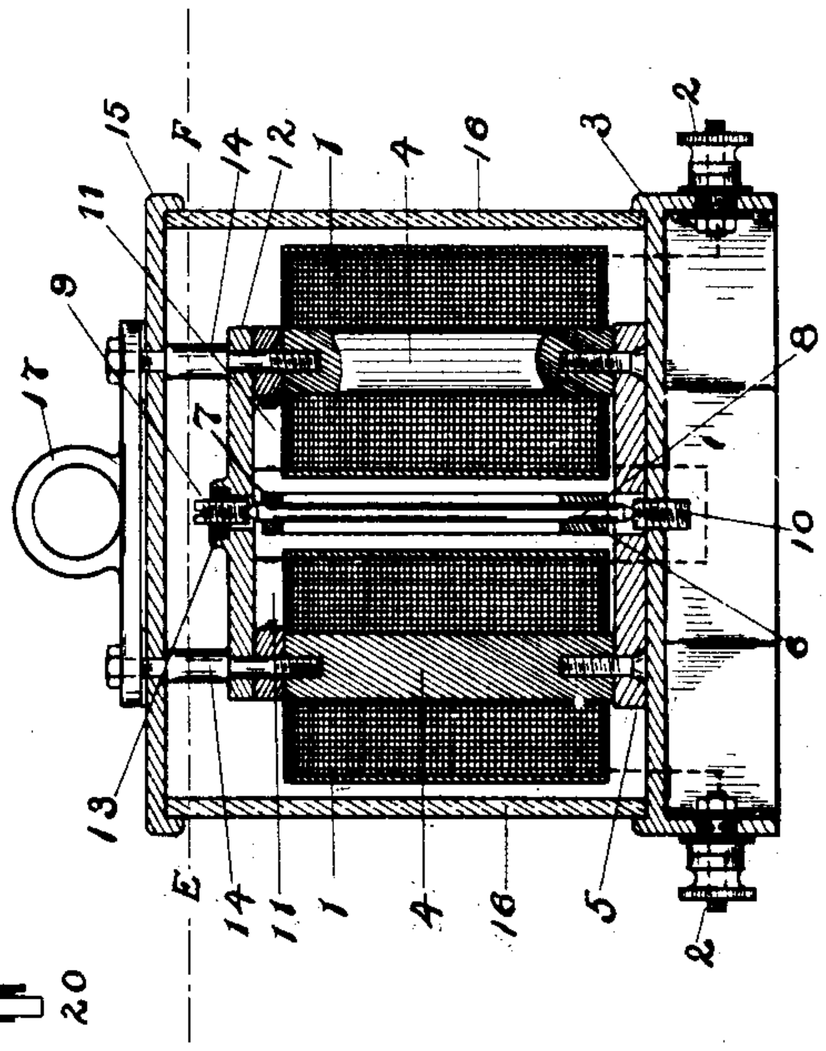

FIG 2

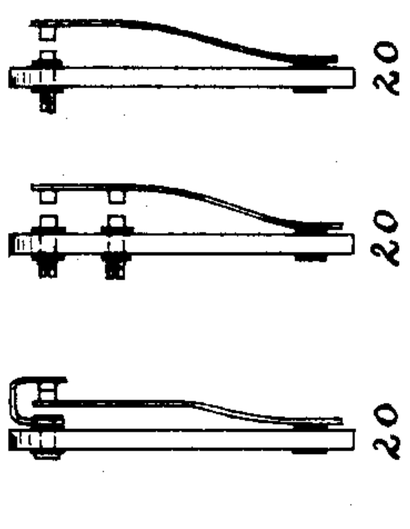

FIG 6 - FIG 5 - FIG 4

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UNITED STATES PATENT OFFICE.

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RELAY.

SPECIFICATION forming part of Letters Patent No. 793,329, dated June 27, 1905.

Application filed December 4, 1903. Serial No. 183,709.

To all whom it may concern:

Be it known that I, HERBERT B. TAYLOR, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented and produced new and original Improvements in Relays; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to numerals of reference marked thereon, which form a part of this specification.

My invention relates to relays, and more particularly to that class of relays known as "polarized" relays, and is more particularly designed for use in connection with electric-railway signaling-circuits, though it will be understood that my invention may be used in other connections where a sensitive relay is required.

The objects of the invention are to increase the dynamic power of the relay by utilizing a greater portion of the magnetic flux, much of which has heretofore been wasted, and to simplify the construction of the relay and render the moving parts more sensitive to the influence of the energizing electric current, and to secure other advantages and results, some of which may be hereinafter referred to in connection with the description of the working parts.

The invention consists in the improved relay and in the arrangements and combinations of parts of the same, all substantially as will be hereinafter set forth, and finally embraced in the clauses of the claim.

The following is a specification and description of the invention, setting forth clearly its novel features, and to more clearly illustrate the construction of the several parts the specification is accompanied by drawings, in which—

Figure 1 is a horizontal section taken on line E F of Fig. 2. Fig. 2 is a section taken on line A B of Fig. 1. Fig. 3 is a vertical section on line C D of Fig. 1. Figs. 4, 5, and 6 show different forms of contacts that may be employed.

In the figures like numerals designate like parts wherever they occur.

In said drawings, 1 1 indicate the magnet-spools, which are wound with suitable wire, the terminals of which wire are connected with binding-posts 2 2, which are located on and insulated from the metal base 3. The iron cores 4 4 of said magnets 1 1 are connected at their lower ends by an iron yoke 5, which is attached in a suitable manner to the top of the base 3. Between the poles 4 4 of magnet 1 1 is pivotally mounted a permanently-magnetized armature 6 of a horseshoe or U shape or any other shape that might answer the same purpose. Across the poles of the permanently-magnetized armature 6 is a yoke 7, of non-magnetic material. Through this yoke 7 and the central portion of the magnet 6 extends a pivotal rod 8, which is pointed at opposite ends, the said rod being adapted to turn with very little friction in threaded bearings 9 10, which are located at both ends of said spindle 8. Secured to the upper poles of the magnet 1 1 are pole extensions 11 11, which have each two horns so disposed that the magnetic flux in flowing from one to the other of the poles 1 1 passes across the poles of the permanent magnet 6.

Owing to the bifurcations or horns 11 11 of the pole-pieces, when the electromagnet of which they form a part becomes magnetized one of the horns of one pole will attract one pole of the armature 6 and the corresponding horn of the other pole of the magnet will repel said pole of the armature—that is to say, each pole of the armature will be simultaneously and oppositely acted upon by each pole of the magnet. Thus there is a fourfold magnetic influence brought to bear on a single armature with a minimum amount of magnetic leakage.

A non-magnetic yoke 12 tends to bind the upper ends of the cores 4 4 together and also serve as a seat for the screw-bearing 9 for the spindle 8 and to support the permanently-magnetized keeper 13 of the permanently-magnetized armature 6. Screws 14 and 14 serve to connect the yoke 12 and polar extensions 11 11 to cores 4 and 4 and also to

clamp the metal cover 15 and glass shell 16 to the base 3. The ring 17 is also secured to the cover 15 by the same screws and serves as means by which the relay may be lifted or carried.

The base 3 has secured thereto contacts 20 20 20 20, which are or may be similar to the contacts shown in Figs. 4, 5, and 6 and consists simply of a fixed and a movable part, which are adapted to be opened or closed by the action of the relay-armature 6. Fig. 4 represents an open contact. Fig. 5 represents a double open contact. Fig. 6 represents a closed contact. All of these are well known and understood by those familiar with the art. To actuate these contacts, I mount on the armature 6 the fingers 22 23, which are preferably of metal and are provided each with a button 24 25, of insulating material, the objects of these buttons being to prevent the charging of the armature with current from the contacts. The fixed member and the movable member of the contacts are connected to the different insulated binding-posts by wires or connections, as shown by the dotted lines in Fig. 1. Many variations in these contact connections may be made to suit special requirements without departing from the invention in any way.

The operations of the relay are as follows: If a source of electric energy be connected with the binding-posts 2 2 and current flows through the magnet-spools 1 1 from 2 to 2, the magnetic flux being in two paths through the horns of said magnet, the armature 6 will be attracted and repelled at the same time by the bifurcated polar extensions 11 11 of the electromagnet 1 1—*i. e.*, one horn of pole extension 11 will attract the north pole of polarized armature 6, while the other horn will repel the south pole of the said armature, as both horns are of the same polarity. A similar action takes place at the other pole extension 11—*i. e.*, one horn of the extension will attract the south pole of polarized armature 6, while the other horn will repel the north pole of the said armature. It will thus be seen that the force in dynes exerted at the poles of the magnets and armatures is very much greater for the power expended than in other forms of polarized relays. As this force is exerted the oscillating armature 6 will instantly swing in one direction and close or open, as the case may be, the contacts which are diametrically opposite, owing to the fact that the fingers 22 23 press against the movable members of the said contacts and cause the said members to leave their normal positions. If current is now reversed through the magnets 1 1, a similar attraction and repulsion will take place, but in an exactly opposite direction, causing the armature 6 to swing the opposite way and actuate the other contacts that are suitably located. While the magnets 1 and 1 are energized the polarized keeper 13, which is located close to the poles of the said magnets 1 1, becomes somewhat demagnetized, owing to the strong magnetic flux passing from pole to pole of the magnets 1 1 across the said keeper 13 and diverting or weakening the normal magnetic flux of said keeper 13. Thus the said keeper has very slight, if any, effect on the moving armature 6. When, however, magnets 1 and 1 are entirely deenergized or open-circuited, the keeper 13 regains its attractive power and attracts with its opposite poles the opposite poles of polarized armature 6, which swings to a middle or off position, as shown in Fig. 1, and will remain in this off position until the magnets 1 and 1 are again energized regardless of the position that the relay may be set in. The value of this desirable feature lies in the fact that no springs are required to pull and hold the armature into an off position, and therefore no power is expended in flexing such springs, the full dynamic force of the magnet thus being available for actuating the contacts. The spring contact-pieces when the electromagnet becomes deënergized will tend to start the armature back to its normal position and to bring it within the magnetic flux of the keeper, which then holds it in the neutral position.

A relay constructed in accordance with my invention embodies many features of superiority and advantage over relays at present known and used. By providing the electromagnet with pole-pieces of the character described it is possible to bring the opposing poles within a very short distance of each other, and as the magnetic flux is across a small air-gap there is comparatively little or no loss of magnetic force, and therefore from the duplex construction of each pole-piece a much greater dynamic force is applied to the armature, each pole of which is thus subjected simultaneously to attraction from one pole-piece of the magnet and repulsion from the opposite pole-piece. By the employment of a comparatively strong magnet for the armature and mounting the same as described upon practically frictionless bearings great sensitiveness is attained. Also by employing an armature of the horseshoe type instead of the usual bar-magnet a much more powerful magnet for a given size is obtained, thereby adding to the sensitiveness of the device, and, moreover, in an armature of this kind it is possible to bring each pole thereof within the path of magnetic flux between the pole-pieces of the electromagnet. By employing a polarized keeper, as described, and arranging the same at right angles to the path of the magnet-flux the armature is quickly brought to neutral position upon deënergizing of the electromagnet, and, moreover, since the path of the magnet-flux is at right angles to the direction of magnetic flux in the keeper the magnetism of the keeper is neutralized to a great

extent when the electromagnet is energized, thus releasing the armature from the controlling effect of the keeper and permittiug it to respond quickly to the magnetism of the electromagnet. As soon as the electromagnet is deënergized the magnetism of the keeper immediately controls the armature and causes the same to assume its neutral position. It will therefore be seen that a relay embodying my invention has many superior features of advantage which in their several and combined effects tend to produce a relay of great sensitiveness, efficiency, and reliability.

Having thus described the invention, what I claim as new is—

1. A device of the character described, comprising an electromagnet, a polarized armature mounted to swing freely between the poles of said magnet, said armature having a normal position at right angles to the magnetic flux between the poles of the magnet, and each pole of the armature simultaneously and oppositely acted upon by each pole-piece of the electromagnet.

2. A device of the character described comprising an electromagnet of the horseshoe type, a polarized horseshoe-armature mounted to swing freely and having its poles in the path of magnetic flux between the poles of the electromagnet, each pole of said armature simultaneously and oppositely acted upon by each pole of the electromagnet.

3. A device of the character described, comprising an electromagnet, a polarized armature mounted to swing freely between the poles of said magnet, said armature having a normal position at right angles to the magnetic flux between the poles of the magnet, each pole of the armature simultaneously and oppositely influenced by each pole of the electromagnet, and a keeper arranged at right angles to the path of magnetic flux between the pole-pieces of the electromagnet for the purposes described.

4. A device of the character described comprising an electromagnet of the horseshoe type, a polarized horseshoe-armature mounted to swing freely and having its poles in the path of magnetic flux between the poles of the electromagnet, each pole of said armature simultaneously and oppositely acted upon by each pole of the electromagnet, and a keeper to maintain said armature normally in neutral position.

5. A device of the character described, comprising an electromagnet having two pole-pieces of one polarity opposed to two pole-pieces of opposite polarity, a polarized armature mounted to swing freely between the said pole-pieces, each pole of the armature lying in the path of the magnetic flux between the pole-pieces of opposite polarity, and a keeper for said armature arranged at right angles to the path of magnetic flux between the pole-pieces of the electromagnet, for the purpose described.

6. A device of the character described, comprising an electromagnet each pole of which is formed with a bifurcated extension with the bifurcations of one polarity opposite bifurcations of opposite polarity, a polarized armature mounted to swing freely between said pole-pieces each pole of said armature being simultaneously and oppositely acted upon by bifurcations of opposite polarity, and a magnetic keeper for said armature arranged at right angles to the path of magnetic flux between the pole-pieces of the electromagnet.

7. A device of the character described, comprising an electromagnet having two pole-pieces of one polarity opposed to two pole-pieces of opposite polarity, a polarized armature mounted to swing freely between said pole-pieces each pole of said armature lying in the path of magnetic flux between the pole-pieces of opposite polarity, a circuit-closer connected with said armature, and contacts arranged to be engaged by said circuit-closer, and means to prevent charging of the armature with current from the contacts.

8. A device of the character described, comprising an electromagnet of the horseshoe type each pole of which is provided with a bifurcated extension, a polarized armature mounted to swing freely between said extensions with each pole thereof lying in the path of the magnetic flux between bifurcations of opposite polarity, a circuit-closer operated by the armature, contacts engaged by the circuit-closer, said contacts provided with spring members carrying contact-pieces, and insulation to protect the armature from currents in the contact-pieces when engaging the same.

9. A device of the character described, comprising a single electromagnet having two pole-pieces of like polarity opposed to two pole-pieces of like but opposite polarity, a polarized armature mounted to swing freely between the pole-pieces of the electromagnet each pole of said armature arranged in the path of magnetic flux between pole-pieces of opposite polarity, a magnetic keeper for said armature the direction of magnetic flux of which is at right angles to the direction of flux between the pole-pieces of the electromagnet, a circuit-closer operated by said armature, contact-pieces adapted to be engaged by said circuit-closer and insulation at the point of engagement between the circuit-closer and the contact-pieces.

In testimony that I claim the foregoing I have hereunto set my hand this 1st day of December, 1903.

HERBERT B. TAYLOR.

Witnesses:
CHARLES H. PELL,
RUSSELL M. EVERETT.