

H. D. CURRIER & L. ERICSON.

RELAY.

APPLICATION FILED OCT. 9, 1915.

1,239,357.

Patented Sept. 4, 1917.

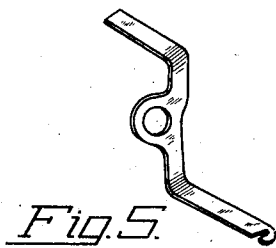


Fig. 5.

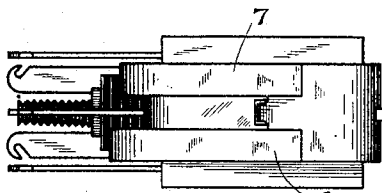


Fig. 1.

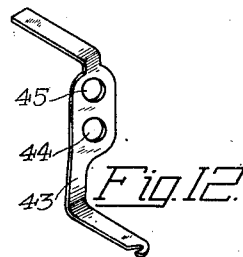


Fig. 12.

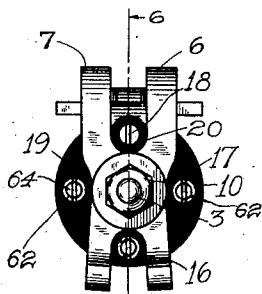


Fig. 4.

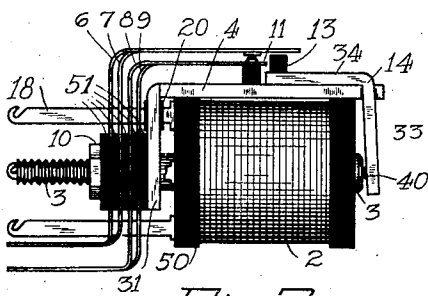


Fig. 2.

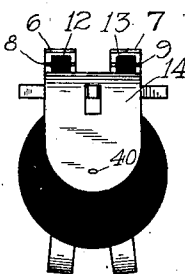


Fig. 3.

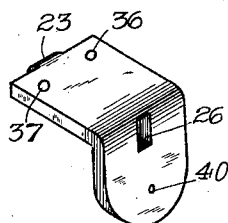


Fig. 10.

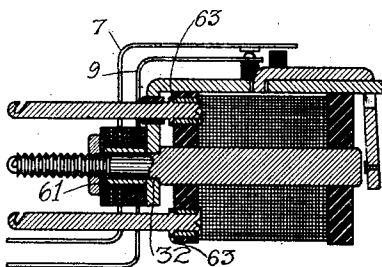


Fig. 6.

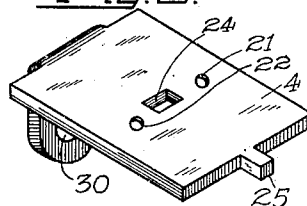


Fig. 11.

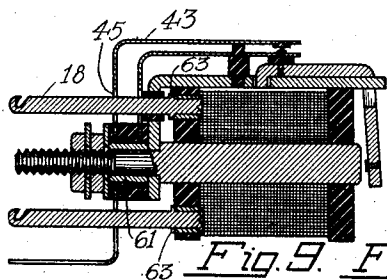


Fig. 9.

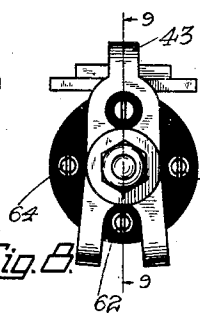


Fig. 8.

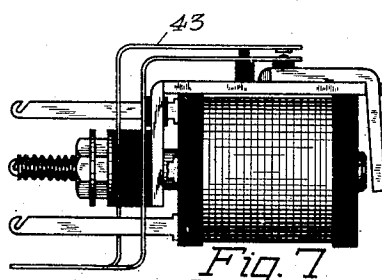


Fig. 7.

Witnesses:

G. A. Janowski

Wm. Berghahn

Inventors:

Hiram D. Currier

Laurence Ericson

By Curtis B. Camp.
Attorney

UNITED STATES PATENT OFFICE.

HIRAM D. CURRIER AND LAWRENCE ERICSON, OF CHICAGO, ILLINOIS, ASSIGNORS TO
KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A COR-
PORATION OF ILLINOIS.

RELAY.

1,239,357.

Specification of Letters Patent.

Patented Sept. 4, 1917.

Application filed October 9, 1915. Serial No. 54,929.

To all whom it may concern:

Be it known that we, HIRAM D. CURRIER and LAWRENCE ERICSON, citizens of the United States of America, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Relays, of which the following is a specification.

Our invention relates to electromagnetic devices for use in electrical circuits, and has to do particularly with relays for use in connection with telephone apparatus, although they are equally applicable for other uses. The present relays in commercial use are objectionable for the reason that they must be made of a certain size and length to permit mounting the contact springs, which must be of a certain length in order that the proper amount of spring tension may be secured, upon the heel piece of the relay. To overcome the above objection we have mounted the contact springs upon the extended core of the relay, and at right angles thereto. The springs are then bent back parallel to the core of the magnet and brought forward in position to be engaged by the rear end of the armature. By this method of mounting the springs we are able to procure the same amount of tension as is procured in the said present type of relay in use.

Another feature of our invention is the provision of an armature that when placed in position remains so without the provision of any additional holding means, that is, the armature and heel piece are so constructed that the armature when placed in position remains in position without necessitating the use of a lock nut or any other holding means.

It is the object of our invention to produce an improved relay of the class above described which will obviate the above mentioned objection and others, and that embodies the above-mentioned desirable features and others, all in a simple, efficient, and economical manner; therefore to accomplish this object and others that will be pointed out in the ensuing specification and in the appended claims, our invention consists in the novel details of construction, parts and combination of parts, reference being had to the accompanying sheet of drawings, forming a part hereof, in which the same reference characters indicate like

parts throughout the several views, and in which—

Figure 1 is a top view of one embodiment of the relay of our invention;

Fig. 2 is a side view of Fig. 1;

Fig. 3 is an end view of Fig. 2 as viewed from the right;

Fig. 4 is an end view of Fig. 2 as viewed from the left;

Fig. 5 is a perspective view of one of the contact springs;

Fig. 6 is a cross sectional view taken along line 6, 6, of Fig. 4;

Fig. 7 is a side view of another embodiment of the relay of our invention;

Fig. 8 is a rear view of Fig. 7;

Fig. 9 is a cross section taken along the line 9, 9 of Fig. 8;

Fig. 10 is a perspective view of the armature of either embodiment of our invention;

Fig. 11 is a perspective view of the heel iron of either embodiment of our invention;

Fig. 12 is a perspective view of a contact spring of the second embodiment of our invention.

Referring more particularly to Figs. 1 and 6 of the accompanying sheet of drawings, 2 represents the magnet coil of the relay which is mounted upon a suitable core 3 that is provided with a threaded end portion which passes through an orifice 30 in the downwardly bent end 31 of the heel iron 4, that extends parallel with the coil 2 to a point substantially in line with the forward end of the core 3. The core is provided with a shoulder 32 adapted to abut against the bent portion 31 of the heel iron 4 and is secured to the heel iron 4 by means of the hexagonal nut 10 that is threaded upon the end portion of the core 3. The core 3 and the heel iron 4 including portion 31, form the fixed part of the magnetic circuit of the instrument, which circuit is completed by the downwardly extending portion 33 of the bent armature 14, the portion 34 of which extends rearwardly and normally rests upon the outer face of the heel iron 4. The switch springs of the relay consist in sets of superposed metal strips 6, 7, 8 and 9 which are mounted upon the extended portion of the core 3 parallel to the portion 31 of the heel iron 4 and are secured in place by means of the hexagonal nut 10 which also acts as hereinbefore mentioned, to securely hold the core 3 in its place. These springs are

superposed and are separated by suitable strips of insulation 51 and are likewise insulated from the extended core 3 by means of insulation. The free contact carrying ends of these springs are bent parallel to the core of the electromagnet and extend forward toward the rear portion 34 of the armature 14, springs 8 and 9, as shown, resting upon studs of insulation 11 which are securely fastened by having ears extending into the annular orifices 21 and 22 of the heel iron 4, while springs 6 and 7 which are normally in contact with springs 8 and 9 respectively extend farther forward into a position to be engaged, when the armature of the relay is operated, by studs of insulation 12 and 13. The studs 12 and 13 fit into annular orifices 36 and 37 drilled in the portion 34 of the armature 14. The opposite ends of the springs 6, 7, 8, and 9 are bent parallel to the core of the electromagnet but extend rearwardly and form terminals for the connecting wires of the circuits controlled by the electromagnet. The springs 6 and 7 are provided with tension which tends to keep them in contact with the springs 8 and 9. A sleeve member 61 is provided upon which the superposed springs are mounted, thus forming a unitary structure so that the contact springs may be removed from the core of the magnet as a unit.

The terminals 16, 17, 18, 19 of the magnet coil are securely fastened to the spool head 50 of the relay and extend rearwardly parallel to the core of the magnet. The terminal spring 18 extends through an aperture in the portion 31 of the heel iron 4 and is insulated therefrom by means of a bushing 20. The contact springs are so constructed that their free contact carrying ends pass around each side of the terminal 18 and their terminal carrying ends pass upon each side of the terminal 16. The rearwardly extending portion 34 of the armature 14 is provided with an arm 23 that is bent at right angles to the main portion and is adapted to fit into the rectangular aperture 24 cut in the heel iron 4 to prevent endwise movement of the armature.

Formed integrally with the front portion of the heel iron 4 is an ear 25 that is adapted to fit into a rectangular slot 26 in the bent portion 33 of the armature 14 to prevent a sidewise movement of the armature. The armature in this particular instance rocks upon the corner of the heel iron 4 as a fulcrum and is held in place by the said arms 23 and 25 of the armature 14 and heel iron 4 respectively. To prevent the armature sticking to the forward end of the heel iron, a rivet 40 of non-magnetic material such as brass or copper is carried by the armature and is adapted to engage the ends of the core when the armature is attracted.

To remove the armature from the heel

iron the rearwardly extending portion 34 is raised until its arm 23 is removed from the aperture 24 in the heel iron. The armature is then brought forward until the ear 25 of the heel iron passes out of the aperture 26 of the armature, then the armature may be raised and freed from engagement with the heel iron 4. The relay is shown in its normal position, the armature not quite touching the forward end of the core 3, and when a suitable electrical current passes through the magnet said armature is attracted and the rearwardly extending portion 34 is turned about the heel iron 4 as a pivot and the studs 12 and 13 operate to raise the springs 6 and 7 from engagement with springs 8, 9, thereby opening the electrical circuit controlled by these springs.

The relay thus far described is shown as provided with a certain spring combination but it will be evident that a greater or less number of springs may be provided and that the number of springs in each set and arrangement and operation, may be varied according to the particular results to be accomplished in each case.

Referring more particularly to Figs. 7, 8, 9 and 12, the relay construction as shown is substantially the same as for the previously described relay. However, as only one set of springs are to be controlled by the armature of the relay shown in these figures, it is necessary to differently construct the contact springs so that they may be brought forward directly over the center of the armature. Referring now particularly to Fig. 12 which shows a contact spring of the second embodiment of our invention, it will be noted that the contact spring 43 is provided with an annular aperture 44 that is adapted to fit over the extended portion of the core 3 to securely hold it in place and that it is also provided with an annular aperture 45 through which the coil terminal 18 passes thus permitting the spring to be brought forward to the center of the armature. The manner in which the contact springs are controlled is substantially the same in this relay as in the above described relay.

To fasten the winding terminals in the spool head 50 annular recesses are first cut in the said spool head, then annular metallic rings 62 are fitted and staked into these recesses to securely fasten them to the spool head 50. The split ends of the terminal are then inserted into these metallic rings in a manner to permit the shoulders 63 of the said terminals to abut against the outer surface of the metallic rings. The split ends of the terminals are then flared outwardly to securely hold them within the recesses of the annular rings. The ends of the windings are then passed through the spaces 64 between the sides of the terminals and the

inner surface of the annular rings, and then soldered to the main portions of the said terminals.

It is to be understood that the invention is not limited to the type of relay in which a heel iron is employed but is adapted to be used in those relays in which a shell is employed in place of the heel plate. It is apparent from the construction of our relays, from the easy manner in which the springs may be reached for adjustment and due to the ease with which the armature may be removed that we have provided relays that may be mounted in a very small space and very close together.

While we have described one particular construction embodying our improvements we do not desire to be limited in all respects thereto as it is apparent that various modifications and changes may be made without departing from the spirit and scope of our invention.

Having described our invention what we claim as new and desire to secure by United States Letters Patent, is:

1. In a relay, the combination with a heel iron and an armature carried thereby, orifices and cooperating ears provided for said heel iron and said armature, said ears and orifices providing the sole means for maintaining said armature in its pivoted position upon said heel iron.

2. In a relay structure, the combination with a heel iron and an armature carried thereby, an integrally formed ear for said heel iron adapted to fit into an oblong orifice in said armature, an integrally formed ear for said armature adapted to fit into an orifice in said heel iron, said integrally formed ears and orifices holding the armature in a pivoted position upon said heel iron, and said ears and orifices being so positioned that said armature may be raised vertically and removed from its pivoted position.

3. A relay structure including an electromagnet provided with a core, an angular heel iron secured to said core and having one limb thereof extending parallel thereto, an angular armature fulcrumed to said heel iron having one of its arms extending across and in front of the core of said electromagnet and its other arm extending back and parallel to the core of said electromagnet, an oblong orifice cut in the first mentioned arm of said armature, a rectangular orifice cut in an arm of said heel iron, a forwardly projecting ear for said heel iron and a downwardly projecting ear for said armature for cooperation with the orifices in said armature and said heel iron respectively, the said projecting ears and orifices forming cooperating means to securely fulcrum the armature in its position upon said heel iron.

4. In a relay, the combination with a mag-

net structure, of an angular heel piece for said structure provided with an extended ear parallel to the core of the magnet, an armature provided with an integrally formed ear extending at right angles to said core, and orifices cut in said heel iron and said armature adapted to cooperate with the ears of said armature and heel piece, respectively to provide means for securing said armature in its pivoted position upon said heel iron.

5. A relay structure of the class described including a heel iron and an armature, an integrally formed ear for said heel iron, an orifice cut in said heel iron, an integrally formed ear for said armature, an oblong orifice cut in said armature, said heel iron ear and said armature ear being so positioned with relation to the orifices cut in the said armature and heel iron, respectively, that said armature may be raised and removed from its fulcrumed position upon said heel iron.

6. In a relay, the combination with a magnet structure provided with a heel iron, having a centrally located forwardly projecting integrally formed ear extending parallel to the core of said magnet, of an armature for said magnet having an integrally formed downwardly projecting ear extending at right angles to the core of said magnet, a centrally located orifice for said heel iron, an oblong orifice for said armature, the projecting ear of said heel iron and the projecting ear of said armature cooperating with the orifice of said armature and the orifice of said heel iron, respectively, to provide means for retaining said armature in its fulcrumed position upon said heel iron.

7. The combination with a magnet, an armature therefor having two arms at an angle to each other, a support for the armature having an edge upon which as a fulcrum said armature is carried intermediate of its ends, a protruding member for said support extending into an orifice cut in one arm of said armature, a protruding member carried by the other arm of said armature and extending into an orifice cut in said support, said protruding members and orifices cooperating to maintain said armature in its fulcrum position upon said support.

8. The combination with a magnet, an armature therefor having two arms at an angle to each other, a support for the armature having an edge upon which as a fulcrum said armature is carried intermediate of its ends, a protruding member for said support extending into an oblong orifice cut in one arm of said armature, a protruding member carried by the other arm of said armature and extending into an orifice cut in said support, said protruding members and orifices cooperating to maintain said armature in its fulcrumed position upon

said support, said oblong orifice permitting the said armature to be raised and removed from its fulcrumed position.

9. In an electromagnet, the combination with a U-shaped frame of magnetic material, one leg thereof forming the core and provided with an energizing coil, of an angular armature fulcrumed on the end of the other leg, superposed contact springs secured to the said core and mounted parallel to the bridge connecting piece of the U-shaped frame and having their free ends bent at right angles and extended forward in position to be actuated by said armature.

10. The combination with a magnet having a core, of a member secured to the rear end of the core and serving to extend the magnetic circuit of the magnet toward the front end thereof, an armature having two arms at an angle to each other supported upon a suitable edge upon which as a fulcrum it may rock, superposed contact springs provided with orifices through which the extended end of said core protrudes, the free ends of said contact spring extending forward in a position to be actuated by said armature, and means for securing said member and said springs upon said core.

11. A combination with a magnet coil provided with a core, of a member extending longitudinally thereof, an armature for the magnet having two arms extending at an angle to each other, one arm passing transversely across the end of the magnet in front of its pole so as to be actuated thereby while the other arm extends back over said member, a set of superposed switch springs and alternately disposed strips of insulation provided with annular recesses adapted to receive the extended end of said core upon which they are mounted at right angles to said longitudinal member, the free ends of said springs terminating adjacent to the said second arm of the armature, and one of said springs extending beyond the others to the said second arm of the armature, whereby when the magnet is energized the said spring is lifted and when the magnet is deenergized the spring returns the armature to normal position.

12. In a relay, the combination with a magnet structure provided with an angular heel iron having one portion extending forward and parallel to the core of the magnet, of an armature lever having an arm extending across in front of one end of the magnet and adapted to be attracted thereby and the other end extending back parallel to the heel iron, a forwardly projecting ear for said heel iron protruding through an orifice in the first mentioned arm of said armature lever, a downwardly projecting ear for said latter mentioned arm of said lever extending through an orifice in the portion of said heel iron which extends parallel to the core

of the magnet, said projecting ears and orifices forming means for maintaining the said armature lever in its fulcrumed position upon said heel iron and being so arranged that said armature lever may be removed from its fulcrumed position by raising it vertically until the downwardly projecting ear is raised above the heel iron and then moving it forward until said armature is removed from said forwardly projecting ear.

13. In a relay, the combination of a magnet structure provided with an angularly-shaped heel piece having one arm extending forward substantially parallel to the magnet core of said structure and the other arm extending at right angles to and supporting said magnet, an armature pivotally carried by the forwardly extending portion of said heel iron, a set of superposed switch springs and alternately disposed strips of insulation provided with annular recesses adapted to receive and be secured to the extended end of the core of said magnet, the free ends of said springs being bent back at right angles to extend parallel to the core of said magnet and in position to be actuated by said pivotally carried armature.

14. In a relay, the combination of a magnet structure provided with an angularly-shaped heel piece having one arm extending forward substantially parallel to the magnet core of said structure and the other arm extending at right angles to and supporting said magnet, an armature pivotally carried by the forwardly extending portion of said heel iron, and a contact spring provided with an annular recess adapted to receive and be secured to the extended end of the said core and mounted at substantially a right angle to the core of said electromagnet and having its unattached end extending parallel to the core of said electromagnet in a position to be operated by said armature.

15. The combination with a magnet provided with an extended core, of an armature having two arms at an angle to each other, a support for said armature to which it is pivotally secured, one arm of said armature extending across and in front of the core of said magnet so as to be attracted thereby, a contact spring provided with an orifice through which the extended end of said core passes and to which it is firmly secured in a plane substantially parallel to the movement of the other arm of said armature when it is attracted, and means carried by said armature for actuating said spring.

16. In a relay, the combination of a magnet structure provided with an angularly shaped heel piece having one arm extending forward parallel to the core of the magnet and the other arm extending at right angles to and supporting the core of said magnet, of an angular armature fulcrumed at one end to said heel piece, superposed contact springs

secured to the said core and mounted parallel to the second mentioned arm of said heel piece and having their free ends bent at right angles and extending parallel to the
5 first mentioned arm of said heel piece in position to be actuated by said armature.

Signed by us at Chicago, county of Cook

and State of Illinois in the presence of two witnesses.

HIRAM D. CURRIER.
LAWRENCE ERICSON.

Witnesses:

G. A. YANOSCHOWSKI,
B. O'BRIEN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."