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ELECTROMAGNETIC DEVICE

Filed July 6, 1928

FIG. 1.

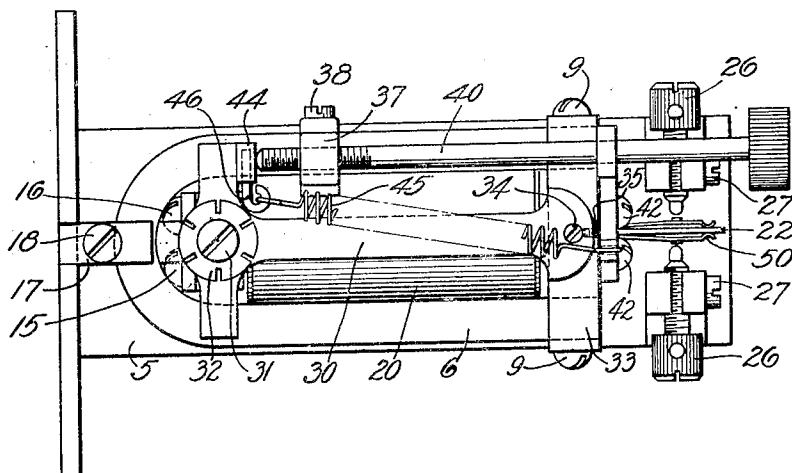


FIG. 3.

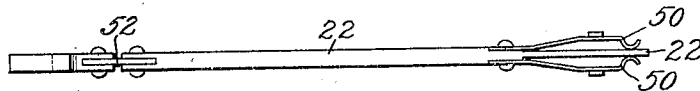
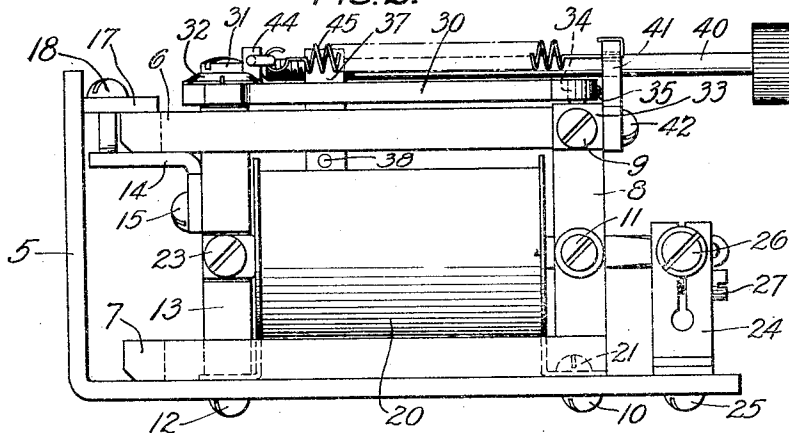


FIG. 2.



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## ELECTROMAGNETIC DEVICE

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This invention relates to electromagnetic devices and more particularly to electromagnetic relays of the polarized type.

In the general practice of telephony and telegraphy polarized relays constitute a well known field of equipment and in many cases such relays are biased in one direction or the other in order to satisfy certain characteristics of the circuits with which they are employed and to perform certain predetermined functions. Generally the biasing of such relays is effected mechanically; that is, the armature of such a piece of equipment is moved toward one or the other pole face of the permanent magnet by means of some mechanical device directly associated with the armature. This mechanical device may be in the form of a coil spring having one end secured to the armature and the other end to a regulating screw which in turn is mounted on the relay structure in any suitable manner. By adjusting the screw, the tension on the coil spring may be varied and a corresponding bias applied to the armature. Another arrangement which is more common on relays for telegraph circuits consists of mechanical means for moving the two contacts with which the armature contacts are associated. The movement of these contacts indirectly restricts the motion of the armature relative to the two pole pieces by forcing the armature nearer to one pole piece or the other. Such mechanical methods require a high degree of precision, making it difficult to obtain smooth biasing.

It is the object of this invention to improve the biasing of electromagnetic relays.

This object is attained in accordance with a feature of the invention by the provision of a magnetic element pivotally mounted on the relay structure in such a manner as to be capable of assuming various positions relative to the permanent magnet poles and accordingly varying the polarizing magnetic flux in the pole gaps; that is, unbal-

ancing the field strengths in the two pole gaps. The armature of the relay is influenced accordingly and its movement is regulated or controlled by the magnetic element. As the magnetic element is gradually moved toward the N pole of the permanent magnet the relay armature is gradually biased toward the S pole of the magnet and vice versa.

Another feature of the invention resides in the provision of an armature having a longitudinal projection which extends midway between the armature contact springs and serves as a rest for the outermost ends thereof. This design of armature is an aid towards the elimination of contact chattering and maintaining sufficient rigidity so that in operating, the armature will not strike the associated pole pieces.

The invention will be readily understood from the following detailed description made with reference to the accompanying drawings in which:

Fig. 1 is a plan view of a relay structure embodying the features of the invention;

Fig. 2 is a side elevation of the relay shown in Fig. 1; and

Fig. 3 discloses the novel armature and spring contact construction which is employed in the relay shown in Figs. 1 and 2.

The base or mounting plate 5 is provided as a means for mounting and supporting the relay structure, and is substantially L shaped. The relay is shown employing two U-shaped permanent magnets 6 and 7 but it is to be understood that applicant's invention need not be confined to such a structure and that it functions equally as well with but one permanent magnet.

The U-shaped magnets 6 and 7 are held in spaced relation at their open ends by means of a pair of magnetic elements 8, only one of which is disclosed in Fig. 2, it being understood that a similar element is situated between the inner set of magnet

legs. The elements 8 are rabbet-notched at their upper ends to provide a seat for the legs of the upper magnet and are secured thereto by means of a pair of screw bolts such as 9. The lower ends of the elements 8 rest on the legs of the lower magnet and are drilled and tapped to provide a recess for the screw bolts 10 by means of which the lower magnet and the elements 8 are secured to the base 5. A pair of pole piece screws 11 is provided and each is threaded through the magnetic elements 8. These screws are adjustable and may be regulated to adjust the gap between the pole pieces.

Secured to the base 5 by means of screws such as 12 is a heel-block 13 which is located between the legs of the magnets and nearer the bended portions thereof. A bracket member 14 is secured to the upper end of the heel-block 13 by screws 15 and 16. The curved portion of the U-shaped magnet 6 rests on the bracket 14 and is held tightly in position by means of the clamps 17 and screw 18.

The spool upon which the operating windings of the electromagnet 20 are wound is secured to the base 5 by means of the screws 12 and 21, the screw 12 serving to secure one end of the spool and the heel-block 13 to the base.

The heel-block 13 is provided with a notch or slot over which the bifurcated end of armature 22 extends. A screw 23 passes through the heel-block 13 and between the prongs of the end of armature 22 and secures the armature to the heel-block. The armature passes through the core of the electromagnet 20.

A block 24 is secured to the base 5 by means of screw 25 and is slotted in such a manner as to permit adjustment of the contact screws 26. By turning the screws 26 one way or another the distance traveled by the armature may be varied and when the required setting is attained the screws 27 are tightened and the slot in block 24 closes in on the contact screws 26 holding them firmly in position.

A T-shaped magnetic element 30 is mounted on the heel-block 13 by means of the screw 31 and spring washer 32, and normally assumes a position mid-way between and immediately above the legs of magnet 6. A U-shaped element 33 embraces the legs of magnet 6 near their ends and its horizontal portion serves as a riding surface for the set screw 34 which protrudes from the under side of the T-shaped element 30 at its free end and is held in position by the screw 35. By means of the two screws 34 and 35, the free end of element 30 may be raised or lowered to vary the air gap between it and the pole pieces of the permanent magnets. The adjustment of the air gap is in turn

an adjustment of the effectiveness of the magnetic element 30.

A nut 37 is provided with a bifurcated extension which fits over one leg of magnet 6 and is held in position by means of the screw 38 which engages the extended portions of the nut 37 and clamps the nut securely to the magnet 6. A regulating screw 40 is supported near one end by means of the supporting member 41 which is secured to the relay structure by means of screws 42 and is provided with two projecting portions in one of which a circular hole is provided through which the regulating screw passes. At its other end the regulating screw 40 is threaded through the nut 37, preferably a multiple thread, and abuts against the projection 44 which forms an integral part of the T-shaped element 30.

A coil spring 45 has one end attached to a wire hook 46 which is embedded in the projection 44. Its other end is attached to one of the projections on the supporting element 41. This spring serves to maintain the projection 44 in engagement with the end of the regulating screw 40.

With the magnetic biasing element 30 occupying a position with its free end mid-way between the poles of the permanent magnet 6, the armature 22 experiences no biasing effect and at its mid-way position between the magnet poles it is acted upon with equal forces by both poles. Should it be desired to give the armature a bias in a certain direction the screw 40 is rotated one way or the other so that the T-shaped member 30 pivots about the screw 31, its free end moving towards one or the other permanent magnet poles. By so doing, the strength of the field between the armature and pole piece on the side into which the T-shaped member has moved is weakened relative to the field strength between the armature and pole piece on the other side. Consequently the armature is attracted towards the stronger field. In this manner the armature is biased in a direction opposite to that in which the T-shaped element has been moved.

The biasing influence of the T-shaped element 30 on the armature 22 may be explained in the following manner: As heretofore stated, when the element 30 occupies a position with its free end mid-way between the poles of the permanent magnet 6, the polarizing flux values in the pole gaps on both sides of the armature are equal. This is due to the fact that the T-shaped element, when in its normal or unbiasing position does not influence the polarizing flux relative to its effect upon the armature. This may be understood by tracing the flux paths of which the biasing element 30 is a part. Assuming for instance the upper pole (Fig. 1) of permanent magnet 6 to be a

north pole, a portion of the polarizing flux emanating from this pole tends to traverse the T-shaped element towards its mounted end, through the upper arm of the T, along the upper arm of the magnet 6 to the north pole in a closed magnetic circuit; also flux entering the lower or south pole of magnet 6 tends to traverse the lower arm of the magnet, up the lower arm of the T and down its center portion. It will now be observed that the fluxes tending to traverse the T-shaped element are directionally opposed and being equal in value balance out, so that the effect of the biasing element when in its normal position is nil. However, when the T-shaped element is moved towards the north pole the magnetic circuit for the flux emanating from this pole is shortened and its reluctance decreased accordingly. In like manner the magnetic circuit for the flux entering the south pole is lengthened and its reluctance increased. There will be accordingly, an excess of flux traversing the T-shaped element towards its mounted end. A portion of this flux passes down the heel plate 13 through the armature 22 to the south pole of the permanent magnet 6. This relatively strengthens the south pole field and the armature accordingly experiences a greater pull towards the south pole and is biased in that direction. It is understood that other paths for the polarizing flux exist but in each case when the T-shaped element is in its normal position, as shown in Fig. 1, the resultant flux therein is zero, and it is only when this element is moved in one direction or the other that this equilibrium is disturbed and attended by a bypassing of flux therethrough with a consequent biasing effect on the armature. The cross arms of the T-shaped magnetic element 30 need not be necessarily in contact with the permanent magnet 6 nor is its construction limited to the specific design shown. The pivot point on the magnetic element 30 can be located anywhere along its length, depending on the method of actuating it to give it angular displacement.

It is apparent that this invention obviates the association of any mechanical means with the armature or the relay contacts and relies entirely upon the weakening of the permanent magnetic flux in either pole gap to produce a bias on the armature. This biasing arrangement permits a smoother and greater range of biasing than can be obtained practicably by mechanical means.

Referring to Fig. 3 the armature 22 is shown having its operating end of a smaller cross-section than the main body portion thereof. The contact carrying springs 50 are riveted to the main body portion of the armature at a distance from its free end substantially equal to the length of the contact springs themselves and are so con-

formed that the extended portion of the armature passes mid-way between the contact springs and serves as a rest for the free ends thereof. This design of armature eliminates contact chattering and affords sufficient rigidity to prevent the armature from striking the associated pole pieces.

The piece 52 is provided to join the two sections of the armature and serves as a flexible hinge.

What is claimed is:

1. A polarized relay having a permanent magnet, an armature, said armature being under the influence of the magnetic field of said permanent magnet, contacts for said armature, and means independent of said armature and said contacts for varying the field strength of said magnet to effect a bias on said armature.

2. A polarized relay having a permanent magnet, an armature, said armature being under the influence of the magnetic field of said permanent magnet, a pivoted magnetic element mechanically independent of said armature, and means for moving said element about its pivot point to magnetically bias said armature.

3. A polarized relay having a permanent magnet, an armature centrally located with respect to the poles of said magnet, a magnetic element normally placed in parallel relationship to said armature, and means for displacing said magnetic element angularly with respect to said armature to effect a magnetic bias of said armature.

4. A polarized relay having a permanent magnet, an armature centrally located with respect to the poles of said magnet, a T-shaped magnetic element having its main body portion normally in parallel relationship to said armature, and means for displacing said T-shaped element angular in either direction from its normal position to effect a magnetic bias of said armature.

5. A polarized relay having a permanent magnet, an armature centrally located with respect to the poles of said magnet, a T-shaped magnetic element having the free end of the stem portion thereof normally located in the magnetic field of said magnet at the point of magnetic balance and manually controlled means for varying the position of the stem portion of said T-shaped element in said field to alter the point of magnetic balance of said field and effect a bias of said armature.

6. A polarized relay having a permanent magnet, an armature centrally located with respect to the poles of said magnet, a magnetic element normally placed in parallel relationship to said armature, and a manually operable screw for displacing said magnetic element angularly with respect to said armature to effect a magnetic bias of said armature.

7. A polarized relay having a permanent magnet, an armature centrally located with respect to the poles of said magnet, a magnetic element normally placed in parallel relationship to said armature, a manually operable screw for displacing said magnetic element angularly with respect to said armature to effect a magnetic bias of said armature, and a spring member for maintaining said magnetic element in engagement with said screw throughout its range of positions.

In witness whereof, I hereunto subscribe my name this 29th day of June, 1928.

FRANK A. ZUPA.

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