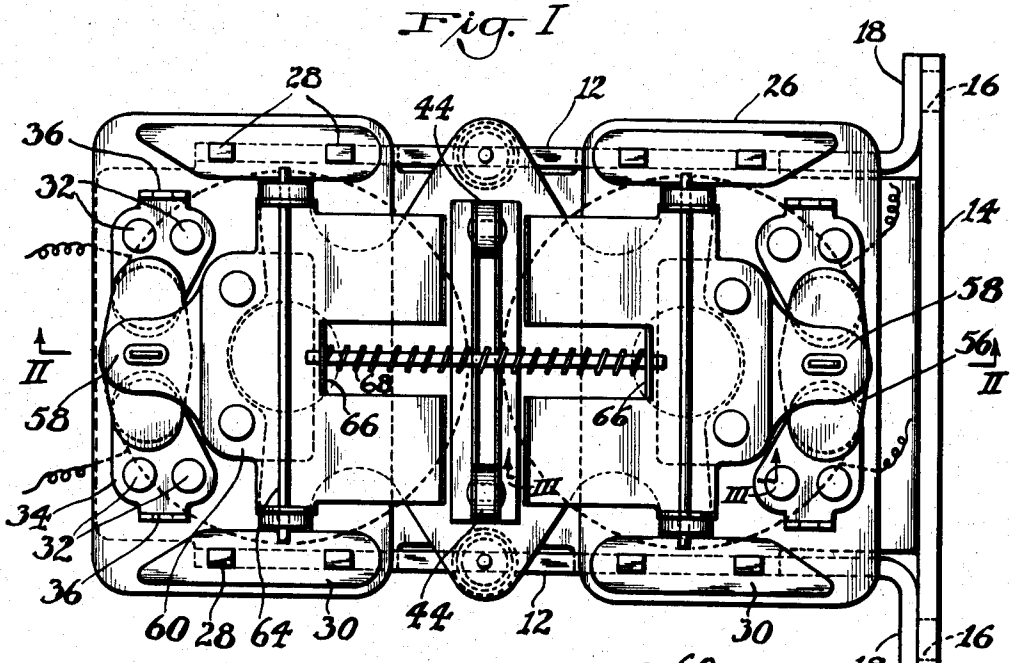
April 16, 1946. V. WEBER 2,398,681

RELAY

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Fig. I



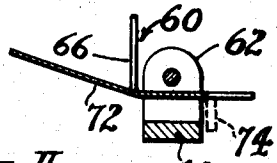
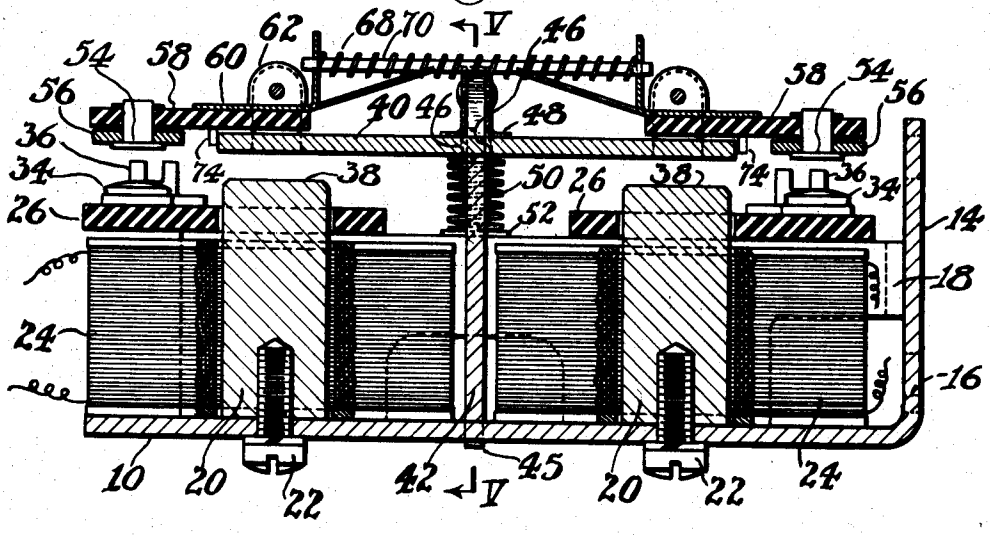


Fig. III

Fig. II



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RELAY

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Fig. IV

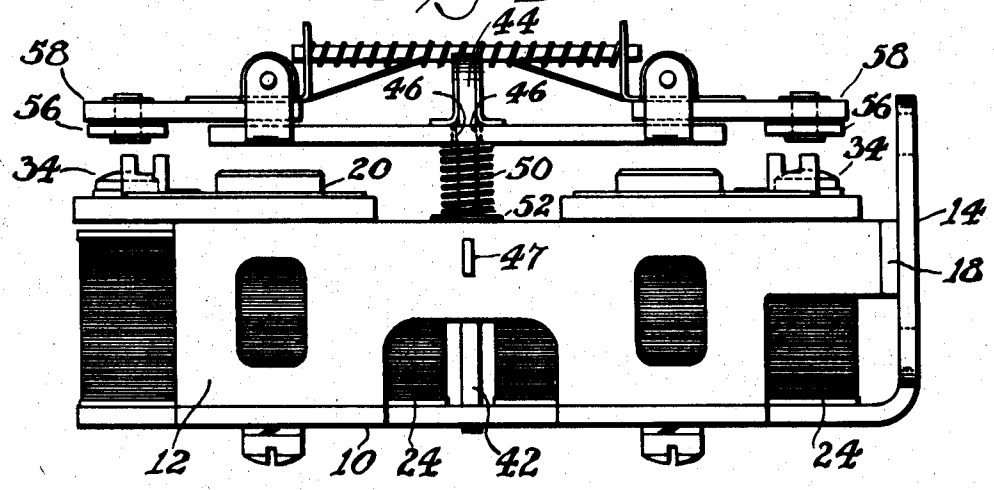


Fig. V

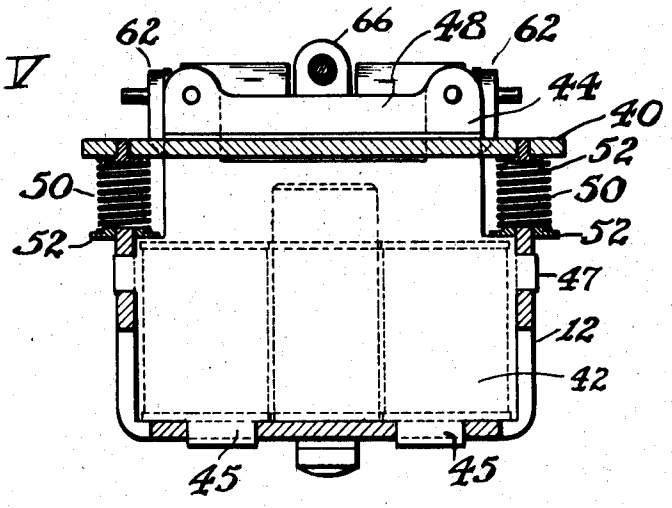
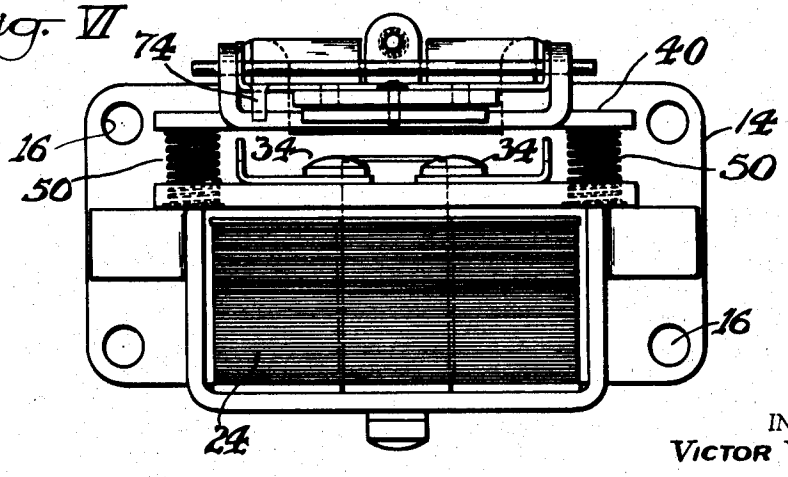


Fig. VI



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UNITED STATES PATENT OFFICE

2,398,681

RELAY

Victor Weber, Greensburg, Pa., assignor to Robertshaw Thermostat Company, Youngwood, Pa., a corporation of Pennsylvania

Application February 19, 1943, Serial No. 476,395

12 Claims. (Cl. 200—98)

This invention relates to relays and, more particularly, to double-throw relays having a neutral position.

One object of the invention is to preclude simultaneous engagement of both sets of contacts in such devices.

Another object of the invention is to ensure return of the relay to neutral position under normal conditions.

Another object of the invention is to assure successful operation of the relay where the gravity pull is greater than earth gravity.

Another object of the invention is to obviate undue wear on the contact faces while obtaining good electrical contact therebetween.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, wherein

Fig. I is a plan view of the relay;

Fig. II is a section taken on the line II—II of Fig. I;

Fig. III is a partial section taken on the line III—III of Fig. I;

Fig. IV is a front elevation;

Fig. V is a section taken on the line V—V of Fig. II; and

Fig. VI is an end elevation.

Referring more particularly to the drawings, the relay structure is carried upon a base 10 of rectangular form having integral upturned sides 12 forming a channel section. The relay structure is adapted to be mounted on any suitable support by means of an integral upturned flange 14 at one end which is provided with apertures 16 for the reception of securing means for this purpose. Added rigidity may be given to the flange 14 by the provision of oppositely disposed lugs 18 projecting from the sides 12 and secured by soldering, riveting or other suitable means to the upturned flange 14.

The electromagnets of the double-throw relay of this invention are housed within the channel section and may comprise identical parts to which similar reference numerals have been given. Accordingly, the two cores 20 of the magnet are secured to the base 10 by screws 22 in spaced apart relation and carry the usual coils 24 which extend substantially flush with the edges of the side portions 12. Surmounting each coil 24 is a sheet of insulating material 26 which also overlies the edges of the side portions 12. The insulating sheets 26 thus extend transversely across the channel section and may be secured in position by spaced prongs 28 which project therethrough from the sides 12 and are riveted against metal support plates 30 to prevent tearing of the insulating material.

Secured to the upper surface of the sheets 26 by rivets 32 is a plurality of contact elements 34, there being two such contacts for each insulating sheet 26 and secured thereto in spaced relation on either side of the longitudinal axis of the sheets 26. Each contact element 34 is preferably provided with an associated terminal 36 for connection into the electrical circuit with which the relay is used. As the cores 20 of the electromagnet have their exposed surfaces 38 in substantially the same plane as the contacts 34, the insulating sheets 26 are suitably perforated to permit the cores 20 to extend therethrough.

A plate 40 extends across the upper surfaces 38 of both cores 20 and forms a common armature for the electromagnets. This plate or armature 40 is adapted to occupy a neutral position with respect to the electromagnets when both magnets are deenergized; to engage one or the other of the cores 20 when either magnet is energized; but it is not permitted to engage both cores 20 simultaneously. To this end, the armature 40 is mounted on a support 42 in the form of a plate projecting normal to the base 10 and being provided with end prongs 45 by means of which it is secured in position on the base 10 and side prongs 47 engaging the sides 12 to preclude tilting.

The armature support 42 also has a pair of projections 44 on the end opposite the base prongs 45 located one on each side thereof and extending through apertures 46 formed in the median portion of the armature 40. The apertures 46 are made sufficiently larger in area than the projections 44 in order that the armature 40 may both tilt and move bodily with respect to its support, although the latter movement is restricted as will hereinafter appear. Secured one on each side of the projections 44 is a pair of angle strips 48, each having one side projecting outwardly from the armature support 42 and engaging the exposed surface of the armature 40. The angle strips 48 are so arranged, that when the surface of the armature 40 is in contact therewith, the underside of the armature 40 is slightly spaced from the top of the support 42. Owing to the clearance provided at this point, and also between the projections 44 and the apertures 46 as described, the armature 40 may tilt or rock about the support 42 when attracted by one or the other of the electromagnets. The outwardly

projecting sides of the angle strips 48 provide spaced fulcrums for such movement.

The armature 40 is normally retained in a neutral position with the opposite ends thereof spaced substantially equal distances from the two core surfaces 38, by a pair of coil springs 50 which extend on either side of the support 42 between the underside of the armature 40 and the edge of the sides 12. The coil springs 50 may be prevented from bodily shift by cupped washers 52 located at each end of the springs and secured to the armature 40 and the sides 12, respectively. Thus, the springs normally bias the armature 40 toward the fulcrums provided therefor by the angle strips 48 until the armature is attracted by one or the other of the electromagnets, whereupon the springs 50 yield to permit pivotal movement of the armature 40. As the armature 40 is pivotally mounted at its median portion about the support 42 it is in substantial balance. This feature is referred to more in detail hereinafter. The pivotal movement of the armature 40 always occurs about the fulcrum on the far side of the support 42 from the magnet which attracts it. The springs 50 which are thus between the fulcrum and the attracting magnet, tend to urge the armature to neutral position where both fulcrums engage it.

The four contacts 34 forming the fixed contacts of the relay are adapted to be engaged by a pair of movable contacts 56 associated with the armature 40. Each of the armature contacts 56 is of sufficient area to span the two associated fixed contacts 34 and is attached by a rivet 54 for rocking motion on an insulating strip 58 extending beyond the end of the armature 40 at each end thereof so that the contacts 56 overlie the contacts 34. Each insulating strip is carried on a bracket 60 secured to a pair of upturned lugs 62 on each end of the armature 40 by means of a pin 64 extending therebetween. The brackets 60 and the insulating strips 58 forming the contact arms of the assembly are thus adapted for pivotal movement with respect to the armature 40 although also movable therewith upon pivotal movement of this element. The brackets 60 are provided with upturned lugs 66 located substantially in the center portion thereof for engagement by a coil spring 68 mounted on a bar 70 which is fastened in suitable apertures in the upturned lugs 66. The portion of these brackets 60 from which the upturned lugs 66 are formed leaves a clearance opening 72 for the spring 68 and bar 70. Pivotal movement of the brackets 60 under pressure of spring 68 is restricted by engagement of a depending flange 74 forming a stop element on each bracket which engages with the adjacent end of the armature 40. It is to be observed that the contact arms 58, 60 are pivoted at the median portions and are therefore individually balanced on the armature 40. As previously noted the armature itself is balanced about support 42. Thus, in addition to the individual balancing of the contact arms, these elements and the armature are jointly balanced.

When either of the electromagnets is energized, the related end of the armature 40 will be attracted toward the core 20, causing rocking movement of the armature relative to the support 42. The angle strip 48 located on the side opposite to the attracted side of the armature acts as a fulcrum for this rocking movement. Both in engaging and separating from fixed contacts 34, the movable contacts 54 undergo slight sliding motion thereacross. This wiping action is effected by pivoting of the bracket 60 and compression of the spring 68 when the contacts engage. Thus, upon sufficient rocking motion of the armature 40 the contacts associated with one end thereof will become engaged and close the circuit through the terminals 36. Upon deenergization of the electromagnet the armature 40 is released and springs 50 return it to the neutral position, unless the other electromagnet of the pair is energized to rock the armature in the other direction. The wiping motion of the contacts 54 upon separating from contacts 34 serves to break any weld which may have been created between them and cleans the contact surface upon making contact.

The relay of this invention finds a wide field of usefulness and is particularly adapted for use on aircraft where conditions encountered in flight result in gravity pulls far greater than the normal earth gravity. The entire movable part of the assembly comprising the armature 40 and attached contact arms 58, 60 is substantially balanced as a unit. In addition to the balancing of the assembled parts, the individual contact arms 58, 60 are also substantially balanced. During high speed flight the relay operates normally and excess gravity pull cannot disturb the usual functioning due to the novel construction. It will be apparent that the balancing feature could be applied to single relays as distinguished from the double-throw type described and shown by providing a counterweight in place of the armature portion and take-up arm on one side of the central support 42.

It will be apparent that the relay contacts engage and disengage in such manner that undue wear upon the contact faces is avoided and the life of these elements is prolonged. The contact arms can be adjusted to give a large amount of take-up movement. Therefore, the contacts can wear considerably before the relay ceases to operate. The common armature can only rock about its support and is positively prevented from moving bodily to engage the fixed and movable contacts simultaneously. It will be understood that various changes can be made in the arrangement and combination of parts and in the details of construction herein disclosed within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A relay comprising spaced electromagnets, a common armature for said magnets, separate contacts carried on one side of said armature at opposite ends thereof, stationary contacts adapted to be engaged by said armature contacts, means for supporting said armature intermediate said ends thereof, spaced fulcrums engageable with said armature on a side opposite said armature contacts and being positioned in proximate relation to said supporting means, and yieldable means cooperating with said fulcrums for pivotal movement of said armature about one or another of said fulcrums to engage said contacts at whichever end of said armature is most distant from said engaged fulcrum, said supporting means being adapted for limiting bodily movement of said armature and preventing simultaneous engagement of said contacts.

2. A relay comprising spaced electromagnets, a common armature for said magnets, separate contacts carried by said armature at opposite ends thereof, stationary contacts adapted to be engaged by said armature contacts, a support for said armature intermediate said ends and pro-

jecting therethrough, means carried by said projection providing spaced fulcrums engageable with said armature for pivotal movement of said armature about one or another of said fulcrums, and means for maintaining said armature normally in neutral position engaging both of said spaced fulcrums but being yieldable to permit said pivotal movement to engage said contacts at whichever end of said armature is most distant from said engaged fulcrum, said support being adapted for limiting movement of said armature to engage said contacts to said pivotal movement only.

3. A relay comprising spaced electromagnets, a support between said magnets, an armature carried intermediate its ends on said support and overlying said magnets, said armature being movable with respect to said support when attracted by said magnets, lug portions projecting from said support through apertures in said armature and restraining longitudinal and lateral movement thereof with respect to said magnets, abutment means carried by said lugs overlying said armature and restraining movement thereof axially of said magnets, said abutment means providing spaced fulcrums for pivotal movement of said armature when attracted by one or another of said magnets, and yieldable means urging said armature into engagement with said abutment means and preventing disengagement thereof from that said fulcrum which is most distant from the attracting magnet upon said pivotal movement.

4. A relay comprising a pair of electromagnets spaced one from the other, a common armature for said magnets, separate contacts carried by said armature at opposite ends thereof and insulated therefrom, stationary contacts mounted on said magnets and insulated therefrom, a support extending between said magnets and projecting through said armature intermediate the ends thereof, said armature being thereby restrained from lateral and longitudinal movement with respect to said magnets, abutment means carried on the projecting portion of said support and providing spaced fulcrums for pivotal movement of said armature when attracted by one or another of said magnets, and yieldable means urging said armature into engagement with said abutment means and preventing disengagement thereof from that said fulcrum which is most distant from the attracting magnet upon said pivotal movement to engage said separate contacts individually with said stationary contacts, said support being adapted for preventing simultaneous engagement of said separate contacts with said stationary contacts.

5. A relay comprising a base, a pair of electromagnets secured side-by-side on said base, a pair of stationary contacts for each magnet insulated therefrom and carried on said base, a plate overlying both magnets and forming a common armature therefor, a pair of contacts carried at each end of said plate and insulated therefrom, each contact pair overlying one pair of stationary contacts associated with each magnet, a rigid support extending from said base between said magnets and about which said plate is adapted to rock from a neutral position substantially normal to said support, said support providing spaced relation between said plate and magnets in said neutral position and in which said contacts are disengaged, a lug at each end of said support projecting through apertures therein and restraining lateral and longitudinal movement relative to said base, bar portions carried on opposite faces of said lugs extending laterally of said plate and providing spaced fulcrums, said fulcrums being individually engageable with said plate for rocking movement thereof from neutral position to engage the contact pairs at whichever end of the plate is most distant from said engaged fulcrum, coil springs extending from said base to the underside of said plate at each end of said support, said springs urging said plate into the neutral position against said bar portions and being yieldable to permit said rocking movement when the plate is attracted by one or the other of said magnets.

6. A relay comprising a base, a pair of electromagnets mounted side-by-side on said base, a plate overlying said magnets and forming a common armature therefor, a rigid support extending from said base between said magnets and about which said plate is adapted to rock toward one or the other of said magnets, means for completing an electric circuit when said plate is rocked, comprising contact elements associated with said plate and base, said base contacts being fixedly mounted on insulation and surmounting said magnets beyond the ends of said plate, a pair of brackets pivotally mounted one at each end of said plate, insulating means carried by said brackets and projecting beyond the ends of said plate, said plate contacts being loosely mounted on said insulating means for operative engagement with said base contacts, and yieldable means extending between said brackets and compressible thereby for sliding said plate contacts across said base contacts upon engagement therewith.

7. A relay comprising spaced electromagnets, a common armature for said magnets, a support for said armature intermediate the ends thereof and projecting therethrough, means carried by said projection providing spaced fulcrums for pivotal movement of said armature toward one or another of said magnets, means for maintaining said armature normally in neutral position engaging said separate fulcrums but being yieldable to permit said pivotal movement, said support being adapted for limiting movement of said armature to said pivotal movement from neutral position, means for completing an electric circuit when said armature completes said pivotal movement, comprising separate contact elements at each end of said armature and adapted for engagement with separate fixed contact elements, means for pivotally mounting said armature contacts at opposite ends of said armature, and yieldable means extending longitudinally of said armature and compressible between said mounting means for sliding said armature contacts across said fixed contacts upon engagement therewith.

8. A relay comprising an electromagnet, an armature for said magnet, a support upon which said armature is pivotally mounted at one end thereof to overlie said magnet, a contact arm pivotally mounted on said armature, means for substantially counterbalancing said armature and contact arm jointly on said support, and means for substantially counterbalancing said contact arm individually on said armature.

9. A relay comprising an electromagnet, an armature for said magnet, a support upon which said armature is pivotally mounted at one end thereof to overlie said magnet, a contact arm pivotally mounted on the opposite end of said armature and extending therebeyond, means for substantially counterbalancing said armature and contact arm jointly on said support, and means

for substantially counterbalancing said contact arm individually on said armature.

10. A relay comprising an electromagnet, an armature for said magnet, a support upon which said armature is pivotally mounted at one end thereof to overlie said magnet, a stationary contact element beyond the end of said armature, a bracket pivotally mounted on the opposite end of said armature and extending therebeyond, a contact element carried on said bracket and overlying said stationary contact, said bracket and the contact carried thereby constituting a substantially balanced contact arm pivoted at the median portion thereof, and means extending on the side of said support opposite said armature and connected thereto for substantially counterbalancing said armature and contact arm jointly.

11. A relay comprising spaced electromagnets, a common armature for said magnets, means for supporting said armature intermediate the ends thereof for rocking movement toward one or the other of said magnets, a contact arm pivotally mounted at each end of said armature, said armature and contact arms jointly being in substantial balance on each side of said support, and counterbalancing portions on said contact arms for placing said arms individually in substantial balance on each side of said pivotal mounting.

12. A relay comprising spaced electromagnets, a support between said magnets, an armature carried intermediate its ends on said support and overlying said magnets, said armature being movable with respect to said support when attracted by said magnets, means carried by said support providing spaced fulcrums on either side thereof for pivotal movement of said armature, and yieldable means normally maintaining said armature in engagement with said fulcrums until attracted by one or the other of said magnets, whereupon said armature pivots about the fulcrum on that side of said support most distant from the attracting magnet and against the pressure exerted by said yieldable means on the side of the support nearest to said magnet.

VICTOR WEBER.