March 4, 1941. F. F. HUMPHREYS ET AL 2,233,532

ELECTRICAL CIRCUIT CONTROLLING DEVICE

Filed Sept. 1, 1937

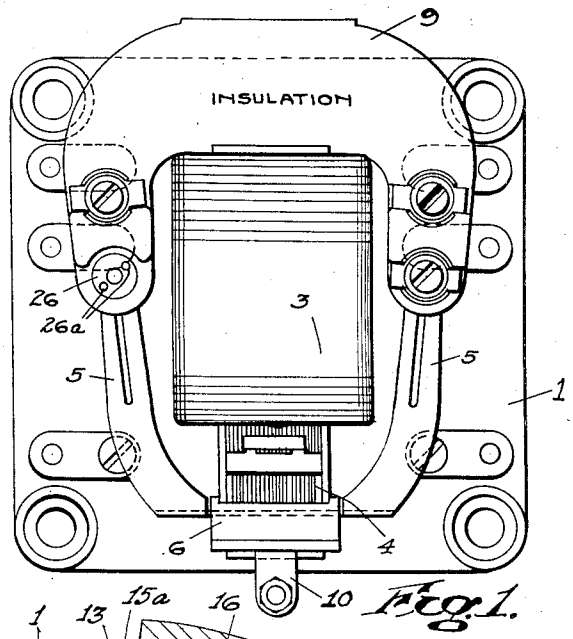


Fig. 1.

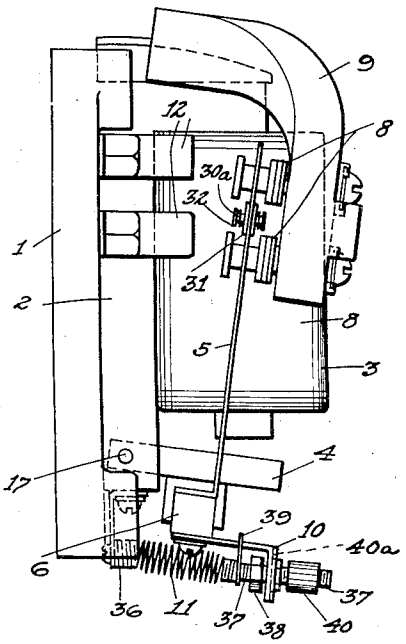


Fig. 2.

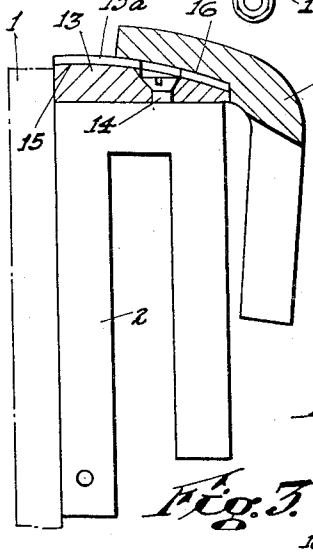


Fig. 3.

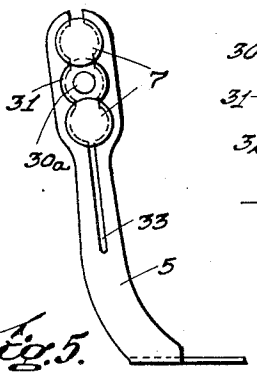


Fig. 5.

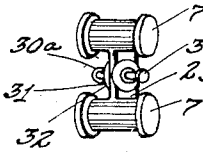


Fig. 7.

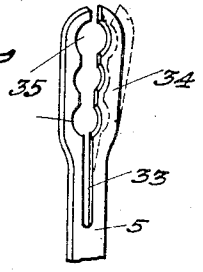


Fig. 6.

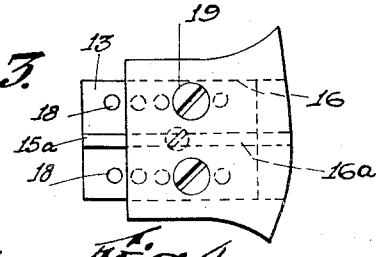


Fig. 4.

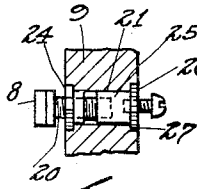


Fig. 8.

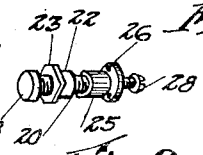


Fig. 9.

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ELECTRICAL CIRCUIT CONTROLLING DEVICE

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Application September 1, 1937, Serial No. 161,956

5 Claims. (Cl. 200—87)

The present invention relates to electrical circuit controlling devices, of the type commonly known as relays, and has for its object to provide an improved device of this character that is capable of ready adjustment to meet different operating conditions.

The above and other advantageous features of the invention will hereinafter more fully appear from the following description with reference to the accompanying drawing in which:

Fig. 1 is a view in front elevation of a circuit controlling device embodying the invention.

Fig. 2 is a view in side elevation of the parts shown in Fig. 1.

Fig. 3 is a fragmentary view partially in section illustrating the mounting of the yoke for the back contacts.

Fig. 4 is a plan view of the parts shown in Fig. 3.

Fig. 5 is a fragmentary view of one contact arm assembly.

Figs. 6 and 7 are perspective views illustrating the contact arm and contact structure separated from each other.

Fig. 8 is a fragmentary sectional view through one of the back contacts.

Fig. 9 is a perspective view of a back contact assembly.

Like reference characters refer to like parts in the different figures.

Referring first to Figs. 1 and 2, the invention is shown, for purposes of illustration, as being embodied in a circuit controller of the relay type, the essential elements of which comprise an insulating base 1 carrying U-shaped core 2 one end of which is surrounded by an energizing winding 3. A magnetic armature 4 is pivotally supported on the lower end of the core leg and carries a pair of arms 5 suitably insulated from the armature 4 at 6. Each arm 5 carries a pair of contacts 7 projecting from opposite sides of an arm 5, which contacts 7 constitute an assembly separately removable from the arm, as will be hereinafter described.

In the normal deenergized condition of the winding 3 the armature 4 occupies the position of Fig. 2 with the arm contacts 7 in engagement with a pair of back contacts 8 mounted on a yoke 9 of insulating material. The armature 4 provides an extension 10, and a spring 11 cooperating with this extension 10 tends to pull the armature 4 downwardly about its pivot and maintain the arm contacts 7 in engagement with the back contacts 8 with a predetermined pressure dependent upon the adjustment of the spring 11.

Upon energization of the winding 3, the armature 4 will be turned upwardly about its pivot to move the arm contacts 7 into engagement with the pair of front stationary contacts 12 mounted on the base 1. A relay of the type described thus far is known as a front and back contact relay, wherein the flow of current through the back contacts 8 is maintained for one outside circuit condition as long as the winding 3 remains deenergized, while flow of current between the front contacts 12 is maintained for another circuit condition, as long as the winding 3 is energized. The amount of current required to energize the winding depends upon the air gap between the armature 4 and the end of the opposed core leg, combined with the pull of the spring 11 and this air gap in turn depends upon the distance between the front and back contacts 12 and 8, respectively. As previously pointed out, the invention contemplates the provision of means whereby the relative position between the contacts 12 and 8 can be varied without disturbing the parallel relation between the contact faces and with the assurance that the contacts 7 carried by the arm 5 will always engage these stationary contacts with a uniform pressure for different settings.

To this end, the yoke 9 carrying the contacts 8 is mounted on a block 13 secured to the top of the core 2 by a screw 14. The block 13 provides a curved upper surface 15 and the yoke 9 provides a correspondingly curved slot 16, with a rib 15a located centrally of the surface 15 received in a groove 16a at the top of the slot 16, see Fig. 4. As best shown in Fig. 3, the center of curvature of the block surface 15 and the yoke slot 16 is located at the center of the pivot 17 of the armature 4. As a result of the above described mounting of the yoke 9, it follows that any movement of the yoke for the purpose of adjusting the position of the contacts 8 is accomplished without disturbing the parallel relation between the faces of the arm contacts 7 and the back contacts 8. This is because movement of the contacts 8 with the yoke 9 is about the same pivot 17 on which the armature 4 turns with the contacts 7. In order to secure the yoke 9 in adjusted position the block 13 provides a number of pairs of threaded holes 18 adapted to receive screws 19 passing through the slot 16 in the yoke 9, or separate blocks 13 with differently drilled pairs of holes 18, can be used. In this way, the yoke 9 can be set in

order to determine the initial air gap between the armature 4 and the core leg.

In addition to the adjustment of the yoke 9 in order to obtain setting of the contacts 8 in unison, there is also provided means for adjustably mounting each contact 8 separately on the yoke. As best shown in Figs. 8 and 9, each contact 8 is mounted on a threaded stud 20 received in an opening 21 extending through the yoke 9. The stud 20 carries a circular nut 22 having an enlarged portion 23 of angular form which is received in a correspondingly shaped seat 24 adjacent the yoke opening 21, so that the nut and stud cannot turn in the opening 21. The end of the stud 20 is received in an internally threaded sleeve 25 turnable in the opening 21 and the sleeve 25 provides an enlarged head 26 receivable in a seat 27 surrounding the opening 21.

As best shown in Fig. 1, the head 26 provides openings 26a for receiving a suitable tool, whereby the sleeve 25 may be turned in the opening 21. Since the angular portion 23 of the nut 22 cannot turn in the opening 21, clockwise turning of the head 26, as viewed in Fig. 1, causes the stud 20 to be clamped in the opening 21 between the seats 24 and 27. In this way each contact 8 can be locked in position on the yoke 9 and minor adjustments of the contacts 8 with respect to the arm contacts 7 can be made individually after an initial adjustment of the yoke 9 by shifting the nut 22 on any stud 20 in order to obtain just the right engagement between the opposed surfaces of the contacts 7 and 8. Each head 26 also provides a threaded opening to receive a terminal screw 28 for connecting a conductor to the contact 8. Furthermore it is an easy matter to remove an individual contact 8 and replace it with a new one without in any way disturbing the setting of the other three contacts carried by the yoke 9.

As previously pointed out, a pair of arm contacts 7 are constructed as a unit for mounting on an arm 5 and this construction is best shown in Figs. 5, 6 and 7. The contacts 7 are connected by a cross bar 29 providing an opening through which freely extends a pin 30 providing heads 30a at its ends. Washers 31 are mounted on the pin 30 on either side of the bar 29 and a coil spring 32 surrounds the free portion of the pin 30 between its head 30a and each washer 31. Thus each washer 31 is yieldingly maintained in engagement with the bar 29 so that normally in the assembled contact unit, the washers 31 extend in parallel relation.

As best shown in Fig. 6, each arm 5 provides a slot 33 the sides of which are parallel near the base of the arm. The free end of the arm 5 is enlarged as indicated at 34 and the slot 33 widens to provide curved portions 35 only slightly less in diameter than the contacts 7 and washers 31. When it is desired to position an assembled contact unit, such as shown in Fig. 7, in an arm 5, the extremities of the arm 5 are flexed, as indicated in dotted lines in Fig. 6, to permit the insertion of the contacts 7 between the opened sides of the slot portions 35. This results in the washers 31 engaging opposite sides of the arm 5 and the springs 32 tend to yieldingly maintain the washers 31 in such engagement. Therefore the entire contact assembly is in effect floating at the end of the arm 5 so that each contact 7 may seek its own adjustment with the front or back contact 12 or 8. Obviously when the contacts 7 become worn, the entire assembly can be readily removed from an arm 5 by flexing it so as to release the washers 31 and a new contact unit substituted, without in any way disturbing any other parts of the device or necessitating removal from its mounting, this latter feature being claimed in our copending divisional application, filed August 3, 1940, Serial No. 350,670.

As previously pointed out, the spring 11 serves to yieldingly maintain the contacts 7 in engagement with contacts 8 and the degree of contact pressure can be readily controlled by a convenient adjustment of the spring tension. For this purpose, one end of the spring 11 is anchored by threading its end coils around a fixed screw 36. The opposite end of the spring 11 is similarly engaged with threads on a stud 37 extending through an opening in the armature extension 10. The stud 37 carries a lock nut 38 between the extension 10 and a guide 39, and an adjusting nut 40 beyond the extension 10. By turning the adjusting nut 40 in one direction or the other, the tension of the spring 11 can be increased or decreased to control the contact pressure. Any setting of the spring 11 thus obtained can be maintained by turning the lock nut 38 up against the extension 10 to cause the end of the nut 40 to be received within an angular seat 40a provided in the extension 10. Thus the lock nut 38 will effectively prevent any backing off of the adjusting nut 40 following an adjustment of the spring and which might otherwise occur as a result of repeated operations of the armature.

From the foregoing it is apparent that by the present invention there is provided a circuit controlling device, or relay, of the front and back contact type in which the air gap can be closely adjusted to the desired point, without in any way effecting the proper engagement between the surfaces of the contacts.

We claim:

1. A device of the class described, comprising in combination a core member carrying an energizing winding, an armature pivotally mounted on said core member carrying a contact at its free end, a yoke of insulating material mounted on said core member and providing a stop against which said armature contact rests when said winding is deenergized, said yoke providing a curved surface along which it is adjustable to vary the position of said contact stop and thereby determine the air gap between the free end of said armature and said core, with the center of curvature of said yoke surface located substantially at the pivotal axis of said armature.

2. A device of the class described, comprising in combination a core member carrying an energizing winding, an armature pivotally mounted on said core member carrying a contact at its free end, a yoke of insulating material mounted on said core member and providing a stop against which said armature contact rests when said winding is deenergized, a block mounted on said core providing a surface curved about the pivotal axis of said armature, with said yoke providing a correspondingly curved surface, and means for securing said yoke and said block together with said curved surfaces in different relative positions, whereby to vary the position of said yoke stop and the length of the air gap between said armature and core.

3. A device of the class described, comprising in combination a U-shaped magnetic core having a winding carried by one leg thereof and an armature pivotally mounted at the end of the

other core leg, contacts extending upwardly from said armature on each side of said winding, and a yoke of insulating material mounted on the top of said core and providing legs extending downwardly on each side of said winding to provide stops against which said armature contacts rest when said winding is deenergized, said yoke providing a curved surface along which it is adjustable on said core to determine the position of said stops, with the center of curvature of said surface located substantially at the pivotal axis of said armature.

4. A device of the class described, comprising in combination a U-shaped magnetic core having a winding carried by one leg thereof and an armature pivotally mounted at the end of the other core leg, contacts extending upwardly from said armature on each side of said winding, and a yoke of insulating material mounted on the top of said core and providing legs extending downwardly on each side of said winding to provide stops against which said armature contacts rest when said winding is deenergized, a block mounted on the top of said core and providing a surface curved about the pivotal axis of said armature, with a correspondingly curved surface provided by said yoke in engagement with said block surface, and means for holding said yoke and said block together with said surfaces in different relative positions, to simultaneously vary the positions of both yoke stops, and thereby determine the length of the air gap between said armature and core.

5. A back contact relay, comprising in combination a core member carrying an energizing winding, an armature pivotally mounted on said core member and carrying spaced contacts at its free end, a yoke of insulating material mounted on said core member and providing spaced contacts with which said armature contacts are in engagement when said winding is deenergized, said yoke providing a curved surface along which it is adjustable to vary the position of said yoke contacts and thereby determine the air gap between the free end of said armature and said core, with the center of curvature of said yoke surface located substantially at the pivotal axis of said armature, so that the surfaces of said contacts remain substantially parallel in different positions of said yoke.

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