Feb. 2, 1943. J. S. GARVIN 2,309,945

POLARIZED RELAY

Filed July 11, 1940

FIG. 1

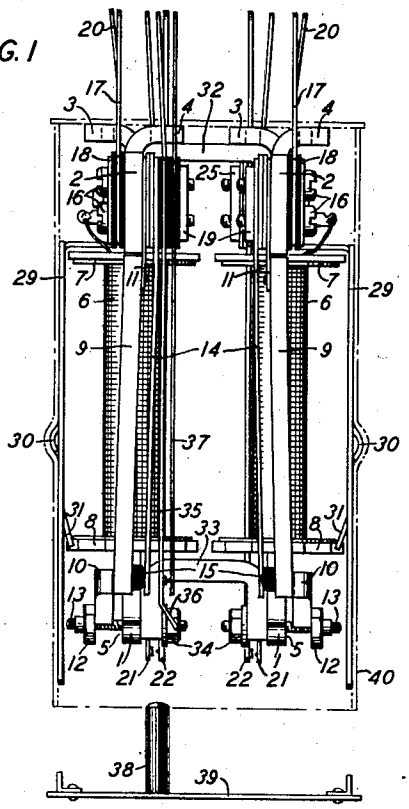


FIG. 3

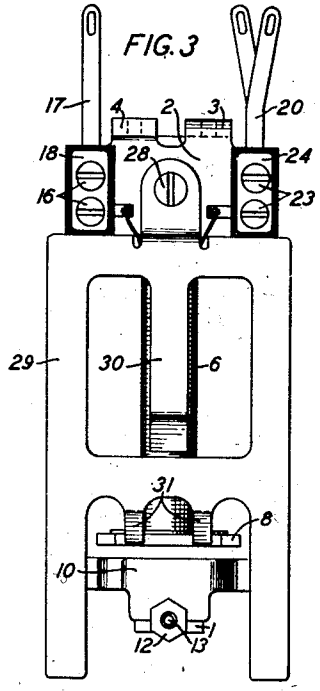


FIG. 2

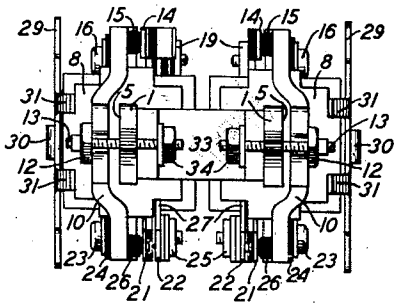
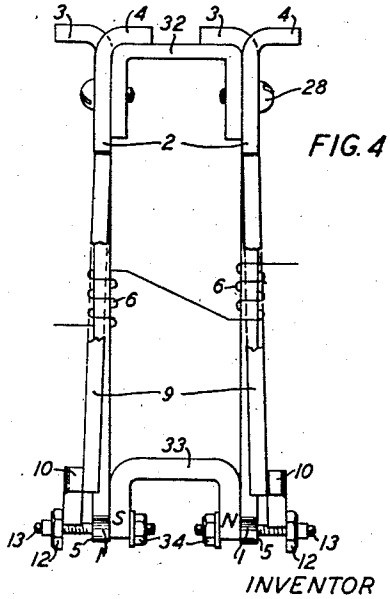


FIG. 4



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POLARIZED RELAY

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5 Claims. (Cl. 175—339)

This invention relates to an electromagnetic device and more particularly to a polarized relay.

It is often desirable in signalling systems to selectively close two work circuits by the operation of a polarized relay in response to the energization of its winding by current of either positive or negative potential. If a polarized relay of the type which has a single armature biased to a neutral position is used for this type of service, there is always the possibility that if the armature is not accurately biased in its neutral position, it may fail to operate on current of one polarity or may operate falsely due to vibration when its winding is not energized or is energized by current of a non-operating value.

It is therefore the object of the present invention to provide a relay structure of the polarized type which has three very definite positions of which two are circuit closing and the third a neutral or open circuit position.

It is a further object of the invention to provide a polarized relay structure which has a suitable margin of safety against false operation when a high percentage of the operate current is flowing and the device is at the same time subject to vibration.

It is a further object of the invention to provide a polarized relay structure which is economical to manufacture and which requires a minimum of maintenance.

In accordance with this invention, these objects are attained by assembling two neutral relays of a well-known commercial type side by side and interconnecting their cores at their heel-piece ends by a strip of magnetic material and interconnecting their cores at their forward ends by a polarizing magnet. The windings of the two relays may be either connected in series or in parallel in such a manner as to magnetize the two cores in the same sense.

For a more comprehensive understanding of the invention reference may be had to the following detailed description taken in connection with the accompanying drawing in which:

Fig. 1 is a top plan view of the relay assembly;

Fig. 2 is a front end view of the relay;

Fig. 3 is a side elevational view of the relay; and,

Fig. 4 shows the magnetic circuit elements of the relay.

As hereinbefore stated the relay is an assembly of two neutral relay units of a well-known type. It is to be understood, however, that while a particular type of relay is disclosed, neutral relays of other types could equally well be employed in the assembly or the assembly could be designed de novo to incorporate the features of the invention.

Each relay unit comprises a core 1, the rear end of which is widened to form a heel-piece 2 and is bifurcated to form two sections bent in opposite directions to provide mounting ears 3 and 4 by which the relay unit may be attached to a mounting plate and the forward end of which core is provided with a pole-face 5. Mounted on the core 1 is an energizing winding 6 having a rear spoolhead 7 and a forward spoolhead 8. The U-shaped armature 9 is positioned with its forward cross-reach 10 overlying the pole-face 5 of the core and its side arms extending on either side of the winding 6 with their ends pivoted to the forward edge of the heel-piece 2 by reed springs 11. The cross-reach 10 of the armature is normally biased against the back-stop nut 12 which is threaded upon one end of stud 13 secured in a hole in the end of the core 1. The back-stop nut 12 serves as a means for limiting the releasing movement of the armature and for adjusting the width of the air-gap between the cross-reach 10 of the armature and the pole-face 5 of the core 1.

For biasing the armature against the back-stop nut, a balancing spring 14 is provided, the forward or free end of which engages an insulating stud 15 secured to the forward end of the armature and the rear end of which is secured to one end of the heel-piece 2 by screws 16. Also secured to the same end of the heel-piece 2 by the screws 16 is a winding terminal lug 17. The screws 16 extend through holes in an outer clamping plate 18, terminal lug 17, insulating strips which insulate the lug from the plate 18 and from the heel-piece 2, through holes in the heel-piece, spacers and spring 14 into threaded holes in the inner clamping plate 19.

Insulatedly mounted on the other end of the heel-piece 2 are a second winding terminal lug 20 and a pair of contact springs 21 and 22 which are secured to the heel-piece by the screws 23, outer clamping plate 24 and inner clamping plate 25. The free ends of contact springs 21 and 22 extend forwardly beneath a side-arm of the armature, the end of spring 21 engaging against an insulating stud 26 secured to the forward end of the armature. Spring 21 thus assists balancing spring 14 in normally biasing the armature against the back-stop nut 12 in which position the contacts carried by the springs 21 and 22 are out of engagement. For determining the normal gap between the contacts of springs 21 and 22, the spring 22 is provided with a bendable tang 27

which engages a shoulder on the edge of the front spoolhead 8.

Also secured to the outer face of the heel-piece 2 by the screw 28 is a cover guide 29. This guide is substantially rectangular in shape having side-arms which serve to guide a can cover 40 into position, a central spring arm 30 having the end thereof formed for engagement in a depression in a wall of the can cover to retain the cover upon the cover guide and with two fingers 31 which engage in notches in the edge of the front spoolhead 8 and which with the screw 28 hold the guide in its proper position. The cover 40, which also serves as a shield for the relay, is indicated in dotted lines as positioned on the cover guides 29 of the assembled relay. The front closure 39 of the cover is shown in full lines as removed from the forward end of the cover 40 and is provided with a spring actuating stud 38 secured thereto for a purpose to be later described.

One of the relay units is also provided with a pair of springs 35 and 37 insulated from each other and clamped with the balancing spring 14 to the heel-piece 2 by the clamping plates 18 and 19 and the screws 16. Spring 35 is provided with a cam surface 36 on its outer end for engagement by the actuating stud 38 secured to the can cover closure 39 whereby when the can cover 40 is positioned on the cover guides 29 and the closure 39 is in position in the forward end of the can cover the stud 38 will cause the spring 35 to be cammed into engagement with spring 37. The springs 35 and 37 may be connected in series with one spring of each pair 21, 22 so that when the can cover and closure are in place the springs 35 and 37 will be closed to render the work circuits of the relay effective but that when either the can cover or the closure is removed the springs will be open to render the work circuits ineffective. It is thus possible to remove the can cover or the front closure thereof and to adjust the pairs of springs 21, 22 without falsely closing the work circuits controlled by such pairs of springs.

The two relay units are secured together side by side as most clearly disclosed in Figs. 1 and 2 by a U-shaped strip 32 of magnetic material and a U-shaped permanent magnet 33. The strip 32 is secured between the heel-pieces 2 by the screws 28 which extend through holes in the heel-pieces into threaded holes in the arms of the strip 32. The arms of the permanent magnet 33 are provided with slots through which the inner ends of the studs 13 extend, the arms being clamped to the ends of the cores 1 by the nuts 34 threaded upon studs.

The windings 6 of the two relay units may be connected in series or in parallel in such a manner that when they are energized, they will cause flux to flow in the same direction in both cores 1.

Referring to Fig. 4, it will be noted that there is normally a closed magnetic circuit extending through the permanent magnet 33, the two cores 1 and the strip 32 and that with the magnet 33 polarized as indicated, the pole-face 5 on the right-hand core 1 is made a north pole and the pole-face of the left-hand core 1 is made a south pole. Because of the low reluctance of the closed magnetic circuit through the magnet 33, there will be little, if any, flux flowing in the open magnetic circuit extending from the north pole of magnet 33, across the right-hand air-gap through the right-hand armature 9, the strip 32, the left-hand armature 9 and the left-hand air-gap to the south pole of magnet 33 and consequently both armatures will be held against their back-stop nuts 12 by their associated springs 14 and 21 and the contacts between the two pairs of springs 21 and 22 will be maintained open as shown in Fig. 1.

If it now be assumed that current is directed through the windings 6 in such a direction as to establish a flow of flux through the two cores 1 in such a direction as to make the forward ends of both cores electromagnetic north poles and the rear ends of both cores south poles, then the forward ends of both armatures will become south poles. The pole-face 5 of the right-hand core 1 now becomes more strongly a north pole and since the end of the right-hand armature is made a south pole, a substantial difference of magnetic potential is established across the right-hand air-gap and flux will flow forwardly through the right-hand core 1 across the right-hand air-gap and back through the right-hand armature and flux will also flow forwardly in the left-hand core 1 through the magnet 33 across the right-hand air-gap back through the right-hand armature 9 and strip 32, of sufficient strength to cause the attraction of the right-hand armature and the closure of its associated contact springs 21 and 22. Since, however, the pole-face 5 of the left-hand core has been made a north pole in opposition to the polarity impressed thereon by the magnet 33, the difference in magnetic potential between this pole-face and the end of the left-hand armature is slight, little flux flows across the left-hand air-gap, and the left-hand armature is therefore not attracted.

If current is directed in the opposite direction through the windings 6, then a flow of flux will be established through the two cores 1 in such a direction as to make the forward ends of both cores electromagnetic south poles and the forward ends of both armatures north poles. The pole-face 5 of the left-hand core 1 now becomes more strongly a south pole and since the end of the left-hand armature is made a north pole a substantial difference of magnetic potential is established across the left-hand air-gap and flux will flow rearwardly through the left-hand core 1, forwardly through the left-hand armature 9 and across the left-hand air-gap and flux will also flow rearwardly through the right-hand core 1 through the strip 32, thence forwardly through the left-hand armature and across the left-hand air-gap and through the magnet 33 to cause the attraction of the left-hand armature and the closure of its associated contact springs 21 and 22. Since, however, the pole-face 5 of the right-hand core has been made a south pole in opposition to the polarity impressed therein by the magnet 33, the difference in magnetic potential between this pole-face and the end of the right-hand armature is slight, little flux flows across the right-hand air-gap, and the right-hand armature is therefore not attracted.

While a permanent magnet 33 has been disclosed as interconnecting the forward ends of the cores 1 it will be apparent that the same polarizing effect could be secured by connecting the forward ends of the cores by a bar of magnetic material energized by a polarizing winding.

From the foregoing it will be apparent that a polarized relay structure is provided which is inexpensive to manufacture, since in the main standard relay parts are employed, and which provides for very definite and desirable three-position operation.

What is claimed is:

1. In a polarized relay, two cores, each having an energizing winding thereon, means for magnetically interconnecting one end of one core to one end of the other core, a polarizing magnet interconnecting the other ends of said cores, said cores, interconnecting means and magnet constituting a closed magnetic circuit and two armatures pivotally supported one on each of said cores and forming normally open magnetic circuits therewith, said armatures alternatively attractable to their respective cores in accordance with the direction of current flow through said energizing windings.

2. In a polarized relay, two cores, each having an energizing winding thereon, means for magnetically interconnecting one end of one core to one end of the other core, a permanent magnet interconnecting the other ends of said cores, said cores, means and magnet constituting a closed magnetic circuit, and two armatures pivotally supported one on each of said cores and forming normally open magnetic circuits therewith, said armatures alternatively attractable to their respective cores in accordance with the direction of current flow through said energizing windings.

3. In a polarized relay, two parallelly disposed cores each having an energizing winding thereon, a permanent magnet interconnecting the forward ends of said cores, a yoke of magnetic material for connecting the rear ends of said cores, said cores, yokes and magnet constituting a closed magnetic circuit and two armatures pivotally supported one on each of said cores and forming normally open magnetic circuits therewith, said armatures alternatively attractable to their respective cores in accordance with the direction of current flow through said energizing windings.

4. In a polarized relay, two parallelly disposed cores each having an energizing winding thereon, a U-shaped permanent magnet disposed between the forward ends of said cores, a U-shaped yoke of magnetic material disposed between the rear ends of said cores, screws extending through holes in said cores and in the arms of said yoke for securing the yoke to said cores, a back-stop stud threaded through the forward end of each core and extending through a hole in an arm of said magnet, nuts on said studs for clamping the arms of said magnet to the forward ends of said cores, two armatures cooperative respectively with said cores and back-stop nuts on said studs for adjusting the air-gaps between said cores and said armatures.

5. In a polarized relay, two parallelly disposed cores, each having an energizing winding thereon, a U-shaped permanent magnet disposed between the forward ends of said cores, a U-shaped yoke of magnetic material disposed between the rear ends of said cores, screws extending through holes in said cores and in the arms of said yoke for securing the yoke to said cores, a back-stop stud threaded through the forward end of each core and extending through a hole in an arm of said magnet, nuts on said studs for clamping the arms of said magnet to the forward ends of said cores, two armatures cooperative respectively with said cores, back-stop nuts on said studs for adjusting the air-gaps between said cores and said armatures and biasing springs for normally holding said armatures in their retracted positions against said back-stop nuts.

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