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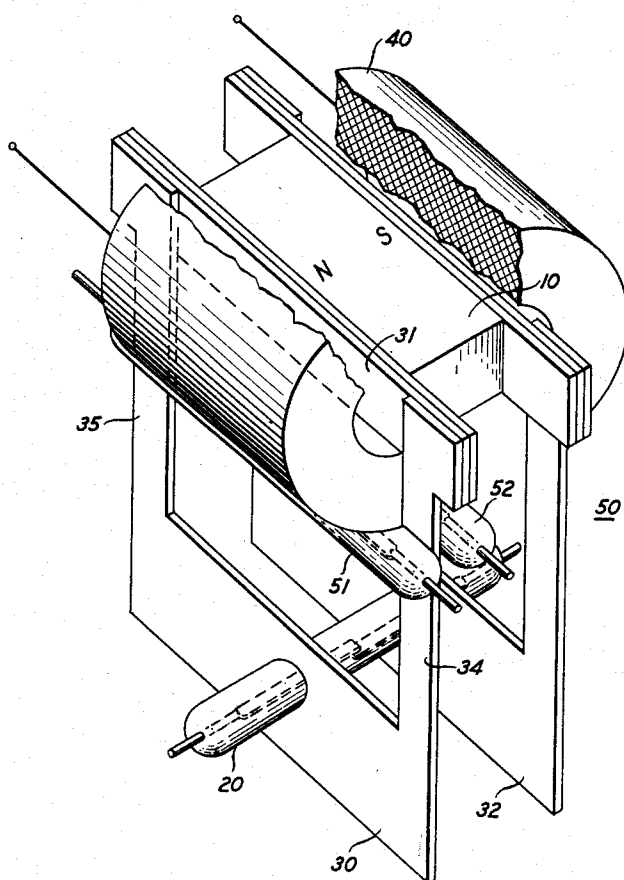
3,190,984

SEALED CONTACT TRANSFER SWITCH

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FIG. 1



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FIG. 2

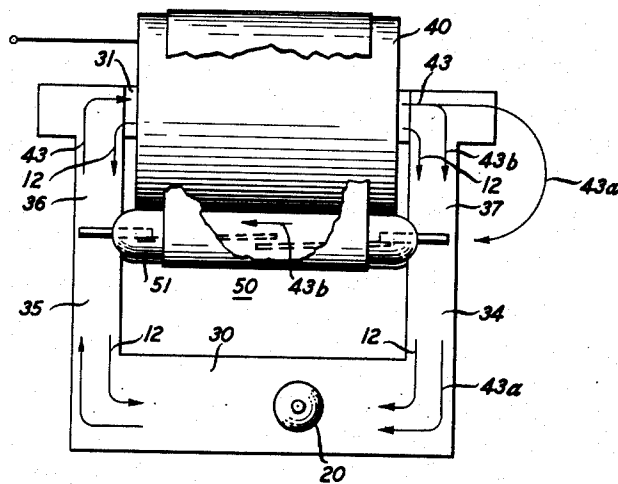
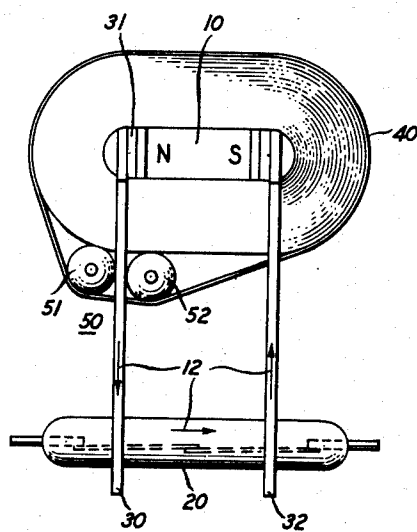


FIG. 3



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SEALED CONTACT TRANSFER SWITCH

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9 Claims. (Cl. 200—87)

This invention relates to an improvement in devices responsive to interacting magnetic fields and has particularly advantageous application in magnetic switching devices.

Devices of the type pertinent to this invention generally comprise a magnetically responsive member, a source for supplying a biasing field to urge the magnetically responsive member to a desired position, and another source responsive to an extrinsic stimulus for supplying an operating field to overcome the effect of the biasing field whereby the magnetically responsive member is allowed to return to its unbiased position.

Where the devices to which this invention applies are used as electrical switches, usually the magnetically responsive member is a contact bearing armature, the biasing field is supplied by a permanent magnet, and the operating field is supplied by an electrical coil. However, satisfactory operation of such switching devices generally depends upon the polarity of an electrical potential applied to the operating coil. Therefore, it is of particular advantage to provide a magnetically biased switch or relay operable without regard to the polarity of the applied electrical potential.

Accordingly, it is a general object of this invention to provide a magnetically responsive device that operates independently of the nature or polarity of the means employed to generate the operative fields.

A more particular object of this invention is to improve magnetically biased switching devices by providing an arrangement whereby said devices are operable without regard to the direction in which a magnetic operating field is applied.

Still another particular object of this invention is to improve sealed contact reed switch relays of the type which disconnect or transfer an electrical input when a magnetic operating field nullifies a biasing field by providing an arrangement whereby such switches are releasable without regard to the polarity of the electrical potential generating the magnetic operating field.

A feature of this invention is a flux permeable member for concentrating a magnetic field from a first source upon a magnetically responsive member, said flux permeable member comprising two parallel paths wherein the field in the parallel paths is the resultant of the field from said first source and a magnetic field from a second source.

This invention achieves the aforementioned objects as well as others appearing hereinafter by employing a magnetic field of fixed magnitude to supply flux to an armature through two parallel paths whereby the armature is held closed. Further, the armature is chosen so that the flux required to hold it closed is greater than the flux saturation level of either of the parallel paths. Finally, an externally controllable magnetic field is employed to supply flux serially to said two parallel paths whereby the resultant flux in one path is series aiding and the resultant flux in the other is series opposing. As a consequence, the flux supplied to the armature becomes insufficient to maintain the closed position and the armature is released whereby it is allowed to assume an open position.

Other objects, features, and advantages of this invention will become apparent from the following description illustrated by the accompanying drawing which forms a

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part of this specification and in which like numbers are employed to designate like parts throughout.

FIG. 1 is a perspective view with parts broken away of a magnetic switching device employing sealed contact reed switches;

FIG. 2 is a side view with parts broken away of the magnetic switching device shown in FIG. 1; and

FIG. 3 is an end view of the magnetic switching device shown in FIG. 1.

In the drawing, a specific embodiment of the invention in a switching application is shown for the purpose of illustration. FIG. 1 shows a permanent magnet 10; a switch 20 of the sealed contact reed type; yokes 30 and 32, each for concentrating a magnetic field from the permanent magnet 10 in two parallel paths; a coil 40 for supplying a magnetic field serially through each of the yokes 30 and 32; and a shunt 50 comprising two switches 51 and 52 also of the sealed contact reed type.

The flux carrying yokes 30 and 32 as shown in FIG. 1 are identical with each other, and a description of the yoke 30 will also identify comparable parts in yoke 32. The yoke 30 serves to concentrate the magnetic field or flux from the permanent magnet 10 upon the switch 20. The yoke 30 comprises a bifurcated member having flux conducting furcations or branches 34 and 35 joined adjacent the permanent magnet 10 by a flux conducting member 31. In order to practice this invention, however, only one yoke member similar to yoke 30 or 32 is required. As a consequence, the other yoke can be used merely as a magnetic return path between the switch 20 and the permanent magnet 10; and, when used in such a capacity, could be replaced by any other path, even air.

The method of operation of this device can be most readily understood by reference to FIGS. 2 and 3. FIG. 3 shows a magnetic field or flux 12 illustrated in representative form by an arrow. The field 12 is supplied by the permanent magnet 10. The direction of the field is not material to the invention and is arbitrarily shown circulating through a magnetic circuit which includes yoke 30, switch 20, and yoke 32. From FIG. 2 it can be seen that the field 12 divides and is supplied to the switch 20 through parallel paths in the yoke 30 comprising the branches 34 and 35. Further, the field 12 has a magnitude sufficient to hold the switch 20 closed as shown in FIG. 3. Moreover, the switch 20 should be chosen to have a characteristic such that the field or flux level necessary to sustain the closed position is greater than the flux level necessary to saturate either branch 34 or 35. One consequence of employing such a characteristic is that if either branch is disabled from conducting flux to the switch 20, the reduced resultant flux or the flux from the remaining branch alone will be unable to supply sufficient flux to sustain the closed position and the switch 20 will open. Such a result is achieved when the coil 40 is operated to supply a field or flux 43 to the yoke 30. FIG. 2 illustrates, in representative form, the interaction with the flux 12 by the flux 43 as it serially traverses a magnetic path including the branches 34 and 35 and the switches 51 and 52 comprising the shunt 50. Initially all of the flux 43 is contained in branches 34 and 35. However, when the total of flux 12 and flux 43 reaches the flux saturation level for branch 34, the flux 43 divides into a component 43a having a magnitude sufficient to sustain saturation in branch 34, and a component 43b shunted to the branch 35 through a preferred path including the normally open contacts of the switches 51 and 52. At this point, although the branch 34 is flux saturated, the branch 35 is not, and the resultant flux delivered to the switch 20 continues to hold the contacts closed. However, as the magnitude of flux 43 increases, the flux components 43a and 43b will concentrate in a portion 36 of branch 35 and oppose flux 12 until the resultant flux delivered to the

switch 20 becomes insufficient to sustain the closed position.

It will be readily understood that the direction in which the flux 43 traverses the yoke 30 is immaterial in obtaining the release of the switch 20. It can be seen from FIG. 2 that a change of direction by the flux 43 merely causes the controlling or flux biasing action in portion 36 of the branch 35 to relocate to portion 37 of the branch 34. As a consequence, proper choice of a switch 20 will allow anyone skilled in the art to construct a device embodying this invention for use as an alternating current relay. The foregoing describes what occurs when the yoke 30 is used alone. However, since the yoke 32 operates in the same manner as the yoke 30, using yokes 30 and 32 together as shown will increase the efficiency of the structure. Furthermore, while the shunt 50 is not essential to the operation of the invention, the use thereof will further increase the efficiency of the invention. Moreover, in addition to increased efficiency, the use of another yoke and a shunt comprising sealed contact reed switches allows another advantage to be obtained. As shown in FIGS. 2 and 3, the flux component 43b traversing the switches 51 and 52 can be utilized to close contacts contained therein. Furthermore, the use of the yoke 32 will permit switches similar to switches 51 and 52 to be mounted thereon and closed in a like manner. Therefore, a relay has been illustrated and described which functions as a transfer switch providing, for example, a make-before-break, or a break-before-make switching sequence that operates independently of polarity of an electrical potential applied to the operating coil.

It will be readily be understood that switching capacity may easily be increased merely by providing additional switches similar to switch 20. Moreover, switches similar to 51 and 52 may be added to the yoke 30, or the yoke 32, as desired.

It is to be understood that the above-described arrangements are illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A relay comprising switching means closable in response to a first field, said switching means comprising at least one sealed contact reed switch; a permanent magnet for supplying said first field, a pair of magnetically permeable yokes interconnecting said switching means and said permanent magnet, each yoke adjacent a different pole of said permanent magnet and including two parallel flux paths, each of said flux paths having a flux saturation level below the flux level necessary to hold said switching means closed; shunting means comprising at least one flux conducting member interconnecting said two flux paths intermediate said permanent magnet and said switching means, and a coil wound on said pair of flux conducting yokes and embracing said permanent magnet therein for supplying a second flux through at least one of said yokes in a path serially including said two flux paths and said shunting means.

2. A relay in accordance with claim 1 wherein said shunting means comprises at least one sealed contact reed switch.

3. A relay comprising a first source for supplying magnetic flux, switching means closable in response to mag-

netic flux from said first source, means for concentrating flux from said first source through parallel paths onto said switching means, each path having a flux saturation level below the flux level required to hold said switching means closed; shunting means joining said parallel paths intermediate said first source and said switching means, and a second source of magnetic flux for supplying magnetic flux serially through a path including said parallel paths and said shunting means.

4. A relay in accordance with claim 3 wherein said switching means comprises at least one sealed contact reed switch and said shunting means comprises at least one sealed contact reed switch.

5. A relay comprising a source for supplying a first flux, switching means closable in response to said first flux, at least one pair of flux carrying branches for conducting said first flux to said switching means, said branches each having a flux saturation level below the flux level required to hold said switching means closed, and a source for supplying a second flux serially through the branches of said pair of flux carrying branches whereby one of said branches become flux saturated and said switching means opens.

6. A device comprising means for establishing a first field, switching means operable by said first field, two paths for concentrating parallel portions of said first field upon said switching means, each of said paths having a field saturation level below the field level necessary to hold said means closed, and control means for reducing the field concentration in one of said paths, said control means including a second source of magnetic field.

7. A device responsive to magnetic flux comprising two flux conducting paths each having adjacent first and second ends, each of said paths capable of carrying a predetermined maximum amount of flux; a source of biasing flux adjacent the first ends of said paths, means for applying said biasing flux in parallel through said two flux conducting paths, a source of variable flux, means for applying said variable flux serially through said two flux conducting paths, and armature means biased to a closed position in response to said biasing flux, said armature means adjacent the second ends of said paths and requiring a flux level in excess of said predetermined maximum amount to remain closed.

8. A device in accordance with claim 7 including means interconnecting said two flux conducting paths intermediate said source of biasing flux and said armature means for shunting said variable flux from one of said two flux conducting paths to the other.

9. A device in accordance with claim 8 wherein said armature means is at least one sealed contact reed switch; said interconnecting means is at least one sealed contact reed switch; said source of biasing flux is a permanent magnet; and said source of variable flux is a coil.

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