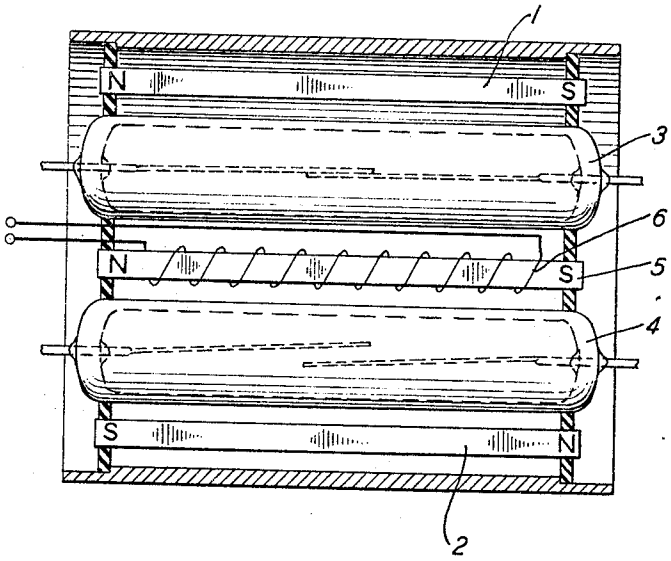
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POLAR TRANSFER SWITCH

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POLAR TRANSFER SWITCH

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This invention relates to electromagnetic switching devices and in particular pertains to electromagnetic relays of the type in which sealed contact reed switches may conveniently be used.

Electromagnetic relays employing sealed contact switches have been developed to take advantage of the low power requirements, long contact life, and reliable switching action which can be obtained when moving contacts are encapsulated in a sealed vessel. Sealed contact switches of the reed type are particularly suitable for use in such relays and are readily available commercially.

The conventional sealed contact reed switch comprises a pair of magnetic members sealed in overlapping relationship within a glass tube. Functionally, such devices are of the make-break type. For example, when a magnetic flux is applied axially through a reed switch, the reeds are attracted until they close. The reeds open by springing apart when the flux is discontinued.

Although make-break switches are sufficient in many applications, there are many other applications wherein it is advantageous to open one circuit while closing another circuit. A switching device performing this function is commonly called a transfer relay.

It is, therefore, an object of this invention to control the flow of electricity between alternate paths.

It is another object of this invention to control the switching of electricity between alternate paths by using sealed contact reed switches.

It is still another object of this invention to control the switching of electricity by using sealed contact reed switches and opposed flux sources.

One feature of this invention resides in alternately directing one magnetic flux emanating from a magnetic member magnetically poled in one direction through a shunt and a sealed contact reed switch in that order while concurrently directing another magnetic flux emanating from an oppositely poled magnetic member alternately through another sealed contact reed switch and another shunt in that order by controlling the reluctance of a magnetic core common to both magnetic fluxes.

According to one embodiment of this invention, a pair of remanent magnetic members is combined in parallel with a pair of sealed contact reed switches and a magnetic core having a coil wound thereon. In one form of the invention, one sealed contact reed switch is disposed between the magnetic core and a first remanent magnetic member having an opposite magnetic pole at each end. The other sealed contact reed switch is disposed between the magnetic core and the remaining magnetic remanent member. The remaining magnetic member has an opposite magnetic pole at each end and is disposed with respect to the first remanent magnetic member in such a manner that opposite poles on each remanent magnetic member are adjacent.

Other objects, advantages, and novel aspects of this invention will become apparent upon consideration of the following detailed description in conjunction with the accompanying drawing wherein:

FIG. 1 is a plan view of a relay assembly constructed in accordance with the present invention.

The embodiment illustrated in FIG. 1 comprises two magnetic members **1** and **2**, two sealed contact reed switches **3** and **4**, and a magnetic core **5** having a coil

6 wound thereon. The core **5** may conveniently be made from any magnetic material. A material having a coercive force in the order of 50 oersteds, however, is preferred. The magnetic members **1** and **2** may also be conveniently made from any magnetic material. A material having a coercive force of approximately 500 oersteds, however, is preferred. In fact, either or both of the magnetic members **1** and **2** may be replaced by any convenient source of magnetic flux. As illustrated in FIG. 1, each of the switches **3** and **4** is disposed between the magnetic core **5** and one of the magnetic members **1** and **2**, respectively. Moreover, all of the components of the switch are disposed in parallel with each other. Furthermore, each magnetic member **1** and **2** is magnetically poled in a direction opposite to the other.

In the unoperated state, flux from the magnetic members **1** and **2** travels through the relay in parallel paths comprising the magnetic core **5** and the sealed contact reed switches **3** and **4**, respectively.

When the coil **6** is energized, however, the flux pattern of the unoperated state is disturbed. The flux pattern with respect to a first magnetic member, a first sealed contact reed switch, and the magnetic core **5** remains unchanged, but the flux pattern with respect to a second magnetic member, a second sealed contact reed switch, and the magnetic core **5** is rearranged because flux induced in the magnetic core **5** opposes flux in one flux pattern and aids flux in the other.

For example, when the coil **6** is energized to produce magnetic polarities as illustrated in FIG. 1, the reluctance of the magnetic core **5** is increased with respect to the flux entering from the magnetic member **1**. As a consequence, most of the flux from the magnetic member **1** is unable to enter the magnetic core **5** and so takes an alternate path through the sealed contact reed switch **3**.

Furthermore, when the coil **6** is energized, it develops a flux in the magnetic core **5**. As this flux opposes the flux from the magnetic member **1**, a portion thereof is also compelled to pass through the sealed contact reed switch **3**. When both fluxes pass through the sealed contact reed switch **3** together, the switch operates. Moreover, it remains operated until the magnetic polarity of the magnetic core **5** is changed.

On the other hand, with the coil **6** energized to produce the magnetic polarities shown in FIG. 1, the state of the sealed contact reed switch **4** remains unchanged. As illustrated in FIG. 1, a portion of the flux from the magnetic member **2** continues to shunt the sealed contact reed switch **4** and pass through the magnetic core **5**.

If the coil **6** is merely de-energized and the magnetic core **5** is made of a soft magnetic material, all the magnetic systems in the relay will return to the unoperated state. If, however, the coil **6** is energized so as to magnetically pole the magnetic core **5** in a direction opposite to that illustrated in FIG. 1, the above-described magnetic patterns will reverse themselves. It will be readily seen, therefore, that the sealed contact reed switch **3** will open while the sealed contact reed switch **4** will close.

Where, however, the coil **6** is de-energized and the magnetic core **5** is not soft but is made of a remanent material such as remandur, the magnetic polarity of the magnetic core **5** remains substantially unchanged. As a result, the sealed contact reed switch **3** will remain closed and the sealed contact reed switch **4** will remain open without the necessity of supplying power to the coil **6** from an external source. Moreover, when the magnetic core **5** is switched from one magnetic polarity to the other, the sealed contact reed switch **4** will close and remain closed while the sealed contact reed switch **3** will open and remain open without the necessity of supplying power to the coil **6** from an external source.

Experiment has disclosed that for a current pulse in the coil 6 in the order of 8.25 amperes, the closed contacts will open about 30 microseconds after the start of the current pulse and the open contacts will initially close about 400 microseconds after the start of the drive pulse. Release time for the closed contacts remains about 30 microseconds when the current pulse is varied from 4.8 to 11 amperes; but the closure time varies from 440 to 600 microseconds for 4.8 amperes, and 390 to 500 microseconds for 11 amperes. From this data, it is clear that a relay in accordance with this form of the invention will invariably produce a break-before-make switching function.

From the foregoing, it is readily apparent that various arrangements of components can be advantageously used to exploit this invention. Therefore, while certain specific embodiments have been selected for detailed disclosure, the invention is not limited in its application to the embodiments disclosed. As a result, the embodiment which has been described should be taken as illustrative of the invention and its application rather than restrictive thereof.

What is claimed is:

1. The combination comprising:
- a core made of a material having a coercive force in the order of 50 oersteds;
- a coil wound on said core;
- a first bar-type permanent magnet disposed in parallel with said core;
- a sealed contact reed switch disposed in parallel between said core and said first permanent magnet;
- a second permanent magnet disposed in parallel with said core and with its magnetic polarity reversed with respect to the polarity of said first permanent magnet;
- and another sealed contact reed switch disposed in parallel between said second permanent magnet and said core.

2. In a switching device, the combination comprising:
- a first magnetic member;
- a core having a flux-generating coil wound thereon;
- a first pair of overlapping reed contacts disposed in parallel to and between said first magnetic member and said core, said first pair of overlapping reed contacts being arranged to close when flux from said first magnetic member and said coil is aiding and to open when said flux is opposing;
- a second magnetic member disposed with its poles opposite to those of said first magnetic member;
- and a second pair of overlapping reed contacts disposed in parallel to and between said second magnetic member and said core, said second pair of overlapping reed contacts being arranged to close when flux from said second magnetic member and said coil is aiding and to open when said flux is opposed.

References Cited by the Examiner

UNITED STATES PATENTS

1,953,929	4/1934	Droysen	200—93
2,794,178	5/1957	Reynolds	200—93
2,902,558	9/1959	Peek	200—87
3,184,563	5/1965	Myatt	200—87

References Cited by the Applicant

UNITED STATES PATENTS

2,995,637	8/1961	Feiner.
3,002,066	9/1961	Kethledge.
3,020,369	2/1962	Jacobson.

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