Jan. 27, 1970 H. W. VAN HUSEN 3,492,613

REED RELAYS HAVING AIDING COILS TO COUPLE HIGHLY INDUCTIVE OPERATING COILS TO REED BLADES

Filed Aug. 14, 1967

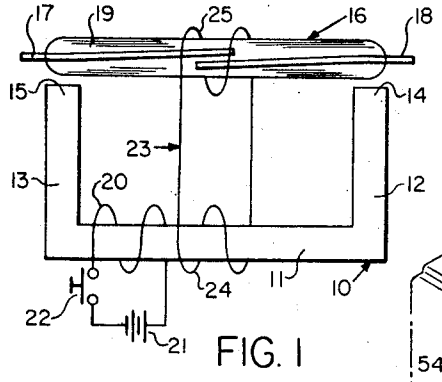

FIG. 1

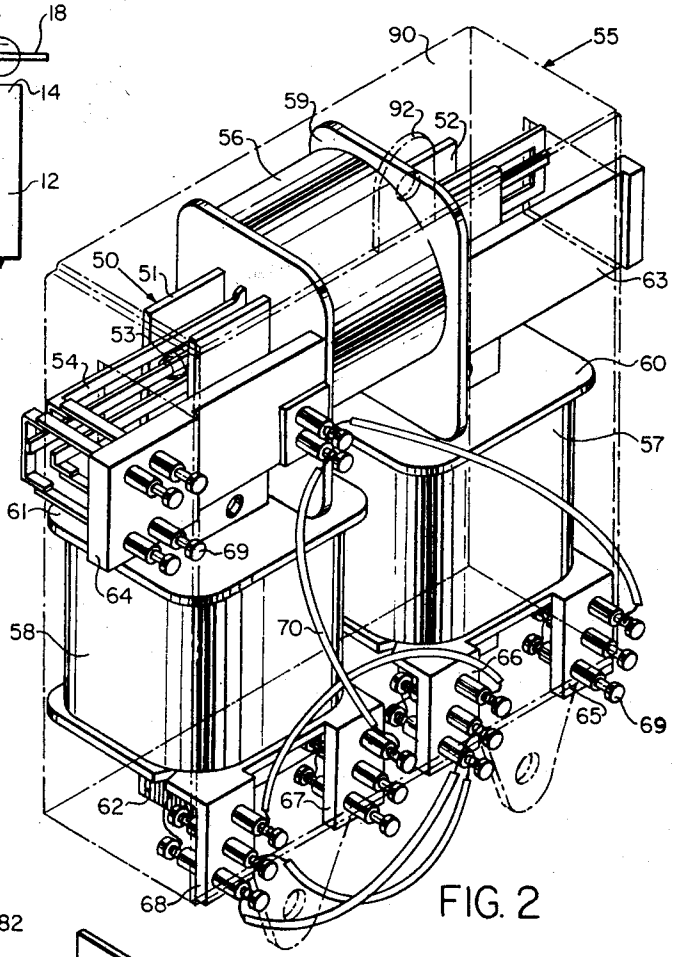

FIG. 2

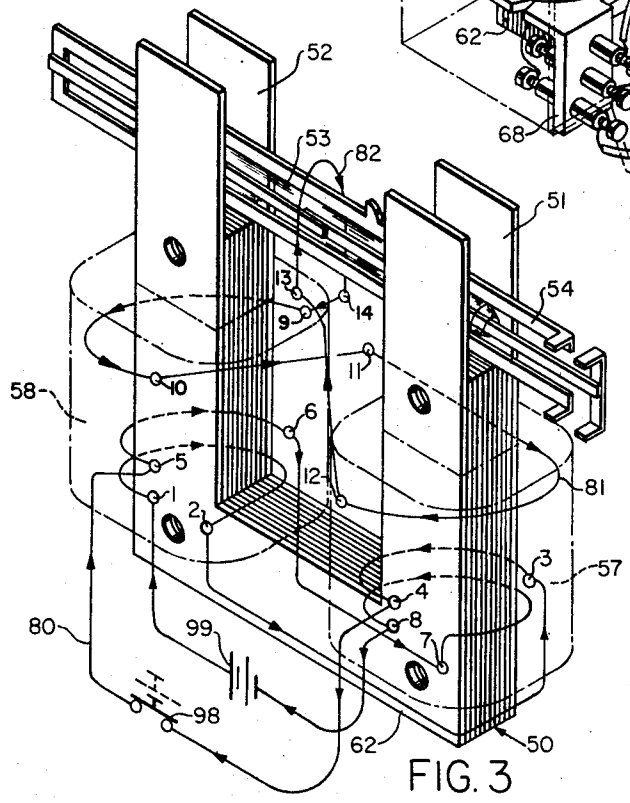

FIG. 3

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United States Patent Office 3,492,613
Patented Jan. 27, 1970

3,492,613

REED RELAYS HAVING AIDING COILS TO COUPLE HIGHLY INDUCTIVE OPERATING COILS TO REED BLADES

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Filed Aug. 14, 1967, Ser. No. 660,481
Int. Cl. H01h 1/66, 51/00
U.S. Cl. 335—151 4 Claims

ABSTRACT OF THE DISCLOSURE

A reed relay comprising a coil wound iron core adjacent an electromagnetic reed switch. An additional coil or magnetic coupling means surrounds both the iron core and the reed switch so that upon the energization or deenergization of the first-mentioned coil, a resultant change in the magnetic field of the core occurs, inducing a current in the additional coil, which, in turn, creates a momentary magnetic field about the reed switch to aid or oppose the operating field, depending upon the sense in which the additional coil is wound with respect to the first-mentioned coil.

This invention relates generally to reed relays and more particularly to reed relays of the type having the operating coil wound about a core adjacent the reed switches thereof.

Normally, in the use of reed relay devices, the inductance of the relay is kept to a minimum; however, in some cases, notably in certain communications applications, for example, as in the case of a battery feed device of a telephone system, such as disclosed in U.S. Patent 3,293,368, a high inductance condition is desirable.

While a reed relay of the type using a coil wound iron core as the operating medium is well suited for these purposes, the low reluctance path of the relatively closed magnetic circuit of the relay and the leakage currents which sometimes exist when all current should have ceased, often cause the reed contacts of a normally open version of the relay, after having been operated to a closed condition, to remain closed when they should be released.

It has been observed in a reed relay of the above-mentioned type that upon the energization or deenergization of the operating coil, because of the respective increase and decrease in current in the coil, a resultant change in the magnetic field of the relay occurs. It is the utilization of this change in field upon the deenergization of the operating coil to remedy the "holding" situation described above, as well as the use of this change generally, to modify the close and release characteristics of the reed switch contacts of such a reed relay, upon which the present invention is based.

SUMMARY OF THE INVENTION

Accordingly, this invention provides a reed relay of the type described which avoids the problem of the reed switch contacts thereof, once operated to a closed condition from remaining in said condition upon the deenergization of the operatnig coil.

The invention also provides a reed relay of the above type in which, by means of the utilization of the change in the magnetic field occurring in the relay upon the energization or deenergization of the operating coil, the operating characteristics may be modified.

The invention further provides a reed relay of the above type which may be advantageously used as a battery-feed relay of a telephone, or similar system.

Briefly, a preferred embodiment of the reed relay according to the invention comprises a U-shaped iron core, the ends of which are adjacent a reed switch or switches. In addition to the usual operating coil wound about the core, there is also wound thereabout a second winding. A tertiary portion of this second winding is wound, in a predetermined sense; i.e., either in aiding or opposing relation to the operating winding, about the reed switch or switches. Upon the energization or deenergization of the operating coil, a short surge of voltage is induced in the second winding to apply a resulting momentary magnetic flux through the tertiary portion thereof, to the reed switch or switches, which in turn, depending upon the manner in which the second winding is wound about both the switches and core, will either act to boost the action of the operating coil or opposed the action thereof, thus causing the reeds either to open or to close more rapidly or more slowly as the case may be.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention, and its organization and construction may be had by referring to the description below in conjunction with the accompanying drawings, of which:

FIG. 1 is a schematic representation of a reed relay according to the invention, which serves to illustrate, in a simple manner, the principle upon which the invention is based;

FIG. 2 is a perspective view of a preferred, practical embodiment of a reed relay according to the invention which may be used as a battery feed relay of a telephone system; and

FIG. 3 is also a perspective view of the reed relay of FIG. 2 with single turn windings being substituted for the coils shown in FIG. 2, so as to better described the construction of the relay.

DETAILED DESCRIPTION

Referring to FIG. 1 of the drawings, a prefered embodiment of the reed relay according to the invention comprises a U-shaped iron core **10** having bight portion **11** and legs **12** and **13**. Adjacent the ends **14** and **15** of legs **12** and **13**, respectively, is located a reed switch device **16**. The reed switch device is of the usual type including a pair of magnetic reed blades **17** and **18**, which when subjected to a magnetic field, close to complete an external circuit (not shown) connected thereto. The blades, as can be seen, are sealed into a closed, insulated chamber **19**, normally constructed of a vitreous material. The U-shaped core shown in the drawings is not essential to the invention; however, it is preferred because it provides a better concentration of the magnetic operating field at the reed switch than does a conventional parallel, straight-line core.

An operating coil **20** is wound about the bight portion of iron core **10**, which when energized by means of battery **21** upon depression of switch **22**, serves to produce, through iron core **10**, the necessary magnetic field to operate the reed switch **16**. An additional coil **23** which

serves as a magnetic coupling means is wound about both the reed switch **16** and the iron core **10**, shown here on the bight portion **11**, such that upon the energization or deenergization of coil **20**, a change in the magnetic field of core **10** results, which in turn, causes a voltage to be induced into portion **24** of the coil **23**. This induced voltage causes current to flow in coil **23** which produces a momentary magnetic field at the tertiary portion **25** thereof, wound about the reed switch **16**. The magnetic energy from this momentary field or flux, depending on the sense in which coil **23** is wound about the iron core and the reed switch with respect to the manner in which operating coil **20** is wound about the core, either aids or opposes the operating magnetic field created upon the energization of operating coil **20**. For example, in the case of a normally open reed switch device, if coil **23** is wound about iron core **10** and reed switch **16** in such a manner as to assist the operating magnetic field, the induced momentary magnetic field will cause the reed switch **16** to close more quickly and positively. Furthermore, upon the deenergization of the operating winding **20**, i.e., upon the opening of switch **22**, an opposing magnetic field is produced in the manner explained above, which tends to quickly spring the reed blades apart. Thus, through the addition of this extra coil, acting as a magnetic coupling means, a normally open reed switch device which might tend to remain closed upon the deenergization of the operating coil can be made to be opened promptly and efficiently. Furthermore, through the effective use of this magnetic coupling means, the speed of operation of the device may be modified as desired for specific applications.

FIG. 2 illustrates an embodiment of a relay according to the invention designed primarily for use as a battery feed relay of a telephone system. As is well known in the telephony art, a battery feed relay supplies talking battery to the subscriber station of the telephone exchange. In performing this task the relay should maintain the talking or voice frequency on the telephone line, and the noise, if any, in the battery. To do this well the windings of the battery feed relay should be balanced electrically, thus reducing pick up of extraneous voltages to which a telephone line might be exposed. The relay of course may be used in other applications as desired.

The embodiment as illustrated in FIG. 2 comprises a U-shaped, laminated iron core **50**, best seen in FIG. 3 of the drawings. As will be noted, the outer laminations of each of the legs **51** and **52** of the core extend beyond the other laminations thereof to provide support for the reed switch device **53**, in its specially designed holder **54** in the magnetic operating field of the relay.

In the relay of FIG. 2, three coils **56**, **57** and **58** are each wound on a respective bobbin **59**, **60** and **61**, the latter two being fabricated so as to slide over the legs of the U-shaped core into a mounted position on bight portion **62**. Bobbin **59**, which is supported between the core legs **51** and **52**, has a pair of protrusions **63** and **64** which extend in opposite directions as shown. Protrusion **64** has mounted thereon terminals **69** which are used to connect the reed switch via holder **54** to an external circuit (not shown). Bobbins **59**, **60** and **61** are preferably constructed of a molded plastic.

Each of the bobbins **57** and **58** has a pair of legs **65**, **66** and **67**, **68**, respectively, extending downward and having terminals such as **69** mounted thereon. Through these terminals, coils **56**, **57**, **58** are interconnected by means of wires such as **70** in the manner illustrated in FIG. 3 by single windings **80**, **81** and **82**.

As explained above, when used as a battery feed device it is essential that windings of the relay be balanced so as not to pick up noise and distortion on the telephone line in which the relay is being used. To achieve this necessary balance operating coil **80** is wound partially about both legs **51** and **52** of the iron core. With each portion of the operating coil, there is, as shown in FIG. 3, concentrically wound, a portion of the secondary winding **81**. The tertiary portion thereof, **82** is wound separately about the reed switch device **53**. Thus, to relate FIGS. 2 and 3, winding **56** of FIG. 2 corresponds to tertiary portion **82** of winding **81** of FIG. 3. Approximately one-half of secondary winding **81** and one-half of operating winding **80** are concentrically wound about leg **52** of the core in FIG. 3 and correspond to coil **57** of FIG. 2, and likewise approximately one-half of secondary winding **81** and one-half of operating winding **80** are concentrically wound about the core leg **51** of FIG. 3 and correspond to coil **58** of FIG. 2. The coils **56**, **57** and **58** of FIG. 2 have been superimposed in dotted lines in FIG. 3 to further describe their relation to windings **80** and **81** of FIG. 3.

The entire relay when completely assembled is placed in a housing **55** shown in dotted lines in FIG. 2. The housing preferably is constructed of a metallic material for magnetic shielding purposes, but could be of a different material if desired. As can be seen in FIG. 2, the housing **55** includes a cover portion **90** having tabs such as **92** with apertures therethrough for mounting the entire relay structure to a support surface, such as printed circuit card (not shown). A base plate portion (not shown) is fitted to cover portion **90** to completely enclose the relay structure.

The operation of the relay of FIGS. 2 and 3 is like that of the relay of FIG. 1. Upon the energization of the operating coil **80** by depressing switch **98**, battery **99** supplies current which passes through coil **80**, here in a direction from point **1** to **8** thereof. As the current passes through winding **80**, a current is induced in winding **81** in a direction from point **9** to **14** thereof. The current in winding **81** creates a momentary magnetic field in tertiary portion **82** about reed switch **53** which, because of the manner in which the winding **81** is wound about the reed switch and core, assists the magnetic operating field, and causes the reed blades to close positively and rapidly. Upon the deenergization of the operating winding **80**, caused by the release of switch **98**, another change in field results. This change in field again induces a current in winding **81**, but in a direction opposite to the one induced upon the energization of the operating coil; i.e., in a direction from points **14** to **9** thereof. The magnetic field resulting from induced current will oppose the operating magnetic field and therefore assist the reed blades in opening.

Thus, the instant invention provides a relay of the high inductance type, using a coil wound iron core as the operating medium, which not only is free from the drawbacks frequently present with such a relay, but in addition, is capable of having the operation thereof modified so as to suit the particular environment and function in which, and for which, it might be used.

What is claimed is:

1. A relay comprising:

a core structure having a pair of separated poles,

a magnetic switching element bridging said poles,

an operating winding wound on said core structure,

said magnetic switching element conducting a sufficient portion of the magnetic flux resulting from energization of said operating winding to cause operation of the switching element,

an additional coil electromagnetically coupled to said core structure and to said magnetic switching element, magnetic energy being coupled from said core to said switching element to modify the amount of magnetic flux through said switching element according to the sense of said coil in response to changing current in said operating winding, whereby the operating characteristic of said switching element is modified by the electromagnetic coupling of said additional coil.

2. A relay according to claim **1** wherein said magnetic switching element is a reed switch having blades of magnetic material, said blades having free ends overlapping

to form a pair of contacts, and said additional coil being closely magnetically coupled to said contacts.

3. A relay according to claim 2 wherein said core structure is substantially U-shaped said additional coil having a first portion encircling said contacts of said switching element and a second portion wound on said cover structure, said first and second portions being interconnected in a series closed circuit.

4. A relay according to claim 3 wherein said core is symmetrical, said core comprising a pair of legs joined by a bight, said operating winding comprising two sets of similar interconnected operating coils, each winding having an equal number of said operating coils on each of said legs, said operating coils of each winding being connected in a series aiding arrangement with successively connected ones of said operating coils being on different ones of said legs, whereby said sets of coils comprise a symmetrical electrically balanced circuit.

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U.S. Cl. X.R.

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