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ELECTROMAGNETICALLY OPERATED SWITCHING MECHANISM

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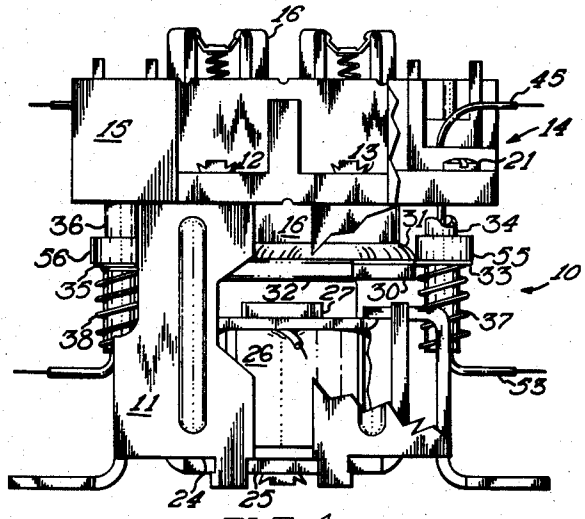

FIG 1

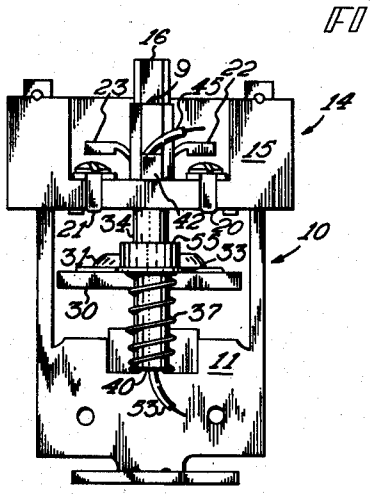

FIG 2

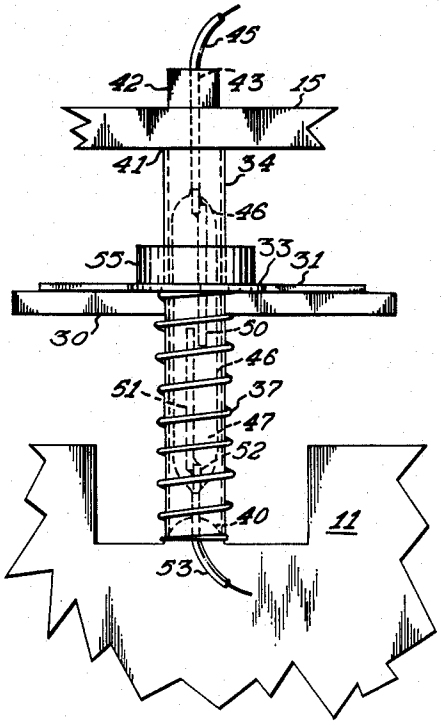

FIG 3

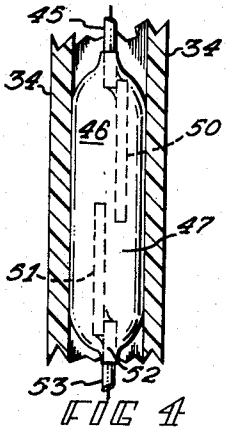

FIG 4

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ELECTROMAGNETICALLY OPERATED SWITCHING MECHANISM

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5 Claims. (Cl. 200—87)

The present invention is directed to an improvement in the relay or contactor art, by the addition of a pilot duty switch without complex or expensive modification to existing devices.

The present invention is an improvement in a relay or contactor of the type generally disclosed in a co-pending application Serial No. 851,596, which was filed on November 9, 1959, now Patent No. 3,066,204, in the name of John W. Mobarry on an electric terminal construction for a relay or contactor. The above-referenced pending application is assigned in total to the assignee of the present application and is cited as a means of fully disclosing the details of an operable device in which the present invention is incorporated. In the relay or contactor art, it has been common practice to add pilot duty switches to an existing heavy duty device in order to provide low voltage or low current switching as an adjunct to the heavy duty operation of the basic unit. The addition normally is incorporated by adding a mounting bracket and a separate switch on a conventional relay or contactor with some type of mechanical interconnection between the added pilot duty switch and the operating mechanism of the parent relay or contactor. This entails unbalancing the force-pull characteristics of the parent relay or contactor and creates design problems if the pilot duty switch is added after the final design of the unit. The present invention provides for adding the pilot duty switch to a parent device without changing the magnetic loading or characteristics of the parent unit and further provides for the addition in a very economical fashion.

It is the primary object of the present invention to provide a magnetically responsive switch which is used as an auxiliary or pilot duty switch to a relay or contactor and which is operated by the parent relay or contactor.

Another object of the present invention is to disclose a parent relay or contactor with a pilot duty switch that is activated by the relay or contactor without expensive revision of the parent device, either physically or in the amount of electrical energy required for operation.

Yet another object of the present invention is to provide an inexpensive means of adding a pilot duty switch to an already existing production device.

These and other objects will become fully apparent when the drawings are considered along with the present specification. It is understood that the drawings represent only one possible embodiment, that of a contactor of the type previously referred to as contained in the Mobarry application, and wherein:

FIGURE 1 is an elevation of a complete device with a cutaway of part of the support structure to disclose the area of novelty;

FIGURE 2 is an end view of the device disclosed in FIGURE 1;

FIGURE 3 is a partial elevation of the center portion of FIGURE 2; and

FIGURE 4 is an enlarged view of the interior of the guide post disclosed in FIGURE 3.

In FIGURE 1, an elevation of a contactor is generally disclosed at **10**. The contactor utilizes a metal frame or support means **11**. Staked at **12** and **13**, to the support means **11**, is a contact structure generally disclosed at **14**. The contact structure **14** includes a fixed insulating member **15** that include a guideway **9** (FIGURE 2)

to guide the movable member **16**, in a conventional manner. The exact configuration of the contact structure is not material to the present invention, but as has been stated before, follows the structure disclosed in the cited Mobarry application.

The insulating member **15**, in FIGURE 2, shows mounted on it a pair of fixed electrical contact members **20** and **21** that cooperate with a pair of movable bridging contacts **22** and **23** that provide an electrical contact means for the device. The movable member **16** carries the movable contacts **22** and **23** to bridge the fixed contact members **20** and **21** when the movable member **16** is operated, as will be explained below.

In FIGURE 1, the support means **11** at its lower end **24** has staked to it a fixed magnetic member **25** that is generally E-shaped. This fixed E-shaped magnetic member **25** has a coil **26** surrounding the center leg **27** to form a fixed portion of an electromagnet which is operated by energizing coil **26**. An armature or movable portion **30** (FIGURE 2) of the electromagnet is formed of a flat magnetic plate that is held by a magnetic retainer **31** that has a bent over portion **32** and a portion **33** that extends outwardly around a guide means **34**. The retainer **31**, at its opposite end, has a portion **35** that encircles a second guide means **36** so that the movable magnetic portion **30** of the electromagnetic circuit can slide up and down as disclosed in FIGURE 1, upon the energization of the coil **26**. A pair of springs **37** and **38** encircle the guide means **34** and **36** and bear between the support means **11** and the projections **33** and **35** of the retainer **31**. The springs **37** and **38** are used to return the electromagnetic device to the position shown when the coil **26** is deenergized.

To this point, in the description, a conventional contactor of the type disclosed in the Mobarry application has been described. The improvement in the present device lies in the area of the guide means **34** and **36**, and the guide means **34** is shown in an enlarged elevation in FIGURE 3 and in a cutaway in FIGURE 4.

In FIGURE 3, the guide means **34** is disclosed as a tubular insulating member that is supported between the upper insulating member **15** and the frame **11**. The frame **11** has a slight projection **40** that centers the tubular guide means **34** at its bottom end. At the top end **41**, the tubular guide means attaches to the plastic member **15** which in turn has a raised portion **42** that is drilled out at **43** to provide space for an electrical wire **45**. The wire **45** is connected to a hermetically sealed magnetically responsive switch **46** which is often referred to as a "reed switch." The switch **46** is disclosed in detail in FIGURE 4. The wire **45** enters a glass envelope **47** of the magnetically responsive switch **46** and goes to a flexible magnetic switch member **50**. A second flexible magnetic contact member **51** is supported in the bottom of the glass tube **47** and exits at **52** on a wire **53**. It will be noted that the flexible members **50** and **51** overlap one another and these members can be caused to move towards one another when a magnetic field is applied near the switch **46**. Surrounding the switch **46** is the tubular guide means **34** which holds the switch **46** in a friction fit so that the switch is properly supported.

In referring back to FIGURE 3, the magnetically responsive switch **46** is seen to be, in phantom, encased in the tubular guide means **34**. Around the guide means is the spring **37** which applies a bias between the frame **11** and the magnetic retainer **31** particularly at the projection **33**. Projection **33** encircles the tubular guide means **34**.

In FIGURES 1, 2, and 3, these is also disclosed a permanent magnet **55** that is toroidal in form and which is placed around the tubular guide means **34**. The permanent magnet **55** attaches itself magnetically to the mag-

netic retainer plate 31 and moves with the retainer plate 31 whenever the retainer plate is in turn moved by movement of the armature 30 of the electromagnetic portion of the device. The movement of the armature 30 of the electromagnetic device in a downward direction causes the permanent magnet 55 to move in a downward direction so that the magnet 55 encircles the overlapping ends of the flexible reeds 50 and 51 thereby causing the ends to flex inwardly towards one another to complete an electric circuit connecting the wires 45 and 53.

It will be noted that an identical magnet 56 is placed on the projection 35 of the retainer 31 around the tubular support means 36 on the left-hand side of the contactor, as disclosed in FIGURE 1. With this arrangement, two switches can be operated simultaneously for pilot duty operation when the main contactor operates under the energization of coil 26 in a conventional fashion. It should be noted that the magnets 55 and 56, while magnetically attached to the retainer 31, can be attached to the retainer 31 by more positive means, such as a cement, or in any other convenient fashion.

In the device disclosed, it becomes apparent that a contactor having normal guide means has been improved by the addition of a pilot duty switch by the nominal addition of only two parts. The first part being a permanent magnet that encircles the guide means and a switch member which is placed within the tubular guide means. The addition of the permanent magnet to the retainer 31 of the device does not upset the magnetic circuit or the rather delicate balance of the device and allows the operation of the pilot duty switch 46 without upsetting the operation of the contactor as a whole. The addition of the present pilot duty switch to the contactor does not entail any great expense or retooling of an existing production item and does provide a very cheap and convenient way of adding a low voltage or low current switching action to any device that is electromagnetically operated and which utilizes some form of guide means in which a switch can be located. In the device currently under consideration, the hermetically sealed switch 46 is approximately one-eighth of an inch in diameter and its operation has proved to be satisfactory. The particular size or configuration is of little specific concern.

The present invention, being applicable to any electromagnetically operated device that has a tubular guide means upon it, has been disclosed in its preferred form in FIGURES 1 to 4. It is obvious that one skilled in the art could modify many devices to incorporate this invention, and, therefore, the inventor wishes to be limited in the scope of his invention only by the scope of the appended claims.

I claim as my invention:

1. In an electromagnetically operated relay, comprising: support means including an electromagnet having a fixed portion and a movable portion including a magnetic retainer; contact means operatively mounted upon said support means and moved by said electromagnet to control electric current through said contact means; said support means further including at least one tubular guide means to guide said fixed and movable portions with said retainer around said guide means thereby allowing said portions to be moved by said electromagnet relative to each other to operate said contact means; a permanent magnet mounted by its own magnetic field on said retainer of said movable portion and encircling said tubular guide means; and a hermetically sealed magnetically responsive switch mounted within said tubular guide means; said permanent magnet operating said switch when said electromagnet is operated to move said portions relative to each other by moving said permanent magnet adjacent the exterior of said tubular guide means.

2. In an electromagnetically operated contactor, comprising: support means including an electromagnet having a fixed portion and a movable portion; contact means operatively mounted upon said support means and moved by said electromagnet to control electric current through said contact means; said support means further including two parallel tubular guides to guide said fixed and movable portions when said portions are moved by said electromagnet relative to each other to operate said contact means; two permanent magnets mounted on said movable portion with one magnet adjacent each of said tubular guides; and a magnetically responsive switch mounted within each of said guides; said permanent magnets operating said switches when said electromagnet is operated to move said portions relative to each other by said magnets moving adjacent said tubular guides.

3. In an electromagnetically operated relay, comprising: support means including an electromagnet having a fixed portion and a movable portion; electrical contacts operatively mounted upon said support means and moved by said electromagnet to control electric current through said contacts; said support means further including at least one tubular guide means to guide said fixed and movable portions when said portions are moved by said electromagnet relative to each other to operate said contacts; permanent magnet means mounted on said movable portion and encircling said guide means; and magnetically responsive switch means mounted within said guide means; said permanent magnet means operating said switch means when said electromagnet is operated to move said portions relative to each other by moving said permanent magnet adjacent the exterior of said tubular guide means.

4. In an electromagnetically operated device, comprising: support means including an electromagnet having a fixed portion and a movable portion; contact means operatively mounted upon said support means and moved by said electromagnet to control electric curernt through said contact means; said support mean further including at least one hollow guide means to guide said fixed and movable portions when said portions are moved by said electromagnet relative to each other to operate said contact means; permanent magnet means mounted on said movable portion and adjacent said guide means; and sealed magnetically responsive switch means mounted within said guide means; said permanent magnet means magnetically operating said switch means when said electromagnet is operated to move said portions relative to each other by moving adjacent to said switch means.

5. In an electromagnetically operated device, comprising: support means including an electromagnet having a fixed portion and a movable portion; contact means operatively mounted upon said support means and moved by said electromagnet to control electric current through said contact means; said support means further including hollow guide means to guide said fixed and movable portions when said portions are moved by said electromagnet relative to each other to operate said contact means; permanent magnet means mounted on said movable portion and adjacent said guide means; and magnetically responsive switch means mounted within said guide means; said permanent magnet means magnetically operating said switch means when said electromagnet is operated to move said portions relative to each other.

No references cited.