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APPARATUS FOR INDICATING AN OPEN ELECTRICAL CIRCUIT

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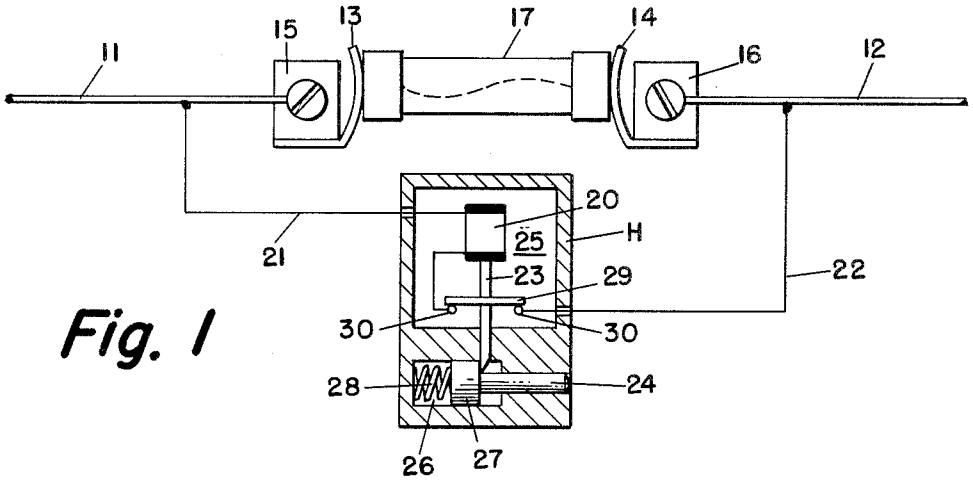


Fig. 1

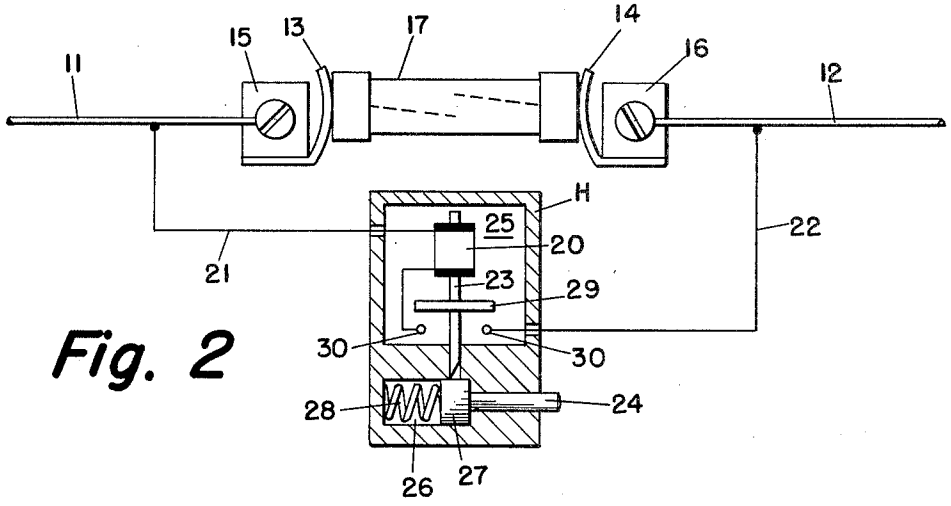


Fig. 2

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APPARATUS FOR INDICATING AN OPEN ELECTRICAL CIRCUIT

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Continuation of application Ser. No. 58,861, Sept. 27, 1960. This application May 22, 1963, Ser. No. 285,187
1 Claim. (Cl. 200—87)
(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This application is a continuation of my copending application Ser. No. 58,861, filed September 27, 1960, for Electromagnetically Controlled Indicator and now abandoned.

The invention relates to improvements in indicating the condition of protectors or fuses for electric circuits and more particularly to such improvements utilizing an indicator which is operative at all times to show the condition of such protectors.

As is well known, protectors for electric circuits are of numerous types and employ a fusible element which is enclosed in a suitable housing such as, for example, a cylinder of insulating material for preventing the component parts of the protectors from damage or deterioration. Additionally, the protector housings are constructed of various sizes and shapes to be readily received in or removed from receptacles provided in the circuits with which the protectors are to be used.

When numerous circuits are provided in an installation, such as those required on shipboard, it is practically impossible for maintenance personnel to make the necessary tests of a number of protectors for the electric circuits before the particular protector that has acted to open a circuit can be located. This is too time-consuming and is more or less of a hit-or-miss proposition.

Various attempts have been made in the past to develop protectors for electric circuits which have indicators associated therewith in order to eliminate the necessity of manual inspection of the protectors. Some of these have been arranged to give an audible indication that a circuit has opened while others have provided for a visual indication of such a condition. One prior and commonly used indicating arrangement for visually showing that a protector or fuse has blown and that a circuit is open has been to arrange an incandescent lamp and series resistor in the circuit, across the fuse, in such a manner that when the fused circuit was operating properly, the lamp and resistor would be shorted out but in the event the circuit was overloaded to the extent that the fuse or protector interrupted the circuit, a voltage would appear across the lamp to visually indicate this condition. The use of series resistor and incandescent lamp has proved disadvantageous, particularly for low voltage circuits since, in one instance, when the fuse blows, current will flow through the lamp and also the small load devices which the low voltage circuit is operating, which may cause further breakdown in the circuit or device. In another instance, in low voltage circuits, if an instantaneous short circuit occurs and later corrects itself, sufficient resistance remains in the load which, when added to the resistance in series with the lamp, reduces the voltages across the lamp to a value insufficient to light the lamp. Also, in some equipment, particularly in aircraft, maintenance is performed with the power off. If a fuse has blown during operation and the power shut off for maintenance no blown fuse indication is provided.

The principal object of the present invention is to

provide an inexpensive and positive indicator arrangement for electrical circuits.

Another object is to provide an indicator arrangement which positively indicates that the fuse in a low voltage circuit has blown.

Still another object is to provide housing structure for assembling elements of a circuit closer in a manner to be positively actuated by the circuit current to indicate that the current is interrupted.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings, wherein:

FIG. 1 is a view in elevation of a load circuit with detailed structure of the elements of the invention sectioned to show their position when the load circuit is closed.

FIG. 2 is a view similar to FIG. 1 showing the position of the elements when the load circuit is open.

The circuit wires for a load (not shown) are indicated at **11** and **12** and will receive power from a source. The circuit is provided with a fuse receptacle which may, as shown, take the form of spring clips **13** and **14** which are supported by the terminal posts **15** and **16** of the respective wires **11** and **12**. A cylindrical fuse **17** is removably received between the clips **13** and **14** and forms part of the load circuit and, as is well known, the fuse blows or burns out when the circuit is overloaded and opens the circuit.

For the purpose of positively showing that the load circuit is open, an indicator circuit is connected in parallel with the fuse **17**. The indicator circuit is made up of a solenoid **20** having its coil connected to the wires **11** and **12** respectively by leads **21** and **22** for actuating the core **23**, when the fuse **17** has blown, to control the position of an indicator pin **24**.

As shown in the figures, a housing H is provided with a first compartment **25** for receiving the solenoid **20** and a second compartment **26** is provided for receiving the pin **24**. A passageway is located, as shown, in the housing structure providing communication between the compartments and the solenoid **20** is positioned in compartment **25** so that its core **23** is received in the passageway. The size of the passageway is such that the core is snugly received therein but the core is movable from one to the other of its positions shown in FIG. 1 and FIG. 2. The second compartment has an outer portion of relatively small or narrow cross section for receiving the pin **24** which has an abutment in the form of a flange **27** on its inner end. The flange **27** is received in the inner portion of the compartment **26** which is of relatively larger or wider cross section than the outer portion and the inner and outer portions of the compartment have a common longitudinal axis and the core **23** is disposed normal to this axis as shown in the drawings. The pin **24** is urged outwardly of the housing by means of a spring **28** which is located in the inner end of the compartment **26** and positioned in abutting relation with the inner face of the flange **27** as shown.

In FIG. 1, which is the position of the indicator elements when the load circuit is closed, the solenoid core **23** will be in its normal or outer position and have its outer end in contact with the outer face of the flange **27** for maintaining the pin **24** in retracted position. The pin **24** having been pushed inwardly to this position, against the pressure of spring **28**, when the fuse **17** was placed in the load circuit. When the fuse **17** has blown and the load circuit is opened, the solenoid **20** is energized by power through **21**–**22**, contactor **29** and contacts **30** and functions to retract the core **23** to the position shown in FIG. 2 releasing it from contact with the outer face of the flange **27** and permitting the pin **24** to be

urged outwardly of the housing H under the force of the spring 28 as an indication that the fuse has blown. The outer end of core 23 will then contact the side wall of flange 27 and maintain the solenoid contactor 29 separated from the contacts 30—30 until the blown fuse is replaced by a new fuse and the pin 24 is pushed inwardly to permit the core 23 to again move across the outer face of flange 27. The pin 24 may have its outer end suitably colored to provide a ready visual indication to a maintenance operator and this is particularly desired when a number of circuits are provided with the indicators as, for example, when a number of fuse receptacles are supported on the inner face of a switchboard and the ends of the indicators 24 are arranged to be visible from the outer face when a fuse has blown.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claim the invention may be practiced otherwise than as specifically described.

What is claimed is:

Apparatus for visually indicating that an electrical load circuit is open which comprises:

(*a*) an electromagnet formed of a coil and having a core movable from a forward position to a retracted position when the coil is energized,

(*b*) a parallel circuit between the coil and the load circuit having a switch therein formed of a contactor fixed to said core and a pair of contacts,

(*c*) said switch being closed when the core is in its forward position,

(*d*) a pin mounted for movement in a path normal to said core,

(*e*) said pin having a flange portion and an elongate portion extending therefrom,

(*f*) said flange portion having a side wall and an end wall generally normal to each other,

(*g*) spring means positioning the flange side wall to abut the end of the core and prevent its movement to the forward position in order to maintain the switch open,

(*h*) said pin being movable against the spring means to adjust the position of the flange and permit the core to ride over the end wall of the flange and advance to its forward position and close the switch and

(*i*) means for holding the flange in this position until the coil becomes energized by current passing through the parallel circuit and the core moves to its retracted position whereby the pin is moved by the spring means to a position indicating that the load circuit is open.

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