Dec. 6, 1955 G. A. NORCROSS 2,726,378

BLOWN FUSE INDICATOR

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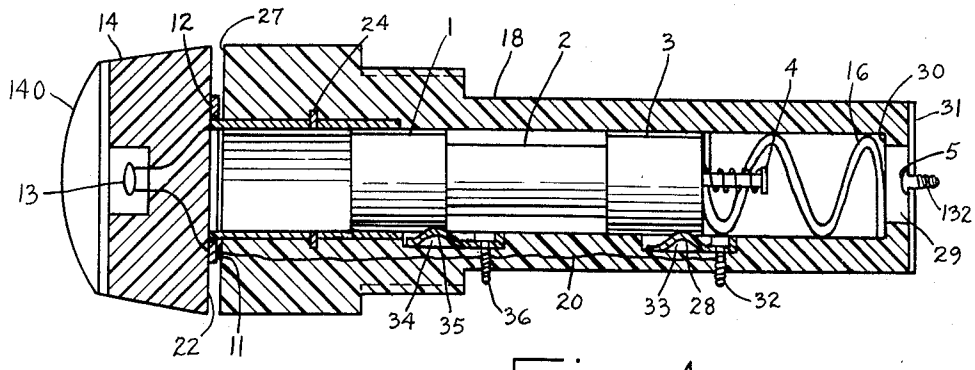


Fig. 1

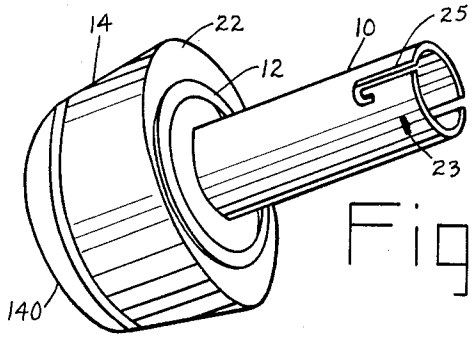


Fig. 2

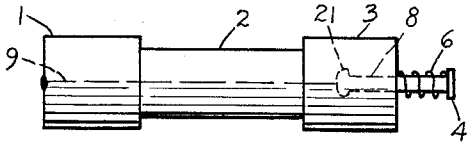


Fig. 3

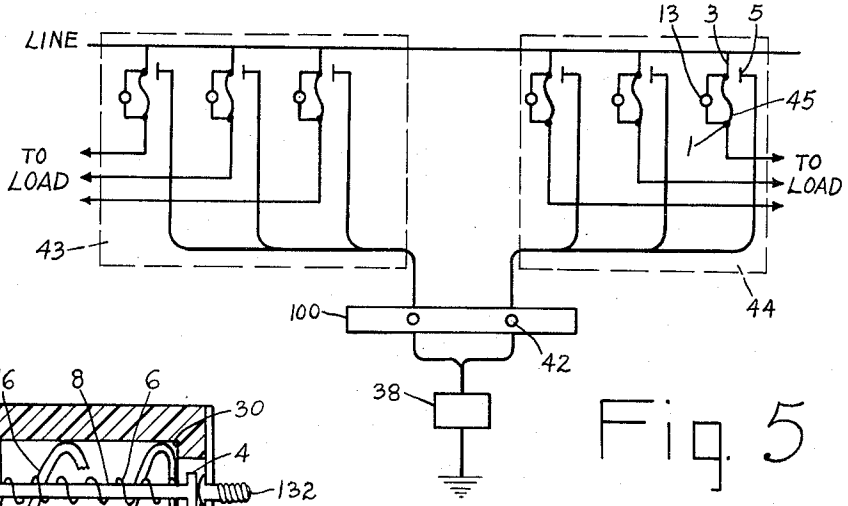


Fig. 5

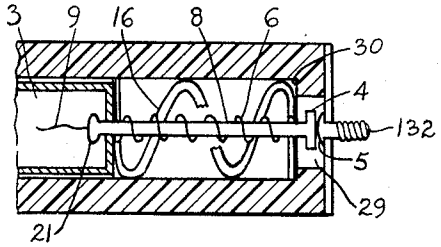


Fig. 4

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BLOWN FUSE INDICATOR

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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.

The present invention relates, in general, to protective devices that are used in conjunction with electrical circuits, and more particularly pertains to a means of indicating immediately the failure of a circuit, and indicating accurately the location of the defective circuit protective device.

At the present time, some form of protective device is utilized as a protection against overload in practically all electrical circuits. The most common types of overload protectors in use today are the circuit breaker and the common fuse containing an expendable strip of conductive material, or a thermal cutout element.

In many instances, a plurality or multiplicity of protective units are grouped together into one unit. Often there are many such units, containing many electrical protective devices, located at various places. When, due to a defective circuit, a protective device opens a circuit, it becomes a tedious and time consuming job to locate the open circuit. Very often a blown fuse will result in malfunctioning of the equipment. This malfunctioning may not be evident immediately in devices such as computers and will result in erroneous solutions and information. (Malfunctioning, due to a blown fuse, is common in computers and electronic training equipment. Once it becomes evident that the malfunctioning or inoperativeness of the equipment is due to a "blown" fuse, it becomes a tedious and time consuming job to locate the open circuit.)

At the present time, it is necessary for the maintenance man to inspect and test each fuse in each bank of fuses to determine which fuse is open. This results in high maintenance costs and, sometimes, inoperativeness of the device at a time when its functions are of utmost usefulness.

The present invention utilizes a fuse that contains a thermal element attached rigidly to the conducting portion that is located at one end of the cartridge. The other end of the thermal wire is attached rigidly to a stud that is mounted slidably through the conducting tip that is located at the other end of the cartridge. The stud, through the action of the thermal wire, maintains a helical spring in compression. When the thermal wire separates, the spring forces the stud to protrude from the cartridge.

In the present invention, an external contact is provided that makes contact with the stud, in its extended position, and completes a circuit between a terminal that is connected electrically to a bell and an indicating light and the high side of the voltage line. Accordingly, the instant that current stops flowing through the thermal element of the fuse, it starts along a new path to an alarm bell and an indicator light.

The bell is an alarm and audio indication that a fuse is open; the indicator light informs the observers of the location of that panel that contains the "blown" fuse.

A neon lamp is connected across the terminals of each fuse. This lamp will conduct current and emit light only when there is an open circuit between the terminals of the cartridge fuse, thus resulting in a voltage differential between the terminals of the gas bulb. Upon inspection of that particular panel that is indicated by the indicator light, the particular fuse that is open can be identified by the presence of the glowing neon lamp.

It is an object of the present invention to provide a system that will indicate the inoperativeness of a circuit protection device and the exact location of the inoperative unit at the instant of failure.

Another object is to provide means to determine, by means of the senses only, the exact location of a defective fuse at the instant of failure and to indicate to the operator the instant a fuse becomes inoperative.

Another object is the provision of an assembly device consisting of several parts, so that the malfunctioning of one element will not necessitate replacement of the entire assembly.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 shows a longitudinal cross section of the completely assembled unit;

Fig. 2 is a perspective view of the removable unit that contains a lens, a gas bulb and a fuse adapter;

Fig. 3 is a plan view of a good conducting fuse;

Fig. 4 is an enlarged view showing the connection between a blown fuse and the alarm contact; and

Fig. 5 illustrates a circuit diagram of a complete layout.

The electrical protective and indicating device is utilized in the same form and manner as a standard fuse would be utilized to protect a circuit from overload, with the addition of an indicator circuit and an alarm device.

The central or body portion 2 of the fuse of Fig. 3 is composed of some suitable insulating material that is in the form of a hollow cylinder or tube. A cup 1 composed of a suitable conductive material is attached securely to one end of tube 2. A similar type cup 3 is attached securely to the other end of tube 2. Projecting through a small opening, of suitable size, in the end of cup 3 is a plunger or stud 8. The stud 8 is composed of a material that has good electrical conductive properties, is of suitable length and contains an annular flange 4 at its outer end. A circular coil spring is maintained in a captive position around the stud 8 by the action of annular flange 4 and cup 3. A thermal element 9, contained within the unit formed by tube 2 and the two cups 1 and 3, has one of its extremities attached securely to the inner end of cup 1 and the other extremity is attached securely to end 21 of stud 8, thus maintaining captive coil spring 6 in a compressed position. A parting or breaking of the thermal element 9 allows the stud 8 to increase its extension from the exterior end of cup 3 from the Fig. 1 position to the Fig. 4 position through the action of helical spring 6.

The local indicator unit 14 consists of a lens 140 that is composed of any suitable material, and can be colored red or any other desired color. The body portion 14 is attached securely to lens 140 and is composed of a suitable non-conducting material of the desired size and shape. The inner portion of body 14 is hollow and contains a gas discharge light bulb such as a neon or argon gas filled glow bulb.

Attached securely to the base 22 of body 14 is a hollow cylinder fuse holder 10 that is composed of a material having good electrical conductive properties. One terminal of the glow bulb is connected electrically to fuse holder 10. As mentioned above, one end of fuse holder 10 is at-

tached securely to base 22 of body 14. The other end of tube 10 has an inside diameter that is slightly larger than the outside diameter of the cap 1 of the fuse. Cap 1 slides into tube 10 and strikes a small embossed stop 23. The embossed stop 23 consists of any projection on the inner wall of tube 10 that will decrease the inside diameter of tube 10 to a size that is smaller than the outside diameter of the cap 1 of the fuse. In the present invention, stop 23 consists of a small indentation of the external surface of tube 10, thus resulting in a metallic projection on the inner surface of tube 10.

Located in the free end of tube 10 are two bayonet slots in the form of J-shaped cutouts 25 that receive pins 24 that are mounted in unit 18 of Fig. 1. The bayonet slots 25 and pins 24 perform as a catch and locking mechanism to retain the local light indicator unit 14 within close proximity to unit 18. The other terminal of glow tube 13 is connected to contact ring 12 which is attached securely to base 22 of unit 14. Contact ring 12 is composed of material possessing good electrical conducting properties, and makes contact with the stud containing end cap 3 of the fuse through a pressure contact 28, connecting wire 20 and contact 11. Contact 11 is located on the face 27 of fuse holder 18 and is composed of a material possessing good electrical conducting properties.

Fuse holder 18 is composed of a non-conducting material, such as Bakelite, having a blind passageway of sufficient diameter to accommodate the fuse unit 2. Just prior to reaching the walled bulkhead 31 that seals the end of the blind passageway, there is an axial channel 29 that is of smaller diameter than the main fuse accommodating passageway. The junction of the fuse passageway and channel 29 forms a shoulder 30 of non-conducting material.

Secured in recesses 33 and 34 are electrical conducting, spring pressure, insert clips 28 and 35 that make electrical contact with end 3 and 1 respectively of fuse 2. Terminal studs 32 and 36 are connected electrically to spring contacts 28 and 35, said studs passing through and projecting beyond the outer surface of the non-conducting wall of fuse holder 18.

Contact button 5 is attached securely to the inner surface of bulkhead 31 and is connected electrically to terminal stud 132. Terminal stud 132 is connected rigidly to bulkhead wall 31 and extends beyond the exterior surface of said wall.

Helical spring 16 is inserted within the blind passageway and is of sufficient diameter so that one end of said helical spring 16 rests against the shoulder 30. When the unit is in the assembled form as illustrated in Fig. 1, helical spring 16 exerts a pressure against the end 3 of fuse 2 of sufficient force to maintain said fuse in the proper relative position to the various contacts 35, 28 and 5.

To assemble the unit, end 1 of fuse 2 is inserted within the open end of tube 10 of the local light indicator unit 14. Said assembly of fuse 2 and local light indicator unit 14 is then inserted within the fuse passageway and locked in place by the interaction of pins 24, which are attached to fuse holder 18 and the J slots 25 of tube 10.

The movement of fuse 2 along the fuse passageway is restricted by the action of the helical spring 16. Said spring 16 is a spring pressure stop and is utilized to maintain fuse 2 against stop 23. The inner diameter of the helical spring 16 is very large when compared to the maximum diameter of contact head 4 of stud 8, thus allowing stud 8 free movement through the helical spring 16 along its longitudinal axis to contact button 5.

The exterior surfaces of the fuse holder 18 can be made to the desired size and contours.

In operation, terminal 32 is connected electrically to the line or high side of the line. Terminal 36 is connected to the desired load. There is an internal electrical connection from terminal 32 to terminal 36 through

pressure contact 28, end cup 3, thermal fuse element 9, end cups 1, and pressure contact 35.

Terminal 132 is connected electrically to an alarm and a general location trouble panel. The alarm indicates the presence of a blown fuse and the general location trouble panel indicates the panel board in which the defective fuse is located. As previously stated, indicator lamp 13 is connected across or in parallel with the fuse.

When, due to an overload, the thermal fuse element burns out, the following sequence of events occurs;

An open circuit occurs between end cap 1 and end cap 3, thus stopping the flow of current at 32 to the load.

A potential differential that is equal to the line voltage will appear across end cap 3 and end cap 1, thus igniting gas bulb 13.

Stud 8, no longer retained in its retracted position by the retarding action of thermal fuse element 9, is advanced by the action of helical spring 6 along the longitudinal axis of fuse 2 to contact button 5. At this instant, electrical contact is made between end cap 3 and terminal post 132. Therefore the current will now flow to a panel location indicating device 100 that can be a bell, a horn or a light, and then to a general trouble indicating device such as a gong or buzzer 38, as shown in Fig. 5.

The panel location indicating device indicates the panel within which the defective fuse is located.

Fig. 5 illustrates a typical layout for a plurality of fuse boxes, where each fuse box contains a plurality of fuses.

Unit 43 (Fig. 5) is a fuse box containing a plurality of fuses and located at some convenient place. Unit 44 is another fuse box containing a plurality of fuses and is located at some other convenient place. Fuse box 43 can be displaced many feet from fuse box 44. We shall assume that fuse 45 of fuse box 44 burns out as the result of an overload. Immediately, indicator light 42 will light and alarm 38 will sound. Alarm 38 warns that a fuse has blown. Indicator light 42 indicates that the blown fuse is located within panel 44.

Upon examination of the fuse box 44 it will be obvious that light 13, adjacent to fuse 45, will be emitting light, thus indicating the specific fuse that is inoperative.

From the foregoing description and from the drawings it will become obvious to those experienced in the art that the present invention is subject to various modifications. The indicators may be lights or bells or a combination of both, and the method of holding and making electrical contacts with the fuse may be altered to include clips, springs, wires or clamps.

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 claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A device of the type described comprising a fuse holder, contacts at opposite ends thereof and fuse engaging contacts between the ends thereof, a removable light producing indicating element at one end of the holder, means to slidably connect the indicating element to the fuse engaging contacts, and means for connecting one end contact to a fuse engaging contact when the fuse is blown.

2. A circuit controlling device comprising a fuse holder having first and second fuse-engaging contacts and a third contact, a fuse carried by said holder and coupling said first and second contacts electrically, a light in series with said first and second contacts, a signal element in series with said third contact, and means actuated by rupture of said fuse to connect said second and third contacts electrically.

3. A circuit protective and indicating device comprising a single fuse element, switching means mechanically connected to said fuse element and operable upon the breakdown of said fuse element, and a light slidably con-

nected in shunt to said fuse element and actuated by breakdown of said fuse to automatically indicate a defective fuse element.

4. The combination of claim 3 wherein said switching means comprises a plunger and a helical spring acting upon said plunger to propel said plunger, said fuse element being connected to said plunger to maintain the spring in a compressed state and the plunger in a withdrawn position.

5. A circuit protective and indicating device comprising a fuse, a fuse holder to slidably accommodate said fuse, a neon indicating light housing slidably connected to said fuse and carrying a light in shunt therewith to indicate a defective fuse, an electrical contact, and switching means coupled to said fuse and actuated, at the instant said fuse blows, to electrically connect said electrical contact to said fuse.

6. A circuit controlling device comprising a hollow cylindrical fuse holder, a plurality of contacts attached to the wall of the cylindrical interior of said holder, a fuse slidably mounted within said interior to contact a first and a second of said contacts, a neon light having a sleeve slidably and detachably secured to said fuse and coupled electrically across said fuse and switching means coupled to said fuse and actuated, at the instant said fuse blows, to contact another of said plurality of contacts.

7. A circuit protective and indicating device comprising a fuse holder, contacts at opposite ends thereof and fuse engaging contacts between the ends thereof, a fuse coupling said fuse-engaging contacts, a removable light carried by said holder and mounted slidably upon said fuse, said light being connected in shunt with said fuse, and means for connecting one end contact to a fuse engaging contact when the fuse is blown.

8. A device of the type described comprising a fuse holder, contacts at opposite ends thereof and fuse engaging contacts between the ends thereof, a removable indicating element at one end of the holder, means to connect the element to the fuse engaging contacts, means retaining a fuse in engagement with said fuse engaging contacts, and means for connecting one end contact to a fuse engaging contact when the fuse is blown.

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