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PROTECTIVE ARRANGEMENT FOR SWITCH CONTACTS

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FIG. 1

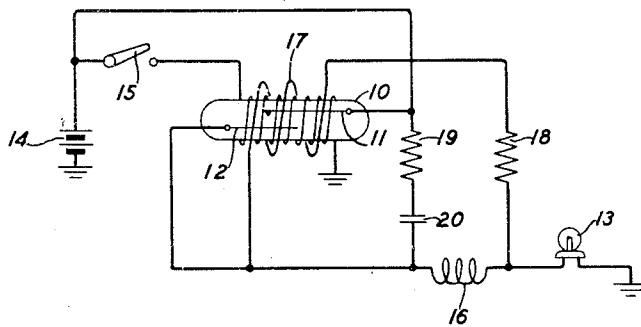
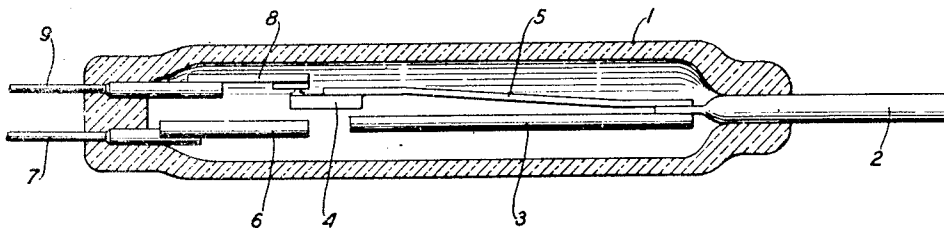


FIG. 2



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PROTECTIVE ARRANGEMENT FOR
SWITCH CONTACTSAusten M. Curtis, South Orange, N. J., assignor
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2 Claims. (Cl. 175-294)

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This invention relates to circuit makers and breakers and particularly to contact protection of glass sealed contact devices.

The object of the invention is to protect the contacts of a switching device from the ill effects of breaking an abnormally high current. It is known that certain types of load give rise to transient currents which may reach abnormally high values, such for instance, as the ordinary tungsten filament lamp. In such a case the cold resistance of the lamp is very low in comparison to the hot resistance thereof, so that when a lamp circuit is closed the initial current is many times the normal amount. Usually this has no adverse effect on the various circuit elements for the period which is required for the lamp to reach incandescence is very short. There are however, situations in which it is desired to use glass sealed contact elements to close such a circuit and in which the contact device is adequate to carry the normal current, but wherein the contacts are subject to serious injury or destruction, if for instance, they are opened during the initial rush of current into the cold lamps. Such an operation might come about through various circumstances, as for instance, the chattering of the contacts which control the magnetic means which are used to operate the said contacts.

In accordance with the present invention a means is employed responsive to the abnormal current to hold the closed contacts firmly together so that they cannot break the circuit during the period of the abnormal transient. This takes the form of an extra winding to influence the magnetic circuit of the contacts of such proportions that it will not interfere with the normal operation of the circuits but will respond to an abnormal condition.

A feature of the invention is a locking means for a pair of circuit closing contacts responsive to an abnormal rush of current therethrough. According to this feature an operating winding for the contacts is included in series with the said contacts but is so proportioned and arranged that it will not prevent the opening of the contacts when a normal amount of current is flowing therethrough.

Another feature of the invention is the use of an inductance in series with the contacts across which the auxiliary winding is bridged, the inductance playing the dual role of a means to delay the rate of current increase during the first 50 or more microseconds after the contacts are closed while at the same time acting as a source of potential for energizing the said aux-

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iliary winding. By this arrangement a standard or universal auxiliary winding may be employed and it will not be necessary to provide a different one of such windings for each different load condition.

The drawings consist of a single sheet having two figures as follows:

Fig. 1 is a schematic circuit diagram illustrating the invention; and

Fig. 2 is a cross-sectional view of a typical form of glass-sealed contact device greatly enlarged.

In Fig. 2 the contact device consists of a glass envelope 1 into one end of which a tube 2 is sealed and which may be used during the construction for tubulation purposes and later when the device is in operation as an electrode. An element 3 of magnetic material is welded to the electrode 2 and a multiple armature 4 of magnetic material is welded to a spring 5 which is also attached to the electrode 2. At the other end of this device a magnetic element 6 is welded to a lead-in terminal 7 in such a position that air gaps are provided between the elements 3, 4 and 6. A back contact element is also provided by the non-magnetic piece 8 welded to another lead-in terminal 9. This glass-sealed element may be inserted within a coil and thus subjected to magnetic influence whereupon the element 4 is moved to decrease the air gaps and make an electrical connection with the terminal piece 6 so that an electrical circuit may be completed through the device from the electrode 2 to the terminal 7.

Generally, these devices are evacuated and then filled with an inert gas such as hydrogen.

In the schematic circuit diagram, the element 10 represents a contact element such as that shown in Fig. 2 having the contacts 11 and 12 which may be closed together upon the energization of the main winding of this device. A lamp 13 is shown as representative of that type of load which requires a high starting current such as the ordinary tungsten filament lamp which has a low cold resistance. The battery 14 may be connected to the lamp 13 through the closure of any type of switch such as 15. When this is closed, a circuit will be extended from ground, battery 14, switch 15, the main winding of the device 10 to ground whereupon a circuit will be closed through the contacts 11 and 12 extended from the battery 14 through an inductance 16 to the lamp 13 and thence to ground. Since the starting current for the lamp 13 is high the drop across the inductance is correspondingly high

and therefore a secondary winding of the contact device 17 will be energized in a circuit from the battery 14, the contacts 11 and 12, the secondary winding 17, the resistance 18, the lamp 13 to ground. The current flowing through this auxiliary winding at this time is sufficient to hold the contacts 11 and 12 closed so that should the circuit of the main winding of the device become accidentally opened during this period the contacts 11 and 12 will nevertheless be held firmly closed. As the load current settles down to its normal value, the resistance drop across the reactance 16 goes down to a very low value so that the current through the winding 17 becomes insufficient to hold the contacts 11 and 12 closed. Therefore, if the circuit of the main winding of the device is opened at any time after the current through the load 13 has reached its normal value, the contacts 11 and 12 will quickly release.

While it is impractical to use a large enough inductance in series with the load to materially influence the low frequency components of the surge when voltage is first applied, this inductance will retard the rise of current for the first 50 to 60 microseconds without introducing a prohibitive direct current drop. The inductance 16 (rather than a pure resistance which would equally well provide for the energization of the auxiliary winding) therefore protects the contacts from welding currents on closing while at the same time acting as an agent for the energization of the auxiliary winding.

The resistance 18 may be changed to suit differing load conditions so that a standard winding 17 may be used in accordance with the particular load which the device will be called upon to handle.

A resistance 19 and a capacitor 20 are bridged across the contacts 11 and 12 for the purpose

of protecting these contacts on opening in accordance with standard practice.

What is claimed is:

1. The combination of an electromagnetically operated circuit closer comprising a pair of co-operating contacts and an operating winding therefor, of an impedance element in series with said contacts and an auxiliary winding for said contacts bridged across said impedance element, said impedance element having sufficient inductance to transiently retard the rise of current through said contacts upon the closure thereof and sufficient resistance to cause the energization of said auxiliary winding when and only when said contacts are carrying an abnormally high steady load current.

2. The combination of a glass sealed reed contact device having a many turn operating winding wound thereabout and a few turn auxiliary winding wound thereabout, of an impedance element in series with said reed contacts and connections for bridging said auxiliary winding about said impedance element, said impedance element having sufficient inductance to transiently retard the rise of current through said contacts upon the closure thereof and sufficient resistance to cause the energization of said auxiliary winding when and only when said contacts are carrying an abnormally high steady load current.

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