April 23, 1940. H. E. YOUNG ET AL 2,198,101

AUTOMATIC CUT-IN SWITCH

Filed April 7, 1939

Fig. 1

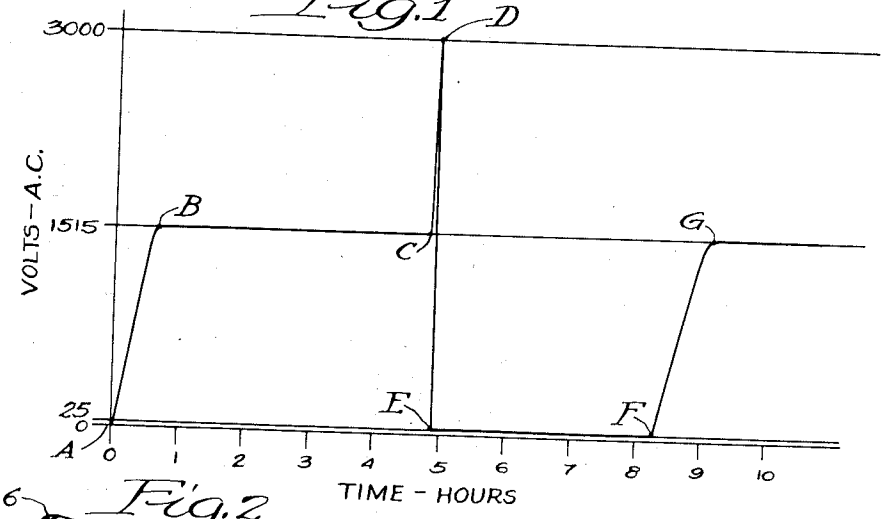


Fig. 2

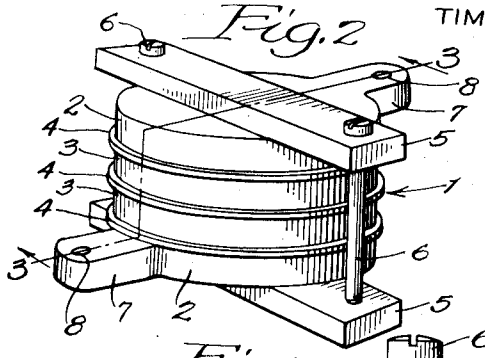


Fig. 4

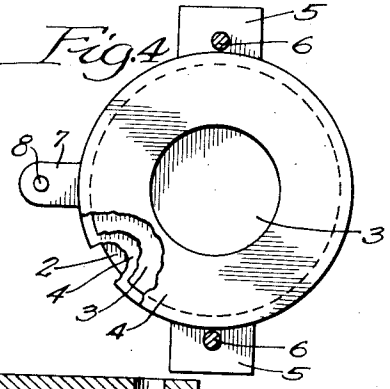
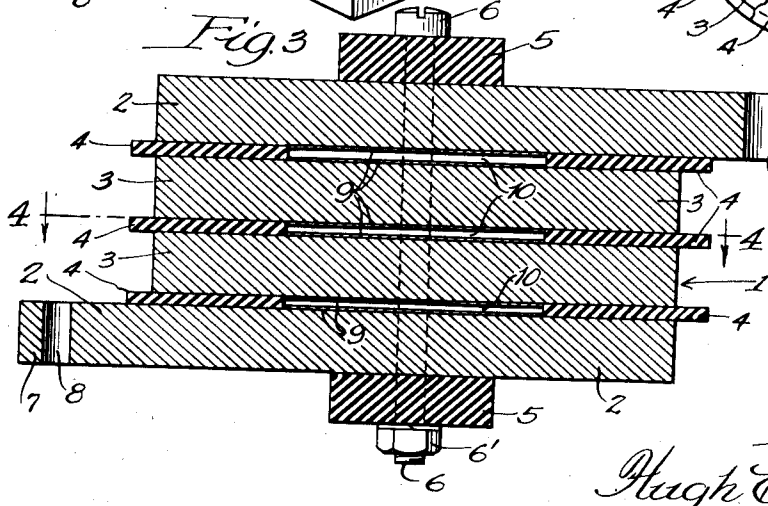


Fig. 3



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AUTOMATIC CUT-IN SWITCH

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3 Claims. (Cl. 200—118)

This invention relates to an electric circuit control apparatus adapted for automatic operation to close a circuit especially for use in constant current distributing circuits, as for instance in lighting systems. Heretofore in such circuits fed by a constant current transformer source, where there is a tendency for the voltage to run upward to infinity in the event of a break in the circuit, difficulty has been had in controlling such voltage and keeping it within safe limits.

Our use of this short circuiting switch device is illustrated at **25** in the drawing of our application No. 234,394, filed October 11, 1938. Commercial tests have shown it to be thoroughly practical and efficient.

The main objects of the present invention are to provide for the transformer secondary and across the distributing load line an appropriate means to prevent abnormal or dangerous rise of voltage and moreover to greatly diminish the voltage in case of accident; to provide such a device to function substantially as a kind of automatic cut-in switch operable to substantially short circuit the transformer secondary; to provide such a switch of mechanically static character; to provide such a cut-in device or shorting switch operable by ionization and adapted by design for a desired ionization time element for effective operation; to provide such a device having inherent power to become effective and also self-restorative so as not to require any changes or renewals after operation; and to provide such a device of low cost and requiring very little skill or attention in use.

This invention is illustrated by the accompanying drawing, in which:

Figure 1 is a conventional diagram showing a typical voltage curve for a substantial period of time, including the moment of initial build-up of voltage upon cutting in the transformer, a normal-operation period, an interval of abrupt rise and fall of voltage incident to accidental opening of the series load circuit, and a repair interval of open circuit, followed by a re-build-up of voltage and the resumption of normal operation after repairs have been made.

Fig. 2 is a perspective view switch constituting the main basis of this invention.

Fig. 3 is a vertical axial section on the line 3—3 of Fig. 2.

Fig. 4 is a sectional plan taken on the line 4—4 of Fig. 3.

Referring first to the construction shown, the protective switch device as a whole **1** comprises a pair of terminal discs **2** and two intermediate discs **3** all of amalgamated or mercurized copper in combination with a pair of intermediate insulating rings **4** of mica, and a clamping support comprising rigid insulating bars **5** between which the elements **2**, **3** and **4** are securely held by bolts **6**. Each end plate **2** has a side terminal **7** apertured at **8** to receive a conductor or fastening therefor (not shown) as will be apparent. The thin layer of mercury on the copper plates is illustrated at **9**.

The holes **10** in the discoidal rings or annuli **4** serve each as an ionization chamber where in use dangerously abnormal high pressures cause ionization of the mercury and hence a short circuiting arc of low resistance.

Referring now to the diagram of Fig. 1, it is to be noted that in throwing the load circuit into use, as by appropriate, transformer switching, voltage builds up quickly during a brief period. The beginning of this period is indicated at A. As soon as the voltage reaches about 1515 volts indicated at B, it remains constant so long as the load remains the same. Then, in case of an accident to the load circuit, whereby it is opened, as by destruction of a lamp or the breaking of a load conductor, as indicated at C, the voltage jumps upward immediately toward infinity but is arrested at about 3000 volts, indicated at D, by operation of the short circuiting switch **1** featuring this invention. The voltage then drops immediately to about 25 volts as indicated at E where it remains, due to the characteristic of the transformer. Then, after the necessary repair interval the circuit is closed as indicated at F whereupon the voltage climbs gradually to the normal indicated at G, after which it continues so long as conditions remain normal. The climb from F to G is substantially like that from A to B. If desirable or necessary the load circuit may be disconnected back of the transformer during repairs. In the meantime ionization switch **1** has saved the load line against extreme voltages such as otherwise would have developed on opening the circuit.

The device is extremely simple and requires practically no care or attention after it has been installed.

Mercury has been specified as the preferred ionizing element for use in the short circuiting device **1** above described, but our invention is not intended to be limited thereto, for other coatings of ready ionizing material may be used. This device is intended especially for safeguarding against the high voltages ordinarily arising

from breaks in constant current load circuits; but its use is more general and is fit for use wherever extremely high voltages are to be prevented or controlled, as for instance in the event of line surges and lightening. In the case of surges this device tempers the severity and respecting the voltage curve of a surge it may aptly be called a "surge slanter."

The plates **2** and **3** may be properly amalgamated preferably by first roughening the appropriate central area as by scratching or filing at **9**, then applying weak acid to cleanse and remove possible oil and grease at these areas, then applying evenly a drop or two of mercury, letting it stand for a little while and then brushing off any surplus mercury.

Instead of mercury to produce the ionization feature one may apply sodium, potassium, lead or zinc at areas **9**, but mercury is more convenient and is usually preferable, although some of these other materials may be considered advantageous for use with higher voltages.

The plates **2** and **3** may well be about an inch in diameter and an eighth of an inch thick; and the insulators **4** about a sixty-fourth of an inch thick and broader than plates **3** so as to prevent arcing around their edges, and the holes **10** being about a half inch across and corresponding substantially with the amalgam areas **9** on the copper plates.

It is to be understood that some of the details set forth may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

We claim:

1. A device of the class described comprising a plurality of mercurized metallic plates and means to hold said plates in appropriately spaced relation to accommodate ionization of the mercury when a high electrical potential is applied to said device.

2. An automatic cut-in switch comprising alternately arranged mercurized copper plates and apertured insulating plates.

3. An automatic cut-in switch of laminate character comprising a plurality of plates including a pair of mercurized plates having terminals adapted for connecting to opposite sides of an electrical circuit in combination with one or more perforatorily apertured insulator plates, the mercurized and insulator plates being arranged alternately.

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