The present invention relates to protective circuitry and more particularly to an interlock system suitable for use with a high voltage power supply, the voltage of which is of the order of 4,000 volts direct current. High frequency triggering pulses for the lamps may have peak voltages of the order of 15,000 volts. Modeling lamps generally require the usual power supply voltage of 117 volts.

In using the lighting equipment, it is customary to provide disconnect fittings in the cables supplying the discharge lamps and on the capacitor banks. Because the voltages used may vary from 117 volts upwardly, there is a possible hazard to operating personnel in the event live contacts of the disconnect fittings are touched.

The present invention aims to overcome the possible hazard by providing an interlock system which prevents energization of the capacitor banks unless the disconnect fittings are coupled together so as to prevent contact of personnel with exposed contacts.

In accordance with the invention an interlock system is incorporated with the high voltage power supply which may be of the order of 117 volts. The interlock circuit is provided extending in parallel with at least the disconnect fittings of the 117 volt power supply circuit, or with parts of other circuits of even higher voltage which may have disconnect fittings or the like wherein high voltage live contacts may be exposed. The interlock circuit is complete when the disconnect fittings or the like are properly connected.

In a commercial embodiment of the invention the operating voltage for the interlock system is below that which would cause hazard if contacted by personnel and may be a low voltage of the order of 24 volts. After the 24 volt circuit has sensed that the interlock circuit is complete it is switched to a 117 volt power circuit which is locked in, the interlock circuit being immediately switched back to 24 volts in the event it is open circuit.

Another object of the invention is to provide an interlock system which is simple and economical in manufacture, efficient in operation, and rugged in use.

Other objects and advantages of the invention will be apparent from the following description and from the accompanying drawing which shows, by way of example, an embodiment of the invention.

The drawing shows a wiring diagram of a power supply to a load incorporating an interlock system in accordance with the invention. The electrical system is depicted to be supplied from an alternating current power source through terminals 1 and 2. This power source may have a voltage of the order of 117 volts and may be termed a high voltage, as it is hazardous if contacted by personnel operating the system.

The terminals 1 and 2 are respectively connected by conductors 3 and 4 to a load 5. The load 5 for example may be a power supply to a capacitor bank for an electronic flash lamp. In this event the load may be separated into a plurality of separate units and likewise the electronic flash lamp may be separately positioned from the remaining units. If desired one or more modeling lamps 6 might be included with the electronic flash lamp. A plurality of disconnect fittings 7 may be connected in the high voltage circuit incorporating the conductors 3 or 4 or incorporating other circuits such as the supply lines from a capacitor bank to an electronic flash lamp or triggering circuits for such an electronic flash lamp, all of which are included as the load in the drawing.

Throughout each of the disconnect fittings 7 is passed an interlock conductor 8. If desired the interlock conductor may be run through other parts of the apparatus through doors of switch cabinets and the like. Circuit closing means such as load switches 9 and 10 are located in each conductor of the high voltage circuit. These switches are positioned between the terminals 1 and 2 and the first of the disconnect fittings 7. A starting switch 11 is provided having one of its contacts connected with the terminal 1 and its other contact connected to one end of a primary winding 12 of a transformer 13, the other terminal of the primary winding 12 being connected to the terminal 2. Secondary 14 of the transformer 13 is one of its ends connected to conductor 4 on the load side of its load switch 16.

A first low voltage relay 15 has its coil connected at one end to the other side of the transformer secondary 14 by a lead 16. The first relay 15 has upper and lower normally open contact switches 17 and 18 adapted to be closed upon energization of the first relay 15.

The interlock conductor 8 is connected at one end to the high voltage conductor 4, the interlock conductor 8 being connected outwardly of the load switch 10 in said conductor 4. A second high voltage relay 19 has its coil connected at one end to the transformer primary 12 by a wire 20 inwardly of the starting switch 11. The second relay 19 is adapted to actuate a normally open contact lock-in switch 21 and also to actuate the load switches 9 and 10. These three switches are adapted to be closed upon energization of the second relay 19. The other end of the second relay coil is connected by a wire 22 to one contact of the normally open lock-in switch 21 and by wire 23 to one of the contacts of the normally open upper switch 17 of the first relay 15, the other contacts of the switches 21 and 17 being connected respectively by wires 24 and 25 to end 26 of the interlock conductor 8. The lower normally open contact switch 18 of the relay 15 is connected across the contacts of the normally open load switch 10.

A third high voltage relay 27 has its coil connected across the terminals of the load 5 and is adapted to actuate a normally closed contact switch 28 which has its contacts connected between the coil of the first relay 15 and end 26 of the interlock conductor 8.

In the operation of the electrical system in accordance with the invention the terminals 1 and 2 are connected to a high voltage supply which may be 117 volts alternating current. The starting switch 11 is closed, thereby energizing the transformer 13. Its secondary voltage of the order of 24 volts is applied through the coil of the first relay 15, through the normally closed contact switch 28, through the interlock circuit 8, and returned to the transformer secondary 14. In the event the interlock circuit 8 is completed, the first relay 15 is actuated by 24 volts, closing its contacts 17 and 18, which apply high voltage to the interlock circuit through the coil of the second
3,413,486

relay 19. The second relay 19 thereupon becomes energized and closes the three switches 9, 10 and 21. High voltage is then applied to the load 5 and to the coil of the relay 27 which is actuated, opening the switch 28 to disconnect the low voltage from the interlock circuit 8 which is supplied with high voltage through the switch 10. While switch 10 is closed the interlock circuit may accomplish its dual purpose of supplying a load such as the modeling lamp 18 which is connected between the interlock circuit 8 and the conductor 3.

While the invention has been described and illustrated with reference to a specific embodiment thereof, it will be understood that other embodiments may be resorted to without departing from the invention. Therefore, the form of the invention set out above should be considered as illustrative and not as limiting the scope of the following claims.

1. An interlock system for switching a high voltage power supply to a load, the system comprising sources of high and low voltages, the load adapted to be supplied by the high voltage, at least one disconnect fitting, the high voltage current passing through the disconnect fitting to the load, an interlock circuit paralleling the high voltage circuit at least through said disconnect fitting, first switching means including control means actuated by the low voltage completed through the interlock circuit, second switching means including control means actuated by the high voltage completed through the first switching means for connecting high voltage to the load, and third switching means including control means responsive to load potential for deenergizing said control means for said first switching means, whereby said interlock circuit is energized by low voltage until the system senses that the interlock circuit is closed whereupon the interlock circuit is energized with high voltage.

2. An interlock system for switching a high voltage power supply to a load, the system comprising sources of high and low voltages, the load adapted to be supplied by the high voltage, at least one disconnect fitting, the high voltage current passing through the disconnect fitting to the load, an interlock circuit paralleling the high voltage circuit at least through said disconnect fitting, first switching means including control means actuated by the low voltage completed through the interlock circuit, second switching means including control means actuated by the high voltage completed through the first switching means for connecting high voltage to the load, and third switching means including control means responsive to load potential for deenergizing said control means for said first switching means, whereby said interlock circuit is energized by low voltage until the system senses that the interlock circuit is closed whereupon the interlock circuit is energized with high voltage.

3. An interlock system for switching a high voltage power supply to a load, the system comprising a pair of terminals adapted to be supplied from a high voltage source, the load adapted to be supplied by the high voltage, a pair of conductors forming a high voltage circuit leading from the terminals to the load, a plurality of disconnect fittings connected in said high voltage circuit, normally open circuit closing means in each conductor of said circuit positioned between the terminals and the first disconnect fitting, starting circuit closing means, a transformer having its primary connected to said terminals through said starting circuit closing means, the secondary of the transformer connected at one end to one of said conductors on the load side of its circuit closing means, first control means, upper and lower normally open circuit closing means adapted to be closed upon energization of the control means, an interlock conductor paralleling the high voltage conductors at least through the disconnect fittings so as to be disconnected at least with the high voltage conductors, the interlock conductor connected at one end to the high voltage conductor which is connected to said one end of the secondary of the transformer, said interlock conductor being connected outwardly of the load circuit closing means in said conductor, a second control means, lock-in circuit means, said open circuit closing means and said lock-in circuit means adapted to be closed upon energization of said second control means, a third control means, and a normally closed circuit closing means adapted to be opened upon energization of the third control means, whereby the interlock conductor is energized at low voltage whereupon if the first control means senses a completed interlock conductor the third and second control means are actuated opening the low voltage connection and closing the high voltage connection to the interlock conductor.

4. An interlock system for switching a power system connection to a load, the system comprising a pair of terminals adapted to be supplied from a first source, the load adapted to be supplied by the source, a pair of conductors forming a first circuit leading from the terminals to the load, at least one disconnect fitting connected in said first circuit, a load switch in each conductor of said first circuit positioned between the terminals and the disconnect fitting, a starting switch, a transformer primary connected to said terminals through said starting switch, the secondary of the transformer providing a second circuit voltage and connected at one end to one of said conductors on the load side of its load switch, a first secondary circuit relay having its coil connected at one end to the other side of the transformer secondary, upper and lower switches adapted to be actuated upon energization of the first relay, an interlock conductor paralleling the first circuit conductors at least through the disconnect fitting so as to be disconnected at least with the first circuit conductors, the interlock conductor connected at one end to the first circuit conductor which is connected to said one end of the secondary of the transformer, said interlock conductor connected outwardly of the load switch in said conductor, a second first circuit relay having its coil connected at one end to the transformer primary inwardly of said starting switch, a lock-in switch, said load switches and said lock-in switch adapted to be supplied by said second relay upon energization of said second relay, the other end of the second relay coil connected to one contact of the lock-in switch and to one of the contacts of the upper switch of said first relay, the contacts of said last mentioned switch connected in parallel to the other end of said load switch of said second relay connected across the contacts of said load switch which is connected to the transformer secondary, a third first circuit relay having its coil connected across the load, a switch adapted to be actuated upon energization of the third relay coil, the contacts of said last mentioned switch connected between the other end of the first relay coil and said parallel connected contacts at said other end of said interlock conductor, whereby the interlock conductor is energized at the voltage of the second circuit whereupon if the first relay senses a completed interlock conductor the third and second relays are actuated so as to remove the second circuit voltage and apply the first circuit voltage to said interlock conductor.

5. An interlock system for switching a high voltage power system connection to a load, the system comprising a pair of terminals adapted to be supplied from a first high voltage source, the load adapted to be supplied by the high voltage, a pair of conductors forming a high voltage circuit through said starting circuit closing means, the secondary of the transformer connected at one end to one of said conductors on the load side of its circuit closing means, first control means, upper and lower normally open circuit closing means adapted to be closed upon energization of the control means, an interlock conductor paralleling the high voltage conductors at least through the disconnect fittings so as to be disconnected at least with the high voltage conductors, the interlock conductor connected at one end to the high voltage conductor which is connected to said one end of the secondary of the transformer, said interlock conductor being connected outwardly of the load circuit closing means in said conductor, a second control means, lock-in circuit means, said open circuit closing means and said lock-in circuit means adapted to be closed upon energization of said second control means, a third control means, and a normally closed circuit closing means adapted to be opened upon energization of the third control means, whereby the interlock conductor is energized at low voltage whereupon if the first control means senses a completed interlock conductor the third and second control means are actuated opening the low voltage connection and closing the high voltage connection to the interlock conductor.
3,413,486

switch, a first low voltage relay having its coil connected at one end to the other side of the transformer secondary, upper and lower switches adapted to be actuated upon energization of the first relay, an interlock conductor paralleling the high voltage conductors at least through the disconnect fittings so as to be disconnected at least with the high voltage conductors, the interlock conductor connected at one end to the high voltage conductor which is connected to said one end of the secondary of the transformer, said interlock conductor being connected outwardly of the load switch in said conductor, a second high voltage relay having its coil connected at one end to the transformer primary inwardly of said starting switch, a lock-in switch, said load switches and said lock-in switch adapted to be actuated upon energization of said second relay, the other end of the second relay coil connected to one contact of the lock-in switch and to one of the contacts of the upper switch of said first relay, the other contacts of said last mentioned switches connected in parallel to the other end of said interlock conductor, said lower switch of said first relay connected across the contacts of said load switch which is connected to the transformer secondary, a third high voltage relay having its coil connected across the load, and a switch adapted to be actuated upon energization of the third relay coil, the contacts of said last mentioned switch being connected between the other end of the first relay coil and said parallel connected contacts at said other end of said interlock conductor, whereby the interlock conductor is energized at low voltage thereupon if the first relay senses a completed interlock conductor the third and second relays are actuated opening the low voltage connection and closing the high voltage connection to the interlock conductor.

6. An interlock system for switching a high voltage power system connection to a load, the system comprising a pair of terminals adapted to be supplied from a high voltage source, a pair of conductors forming a high voltage circuit leading from the terminals to the load, a plurality of disconnect fittings connected in said high voltage circuit, a normally open contact load switch in each conductor of said circuit positioned between the terminals and the first disconnect fitting, a starting switch, a transformer having its primary connected to said terminals through said starting switch, the secondary of the transformer connected at one end to one of said conductors on the load side of its load switch, a first low voltage relay having its coil connected at one end to the other side of the transformer secondary, upper and lower normally open contact switches adapted to be closed upon energization of the first relay, an interlock conductor paralleling the high voltage conductors at least through the disconnect fittings so as to be disconnected at least with the high voltage conductors, the interlock conductor connected at one end to the high voltage conductor which is connected to said one end of the secondary of the transformer, said interlock conductor being connected outwardly of the load switch in said conductor, a second high voltage relay having its coil connected at one end to the transformer primary inwardly of said starting switch, a normally open contact load switch, said normally open contact load switches and said normally open contact lock-in switch adapted to be closed upon energization of said second relay, the other end of the second relay coil connected to one contact of the normally open contact lock-in switch and to one of the contacts of said last mentioned switches connected in parallel to the other end of said interlock conductor, said lower switch of said first relay connected across the contacts of said load switch which is connected to the transformer secondary, a third high voltage relay having its coil connected across the load, and a switch adapted to be actuated upon energization of the third relay coil, the contacts of said last mentioned switch being connected between the other end of the first relay coil and said parallel connected contacts at said other end of said interlock conductor, whereby the interlock conductor is energized at low voltage thereupon if the first relay senses a completed interlock conductor the third and second relays are actuated opening the low voltage connection and closing the high voltage connection to the interlock conductor.

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