

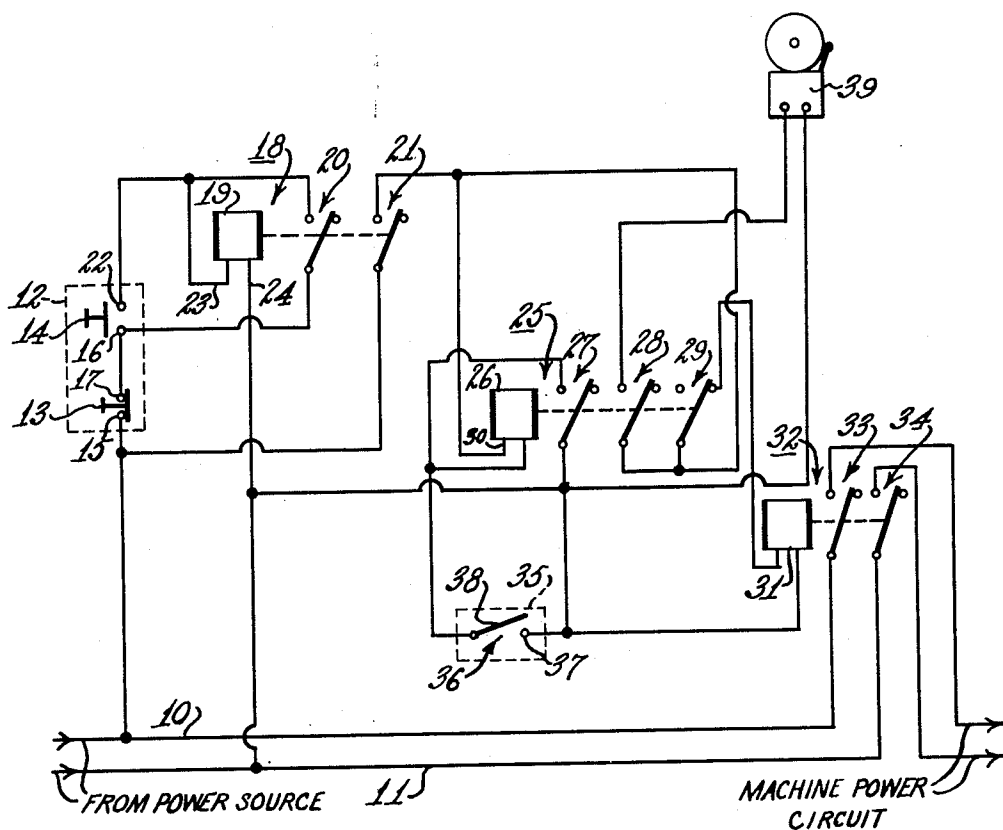
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AUTOMATIC CONTROL ALARM SYSTEM

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1

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AUTOMATIC CONTROL ALARM SYSTEM

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This invention relates to automatic control and alarm systems, and more particularly, to a system for providing an alarm indicator and for interrupting power to a machine, power utilization device, or the like upon occurrence of a danger condition.

This invention may be used advantageously in controlling machinery. It will automatically shut down a machine before excessive damage may develop. A system embodying this invention features three distinct operating conditions for a machine, namely: (1) With the machine in normal operation; (2) with the machine inoperative and with an alarm indication; and (3) with the machine inoperative and with no alarm indication.

Automatic alarm systems provide more efficient operation for the machinery with which they are associated. A machine may be left unattended over long periods. An automatic control alarm system is particularly useful for continuously operating machines of which wire plating machines are a typical example. In one wire plating machine, wire is drawn through several plating baths and reeled onto a spool at the end of the machine. Should the wire break, it is necessary to stop the reeling and unreeling motors immediately. An alarm must also be sounded to attract the attention of an attendant, who may restore normal operation of the machine.

Previous alarm systems have been developed to stop a machine and sound an alarm. However, such known alarm systems do not provide the three conditions of operation afforded by the alarm system of the present invention without complicated circuits which are costly to build and to maintain.

According to an embodiment of the present invention an alarm system having three relays provides not only stop-and-start controls for the machine with which it is associated, but also shuts down the machine and sounds an alarm on occurrence of a danger condition. Pressing the start button of the machine energizes one of these relays. Upon occurrence of a danger condition, another of the relays is energized. The last of these relays is immediately energized by means of contacts on the first-mentioned and the second-mentioned relays. The third-mentioned relay is provided with contacts in the power circuit to the machine. The arrangement of closed-and-open contacts on the second-mentioned relay completes a circuit that causes the third-mentioned relay to become deenergized, thereby interrupting power to the machine. An alarm indicator is also actuated. To turn off the alarm indicator, the stop button of the machine must be depressed. This also resets all of the relays into their deenergized position. When the danger condition has been eliminated, the machine may be started by pressing the start button.

It is an object of the present invention to provide a novel automatic alarm system.

It is a further object of the present invention to provide an automatic control alarm system.

It is a still further object of the present invention to provide an automatic alarm system that is economical to construct and to maintain.

2

It is a still further object of the present invention to provide a simplified alarm system allowing three conditions of operation.

It is a still further object of the present invention to provide an automatic alarm system that must be reset before the machine with which it is associated may be started.

Other objects and advantages of the present invention will, of course, become apparent and immediately suggest themselves to those skilled in the art to which the invention is directed from a reading of the following specification in connection with the accompanying drawing, the single figure of which is a schematic diagram of an automatic alarm system according to the present invention.

Referring to the drawing, a pair of power lines 10 and 11 is shown coming from a source of power (not shown). A control switch 12 of the push-button type having a normally closed "stop" push-button 13 and a normally open "start" push-button 14 is used to start and stop a machine (not shown) which may be controlled by the alarm system. One terminal 15 of the "stop" push-button 13 is connected to one side 10 of the power line. Adjacent terminals 16 and 17 of the start-and-stop switches 13 and 14 are connected together. A first relay 18 has an operating winding 19 and two pairs of ganged contacts 20 and 21 which are shown in the open position they occupy when the relay is not energized. One side 23 of the operating winding 19 is connected to the upper terminal 22 of the "start" push-button 14, and the other side 24 of the operating winding 19 is connected to the lower side 11 of the power line. It will be apparent that the operating winding 19 of the first relay 18 will be energized upon pressing the "start" push-button 14. The fixed contact of the pair of contacts 20 that are located closest to the operating winding 19 of the first relay 18 is connected to one side 23 of the relay operating winding 19. The movable arm of this contact pair 20 is connected to the adjacent terminals 16 and 17 of the start-and-stop push-buttons 13 and 14. Upon energization of the first relay 18, these contacts 20 close, and serve to lock in the relay 18 by maintaining a closed condition for the circuit that energizes the relay operating winding 19.

The second relay 25 has an operating winding 26 and three pairs of ganged contacts 27, 28 and 29. This relay 25 is also shown in its deenergized condition. The movable arm of the outer pair of contacts 21 of the first relay 18 is connected to the upper side 10 of the power line. The fixed contact of this contact pair 21 is connected to one side 30 of the second relay operating winding 26. This fixed contact is also connected to the movable arms of the outermost contacts 28 and 29 of the second relay 25. The movable arm of the last contact pair 29 of the second relay is shown in contact with a fixed contact. This fixed contact is connected to one side of the operating winding 31 of a third relay 32. The operating winding 31 of this third relay is also connected to the lower side 11 of the power line. Therefore, energization of the first relay immediately energizes the third relay 32. This third relay is provided with two sets of ganged contacts 33 and 34 which are connected in series with the upper and lower sides 10 and 11 of the power lines, respectively. These contacts 33 and 34 are shown in the position they assume when the third relay 32 is deenergized. Therefore, the power lines constituting the power circuit to the machine are open when the third relay is deenergized.

The second relay 25 remains deenergized after the "start" push-button 14 is depressed and is only energized upon occurrence of a danger condition. This occurs because the relay operating winding 26 is connected to a danger condition responsive means shown illustra-

3

tively as a switch 36 enclosed in a dotted box 35. The fixed terminal 37 of this switch 36 is connected to the lower side 11 of the power lines.

This danger condition responsive means 35 may be different from the simple switch 36 depending upon the machine used and the danger condition to which a response is desired. For example, this switch may be a device responsive to heat, cold, or water level. In the wire plating machine discussed above, the lower side of the power lines 11 is normally at ground potential and the wire to be plated is also at ground potential. The wire is drawn through a large metallic loop which is insulated from the rest of the machine. This large metallic loop may be thought of as the movable arm 38 on the switch 36. When the machine is in normal operation, there is sufficient tension in the wire so that it will be prevented from striking any part of the loop. However, should the wire break, it will make contact with the loop and effectively close the switch. This causes the operation of the second relay 25. The movable arm of the closest contacts 27 of this relay 25 is connected to the lower side of the power line 11 and the fixed contact of these contacts 27 is connected to one side of the relay operating winding for the second relay. Therefore, operation of the second relay closes these contacts and locks the relay 25 into its operated condition.

The centrally located contacts 28 of the second relay 25 are connected in series with an alarm indicator 39 shown herein illustratively as a bell. One terminal of this bell 39 is connected to the fixed contact of the contacts 28 and the other terminal of the bell is connected to the lower side 11 of the power line. Therefore, upon operation of the second relay 25 the bell will sound. The complete circuit for the bell 39 is seen to be from the upper side 10 of the power line; through the outer contacts 21 of the first relay 18; the centrally located contacts 28 of the second relay 25; the bell 39; and to the lower side 11 of the power lines.

Also, upon operation of the second relay 25 in response to a danger condition, the outermost contacts 29 of this relay are caused to open. This deenergizes the third relay 32 and causes interruption of power to the machine since the contacts 33 and 34 of the third relay 32 open.

In order to start the machine after the danger condition has been corrected and also to shut off the alarm, the "stop" push-button 13 must be pressed. Opening of the "stop" push-button 13 opens the circuit to the operating winding 19 of the first relay 18. Accordingly, the circuit to the second relay operating winding 26 is also opened, and the alarm ceases to sound. When the "start" push-button 14 is depressed, the first relay 18 is operated and this closes the contacts thereof. The operating winding 31 of the third relay 32 is thereupon energized which closes the power circuit to the machine. Normal operation is then resumed unless a further danger condition arises.

The power lines are shown connected to the machine power circuit as well as to the alarm system. It may be desirable in some applications to use a separate power source to supply power to the machine. This source may be connected to the movable contact arms 33 and 34 of the third relay 32.

What is claimed is:

1. An automatic alarm system for providing an alarm signal on occurrence of a danger condition in a machine

4

and interrupting power thereto comprising a first relay, a second relay and a third relay, means for energizing said first relay, said first relay being provided with contacts which are closed upon the energization thereof, said second relay being provided with a plurality of pairs of contacts, means for energizing said third relay including a first pair of said plurality of pairs of contacts and said contacts of said first relay, said third relay being provided with contacts operable to interrupt the power circuit of said machine, means for applying operating power to said power circuit of said machine through said contacts of said third relay, a second pair and a third pair of said plurality of pairs of contacts being closed on energization of said second relay, said first pair of contacts being opened upon energization of said second relay, means for energizing said second relay and breaking said first pair of contacts thereby deenergizing said third relay to interrupt said power circuit of said machine, an alarm indicator, and said alarm indicator being connected in series with said third pair of contacts of said second relay that are closed on energization thereof.

2. An automatic alarm system according to claim 1 including means for deenergizing said first relay, thereby resetting all of said relays in their deenergized condition.

3. An automatic alarm system for providing power interruption on occurrence of a danger condition comprising a first relay having an operating winding and a pair of contacts adapted to be closed on operation thereof, a second relay having an operating winding and a pair of contacts adapted to be opened upon the operation thereof, a third relay having an operating winding and a pair of contacts adapted to be closed upon the operation thereof, means for connecting a source of power across the operating winding of said first relay to thereby operate said first relay and close the contacts thereof, means for connecting said power source across the operating winding of said second relay through the contacts of said first relay in their closed condition, means for connecting said source of power across said operating winding of said third relay through said contacts of said first relay in their closed condition and the contacts of said second relay in their closed condition, said contacts of said third relay thereby being closed upon operation of said first relay, danger condition responsive means for connecting said power source across said second relay operating winding only upon the occurrence of said danger condition whereby said power source is disconnected from said operating winding of said third relay and said contacts thereof are opened, and means for disconnecting said power source from the operating winding of said first relay.

4. A alarm system according to claim 3 including an alarm indicator, a further pair of contacts associated with said second relay and adapted to be closed on operation thereof, and means for connecting said alarm indicator in series with said last-mentioned contacts of said second relay and said contacts of said first relay to said power source.

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