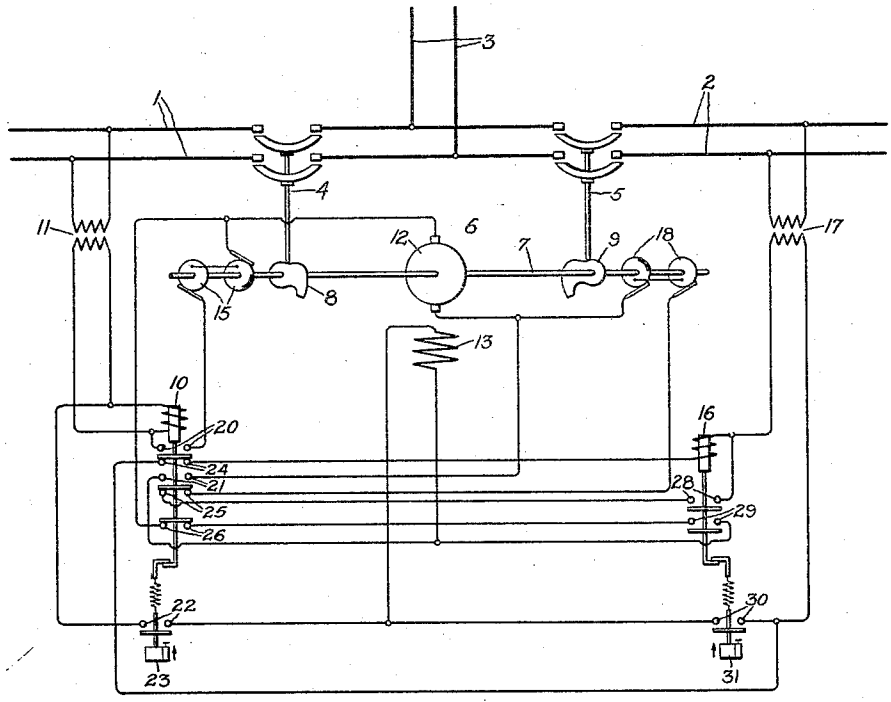
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AUTOMATIC SWITCHING SYSTEM

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AUTOMATIC SWITCHING SYSTEM

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My invention relates to automatic switching systems and particularly to systems for controlling the connections between a plurality of sources of current and a load circuit so that the load circuit is connected to an energized source when either or both of these sources are energized and one object of my invention is to provide a simplified control arrangement for accomplishing this result.

In accordance with my invention I provide a switch between each source and the load circuit, a reversible motor which is arranged to close one of the switches and to open the other switch when the motor armature is rotated in one direction and to close said other switch and to open said one of said switches when the motor armature is rotated in the opposite direction, and means responsive to the voltages of the sources for selectively controlling the direction of rotation of the motor armature.

My invention will be better understood from the following description when taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

Referring to the accompanying drawing which is a diagram of an automatic switching system for selectively controlling the connections between a load circuit, a preferred source of current for the load circuit and an emergency source of current which is to be connected to the load circuit when the preferred source is deenergized, 1 and 2 represent respectively the preferred and emergency sources and 3 represents the load circuit. The sources 1 and 2, which are shown as single phase supply circuits, are arranged to be connected to the load circuit 3 by suitable switches 4 and 5 respectively.

For effecting the selective operation of the switches 4 and 5 a reversible motor 6 is provided which drives a suitable cam shaft 7 to which are fixed two operating cams 8 and 9 for respectively controlling the operation of the switches 4 and 5. The cams 8 and 9 are identical in shape but are reversely arranged on the shaft 7 and so shaped that when the shaft is in the position shown in the drawing both of the switches 4 and 5 are open. When, however, the shaft 7 is rotated in a counter-clockwise direction from the position shown in the drawing, the cam 8 is arranged to effect the closing of the switch 4 and the cam 9 is arranged to maintain the switch 5 in its open position. When the shaft 7 is rotated in a clockwise direction from the position shown in the drawing, the cam 9 is arranged to effect the closing of the switch 5 and the cam 8 is arranged to maintain the switch 4 in its open position. It will be seen that with the arrangement shown in the drawing only one switch can be closed at a time and, therefore, the load circuit 3 cannot be simultaneously connected to both sources of current.

In order to effect the selective operation of the motor 6 so that the switch 4 is closed whenever the preferred source 1 is energized and so that the switch 5 is closed whenever the preferred source 1 is deenergized and the emergency source 2 is energized, I provide a potential relay 10 which is connected across the secondary of a potential transformer 11 the primary of which is connected across the preferred source 1. When the preferred source 1 is energized the relay 10 is arranged to connect the armature winding 12 and the field winding 13 of the motor 6 across the secondary of the potential transformer 11 so that the shaft 7 is rotated in a counter-clockwise direction to effect the opening of the switch 5 if it is closed and the closing of the switch 4 if it is open. In order to stop the motor after the shaft 7 has been rotated far enough to close the switch 4, the shaft 7 is provided with a suitable limit switch 15 which is connected in the motor circuit and which is arranged to open the motor circuit when the shaft 7 has been rotated to a pre-

determined position in a counter-clockwise direction.

When the preferred source 1 is deenergized, the potential relay 10 connects another potential relay 16 across the secondary of a potential transformer 17 the primary of which is connected across the emergency source 2. The potential relay 16 when energized is arranged to complete a circuit for the armature winding 12 and the field winding 13 of the motor 6 across the secondary of the potential transformer 17 so that the shaft 7 is rotated in a clockwise direction to effect the opening of the switch 4, if it is closed, and the closing of the switch 5, if it is open. It will be observed that the potential relay 16 can effect the operation of the motor 6 only when the preferred source 1 is deenergized and the emergency source 2 is energized. In order to stop the motor 6 after the shaft has been rotated far enough to close the switch 5, the shaft 7 is provided with a suitable limit switch 18 which is in the motor circuit and which is arranged to open the motor circuit when the motor 7 has been rotated to a predetermined position in a clockwise direction.

The operation of the arrangement shown in the drawing is as follows: Let it be assumed that the shaft 7 is in the position shown so that both of the switches 4 and 5 are open and that the preferred source 1 becomes energized. The energization of the preferred source 1 effects the energization of the potential relay 10 so that it effects the immediate closing of its contacts 20 and 21 and the closing of its time delay contacts 22 if the preferred source remains energized for a certain length of time. The relay 10 may be provided with any suitable means for delaying the closing of the contacts 22 for a certain length of time after the winding of the relay is energized. As shown in the drawing, the operation of the contacts 22 is delayed by means of a dash pot 23. The energization of the relay 10 also effects the opening of the contacts 24, 25 and 26.

As soon as the time delay contacts 22 of the relay 10 are closed, a circuit is completed for the motor 6 so that the shaft 7 is rotated in a counter-clockwise direction. This circuit of the motor 6 is from one secondary terminal of the transformer 11 through the contacts 22 of the relay 10, field winding 13 of the motor 6, contacts 21 of the relay 10, armature winding 12 of the motor 6, limit switch 15 on the shaft 7, contacts 20 of the relay 10 to the other secondary terminal of the transformer 11. The counter-clockwise rotation of the shaft 7 effects the closing of the switch 4 so that the preferred source 1 is connected to the load circuit 3. After the shaft 7 is rotated far enough to complete the closing operation of the switch 4, the limit switch 15 opens the above traced circuit for the motor 6 to stop further counter-clockwise rotation of the shaft 7.

Let it be assumed now that while the switch 4 is closed, the preferred source 1 becomes deenergized while the emergency source 2 is energized. The deenergization of the preferred source 1 effects the deenergization of the potential relay 10 so that this relay opens its contacts 20, 21 and 22 and closes its contacts 24, 25 and 26. The closing of the contacts 24 of the relay 10 connects the winding of the potential relay 16 across the secondary of the potential transformer 17 so that the relay 16 becomes energized and immediately closes its contacts 28 and 29 and closes after a predetermined time its time delay contacts 30. Any suitable means, examples of which are well known in the art, may be provided for delaying the closing of the contacts 30. As shown in the drawing, the delayed closing of the contacts 30 is effected by means of a dash pot 31. After the potential relay 16 has been energized for a certain length of time, the contacts 30 close and complete an energizing circuit for the motor 6 so that the motor armature rotates in a clockwise direction. This energizing circuit is from one secondary terminal of the transformer 17 through the contacts 30 of the relay 16, the field winding 13 of the motor 6, contacts 29 of the relay 16, contacts 26 of the relay 10, armature winding 12 of the motor 6, limit switch 18 on the shaft 7, contacts 25 of the relay 10, contacts 28 of the relay 16 to the other secondary terminal of the transformer 17. It will be observed that the armature 12 of the motor 6 is so connected in this circuit that the current flows through it in the opposite direction with respect to current in the field winding 13 from the direction in which current flowed through the armature winding 12 when the motor was connected to the secondary of the transformer 11. This reversal of current through the armature winding 12 with respect to the current through the field winding 13 causes the motor 6 to rotate in a clockwise direction. This clockwise rotation of the shaft first effects the opening of the switch 4 so as to disconnect the deenergized preferred source 1 from the load circuit 3 and then effects the closing of the switch 5 so that the energized emergency source 2 is connected to the load circuit 3. After the shaft 7 has been rotated far enough in a clockwise direction to complete the closing of the switch 5, the limit switch 18 operates to open the above traced circuit of the motor 6 so as to stop further clockwise rotation of the shaft 7.

The switch 5 remains closed until the preferred source 1 is again energized so as to effect the energization of the potential relay 10. The energization of the potential relay 10 then completes in the manner above described a circuit for the motor 6 so that the

shaft 7 is rotated in a counterclockwise direction to effect the opening of the switch 5 and the closing of the switch 4.

While I have, in accordance with the patent statutes, shown and described my invention as applied to a particular system and as embodying various devices diagrammatically indicated, changes and modifications will be obvious to those skilled in the art and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, two electric circuits, a switch in each circuit, means including a reversible motor for closing one of said switches and opening the other of said switches when the armature of said motor rotates in one direction and for opening said one of said switches and closing said other of said switches when the armature of said motor rotates in the opposite direction, and means responsive to the voltages of said circuits for controlling the energization of said motor so that it develops a torque in a direction to cause the armature of said motor to rotate in one direction when one of said circuits is energized and the other circuit is deenergized and it develops a torque which causes the armature to rotate in the opposite direction when said one of said circuits is deenergized and the other circuit is energized.

2. In combination, two electric circuits, a switch in each circuit, means including a reversible motor for closing one of said switches and opening the other of said switches when the armature of said motor rotates in one direction and for opening said one of said switches and closing said other of said switches when the armature of said motor rotates in the opposite direction, and means responsive to the voltages of said circuits for controlling the energization of said motor so that when a certain one of said circuits is energized and its respective switch is open the motor develops a torque which causes the armature to rotate in a direction to close the switch in said energized circuit and so that when said certain one of said circuits is deenergized and the other circuit is energized and its respective switch is open the motor develops a torque which causes the armature to rotate in a direction to close the switch in said other circuit.

3. In combination, two electric circuits, a switch in each circuit, means including a reversible motor for closing one of said switches and opening the other of said switches when the armature of said motor rotates in one direction and for opening said one of said switches and closing said other of said switches when the armature of said motor rotates in the opposite direction, said motor having an armature winding and a field winding, means responsive to the voltage of one of said circuits for connecting said windings across said one of said circuits so that said motor effects the closing of the switch in said one of said circuits if it is open while the voltage of said one of said circuits is above a predetermined value, and means controlled by the voltages of both circuits for connecting said windings across the other of said circuits when said one of said circuits is deenergized and the other is energized so that the switch in said other circuit is closed.

4. In combination, two electric circuits, a switch in each circuit, means including a reversible motor for closing one of said switches and opening the other of said switches when the armature of said motor rotates in one direction and for opening said one of said switches and closing said other of said switches when the armature of said motor rotates in the opposite direction, said motor having an armature winding and a field winding, means responsive to the voltage of one of said circuits for connecting said armature and field windings in series across said one of said circuits when the switch in said one of said circuits is open and the voltage of said one of said circuits is above a predetermined value for a predetermined time, and means controlled by said voltage responsive means and the voltage of the other of said circuits for connecting said armature and field windings in series across said other of said circuits when the switch in said other of said circuits is open and the voltage of said one of said circuits is below a predetermined value and the voltage of said other of said circuits is above a predetermined value.

5. In combination, two electric circuits, a switch in each circuit, means including a reversible motor for closing one of said switches and opening the other of said switches when the armature of said motor rotates in one direction and for opening said one of said switches and closing said other of said switches when the armature of said motor rotates in the opposite direction, and means responsive to the voltages of said circuits for selectively controlling the connection of said motor to said circuits so that said motor rotates in one direction when one of said circuits is energized and rotates in the opposite direction when said one of said circuits is deenergized and the other circuit is energized.

6. In combination, two electric circuits, a switch in each circuit, means including a reversible motor for closing one of said switches and opening the other of said switches when the armature of said motor rotates in one direction and for opening said one of said switches and closing said other of said switches when the armature of said motor rotates in the opposite direction, said motor

having an armature winding and a field winding, and means responsive to the voltages of said circuits for selectively connecting said armature and field windings in series across one of said electric circuits when it is energized and the switch therein is open and across the other of said electric circuits when the switch therein is open and said one of said electric circuits is deenergized.

In witness whereof, I have hereunto set my hand this 26th day of November, 1929.

ROGER A. FULLER.