

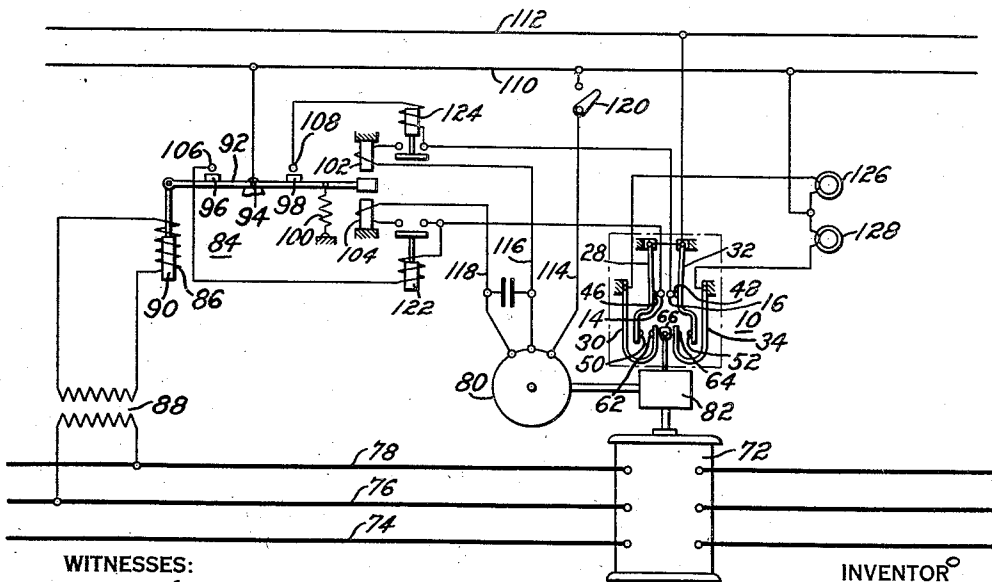
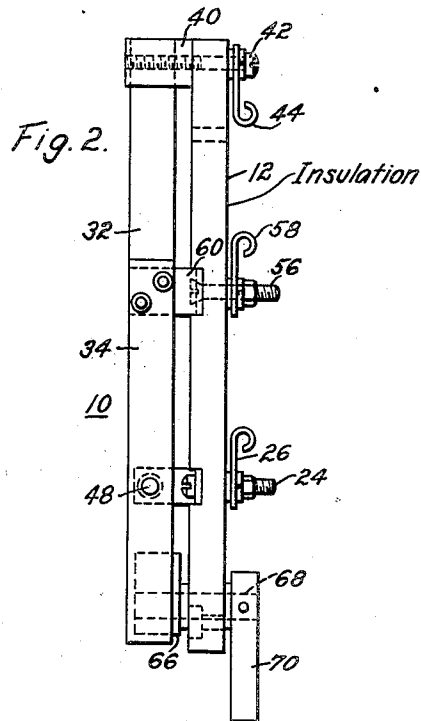
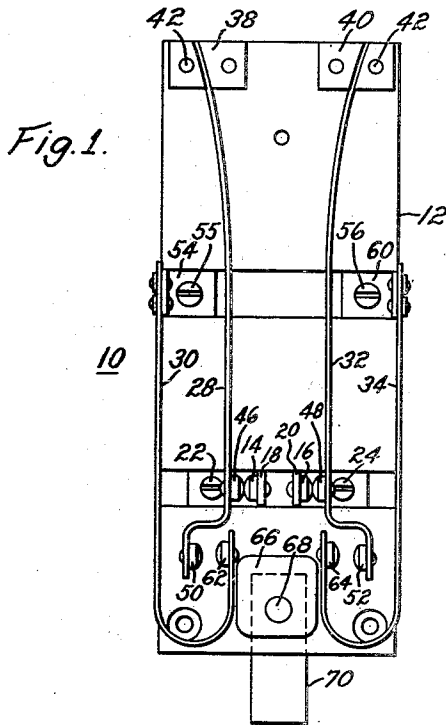
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CIRCUIT CONTROLLING APPARATUS

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WITNESSES:

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Fig. 3.

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CIRCUIT CONTROLLING APPARATUS

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This invention relates to electrical apparatus, and particularly to circuit controlling apparatus. An object of this invention is to provide in a circuit controlling apparatus for obtaining a predetermined sequential switching operation.

Other objects of this invention will become apparent from the following description when taken in conjunction with the accompanying drawing, in which:

Figure 1 is a view in elevation of the circuit controlling apparatus of this invention;

Fig. 2 is a side elevational view of the circuit controlling apparatus shown in Fig. 1; and

Fig. 3 is a schematic diagram illustrating the application of the circuit controlling apparatus of Fig. 1 in a regulating system.

Referring to Figure 1, this invention is illustrated by reference to a circuit controlling apparatus 10 comprising a plurality of elements assembled in operative relation on a base 12 of any suitable insulating material. As illustrated, a plurality of fixed contact members 14 and 16 are carried on suitable supporting members 18 and 20, respectively, which are mounted in spaced relation on the base 12 by means of the bolts 22 and 24, respectively. The bolts 22 and 24 are of conducting material and project through the base member 12 and carry terminal members 26 to facilitate the making of electrical connections to the contact members.

As illustrated in Fig. 1, a set of movable conducting members 28 and 30 is operatively associated with the fixed contact member 14 and a set of movable conducting members 32 and 34 is operatively associated with the fixed contact member 16. Each of the conducting members 28 through 34 is of elongated form, being formed of stainless spring steel, and are self-biased in a predetermined direction. The conducting members 28 and 32 in this instance are like members but are biased and mounted for movement in opposite directions with respect to the fixed contact members 14 and 16, one end of the conducting members 28 and 32 being fixedly secured in a conducting terminal block 36 and 40, respectively. As illustrated in Fig. 2, a bolt 42 of conducting material is associated with each of the terminal blocks 36 and 40 and carries a terminal 44 to facilitate the making of electrical connections to the fixed ends of the conducting members.

The conducting member 28 carries a movable contact member 46 thereon intermediate of its ends disposed to be biased into engagement with and for cooperating with the fixed contact mem-

ber 14. Similarly, the conducting member 32 carries a movable contact member 48 intermediate of its ends disposed to be biased into engagement with and for cooperating with its associated fixed contact member 16.

In addition to the movable contact members 46 and 48, the conducting members 28 and 32 carry movable contact members 50 and 52, respectively, adjacent their free ends, such ends being offset from the main body portion of the conducting members.

The conducting members 36 and 34 are also similar to one another, each being formed of stainless spring steel and so mounted on the base member 12 as to be self-biasing in opposite directions. The conducting member 36 has one end fixedly secured to the bracket 54, which is held on the base member 12 by means of the bolt 56 of conducting material, which extends through the base member, a terminal (not shown) being carried by the bolt for facilitating the making of electrical connections thereto. Likewise, the conducting member 34 is carried by a bracket 60 which is secured to the base member 12 by a bolt 62 of conducting material which carries a terminal 64. As illustrated, each of the conducting members 36 and 34 is bent so that the free ends thereof are returned upon the main body portion of the conducting members. The free ends of each of the conducting members carries a contact member normally biased out of engagement with the contact member carried by the free end of the other conducting member of the set associated with each of the fixed contact members.

As illustrated, contact member 62 is carried by the free end of the conducting member 36 and is so disposed that when the free end of the conducting member 36 is actuated, it will engage the contact member 50 of the conducting member 28. Likewise, a contact member 64 is carried on the free end of the conducting member 34 disposed to be actuated into engagement with the contact member 52 carried on the free end of the conducting member 32.

In order to effect a movement of the free ends of the conducting members 36 and 34 in a predetermined manner, a cam 66 is positioned between the free ends of the conducting members 36 and 34 and disposed for movement to physically engage and actuate one or the other of the conducting members. The cam 66 is carried on a pin 68 which extends through the base 12 and is secured to an arm 70 disposed for movement in response to a predetermined condition. As il-

illustrated, when the cam is actuated it will tend to move the free ends of both the conductors 30 and 34 but since the radius of movement of the contacting portions of the cam 66 are different, the one of the free ends will be actuated to a position where the contact member carried thereon is in engagement with the contact member of its associated conducting member, whereas the other free end will be moved only a slight distance insufficient to effect the engagement of the contact member carried thereon with the contact member of its associated conducting member.

Referring to Fig. 3 of the drawing, the circuit controlling apparatus 10 of this invention is utilized in a regulator system for indicating and controlling the operation of the induction regulator 72 connected in the circuit formed by the conductors 74, 76 and 78. As illustrated, an electric motor 80 is provided to actuate the induction regulator 72 through a suitable gear drive 82, the details of which are not shown, in accordance with the correction required to maintain a constant voltage in the circuit formed by the conductors 74, 76 and 78.

A relay 84 or a contact making voltmeter, is provided to initiate the operation of the motor 80. The relay is operated by means of an electromagnet provided with a coil 86 that is energized from the transformer 88 connected across the conductors 76 and 78. The core 90 of the electromagnet operates a lever 92 pivoted at 94 and carrying a pair of contact members 96 and 98, the spring 100 being provided for aiding the electromagnet when the coil 86 is energized. Auxiliary electromagnets 102 and 104 are provided for aiding the electromagnet to control the operation of relay 84, as will be explained more fully hereinafter. Cooperating with the contact members 96 and 98 are auxiliary contact members 106 and 108, respectively.

The motor 80 in this instance is illustrated as being a capacitor type motor and is disposed to be energized from a constant source of power, such as the conductors 110 and 112. The motor is provided with suitable leads 114, 116 and 118 for connecting it to the conductors 110 and 112 in a predetermined manner for obtaining a predetermined directional operation of the motor 80, the switch 120 being provided in the lead 114 for giving a manual control of the operation of the motor.

The contact members 96 and 98 of the relay 84 are illustrated as connected to the conductor 110, whereas the auxiliary contact member 106 is disposed to be connected through the contactor 122 and the circuit controlling apparatus 10 of this invention to the conductor 112. Likewise, the auxiliary contact member 108 is disposed to be connected through a contactor 124 and the circuit controlling apparatus 10 of this invention to the conductor 112. The contactors 122 and 124 are provided for controlling the operation of the motor 80.

In order to give an indication of the direction of operation of the motor 80, signal devices 126 and 128, in this instance represented as lights, are disposed to be connected across the conductors 110 and 112 by the circuit controlling apparatus 10 of this invention in response to predetermined conditions.

In operation, assuming that the switch 120 is moved to its circuit closing position, the regulator 72 is operated to deliver a predetermined constant voltage across the conductors 74, 76 and

78. If for any reason the voltage across conductors 76 and 78 should increase, then the coil 86 of the electromagnet associated with the relay 84 is so energized as to effect a clockwise pivotal movement of the lever 92 about its pivot 94 to close a circuit which extends from conductor 110 through the lever 92, the contact members 96 and 106, the energizing winding of contactor 122 is actuated to close a circuit which conducting member 28 of the circuit controlling apparatus 10, to conductor 112. Upon the completion of this circuit, the contact member of contactor 122 is actuated to close a circuit which extends from conductor 110 through the switch 120, conductor 114, motor 80, conductor 118, the energizing winding of the auxiliary electromagnetic device 104, the contact bridging member of contactor 122, contact members 14 and 46 and the conducting member 28 of the circuit controlling apparatus 10, to the conductor 112. The closing of this circuit so energizes the auxiliary electromagnet 104 as to aid the electromagnet in maintaining the contact member 96 in engagement with the contact member 106. When the motor circuit is thus established, the motor 80 operates to drive the induction regulator 72 in such a manner as to decrease the voltage across conductors 76 and 78.

If, in attempting to drive the induction regulator 72, it is necessary to operate the regulator near its lower limit, the cam 66 of the circuit controlling apparatus 10 is actuated through the gear drive 82 to drive the free end of the conducting member 30 to a position where the contact member 62 engages contact member 50 to close an alarm circuit. The alarm circuit extends from conductor 110, through the light 126, conducting member 30, contact members 62 and 50 and the conducting member 28 of the circuit controlling apparatus 10, to the conductor 112. Upon this indication, the operator is warned to take steps to rectify the unwanted condition on the system. If, however, the operator fails to rectify the unwanted condition, then the cam is further actuated to effect a movement of the engaged free ends of both conducting members 30 and 28 to a position where the movable contact member 46 carried by the conducting member 28 is moved to a circuit opening position and disengages the fixed contact member 14 of the circuit controlling apparatus 10. Such a switching operation interrupts the circuit to the motor and the operation of the regulator is stopped.

If, on the other hand, the change in voltage across conductors 76 and 78 is a decrease, then the winding 86 of the electromagnet is so de-energized that the lever 92 moves in a counter-clockwise direction about its pivot 94 to a position where the contact member 98 is in engagement with the contact member 108. The engagement of the contact members 98 and 108 closes a circuit which extends from the conductor 110, through lever 92, contact members 98 and 108, the energizing coil of contactor 124, the contact members 16 and 48 and the conducting member 32 of the circuit controlling apparatus 10, to the conductor 112. Upon the closing of this circuit and the energization of the winding of contactor 124, the bridging contact member of the contactor 124 is operated to close a circuit, which extends from conductor 110, through the switch 120, conductor 114, motor 80, conductor 118, the energizing winding of auxiliary electromagnet 102, bridging contact member of contactor 124, the contact members 10

and 48 and the conducting member 32 of the circuit controlling apparatus 10, to conductor 112. Upon the establishment of this circuit, the winding of the auxiliary electromagnet 102 is so energized as to aid the electromagnet in maintaining the contacts 96 and 108 in circuit closed position, and the motor 80 is so energized as to drive the induction regulator 72 in a direction to increase the voltage across conductors 76 and 78.

If, in effecting the increase in the voltage across conductors 76 and 78, the induction regulator is operated to a position near its upper limit, then the cam 66 is operated through the gear drive 82 to drive the free end of the conducting member 34 to a position where the contact member 64 engages the contact member 52 carried on the free end of the conducting member 32 of the circuit controlling apparatus 10. This switching operation establishes an alarm circuit extending from conductor 110, through the light 120, conducting member 34, contact members 64 and 52, and the conducting member 32 of the circuit controlling apparatus 10, to the conductor 112, to warn the operator that the induction regulator is being operated near its upper limit. If the operator does not take steps to correct the unwanted condition on the regulator, the gear drive 82 further drives the cam 66 to move the engaged free ends of the conducting members 34 and 32 to a position where the movable contact member 48 carried by the conducting member 32 is moved to a circuit opening position and disengages the fixed contact member 16 to interrupt the supply of current to the motor 80 and thereby stop the operation of the induction regulator 72 before it is damaged.

The circuit controlling apparatus of this invention is quite efficient in its operation, giving a sequential operation whereby an indication is given of the operation of the system before the circuit controlling apparatus is operated to interrupt the operation of the regulator motor. With the circuit controlling apparatus of this invention as employed in the regulating system described, it is possible to always obtain an indication of the operation of the regulator before the limit switches formed by the fixed contact members and the movable contact member operatively associated therewith are operated to interrupt the operation of the regulator motor. The operation of the limit switches and the regulator motor controlling switches is thereby sequentially controlled by the movement of only one operating or actuating member responsive to a predetermined operation of the regulator motor.

Although this invention has been described with reference to a particular embodiment thereof, it is, of course, not to be limited thereto except insofar as is necessitated by the scope of the appended claims.

I claim as my invention:

1. In a circuit controlling apparatus, in combination, a fixed contact member, a first elongated spring biased conducting member operatively associated for movement relative to the fixed contact member, a second elongated spring biased conducting member disposed for movement relative to the first conducting member to actuate it, the elongated conducting members having one of their ends fixedly supported and the other ends free to move, a first movable contact member carried by the first conducting member intermediate

the ends thereof disposed to engage the fixed contact member to establish a conducting path between the fixed end of the conducting member and the fixed contact member, a second movable contact member carried by the first conducting member adjacent the free end thereof, a movable contact member carried by the second conducting member disposed to be actuated into engagement with the second contact member, and means for actuating the second conducting member in response to predetermined conditions to move the contact member carried thereon into engagement with the second contact member to provide a closed conducting path between the fixed ends of the conducting members, said means also being disposed to actuate the second conducting member to effect a movement of the first conducting member after the closed conducting path is established to effect the separation of the first contact member and the fixed contact member and interrupt the conducting path from the fixed end of the first conducting member to the fixed contact member.

2. In a circuit controlling apparatus, in combination, a plurality of fixed contact members disposed in spaced relation, a set of elongated spring biased conducting members operatively associated with each of the fixed contact members, each set of the conducting members comprising a first and a second member having one of their ends fixedly supported and the other of their ends free to move but biased in the same direction, a first movable contact member carried by the first conducting member of each set intermediate the ends thereof disposed to be and normally biased into engagement with the fixed contact member associated therewith to establish a conducting path between the fixed end of the conducting member and the fixed contact member, a second movable contact member carried by the first conducting member of each set adjacent the free end thereof, a movable contact member carried by the second conducting member of each set disposed to be actuated into engagement with the second contact member, and means common to both sets for selectively actuating the conducting members thereof in response to predetermined conditions to effect a predetermined switching operation of the conducting members of one or the other of the sets only, the actuating means being disposed to actuate the second conducting member of the predetermined set to effect the engagement of the movable contact member carried thereby with the second movable contact member to provide a closed conducting path between the fixed ends of the conducting members, the actuating means also being disposed to actuate the second conducting member to effect a movement of the first conducting member after the closed conducting path is established to effect the separation of the first contact member and the fixed contact member to interrupt the conducting path from the fixed end of the first conducting member to the fixed contact member.

3. In a circuit controlling apparatus, in combination, a plurality of fixed contact members disposed in spaced relation, a set of elongated spring biased conducting members operatively associated with each of the fixed contact members, each set of the conducting members comprising a first and a second member having one of their ends fixedly supported and the other of their ends free to move but biased in the same direction, a first movable contact member carried by the first conducting member of each set intermediate

the ends thereof disposed to be and normally biased into engagement with the fixed contact member associated therewith to establish a conducting path between the fixed end of the conducting member and the fixed contact member, a second movable contact member carried by the first conducting member of each set adjacent the free end thereof, a movable contact member carried by the second conducting member of each set disposed to be actuated into engagement with the second contact member, and a cam positioned between the free ends of the second conducting member of the sets disposed for operation to effect a predetermined switching operation of either of the sets, the direction of operation of the cam being responsive to predetermined conditions and determining the selection of the set in effecting the switching operation, the cam being disposed to actuate the second conducting member of the selected set to move the contact member carried thereby into engagement with the second contact member to provide a closed conducting path between the fixed ends of the conducting members of the selected set, the cam also being disposed to actuate the second conducting member to effect a movement of the first conducting member after the closed conducting path is established to effect the separation of the first contact member and the fixed contact member to interrupt the conducting path from the fixed end of the first conducting member of the selected set to the fixed contact member associated therewith.

4. In a circuit controlling apparatus, in combination, a plurality of fixed contact members disposed in spaced relation, a first self-biasing conducting member associated with each of the fixed contact members, the conducting members having

one of their ends fixedly supported and the other end free to move but biased in opposite directions, a first contact member carried by each of the first conducting members intermediate the ends thereof and disposed to be normally in engagement with the fixed contact member associated therewith, a second contact member carried by each of the first conducting members adjacent its free end, a second self-biasing conducting member associated with each of the fixed contact members, each of the second conducting members being fixedly supported at one end thereof and having the other end free to move, a contact member carried by the second conducting member adjacent its free end, the free ends of the conducting members associated with each of the fixed contact members being aligned and biased in the same direction, and means common to the conducting members associated with the fixed contact members for actuating the conducting members associated with one or the other of the fixed contact members in response to predetermined conditions to effect a predetermined sequential operation, the actuating means being disposed to effect the movement of the second conducting member to effect the engagement of the contact member carried thereby with the second contact member of the first conducting member to give a closed conducting path between the fixed ends of the associated first and second conducting members, the actuating means also being disposed to effectively move the engaged conducting members thereafter to effect the separation of the first contact member and the fixed contact member to interrupt the conducting path to the fixed contact member.

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