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TRANSITORY LATCHING SWITCH MECHANISM

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2 Sheets-Sheet 1

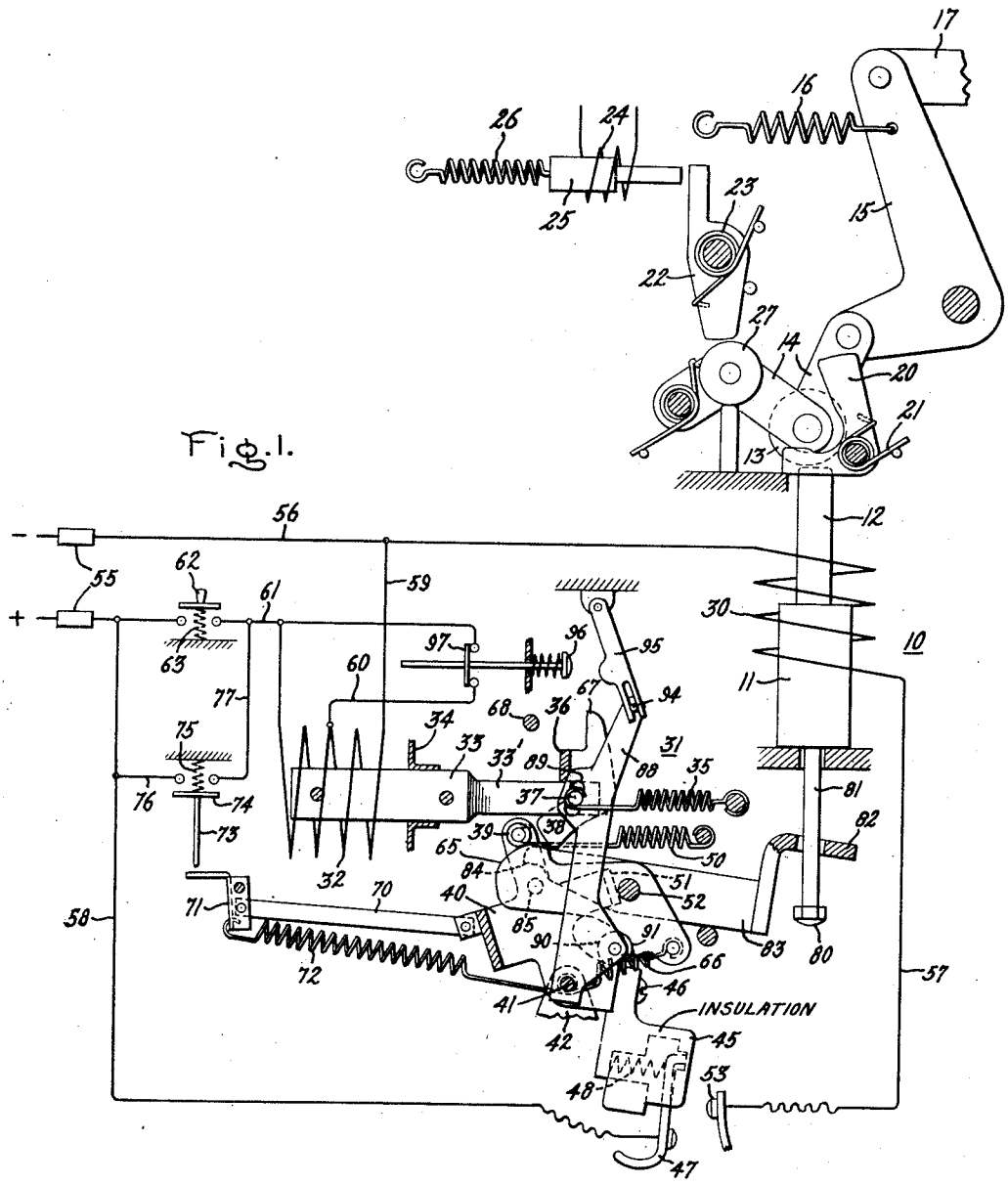


Fig. 1.

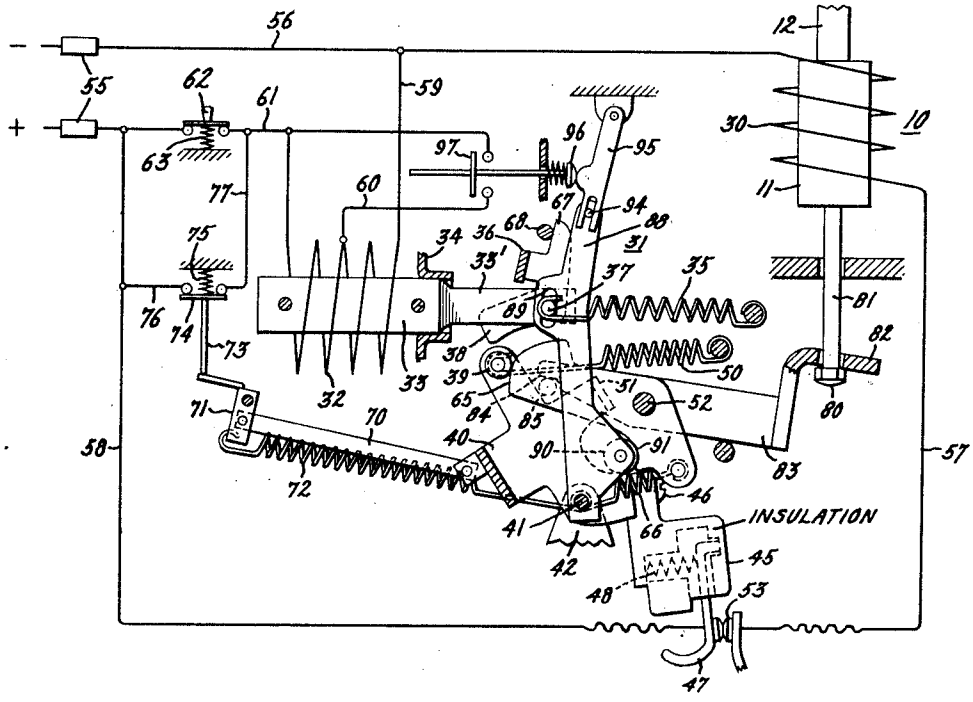
Inventors:
John A. Oppel,
Edward J. Frank,
by Ernest C. Britton
Their Attorney.

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Fig. 2.



Inventors:
John A. Oppel,
Edward J. Frank,
by Ernest C. Britton
Their Attorney.

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TRANSITORY LATCHING SWITCH MECHANISM

John A. Oppel, Aldan, and Edward J. Frank, Springfield, Pa., assignors to General Electric Company, a corporation of New York

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This invention relates to switching control mechanism, particularly of a positive latching type suitable for controlling the electrical closing means of circuit breakers or similar devices of the biased open type.

An object of this invention is to provide an improved electrically operated sequential mechanically latched switching mechanism capable of releasing an operating latch when a holding latch is engaged and of releasing the holding latch to de-energize the circuit breaker closing means such as motor or solenoid, immediately upon completion of the closing stroke and also incorporates auxiliary holding latch releasing means that prevents improper re-energization of the circuit breaker closing means upon re-establishment of the control power source after an accidental power failure due to a blown fuse or the like.

Thus the invention relates to switching control mechanism and the principal object is to provide an improved sequential transitory latching switch mechanism having selective latch releasing means suitable for use in a circuit breaker closing control or in other transitory switching control service where severe shocks and vibration are likely to be encountered.

Another object is to provide an improved sequential electroresponsive transitory latching switch mechanism having a two position switch member biased to the open position and capable of an initial transitory operation by means of a transitory operating latch actuated by a first electroresponsive operator under control of a master switch to the closed position wherein the switch member is held by a positive holding latch for energizing a circuit breaker closing solenoid or second electroresponsive operator and provided with means for enabling the solenoid or second operator to immediately release the holding latch so as to open the switch mechanism and thus de-energize itself immediately upon response thereof.

Another object is to enable the first electroresponsive operator to selectively release the holding latch so as to open the switch mechanism in case the holding latch has not already been released by the second electroresponsive operator when the first electroresponsive operator becomes de-energized. Thus in case of any failure of the closing solenoid or second electroresponsive operator to respond or because of power failure during closing operation due to jamming or other faulty conditions so that the energizing circuit of both the first and second electroresponsive operators remain energized for a period likely to produce overheating and blowing of any protective

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fuses in the circuit, the resulting de-energization of the first electroresponsive operator becomes effective to release the holding latch and open the switch mechanism to permit correction of the fault and to permit safe replacement of the fuse.

Another object is to provide an automatically releasable transitory operating latch connection between the first electroresponsive operator and the transitory latching switch mechanism so as to effectively insure against "pumping" (in case the master closing control switch should be maintained in the closing position) when the holding latch is released by the second electroresponsive operator to return the switch mechanism to the open position in accordance with its bias.

Other objects are to insure a successful closure of the switch mechanism by the first electroresponsive operator, even upon a momentary closure of the master control switch, by means of a sealing-in switch that is closed upon the initial response of the first electroresponsive operator to maintain an effective energization thereof independently of the master switch and also to reduce the effective energization of the first electroresponsive operator as soon as the transitory operating latch is released and the switch mechanism becomes positively latched in the closed position.

Other objects and advantages of the invention will appear in the following description of the accompanying drawing in which Fig. 1 is a schematic view of a circuit breaker closing control embodying the improvements of the present invention and showing both the electrical control circuit connections and the mechanical latch releasing connections of the improved selective electroresponsive transitory latching switch mechanism with the parts in their normal position ready to perform a circuit breaker closing operation, Fig. 2 is a similar schematic view showing the parts in their relative positions occupied during a closing operation when the circuit breaker solenoid is being energized by the closure and transitory latching of the biased open switch member and just as the latch is about to be released by the resulting closing response of the secondary solenoid plunger.

As schematically shown in Fig. 1, the circuit breaker closing solenoid or second electroresponsive operator indicated generally by the reference character 10 is applied to operate a well-known form of circuit breaker mechanism (such as in the Patent 1,827,626) and for this purpose has an armature or plunger 11 provided with the push rod 12 for engagement with the roller 13

to straighten the circuit breaker closing toggle links 14 and thereby rotate the bell crank 15 against the bias of spring 16 to move the link 17 in the circuit breaker closing direction. It may be noted that a hold-close prop 20 is biased by spring 21 to engage with the knee pin of the toggle links 14 in the straightened position thereof and thereby maintain the bell crank 15 in the circuit breaker closing position until the trip latch 22 is moved against the bias of its resetting spring 23 upon energization of the trip coil 24 and resulting attraction of armature 25 against the bias of spring 26 to rotate the trip latch 22 from holding the roller 27 to thereby effect collapse to the left of the toggle links 14 from the prop 20. However, such trip-free type of latched toggle operating mechanism forms no part of the present invention as the solenoid or second electroresponsive operator 10 may be applied for imparting an activating thrust to operate any other device desired.

The armature or plunger 11 of the closing solenoid 10 is attracted upon energization of the solenoid winding 30 by the closure of the improved transitory latching switch mechanism of the present invention indicated generally by the reference character 31. This improved mechanism is provided with a first electroresponsive operator in the form of a solenoid 32 having an armature or plunger 33 sliding in suitable guide elements 34 and provided with an extension 33' for carrying a one way transitory latch 36 pivotally supported thereon by the pin 37. The latch 36 is normally biased to the position in which it is shown in Fig. 1 so as to engage the latch finger 38 thereof with the roller 39 carried on the movable switch member 40 that is pivotally supported on the pin 41 extending from a fixed bracket 42. The movable switch member 40 also carries an insulating contact housing 43 secured thereto by the screw 45 and having the switch contact finger 47 yieldingly mounted therein by means of the wipe spring 48. The movable switch member 40 is biased to the open position in which it is shown in Fig. 1 by means of the opening bias spring 50 and in which the upturned stop 51 engages with the stationary pin 52 so that the yieldingly mounted movable switch finger 47 is held disengaged from the cooperating stationary switch contact 53. Thus the switch member 40 is normally biased to open the energizing circuit of the solenoid winding 30 of the second electroresponsive operator 10 that extends from a suitable supply source indicated in the drawing as plus and minus through the overload protective fuses 55 and the conductors 56, 57 and 58. These fuses 55 preferably are rated to blow in case the circuit breaker closing solenoid winding 30 should be maintained energized for any appreciable interval since such a closing solenoid winding ordinarily has only a short time current carrying rating.

In order to close the normally open switch member 40, a solenoid or first electroresponsive operator 32 may be energized from the same suitable supply source through the conductors 58, 59, 60, normally closed switch 97, conductor 61 and the master control switch 62 that is normally biased to the open position in which it is shown by the spring 63. Thus upon any momentary or extended closure of the master control switch 62 the low resistance portion of the solenoid winding or first electroresponsive operator 32 becomes energized very strongly due to the short circuiting of the conventional high resistance portion of the solenoid winding by switch 97 and armature 33 is attracted to carry the finger 38 of latch 36 into engagement with roller 39 and thereby move the switch member 40 about the pivot 41 to carry the yieldingly mounted switch finger 47 into circuit closing engagement with the stationary switch finger 53 and thereby energize the circuit breaker closing solenoid winding 30 of the second electroresponsive operator 10. As soon as the wiping engagement of the switch contacts 47 and 53 is effected, the main transitory latch 65 is biased to move about the pivotal mounting pin 52 by the spring 66 so as to engage with the roller 39 and thereby latch the main switch contacts 47 and 53, in circuit closing engagement. Thus when the finger 67 projecting from the one way transitory latch 36 engages with the stop 68 to produce clockwise movement of the latch during an appropriate over-travel of the armature 33 so as to release the latch finger 38 from its driving engagement with the roller 39 the main latch 65 immediately engages the roller 39 and thus becomes effective to hold switch member 40 and thereby maintain the contact fingers 47 and 53 in circuit closing engagement.

Upon the initial response of the armature 33 to the strong energization of the low resistance part of the solenoid winding 32 of the first electroresponsive operator, the movable switch member 40 is connected by the link 70 to move the bell crank arm 71 against the bias of spring 72 to engage with the operating pin 73 of the sealing-in switch contact 74 and thereby move contact 74 against the bias of spring 75 to its circuit closing position. This closes a sealing-in circuit extending from the plus supply source through one of the fuses 55, conductors 58, 76, and 77 in shunt with the master control switch 62 so as to insure a continued closing operation of the switching contacts 47 and 53 even upon a momentary closure of the master control switch 62 and thereby insures a continued energization of the circuit breaker closing solenoid 30.

As soon as the circuit breaker closing solenoid winding 30 becomes effectively energized so as to attract the armature 11 upwardly to close the circuit breaker as indicated in Fig. 2, if the closing operation is successful, then the head 80 of the pin 81 extending from the armature 11 will engage with the bent finger 82 extending from the latch tripping lever 83 that is pivotally mounted on the fixed pin 52 and provided with a finger 84 for engaging with the pin 85 carried by the main latch 65 so as to rotate this latch 65 about the pin 52 out of latching engagement with the roller 39 and enable the opening bias spring 50 to return the switch member 40 to its open position in engagement with the pin 52 and thereby separate the switch finger 47 from the stationary switch finger 53. In this way the control power to the circuit breaker closing solenoid 30 is cut off at a precise predetermined instant upon response thereof to effect a full closure of the circuit breaker; and it will be understood that the latch tripping member 83 could be actuated from any moving mechanism member associated with the plunger 11 which would constitute an equivalent to the bolt 80 shown.

If, however, due to jamming of the circuit breaker mechanism or for any other reason, the closing solenoid 30 is unable to effect a full circuit breaker closing operation so that the head 80 of pin 81 is not moved sufficiently into operating engagement with finger 82 to release the latch 65 and open the contacts 47 and 53 as described

above, then the short time rating for energization of the closing solenoid may be exceeded and cause the blowing of one or both of the protective fuses 55. In such case, the solenoid winding of the first electroresponsive operator 32 will likewise be de-energized along with the circuit breaker operating solenoid 30 and the armature 33 will no longer be attracted even though the sealing-in switch 74 remains closed. As a result, the biasing spring 35 becomes effective to return the armature 33 to its unattracted position and thereby move an auxiliary latch tripping lever 88 that is coaxially pivotally mounted on the pin 41 and provided with a slot 89 in operating engagement with the latch pivot pin 37. The auxiliary tripping lever arm 88 carries a tripping roller 90 for engaging with the cam face 91 formed on the latch member 65 so as to enable the force of biasing spring 35 to rotate the latch 65 about the pivot pin 52 against the comparatively light opposing bias of spring 66 and thereby release the switch member 40 for opening movement in accordance with the bias of spring 50 to disengage the switch contacts 47 and 53. In this way, the main transitory latch 65 is released upon response of the operating solenoid 32 to de-energization thereof to produce the unlatching of the latch-closed contacts 47 and 53 equivalent to that of the response of the circuit breaker closing solenoid 30 to a full stroke thereof. Thus, there is no hazard that the control switch, once latched closed, can continue so indefinitely, for, if the normal cut-off operation by the opening of contacts 47 and 53 is not achieved through the main trip lever 83 responsive to closing movement of the second operator, then such opening movement is assured automatically by the auxiliary trip lever 88 coincident with the failure of the control power as from blowing of fuses or any other cause. Accordingly, there is no danger, to apparatus or person, that power is restored with the control switch contacts 47 and 53 already latched closed so as to hazard an inadvertent or unpremeditated closure of the power operator 10 thereby.

In order to reduce the effective energization of the operating solenoid 32 as soon as the armature 33 has latched the control switch closed to that amount required merely for holding the armature closed, the pivoted auxiliary tripping lever 88 is adapted for operating the switch 97. Thus it is provided with a pin 94 for operating in a suitable slot formed in the pivoted arm 95 so as to engage arm 95 with the operating element 96 of the normally closed switch 97 to effectively insert all of the turns of the high resistance portion of solenoid winding 32 in the circuit as seen clearly in Fig. 2 and in this way limit the energizing current thereof to a safe value. Although the lever 88 could be extended to actuate the member 96 directly, it is found preferable to employ the additional actuating lever 95 thereby to reduce the speed and impact at which the member 96 is actuated in accordance with the movement of armature 33.

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

1. A sequential latching switch mechanism having in combination a movable switch member biased to one position, a latch biased to hold the switch member in another position, a first electroresponsive operator having a transitory latch carried thereby for operating the switch member to said other position and provided with means for releasing the transitory latch upon response of the first operator to energization thereof and having a connection for releasing the holding latch upon de-energization of the first electroresponsive operator, and a second electroresponsive operator connected to be energized upon movement of the switch member to the other position and provided with a connection for independently releasing the holding latch upon response of the second electroresponsive operator during the energization of the first electroresponsive operator.

2. A switch mechanism having in combination a two-position switch member biased to one position, means including a pivoted holding latch for holding the switch member in the other position, a first electroresponsive operator having a pivoted latch carried thereby for operating the switch member to said other position upon energization of the first operator and provided with means for releasing the operating latch upon engagement of the holding latch and with a connection for releasing the holding latch upon de-energization of the first electroresponsive operator, and a second electroresponsive operator connected to be energized upon movement of the switch member to the other position and provided with means for independently releasing the holding latch upon response of the second electroresponsive operator during the energization of the first electroresponsive operator.

3. In a sequential latching switch mechanism, a pair of movable operators, each biased to one position, a two-position switch member having a releasable latch operating connection with one operator provided with means for releasing the operating latch connection upon movement of the one operator to another position to operate the switch member from one position to the other position, electroresponsive means connected to be energized upon movement of the switch member to the other position for moving the other operator to another position and means including a releasable holding latch element having releasing connections with each operator for maintaining the switch member latched in the other position until movement either of the other operator to the other position or of the one operator to the one position.

4. A switch mechanism having in combination a movable switch member biased to one position, a first latch biased to hold the switch member in another position, a first reversely movable operator having means including a second latch for operating the switch member to said other position and provided with means for releasing the second latch upon operation of the switch member to said other position and having a connection for releasing the first latch upon reverse movement of the first operator, and an electroresponsive operator connected to be energized upon movement of the switch member to the other position and provided with a connection for independently releasing the first latch after the switch member is operated to said other position when the electroresponsive operator responds before the reverse movement of the first operator.

5. A transitory latching switch mechanism having in combination a pivoted switch member biased to the open position, means including a first latch for holding the switch member in the closed position, electroresponsive means for operating the switch member to the closed position and including a pivoted lever provided with a second latch connectable with the switch member for sequentially operating the switch mem-

ber to the closed position and releasing the second latch upon energization of the electroresponsive means, an electroresponsive operating device connected to be energized upon movement of the switch member to the closed position and having means for releasing the first latch upon normal response of the electroresponsive operating device, and means carried by the lever for releasing the first latch upon deenergization of the electroresponsive means when the electroresponsive operating device is ineffective to release the first latch.

6. A transitory latching switch mechanism having in combination a movable switch member biased to one position, a roller carried by said member, a reversely movable operating member having a latch pivoted thereon for engaging the roller to operate the switch member to another position upon movement of the operating member in one direction, stop means for releasing the latch from the roller in said other position, a second latch biased into engagement with the roller in said other position for holding the switch member in said other position, and means connected with the operating member for releasing the second latch upon return movement of the operating member in the opposite direction.

7. A transitory latching switch mechanism having in combination a movable switch member biased to one position, a roller carried by said member, a reversely movable operating member having a latch pivoted thereon for engaging the roller to operate the switch member to another position upon movement of the operating member in one direction, stop means for releasing the latch from the roller in said other position, a second latch biased into engagement with the roller in said other position for holding the switch member in said other position, means connected with the operating member for releasing the second latch upon return movement of the operating member in the opposite direction, and an independently operable member for releasing the second latch having electroresponsive operating means connected to be energized upon movement of the switch member to the other position.

8. A transitory latching switch mechanism having in combination a movable switch member biased to one position, a roller carried by said member, a reversely movable operating member having a latch pivoted thereon for engaging the roller to operate the switch member to another position upon movement of the operating member in one direction, stop means for releasing the latch from the roller in said other position, a second latch biased into engagement with the roller in said other position for holding the switch member therein, means connected with the operating member for releasing the second latch upon return movement of the operating member in the opposite direction, and a separately movable member for independently releasing the second latch having electroresponsive operating means connected to be energized upon movement of the switch member to the other position.

JOHN A. OPPEL.
EDWARD J. FRANK.

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