July 31, 1956 J. B. OWENS ET AL 2,757,255

HIGH-SPEED SWITCH MECHANISM

Filed Sept. 11, 1952 5 Sheets-Sheet 1

Fig.1.

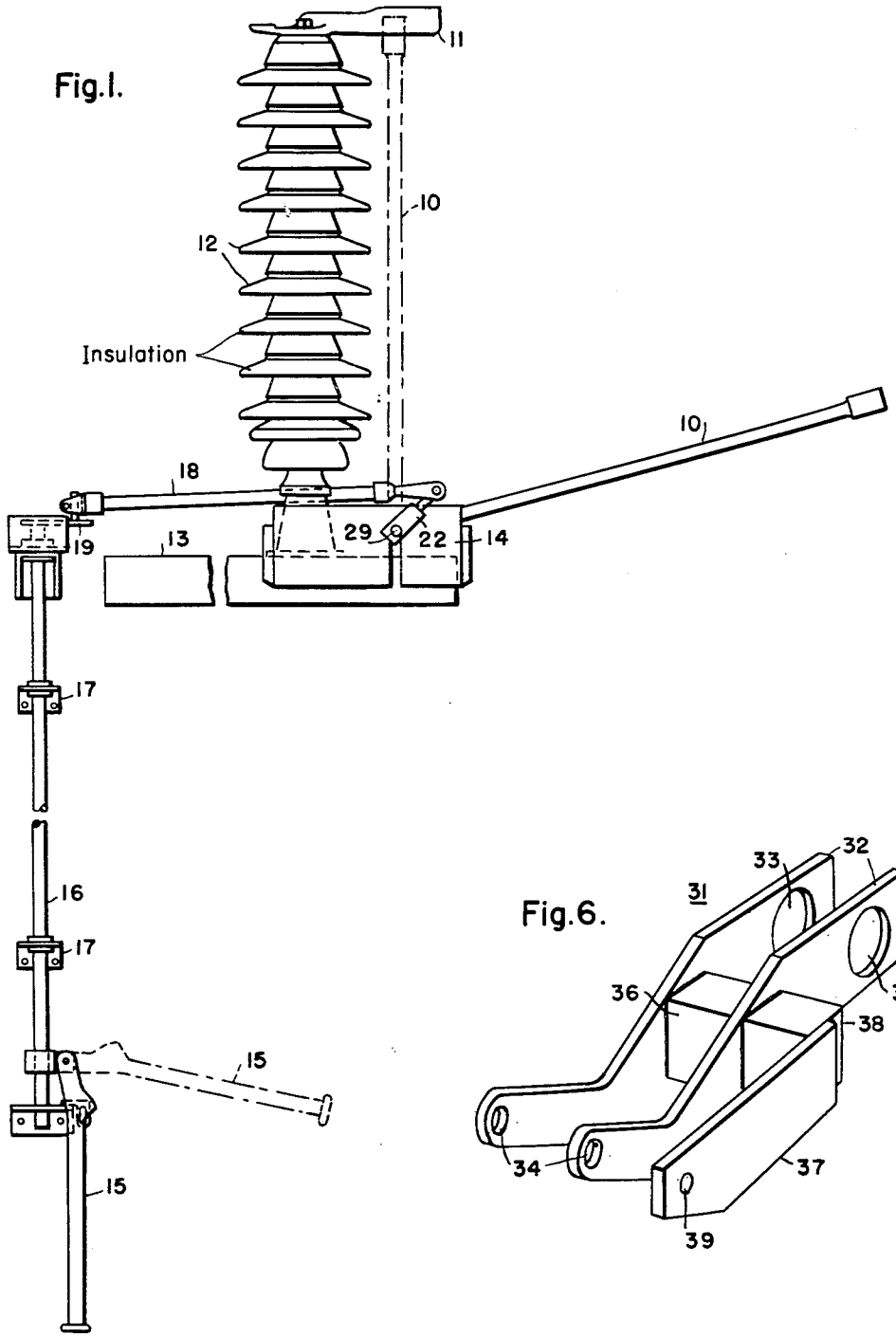

Fig.6.

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HIGH-SPEED SWITCH MECHANISM

Filed Sept. 11, 1952 5 Sheets-Sheet 2

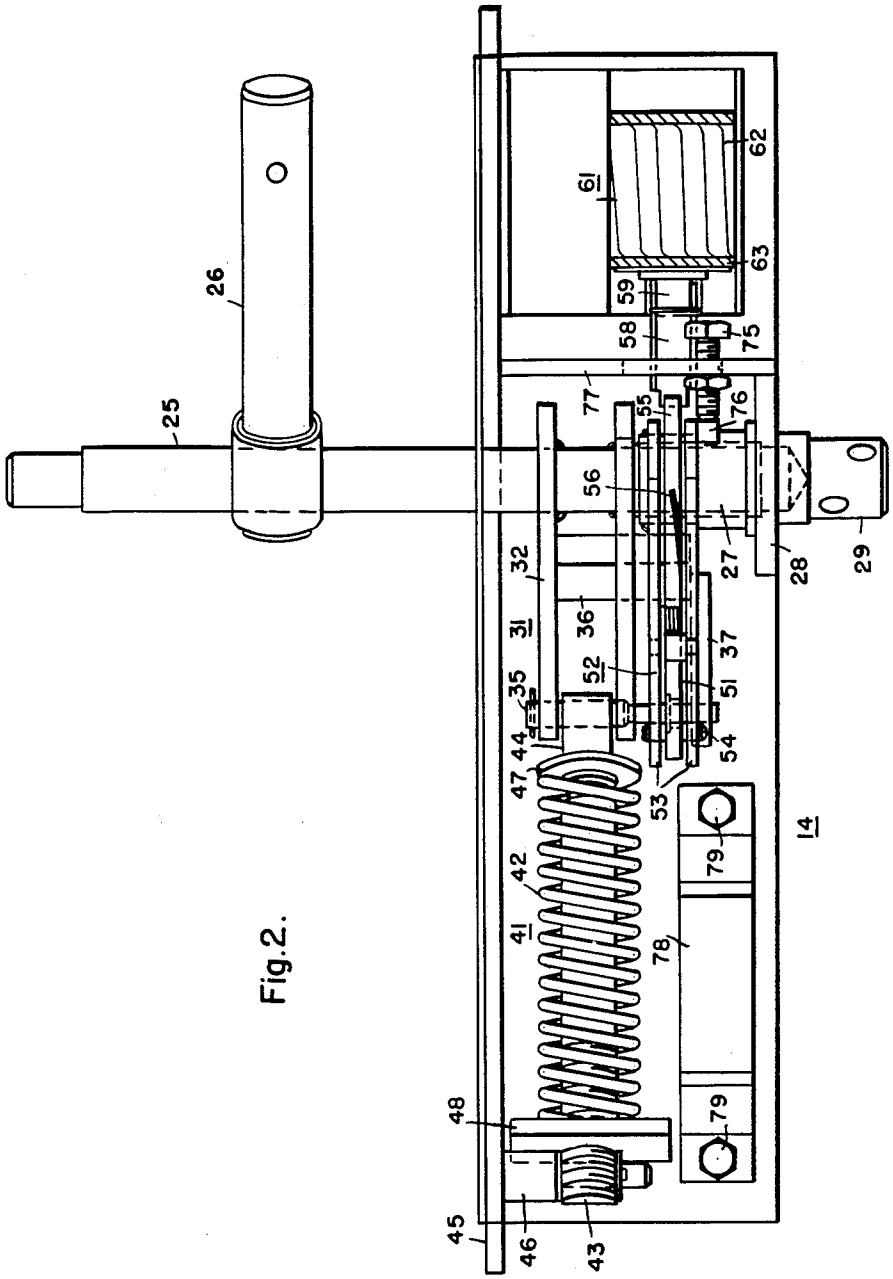

Fig.2.

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HIGH-SPEED SWITCH MECHANISM

Filed Sept. 11, 1952 5 Sheets--Sheet 3

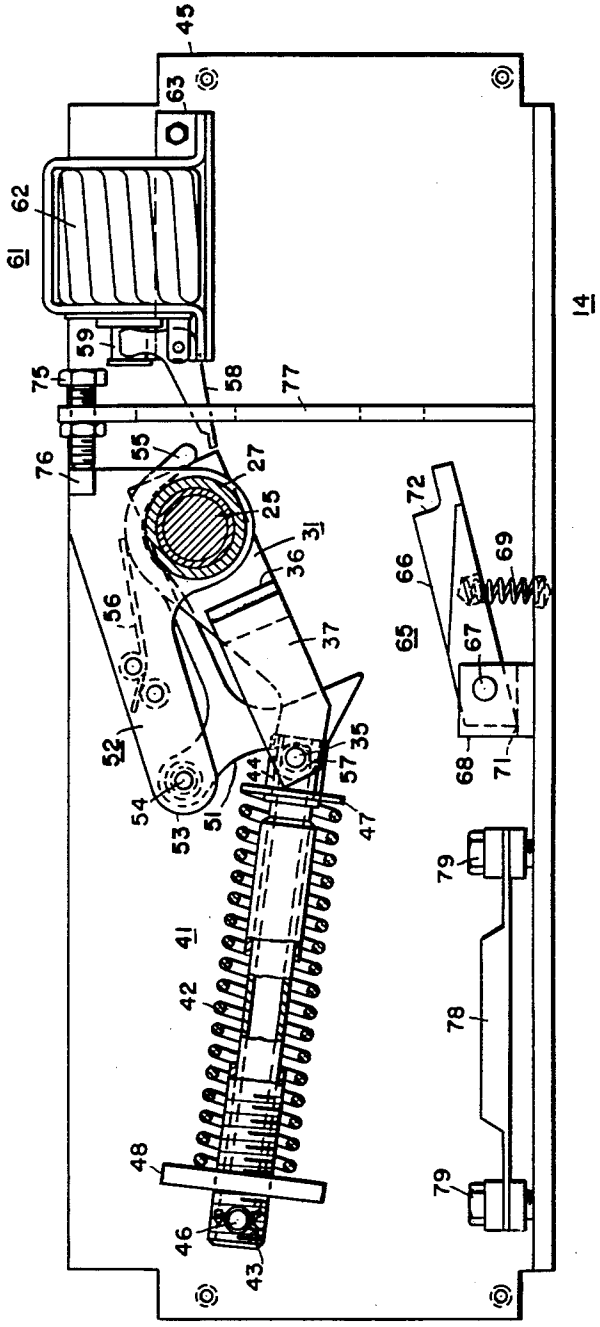

Fig. 3.

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HIGH-SPEED SWITCH MECHANISM

Filed Sept. 11, 1952 5 Sheets-Sheet 4

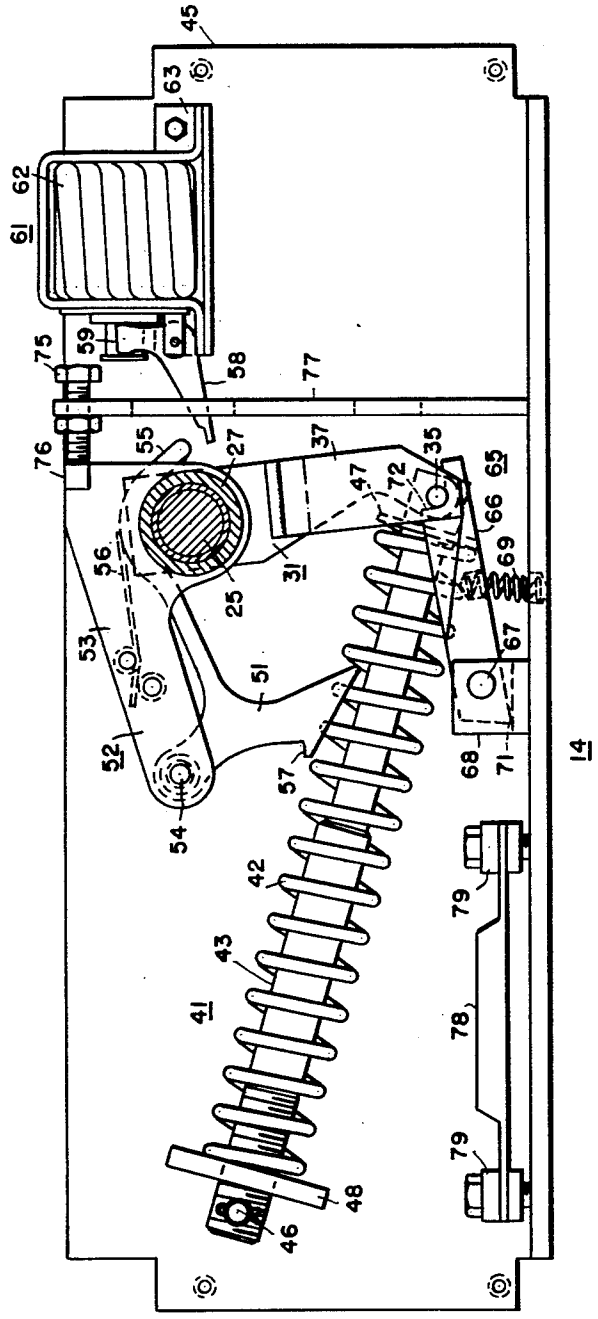

Fig. 4.

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HIGH-SPEED SWITCH MECHANISM

Filed Sept. 11, 1952 5 Sheets-Sheet 5

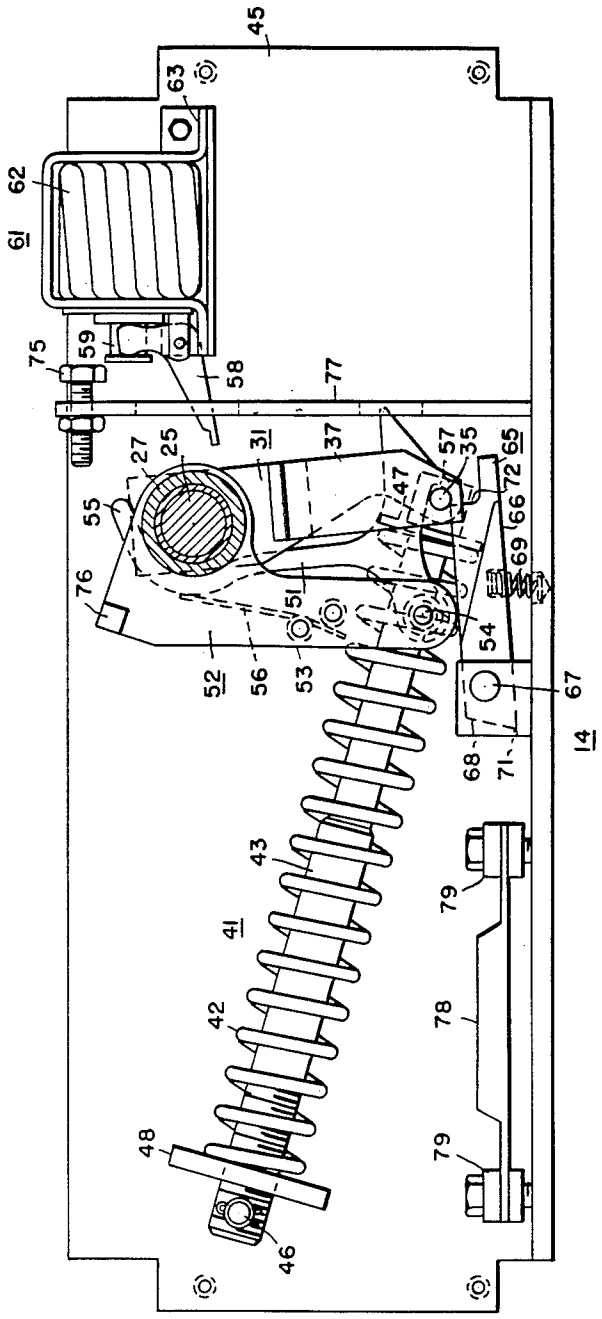

Fig.5.

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2,757,255

Patented July 31, 1956

2,757,255

HIGH-SPEED SWITCH MECHANISM

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Application September 11, 1952, Serial No. 308,954

12 Claims. (Cl. 200—106)

Our invention relates, generally, to electric switches and, more particularly, to operating mechanisms for switches suitable for use as grounding switches.

For certain protective schemes, for example the differential protection of a power transformer, a switch is provided for grounding the power circuit to one side of the transformer, thereby causing positive tripping of the high-voltage circuit breaker which may be located some distance from the transformer. The grounding switch is normally latched open and spring biased to the closed position. The latch is tripped by a solenoid which is energized through the contact members of a differential relay. It is desirable that the switch close at a high speed and that rebounding of the switch blade upon closing be prevented.

An object of our invention, generally stated, is to provide a grounding switch which shall be simple and efficient in operation and which may be economically manufactured and installed.

A more specific object of our invention is to provide a high-speed actuating mechanism for a switch of the blade type having a rotatable operating shaft.

Another object of our invention is to provide a resetting mechanism for a spring-actuated switch.

A further object of our invention is to prevent rebounding of the switch blade upon closing.

Still another object of our invention is to provide a spring-biased switch which is latched in both the open and the closed positions.

Other objects of our invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of our invention, the switch blade of a grounding switch is actuated by a rotatable shaft having a lever arm secured thereto. The lever is connected to a spring assembly which is compressed when the blade is in the open position and is held under compression by a primary latch carried by an arm secured to a sleeve which is coaxial with the shaft for the blade. The latch is released by a lever actuated by a tripping solenoid and the spring rotates the shaft to close the switch blade. A secondary latch engages the lever on the shaft to prevent rebound upon closing and to hold the blade closed. The mechanism is reset by rotating the sleeve and the primary latch arm in one direction to cause the secondary latch to be disengaged from, and the primary latch engaged to the shaft lever and the spring assembly. The sleeve is then rotated in the opposite direction to open the switch blade and compress the closing spring.

For a better understanding of the nature and objects of our invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a view, in side elevation, of a grounding switch embodying the principal features of the invention;

Fig. 2 is an enlarged view, in plan, of a portion of the actuating mechanism for the switch;

Fig. 3 is an enlarged view, in side elevation, of the structure shown in Fig. 2, the mechanism being shown in a position corresponding to the open position of the switch blade;

Fig. 4 is a view, similar to Fig. 3, showing the mechanism in a position corresponding to the closed position of the switch blade;

Fig. 5 is a view, similar to Figs. 3 and 4, showing the mechanism in position to reset the switch, and

Fig. 6 is an enlarged view, in perspective, of the lever for connecting the spring assembly to the blade shaft.

Referring to the drawings, and particularly to Fig. 1, the structure shown therein comprises a switch blade **10** which is disposed to engage stationary contact members **11** supported by an insulator stack **12** mounted upon a base **13**. The base **13** may be supported by a suitable structural framework (not shown). As explained hereinbefore, the switch blade **10** may be utilized for grounding a power circuit when closed. Accordingly, the blade is normally in the open position, as shown by the full lines in Fig. 1. As shown, the blade **10** may be so mounted that it travels approximately 75° between the open and the closed positions.

The blade **10** is normally retained in the open position and is biased to the closed position by a spring assembly or other suitable energy-storing means which will be described more fully hereinafter. The blade **10** is also retained in the closed position and may be reset by a resettting mechanism which is enclosed in a housing **14** which is mounted upon the base **13**. The resetting mechanism may be manually operated by a handle **15** which is pivotally connected to a vertical shaft **16** rotatably mounted in bearing supports **17** which may be attached to the framework for supporting the base **13**. The shaft **16** is connected to one end of a horizontally disposed rod **18** through a crank arm **19**. The other end of the rod **18** is connected to a lever arm **22**. The arm **22** is connected to a rotatable sleeve which is part of the operating mechanism for the switch, as will be described more fully hereinafter.

As shown by the dot-dash lines, the handle **15** may be raised to a substantially horizontal position when it is desired to operate the resetting mechanism. The handle is utilized to rotate the vertical shaft **16**, thereby operating the mechanism, as will be described hereinafter. The handle **15** may be locked in the position shown by the full lines by means of a padlock (not shown).

As shown in Figs. 2 to 5, the operating mechanism for the switch blade **10** comprises a rotatable shaft **25** having an arm **26** secured thereto and to which the blade **10** may be attached. One end of the shaft **25** is mounted in a sleeve **27** which is rotatably disposed in a bearing member **28** mounted in the housing **14**. The other end of the shaft **25** may be supported by a suitable bearing bracket (not shown) which may be mounted on the base **13**. As explained hereinbefore, one end **29** of the sleeve **27** is attached to the lever arm **22**, shown in Fig. 1.

A lever arm **31** is secured to the shaft **25**. As shown more clearly in Fig. 6, the lever arm **31** comprises a pair of spaced arms **32** having holes **33** at one end thereof for receiving the shaft **25** and holes **34** at the other end thereof for receiving a pin **35**. The arms **32** may be welded to a spacing member **36** and an additional arm **37** may be welded to another spacing member **38**. The arm **37** is provided with a hole **39** for receiving one end of the pin **35**, as shown more clearly in Fig. 2.

The pin **35** connects the lever arm **31** to a spring assembly **41**. As shown in Fig. 2, the spring assembly **41** comprises a coil spring **42** which surrounds a telescoping guide rod **43**. One member of the rod **43** is attached to the pin **35** by a connector **44** and the other member is pivotally attached to a back plate **45** of the

housing 14 by a pin 46. The spring 42 is disposed between a seat 47 on the connector 44 and a square nut 48 which is threaded on the outer member of the telescoping guide 43. In this manner the compression of the spring 42 may be adjusted by means of the threaded nut 48.

As shown most clearly in Fig. 3, the spring assembly 41 is retained in the compressed or loaded position by means of a primary latch 51 or other releasable device which is carried by a latch arm 52, one end of which is secured to the sleeve 27. As shown in Fig. 2, the latch arm 52 comprises a pair of spaced members 53 between which the latch 51 is mounted on a pin 54. The latch 51 has a curved end 55 which is normally biased against the sleeve 27 by a spring 56. The latch 51 has a hook portion 57 which engages the pin 35 to retain the spring 42 in the compressed position. When the spring 42 is compressed, as shown in Figs. 2 and 3, the spring assembly 41 and the lever arm 31 are disposed to actuate the switch blade 10 from the open to the closed position but are prevented from closing the blade by the latch 51.

The primary latch 51 may be disengaged from the pin 35 by a tripping lever 58 which is actuated by a remotely-controlled device, such as a core 59 of a solenoid mechanism 61 having a coil 62. The solenoid mechanism may be mounted on a bracket 63 which is attached to the back plate 45 of the housing 14. As explained hereinbefore the solenoid coil 62 may be energized through the contact members of a differential relay or other protective device located remotely from the switch mechanism. When the coil 62 is energized, the lever 58 is actuated to engage the curved end 55 of the primary latch 51, thereby disengaging the hook 57 from the pin 35 and releasing the spring 42 which rotates the shaft 25 through the lever arm 31, thereby closing the switch blade 10.

As explained hereinbefore, it is desirable to have the grounding switch closed at a relatively high speed, the closing time of the embodiment disclosed being of the order of 20 cycles on a 60 cycle system. Because of this high speed, there is a considerable tendency for the blade 10 to rebound from the stationary contacts 11 upon closing. To prevent this rebounding, a spring-biased secondary latch 65, or other releasable device, is provided. The secondary latch 65 comprises a bar 66, one end of which is pivotally mounted on a pin 67 disposed in a bracket 68 in the housing 14. The bar 66 is biased upwardly by a spring 69, the upward travel being limited by a corner 71 of the bar engaging the bracket 68. During the closing of the switch, the pin 35 engages the bar 66 to compress the spring 69. Near the end of the stroke the pin 35 drops into a notch at one end of the bar 66 and is engaged by a shoulder 72 to prevent rebounding of the switch blade 10 and also to retain the blade in the closed position. The positions of the members of the operating mechanism, corresponding to the closed position of the switch blade 10, are shown in Fig. 4.

In order to reset the mechanism after an automatic operation, the sleeve 27 is rotated in a counterclockwise direction, thereby causing the latch arm 52 to carry the primary latch 51 downwardly from the position shown in Fig. 4 to the position shown in Fig. 5. As explained hereinbefore, the sleeve 27 may be rotated counterclockwise by means of the manually-operated handle 15. As the latch arm 52 moves downwardly, the end of one of the members 53 engages the secondary latch bar 66, thereby lowering the bar to disengage the pin 35. At the end of the downward travel of the latch arm 52, the hook 57 on the primary latch 51 engages the pin 35, as shown in Fig. 5.

The sleeve 27 is then rotated clockwise by means of the handle 15 to open the switch blade 10 and compress the spring 42. When the spring 42 is fully compressed, the members of the actuating mechanism are returned to the positions shown in Fig. 3. As explained hereinbefore, the handle 15 may be locked in the position shown

by the full lines in Fig. 1, thereby retaining the members in the positions shown in Fig. 3 until the primary latch 51 is released by operation of the tripping solenoid 61.

An adjustable screw 75 is disposed to engage a shoulder 76 upon one of the members 53 on the latch arm 52 to stop the upward travel of the latch arm as the switch blade is returned to its open position. The screw 75 is disposed in a member 77 of the housing 14.

An electrical heating device 78 may be mounted in the housing 14 on supports 79 to prevent condensation from taking place in the housing. Thus, the operating mechanism is well protected from the elements since it is enclosed by the housing 14. The stationary contact structure 11 is preferably of the semi-enclosed type having a hood over the contact members to protect them from ice accumulations.

From the foregoing description it is apparent that we have provided a switch mechanism which is particularly suitable for operating a grounding switch, but which may be utilized for operating switches of other types. Provision is made for latching the switch blade in both of its extreme positions of travel. Since the blade is required to travel through less than 90°, the time required for the switch to close is reduced as compared with switches which must travel through 90° or more. The mechanism herein described is relatively simple in structure and positive in operation.

Since numerous changes may be made in the above-described construction, and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. In a switch, in combination, a rotatable shaft, a switch blade secured to the shaft and movable in an arc as the shaft is rotated, a spring assembly, a lever arm connecting the spring assembly to the shaft, a primary latch engaging the lever arm to hold the spring compressed, electrically operated means for disengaging said latch to release the spring to rotate the shaft and actuate the blade to closed position, a secondary latch engaging the lever arm to retain the blade in the closed position, and manually operable means for first rotating the primary latch about the shaft in one direction to engage the lever arm and then in the other direction to rotate the shaft to open the switch blade and compress the spring at the same time.

2. In a switch, in combination, a rotatable shaft, a switch blade actuated by rotation of the shaft to open and closed positions, a spring assembly, a lever arm having one end secured to the shaft, a pin connecting the other end of the lever arm to the spring assembly, a primary latch engaging the pin to hold the spring compressed, an electrically actuated lever for disengaging said latch to release the spring to rotate the shaft and actuate the blade to the closed position, a secondary latch engaging the pin to retain the blade in the closed position, and manually operable means for first actuating the primary latch in one direction to engage the pin and then in the other direction to rotate the shaft to open the switch blade and compress the spring with the same operation.

3. In a switch, in combination, a rotatable shaft, a switch blade actuated by rotation of the shaft to open and closed positions, a spring assembly, a lever arm having one end secured to the shaft, a pin connecting the other end of the lever arm to the spring assembly, a primary latch engaging the pin to hold the spring compressed, an electrically actuated lever for disengaging said latch to release the spring to rotate the shaft and actuate the blade to the closed position, a spring-biased secondary latch engaging the pin to retain the blade in the closed position, and manually operable means for first rotating

the primary latch in one direction to engage the pin and then in the other direction to rotate the shaft to open the switch blade and compress the spring at the same time, said secondary latch being disengaged from said pin through operation of the primary latch.

4. In a switch, in combination, a rotatable shaft, a switch blade actuated by the shaft to open and closed positions, a spring assembly, a lever arm connecting the spring assembly to the shaft, a rotatable sleeve surrounding the shaft, a latch arm secured to the sleeve and rotatable about said shaft, a primary latch carried by the latch arm to compress the spring, tripping means for disengaging the primary latch to release the spring and actuate the blade to the closed position, a secondary latch for retaining the blade in the closed position, and manually operable means connected to said sleeve for first rotating said latch arm in one direction to release said secondary latch and engage the primary latch and then in the other direction to open the switch blade and compress the spring simultaneously with the opening of the switch blade.

5. In a switch, in combination, a rotatable shaft, a switch blade actuated by the shaft to open and closed positions, a spring assembly, a lever arm connecting the spring assembly to the shaft, a rotatable sleeve surrounding the shaft, a latch arm secured to the sleeve and rotatable about said shaft, a primary latch carried by the latch arm to load the spring, tripping means for disengaging the primary latch to release the spring and actuate the blade from one of said positions to the other, a spring-biased secondary latch for retaining the blade in said other position, and mechanical means operable first in one direction to rotate the latch arm in one direction to release the secondary latch and engage the primary latch, said mechanical means being then operable in another direction to rotate the latch arm in the other direction to actuate the blade to its first position and reload the spring.

6. In a switch, in combination, a rotatable shaft, a switch blade actuated by the shaft to open and closed positions, a spring assembly, a lever arm having one end secured to the shaft, a pin connecting the other end of the lever arm to the spring assembly, a rotatable sleeve surrounding the shaft, a latch arm secured to the sleeve and rotatable about the shaft, a primary latch carried by the latch arm and engaging the pin to load the spring, tripping means for disengaging the primary latch from the pin to release the spring and actuate the blade from one of said positions to the other, a spring-biased secondary latch for retaining the blade in said other position, and mechanical means operable first in one direction to rotate the latch arm in one direction to release the secondary latch and engage the primary latch, said mechanical means being then operable in the opposite direction to rotate the latch arm in the opposite direction to actuate the blade to its first position and reload the spring.

7. In a switch, in combination, a rotatable shaft, a switch blade actuated by the shaft to open and closed positions, a spring assembly, a lever arm having one end secured to the shaft, a pin connecting the other end of the lever arm to the spring assembly, a rotatable sleeve surrounding the shaft, a latch arm secured to the sleeve and rotatable about the shaft, a primary latch carried by the latch arm and engaging the pin to load the spring, tripping means for disengaging the primary latch from the pin to release the spring and actuate the blade from one of said positions to the other, a spring biased secondary latch for engaging said pin to retain the blade in said other position, and manually operable means connected to the sleeve for first rotating the latch arm in one direction to disengage the secondary latch from the pin and engage the primary latch on the pin and then in the opposite direction to actuate the blade to its first position and reload the spring at the same time.

8. In a switch, a stationary contact member, a rotatable shaft, a movable switch blade secured to the shaft and

engageable with the stationary contact member, energy-storing means for moving the switch blade toward the stationary contact, a releasable device controlling operation of the energy-storing means, a remotely-controlled device operable to actuate said releasable device and release energy of the energy-storing means to rotate the shaft and move the switch blade to engage the stationary contact, a second releasable device for holding said switch blade in engagement with the stationary contact and opposing rebound therefrom at the end of its movement toward the stationary contact, and an operating member for opening the switch blade and resetting the first said releasable device with the same direction.

9. In a switch, a stationary contact member, a rotatable shaft, a movable switch blade secured to the shaft and engageable with the stationary contact member, energy-storing means for moving the switch blade toward the stationary contact, a releasable device controlling operation of the energy-storing means, a remotely-controlled device operable to actuate said releasable device and release energy of the energy-storing means to rotate the shaft and move the switch blade to engage the stationary contact, a second releasable device for holding said switch blade in engagement with the stationary contact and opposing rebound therefrom at the end of its movement toward the stationary contact, and resetting means operable first in one direction to release said second releasable device and then in the opposite direction to reset the first said releasable device.

10. In a switch, a stationary contact member, a rotatable shaft, a switch blade secured to the shaft and movable into and out of engagement with the stationary contact member, energy-storing means for moving said switch blade, a releasable device controlling operation of the energy-storing means, a remotely-controlled device operable to actuate said releasable device and release energy of the energy-storing means to rotate the shaft and move the switch blade, a second releasable device for holding the switch blade at the end of its movement, and an operating member for opening the switch blade and loading the energy-storing means and resetting the first said releasable device with one operation.

11. In a switch, a stationary contact member, a rotatable shaft, a switch blade secured to the shaft and movable into and out of engagement with the stationary contact member, energy-storing means for moving said switch blade, a releasable device controlling operation of the energy-storing means, a remotely-controlled device operable to actuate said releasable device and release energy of the energy-storing means to rotate the shaft and move the switch blade, a second releasable device for holding the switch blade at the end of its movement, and an operating member movable first in one direction to release said second releasable device and then movable in the opposite direction to load the energy-storing means and reset the first said releasable device.

12. In a switch, in combination, a rotatable shaft, a switch blade actuated by rotation of the shaft to open and closed positions, energy-storing means for rotating the shaft, a releasable device controlling operation of the energy-storing means, a remotely-controlled device operable to actuate said releasable device and release energy of the energy-storing means to rotate the shaft to actuate the blade to the closed position, a second releasable device for retaining the blade in the closed position and opposing rebound therefrom, and an operating member for opening the switch blade and resetting the first said releasable device at the same time.

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