Oct. 26, 1943. F. S. GREEN 2,332,633

ENCLOSED SWITCH

Filed Aug. 5, 1940 3 Sheets-Sheet 1

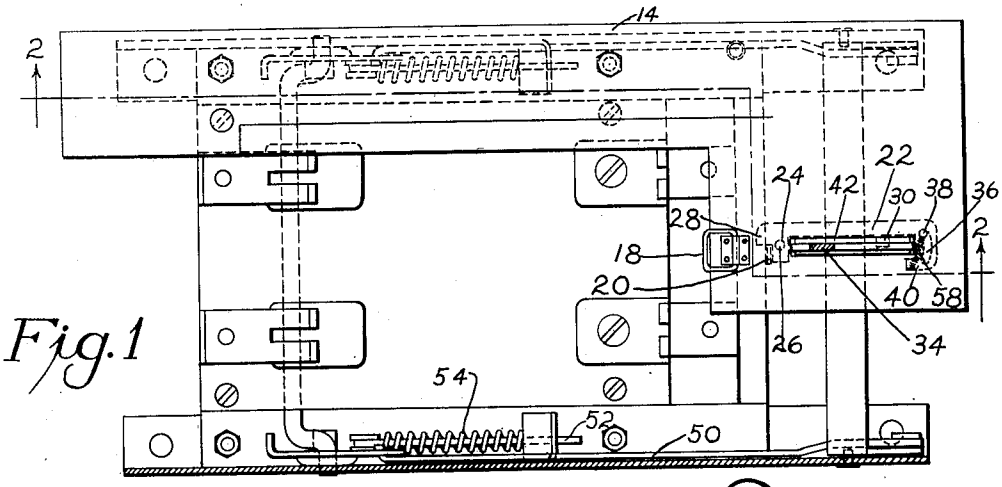


Fig. 1

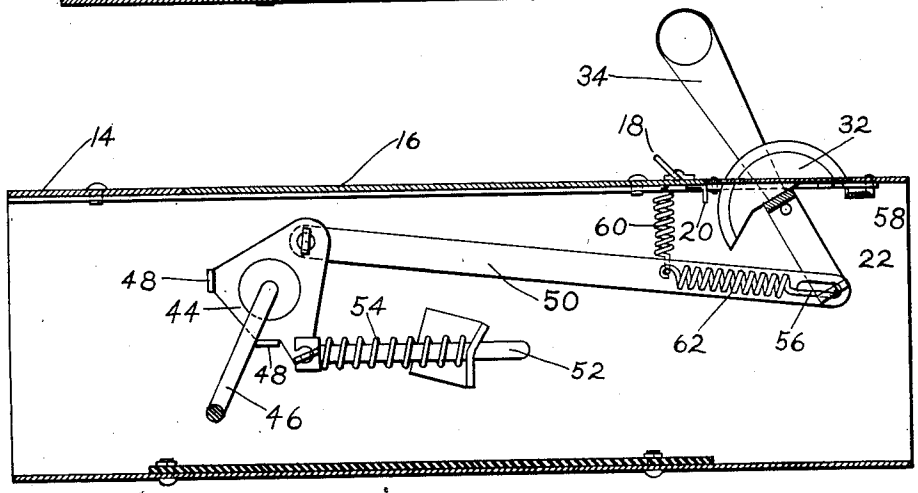


Fig. 2

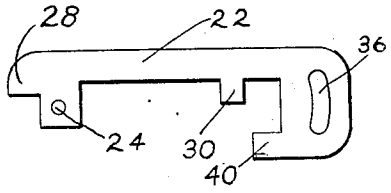


Fig. 3A

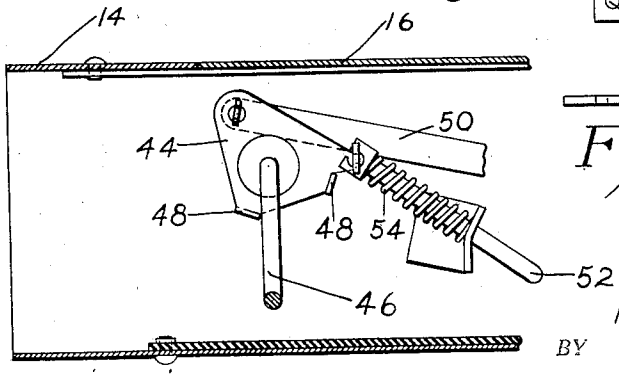


Fig. 4

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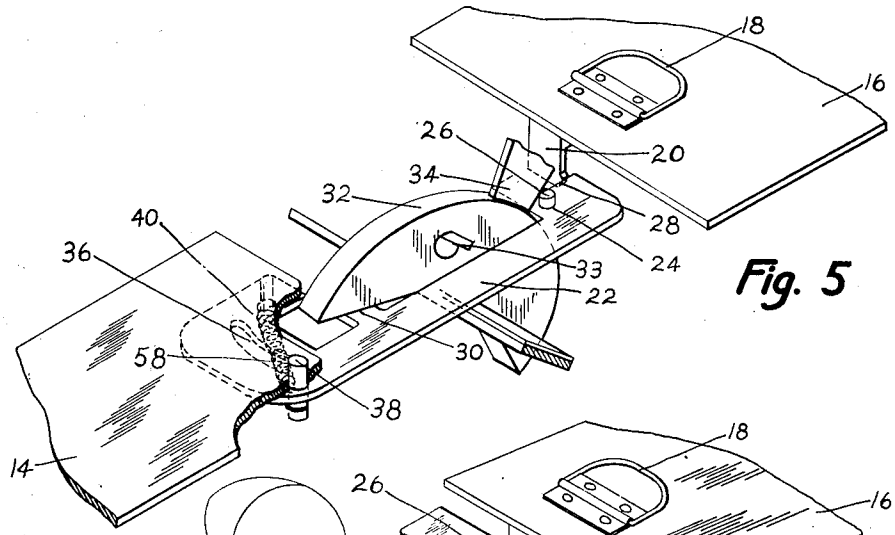


Fig. 5

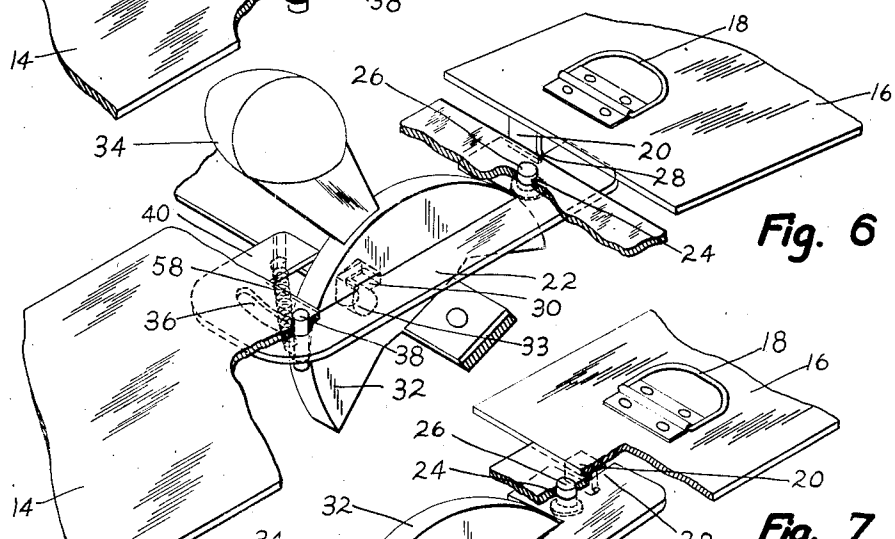


Fig. 6

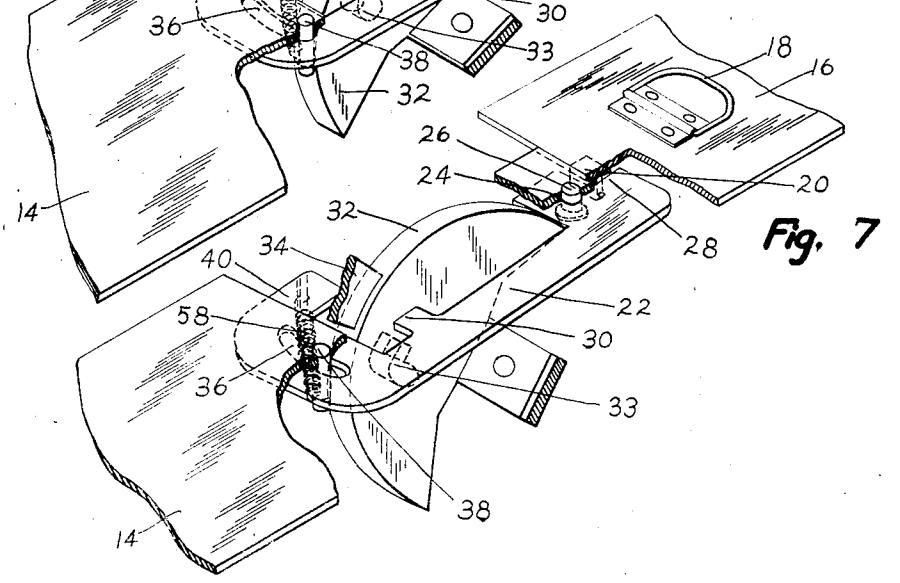


Fig. 7

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ENCLOSED SWITCH

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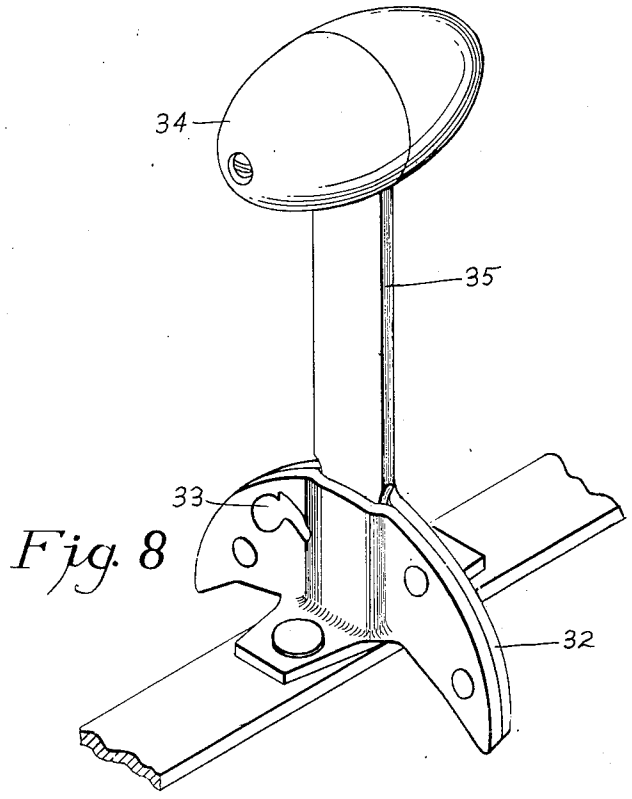


Fig. 8

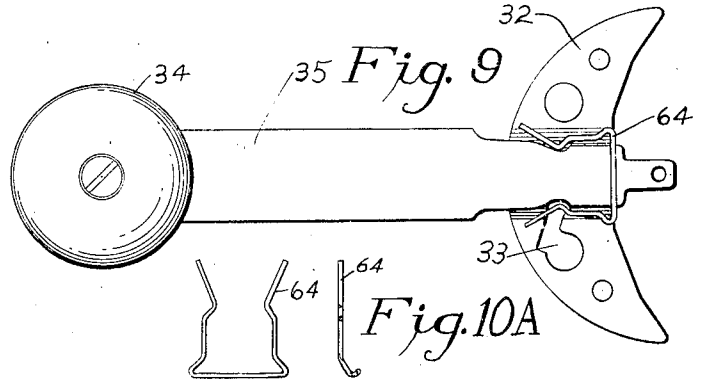


Fig. 9

Fig. 10A

Fig. 10

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Patented Oct. 26, 1943

2,332,633

UNITED STATES PATENT OFFICE

2,332,633

ENCLOSED SWITCH

Floyd S. Green, St. Louis, Mo., assignor to Frank Adam Electric Company, St. Louis, Mo., a corporation of Missouri

Application August 5, 1940, Serial No. 351,522

9 Claims. (Cl. 200—50)

This invention relates to improvements in enclosed switches. More particularly, the invention relates to improvements in safety devices used on enclosed switches. It is an object of the invention to provide simple but positive acting safety devices for enclosed switches.

It has been found by the manufacturers of enclosed type switches, to be advantageous to provide a quick make and break mechanism for circuit making and breaking devices. The provision of quick make and break for such devices, prevents the holding of arcs between the contacts when the circuit is opened or closed. Arcing between the contacts causes burning thereof which materially decreases the efficiency of the electrical connection made by the switch. The burning also shortens the life of the contacts and decreases the effective life of the switch. The quick make and break mechanisms which have been used are of various types. A commonly used type of quick make and break operating mechanism for switches utilizes what is known as the over-center spring. There are various arrangements of this type some employing the spring in tension and some in compression. Such operating mechanisms usually have a dead center position when the spring is either fully compressed or tensioned. This makes a quick make or break in the circuit and saves the contacts from burning. An objection to the use of the quick make and break mechanisms, which have a dead center position, is that the switch sometimes gets set on dead center. In such cases the handle is not completely in the full "on" or "off" position, and the operator cannot be sure that the switch is either "on" or "off." In vertically mounted switches it often happens that the lower position of the handle indicates that the switch is off. If there is any play in the handle mechanism when the switch is in the dead center position the handle will fall to the "off" position even though the switch may be closed. This is obviously a dangerous situation which can give rise to numerous accidents. The applicant avoids such situations by providing means to move the handle into the "on" position when the switch is in the dead center position. As a result of this improvement, the operator will believe the switch is "on" whenever it is on dead center. Since the handle indicates that the circuit is made, the operator will act as though it were and will be careful to avoid shocks.

In enclosed type switches, the manufacturers try to avoid accidents to laymen who work around the switches by locking the door to the switch-box whenever the circuit is made. This prevents contact with the electrified parts of the switches when the circuit is made. It is, however, sometimes desirable for the purpose of inspection, to open the door of the switch-box when the circuit is made. It is, therefore, necessary to provide a locking arrangement which will prevent the opening of the switch door at all ordinary times when the switch is on, but will let the door be opened for purposes of testing and inspection. Such a locking arrangement, to effectuate the object for which it is intended, should be so designed that a person could not open the door while the switch is "on" unless he were shown how it can be done. By showing only electrical inspectors how to open the switch-box when the circuit is "on," the manufacturers would be assured that laymen would be very unlikely to contact electrified parts of the switch. Some of the switches now in use have provided means to do this, but these means are complicated and require the inspector either to have a special tool to open the box, or to insert his hands in the box. This is bothersome and dangerous. The applicant has provided a locking arrangement which precludes opening of the switch door by laymen when the circuit is "on," which will, by an adjustment of the switch handle, permit the door to be opened for inspection even when the circuit is made. This prevents any accidental shocking of laymen, since the box cannot be opened without knowledge of its operation.

In enclosed type switches which have a switch handle extending from the front of the box, it is difficult to ship them efficiently since the handle projects out from the front of the box. This will not permit the boxes to be piled closely together for shipment, and a pile of switches with handles already installed takes much more room than one in which the switches are shipped without the handles being installed. The applicant avoids this objection by providing a handle which may be shipped with the box and assembled merely by inserting it in the front of the box. This permits the box to be shipped economically and yet avoids expensive assembly charges for the user.

Other objects and advantages will be shown and described in the drawings and accompanying description.

In the drawings and accompanying description, a preferred embodiment of the invention is shown and described, but it is to be understood that the drawings and accompanying description do not limit the invention and that the invention will be defined by the accompanying claims.

In the drawings,

Fig. 1 is a plan view of an enclosed type circuit breaker which is equipped with the features detailed in the accompanying description.

Fig. 2 is a cross section of the enclosed switch taken along the plane 2—2 indicated in Fig. 1.

Figs. 3A and 3 are enlarged views of the door-locking member showing a plan and elevation view of said member.

Fig. 4 is a side view of the switch operating mechanism in the "on" position.

Fig. 5 is a view of a broken section of the enclosed switch-box and shows the arrangement and position of the locking means when the handle is in the "off" position.

Fig. 6 is a view of a broken section of the enclosed switch-box and shows the arrangement and position of the locking means when the parts of the switch cooperate to permit opening of the door while the switch is "on."

Fig. 7 is a view of a broken section of the enclosed switch-box and shows the arrangement and position of the locking means when the handle is in the "on" position.

Fig. 8 is a perspective view of an optional form of handle and rotatable member assembly to be used with an enclosed type switch.

Fig. 9 is a partial cross sectional view of the handle and rotatable member shown in Fig. 8, and

Figs. 10 and 10A are side and end views of a spring used to secure the handle to the rotatable member.

Referring to the drawings in detail, the switch-box is denoted by the numeral **14** and has a door which is denoted by the numeral **16**. The switch door **16** has a hasp **18** attached to it which permits the operator to open the door manually. Also attached to the door **16** is a locking catch **20** which engages the locking member **22**. The locking member **22** has a hole **24**, through which a pin **26** extends, and around which the member **22** rotates. The locking member **22** has a locking projection **28** thereon which cooperates with the door-locking catch **20** to prevent the opening of the door. A projection **30** extends from the side of locking member **22** and engages the rotatable member **32** connected to the handle **34**. A curved opening **36** in the locking member **22** cooperates with a pin **38** to permit limited rotation of the locking member **22**. A projection **40** on the locking member **22** rotates with the locking member **22** and serves to clear or to obstruct the opening **42** in the cover of the switch-box.

In the quick-make and break operating mechanism **44** is a pivoted oscillating member. A switch operating bar or lever **46** is struck by turned out portions **48** on the pivoted oscillating member **44**. The pivoted oscillating member is actuated by bar **50** which extends from the operating handle and is rotatably secured to the pivoted oscillating member. A spring **54** is carried on a guide rod **52**. When the rod **52** is aligned with the pivot of the oscillating member and its point of connection with the oscillating member the spring is compressed to its maximum and the oscillating member is in a dead-center position. Slight movement from this position causes the spring to bias the oscillating member away from this position. The lever **50** has a slot **56** with which the lower end of the handle **34** cooperates. The switch mechanism is provided with a number of springs. A spring **58** connects the locking member **22** with the pin **38** and tends to cause the rotation of the locking member into the "off" position. A spring **60** is connected to the switch-box and to the lever **50** and tends to urge the switch into the "on" position. Another spring **62** connected to the lever **50** and the end of handle **32** tends to hold the handle in the "on" position.

An optional form of handle design is shown, by use of which the handle may be shipped separate from the switch-box, and may be inserted in the box when the box is to be used. A spring **64** is set in the rotatable member **32** and holds the optional form of handle **35** so that it cannot slip out. By use of this device, the switches can be shipped economically without wasting space and assembled without inconvenience to the purchaser.

When the box is shipped to the consumer, he need only insert the handle into the rotatable member to put the box in operating condition. When the handle is moved into the "on" position, the member **32** moves the bar or lever **50** which rotates the oscillating member **44** to compress spring **54**. When the oscillating member is carried beyond the dead-center position, the spring **54** is released and quickly rotates the oscillating member **44**. Slots **56** in bar **50** allow movement of the oscillating member independently of the handle, so that the projections **48** strike the switch operating bar **46** to snap the switch into the "on" position. This provides a means to quickly make the circuit and avoid the many objections to slow circuit-making. The rotation of the rotatable member **32** into the "on" position moves it into the path of projection **30** on the locking member **22**. This prevents the opening of the switch door **16** since, to open the door **16**, the locking member **22** must rotate and release the door catch **20**. Since the switch door **16** cannot be opened when the switch is in this position, the operator is protected against shocks of an accidental nature.

It sometimes is desirable to open the door of the enclosed switch-box when the switch is in the "on" position, for the purposes of testing or inspection. In many of the boxes now in use, the door can be opened while the switch is in the "on" position, but the operator is required either to insert a tool or his fingers into the box. The insertion of a tool or a finger into the switch-box renders the operator subject to shock, and this makes the job of testing and inspecting switch-boxes a dangerous one. The invention provides a way of opening the switch-box door by proper manipulation of the handle and does not require the operator to insert anything into the box. This provides a very safe way of opening the door for the purposes of inspection. The operator only needs to grip the hasp on the box with one hand and to rotate the handle with the other. The rotation of the handle causes the rotating member **32** to move a short distance toward the "off" position and open a path for the projection **30** on the locking member **22**. The projection **30** can move into the opening **33** in the rotatable member **32**, and such movement of projection **30** causes the rotation of locking member **22** and permits the opening of switch door **16**. While the switch handle is in this position, the door may be opened or closed freely. There is little or no danger, however, of people accidentally opening the door while the switch is "on," since the handle is urged into the full "on" position by the spring **62**, and in that position the

door cannot be opened. In order to open the door, the operator must overcome the pull of the spring **62** and hold the handle stationary in the proper position. In addition, the opening **33** in the rotatable member **32** is made small and conforms to the shape of projection **30** on the locking member **22**. This permits the door to be opened at only one position of the handle when the switch is "on," and prevents the opening of the door at all other positions except the "off" position. When the handle is in the "off" position, the rotatable member **32** is in the position shown in Fig. 5. The projection **40** on the locking member **22** is free to move across the opening **42** in the switch-box cover under the influence of the spring **58**. While the projection **40** is across the opening **42**, the handle cannot be rotated into the "on" position, since rotation of the rotatable member **32** is prevented by the projection **40**. This is an additional safety feature since the operator cannot turn on the switch while the switch door is open. The operator, therefore, cannot electrify the parts of the switch while he is working on the box and is protected from accidental shocks. When the locking member **22** is in the "off" position, the projection **28** is rotated so that it does not obstruct the door catch **20**. This permits the door **16** to be opened and closed freely. By use of this type of locking member, a switch-box is provided which cannot be opened when the switch is in the full "on" position, which can be opened by proper manipulation of the handle when the switch is in the "on" position, and which can be freely opened and closed when the switch is in the "off" position.

Another feature of the invention is the means which keeps the handle in the "on" position whenever the oscillating member is in the dead center position. In circuit breaker boxes now in use which employ a dead center snap-acting mechanism, the handle can drop down near the "off" position when the oscillating member is in the dead center position. This is dangerous since it indicates that the switch is "off" even though it may be "on." Because the handle indicates that the switch is "off," the operator may work on sub-panels and distribution boxes and be shocked. This is very dangerous and has been objected to by various organizations. The aplicant has devised a means to move the handle into the "on" position whenever the switch is on dead center. This warns the operator and prevents his believing that the switch is "off" when the circuit is made. The means is simple and consists of a spring **62** that is connected to **50** and the handle **34** and urges the handle into the "on" position.

Whereas I have described a preferred embodiment of my invention, it is obvious to those skilled in the art that various changes and alterations may be made in the form of the invention without altering its scope.

It can be seen from the above, that by use of the present invention, a switch-box is provided which safeguards the operator from shocks and electrical accidents.

What I claim is:

1. In an enclosed type switch, a switch-box having an opening therethrough, a switch-operating mechanism located in the switch-box comprising a bail having a handle receptacle attached thereto, a spring in the handle receptacle, and a handle, said handle being adapted to be inserted through the opening in the switch-box into the handle receptacle and tightly held by a spring mounted therein, said spring and said handle receptacle being arranged to lock the handle in engagement with the handle receptacle and prevent the disengagement of the handle and the handle receptacle under most conditions.

2. In a switch-operating mechanism, the combination of a switch-box, a bail having a handle receptacle attached thereto, a handle adapted to be installed in the switch-operating mechanism by insertion in the handle receptacle, and means to automatically hold the handle upon its insertion in the handle receptacle, and prevent the disengagement of the handle and the handle receptacle under most conditions.

3. In a quick make and break operating mechanism for switches, a pivoted oscillating member adapted to bring about actuation of an electric switch, an over-center spring biasing said oscillating member to both "on" and "off" positions, said spring causing a dead-center position of the oscillating member when it is under maximum stress, a handle effective to rotate the oscillating member and a means biasing the handle to "on" position when the oscillating member is in dead-center position.

4. In an enclosed type switch a quick make and break operating mechanism comprising a switch operating bar, a pivoted oscillating member arranged to actuate said bar, means to operate said oscillating member into "on" and "off" position, an over-center spring biasing said oscillating member into both "off" and "on" position, said spring causing the oscillating member to assume a dead-center position when it is under maximum stress and means to indicate that the switch is "on" when the oscillating member is in the dead-center position.

5. A switch operating mechanism comprising a switch operating bar, a pivoted oscillating member arranged to actuate said bar, an operating handle, a lost-motion connection between the handle and the oscillating member, an over-center spring biasing the oscillating member to both "on" and "off" position and means biasing the handle to the "on" position.

6. In an enclosed type switch, an enclosing box, an electric switch in said box, a door in the box, a catch on the door, a locking member pivotally supported from the box, one end of said locking member engaging the catch, means biasing the locking member to rotate said end against the catch, a handle pivotally supported from the box and movable to an "off" and "on" position and effective to actuate the electric switch, a disc rotatable with the handle, a projection on the other end of the locking member adapted to move under the disc to prevent its rotation when opening of the door moves the catch out of the path of the first named end of the locking member, a projection on the catch adapted to cause movement of the locking member whenever the door is opened or closed, a projection on the locking member engaging the side of the disc and arranged to prevent movement of the locking member, a recess in the disc adapted to allow entrance of the projection on the locking member and thus allow movement of the locking member when the switch handle and rotatable disc are in a predetermined position.

7. In an enclosed type switch, an enclosing box, an electric switch therein, a door in said box, a catch on the door, a locking member pivotally supported from the box, one end of said locking member engaging the catch, means biasing

the locking member to rotate said end against the catch, a handle pivotally supported from the box and movable to an "on" and "off" position and effective to actuate the electric switch, a semi-circular disc rotatable with the handle in a plane perpendicular to the face of the box, a projection on the other end of the locking member adapted to move under the disc and prevent movement of the handle to the "on" position when the door is opened and the catch is moved out of the path of the first named end of the locking member, a projection on the door catch adapted to cause movement of the locking member whenever the door is opened or closed, a projection on the locking member engaging the side of the disc and arranged to prevent movement of the locking member and thus opening of the door.

8. In an enclosed type switch, a switch box, a switch, an operating bail for said switch, a pivoted oscillating member provided with projections thereon to strike opposite sides of the operating bail, a bar having one end rotatably secured to said oscillating member and having the other end slotted, a handle, a connection between the handle and the slotted portion of the bar allowing lost motion therebetween, an over-center spring biasing the oscillating member in both "off" and "on" positions and means biasing the handle in the "on" position.

9. In an enclosed type switch, an enclosing box, an electric switch therein, a switch operating mechanism located in the switch box comprising a bail and a handle receptacle attached thereto, a spring in the handle receptacle, and a handle adapted to have one end inserted into the handle receptacle, said spring and said handle receptacle being arranged to lock the handle in the receptacle and prevent the removal of the handle under most conditions.

FLOYD S. GREEN.