

June 14, 1932.

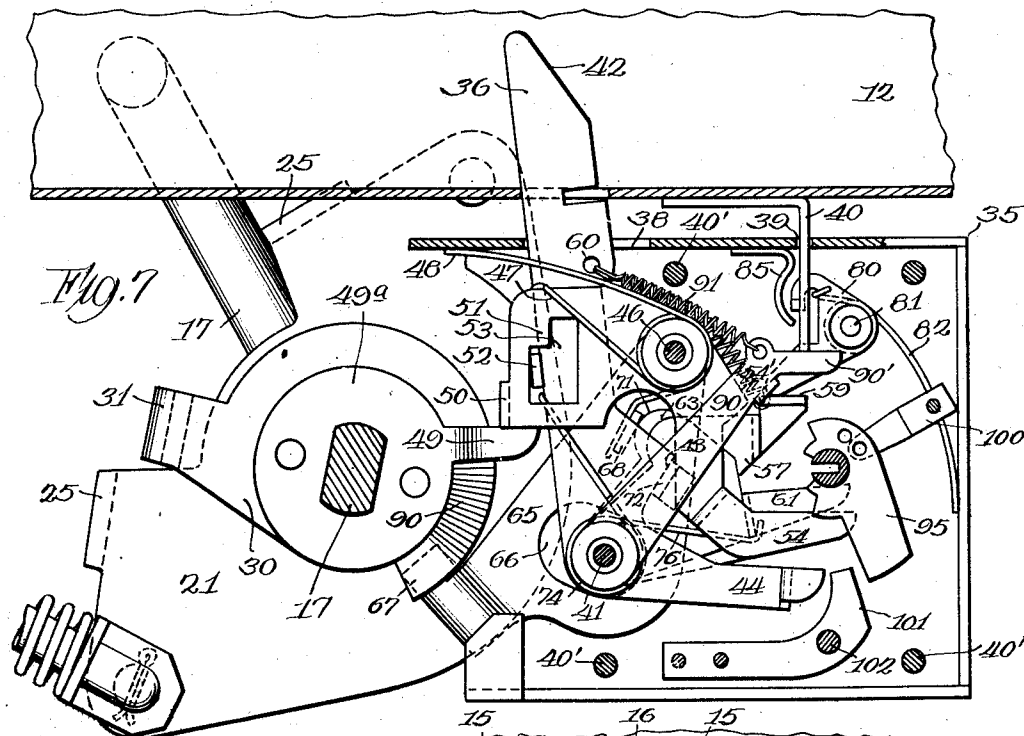
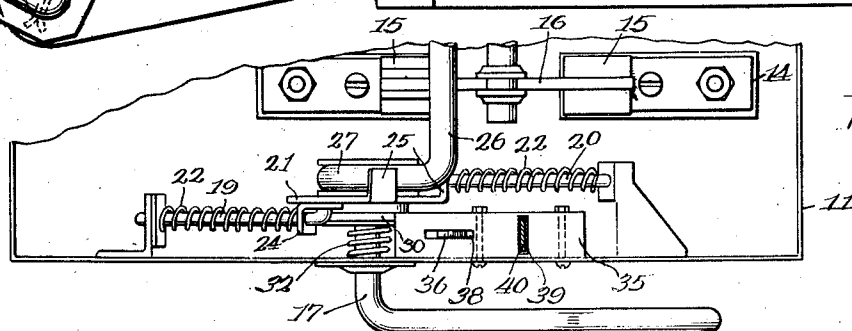
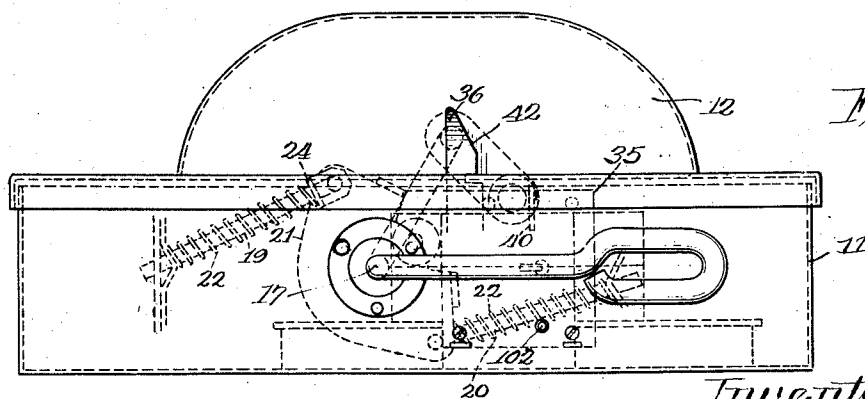
T. J. KAUFFMAN ET AL

1,863,224

ELECTRICAL SWITCH

Filed Jan. 28, 1925

5 Sheets-Sheet 1



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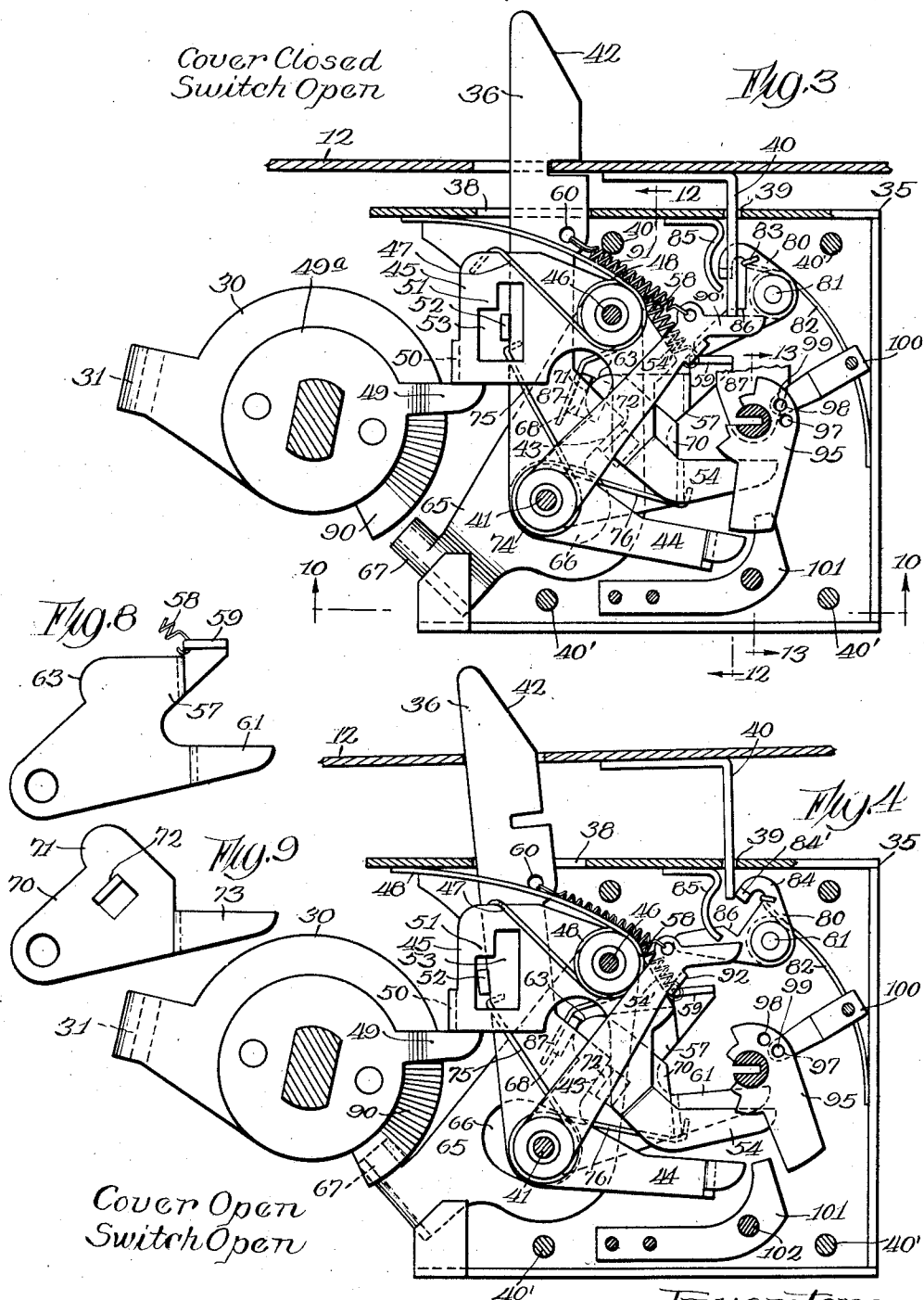
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ELECTRICAL SWITCH

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5 Sheets-Sheet 2



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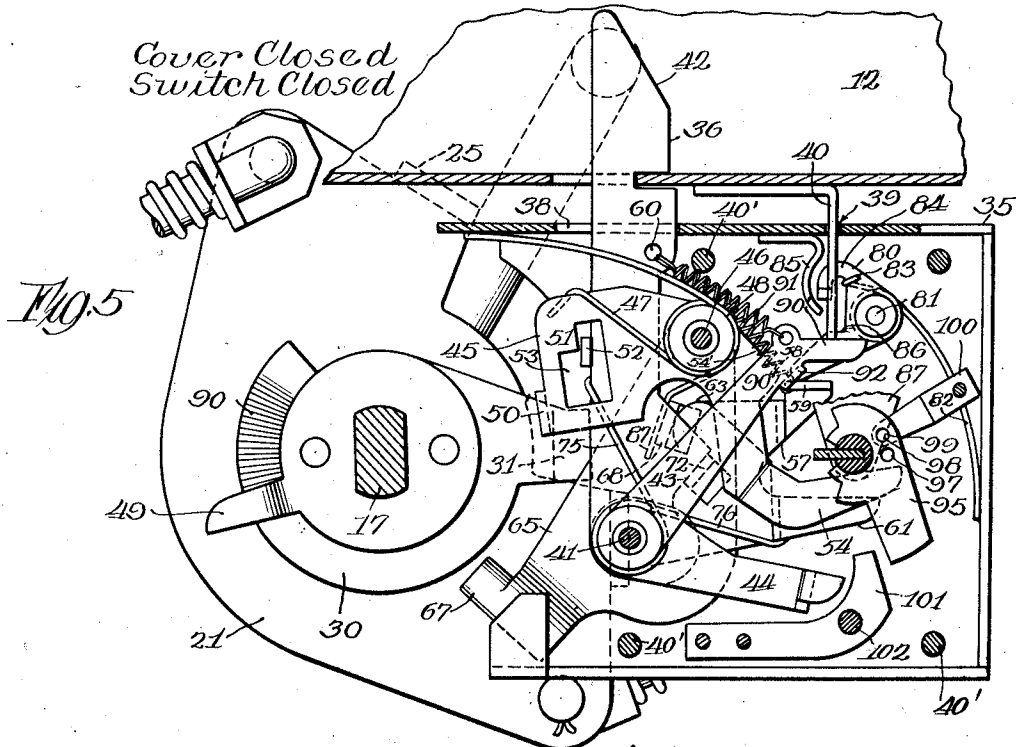
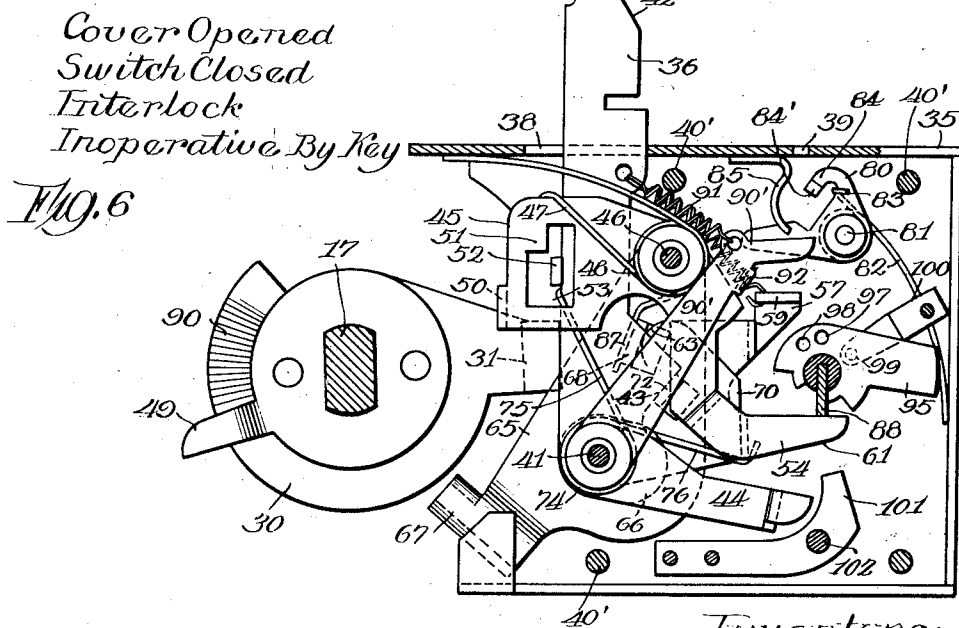
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ELECTRICAL SWITCH

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1,863,224

ELECTRICAL SWITCH

Filed Jan. 28, 1925

5 Sheets-Sheet 4

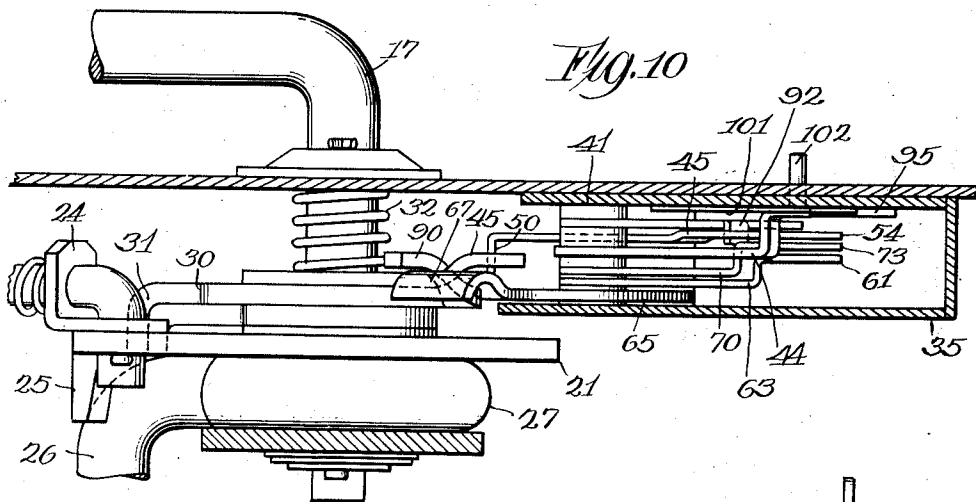
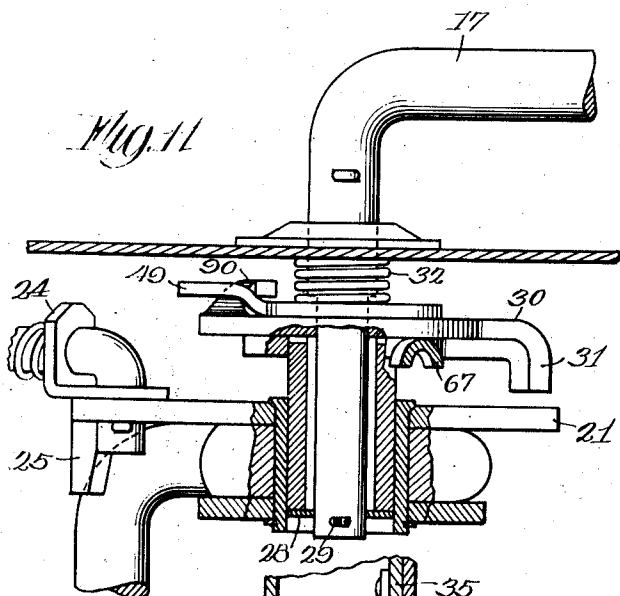
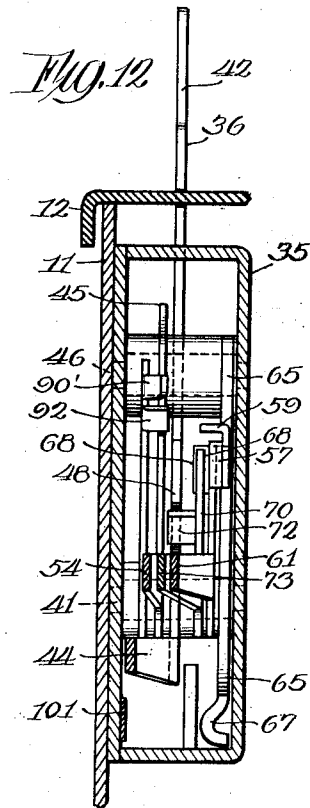
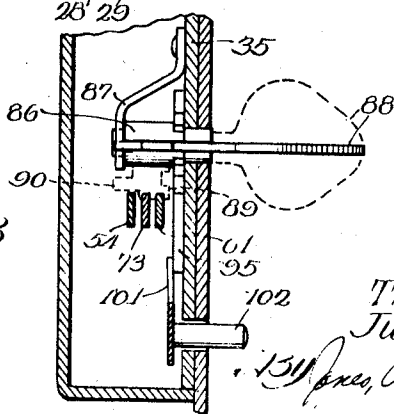


Fig. 13



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T. J. KAUFFMAN ET AL

1,863,224

ELECTRICAL SWITCH

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5 Sheets-Sheet 5

Fig. 14

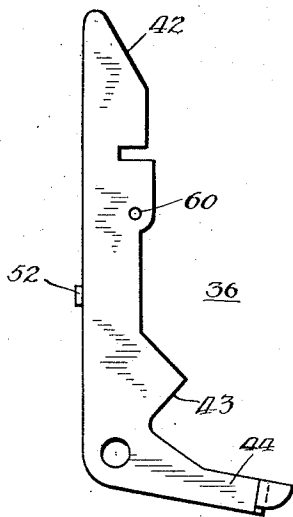


Fig. 15

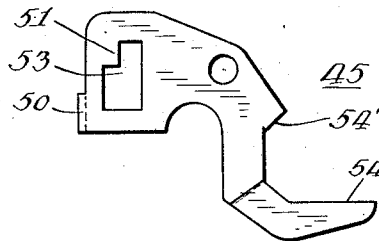


Fig. 16

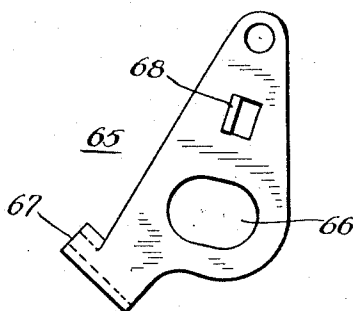
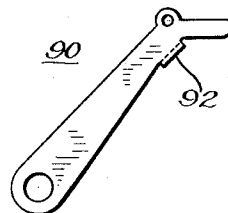


Fig. 17



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UNITED STATES PATENT OFFICE

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ELECTRICAL SWITCH

Application filed January 28, 1925. Serial No. 5,324.

Our invention relates to electrical switches and more particularly to the type known as the "safety" or "cover interlocking switch" wherein an interlock is provided so that the cover can not be opened while the switch is closed, nor the switch closed while the cover is open.

The trend of development in the electrical art has been to provide iron clad switches, having an external operating handle, with a cover control, in order to minimize the danger of unskilled workmen coming in contact with the switch while it is closed. Although it was early recognized that some such provision must be made, there has been considerable opposition thereto, particularly by those who are interested in continuity of operation of those machines which are controlled by such switches. This diversity of opinion between those interested in the safety of workmen and those interested in the continuity of production has resulted in the adoption of an interlocking mechanism having special provision for disabling the interlock between the cover and the switch operating mechanism whereby the cover may be opened and closed while the switch is closed, by one authorized to have such access to the interior of the switch, this being accomplished by the use of a key which co-operates with the interlocking mechanism to disable the latter temporarily while the necessary inspection or repairs are made. This type of interlocking mechanism capable of temporary disablement by one properly authorized to have possession of a key has been disclosed and broadly claimed by Jules A. Widmer in copending application, Serial Number 505,990, filed October 9, 1921, and further disclosed in copending application Serial Number 505,989, filed October 9, 1921, by Jules A. Widmer and Paul S. Jenkins.

There is, however, further disclosed and broadly claimed in these copending applications a type of interlock wherein disabling means will permit temporary closing of the switch while the cover is open. Those skilled in the art have found that such disablement is as necessary as that of releasing the cover from its interlocking relation while the

switch is closed, for it is frequently desirable, while the cover is opened to open and close the switch to observe the manner in which it is functioning. Disablement of the switch interlock is, however, effected in practically the same manner as the cover. The key provided to release the cover is preferably used to release the switch. Such arrangement simplifies the disabling feature of the switch considerably, as only one key is necessary.

Notwithstanding such precautions as these taken by those who are mainly interested in human safety, manufacturers of electrical switches have found interlocking mechanism permanently disabled because the production men in the factories would not allow the continual opening of the motor circuits, which would be occasioned when it is desired to examine a switch of this character. However, with the introduction of a disabling mechanism in connection with the interlocking mechanism, this difficulty was appreciably reduced, but was still experienced somewhat when the shopmen not in the possession of a key would try to close the switch while the cover would be open. As before explained, the cover may be opened while the switch is open. This feature led to the practice of opening the switch and then opening the cover to gain access to the interior of the switch box. But the workman would soon learn that he could not close the switch while the cover was open and consequently would deliberately apply excessive force against the handle to overcome the interlock.

It has been our experience that interlocking mechanism, while strongly made, will not resist this excessive force. On the other hand, however, in order to be effective from a practical standpoint, a switch having an interlocking mechanism ought to be so designed as to care for any excessive force or abuse by workmen in the shops, and this design ought to be such that should excessive force be applied to close the switch while the cover is open, this force cannot be imparted to the switch operating mechanism to effect a forced closing of the switch, nor to the interlocking mechanism to permit the same to be jammed and rendered permanently disabled. With

the embodiment of such a construction in switches of the safety type, an interlock may be provided which is reliable and sure, and may be furnished to the trade with the assurance that the switch may not be closed while the cover is open, except by authorized persons having a key for operating the disabling mechanism.

Our invention, therefore, has for one of its primary objects to provide an interlocked enclosed switch wherein the interlocking mechanism will normally operate to disconnect the switch handle, projecting exteriorly of the switch enclosure, from the switch operating mechanism, each time the cover is opened. The disengaging handle serves to disconnect the switch operating mechanism and is capable of freely rotating about its axis so that it can not engage either the switch or any part of the interlocking mechanism in a manner to cause jamming of the latter. That is to say, by disengaging the switch handle when the cover is open to prevent closing of this switch, no excessive strain may be imparted to the interlocking mechanism to effect a forced release of the switch by forcing the handle to closed position while the cover is open. Unauthorized workmen can not apply excessive force against the handle, because the handle is permitted to rotate freely, and has no physical engagement with the switch, nor such engagement with the interlocking mechanism as to impart any strain upon its members.

It is apparent that we have obtained certain advantages from the manufacturing standpoint, inasmuch as the absence of strain upon the members of the interlocking mechanism at a time when a forced release of the switch is attempted will permit a simpler and lighter mechanism to be used. Due to the independent action between the interlock and the toggle rod of the quick make and break mechanism, which is usually employed as part of what I term the switch operating mechanism, and also to the varying amount of lost motion, we have found that the interlocking action in the present case is more dependable and that larger manufacturing variations may be allowed for the different parts thereof. This effects a considerable saving in labor and expense.

We do not, of course, intend that such a provision contemplates the omission of the key disabling feature included in the above mentioned co-pending applications. Our invention also provides means whereby the interlock feature will be disabled temporarily, and further, it provides means whereby the interlocking mechanism will be temporarily disabled to prevent the switch handle from disengaging the switch operating mechanism, so that the switch may be closed while the cover is open. As before, this provision permits an authorized person provided with a

key to disable the switch interlock so that the switch may be closed while the cover is open. The disabling mechanism serves to prevent the interlocking mechanism from disengaging the switch handle from the switch operating mechanism, and this key being provided of particular design will keep those not authorized to carry a key from closing the switch while the cover is open and opening the cover while the switch is closed.

Many other features of advantage are incident to the embodiment of our improved interlocking mechanism in an enclosed switch, but these will be better understood from the hereafter description read in connection with the accompanying drawings; in which,

Figure 1 is a front elevational view of a portion of an enclosed switch embodying our invention, the cover of the switch box being partly broken away to show the relation of the interlocking mechanism to the main structure of the switch, and the switch here being shown as mounted on a wall which is, of course, the position in which such switches are usually employed;

Fig. 2 is a side elevational view, at a reduced scale, of the switch shown in Fig. 1;

Fig. 3 is a side elevational view of the interlocking mechanism, the side wall of the switch box being omitted and the interlocking housing being shown in section to disclose clearly the interlocking elements, only that portion of the switch operating mechanism which cooperates directly with the interlocking mechanism being shown.

In this figure, the interlocking elements are position as they are when the cover is closed and the switch is open;

Fig. 4 shows the interlocking elements as they appear when the cover is open and the switch is open;

Fig. 5 illustrates the position of the interlocking elements when both the cover and the switch are closed;

Fig. 6 illustrates the interlocking elements as rendered inoperative by a key, the switch being closed with the cover in open position;

Fig. 7 illustrates the manner of preventing a fraudulent disabling of the interlock, by disengaging the switch handle whenever the cover latch is in open position, so that it is impossible with the cover closed to hold this latch in open position and thereby secure a closing of the switch and thereafter an opening of the cover with the switch closed;

Fig. 8 is a detail view of the switch locking member;

Fig. 9 is a similar detail view of an intermediate lever forming part of the interlocking mechanism;

Fig. 10 is a detail sectional view taken on line 10-10 of Fig. 3 looking in the direction of the arrows to illustrate the manner in

which the interlocking mechanism functions to disengage the switch operating handle when the switch cover of the switch box is open;

Fig. 11 is a similar detail view, showing the switch handle totally disengaged from the switch operating mechanism;

Fig. 12 is a sectional view taken on line 12—12 of Fig. 3;

Fig. 13 is a sectional view taken on line 13—13 of Fig. 3, illustrating the disabling mechanism and the manner of preventing accidental locking of the cover latch;

Fig. 14 is a detail view of a cover latch;

Fig. 15 is a detail view of a cover locking member;

Fig. 16 is a detail view of a handle-disengaging cam member; and

Fig. 17 is a detail view of a member adapted to hold the cover locking member in unlatching position under predetermined conditions.

For the sake of convenience, we have illustrated our invention as embodied in a switch of the character described in a co-pending application of Albert P. Ball, Serial No. 614,055, filed January 22, 1923, covering electrical switches, and assigned to the Square D Company.

Although, we have utilized this particular structure to illustrate the manner in which our invention may be utilized and have shown the lost motion plate of the quick make and break toggle mechanism as being operatively associated with the interlocking mechanism, we do not contemplate limiting ourselves to any type of switch, but, on the other hand, intend embodying it as a unit in switches now in use, or in different styles of switches at a later date. Hence, insofar as the broad aspects of the invention are concerned, the showing of the lost motion plate cooperating with the interlock and in fact the showing of the interlocking aggregate as part of this switch is, of course, illustrative. The interlocking mechanism is an aggregate capable of unitary embodiment in a switch box. Its connection or operative association with the switch is through certain interlocking engagements between the lost motion plate and cooperating parts thereof, so that we are advantageously allowed larger manufacturing variations for these different parts of the interlock aggregate and save considerable in labor and other costs.

Referring now more particularly to the drawings, a switch box 11 is provided with a hinge cover 12. Disposed in the interior of the box 11 is a plurality of unitary insulation mounting bases 14 which are preferably secured to the back of the box. On these unitary bases are mounted switch clip contacts 15, which are bridged by a movable contact 16, the latter being opened by a switch operating handle 17, which extends exteriorly of

the switch box. In this disclosure we show a quick make and break mechanism for opening and closing a switch. A pair of toggle rods 19 and 20 are disposed on opposite sides of the operating handle 17, being connected at their inner ends to a lost motion plate 21 and at their outer ends to apertured lugs secured to one side of the switch box 11. These toggle rods have springs 22 encircling the same for compression and extension at various predetermined times during the opening and closing movements of the switch. The lost motion plate 21 moves the toggle rods 19 and 20 from one side to the other of their dead center position, and thereby compresses the springs 22 between lugs 24 on the plate 21 and the apertured lugs fixed on the side of the switch box 11. It will be noted that the lost motion plate 21 is provided with a pair of spaced right angular lugs 25 which alternately engage the bail portion 26 of the switch operating handle for opening and closing the movable contact 16. The lower end of a right angular bend 27 of the bail member 26 is formed circular to loosely surround the horizontal portion of the switch operating member 17, lying within the switch box 11. Lost motion plate 21 is also loosely placed upon the inner end of the switch operating handle, but is prevented from being displaced therefrom by a washer 28, which is held upon the handle by a cotter pin 29.

A plate 30 is fixed upon this inner end of switch operating handle 17, and is provided with a laterally bent lug 31 adapted during normal operation of the switch alternately to engage the lugs 25 on the lost motion plate 21. Plate 30 is fixed to the operating handle so that both relative rotation and longitudinal movement are prevented. As will be later explained, the interlocking mechanism functions to cam or laterally shift the plate 30 out of the plane of engagement with the lost motion plate 21, so that the lug 31 is free from striking against either of the lugs 25. Due to its fixed relation, the plate 30, when laterally shifted, causes the operating handle 17 to move axially toward the exterior of the switch box 11. A spiral spring 32 on the switch operating handle between the lost motion plate 30 and the side of the switch box 11 is compressed. Spring 32 normally holds lug 31 in the plane of engagement with the lugs 25, but, as will be later explained, the interlocking mechanism functions to withdraw it to disengaging position, while the switch cover is open. We shall now describe this interlocking mechanism.

As clearly shown in Figs. 1 and 2, a housing 35 which contains interlocking elements, including a cover latch 36, is of such shape that it may be positioned against the wall of the switch box and adjacent to the switch operating handle 17 near the center of the box, thereby holding the cover more securely than

the interlocking mechanism disclosed in the first two of the co-pending applications above mentioned. The interlocking elements are compactly arranged within the housing 35, so that the latter may occupy a negligible amount of space within the box, being preferably disposed between the box and the toggle rod 20. This housing is provided with a perforation 38 through which the cover latch 36 extends, and a perforation 39 through which a cover hasp 40 extends in the operative relation with the elements within the housing when the cover is closed.

In Figs. 3 to 7, inclusive, it will be seen that the housing is provided with an open end, through which is adapted to pass that portion of the switch operating mechanism which is operatively associated with the interlocking elements within the housing. Bolts 40' pass through the wall of the switch box and the housing, and serve to detachably hold the housing in correct position with respect to the elements which are to be interlocked.

Referring more particularly now to Figs. 3 to 7, inclusive, the cover latch 36 is pivotally mounted on a pin 41 which extends transversely between the side walls of housing 35. Cover latch 36 is provided at the upper end with a downwardly sloping edge 42 by means of which the switch box cover forces the cover latch to the left when the cover is closed. The cover latch is normally urged to the right, or into locking position by means of a spring. On one side of its pivotal point, a shoulder 43 is formed along one edge and, on the other side of the pivotal point, a finger 44 extends to permit the cover latch to be permanently locked in the position shown in Fig. 3; in order to thereby permanently lock the cover of the switch box closed. The mechanism for accomplishing this feature will be later explained.

A cover locking member 45 is pivotally mounted on a pin 46, which also extends transversely between the side walls of the housing 35. It is urged to the left or into locking position by one arm 47 of a coil spring 48, the latter being wound around the pivot pin 46. However, the tension of spring 48 is overcome by the engagement of a finger 49, on a disk 49a secured to the plate 30, engaging a right angular projection 50 at the lower end of the upper portion of member 45. This member 45 then moves into the position shown in Fig. 3 and withdraws a shoulder 51 out of the path of movement of lug 52 on cover latch 36. An opening 53 is furnished in this upper portion of member 45, into which opening lug 52 extends, functioning to engage the shoulder 51 in cover locking position to prevent the cover latch from being moved to the left to release the switch box cover. On the other side of the pivotal point, a shoulder 54' may be provided on member 45, while directly below a finger 54 may ex-

tend for cooperating with the aforesaid disabling device to be later described. Cover locking member 45 functions to lock switch box cover closed through engagement with cover latch 36.

A switch locking lever 57, also pivotally mounted on pin 41, is urged upwardly into locking position by a coil spring 58. Spring 58 engages member 57 at its upper end by passing through an aperture in a transverse projection 59, and the opposite end of the spring engages the upper end of cover latch 36 through a hole 60. Cover latching member 36 is held against the tension of the spring 58, or moved into unlocking position, by a downward movement of cover hasp 40 and will always be in unlocking position when the switch box cover is closed. However, the switch locking member 57 is provided with a finger 61 which cooperates with the aforesaid disabling device for moving temporarily to unlocking position without being engaged at 59 through the downward movement of the cover hasp 40. Directly above its pivotal point, a shoulder 63 is provided. Switch locking member 57 functions to lock the switch in open position through a handle disengaging cam member 65, which is adapted to be engaged by shoulder 63.

Cam member 65 is mounted on the pivot pin 46, adjacent one side of the housing 35, as is illustrated in Fig. 12 and is provided with an elongated slot 66 through which pivot pin 41 may extend. A curved lug 67 is formed integrally on the cam lever, and, above this lug, a right angular projection 68 is secured, for engagement with shoulder 63 on switch locking member 57. Cam lever 65 is engaged by switch locking lever 57 and moved into camming or locking position as the cover is opened. It is held from lateral movement by being pressed against the side wall of casing 35 when camming the switch handle 17 out of engagement with the switch. More specifically it functions to shift this handle 17 out of the plane of engagement with the toggle mechanism by laterally shifting lug 31 free from engagement with the lugs 25 on the lost motion plate 21.

An intermediate lever 70 is pivoted on the pin 41 and is furnished with a shoulder 71 (see Fig. 9) adapted to engage with lug 68 on the cam lever 65. A lug 72 is provided on one side to engage shoulder 43 on cover latch 36. A finger 73 is furnished for engagement with the aforesaid disabling device. A strong spring 74 encircling pivot pin 41 serves to hold the cover latch 36 and intermediate lever 70 in engagement with each other, one arm 75 of the spring engaging the cover latch and the other arm 76 engaging the intermediate lever. With the shoulder 71 engaging the lug 68 on the cam member 65 and the lug 72 engaging the shoulder 43 on the cover latch, it will be noted that the

intermediate lever will move the cam member upwardly to disengage the switch handle when the cover latch 36 is moved to the left. The reason for this is to prevent a person from holding the cover latch at the left, while the switch cover is closed to permit the switch to close, and therefore attempting to open the cover in order to get access to the switch in its closed position.

10 A member 80 functions both as a protective cam at certain times during the operation of the switch and as a controlling member for the switch locking member 57. This member 80 is pivotally mounted on a pin 81 and is normally urged into the position of Fig. 4 15 by the action of a coiled spring 82, one arm 83 of which engages around a portion 84 of the member 80. This member is also provided with a portion 84' which is positioned directly beneath the aperture 39, through which the hasp 40 enters the housing 35. A guard member 85 is positioned as shown.

Referring now to Fig. 13, it will be noted that a key cylinder 86 is supported between 25 a bracket 87 and the front wall of the housing 35, this cylinder being adapted to receive and turn with a key 88. The latter key is provided with ward portions 89 and 90, which are adapted, when said key is turned 30 to the left, to engage the members 61, and 73, and 54, respectively, to turn them about their pivots against the action of their cooperating springs, and thereby render their locking function ineffective.

35 Referring now to the figures illustrating the operation of our invention, attention is first directed to Fig. 3 wherein the position of the various elements when the cover is closed, but with the switch still open, is illustrated. This figure should be considered in 40 connection with Fig. 4, the latter showing the elements as they appear when the cover is open and the switch is open. It will be noted that with the cover closed, the switch locking member 57 is pressed downwardly, 45 against the action of its spring 58, by the protective cam 80. When the cover closes, the hasp 40 enters opening 39 in casing 35 and engages protective cam 80 at a point designated 86 to move it downwardly against the tendency of its spring 82 to hold it in the position in Fig. 4. This action withdraws 50 shoulder 63 of switch locking member 57 from engagement with lug 68 on cam member 65. An arm 87 of spring 48 lightly presses against the opposite side of shoulder 68, thereby causing the cam member 65 to follow the switch locking member 57. Lug 67 of cam member 65 is thereby withdrawn from 60 engagement with lost motion plate 30 to allow the switch operating handle 17 to engage the toggle mechanism for operating the switch. As long as the switch remains open, finger 49 on the lost motion plate 30 (connected to the 65 switch operating handle) will abut the right

angle projection 50 and hold the cover locking member 45 in open or unlocking position, against the action of spring 48. Shoulder 51 is then clear of projection 52, and therefore, the cover latch may be moved to the left to 70 release the switch box cover, the cover latch in this position being shown in Fig. 4. However, as soon as the switch box cover is raised and the cover hasp 40 disengages protective cam 80, spring 58 immediately moves switch 75 locking member 57 upwardly or into its locking position, so that its shoulder 63 engages projection 68 on cam lever 65. This results in moving cam lever 65 against the action of its spring 48 and placing its lug 67 in the 80 path of plate 30.

This plate 30, as will be noted more particularly in Figs. 10 and 11, has its periphery cut and formed so that an end 90 is provided, which is turned outwardly and away from 85 the lug 67 when in the position shown in Fig. 4. Here the lug 67 is not engaging the plate 30, but as soon as the switch operating handle is moved to closed position, the plate comes into direct engagement with lug 67 and is 90 thereby shifted laterally against the action of spring 32; hence, the switch operating handle will be disengaged from the toggle mechanism, or in other words, disengaged from the switch itself. 95

Considering now in Fig. 5 the situation as existing when the switch has been closed, it will be noted that the finger 49 is withdrawn from engagement with the switch 100 locking member 45 and the latter member is moved to locking position by the arm 47 of spring 48. Shoulder 51 is then placed directly in back of projection 52 to prevent the cover latch 36 from being moved to the left to release the switch box cover. With 105 the elements in the position shown, the switch has been closed and the cover is held in locked position.

Assume now that, with the cover closed and the switch closed, it is desired to open 110 the cover without affecting the position of the switch contacts. The manner in which this is accomplished is illustrated in Fig. 6. A key 88 is inserted through the key hole, as shown in Fig. 13, and it is, of course, understood that we contemplate providing a 115 key of particular formation and having the wards thereof so shaped in position that only a key which conforms to all of the required settings may be used. After inserting the 120 key, the same is turned to the left, whereupon the ward portion 90 of the key engages finger 54 of cover locking member 45 and presses it downwardly. The upper portion of member 45 swings about its pivot 46 and 125 withdraws shoulder 51 from engagement with projection 52. Key 88 retains the cover locking member 45 in this position (Fig. 6) against the tension of its spring 48 until the cover hasp 40 is withdrawn from 130

the interlocking casing 35. By pressing cover latch 36 to the left with the finger, the switch box cover may be opened, thereby withdrawing the cover hasp and releasing a member 90' carried by the pivot 41, which also carries cover latch 36. When the switch box cover is closed, this member 90' is held to the right, or in downward position, by engagement with the cover hasp 40, against the tension of a coil spring 91 interconnected between member 90 and the cover latch 36. It will be seen, therefore, that the withdrawal of the cover hasp will release the member 90 and allow the same to move upwardly in order that a projection 92 thereon may engage shoulder 54' on the cover-locking member 45. The reason for this provision is to insure that the cover locking member will be retained in unlocking position, as shown in Fig. 6, as long as the interlock is disabled by the key 88 with the switch in closed position. If this were not provided, the key could be accidentally removed, whereupon the finger 54 would swing upwardly against the key cylinder 86 which would allow shoulder 51 to drop in back of the projection 52 on the cover latch 36. Such a condition would prevent the cover latch from being moved to the left to allow the cover to close, although the switch would be in closed position.

If, on the other hand, the cover is open and the switch is likewise open, the key may be utilized to disable the interlock and permit the closing of the switch while the cover is open. With the elements as shown in Fig. 4, the key is inserted and upon being turned to the left, as shown in Fig. 6, the ward 89 thereof presses against the finger 61 of the switch locking member 57 and turns the latter downwardly to the right, whereby the shoulder 63 thereof is released from engagement with the projection 68 on the cam lever 65. Spring 48 pressing against the opposite side of the projection 68, then forces the cam lever 65 to the right, thereby withdrawing the lug 67 from engagement with the cooperating end 90 on the plate 30. The switch may then be closed by the switch operating handle.

It will be observed in Fig. 3 that we have provided a plate 95 on the key cylinder 86 which rotates therewith and may be moved downwardly to lie directly in front of the finger 44 on cover latch 36. An attempt to move the cover latch 36 to the left would be frustrated by the outer end of finger 44 abutting against the lower end of the plate 95. Plate 95 is provided to engage finger 44 of the cover latch in cases where it is desirable permanently to lock the switch box cover in closed position, irrespective of the position of the elements of the interlock.

It will be noted that this locking plate 95 may be turned into locking position as shown

in Fig. 3 by turning the key approximately 30 degrees to the right. This plate 95 is provided with pits or openings 97 and 98, which receive a ratchet point 99 mounted on a spring member 100. The latter member 100 is secured to the wall of the housing and is so tensioned that the point 99 is constantly urged toward and into these openings in the plate 95. Because of this latter construction, an appreciable twist is required to move the locking plate 95 to the right to lock the cover latch. However, when the latch has been locked, the cooperating pawl and ratchet-like device insures its permanency in the locked position against jarring or other inadvertent movement.

There is a possibility that someone may insert the key for the purpose of disabling the interlocking mechanism and inadvertently move said key slightly to the right, whereupon the cover latch would be locked and undesirable consequences result because of this inadvertent locking of the latch in its extreme right-hand position. We have provided means therefor to insure against such inadvertent locking.

A spring member 101 is mounted on the wall of the housing and has its upper end normally positioned to engage the locking plate 95 and prevent movement thereof to the right. A push button 102 extends from the wall of the switch box, as shown in Fig. 13, and provides means whereby the spring 101 can be pushed inwardly to clear the locking plate 95 so that when the operator has positively pushed the button as indicated, he may turn the key to the right and the locking plate will travel downwardly into engagement with the upper end of the spring 101. To attain access of the switch enclosure, it will now be necessary to insert key 88 in the key cylinder 86 and turn it to the left 30 degrees or more so that the ratchet point will disengage the opening 98, and engage instead the opening 97. The cover latch 36 will then be released and the cover control mechanism of interlock will be restored to its normal position.

From the foregoing description, it will be observed that we have provided a cover control with a disengaging switch handle which prevents the cover from opening when the switch is closed and the closing of the switch when the cover is open. The opening of the cover automatically disengages the switch handle from the switch operating mechanism and also from the interlocking mechanism so that it will be impossible, in trying to throw the switch in closed position, to engage the switch handle with any part of the switch or interlocking mechanism. Furthermore, the interlocking mechanism is located near the center of the switch box, thereby holding the cover more securely than in the former device where the cover control is located near

the top of the box. It will be remembered that this construction permits independent action between the toggle rod of the quick make and break mechanism and the interlocking mechanism. The toggle rod has a certain varying amount of lost motion and by making it independent of the interlock it is possible to secure a more dependable locking action and larger manufacturing variations for the different parts thereof.

We believe that we are the first to provide a switch handle which disengages the switch as soon as the cover is open and therefore shall claim the same broadly.

Certain advantages are obtained by this arrangement and are of considerable importance in the switch art. No attempts can be made to close the switch while the cover is open because the handle, by virtue of its disengaging action, is free to rotate about its axis without engaging either the switch or the interlocking mechanism. Hence, the switch handle cannot be broken nor the parts of the interlock jammed if a workman should attempt to close the switch while the cover is open without a key for disabling the interlock.

Various modifications and other embodiments of our invention are possible and consequently, we do not intend to be limited to the exact disclosure shown herein.

We claim:

1. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle supported by a stationary part of said box and normally moving said switch operating mechanism to open and closed positions, and a plate on said switch operating handle provided with a finger normally engaging said switch operating mechanism, and means operable upon the opening movement of said cover to disengage said finger and switch operating mechanism.

2. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle normally moving said switch operating mechanism to open and closed positions, and a plate on said switch operating handle provided with a finger normally engaging said switch operating mechanism, and a member controlled by movement of said cover for camming said finger out of engagement with said switch operating mechanism while said cover is open.

3. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle therefor, a plate on said switch operating handle, a finger on said plate for normally engaging said switch operating mechanism, a cam member adapted to engage said plate for disengaging said finger from said switch operating mechanism while

said cover is open, and means for restoring said cam member to normal position by closure of said cover whereby said figure re-engages said switch operating mechanism to open and close the switch.

4. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle therefor, a plate on said switch operating handle for normally engaging the handle with said switch operating mechanism, and a pivotally mounted cam member adapted to engage said plate to disconnect said handle and said switch operating mechanism while said cover is open.

5. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle for opening and closing the switch, a lost motion plate loosely mounted on said switch operating handle and comprising part of said switch operating mechanism, a pair of laterally extending lugs on said plate adapted alternately to engage and move a switch operating member when the switch is opened and closed, a member mounted in fixed relation on said switch operating handle, a projection on said member, said projection adapted alternately to engage said lugs for moving said plate when said handle is operated, and means for withdrawing said projection out of the plane of engagement with said lugs when said cover is opened whereby the switch can not be closed while the cover is open.

6. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle for opening and closing the switch, a lost motion plate loosely mounted on said switch operating handle and comprising part of said switch operating mechanism, a pair of lugs on said plate adapted alternately to engage and move a switch operating member which also comprises a part of said switch operating mechanism, a member mounted in fixed relation on said switch operating handle, a projection on said member, said projection adapted alternately to engage said lugs for operating said plate when said handle is operated, and means for engaging said member to shift said switch operating handle axially and also said projection out of the plane of engagement with said lugs, thereby rendering said switch operating handle ineffective to open and close the switch.

7. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle for opening and closing the switch, a lost motion plate loosely mounted on said handle and comprising part of said switch operating mechanism, a pair of lat-

erally extending lugs on said plate adapted alternately to engage and move a switch operating member when the switch is opened and closed, a cooperating member mounted in fixed relation on said switch operating handle, a projection on said member, said projection adapted alternately to engage said lugs for operating said plate when said handle is operated, and means adapted to engage said cooperating member, when said cover is opened, for axially shifting said handle and consequently said projection out of engagement with said lugs whereby the switch cannot be closed while said cover is open.

8. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle for opening and closing the switch, said switch operating mechanism including a member loosely mounted on said handle, a cooperating member mounted in fixed relation on said handle, a spring for urging said cooperating member into engagement with said loosely mounted member, and means controlled by the movement of said cover for disengaging said members and thereby rendering said handle ineffective to operate the switch.

9. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle normally connected to said switch operating mechanism, a spring for holding said switch operating handle connected, and means opposing the action of said spring for temporarily disconnecting said switch operating handle from said switch operating mechanism to prevent the operation of the switch while said cover is open.

10. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a spring pressed switch operating handle adapted normally to connect with said switch operating mechanism, and means for moving said handle against the tension of the spring so as to disconnect the handle, said means operable only when said cover is open.

11. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, an operating handle projecting exteriorly of said box and adapted to be connected to said switch operating mechanism, a lost motion plate loosely mounted on said handle, a member fixed to said handle, a spring confined between said member and the side wall of said box and tending normally to hold said member in engagement with said lost motion plate whereby said handle may open and close said switch, and means for shifting said handle axially against the tension of said spring, said means functioning to disconnect said handle to prevent movement of the switch while the cover is open.

12. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle projecting exteriorly of said box and normally connected to the switch to open and close the same, and an interlocking mechanism whereby the switch can not be closed while the cover is open, said interlocking mechanism including a movable member adapted to engage the handle and thereby disconnect it from the switch so as to render the operation of the switch ineffective, said movable member controlled by the movement of said cover, being moved into the path of the switch handle when the cover is opened, but released automatically, when the cover is closed, for restoring the handle to its engaging relation with the switch.

13. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle projecting exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism including a handle disengaging member and a cooperating switch locking member, and means adapted when the cover is closed to engage said cooperating switch locking member whereby the switch can be closed only when the cover is closed.

14. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle normally connected to the switch to open and close the same, an interlocking mechanism including a switch handle disengaging member normally held out of engagement with said handle but adapted to engage the handle to disconnect it from the switch when the cover is open, a switch locking member, means adapted to engage said switch locking member, when the cover is closed, for holding the switch locking member out of engagement with said handle disengaging member, thereby permitting the latter to withdraw from engagement with said handle whereby the handle may engage and operate the switch.

15. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle normally connected to the switch to open and close the same, an interlocking mechanism including a switch handle disengaging member adapted when in operative position to engage the handle and disconnect it from the switch whereby the switch can not be closed while the cover is open, spring means for returning said member to inoperative position when said cover is closed, a switch locking member, and a member movable by said cover, the closing of said cover causing an engagement between said member and said switch locking member, and a disengagement between said switch locking

member and said switch handle disengaging member.

16. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle normally connected to the switch to open and close the same, an interlocking mechanism including a switch handle disengaging member adapted when in operative position to engage the handle and disconnect it from the switch while the cover is open, a switch locking member adapted to be urged into engagement with said switch handle disengaging member whereby to move the same into engagement with said switch handle, and means for engaging said switch locking member and moving it out of engagement with said switch handle disengaging member when said cover is closed whereby said switch handle will be connected to the switch and the operation of the switch restored.

17. In an electric switch, the combination of a switch box having a cover thereon and switch operating mechanism therein, a switch operating handle normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open, said interlocking mechanism including a pair of pivotally mounted cooperating members, one of which is adapted to be engaged by the cover when closed and the other of which is adapted to engage the switch handle to disconnect it from the switch when the cover is open.

18. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism therein, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch for locking the cover closed while the switch is closed, and a switch handle disengaging member for disconnecting the handle from the switch while the cover is open.

19. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism therein, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch for locking the cover closed while the switch is closed, and a switch handle disengaging member adapted axially to shift the handle from engagement with the switch whereby the handle is free to rotate and inoperative to grip the switch to open or close it.

20. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch adapted to engage the cover when closed, and a member normally disengaged from said switch handle when the cover is closed but adapted to engage the handle when the cover is open for disconnecting the handle from the switch, said cover provided with an element cooperating with a portion of the interlocking mechanism for actuating said member into engagement with said handle.

21. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch adapted to engage the cover when closed, and a switch handle disengaging member normally free of said switch handle when the cover is closed but adapted to interengage therewith when the cover is open for disconnecting the handle from the switch, and means for inter-relating the movements of said cover latch and said switch handle disengaging member whereby said member will remain in engagement with said handle to disconnect the switch as long as said cover latch is held in unlocking position with respect to the cover.

22. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch adapted to lock the cover when closed and a pivotally mounted member adapted to cam said switch handle out of engagement with the switch while the cover is open, said member functioning to disconnect said handle either when the cover is opened or when said cover latch is in unlocking position.

23. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an inter-

locking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism comprising a cover latch serving as a cover lock, and a member functioning to disconnect the handle from the switch serving as a switch lock.

24. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism comprising a cover latch serving as a cover lock, a member functioning to disconnect the handle from the switch serving as a switch lock, means cooperating with said switch handle for controlling said cover latch, and means projecting from said cover and cooperating with a portion of said interlocking mechanism for controlling said member.

25. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism comprising a cover latch and a cover locking member serving as a cover lock, both of which parts are controlled by the position of the switch whereby they are in an unlocking position when the switch is open to allow the cover to open and in a locking position when the switch is closed to lock the cover closed, said interlocking mechanism further comprising the switch handle disengaging member and a switch locking member serving as a switch lock, both of which parts are controlled by the position of the cover whereby they are in an unlocking position when the cover is closed to allow the switch to close and in a locking position when the cover is open to prevent the switch from operating.

26. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a pivotally mounted cover latch, a cooperating cover locking member adapted when in locking position to hold said cover latch locked, means for holding said cover locking member in

locking position, and a projection on said switch handle adapted to engage said cover locking member and release said cover latch when the switch is open.

27. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a pivotally mounted cover latch normally urged into locking relation with the cover, and a cooperating cover locking member when in locking position adapted to prevent the movement of said cover latch from locking relation with the cover, said cover locking member held in locking position when the switch is closed.

28. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch, a spring normally urging said cover latch into locking position, a protrusion on said cover latch, a cover locking member provided with a shoulder adapted to engage said protrusion to hold said cover latch in locking position, and means on said switch handle for engaging said cover locking member and thereby releasing said cover latch from locking position.

29. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch and a switch locking member, both of which are provided with separate pivotal mountings and separate springs for urging them into locking position, means for interlocking the movement of said switch locking member with that of the cover latch so as to lock the cover latch when the switch locking member is held in locking position, and means operably engaging said switch locking member to move it to unlocking position for releasing the cover latch when the switch is opened.

30. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said

box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch and a cooperating switch locking member, said switch locking member normally held in unlocking position when the switch is open whereby said cover latch may be moved to unlocking position to permit the cover to open, and means for rendering the movement of the switch ineffective to prevent closing thereof while said cover latch is in unlocking position.

31. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch and a cooperating switch locking member, said switch locking member normally held in unlocking position when the switch is open whereby said cover latch may be moved to unlocking position to permit the cover to open, a switch handle disengaging member, and an intermediate member between said switch handle disengaging member and said cover latch whereby moving the cover latch to unlocking position will move said switch handle disengaging member into engagement with the handle to disconnect it from the switch.

32. In an electric switch, the combination of a switch box provided with a cover, switch operating mechanism therein, a switch operating handle normally engaging the switch to open and close the same, means for disengaging said handle from the switch to prevent the closing of the switch while said cover is open and means for disabling said disengaging means to permit the switch to close while the cover is open.

33. In an electric switch, the combination of a switch box provided with a cover, switch operating mechanism therein, a switch operating handle normally engaging the switch to open and close the same, means for disengaging said handle from the switch to prevent the closing of the switch while said cover is open, and a key cooperating with and rendering said disengaging means ineffective.

34. In an electric switch, the combination of a switch box provided with a cover, switch operating mechanism therein, a switch operating handle normally engaging the switch to open and close the same, means for disengaging said handle from the switch to prevent the closing of the switch while the cover is open, said means comprising a switch han-

dle disengaging member and a cooperating switch locking member adapted to move said member into engagement with said handle to disconnect the switch, and disabling means associable with said switch locking member to render said switch handle disengaging member ineffective to disconnect said handle from the switch while the cover is open.

35. In an electric switch, the combination of a switch box provided with a cover, switch operating mechanism therein, a switch operating handle normally engaging the switch to open and close the same, means for disengaging said handle from the switch to prevent the closing of the switch while the cover is open, said means including a pair of members one of which is adapted to be engaged by the other to force it into engagement with said handle so as to disconnect the handle from the switch, and disabling means for withdrawing the second member from engagement with the first member whereby said handle may engage the switch while the cover is open.

36. In an electric switch, the combination of a switch box provided with a cover, switch operating mechanism therein, a switch operating handle normally engaging the switch to open and close the same, means for disengaging said handle from the switch to prevent the closing of the switch while the cover is open, said means including a switch handle disengaging member and a switch locking member, said switch locking member adapted when the cover is open to be released for engagement with said switch handle disengaging member whereby the latter member will move into operable relation with said switch handle to disconnect the handle from the switch, and key means adapted to engage a projection on said switch locking member when engaging said switch handle disengaging member, said key means permitting withdrawal of said switch handle disengaging member from the switch handle whereupon the switch handle may be free to connect with and operate the switch while the cover is open.

37. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism being operably connected to said switch handle, when the cover is open, so as to disconnect the same from the switch, and means for disabling the switch interlock to permit the switch to close while the cover is open.

38. In an electric switch, the combination of a switch box provided with a cover there-

on and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism being operably connected to said switch handle, when the cover is open, so as to disconnect the same from the switch, and including a cover locking member, a switch locking member, and means for temporarily disabling both interlocks.

39. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism being operably connected to said switch handle, when the cover is open, so as to disconnect the same from the switch, and including a cover locking member, a switch locking member, means for temporarily disabling both interlocks, and means for thereafter automatically restoring said interlocks.

40. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism being operably connected to said switch handle, when the cover is open, so as to disconnect the same from the switch, and including a cover locking member, a switch locking member, means for temporarily disabling both interlocks, and spring means for thereafter automatically restoring the switch interlock, the closing movement of the switch thereafter restoring the cover interlock automatically.

41. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a switch handle disengaging cam member adapted, when the cover is open, to swing into the path of the operating switch handle to cam it out of the place of normal operation, and means operable at will for disabling said

cam member temporarily so as to close the switch while the cover is open.

42. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch adapted to engage the cover and to lock it closed while the switch is closed, a cover locking member associable with said cover latch to prevent the release of the latch from locking relation with the cover, and means for temporarily disabling said cover locking member.

43. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch adapted to engage the cover and to lock it closed while the switch is closed, a spring pressed cover locking member associable with said cover latch to prevent the release of the latch, a projection on said switch handle for overcoming said cover locking member, thereby allowing the cover to open when the switch is open, and means for permanently locking said cover latch in locking relation with the cover irrespective of the condition of the switch.

44. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch and an intermediate member engaging each other in spring pressed relation, a cam member adapted to disconnect said switch handle from the switch while the cover is open, and means for interconnecting said cover latch and said cam member through said intermediate lever whereby the movement of said cover latch to cover unlocking position will cause said cam member to disconnect said switch handle from the switch although said cover remains closed.

45. In an electric switch, the combination of a switch box provided with a cover thereon and switch operating mechanism, a switch operating handle extending exteriorly of

said box and normally connected to the switch to open and close the same, an interlocking mechanism whereby the switch can not be closed while the cover is open nor the cover opened while the switch is closed, said interlocking mechanism including a cover latch and an intermediate member engaging each other in spring pressed relation, a cam member adapted to disconnect said switch handle from the switch while the cover is open, and means for interconnecting said cover latch and said cam member through said intermediate lever whereby the movement of said cover latch to cover unlocking position will cause said cam member to disconnect said switch handle from the switch although said cover remains closed, and means for temporarily disabling said interconnection.

In witness whereof, we have hereunto subscribed our names.

THOMAS J. KAUFFMAN.
JULES A. WIDMER.