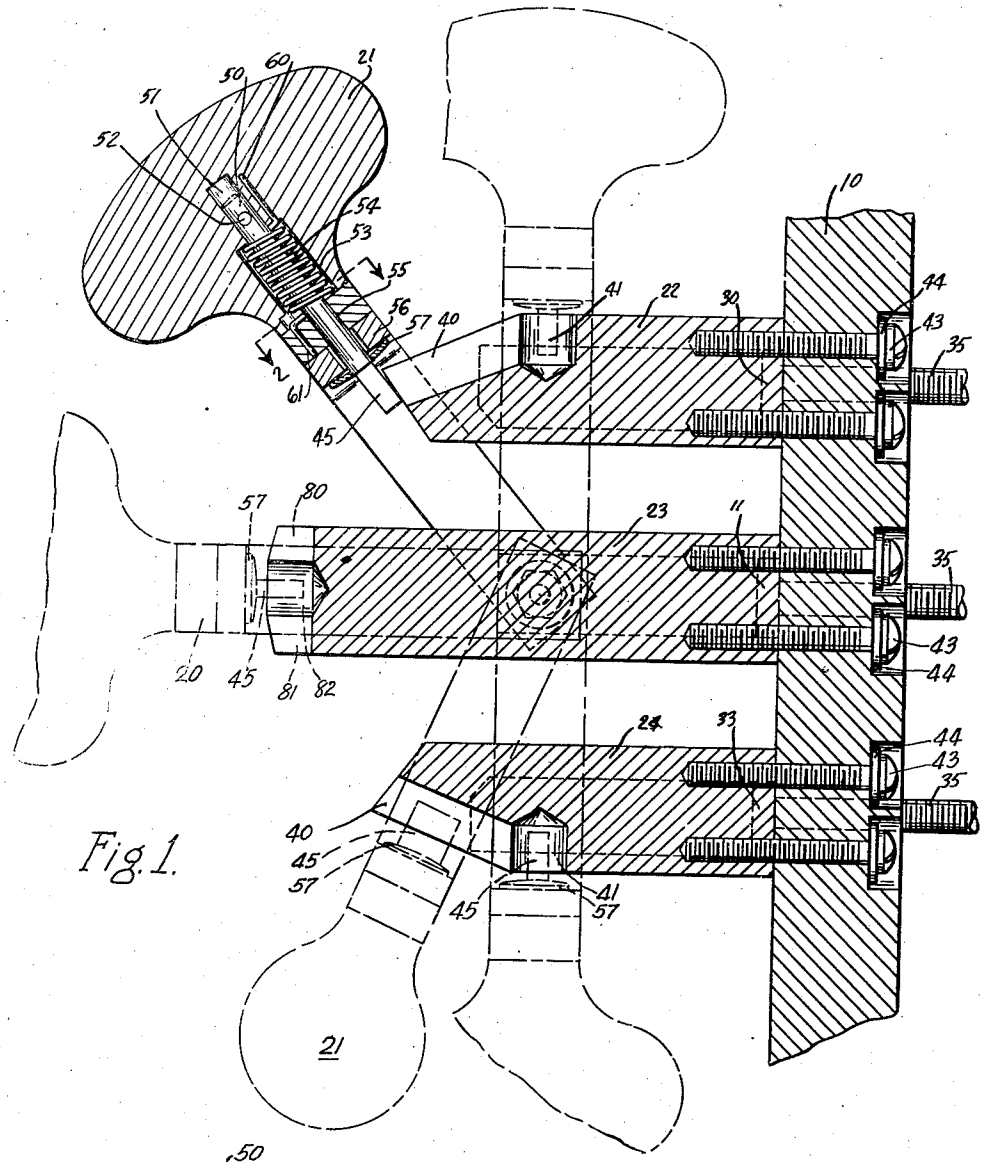
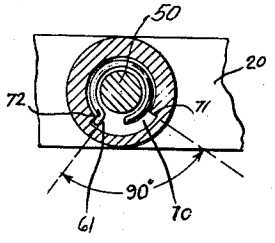
Sept. 18, 1945. W. H. SCHYMIK 2,385,304

SHOCKPROOF SWITCH

Filed Sept. 30, 1944 3 Sheets-Sheet 1





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SHOCKPROOF SWITCH

Filed Sept. 30, 1944 3 Sheets-Sheet 2

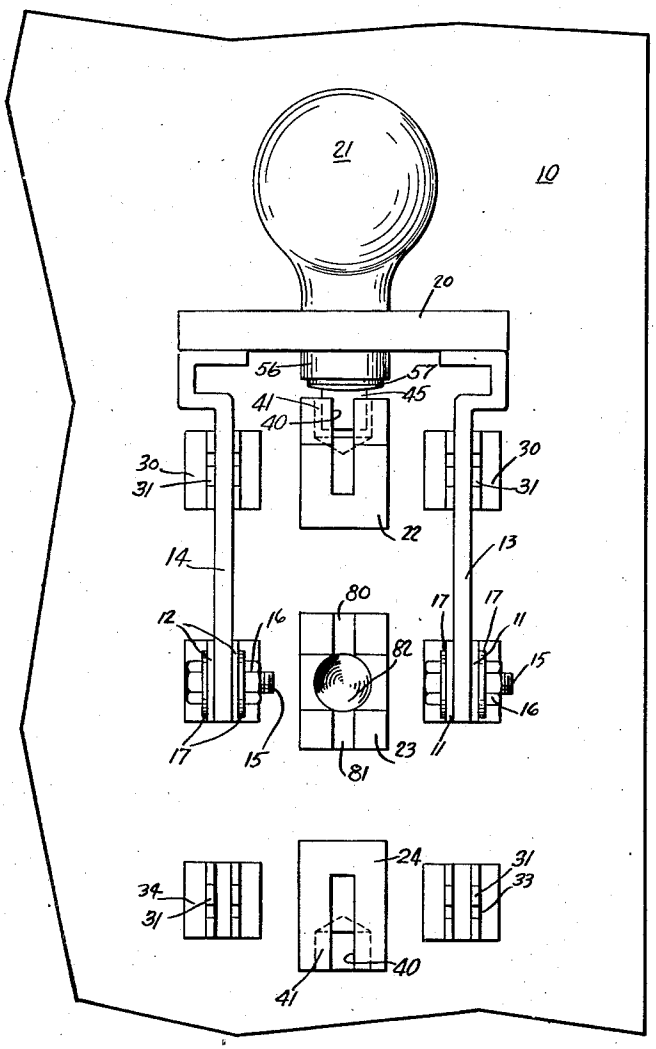

Fig 3

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SHOCKPROOF SWITCH

Filed Sept. 30, 1944 3 Sheets-Sheet 3

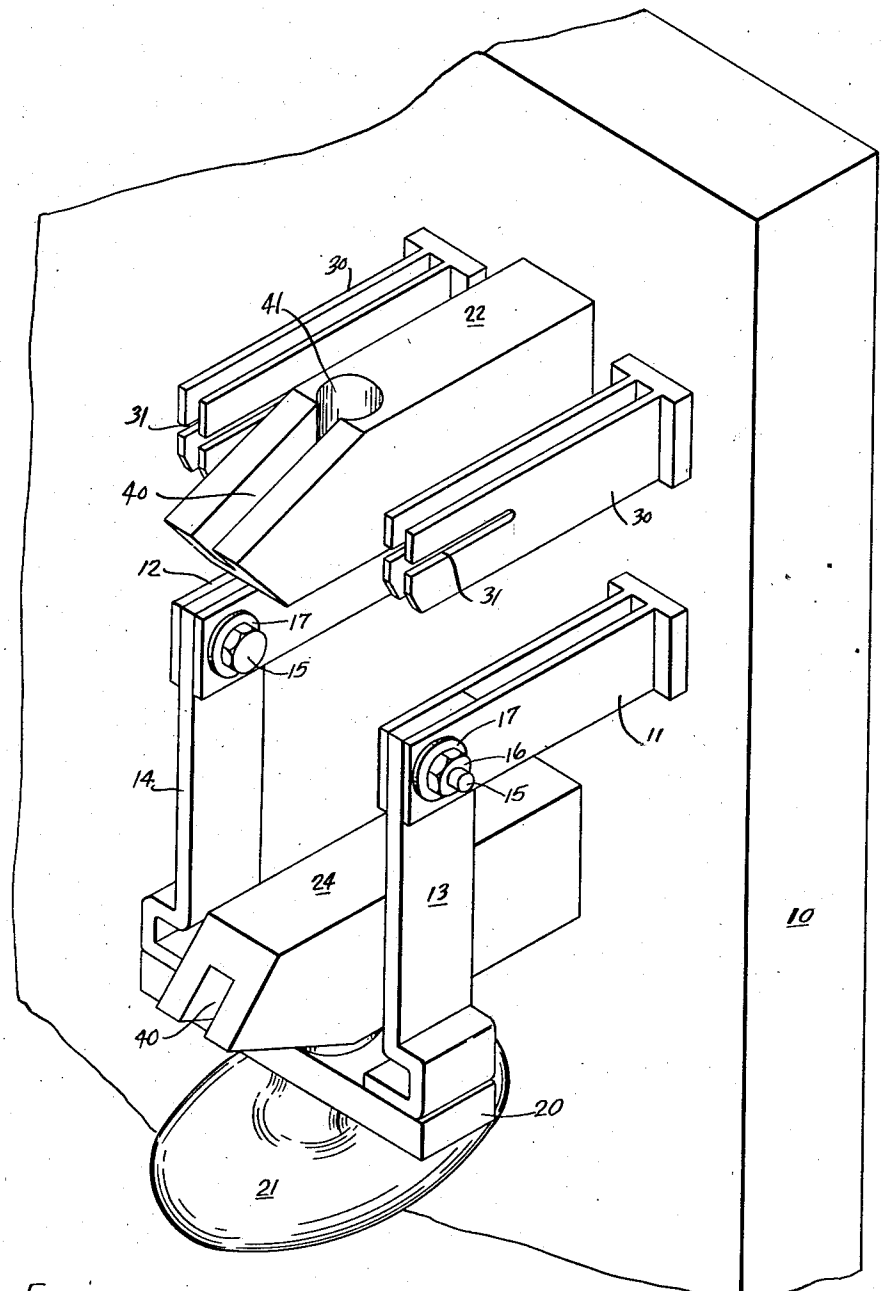

Fig. 4

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Patented Sept. 18, 1945 2,385,304

UNITED STATES PATENT OFFICE

2,385,304

SHOCKPROOF SWITCH

Walter Haines Schymik, Oreland, Pa., assignor to I. T. E. Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania

Application September 30, 1944, Serial No. 556,530

11 Claims. (Cl. 200—169)

My present invention relates to locking devices for switchgear and more particularly to a locking device for use in connection with a knife switch intended to control electrical apparatus on naval vessels.

The essential feature of my novel knife switch and locking device therefor is the prevention of accidental opening or closing of the knife switch owing to severe shocks such as near misses or impacts of aerial bombs or the impact or recoil of gunfire. Such shocks have been known not only to open knife switches but also accidentally to close the same when such circuit closing operation was dangerous or improper.

My invention contemplates that the locking device be a positive one and be automatically brought into operation when the switch handle is placed in the desired position, whether fully opened or fully closed.

My invention also contemplates that in the event the knife switch handle is improperly left at some intermediate point between the fully open and fully closed position, it cannot accidentally be closed.

The kind of shock which must be guarded against is not the mere heeling or skidding of the vessel in response to the impact or recoil of gun fire or near misses or impacts of aerial bombs, but rather the wave motion transmitted through the body of the ship at the rate of 15,000 feet a second, which wave motion has been known to buckle heavy metallic structures, injure personnel and cause switchgear elements to move improperly.

My invention contemplates a novel means including a keyway within which a rotatable member on the handle may slide and be locked. This locking operation will be automatic on the closing or opening of the switch handle and will interpose a positive barrier against movement of the switch handle.

An object of my invention, therefore, is the provision of a locking device for the handle of a knife switch.

Still another object of my invention is the provision of locking means for the handle of a switch, which locking means will automatically lock the switch either in open or closed position upon release of the handle itself.

These and many other objects of my invention will become apparent in the following description and drawings in which

Figure 1 is a side view partly in cross-section of a double-pole, double-throw knife switch embodying my novel handle locking means.

Figure 2 is a cross-sectional view taken on line 2—2 of Figure 1 looking in the direction of the arrows.

Figure 3 is a front view of the double pole, double-throw knife switch of Figure 1.

Figure 4 is a view in perspective showing a single-throw knife switch embodying my novel handle locking means.

Referring now to Figures 1 and 2 and 3, I have here shown a switchboard panel **10** to the front end of which are secured the current carrying clips **11** and **12** to which the blades **13, 14** are hingedly secured.

Figure 4 shows a single throw knife switch arrangement, different from the double throw arrangement of Figures 1 to 3. The current carrying clips and the locking device, which are shown in perspective, have exactly the same construction in all Figures 1 to 4.

Consequently, reference to the current carrying clips **11** and **12** of Figure 4 will aid in a full understanding of the current carrying clip construction of the double throw structure of Figures 1 to 3.

As will be seen, the current carrying clips **11** and **12** are bifurcated members between the elements of which the knife blade elements **13, 14** are rotatably mounted. That is, a bolt **15** on each clip passes through corresponding openings in both elements of the clip and in the switchblade elements **13** and **14**; and each bolt **15** is secured in appropriate position by the nut **16** and the washers **17, 17**.

The upper contact members comprise a pair of similar clips **30, 30** (Figure 3) which, as shown in Figure 4, are substantially similar in construction to the intermediate or lower clips **11** and **12**, except that each of the elements of the clip in Figure 4 is slotted at **31, 31** to ensure close contact thereof with the blade members **13** and **14**. In the double-pole, double-throw arrangement of Figures 1–3, the lowest clips **33** and **34** which connect to an alternate circuit are similar in construction to the uppermost clips **30**. Thus, current may pass from the supporting clips **11** and **12** through the blades **13** and **14** to the upper clips **30, 30**, or from the supporting clips **11** and **12** through the blades **13** and **14** to the lower clips **33** and **34**.

These clips are provided with back connection members **35, 35, 35** passing through the switchboard panel **10**, as shown in Figure 1.

The knife blade switch elements **13** and **14** are bridged at their outer end by the insulating bar **20** which is secured thereto in any suitable manner now well known in the art. The insulating

bridging member 20 is provided with an operating handle 21.

The operating handle 21 includes the locking means which cooperates with stationary locking members 22, 23, 24. The stationary locking member 22 of Figures 1 to 3 has the appearance and function of the upper locking member 22 of the single throw switch of Figure 4. The lower locking member 24 of Figures 1 to 3 has the same appearance as the lower locking member 24 of the single throw switch of Figure 4, which is there seen in perspective. The intermediate, or lock-open member 23, of Figure 1 does not appear in the single throw switch of Figure 4. Members 22 and 24 are similar to each other except that they are reversed in a vertical plane.

Each of the locking members 22 and 24 of Figures 1 to 4 is provided with a relatively narrow slot 40 communicating with a wider opening 41 within the body of the locking member.

Each of the locking members 22, 23 and 24 is secured to the switchboard panel 10 by means of bolts 43 passing through appropriate openings in the panel 10 and threaded into tapped perforations in the respective locking members. These bolts may be recessed in the back surface of the panel 10, as shown, and appropriate clamping members or washers 44 may be provided.

The locking elements 40—41 of the upper and lower locking elements 22 and 24 of Figures 1 and 4 have the over-all form of a keyway with a wider opening at the inner end.

The handle member 21 mounted on the bridge 20 of the knife switch includes a tongue member 45 (see especially Figure 1), which tongue member is, in one dimension, narrower than the slot 40; but, in the other dimension, is much wider than the said slot 40. However, the tongue member 45 is so dimensioned that it may fit freely in any position within the wider inner opening 41 with which the slot 40 communicates.

The handle member 21 includes a central stud 50 secured in an axial recess 51 thereof in any suitable manner as, for instance, by the pin 52. The recess 51 is counterbored at 53 in order to provide a space for the spring 54. The stud 50 projects through the underside of the handle 21 and through an opening 55 in the bridging member 20 and also through an opening in the collar 56 beneath the bridging member 20.

The stud 50 is rotatably secured in the opening 55 and in the opening of the collar member 56 by the washer 57, so that the stud may freely rotate, while, nevertheless, the handle cannot be withdrawn from the bridge 20.

The torsion spring 54 has the upper end 60 thereof captured in the handle 21, and the lower end 61 is captured in the bridge member 20.

As shown in Figures 1 and 2, a 90° annular counterbore 70 is provided in the base of the handle 21, in order to provide clearance for the end 61 of the spring which is captured in the bridge member 20. The end 61 of the spring which is thus captured provides a stop predetermining two positions of the handle 21 90° apart as shown in Figure 2. The stop is provided by the ends 71 and 72 of the 90° annular counterbore 70 of the handle. That is, the normal position of the handle 21 is such that the principal axis of the tongue 45 attached to the stud 50 is perpendicular to the principal axis of the slot 40 so that the tongue cannot enter the slot. The handle 21, however, may be rotated against the tension of the spring until the stop 71 strikes against the portion 61 of the spring, at which time the principal axis of the tongue 45 is parallel to the principal axis of the slot 40, and the tongue may enter the slot.

When the knife blade is now pushed home into the upper clips of Figure 1 and the tongue reaches the wider area 41 of the locking member 22, release of the handle 21 will permit the spring 54 to rotate the same back to its original position, and the principal axis of the tongue 45 will now again be perpendicular to the principal axis of the slot 40 so that the tongue 45 cannot escape from the opening 41 and the switch handle is locked closed in the upper position. The foregoing operations are demonstrated by the solid line position of the handle of Figure 1 showing the condition of the switch just before the handle is turned to permit the tongue to enter the upper slot, and the vertical uppermost dotted line position of the handle showing the locked position.

In the two lower dotted line positions, the lowest vertical position shows a locked position of the handle for closing the circuit to the lower connecting members 33—34. The dotted line position immediately adjacent thereto shows the position of the handle and of the tongue while the tongue is transversing slot 40.

In Figures 1, 2 and 3, the upper locking member 22 and the lower locking member 24 serve the same function, that is, to lock the switch handle in closed circuit position. In Figure 4, the upper locking member 22 locks the switch handle in closed circuit position, while the lower locking member 24 locks the switch member in open circuit position. The difference arises solely from the fact that the Figure 1 construction is a double-pole double-throw arrangement, while the Figure 4 construction is a single throw arrangement. In the Figure 4 construction, it is obvious that by the means thus far described, both a lock open and a lock closed position are achieved.

In the double-pole double-throw construction of Figures 1 to 3, since both the upper and lower position are circuit closing positions, the open circuit position is a horizontal one. Hence the additional locking member 23 is provided in Figures 1 to 3 for the purpose of providing a lock open position for the handle.

As shown in Figures 1 and 3, the locking member 23 comprises an upper vertical slot 80 and a lower vertical slot 81, each connected to a central wider opening 82.

When the switch is moved to open position from either of the closed positions shown in Figure 1, the handle 21 is first grasped and then rotated through 90° to align the tongue 45 with the slot 40 so that the switch handle may be moved out of the locking member 22 or 24, as the case may be.

The switch handle is continuously moved, while the handle 21 is still maintained in its rotated position, until the tongue in its movement enters either the slot 80 or the slot 81 of the locking member 23. When the handle is moved to an exactly horizontal position, the tongue 45 is in registry with the central opening 82 of the locking member 23. Then, when the handle 21 is released, the spring 54 rotates the same back to its original position and the tongue 45 is now arranged so that its larger axis is perpendicular to the axis of the slots 80 and 81; and since the tongue is wider than the slots 80 and 81, the handle cannot escape from the locking member 23 until the handle 21 is turned once more through 90°.

To release the handle from the locking member 23, it is again necessary to rotate handle 21 through 90° against the tension of spring 54 until the stop 71 is reached, and then to move the tongue 45, which has thus been rotated, through the slot 80 or 81 depending on whether the upper or lower circuit is to be closed. Then it is necessary to move the tongue 45 while the handle is thus held in rotated position through the upper or lower slot 40 of the upper or lower locking member 22 or 24 until the knife switch is closed when the tongue 45 will have reached the larger opening 41 in either of the locking members 22 and 24. This will permit the tongue to rotate to locking position on release of the handle 21.

By this means a knife switch handle may be positively locked-closed or positively locked open. If, by any accident, the knife switch handle is left at any intermediate position between the locking member 22 and the locking member 23 or between the locking member 23 and the locking member 24, no degree of shock will be effective to close the switch, since the tongue 45 will block the entry of the knife blades into the connecting elements until the handle 21 is manually turned against the tension of the spring 54. This applies, as well, to the single throw switch of Figure 4 where, should the switch accidentally be left between the locking members 22 and 24, the circuit cannot accidentally be closed.

Nevertheless, since the positive locking arrangement herein prevents accidental opening or accidental closing of the switch, no shock of any kind will be sufficient to change the condition of the circuit, at least as far as the knife switch is concerned. It will be obvious, of course, that other types of switch handles may be held in predetermined positions by the locking arrangements herein shown.

I have described my invention in connection with only a simple illustrative embodiment thereof. Since many variations and modifications of my invention should now be obvious to those skilled in the art, I prefer to be bound not by the specific disclosures herein but only by the appended claims.

I claim:

1. In a circuit interrupter, a contact member having a closed circuit position and an open circuit position; means for operating said contact member between said positions and means for locking said contact member in at least one of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member; said stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end, said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for turning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot.

2. In a circuit interrupter, a contact member having a closed circuit position and an open circuit position; means for operating said contact member between said positions and means for locking said contact member in at least one of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member; said stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end; said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for turning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot, the contact operating member being locked in said one position when the tongue is in said opening, and turned so that the dimension which is greater is presented to the end of the slot.

3. In a circuit interrupter, a contact member having a closed circuit position and an open circuit position; means for operating said contact member between said positions and means for locking said contact member in at least one of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member; said stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end, said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for turning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot, said contact operating means including a rotatable handle connected to and rotating said tongue; means biasing said tongue and handle to a position where the greater dimension of the tongue is presented to the slot.

4. In a circuit interrupter, a contact member having a closed circuit position and an open circuit position; means for operating said contact member between said positions and means for locking said contact member in at least one of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member; said stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end, said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for turning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot, said contact operating means including a rotatable handle connected to and rotating said tongue; means biasing said tongue and handle to a position where the greater dimension of the tongue is presented to the slot, said handle and tongue being manually rotatable against said

biasing means to turn said tongue to a position wherein its smaller dimension is presented to the slot to permit said tongue to move through said slot and said contact member to move with respect to said stationary locking member.

5. In a circuit interrupter, a contact member having a closed circuit position and an open circuit position; means for operating said contact member between said positions and means for locking said contact member in at least one of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member; said stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end, said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for turning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot, said contact operating means including a rotatable handle connected to and rotating said tongue; means biasing said tongue and handle to a position where the greater dimension of the tongue is presented to the slot, said handle and tongue being manually rotatable against said biasing means to turn said tongue to a position wherein its smaller dimension is presented to the slot to permit said tongue to move through said slot and said contact member to move with respect to said stationary locking member, said tongue and handle being automatically returned by said biasing means to a position where said tongue cannot enter said slot upon release of said handle when said tongue disengages said slot.

6. In a circuit interrupter, a contact member having a closed circuit position and an open circuit position; means for operating said contact member between said position and means for locking said contact member in each of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member at each of said positions; each stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end, said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for turning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot.

7. In a circuit interrupter, a contact member having a first closed circuit position, an open circuit position, and a second closed circuit position; means for operating said contact member between said positions and means for locking said contact member in each of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member at each of said positions; each stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end, said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for turning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot.

8. In a circuit interrupter, a contact member having a closed circuit position and an open circuit position; means for operating said contact member between said position and means for locking said contact member in each of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member at each of said positions; each stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end, said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for returning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot, the contact operating member being locked in each position when the tongue is in the opening of the stationary locking member for that position and is turned so that the dimension which is greater is presented to the end of the slot.

9. In a circuit interrupter, a contact member having a first closed circuit position, an open circuit position, and a second closed circuit position; means for operating said contact member between said positions and means for locking said contact member in each of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member at each of said positions; each stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end, said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for turning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot, the contact operating member being locked in each position when the tongue is in the opening of the stationary locking member for that position and is turned so that the dimension which is greater is presented to the end of the slot.

10. In a circuit interrupter, a contact member having a closed circuit position and an open

circuit position; means for operating said contact member between said position and means for locking said contact member in each of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member at each of said positions; each stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end, said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for turning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot, the contact operating member being locked in each position when the tongue is in the opening of the stationary locking member for that position and is turned so that the dimension which is greater is presented to the end of the slot, said contact operating means including a rotatable handle connected to and rotating said tongue; means biasing said tongue and handle to a position where the greater dimension of the tongue is presented to the slot.

11. In a circuit interrupter, a contact member having a first closed circuit position, an open circuit position, and a second closed circuit position; means for operating said contact member between said positions and means for locking said contact member in each of said positions, said locking means comprising a tongue extending from said contact operating means; and a stationary locking member at each of said positions; each stationary locking member having a slot open at one end and communicating with an opening in said locking member at the opposite end, said last mentioned opening having a diameter greater than the width of the slot; said tongue having a lesser width than the slot and a length greater than the width of the slot but less than the diameter of the opening; means for turning the tongue to permit the same to pass through said slot and for turning said tongue when it emerges from either end of the slot to a position where the dimension thereof which is greater than the width of the slot is presented to the end of the slot to prevent entry of the tongue into the slot, the contact operating member being locked in each position when the tongue is in the opening of the stationary locking member for that position and is turned so that the dimension which is greater is presented to the end of the slot, said contact operating member, when left in any intermediate position between any pair of the said closed and open positions being prevented from moving accidentally to the closed position.

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