

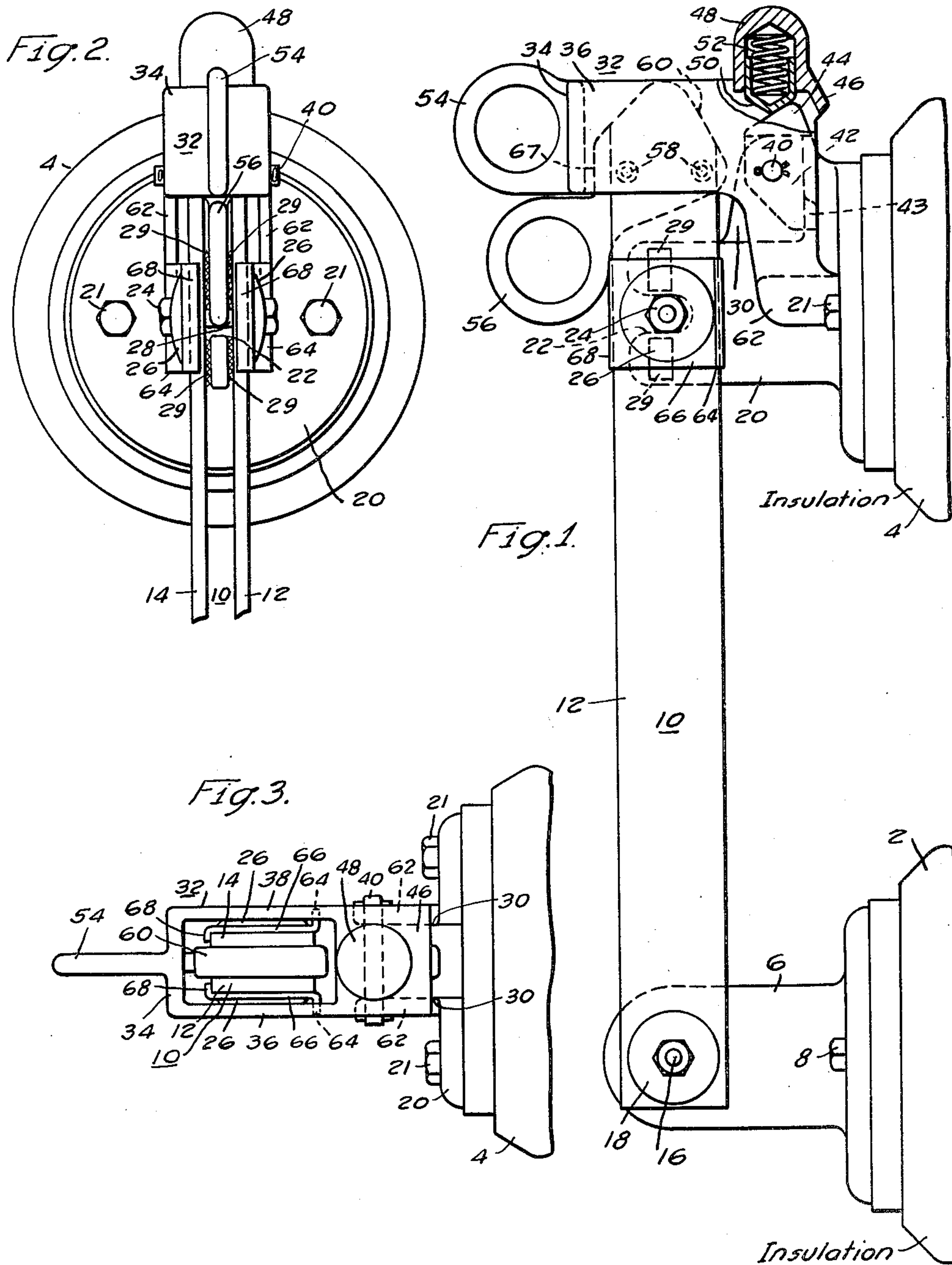
Oct. 31, 1950

H. J. CRABBS  
CIRCUIT INTERRUPTER

2,528,118

Filed Nov. 1, 1946

2 Sheets-Sheet 1



WITNESSES:

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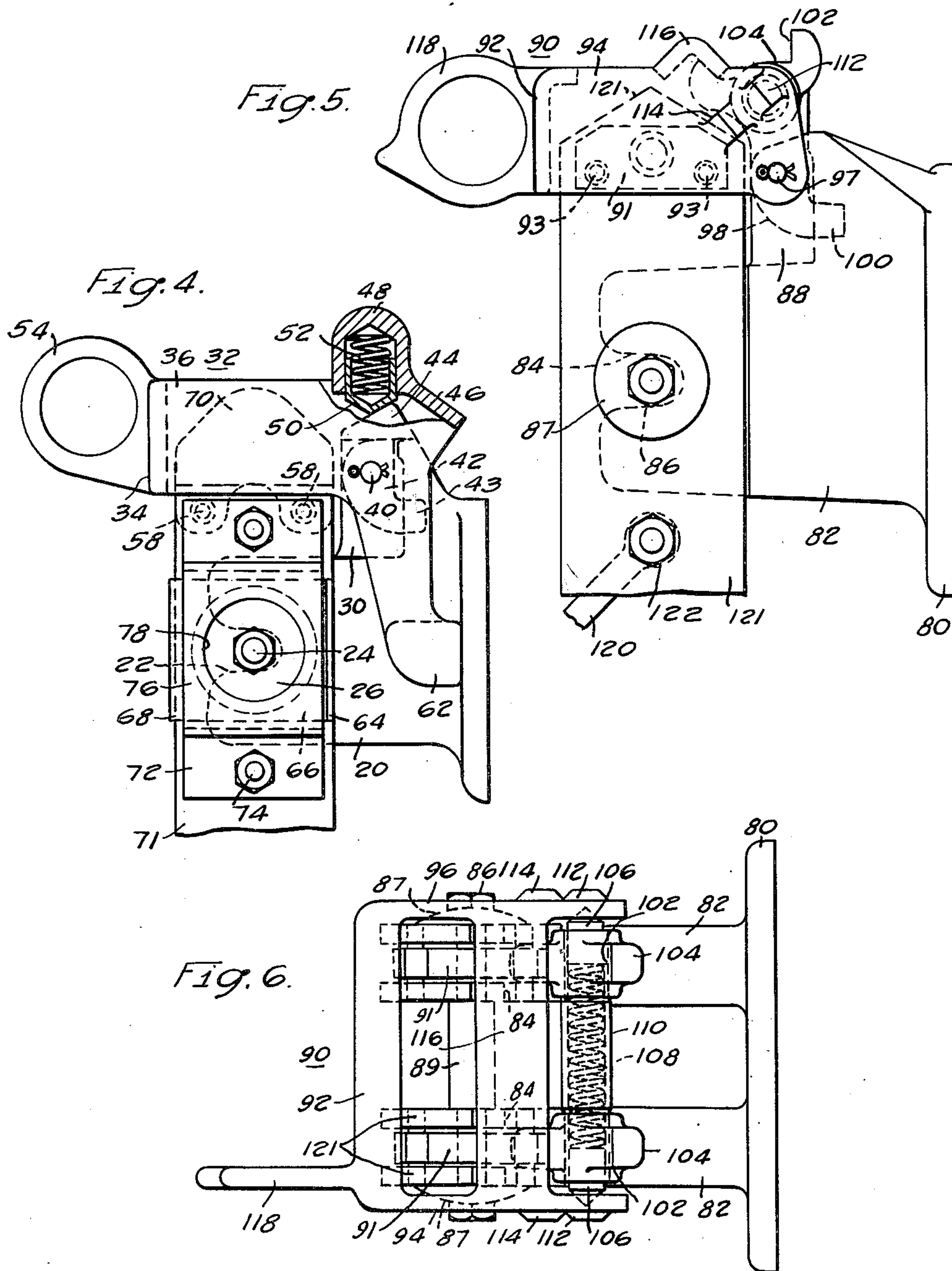
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## UNITED STATES PATENT OFFICE

2,528,118

## CIRCUIT INTERRUPTER

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This invention relates generally to electric circuit interrupters, especially to locking and operating mechanisms for such interrupters.

There are certain applications, such as in power testing circuits, where electric circuit interrupters are subject to extremely heavy duty not only from the standpoint of frequent operation, but also such interrupters, especially switches of the disconnect type, are repeatedly subject to stresses induced by short circuit currents. It is essential that such switches be prevented from blowing open even under conditions where parts of the switch are distorted as a result of the unusually heavy duty imposed upon them, and yet that they remain capable of relatively easy operation to open and close the circuit.

Accordingly, one object of this invention is to provide for interrupters of the type described, a novel form of releasable lock which when in locking position is incapable of accidental release due to any force tending to open the interrupter.

Another object of this invention is to provide circuit interrupters of the type described with novel means for locking them at closed circuit position which is separate and independent of the operating means for opening and closing the interrupter and yet is automatically actuated to locking position when the interrupter is closed.

Another object of this invention is to provide for a circuit interrupter of the type described, novel means for locking the interrupter at closed circuit position which is separate and independent of the operating means for opening and closing the interrupter, and is adapted to initiate opening movement of the interrupter when moved to unlocked position.

Another object of this invention is to provide a circuit interrupter of the type described with novel lock means movable to locking and unlocked positions independently of the interrupter and yet permitting closing of the interrupter when at locking position.

These and other objects of this invention will become more apparent upon consideration of the following detailed description of preferred embodiments of the invention, when taken in connection with the attached drawings, in which:

Figure 1 is a side elevation view partly in section of a switch having locking means constructed in accordance with this invention;

Fig. 2 is a top view of the locked end of the switch shown in Fig. 1;

Fig. 3 is an end view of the locked end of the switch shown in Figs. 1 and 2;

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Fig. 4 is a side elevation view partly in section of the locked end of a modified type of switch;

Fig. 5 is a side elevation view of the locked end of still another modified form of the invention; and

Fig. 6 is an end view of the switch shown in Fig. 5.

The embodiment of the invention shown in Figs. 1, 2 and 3 illustrates the application of this invention to a disconnect type of circuit interrupter, having supporting insulators 2 and 4, preferably of porcelain or a similar insulating material. Insulator 2 has a hinge tongue casting 6 secured on the outer end thereof as by bolts 8 passing through the base of the tongue casting to be threaded into the cap for insulator 2. A split switch blade 10, comprising spaced parallel blade members 12 and 14, is adapted to be pivotally mounted on hinge tongue casting 6 as by a pivot bolt 16 passing through the blade members and tongue casting, and having substantially cup-shaped washers 18, which may be of any desired resilient material, positioned on the bolt 16 between the head and nut thereof and the blade members 12 and 14, respectively, to resiliently urge the blade members into engagement with the hinge tongue casting.

Insulator 4 has a break tongue casting 20 mounted on the outer end thereof as by bolts 21 which pass through the base of the casting to be threadedly engaged in the cap for insulator 4. The outer end of break tongue casting 20 is provided with a notch 22 for receiving in the closed circuit position a bolt 24, which connects the outer ends of blade members 12 and 14. Bolt 24 is provided with cup-shaped spring washers 26 similar to the washers 18 at the hinge end of blade 10, and has a spacing sleeve 28 thereon between blade members 12 and 14 to limit movement of the blade members toward each other. Preferably, blade members 12 and 14 are provided with contact portions 29 limited in area which are engageable at the closed circuit position with break contact tongue 20 under the relatively high pressure exerted by spring washers 26. As illustrated, these limited area contact portions 29 are in the form of a plurality of generally parallel ridges to engage the break contact tongue along a plurality of parallel lines.

Break contact tongue 20 is provided with a pair of outwardly extending integral supporting flanges 30 for supporting a lock member 32 which is generally of inverted U-shape in form, being provided with a bight portion 34 and integral legs 36 and 38. The legs 36 and 38



of lock member 32 are adapted to be supported adjacent their outer ends on supporting flanges 30 by a pivot pin 40 which extends through the legs and flanges and is held in position as by cotter pins, or the like. Pivot pin 40 has mounted thereon between supporting flanges 30 the body of a detent member 42, with this member when mounted on pivot pin 40 extending along the base wall of the recess formed between supporting flanges 30, and having an integral nose 43 adapted to enter a depression formed in this wall. Detent member 42 is also provided with an enlarged cam portion 44 at its outer end, for a purpose to be described. Lock member 32 is provided at its outer edge adjacent the outer ends of legs 36 and 38 with an integral connecting web 46 which is formed with an integral socket portion 48 for slidably receiving a detent cup member 50, normally spring biased outwardly of a socket 48 by a coil compression spring 52 which reacts between the socket and detent cup.

The outer end of lock member 32 is provided substantially centrally thereof with an outwardly extending integral hook-eye 54 adapted to receive a hook-stitch operating member, or the like, for pivotally moving the lock member about its supporting pivot 40. The switch blade 10 is also provided with a hook-eye 56 formed integrally with a cam-shaped nose 60 adapted to project beyond the outer end of blade 10 when secured in position between blade members 12 and 14, as by pins 58 having reduced ends which are received in apertures provided in the switch blade members 12 and 14, respectively. Hook-eye 56 is for the purpose of receiving a hook-stick operating member, or the like, for pivotally moving blade 10 about its pivot 16.

Lock member 32 is provided adjacent to supporting pivot 40 with laterally extending feet 62 cooperable with flange abutments 64 provided on plates 66 secured to the outside of each blade member 12, 14 as by being positioned beneath washers 26. Each plate 66 is preferably provided with an inwardly directed positioning flange 68 adapted to lie along the upper edge of blade members 12 and 14, respectively.

With the switch in the closed circuit position illustrated in Fig. 1, it will be apparent that detent cup 50, being in engagement with the upper cam surface of cam portion 44 of detent member 42, lock member 32, will thus be releasably held at the locking position illustrated, wherein the straight upper edge 67 of the hook-eye member is positioned directly beneath the plane inner surface of bight portion 34 of the lock member, and pivot 40 for the lock member being positioned substantially directly opposite blade 10, any force tending to open the switch is positively prevented from doing so by direct engagement of these straight or plane surfaces. When it is desired to open the switch, lock member 32 may be rotated in a clockwise direction by means of hook-eye 54, thereby causing detent cup 50 to move inwardly of cup 48 by compressing spring 52 to by-pass the nose of cam portion 44 of detent member 42 until it engages the lower surface of cam portion 44 where it will act to releasably hold the lock member at an unlocked position where it does not interfere with opening of the switch blade 10. During the above-mentioned clockwise movement of lock member 32, laterally extending feet 62 will first engage abutment flanges 64

on the blade and then move these together with blade 10 upwardly toward an open circuit position. Preferably this circuit opening movement of blade 10 caused by movement of lock member 32 to an unlocked position is sufficient to move limited area contact portions 29 of blade members 12 and 14 to a position where they no longer engage break contact tongue 20. It will be observed that this initial circuit opening movement of blade 10 is the result of a prying action exerted by lock member 32, and a considerable mechanical advantage is thus obtained to initially move the blade to a position where the contact pressure of contact portions 29 is entirely relieved, so that subsequent movement of blade 10 to its full open circuit position may be accomplished relatively easily. Such subsequent movement of blade 10 to full open circuit position may be readily accomplished by means of hook-eye 56, to continue to rotate the blade in a counterclockwise direction to such a full open circuit position.

With switch blade 10 at its open circuit position and lock member 32 at its unlocked position defined by detent members 44 and 50, the switch blade may be moved to closed circuit position by means of a force exerted on hook-eye 56 to move the blade in a clockwise direction about its pivot 16. In such closing movement of the blade, it will be apparent that as it approaches break contact tongue 20, abutment flanges 64 will first engage the outer ends of feet 62 on the lock member, whereupon continued closing movement of the blade acts to simultaneously move lock member 32 in a counterclockwise direction, finally resulting in movement of the blade and lock member to the closed circuit locked position shown in Fig. 1. While detent members 50 and 42 cooperate to hold lock member 32 at an unlocked position when the switch blade is at an open circuit position, it is possible that the lock member might accidentally be moved to its locked position while the blade is still open. Accordingly, in order to permit closing of the switch under such a condition and still insure that the switch will not be closed unless it is at the same time locked at its closed circuit position, it will be observed that upon closing of switch blade 10 with lock member 32 at the position shown in Fig. 1, on approaching break contact tongue 20 the cam-shaped nose 60 on the blade hook-eye member will first engage the bight portion 34 of the lock member and cam it outwardly to thereby move the lock member in a clockwise direction to an unlocked position where nose 60 passes beneath bight portion 34 of the lock member, whereupon abutment flanges 64 on the blade will engage the feet 62 of the lock member to cause the latter to move in a counterclockwise direction about its pivot 40 back to the locked position illustrated in Fig. 1 when the final closed circuit position of the blade is reached. In other words, closing of the switch blade in a single movement acts to throw the lock member from its locked to an unlocked position and back to its locked position.

In Fig. 4 of the drawings a lock member, similar to that disclosed in Figs. 1, 2 and 3, is illustrated as being applied to a double-throw type of switch blade, and inasmuch as most of the parts illustrated in this embodiment of the invention are identical with those already described, like reference numerals are applied to such like parts, and their description will not be repeated. In-



asmuch as the switch blade 71 illustrated in Fig. 4 is of the double-throw type, the operating hook-eye cannot be positioned outwardly of one edge thereof as in the previously described device, and accordingly it is formed in an offset portion 76 of a bracket 72 having the ends thereof secured to switch blade 71 as by bolts 74. A hook-eye 78 is formed in the outwardly offset part 76 of the bracket so as to be located at one side of switch blade 71 for the reception of a hook-stick operating member, or the like. With the hook-eye 78 positioned at the side of switch blade 71, a cam member 70 is provided at the outer end of switch blade 71 being secured between the sides of the blade by pins 58 for the same purpose as cam-shaped nose 60 illustrated in the embodiment of the invention shown in Figs. 1, 2 and 3.

It will be obvious that the structure illustrated in Fig. 4 can be operated in the same manner described above in connection with the structure illustrated in Figs. 1, 2 and 3, and that the locking and unlocking of lock member 32 will be accomplished in the same way, the only difference being that switch blade 71 will be actuated from hook-eye 78 positioned at one side of the blade, rather than at the outer edge thereof, as in the switch shown in Figs. 1, 2 and 3.

The switch illustrated in Figs. 5 and 6 is of a high capacity type wherein a plurality of switch blades 121 are provided to increase the current carrying ability of the switch. Thus, the hinge tongue casting (not shown) and break tongue casting have a plurality (two in this instance) of integral upwardly extending break contact tongues 82 formed integral with the base 80 of the casting, with each tongue of the break casting being formed with a slot 84 in the outer end thereof for receiving the bolt 86 provided for connecting the outer ends of the blade members of each blade 121. Each bolt 86 is provided with cup-shaped spring washers 87 similar to the washers employed with the previously described embodiments of this invention, and a spacer sleeve may also be provided on each bolt between the sides of each blade 121 together with a spacer block 91 secured in position as by pins 93 and a spacer pin 89 spanning blades 121. Each contact tongue 82 is provided with spaced supporting flanges 88 at the outer side thereof for supporting a pivot pin 97 on which a lock member 90 is adapted to be mounted. Lock member 90 is of substantially inverted U-shape in form, with a bight portion 92 which spans both blades, and integral legs 94 and 96 adapted to extend at the outer sides of blades 121, so that when lock member 90 is at its locking position it overlies the outer ends of both blades. As previously stated, lock member 90 is mounted on pivot pin 97 which also supports intermediate each pair of supporting flanges 88, the body 98 of a stop member which has an integral nose 100 to be seated in a recess provided between flanges 88 for a purpose to be described. The body 98 of the stop member is provided with an enlarged head outwardly of supporting flanges 88, and spaced abutments 102 are provided integral with this head 104.

The heads 104 of the stop members are provided with passages, each adapted to slidably receive a detent member 106, the outer end of which is substantially conical in shape, and these detent members 106 are forced apart by a coil compression spring 108 reacting between them and being located in part in the heads 104 of each

stop member, and in part in a sleeve 110 spanning the space between heads 104. Detent members 106 are adapted to cooperate with spaced depressions 112 and 114 formed in each leg 94 and 96 of lock member 90, to releasably hold the lock member at its locked position illustrated in Figs. 5 and 6, and at an unlocked position, respectively. As illustrated, depressions 112 cooperate with detent members 106 for releasably holding lock member 90 at its locked position and depressions 114 cooperate with detent members 106 to releasably hold lock member 90 at an unlocked position. Moreover, legs 94 and 96 of the locked member are provided with an integral connecting part 116 which is substantially right-angular in cross section, with one side thereof adapted to extend into the space between stop abutments 102 for defining the locked and unlocked positions of lock member 90, respectively.

Lock member 90 is provided with an integral hook-eye 118 extending outwardly from bight portion 92, preferably at one side adjacent leg 94 of the lock member, for the purpose of pivotally moving lock member 90 about its supporting pivot 97. Preferably switch blades 121 are connected for movement together by a bolt 122 passing through the blade members of both switch blades, and this connecting bolt may have an operating rod 120 pivotally mounted thereon for the purpose of moving the switch blades to open and closed circuit positions together.

It will be apparent from the foregoing that the switch structure illustrated in Figs. 5 and 6 may be operated in much the same manner as the structures previously described, except that no prying-out action is obtained upon movement of lock member 90 from its locked to unlocked position. It will be apparent that switch blades 121 of Fig. 5 are locked at their closed circuit position by lock member 90 in substantially the same manner as the blades in the previously described embodiments of this invention. Furthermore, lock member 90 may be rotated in a clockwise direction about its pivot 97 from the position shown in Fig. 5 to an unlocked position defined by lower abutment 102 and detent depressions 114, and with lock member 90 at such an unlocked position, switch blades 10 may be actuated to an open circuit position and may be subsequently closed, whereupon lock member 90 may then be moved by means of hook-eye 118 to its locked position. Moreover, by reason of the tapered form of the outer end of the switch blades 121, it will be apparent that they may be closed even though lock member 90 is at its locked position, because during closing movement of the blades the outer ends thereof will engage the bight portion 92 of the lock member and cam it outwardly until it passes by the lock member to attain full closed circuit position. Thereupon, lock member 90 may be moved, as described before, to its locked position.

It is apparent from the foregoing that the circuit interrupter constructions disclosed above all include a form of contact lock which must be manually operated to unlock the contacts separately from manual operation of the contacts themselves into and out of engagement. Moreover, in certain embodiments of the invention, the lock member when moved to unlocked position acts to pry the contacts apart at least an amount sufficient to relieve contact pressure, and when the contacts are moved back into engage-



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ment, the lock is automatically moved back to its locking position, irrespective of whether it was at its locking or at an unlocking position when the contacts are moved into engagement. It is also desired to point out that the particular means illustrated for accomplishing the results pointed out above are susceptible of being furnished in the form of attachments for standard types of switches in that all the parts necessary for the locking and prying-out functions are in the nature of readily detachable elements and are substantially complete in themselves. The invention is illustrated as being applied, in addition to a single-throw type of disconnect switch, to a double-throw type as well, and to a high-capacity switch employing a plurality of switch blades, and in all cases but a single lock member is provided for positively preventing separation of the switch contacts until the lock is purposely released.

Having described preferred embodiments of this invention in accordance with the patent statutes, it is desired to point out that this invention is not to be limited to these particular constructions, inasmuch as it will be apparent, especially to those skilled in this art, that many changes and modifications may be made in these particular structures without departing from the broad spirit and scope of this invention. Accordingly, it is desired that the invention be interpreted as broadly as possible, and that it be limited only as required by the prior art.

I claim as my invention:

1. In apparatus of the type described, movable contact means mounted for substantially pivotal movement into and out of engagement with a cooperating contact means and having operating means secured thereto, means for locking said movable contact means against separating movement when it is in engagement with said cooperating contact means, comprising a lock member mounted for substantially pivotal movement to and away from a locking position, detent means for releasably retaining said locking member at locking and non-locking positions, said locking member having a portion positioned when said locking member is at said non-locking position to be engaged by said movable contact means in closing to move said locking member to its locking position, and said locking member having operating means thereon which is separate and independent of the operating means for said movable contact so that when said locking member is operated to its non-locking position said portion thereof will engage and move said movable contact means in a circuit opening direction.

2. In apparatus of the type described, movable contact means mounted for substantially pivotal movement into and out of engagement with a cooperating contact means, means for locking said movable contact means against separating movement when it is in engagement with said cooperating contact means comprising a lock member, pivot means mounting said lock member on a support associated with one of said contact means, detent means for releasably retaining said lock member at a locking position wherein it engages the other contact means and at a non-locking position, said detent means comprising cooperable parts one of which is mounted on said lock member and the other of which is mounted on said pivot means and held thereby against said support to prevent movement thereof with said lock member.

3. In apparatus of the type described, movable

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contact means mounted for substantially pivotal movement into and out of engagement with a cooperating contact means, means for locking said movable contact means against separating movement when it is in engagement with said cooperating contact means comprising a lock member, pivot means mounting said lock member on a support associated with one of said contact means for movement to and away from a locking position where said lock member engages the other contact means, abutment means secured to said other contact means, and said lock member having a portion positioned to engage said abutment means when said contact means are in engagement and said locking member is moved from its locking to an unlocking position to pry said contact means apart, and being engageable during closing movement of said movable contact means to move said lock member from an unlocked to its locked position.

4. In apparatus of the type described, movable contact means mounted for substantially pivotal movement into and out of engagement with a cooperating contact means, means for locking said movable contact means against separating movement when it is in engagement with said cooperating contact means comprising a lock member, pivot means mounting said lock member on a support associated with one of said contact means for movement to and away from a locking position where said lock member engages the other contact means, abutment means secured to said other contact means, said lock member having a portion positioned to engage said abutment means when said contact means are in engagement and said locking member is moved from its locking to an unlocking position to pry said contact means apart, and being engageable during closing movement of said movable contact means to move said lock member from an unlocked to its locked position, and another abutment means secured to said other contact means at a position to engage a part of said lock member during closing movement of said movable contact means if said lock member is at its locking position to move the latter to an unlocking position prior to engagement of said first abutment means and said lock member portion.

5. In apparatus of the type described, movable contact means mounted for substantially pivotal movement into and out of engagement with a cooperating contact means, means for locking said movable contact means against separating movement when it is in engagement with said cooperating contact means comprising a lock member, pivot means mounting said lock member on a support associated with said cooperating contact means for movement to and away from a locking position where said lock member engages said movable contact means, abutment means secured to said movable contact means, said lock member having a portion positioned to engage said abutment means when said contact means are in engagement and said locking member is moved from its locking to an unlocking position to pry said contact means apart, and being engageable during closing movement of said movable contact means to move said lock member from an unlocked to its locked position, another abutment means secured to said movable contact means at a position to engage a part of said lock member during closing movement of said movable contact means if said lock member is at its locking position, to move the latter to an unlocking position prior to engagement of said



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first abutment means and said lock member portion, and one of said abutment means having a hook-eye operating member for said movable contact means.

6. In apparatus of the type described, movable contact means mounted for substantially pivotal movement into and out of engagement with a cooperating contact means, means for locking said movable contact means against separating movement when it is in engagement with said cooperating contact means comprising a lock member, a pivot pin mounting said lock member on a support associated with one of said contact means, detent means for releasably retaining said lock member at a locking position wherein it engages the other contact means and at a non-locking position, said detent means comprising cooperable parts one of which is mounted on said lock member and the other of which is mounted on said pivot pin and held thereby against said support to prevent movement thereof with said lock member.

7. In apparatus of the type described, movable contact means mounted for substantially pivotal movement into and out of engagement with a cooperating contact means, means for locking said movable contact means against separating

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movement when it is in engagement with said cooperating contact means comprising a lock member, a pivot pin mounting said lock member on a support associated with one of said contact means, detent means for releasably retaining said lock member at a locking position wherein it engages the other contact means and at a non-locking position, said detent means comprising cooperable parts one of which is mounted on said lock member and the other of which is mounted on said pivot pin, said other part having a non-circular portion which is held by the pivot pin against said support to prevent movement thereof with said lock member.

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