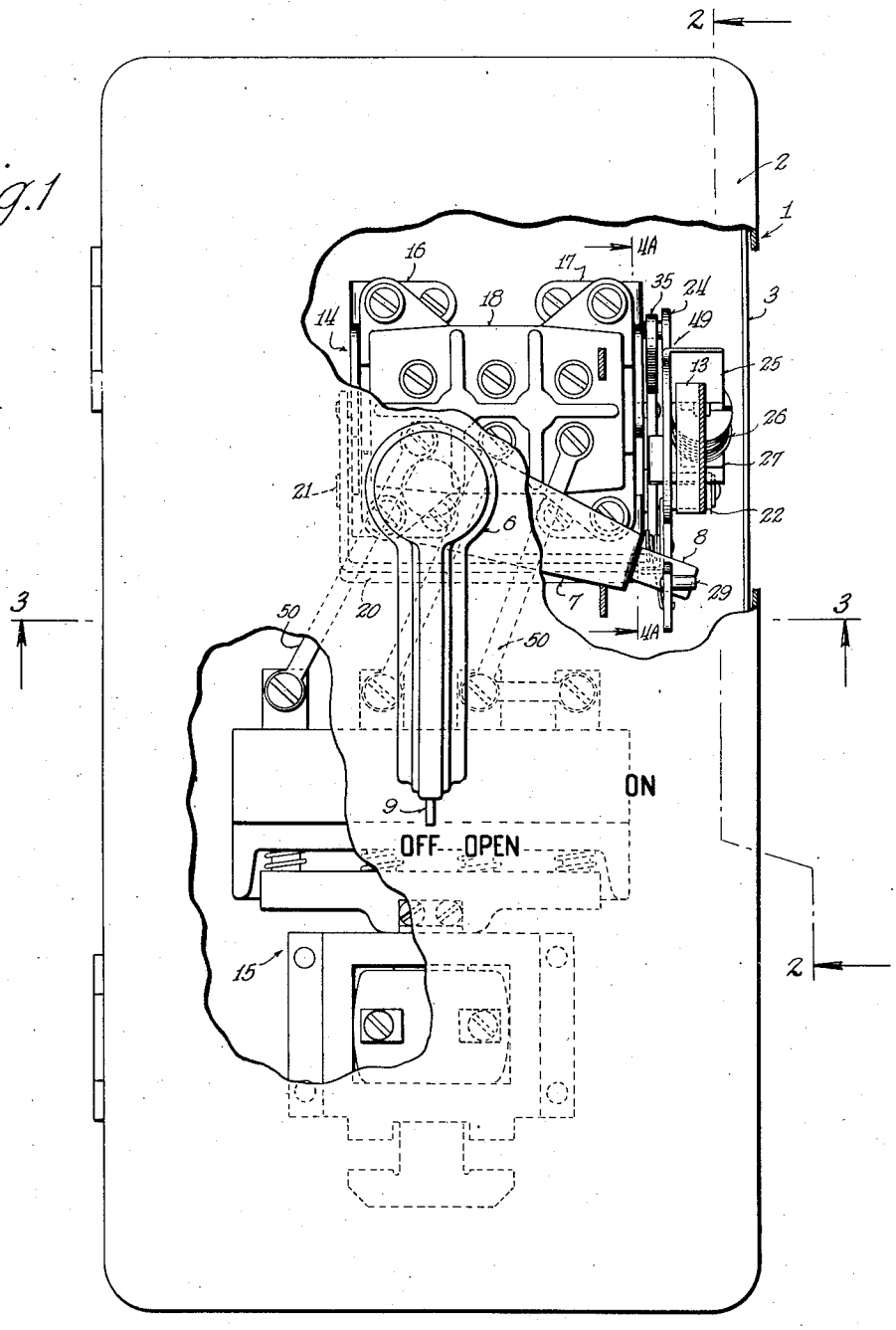
March 21, 1944. W. J. QUAST 2,344,636

ENCLOSED ELECTRIC SAFETY SWITCH

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Fig. 1



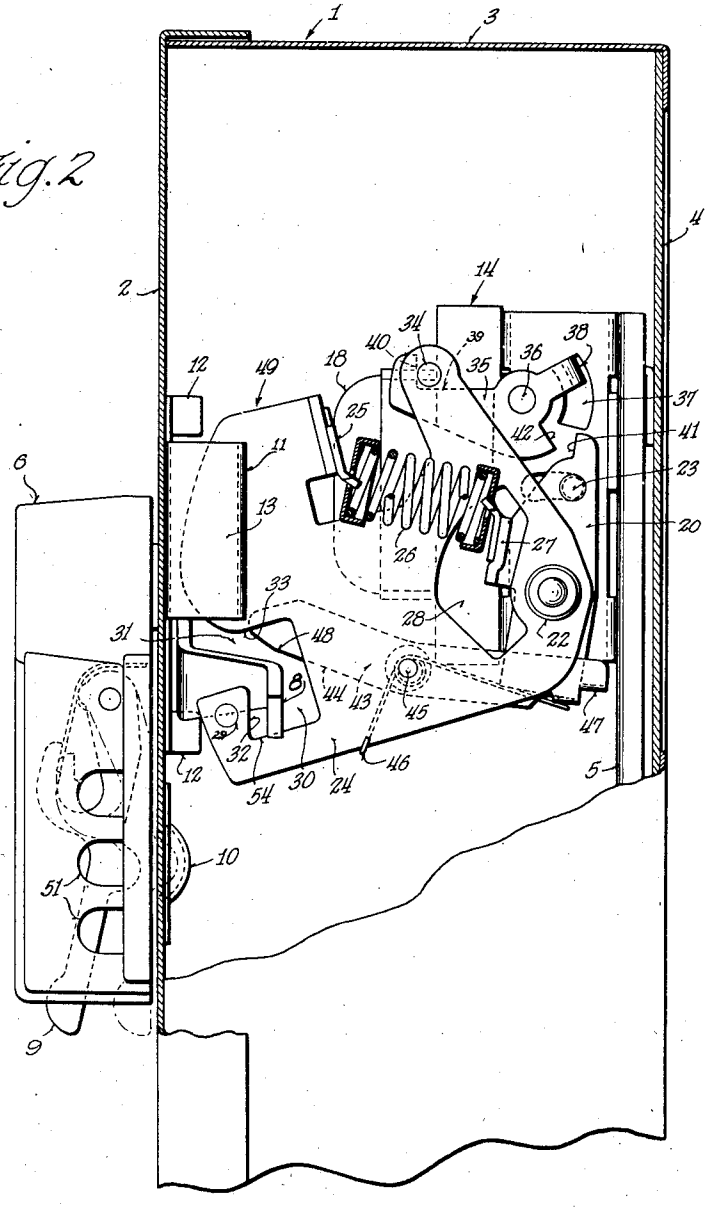
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ENCLOSED ELECTRIC SAFETY SWITCH

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Fig. 2



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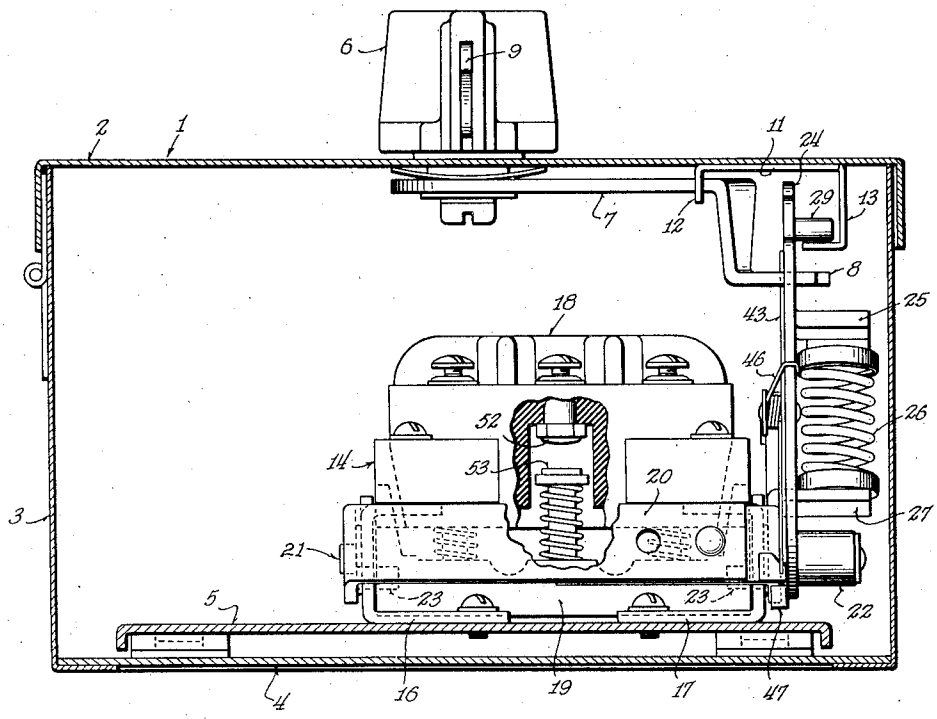


Fig. 3

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Fig. 4A

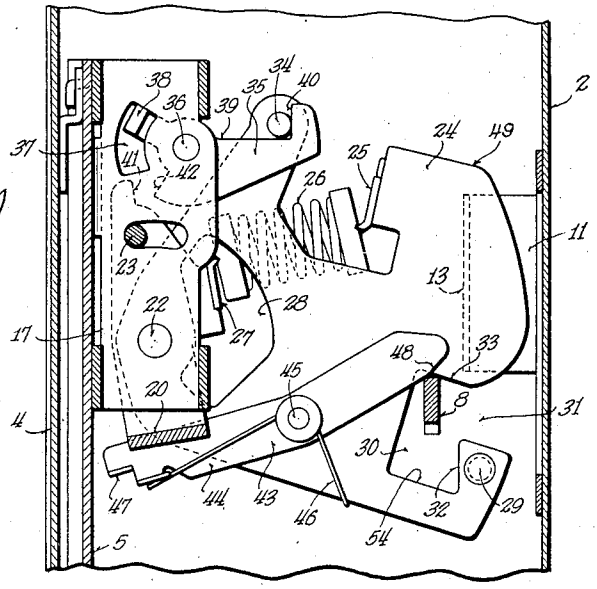
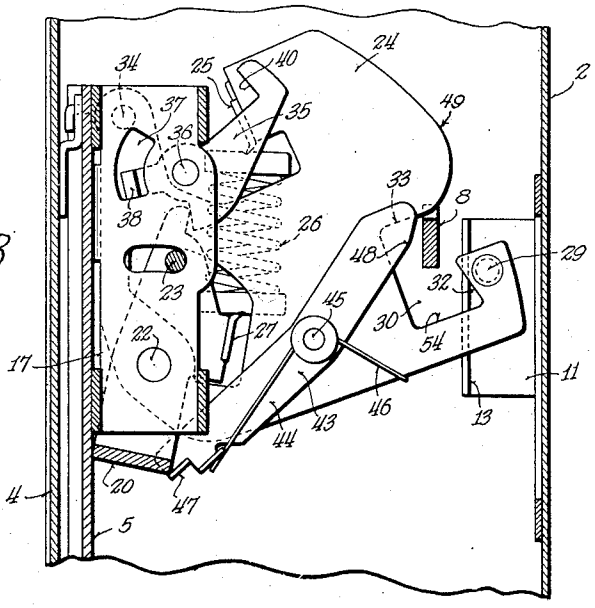


Fig. 4B



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Patented Mar. 21, 1944 2,344,636

UNITED STATES PATENT OFFICE

2,344,636

ENCLOSED ELECTRIC SAFETY SWITCH

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Application April 21, 1941, Serial No. 389,565

11 Claims. (Cl. 200—50)

This invention relates to enclosed electric safety switches that are operable from the exterior of the enclosure.

The object of this invention is to secure an improved enclosed electric safety switch in which the enclosure can be locked "closed" with the switch locked in the "off" position.

A further object of the invention is to secure an improved enclosed electric safety switch that must be returned to the "off" position with the switch locked in the "off" position before the enclosure may be opened, and with the enclosure opened the switch lock being manually releasable for purposes of inspection and test.

A further object of the invention is to secure in an improved enclosed electric safety switch, an enclosure lock, a switch operating means and switch lock, whereby, upon operation to the "on" position, the switch lock is first released, and after the enclosure is locked "closed" the switch is operated to the "on" position.

A further object of this invention is to secure an improved enclosed electric safety switch, in which upon movement from "on" position to "open" position, operation of the switch to "off" position occurs before the position is reached where the enclosure may be unlocked.

The operation of disconnect switches used in enclosed combination starters for industrial motor control, require features that are of vital importance for safe operation. It is important that the enclosure be locked "closed" in the "off" position. Upon "opening" of the enclosure it is desirable that movement of the switch operating lever from the exterior of the enclosure release the cover locking means without operation of the disconnect switch to the "on" position. This permits the enclosure to be opened for purposes of inspection and test with the disconnect switch in the "off" position.

In the "off" position, with the enclosure "open," it is desirable that the disconnect switch be locked in the "off" position. For purposes of test and inspection, it is advantageous to be able, when the enclosure is opened, to operate the switch to the "on" position. This is attained in the safety switch herein described by means of a switch lock that can be released by an electrician to permit operation to the "on" position.

It is also desirable that the disconnect switch be arranged so that it is returned to the locked "off" position before closing of the enclosure.

With the enclosure "closed," operation of the switch operating lever from the exterior of the enclosure should first lock the enclosure and then operate the disconnect switch to the "on" position.

The desired features of operation are obtained in the safety switch herein described and shown in detail in the drawings accompanying this specification.

Figure 1 is a front view of a combination starter showing by means of partial cut-out sections, the safety switch operating means, the disconnect switch, and the electromagnetic starter contained within the enclosure.

Figure 2 is a partially sectioned view taken along the lines 2—2 shown in Figure 1.

Figure 3 is a partially sectioned view taken along the lines 3—3 in Figure 1.

Figure 4A is a section of the disconnect switch operating mechanism and switch operating lever taken along the lines 4A—4A in Figure 1, with the disconnect switch in the "off" position and the switch lock released.

Figure 4B is a section of the disconnect switch operating mechanism and switch operating lever taken along the lines 4A—4A in Figure 1, with the disconnect switch in the "on" position and the enclosure locked "closed."

The combination starter shown in Figure 1 comprises an enclosure 1, a disconnect switch 14 and electromagnetic switch 15 mounted within enclosure 1, and an operating handle 6 mounted on the front of enclosure 1 operable to actuate the disconnect switch 14 and to lock or unlock the enclosure 1. Disconnect switch 14 is electrically connected to electromagnetic switch 15 by means of connectors 50. Combination starters of this type include a wide variety of combinations including fuse blocks, manual starting switches, and automatic starting switches. The preferred form herein described shows the disconnect switch in combination with an electromagnetic starter.

The enclosure 1 includes a box 3 having a back or bottom 4 and a hinged cover 2. A mounting plate 5 is attached to the bottom of the box. The mounting plate 5 is used to support disconnect switch 14 and electromagnetic switch 15. Switch operating handle 6 is mounted on the front face of the cover 2 and has attached to it on the inside wall of cover 2, a lever 7 having a projecting extension 8 that engages the switch operating lever 24. The operating handle 6 has on the front face of the cover, a locking device 9 operable to engage recess 10 in cover 2 to lock lever 6 in the "off" position. The locking position of locking means 9 is shown in broken lines on Figure 2 and is maintained by one, two or three padlocks, not

shown, inserted in the openings 51 of locking means 9. On the inside wall of cover 2, there is mounted a formed piece 11 including stops 12 and a cover lock 13. The formed piece 11 is shown best in Figures 2 and 3.

The disconnect switch 14 includes two mounting brackets 16 and 17 to which is attached an insulating block 18 mounting three pair of stationary switch contacts 52. The bracket 17 supports an over-center switch operating mechanism 49. Brackets 16 and 17 jointly support the U-lever 20 at bearings 21 and 22. Lever 20 is coupled to cross bar 19 by pins 23. Lever 20 actuates cross bar 19 and three pair of bridging contacts 53 operable to engage contacts 52. The U-lever 20 is operated by the over-center switch mechanism 49. Over-center switch operating mechanism 49 includes switch operating lever 24 pivotally mounted on bearing 22. Lever 24 includes bracket 25, an opening 28, a cover locking pin 29, stop pin 34, and a recess 30 for the extension 8 of operating handle lever 7. Recess 30 includes an opening 31, cam surface 33, under cut portion 32 and cam surface 54.

The U-lever 20 includes a bracket 27 that projects through the opening 28 in lever 24. Spaced between bracket 27 and bracket 25 is a compression spring 26. The main bearing 22 jointly supports U-lever 20 and switch operating lever 24. Brackets 25 and 27 are so located with reference to main bearing 22 that upon operating of lever 24, U-lever 20 and cross bar 19 are operated by snap action from "off" to "on" positions.

A releasable lock 43 is pivotally mounted on the lever 24 to lock the switch mechanism in the "off" position. The releasable lock 43 includes a lever 44, a pivot 45 and a spring 46. Lever 44 has a hooked portion 47 positioned to engage the U-lever 20 when the switch is in the "off" position to lock the entire switch mechanism preventing movement to "on" position unless the lock is released. The lock is biased to the locking position by spring 46. Lever 44 has a cam surface 48 normally extending over a portion of the opening 31 of lever 24 where it can be engaged by lever extension 8 to release the lock 43 prior to operation of the over-center switch operating mechanism 49. When the enclosure 1 is open, the lock 43 can be released manually to permit operation of the switch for purposes of test and inspection.

A kick-off lever 35 is pivotally mounted on bracket 17. The lever 35 includes a cam surface 39, stop 40, a stop 38 projecting through recess 37 in bracket 17, and a cam surface 42. In operating lever 24 to actuate the switch from "on" to "off" position, pin 34 engages cam surface 39 moving kick-off lever 35 so that cam surface 42 engages the cam surface 41 on lever 20 positively moving the contacts to open position in the event that the contacts are welded closed. This operation occurs simultaneously with the actuation of the snap action mechanism. In the normal operation to the "off" position the opening occurs entirely by the over-center mechanism. It is only in the event that the contacts are welded that the kick-off mechanism is effective to positively disengage the contacts.

In the "off" position of the operating handle 6, cover 2 is held closed by lever extension 8 engaging the under-cut portion 32 of lever 24. This position is maintained by locking the handle 6 to prevent movement thereof as described above.

The cover 2 of enclosure 1 is opened by moving operating lever to a position where the lever extension 8 is opposite the opening 31 of lever 24. In this position the lever extension 8 does not engage the under-cut portion 32 of lever 24 and the cover 2 is free to be opened. This disconnect switch 14 remains locked in the "off" position when the cover is opened.

When the enclosure is opened, all parts of the combination starter are disconnected from the line except the line connections to disconnect switch 14. If for purposes of test and inspection an electrician or other qualified person desires to operate the starter, operation to the "on" position can be made with the enclosure open by first releasing the locking lever 43 and pushing lever 24 to the "on" position. This operation is not obvious to the ordinary workmen and can only be performed by reaching the switch operating mechanism. An electrician having knowledge of the proper operation of the switch can safely operate the switch to "on" position by exercising reasonable care.

Operation to the "on" position with the enclosure "closed" is shown in Figures 4A and 4B. The operating handle 6 is operated to the right and lever extension 8 engages cam surface 48 of releasable lock 43, moving the releasable lock 43 to the unlocked position shown in Figure 4A. Further movement of the lever extension 8 moves lever 24 to an intermediate position where pin 29 engages cover lock 13 preventing opening of the enclosure. After reaching the cover locking position, further movement of lever extension 8 then completes the operation to "on" position as shown in Figure 4B.

Operation from "on" position to "off" position with the enclosure "closed" follows in general a reversal of the operations to "on" position. Lever extension 8 engages lever 24 at cam surface 54 to move the switch to "off" position with the cover "closed" as shown in Figure 2.

The cover locking position shown in Figure 2 is established at the beginning of the operation to the "off" position so that the cover is locked at all times during movement to "off" position. Upon completion of the operation to "off" position the releasable lock 43 resets to maintain the locked position when the cover is opened.

I claim as my invention:

1. In a manually operable safety switch comprising a switch mounted within an enclosure having a removable cover, switch operating mechanism within said enclosure operable to actuate said switch to "on" or "off" positions, a second switch operating mechanism mounted on said cover and operable from the exterior of the enclosure and arranged to be in engagement to actuate said first switch operating mechanism when the enclosure is closed and a releasable switch locking means to lock said switch in the "off" position and operable by said second switch operating mechanism to its unlocked position when the said two switch operating mechanisms are in their engaged position.

2. In a manually operable safety switch comprising a switch mounted with an enclosure having a removable cover, switch operating mechanism within said enclosure operable to actuate said switch to "on" or "off" positions, a second switch operating mechanism mounted on said cover and operable from the exterior of the enclosure and arranged to be in engagement to actuate said first switch operating mechanism when the enclosure is closed and a releasable switch locking means carried by said first switch operating mechanism to lock said switch in the "off" position and operable by said second switch

operating mechanism to its unlocked position when the said two switch operating mechanisms are in their engaged position.

3. An enclosed manually operable safety switch comprising an enclosure, a removable cover for said enclosure, a switch located within the enclosure, said switch having an operating lever, a cover locking means and a second cover locking means, an operating handle mounted on said cover and operable from the exterior of the enclosure to engage said switch operating lever to operate said switch to "on" or "off" positions, and cover locking means on said cover; said operating handle in the "off" position engaging said first cover locking means to lock said cover closed; said second cover locking means engaging the locking means on said cover to lock said cover closed upon operation of said switch by said operating handle to the "on" position; and said operating handle having a position within the range of said "off" position where the handle can be disengaged from the first cover locking means to allow the cover to open.

4. An enclosed manually operable safety switch comprising an enclosure, a removable cover for said enclosure, a switch located within the enclosure, an operating handle mounted on said cover and operable from the exterior of the enclosure to operate said switch to "on" or "off" positions, locking means for said cover when said switch is in "off" position operable by said operating handle, and a second locking means for said cover when said switch is in "on" position operable by said operating handle; operation of said safety switch by said operating handle to the "off" position locking said cover by said first cover locking means; operation of said safety switch by said operating handle to the "on" position locking said cover closed by said second locking means; and said operating handle having a position within the range of said "off" position where both locking means are ineffective, permitting opening of the enclosure when the switch is in its "off" position.

5. An enclosed manually operable safety switch comprising an enclosure, a removable cover for said enclosure, a switch located within the enclosure, an operating handle mounted on said cover and operable from the exterior of the enclosure to operate said switch to "on" or "off" positions, locking means for said cover when said switch is in "off" position operable by said operating handle, and a second locking means for said cover when said switch is in "on" position operable by said operating handle; operation of said safety switch by said operating handle from "on" to "off" positions rendering said first cover locking means effective before release of said second cover locking means and before movement of said switch from "on" to "off" positions; operation of said safety switch by said operating handle from "off" to "on" position rendering said second cover locking means effective before movement of said switch from "off" to "on" position; and said operating handle having a position within the range of said "off" position where both locking means are ineffective, permitting opening of the enclosure when the switch is in its "off" position.

6. An enclosed manually operable safety switch comprising an enclosure, a removable cover for said enclosure, a switch located within said enclosure, a switch operating mechanism located within said enclosure, an operating handle mounted on said cover actuating a lever on the interior of said enclosure which lever cooperates with said switch operating mechanism, when said cover is closed, to operate said switch to "on" or "off" positions, a cover locking member on the interior wall of said cover, a second cover locking member on said switch operating mechanism, and a third cover locking member on said switch operating mechanism; operation of said safety switch by said operating handle to the "off" position locking said cover closed by engagement of said lever with said second cover locking member; operation of said safety switch by said operating handle to the "on" position locking said cover closed by engagement of said third cover locking member with said cover locking member on said cover; and said operating handle having a position within the range of said "off" position where said lever can be disengaged from the second cover locking member to allow the cover to open.

7. An enclosed manually operable safety switch comprising an enclosure, a removable cover for said enclosure, a switch located within said enclosure, a member inside said cover to operate said switch and an operating handle mounted on said cover and operable from the exterior of said enclosure and having a part extending through an opening in said cover and arranged to engage said member and to operate said switch to "on" or "off" positions; operation of said safety switch by said operating handle to a first position actuating said switch to "off" position and locking said cover by an inter-engagement of said part and said member; operation of said safety switch by said operating handle to a second position actuating said switch to "on" position and locking said cover closed by inter-engagement of said member and a part on the interior of said cover; and said operating handle having a third position intermediate said first and second positions and within the range of the "off" position of said switch where both of said cover locks are ineffective permitting opening of said enclosure when said switch is in its "off" position.

8. An enclosed manually operable safety switch comprising an enclosure, a removable cover for said enclosure, a switch located within said enclosure, a cover lock for said enclosure when said switch is in "off" position, a second cover lock for said enclosure when said switch is in "on" position, a releasable switch lock associated with said switch and within said enclosure, and a common operating means comprising an operating handle mounted on the exterior of said cover and a lever on the interior wall of said cover cooperating with said switch, cover locks and switch lock when the cover is closed to actuate said switch to "off" position and lock said cover closed by said first cover lock, release said switch lock, lock said cover closed by said second cover lock, and actuate said switch to "on" position; and said common operating means having a position, within the range of the "off" position of said switch where both of said cover locks are ineffective, permitting opening of said enclosure when said switch is in "off" position.

9. An enclosed manually operable safety switch comprising an enclosure, a removable cover for said enclosure, a switch located within said enclosure, a switch operating mechanism located within said enclosure, an operating handle mounted on said cover actuating a lever on the interior wall of said cover which lever cooperates

with said switch operating mechanism, when said cover is closed, to operate said switch to "on" or "off" positions, a cover locking member on the interior wall of said cover, a second cover locking member on said switch operating mechanism, and a releasable switch locking means associated with said switch operating mechanism, said operating handle in the "off" position positioning said lever in cover locking engagement with said second cover locking member; and said operating handle upon movement toward the "on" position disengaging said lever from said second cover locking member and releasing said switch locking means to permit operation of said switch to "on" position.

10. An enclosed manually operable safety switch comprising an enclosure, a removable cover for said enclosure, a switch located within said enclosure, a switch operating mechanism located within said enclosure, an operating handle mounted on said cover actuating a lever on the interior wall of said cover which lever cooperates with said switch operating mechanism, when said cover is closed, to operate said switch to "on" or "off" positions, a cover locking member on the interior wall of said cover, a second cover locking member on said switch operating mechanism, a third cover locking member on said switch operating mechanism, and a releasable switch locking means associated with said switch operating mechanism; said operating handle in the "off" position positioning said lever in cover locking engagement with said second cover locking member; said operating handle upon movement toward the "on" position disengaging said lever from said second cover locking member and releasing said switch locking means to permit operation of said switch to "on" position; and said operating handle in the "on" position positioning said third cover locking member in cover locking engagement with the cover locking member on the interior wall of said cover.

11. An enclosed manually operable safety switch comprising an enclosure, a removable cover for said enclosure, a switch located within said enclosure, a switch operating mechanism for said switch and located within said enclosure, an operating handle mounted on said cover actuating a lever on the interior wall of said cover which lever cooperates with said switch operating mechanism, when said cover is closed, to operate said switch to "on" or "off" positions, a cover locking member on the interior wall of said cover, a second cover locking member on said switch operating mechanism, a third cover locking member on said switch operating mechanism, and a releasable switch locking means associated with said switch operating mechanism, said operating handle in the "off" position positioning said lever in cover locking engagement with said second cover locking member; said operating handle upon movement toward the "on" position disengaging said lever from said second cover locking member and releasing said switch locking means to permit operation of said switch to "on" position; said operating handle in the "on" position positioning said third cover locking member in cover locking engagement with the cover locking member on the interior wall of said cover; and upon movement by said operating handle from "off" to "on" position said third cover locking member moving into cover locking engagement with said cover locking member on the interior wall of said cover before actuation of said switch to the "on" position.

WILLIAM J. QUAST.