July 20, 1937. W. A. BONNELL ET AL 2,087,589

HOUSING FOR CIRCUIT BREAKERS

Filed Oct. 21, 1935 3 Sheets-Sheet 1

Fig. 3

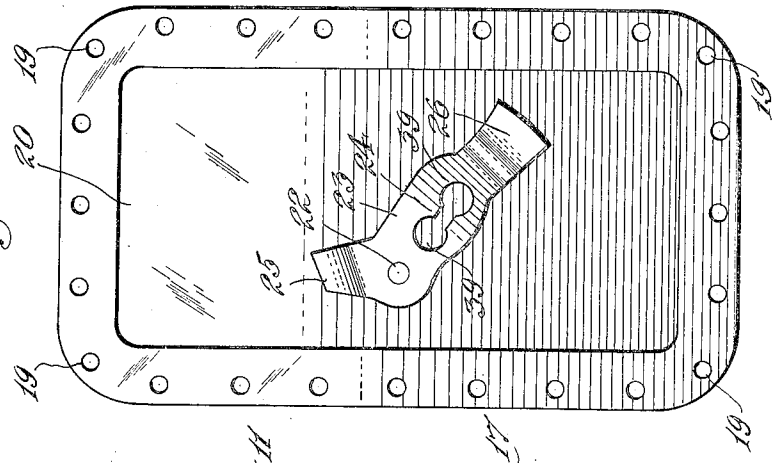



Fig. 2

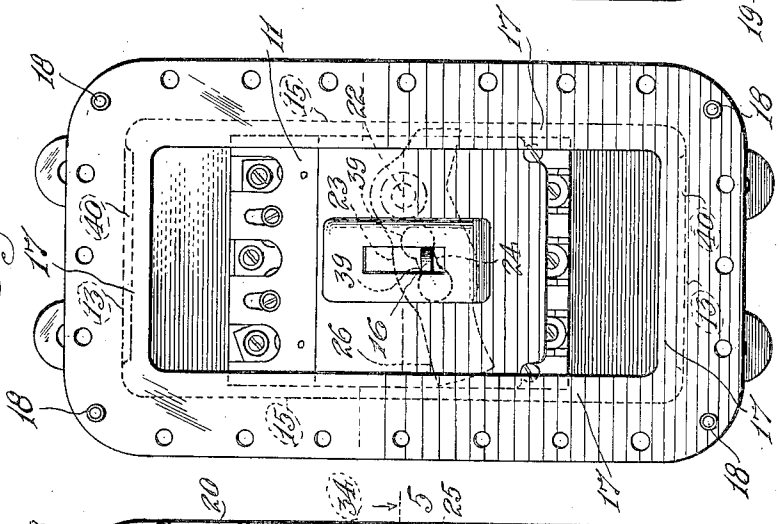
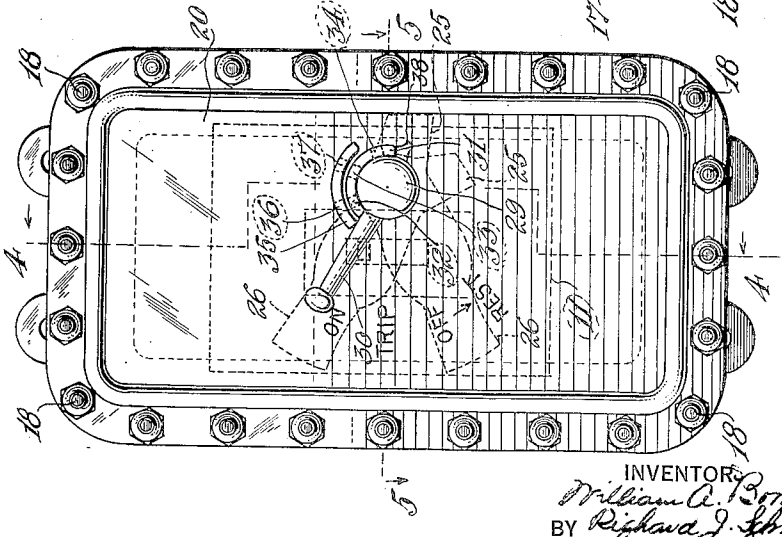



Fig. 1

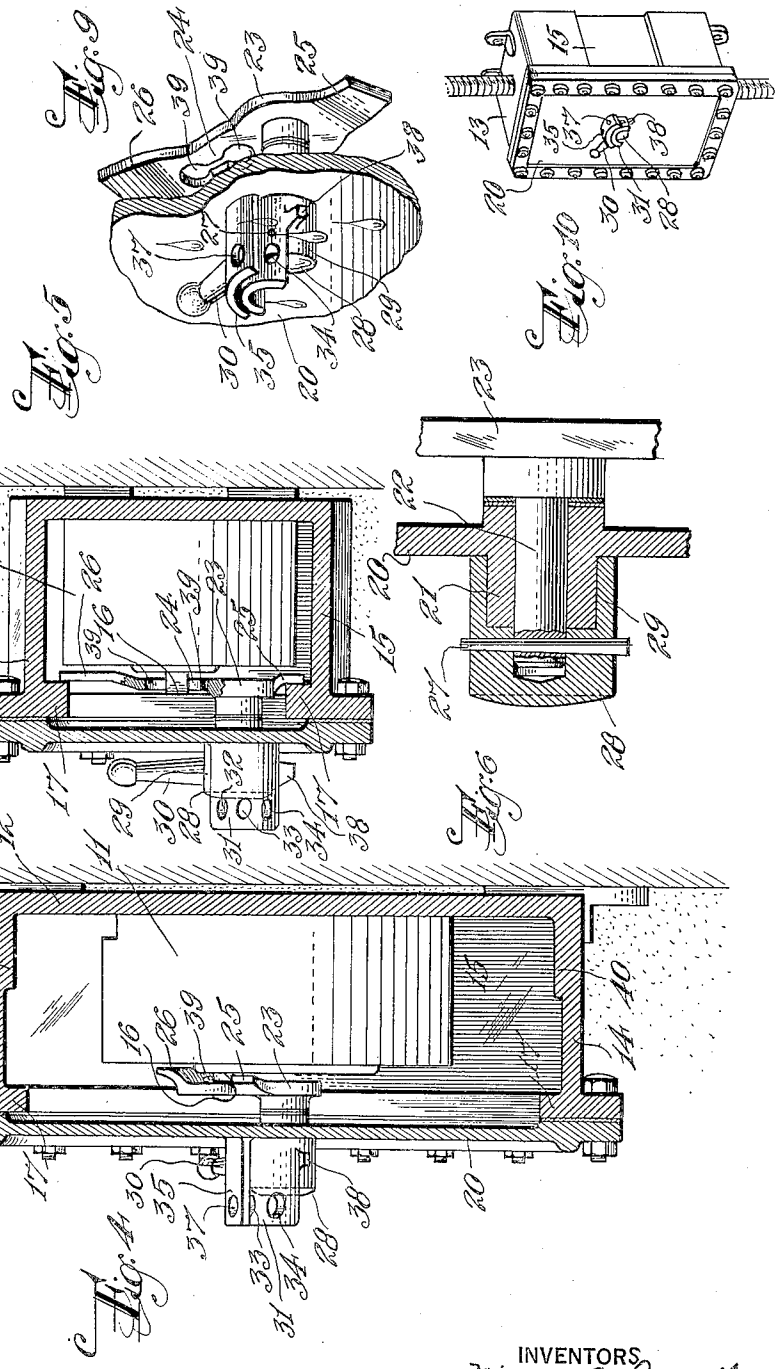



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Filed Oct. 21, 1935 3 Sheets-Sheet 2



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HOUSING FOR CIRCUIT BREAKERS

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Fig. 8

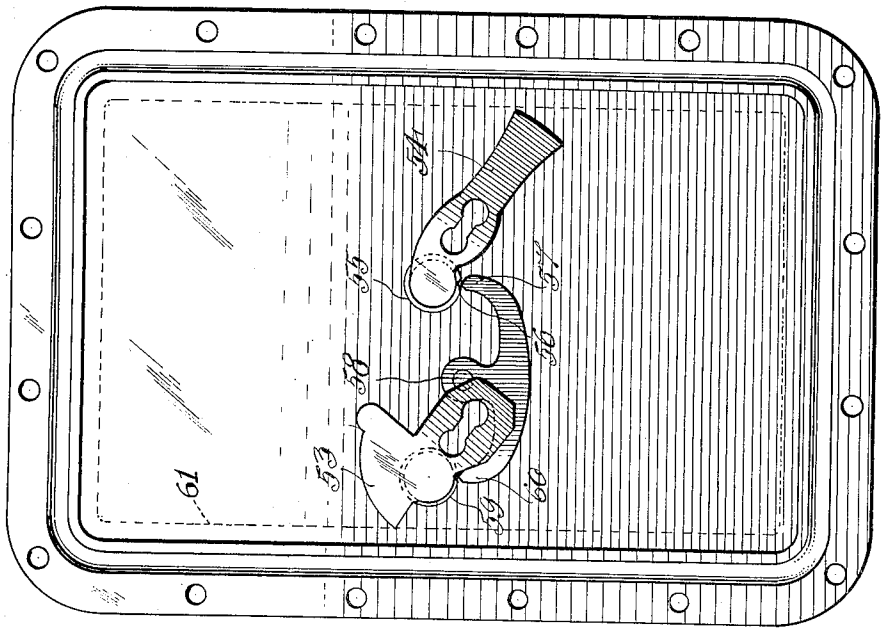
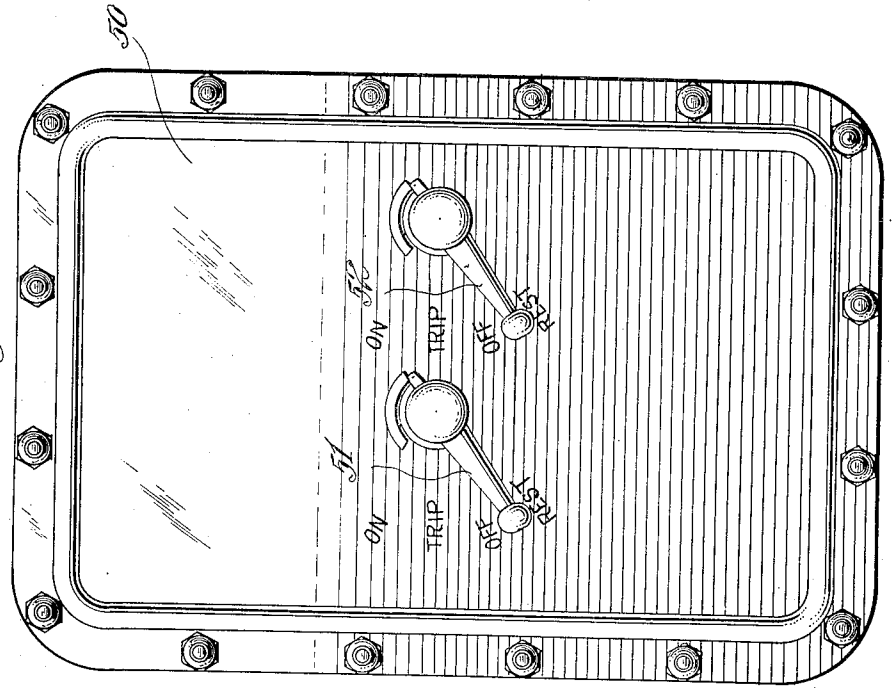



Fig. 7




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Patented July 20, 1937 2,087,589

# UNITED STATES PATENT OFFICE

2,087,589

## HOUSING FOR CIRCUIT BREAKERS

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Application October 21, 1935, Serial No. 45,842

16 Claims. (Cl. 200—50)

This invention relates to housings for circuit breakers; more particularly to the provision of explosion-proof and water-proof means for encasing such breakers.

As is well-known, when a circuit breaker is tripped due to an overload, or manually set to an "off" position, an arc is created which, in the presence of an inflammable gas can produce a serious explosion. This is especially so in coal mines where electrical apparatus is used to a great extent.

It is, therefore, an object of this invention to provide means for effectively encasing a circuit breaker to prevent any arc, which may be created during the tripping of the circuit breaker, from igniting inflammable gases surrounding the housing for the circuit breaker.

In mines, it is common practise to have a central control station through which power passes from an outside source. This station is under the supervision of an operator who attends to the circuit breaker and other switches.

From the central station, power lines extend to various motors and other electrical apparatus used in the mines. When it is necessary to repair the motor or other apparatus, obviously the current must be shut off, and this is done through the circuit breakers. However, since the central station in which the circuit breakers are located frequently are at a considerable distance from the apparatus being repaired, it is necessary to provide means to prevent accidental or inadvertent closing of the circuit during the repair of the apparatus. Obviously, for example, should a motor be in the process of repair and the circuit is suddenly closed, there is a possibility of a large flash being produced across the motor which would ignite the surrounding inflammable gas and create a disastrous explosion.

A further object of this invention is to provide means for preventing the removal of the cover of a circuit breaker housing except when the circuit breaker is in the "off" position, thereby obviating the possibility of a flash being created with the circuit breaker unencased and exposed to the surrounding inflammable gas.

A further object is the provision of means for locking the circuit breaker in an "off" position by means of a plurality of locks so that during the repair of apparatus the circuit breaker cannot be moved to the "on" position except when all of the locks have been removed.

According to this feature of the invention, the operator in control of the circuit breaker would attach a lock to the circuit breaker to hold it in an "off" position, and the repair man of the electrical apparatus would also attach a separate lock to the circuit breaker. It will be seen that by means of this arrangement the circuit breaker cannot be moved to an "on" position until both the repair man and the station attendant are present to remove their locks.

A further object is the provision of a housing having a control lever for operating a circuit breaker, which lever is provided with a shed for preventing water seeping into the circuit breaker, and to also serve as a stop to limit the movement of the handle in both directions of movement.

A further object is the provision of a novel interlocking means on a casing for two circuit breakers to prevent the throwing of both circuit breakers to the "on" position at the same time.

These and other advantageous objects which will later appear, are accomplished by the simple and practical construction and arrangement of parts hereinafter described and exhibited in the accompanying drawings, forming part hereof, and in which:

Fig. 1 is a plan view of a housing for a circuit breaker embodying our invention,

Fig. 2 is a plan view of a circuit breaker housing with the cover removed,

Fig. 3 is a plan view of the inside surface of the cover of the circuit breaker housing,

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1,

Fig. 5 is a sectional view taken on line 5—5 of Fig. 1,

Fig. 6 is a sectional view showing details of the operating handle used on the circuit breaker housing,

Fig. 7 is a plan view of a circuit breaker housing cover for two circuit breakers,

Fig. 8 is a plan view of the inside surface of the cover of the housing shown in Fig. 7, showing in detail the interlocking means between the two operating handles mounted on the cover,

Fig. 9 is a fragmentary perspective view showing details of an operating handle used in connection with our invention, and

Fig. 10 is a perspective view, on a reduced scale, of the housing for a circuit breaker embodying our invention, showing the electrical cables which connect with the circuit breaker.

Referring to the drawings, in Fig. 4 there is shown a circuit breaker 11 of a conventional type, mounted on the back wall 12 of a rectangular, box-like metal casing having a top wall 13, bottom wall 14, and side walls 15.

The circuit breaker is provided with the usual relatively short operating lever 16.

The free edges of the walls of the casing are provided with outwardly and inwardly extending flanges 17' and 17 respectively, which form, with a wall of the casing, a T-shape.

In order to comply with the requirements of certain regulatory bureaus in charge of the inspection of equipment, with regard to the prevention of fire and explosions, the flanges 17' and 17 together must be of sufficient width to prevent a flame created within the casing from passing out to gases surrounding the casing.

By providing the T-shape arrangement of the wall and flanges as above described and shown in the drawings the width of the flange 17' can be decreased.

Projecting from the corners of the casing are four studs 18 which cooperate with apertures 19, in the cover to enable the same to be properly positioned on the casing. The cover is provided with an outwardly projecting bushing 21, see Fig. 6, through which passes a stub shaft 22 having attached to one end thereof a lever or arm 23, provided with a slot 24 in which the lever 16 of the circuit breaker moves.

The lever 23 is provided with depressed end portions 25 and 26 which engage the flange 17 when the circuit breaker has been moved to the "on" position, thereby preventing the removal of the cover from the casing when the circuit breaker is in the "on" position.

Attached to the other end of the stub shaft 22 by means of a pin 27 is a cylindrical head 28 having an apron 29 which encircles the bushing 21, said apron extending to the outer surface of the cover 20. Integral with the head 28 is an operating handle 30.

Referring to Fig. 6 it will be seen that in order for a flame to reach the outside of the casing by way of the stub shaft 22 and head 28, it will be necessary for the flame to travel up along the stub shaft, then over the outer edge of the bushing 21 then down along the space between the apron 29 and the bushing 21, then out between the apron 29 and the cover 20. In other words, it will be necessary for the flame to travel several inches, which is a safe distance considerably in excess of that required by regulatory bureaus, thereby rendering the casing flame-proof.

Projecting outwardly from the head 28 is an arcuate flange 31 having three apertures 32, 33 and 34 therein, said flange being arranged so that when the handle 30 is moved to the "off" position, it will lie beneath a similar arcuate flange 35 projecting from the outer surface of the cover 20, so that apertures 36, and 37, in the flange 35 will register respectively with apertures 32, and 33 in the flange 31.

One edge of the flange 35 engages the lever to limit the movement thereof when it is moved to the "on" position, and the other edge of the flange 35 engages a lug 38 projecting from the head 28 to limit the movement of the handle in the opposite direction. By means of this arrangement excessive stresses on the circuit breaker handle 16 are prevented, and the possibility of breaking the circuit breaker handle is eliminated.

The slot 24 in the lever 23 has rounded ends 39 giving the slot a "dumbbell" shape. This shape of the slot enables the free movement of the elongated flat circuit breaker handle 16 therein. When the circuit breaker has moved to the "trip" position, the circuit breaker handle 16 is parallel to the slot 24 and rests substantially in the straight portion thereof. When the circuit breaker handle is moved to either the "on" or "off" position, the handle will lie at an angle to the slot with the edges thereof positioned in the rounded portions 39 in the slot.

Referring to Fig. 4 it will be seen that the top and bottom walls 13 and 14 are thickened at 40 and the side walls are similarly thickened to enable the casing to be tapped for the passage of conduits from different directions without decreasing the strength of the casing.

In operation, the cover is placed upon the casing as shown in Fig. 1, the cover being guided in position by means of the studs 18 and holes 19, after which the cover is securely bolted into position. The circuit breaker handle 16 is now positioned in the slot 24 and movements of the lever 23 are obviously transmitted to the circuit breaker handle 16. When the handle 30, on the outside of the cover is moved to the "on" position, the depressed portions 25 and 26 engage the underside of the flange 17 and prevent removal of the cover. The studs 18 positioned in the holes 19 of the cover prevent removal of the cover by preventing sliding movement of the cover in either direction.

When the handle 30 is moved to the "off" position or "reset" position, obviously the cover can be readily removed as the lever 23 will be substantially in a position as shown in Fig. 3.

When an attendant desires to lock the lever in the "off" position, he inserts a padlock in the apertures 36 and 32. Should the repair man desire to further lock it in the "off" position he will insert a padlock in the apertures 33 and 37, and should an inspector or other person desire to further lock the device in the "off" position, a padlock can be inserted through the apertures 34. It will be seen that when the lever is so locked in the "off" position, it cannot be moved to the "on" position until all of the padlocks are removed. In other words, accidental moving of the lever to the "on" position during the repair of apparatus, for example, is prevented, and the lever cannot be placed in the "on" position until all of the persons concerned with the repair work are present to remove their respective padlocks.

The flanges 17' and 17 and the corresponding surface on the inside of the cover 20 are preferably ground in order to provide an air tight joint. However, if desired, grooves may be divided in the flanges to receive a gasket to also provide an air tight joint.

From the above description it will be seen that we have provided a relatively simple housing for a circuit breaker which is explosive-proof and water-proof, and fool-proof. That is, the housing is provided with means to prevent excessive forces being applied to circuit breaker lever, means to prevent removal of the cover when the circuit breaker is in the "on" position, and means to prevent the accidental throwing of the circuit breaker to an "on" position during the repair of the electrical apparatus receiving power through the circuit.

The operating levers 30 are mounted on the front cover of the boxes thereby enabling close ganging of a plurality of circuit breakers which is not possible with operating handles on the side walls of the boxes. In some instances it is necessary to use two circuit breakers. Such a case will arise where power is received from two independent sources, and it is not desirable

that power be received from the two sources at the same time. In Fig. 7, we have shown a housing for two circuit breakers, which housing is provided with the cover 50, and having mounted thereon a pair of operating handles 51 and 52 which are of the same construction as described above, in connection with the single circuit breaker.

In Fig. 8 is shown the underside of the cover 50 in which it will be seen that the handles 51 and 52 are provided with levers 53 and 54 which engage the underside of the flange 61 of the casing shown in dotted lines in Fig. 8 of the drawings, for preventing removal of the cover. Obviously, the cover can only be removed when both circuit breakers are in the "off" position. The levers 53 and 54 are provided with slots for engaging the circuit breaker levers as has heretofore been described. The lever 54 is attached to a shaft 55 having a notch 56 adapted to receive the pointed arm 57 of an arcuate lever pivoted at 58. Similarly the lever 53 is attached to a shaft 59 having a notch receiving the arm 60 of the lever pivoted at 58.

From the above description of Fig. 8 it will be seen that the two levers cannot be moved from an "off" position at the same time. For example, when the lever 54 is moved to the "on" position, the arm 57 is moved out of the notch 56 and the arm engages the shaft 55 causing the arm 60 to be pressed tightly into the notch in the shaft 59 thereby locking the lever 53 from movement. Similarly if the lever 53 is moved from the "off" position to the "on" position the lever 54 will be locked in the "off" position.

By means of this arrangement, obviously, it is impossible for both circuit breakers to be thrown into an "on" position and draw current simultaneously from two independent sources while the cover is in position on the circuit breaker casing.

The foregoing disclosure is to be regarded as descriptive and illustrative only, and not as restrictive or limitative of the invention, of which obviously an embodiment may be constructed including many modifications without departing from the general scope herein indicated and denoted in the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In combination with a circuit breaker having a lever, a casing in which the circuit breaker is mounted, a cover for the casing having a lever mounted thereon, said lever engaging the circuit breaker lever to move the latter to an "off" or "on" position, and means on the casing engaging the lever on the cover to prevent removal of the cover from the casing when the circuit breaker is moved to the "on" position.

2. In combination with a circuit breaker having a lever, a casing in which the circuit breaker is mounted, a cover for the casing, a lever mounted on the cover engaging the circuit breaker lever to move the latter to various positions, and means on the casing engaging the lever on the cover to prevent removal of the cover when the circuit breaker lever has been moved to a position to close the circuit breaker.

3. In combination with a circuit breaker having a lever, a casing in which the circuit breaker is mounted, said casing having inwardly projecting flanges from the side walls thereof, a cover for the casing, and a lever rotatably mounted on said cover engaging the circuit breaker lever to move the latter to various positions, said circuit breaker lever moving in a plane perpendicular to the plane of the rotatable lever, said lever on the cover engaging said flanges to prevent removal of the cover when the circuit breaker lever is moved to the "on" position.

4. In combination with a circuit breaker having a lever, a casing in which the circuit breaker is mounted, a cover for the casing having a bushing projecting from the outer side thereof, a stub shaft journalled in said bushing and passing through said cover, a lever attached to the inner end of said stub shaft and engaging the circuit breaker lever to move the latter to various positions, a head attached to said stub shaft and having an apron extending down along the sides of said bushing to a point adjacent the outer surfaces of said cover, and a handle attached to said head.

5. In combination with a circuit breaker having a lever, a casing in which the circuit breaker is mounted, a cover for the casing, a stub shaft journalled in the casing and passing therethrough, a lever attached to the inner end of the stub shaft and engaging the circuit breaker lever to move the latter to various positions, a head attached to the outer end of the stub shaft, an arcuate flange projecting from said head and having a plurality of apertures therein, a handle attached to said head, and an arcuate flange projecting from said cover and having a plurality of apertures therein, said flanges being so arranged that the apertures therein will register when the circuit breaker lever has been moved to the "off" position.

6. In combination with a circuit breaker having a lever, a casing in which the circuit breaker is mounted, a cover for the casing, a stub shaft journalled in the casing and passing therethrough, a lever attached to the inner end of the stub shaft and engaging the circuit breaker lever to move the latter to various positions, a head attached to the outer end of the stub shaft, an arcuate flange projecting from said head and having a plurality of apertures therein, a handle attached to said head, and an arcuate flange projecting from said cover and having a plurality of apertures therein, said flanges being so arranged that the apertures therein will register when the circuit breaker lever has been moved to the "off" position, the arcuate flange projecting from the cover being proportioned to act as a stop to limit the movements of the handle in both directions thereby preventing the application of excessive stresses in the circuit breaker lever.

7. In combination with a circuit breaker having a lever, a box-like rectangular casing in which the circuit breaker is mounted, a cover for the casing, a lever mounted on the cover and engaging the circuit breaker lever to move the latter to various positions, a flange projecting inwardly from the walls of the casing, said lever engaging said flange to prevent removal of the cover when the circuit breaker lever has been moved to the "on" position, said cover having apertures at the corners thereof, and studs projecting from the flange of said casing and passing through said apertures in the cover to prevent sliding movements of the cover on the casing.

8. In combination with a circuit breaker having a substantially flat lever, a casing in which said circuit breaker is mounted, a cover for the casing, a lever mounted on said cover and having a slot therein in which said circuit breaker

lever is positioned, said slot having a "dumbbell" shape to enable the circuit breaker lever to freely move therein at all positions of the lever mounted on the cover.

9. In combination with a pair of circuit breakers having levers, a casing for the circuit breakers, a cover for the casing, levers mounted on said cover engaging said circuit breaker levers to move the latter to various positions, and interlocking means to prevent the moving of both circuit breaker levers to the "on" position simultaneously, said levers on the cover moving in planes transverse to the planes in which said circuit breaker levers move.

10. In combination with a pair of circuit breaker levers, a casing in which said circuit breakers are mounted, a cover for the casing, stub shafts passing through said cover and having levers mounted thereon, each of said stub shafts having a notch therein, said levers engaging the circuit breaker levers to move the latter to various positions, a lever pivotally mounted between said stub shafts and having pointed arms adapted to rest simultaneously in the notches in said stub shafts only when the circuit breaker levers have been moved to the "off" position, and preventing simultaneous movement of both circuit breaker levers to the "on" position.

11. In combination wth a circuit breaker having a lever, a casing in which the circuit breaker is mounted, a cover for the casing having a stub shaft rotatably mounted thereon, an arm fixed to said stub shaft and engaging the circuit breaker lever, a handle fixed to the stub shaft, and means on the casing engaging said arm to prevent removal of the cover from the casing when the circuit breaker lever is in the "on" position.

12. In combination with a circuit breaker having a lever, a casing in which the circuit breaker is mounted, a cover for the casing, an arm rotatably mounted on the cover and having a slot in which said circuit breaker lever is positioned so that it loosely engages said arm, means on the cover to rotate the arm to move the circuit breaker lever to a position to close the circuit breaker, and means on the casing engaging said arm to prevent removal of the cover when the circuit breaker is closed.

13. In combination with a circuit breaker having a lever, a casing in which the circuit breaker is mounted, a cover for the casing, an arm rotatably mounted on the cover and having an elongated slot in which said circuit breaker is positioned so that it loosely engages said arm, said arm being rotatable in a plane transverse to the plane of movement of the circuit breaker lever, and means on the cover to rotate the arm to a position to close the circuit breaker.

14. In combination with a circuit breaker having a lever, a casing in which the circuit breaker is mounted, a cover for the casing, an arm rotatably mounted on the cover and having an elongated slot in which said circuit breaker is positioned so that it loosely engages said arm, said arm being rotatable in a plane transverse to the plane of movement of the circuit breaker lever, means on the cover to rotate the arm to a position to close the circuit breaker, and means on the casing engaging said arm to prevent removal of the cover when the circuit breaker is closed.

15. In combination with a circuit breaker having a lever, a casing in which the circuit breaker is mounted, said casing having inwardly projecting flanges from the side walls thereof, a cover for the casing, and a lever rotatably mounted on said cover engaging the circuit breaker lever to move the latter to various positions, said circuit breaker lever moving in a plane perpendicular to the plane of the rotatable lever, said lever on the cover engaging said flanges to prevent removal of the cover when the circuit breaker lever is moved to the "on" position, and means to prevent sliding movement of the cover on the casing.

16. In combination with a pair of circuit breakers having levers, a casing for the circuit breakers, a cover for the casing, levers mounted on said cover engaging said circuit breaker levers to move the latter to various positions, interlocking means to prevent the moving of both circuit breaker levers to the "on" position simultaneously, said levers on the cover moving in planes transverse to the planes in which said circuit breaker levers move, and means on the casing engaging a lever on the cover when its associated circuit breaker lever has been moved to the "on" position to prevent removal of the cover from the casing.

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