June 10, 1947. W. M. SCOTT, JR 2,421,853

CIRCUIT BREAKER LOCKING DEVICE

Filed Nov. 27, 1942 3 Sheets-Sheet 1

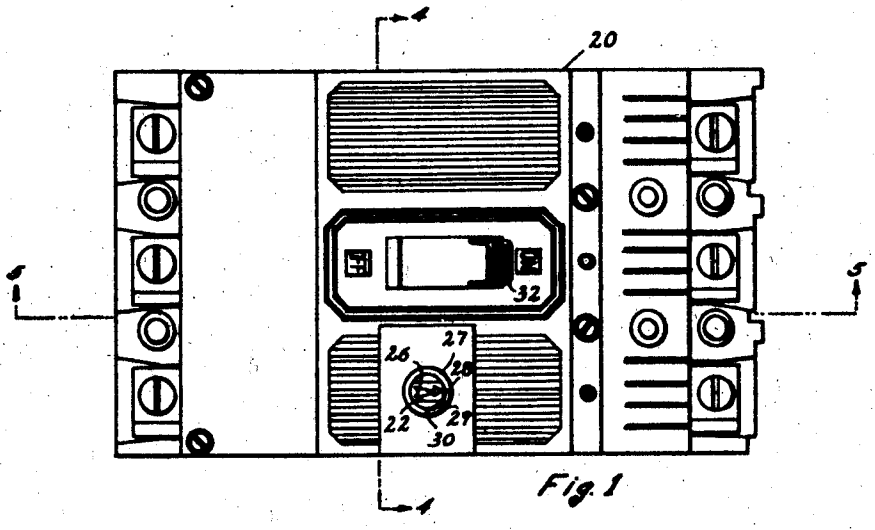


Fig. 1

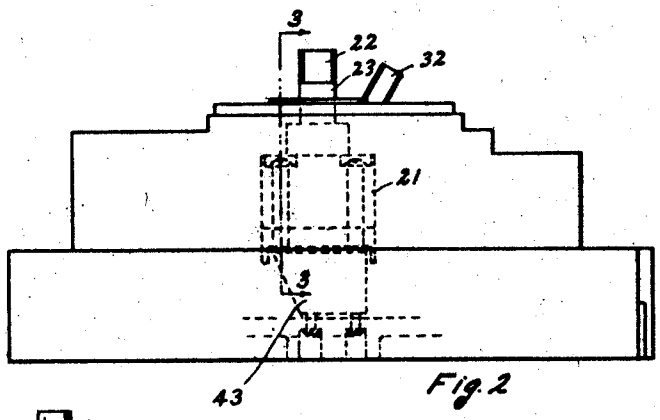


Fig. 2

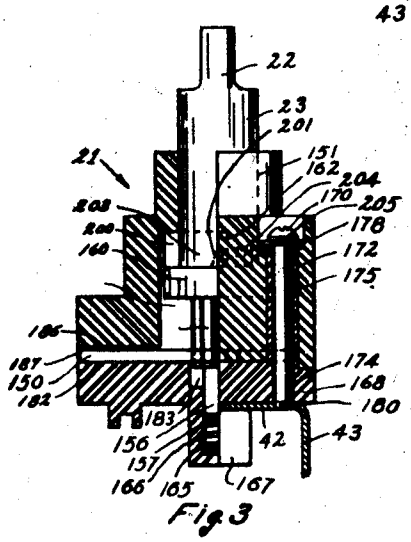


Fig. 3

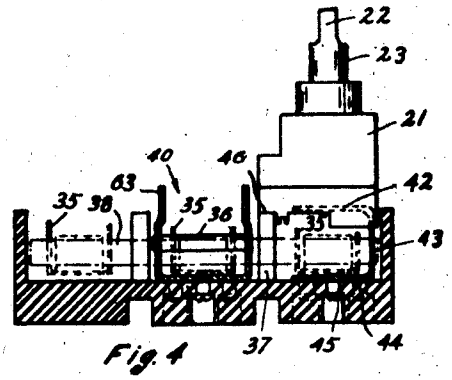


Fig. 4

INVENTOR.

BY William M. Scott Jr.

Samuel Ostrolenk

Attorney

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CIRCUIT BREAKER LOCKING DEVICE

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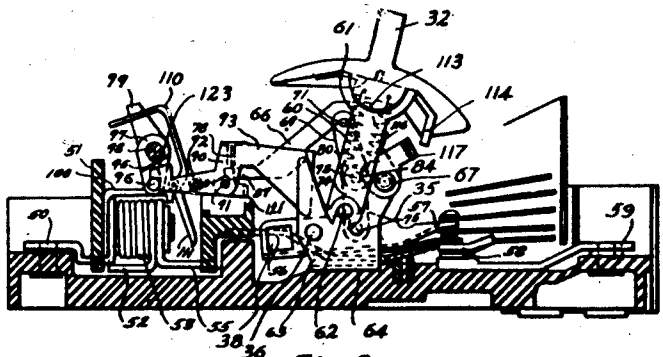


Fig. 5

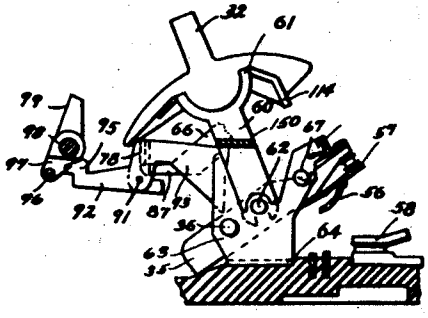


Fig. 6

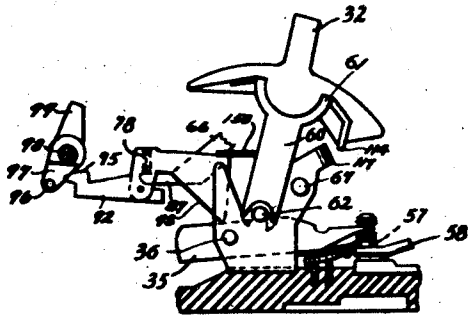


Fig. 7

INVENTOR.

BY William M. Scott Jr.

Sam'l Osterlund

Attorney

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CIRCUIT BREAKER LOCKING DEVICE

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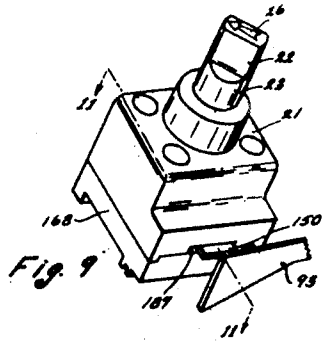


Fig. 9

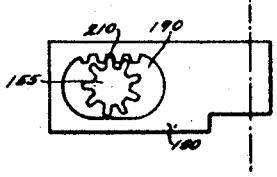
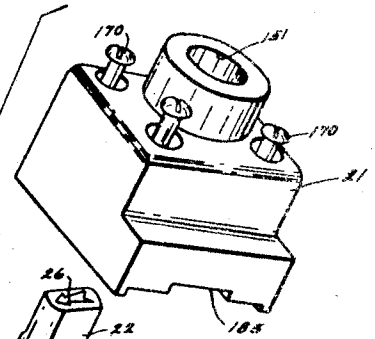


Fig. 11



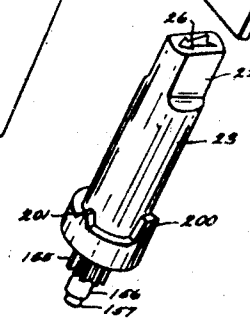


Fig. 8

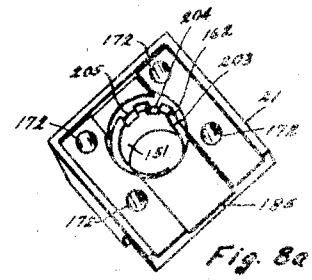
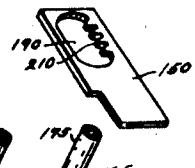
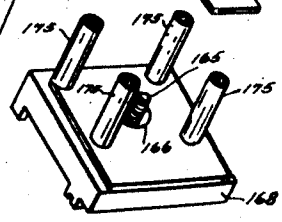


Fig. 8a





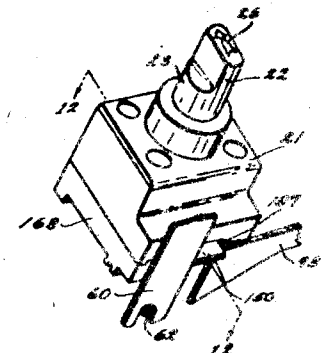


Fig. 10

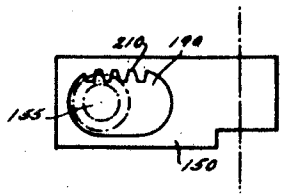


Fig. 12

INVENTOR.

William M. Scott Jr.

BY

Samuel Arthur
Attorney

Patented June 10, 1947 2,421,853

UNITED STATES PATENT OFFICE

2,421,853

CIRCUIT BREAKER LOCKING DEVICE

William M. Scott, Jr., Bryn Mawr, Pa., assignor to I. T. E. Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania

Application November 27, 1942, Serial No. 467,096

3 Claims. (Cl. 200—109)

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My invention relates to circuit breakers and more particularly to locking devices therefor which will, when desired, prevent either manual or automatic operation thereof to open circuit position under selected conditions.

The primary purpose of a circuit breaker, as is well known, is to provide means for automatic or manual closing and interrupting of a circuit under specific predetermined conditions.

However, in the operation of devices which may at times be subjected to unexpected shocks or jars or in the operations of devices which it may, under certain conditions, be necessary to maintain in operation irrespective of possible damage, it becomes necessary to provide means to prevent automatic or even manual opening of the circuit breaker.

Thus, in the operation of electrical installations on naval craft during battle or manoeuvre conditions, it is far more important that an electrical device or system be maintained in operation irrespective of any damage that may occur thereto than that a protective device be opened on the occurrence of a fault.

Also, in the operation of naval craft, it may be desirable or necessary, under certain conditions, that means be provided so that a circuit breaker will be prevented from opening under the shock of gun fire (either impact or recoil).

Under such conditions, it may be fatal to the continued effectiveness of the vessel should the circuit breaker open accidentally owing to the jarring effect of gun fire or even should it open to protect a particular device.

An object of my invention is thus to provide means which may be operated to prevent either or both the automatic or manual opening of a circuit breaker at times when the continued operation of the circuit, which the circuit breaker is designed to protect, is more important than the damage which may occur thereto through the possibility of a fault.

Such locking device to be effective must, however, be adapted in each case to the particular construction and operation of the circuit breaker in connection with which it is to operate. Preferably, the locking device should be so arranged that the same members may be selectively used to lock the circuit breaker against automatic or manual tripping.

At times, for instance, it may be desirable that a circuit breaker should not trip automatically while, however, manual tripping should be possible.

Also, in certain types of circuit breaker, it may

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be possible that the jar of gun fire (either impact or recoil) may cause the operating arm thereof to swing over to open position. In such case, the element of the locking device, which prevents manual opening of the circuit breaker, serves the far more important function of preventing the operating arm from being swung over owing either to its own inertia under the influence of a violent jar or to any other cause.

In either case, however, the locking device must be so arranged that it may readily be operable to any selected position by even an unskilled operator and without any delay.

A further object of my invention, therefore, is the provision of a locking device for a circuit breaker wherein a single locking element may be used selectively to prevent the automatic or manual opening of the circuit breaker.

Still another object of my invention is the provision in a locking device of a single manual operating means therefor which may be readily operated to place the locking elements of the locking device in either of the selected positions above mentioned.

The successful operation of a locking device which is utilized to prevent a circuit breaker from opening under a succession of jars or impacts depends, however, on the fact that the locking device itself be jarproof.

Accordingly, a further object of my invention is the provision of operating elements for my locking device so that a plurality of motions in axes or planes normal to each other are necessary for the performance of the locking function and are also necessary to perform the unlocking function.

A more specific corollary object of my invention is the arrangement of the operating shaft of my locking device in such a manner that it must first be moved longitudinally, then rotated, and then moved longitudinally in the opposite direction before it is in locking position.

Similarly, to unlock the same, it is necessary to move it longitudinally again, then rotate it, and then it must move longitudinally in the opposite direction.

It is thus beyond the realm of probability that any rapid succession of jars or impacts would produce the exact series of movements which would be necessary to effect unlocking.

When in the locked position, the locking element itself is secure against rotation. Should any jar or impact cause the locking element to move longitudinally, a spring element is provided to

urge the operating shaft of the locking device back to its original position.

It would be necessary for the jar or impact to provide at least two forces acting at right angles to each other, one to cause the shaft to move inwardly, and the other to cause it to rotate before the locking device could thus be accidentally opened. And these two forces must be timed to correspond with the compliance of the spring member which biases the locking device against such longitudinal movement.

Thus still another object of my invention is the arrangement of the operating shaft of my locking device in such a manner that it is itself biased into a locked position by a spring, the compliance of which is such that it seeks rapidly to return to its original position on the relaxation of pressure thereon.

A further object of my invention is the arrangement of my lock-in device and its locking element in close proximity to the circuit breaker elements with which they are to cooperate.

These and many other objects of my invention will become apparent and where not apparent will be pointed out in the following description and drawings in which:

Figure 1 is a top plan view of a circuit breaker with my locking device mounted thereon.

Figure 2 is a side view of the circuit breaker of Figure 1 showing also the arrangement of the locking device.

Figure 3 is a cross sectional view taken on line 3—3 of Figure 1 looking in the direction of the arrows and showing certain details of my locking device.

Figure 4 is a cross sectional view taken on line 4—4 of Figure 1 looking in the direction of the arrows and showing the manner of securing my locking device in position.

Figure 5 is a partly schematic cross sectional view of my circuit breaker in the closed position thereof taken on line 5—5 of Figure 1 looking in the direction of the arrows.

Figure 6 is a fragmentary view corresponding to the central portion of the view of Figure 5 showing the position of the locking element of my locking device to prevent automatic opening of the circuit breaker while it does not prevent manual operation thereof.

Figure 7 is a view corresponding to that of Figure 6, showing the movement of the locking element of my locking device to a position where it will prevent both the automatic and manual opening of the circuit breaker so that the circuit breaker cannot be tripped either by the operator or by a fault or by any jar or impact which might force the operating arm to open position.

Figure 8 is an exploded view in perspective of my locking device.

Figure 8a is a view in perspective showing the underside of the cover element of my locking device.

Figure 9 is a view in perspective of my locking device showing the position thereof wherein it prevents only the automatic opening of the circuit breaker; the position of the locking element thereof hence corresponds to the position of the locking element shown in Figure 6.

Figure 10 is a view in perspective of my locking device, this view corresponding in all respects to Figure 9, but showing the position of the locking element wherein it prevents both automatic and manual operation of the circuit breaker; hence, the locking element here is shown in the same position as the locking element of Figure 7.

Figure 11 is a partly schematic cross sectional view taken from line 11—11 of Figure 9 and looking in the direction of the arrows, the said figure showing the manner in which the locking element is only partly extended when it is desired that it engage only the automatic tripping device to prevent operation thereof.

Figure 12 is a partly schematic cross sectional view taken on line 12—12 of Figure 10 looking in the direction of the arrows showing the manner in which the locking element is fully extended to engage both the automatic tripping element and the operating arm of the circuit breaker to prevent opening of the circuit breaker from any cause whatever.

Referring now to Figure 1, I have here shown the housing 20 of a three pole circuit breaker of a type which is designed to protect a circuit carrying as high as 100 amperes, 600 volts.

The locking device of my invention is encased in its own housing 21 which is mounted on one side of the exterior of the circuit breaker housing. An operating handle 22 projects from the top of the housing 21 and is an extension of the operating shaft 23 (Figures 3 and 4). That is, the operating shaft 23 is milled on each side to produce the flat handle 22 which may readily be grasped.

The top face of the handle is provided with a suitable indication as, for instance, in the form of the arrow 26. Suitable markings are also provided in any appropriate position as, for instance, at the ledge 27 or the top of housing 21 to indicate the position of the locking device. Thus, for instance, the location of the arrow 26 at the mark 28 indicates that the locking device is now inoperative. Rotation of the handle 22 so that the arrow points to the marking 29 indicates that the automatic tripping device of the circuit breaker has now been locked so that the circuit breaker will not now automatically trip while, however, it may be manually operated.

Rotation of the handle 22, so that the arrow 26 points to the marking 30 indicates that the locking device has been operated to a position where the circuit breaker is fully locked.

The markings are here merely indicated. In actual use, a plate may be provided indicating by appropriate descriptive legends the conditions of the locking device. The circuit breaker contained in the housing 20 is provided with an operating arm (hereinafter described) carrying at the end thereof the operating handle 32 which may be manually moved to the on or off position.

The three poles of the circuit breaker are interconnected so that the single operating handle operating in connection with the central pole will serve to operate each of the poles simultaneously.

As seen more particularly in Figure 4, the movable contact arm 35 is pivoted on the shaft 36. The same type of contact arm is used on each of the three holes, the same arms being rigidly interconnected by the common rectangular bar 38.

Consequently, the operating mechanism 40, which is, as seen in Figure 4, connected only to the central arm 35 and hence which is apparently connected to the central pole of the circuit breaker, serves to operate each of the poles simultaneously. The fact that the operating mechanism thus need not be mounted on each of the poles and is only mounted at the center pole provides space at one of the outer poles for the mounting of the locking device contained in the housing 21.

As may readily be seen in Figure 4, the base of the locking device is mounted on the upper arm 42 of a metallic supporting member 43 of U-shaped cross section.

The lower arm 44 may be secured to the base of the circuit breaker in any suitable manner as, for instance, by the screws 45, in the position which would normally be occupied by the operating mechanism had the operating mechanism been mounted on the outside pole.

The base of the housing 21 of the locking device is provided with the ledge 46 which rests on the top of the insulating journal 37 and thus provides a secure support therefor. The U-shaped metallic supporting member 43 is of a height which permits the locking element hereinafter described to be projected inwardly into the operating mechanism 40 to prevent either automatic or manual operation thereof.

The circuit breaker has not here been shown in full. Only sufficient portions thereof have been illustrated to demonstrate the operation of the locking device.

Thus, before a complete understanding of the operating device may be had, it will be necessary to describe the operation of the circuit breaker itself.

This description will be made only with respect to the central pole of the circuit breaker; it being understood that each of the other poles operate in exactly the same manner.

Current flows from the connection to the terminal 50 of the circuit breaker through the lead 52 into the solenoid coil 53, which is mounted on the support 51, flows through the coil and thence to the lead 55. A connection is then made by the pig tail 56 to the movable contact element 57 mounted on the operating arm 35. Thence, current flows through the stationary contact 58 to the opposite terminal 59.

The specific form of each of the elements here described and the specific manner of interengagement of the contacts 57 and 58 form no part of the present invention, and hence are only schematically and generally shown.

The movable contact arm 35 is manually operable to closed and open position by means of the handle 32 mounted on the principal arm 60. For structural purposes, the arm 60 is actually a U-shaped member, the base 61 of the U being arranged at the top and providing means for securing the handle 32 thereof and each of the opposite legs 60 being hinged at the hinge pin 62 mounted on opposite flanges 63 of the U-shaped supporting member 64 (see also Figure 4).

A latching member 66 is pivotally mounted on the pin 67 supported between the opposite flanges 63 of the supporting member 64. One end of the link 69 of the operating toggle is pivotally mounted by the pin 71 which bears against the apex of the latching member 66. The opposite end of the link 69 is connected by the knee pin 73 to the end of the other link 74 of the toggle. The end of the link 74 opposite the knee pin 73 is connected by the pin 75 to the contact carrying arm 35.

The position of the pin 71 of the link 69 is fixed by the fact that the latching member 66 is held at one end by the shaft 67 and at the other end is held by the latch 78.

A tension spring 80 is connected at one end to the knee pin 73 of the toggle 69—74 and at the opposite end is secured to the upper end 61 of the principal arm 60 immediately beneath the handle 32.

As may be seen, a plurality of springs 80 may be used. In the specific embodiment here shown, four such springs are used, two on each side.

In the closed position of the circuit breaker, the spring or springs 80 pass on the right hand side of the pin 71 and thus urge the knee pin of the toggle 73 towards further movement towards the right. This bias toward further movement toward the right, as here shown, serves further to extend the toggle 69—74 and thus serves to depress the pin 75 and hence depress the operating arm 35 so that the movable contact 57 is urged into close engagement with the stationary contact 58.

When the handle 32 is moved to the left, the principal arm 60 rotates counterclockwise about its pin 62. When the springs 80 pass to the left of the pin 71, then a collapsing force is exerted on the toggle 69—74 since the springs 80 now pull the knee pin 73 toward the left. The toggle will thus collapse toward the left and the pull of the springs 80 on the knee pins 73 will raise the links 74 and hence raise the operating arm 35 so that contact 57 is raised out of engagement with contact 58.

When, in the particular embodiment shown, the movement of the handle 32 to the right causes the springs 80 to pull the knee pin 73 toward the right and thus pulls the toggle beyond center in the opposite direction, this motion is, however, resisted by the pin 73 abutting against the extension 84 of the latching mechanism 66.

Movement to the left, as above described, causes collapse of the toggle and the opening of the circuit breaker contacts. Consequently, it will be seen that for manual opening of the circuit breaker, it is necessary that the principal arm 60 thereof be moved to the left. Any element which may be interposed in the path of the movement of this arm to prevent movement thereof to the left will serve to prevent manual operation of the circuit breaker and will also serve to prevent the inertia imparted by any jar or impact from moving the arm 60 to the left.

The spring 80, by pulling up on the knee pin 73, also exerts an upward moment on the pin 71 bearing against the latching member 66. This upward moment, which would result in the lifting of the end 87 of the latch member 66 and rotation thereof around the pin 67, is resisted by the latch 78. On release of the latch 78, the upward pull exerted by the springs 80 will thus serve to rotate the latching member 66 upwardly and cause the pin 71 to move clockwise in respect to the pin 67.

In this clockwise movement, the pin 71 will pass to the opposite side of the spring 80 so that the spring will be in a position to exert unresisted collapsing pressure on the toggle 69—73, thus raising the pin 73 upwardly and thus pulling up the link 74 and causing the operating arm 35 to rotate upwardly to disengage the movable contact 57 from the stationary contact 58.

The latch 78 may constitute a pin or a flange mounted on the latch carrying arm 90. The arm 90 is pivotally mounted at 91 and consists of an auxiliary latching extension 92 extending to the left and a lock engaging arm 93 extending to the right.

It will here be obvious that rotation of the arm 90 counterclockwise will move the latch 78 out of engagement with the end 87 of the latching member 66 and thus permit tripping of the circuit breaker. It will also be obvious that any element which engages the upper surface of the

extension or arm 93 and thus prevents counterclockwise rotation thereof, will prevent the disengagement of the latch 78 from the end 87 of the latching member 66 and thus prevent automatic tripping of the circuit breaker.

My locking device hereinafter described is so arranged that a locking element may project immediately above the end of the arm 93 to prevent upward movement thereof and hence to prevent tripping of the circuit breaker. As will also be clear, the same element may also be used to extend behind the principal arm 60 to prevent manual operation.

The latch 78 may be moved out of engagement with the end 87 of the latching arm 66 by an overload which energizes the solenoid coil 53 to a sufficient extent.

The extension 92 of the latch carrying arm 90 is provided with an auxiliary latching member 95 which engages the auxiliary latch 96 mounted at the lower end of the arm 97 mounted on the rod 98 which is rotatable in a suitable journal of the circuit breaker housing.

The rod 98 carries an upward extension 99 behind which extends the hooked extension 110 of the solenoid armature 111. The said armature is pivoted on the end of the platform 100 carried by the support 51. Rotation of the rod 98 and of the armature 111 in a clockwise direction is resisted by suitable springs (not shown).

Should an overload occur which is sufficient in intensity to energize the solenoid 53, it will attract the armature 111, thus also causing arm 99 and rod 98 to rotate in a clockwise direction. This will produce a simultaneous rotation of arm 97 thus pulling the latch 96 towards the left and out of engagement with the auxiliary latching member 95 on the extension 92 of the arm 90.

The latching arm 66 may thus rise out of engagement with the latch 78, since the arm 90 may now rotate freely counterclockwise. When the circuit breaker thus trips, the latching extension 66, as has above been pointed out, is rotated violently upwardly and clockwise.

The member is, however, brought to a stop by the abutment of the portion 116 thereof against the stop 117, supported between the flanges 63 of the supporting member 64. To reset the latches it is necessary now to move the handle 32 to the left. The abutment 114 of the handle 32 engages against the portion 113 of the latching arm 66 and now rotates the same counterclockwise around its pin 67 as the principal operating member 60 and the handle 32 are rotated counterclockwise to the left.

The chamfered portion 120 of the end 87 of the latching arm 66 now strikes against the extension 121 on the arm 90 and rotates this extension in a clockwise direction, thus rotating the entire arm 90 clockwise and raising the end 95 thereof. The upper surface 123 of the end 95 now strikes against the underside of the latch 96 and thus rotates the arm 97 in a counterclockwise direction, until the latching pin 96 has been displaced sufficiently to snap under the latch engaging end 95.

The end 87 of the latching arm 66 now snaps beneath the latch 78 while at the same time the auxiliary latching member 95 comes to rest on the latch 96.

All of the latches are now reset and the circuit breaker may now be closed.

The locking device of my invention is designed to interpose a locking element immediately above the top surface of the arm 93 to prevent counterclockwise rotation of the latch carrying arm 90 from any cause. When the upper surface of the arm 93 is thus blocked, such counterclockwise rotation cannot occur.

Likewise, the very same locking element of my invention also may be interposed behind the principal operating arm 60 to prevent manual operation. Since the principal arm 60 and the extension 93 are in different planes which, however, are parallel to each other, a single locking element extending in a plane normal to the planes of operation of the members 93 and 60 will be sufficient.

When the single locking element is extended to a certain degree, as hereinafter pointed out, it will prevent upward movement of the arm 93. When extended further, it will prevent both upward movement of the arm 93 and counterclockwise movement of the arm 60.

Preliminary to the discussion of the locking device itself, a further essential element of my invention should not be overlooked:

Previously, where locking devices were utilized to prevent operation of the automatic trip elements of a circuit breaker, such devices were interposed in the path of movement of the latch in such manner that the force of the tripping action was directly opposed by the positive locking force. This frequently resulted in breaking of the automatic trip elements or armatures or in the breaking of the locking device itself. My invention provides for a resilient connection between the automatic tripping operating elements and the operating latch itself so that nothing impedes the operation of the automatic tripping elements while at the same time, the locking device may prevent the latch from being moved out of position.

Thus as seen in Figure 5, when the locking element hereinafter described, is interposed above the upper surface of the arm 93, to prevent upward movement thereof, the trip unit may nevertheless freely operate to move the auxiliary latch 96 out of position without causing a tripping of the circuit breaker.

But, as long as the principal latch 78 is maintained in position by the locking element interposed above the upper surface of the arm 93, this latch cannot move out of position and the circuit breaker cannot be automatically tripped.

Thus, as seen in Figure 6, the locking element 150 may be moved to a position where it engages against the upper surface of the arm 93 to prevent automatic tripping of the circuit breaker while, at the same time, the handle 32 may be operated to open position.

In Figure 6 it is seen that the automatic tripping action has been locked. Nevertheless, the manual operation may occur at will.

In Figure 7, the locking element 150 has been moved further so that a portion thereof still abuts against the upper surface of arm 93 to prevent automatic tripping while the edge thereof abuts against the side of the arm 60 thus preventing rotation thereof, and therefore preventing manual operation and also preventing any jar or impact from rocking the arm to open circuit position.

The locking device, as may be seen in Figures 3 and 10, comprises a principal operating shaft 23 mounted in the housing 21. As has above been pointed out, the upper end of the shaft is milled to form the handle 22. The shaft itself is rotatably journalled in the neck 151 of the housing 21 and extends into the interior 152 thereof.

A metallic insert is carried in the lower end of the operating shaft **23** and has formed thereon a pinion **155** below which is mounted the extension **156** having the additional smaller extension **157**. The lower end of the operating shaft **23**, immediately above the pinion **155**, is provided with the collar **160**. The upper surface of the collar **160**, normally in the unlocked position of the locking device, bears against the inner annular ledge **162** at the upper end of the interior **152** of the casing of the locking device (see also Figure 8*a*). The operating shaft is urged upwardly so that the interengagement between the collar and the ledge above described takes place by means of the compression spring **165** mounted in the opening **166** in the cylindrical extension **167** of the base **168** of the locking device.

The housing **21** including the neck **151** thereof and the elements forming the chamber **152** are a molded single integral element. The base **168** is a bottom member which is held in place by the bolts **170**. The housing **21** is provided with four longitudinal openings **172** at each of the corners thereof which extend entirely through the material thereof. These openings are counterbored at the upper ends so that the heads of the bolts **170** may be recessed beneath the upper surface of the housing. The counter bores, when the bolts are in place, are preferably filled with wax so as to present a flush surface and prevent accidental removal of the bolts.

The base **168** is provided with four similar openings **174** above each of which is secured an insulating tube **175**, the said tube extending upwardly and the outer diameter of each tube being slightly less than the inner diameter of the openings **172**. The height of the tubes **175** is such that when the base **168** is in its appropriate position, the tubes extend up to the metallic washers **178** mounted in the counter bore immediately beneath the head of the bolt **170**.

The metallic U shaped supporting member **43** previously referred to is held in place at the bottom of the locking device by the bolts **170** and also provides securing means for the ends of the bolts **170**. That is, the leg **42** of the metallic supporting member **43** has four tapped perforations **180** matching the openings **174** in the base **168**. The bolts **170** pass through the tubes **175** and into the tapped perforations **180** into which they are screwed. This serves securely to interconnect the base **168** with the body member **21** of the locking device, at the same time securing the supporting member **43** thereto.

The upper surface **182** of the base member **168** is substantially flat except for the circular recess **183** and the opening **166** in the cylindrical extension **167** communicating therewith.

The bottom surface of the housing which surrounds the chamber **152** is notched at **185** to permit the locking element **150** to pass therethrough. This notch (as may be seen at the left hand end of Figure 3) communicates with the outside of the housing forming the slot **187** through which the locking element emerges (see also Figures 9 and 10).

The locking device of my invention may be readily assembled and each of the parts may readily be interchanged with other parts of a similar device thus facilitating replacement and repair. The assembling procedure is quite simple. The spring **165** is inserted in the base of the opening **166** in the base plate **168**. The handle end **22** of the operating shaft **23** is inserted first in the chamber **152** and pushed up through

the neck **151** thereof so that the handle member emerges through the top. The locking element is then, while the locking device is held upside down, laid down in the slot **185** so that the slot **190** in the locking element registers with the pinion **155**. Appropriate care is taken to see that the proper portion of the slot **190** of the locking member **150** comes into contact with the pinion **155** while the shaft **23** is in a predetermined position (the interrelationship of the various positions of the shaft will hereinafter be pointed out).

The extensions **156** and **157** of the operating shaft **23** are then inserted in the openings **183** and **166** and the spring thereby compressed while the tubes **175** of the base **168** are pushed up through the openings **172**. The bolts **170** are now placed in position and the entire locking device is held together while the supporting metallic member **43** is placed in position to receive the ends of the bolts.

The ends of the bolts are now screwed into the openings **180** in the base plate **43** and the entire locking device is thereby integrated.

The spring **165** is positioned in the opening **166** by its engagement around the extension **157** and the pressure thereof against the end of extension **156**. The spring is thus compressed between the end of extension **156** and the base of the opening **166**, and thus urges the operating shaft upwardly so that the collar **160** engages against the ledge **162**. As may readily be seen in Figures 3 and 8*a*, the ledge **162** is an annular ledge surrounding a portion of the interior of the chamber **152** at the upper end thereof and extends around the interior of the chamber for approximately 260 degrees. As may also be seen in Figures 8 and 3, the collar **160** of the operating shaft **23** is provided with a pair of extensions **200** and **201**. The side of the extension **200** (in Figure 3) of the collar **160** is visible at the extreme left hand end of the operating shaft **23** and the vertical extension **201** being seen in dotted lines.

The unlocked position of the operating shaft **23** is shown. The extension **200** registers in the annular area **203** of approximately 100° between the ends of the annular ledge **162**. This extension, which is much longer than the extension **201**, serves to limit the degree of rotation, of which the operating shaft is capable, to 90°. This is so since the extension **200** itself occupies about 10° of the inner annular periphery.

The small extension **201** is adapted successively to register in the notches **204** and **205**. In order to rotate the operating shaft **23**, from the position shown in Figure 3, to the intermediate locking position where only the automatic trip device is blocked, it is now necessary to grasp the handle end **22** of the shaft **23** and push the shaft inwardly against the bias of the spring **165** until the upper end of the extension **201** is clear of the ledge **162**. It is obvious from Figure 3 that the operating shaft cannot be rotated towards the left. It may, however, be in this condition rotated to the right while the end of the extension **201** bears against the inner surface of the ledge **162**. When the extension **201** comes opposite the notch **204** during this rotation, the spring **165** will be free to push the operating shaft **23** outwardly so that the extension **201** enters into the notch **204**.

At the same time, as is hereinafter more specifically described, the locking member **150** has been moved to the position shown in Figures 6, 9 and 11.

When it is desired to block even the manual

operation, then again, depression of the handle end **22** and further rotation to the right will cause the extension **201** to enter into the notch **205**. At the same time, the locking member is moved to the positions shown in the Figures 7, 10 and 12.

Likewise, at the same time, the extension **200** has been rotated to the position originally occupied in Figure 3 by the extension **201**. Consequently, now the operating shaft can be rotated only in a reverse direction towards the left.

Should it be desired now to release the locking action, it is necessary to depress the handle end **22** and rotate the same in the reverse direction until the spring **165** forces the handle out once more.

The operator need not necessarily successively perform both the automatic locking action and the manual locking action but may proceed to the manual locking action immediately by simply depressing the handle end **22** and holding the same depressed until he has rotated it 90° when it can rotate no further; whereupon, release of the handle end will permit the spring **165** to force the operating shaft **23** outwardly so that the extension **201** enters the notch **205**.

Should the operator, however, desire to block only the automatic trip, he depresses the handle end **22**, rotates it slightly, and then while continuing to rotate through 45° no longer exerts an inward pressure on the handle end; whereupon, when the extension **201** comes opposite the notch **204**, the spring **165** will force the handle end outwardly once more since the extension may now enter the notch **204**.

The slot **190** in the locking member **150** is provided on one side with a rack **210** (see Figure 8) which registers with the pinion **155**. Consequently, rotation of the pinion **155**, owing to rotation of the operating shaft **23** will result in the sliding of the lock element **150** in and out.

The locking element is fixed against rotation, as above described, and can only move longitudinally owing to the fact that it is confined between the notch **185** at the lower end of the housing **21** and the upper surface of the base plate **168**. Thus, on rotation of the operating shaft **23** in an appropriate manner, the locking element **150** may emerge from or be retracted into the slot **187**, which is formed by the end of the notch **185**.

The exploded view of Figure 8 shows each of the elements of the locking device without, however, showing the supporting metallic member **43** which serves to secure the bolts **170** and which also serves as a mounting means in the manner shown in Figures 3 and 4.

As seen once more in Figures 6, 9 and 11, when the handle **22** is rotated through 45° from its original position so that extension **201** may enter the notch **204**, the locking element **150** is projected outwardly from a slot **187** so that it bears against the upper surface of the arm **93**, thus preventing upward movement thereof and thus preventing the automatic tripping action from being operative to disengage the principal latch.

When the handle element is rotated a full 90° than as shown in Figures 7, 10 and 12, the locking element **150** is projected outwardly so that it extends not only over the upper surface of the arm **93**, but also behind the arm **60** thus preventing manual operation.

The locking device is itself made jarproof by the plurality of motions which are necessary to unlock the same.

Should the locking device be in the fully locked position of Figures 7, 10 and 12, then the motions necessary to unlock the same are (first) an inward motion of the handle **22** against the bias of the spring **165**; (secondly), a counterclockwise motion, with respect to Figure 10, is necessary until the extension **201** arrives opposite the notch **204** or opposite the area **203** when the outward bias of the spring will be effective to drive the operating shaft outwardly once more.

Any jar or impact which the circuit breaker may suffer would be scarcely likely to produce this complex series of motions simultaneously. Should a jar in one direction cause the operating shaft, when in the position of Figure 10, to move inwardly to disengage the extension **201** from the notch **205**; then to unlock the unit, a second jar will be necessary of a nature to cause rotative movement of the operating shaft **23**. Furthermore, this second jar must occur immediately after the first jarring motion and at an interval consonant with the compliance of the spring **165**. If it occurs too soon after the first jar, then the spring **165** will not have yet been fully compressed so that the extension **201** is not yet fully withdrawn from the notch **205** and cannot yet rotate.

Should it occur an instant too late, then the spring **165**, which has already been compressed, is now expanded and the extension **201** is being forced back into the notch **205** so that again the operating shaft cannot rotate.

The coincidence of fortuitous circumstances necessary to produce successive motions longitudinally and then rotationally both within an exact but extremely short time interval is so improbable as to render such a result, to all intents and purposes, impossible.

Accordingly, by this means, the locking device is itself rendered jarproof so that it will always maintain the circuit breaker in locked position when the locking device has been set.

Obviously, the locking device is arranged so that the locking element **150** may be moved to a position where it is clear of all of the operating elements and hence will interfere in no way with the operation of the circuit breaker. When it is desired to utilize the locking device a simple depression of the handle and rotation thereof through either 45° or 90° will result either in the locking out of the automatic tripping device or the locking in of the circuit breaker so that it cannot open at all.

Immediately upon the termination of circumstances, which made necessary the locking in of the circuit breaker, the locking device may be moved to unlocked position by a simple pushing in of the handle and a rotation back through 90°.

The lock-in device may be closed on an overload by first re-setting the latches in the open position of the circuit breaker; then moving the locking device to engage the trip elements; then closing the circuit breaker and moving the lock-in device to engage the operating arm.

Thus, when, for instance, the vessel in which the circuit breaker is utilized enters into engagement with an enemy or enters into dangerous waters the locking device may be set to full locking position or to a position which simply locks out the automatic trip. Should damage occur during an engagement, it is, of course, much more important that the electrical apparatus on the vessel be utilized to the fullest degree irrespective of any damage that may occur thereto owing

to an overload. Furthermore, it is important that any jar or impact should not render the electrical apparatus inoperative. Immediately upon termination of the engagement or upon the arrival of the vessel in safe waters, it is important that the locking device be rendered inoperative without undue delay so that if a fault or damage has occurred, the circuit breaker may then trip open.

The locking device of my invention may immediately, without any complicated motions and within a fraction of a second then be moved from locking to unlocking position.

While I have described the advantages of my locking device with respect to naval craft, it has many uses in connection with circuit breakers used in many other types of structures and in many types of operations where at some stage in a process or operation, it is essential that the process continue to the last possible moment irrespective of damage to the electrical equipment which the circuit breaker is designed to protect.

In the foregoing, I have described my invention in connection with a preferred embodiment thereof and have set forth the same in connection with a type of circuit breaker with which it is best adapted to function.

Many variations of the locking device itself and many variations of its adaptation to different types of circuit breakers will now be obvious to those skilled in the art. Therefore, I prefer to be bound not by the specific disclosure herein, but only by the appended claims.

I claim:

1. A circuit interrupter having an operating arm and tripping mechanism; a locking device engageable in one position thereof with said tripping mechanism; and in a second position thereof with both the tripping mechanism and the operating arm to render both elements inoperative to open the circuit breaker; a handle for operating said locking device, said handle being operable on rotation thereof to move said locking device to selected position; and means for locking said handle in said first and second selected positions and thereby locking said locking device in selected position.

2. A circuit interrupter having an operating arm and tripping mechanism; a locking device

engageable in one position thereof with said tripping mechanism; and in a second position thereof with both the tripping mechanism and the operating arm to render both elements inoperative to open the circuit breaker; a handle for operating said locking device, said handle being operable on rotation to move said locking device to selected position; and means for locking said handle in selected position and thereby locking said locking device in selected position; said means comprising a member urging said handle into one position, means operable upon said handle in said one position to prevent rotation thereof; said handle being manually movable to another position and being disengaged from said last mentioned means in said other position.

3. A circuit interrupter having an operating arm and tripping mechanism; a locking device engageable in one position thereof with said tripping mechanism; and in a second position thereof with both the tripping mechanism and the operating arm to render both elements inoperative to open the circuit breaker; a handle for operating said locking device, said handle being operable on rotation thereof to move said locking device to selected position; an indicator for indicating the selected position of said handle in which said tripping mechanism alone is locked and for indicating the selected position of said handle in which said tripping mechanism and said operating arm are locked; and means for locking said handle in selected position and thereby locking said locking device in selected position.

WILLIAM M. SCOTT, JR.

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