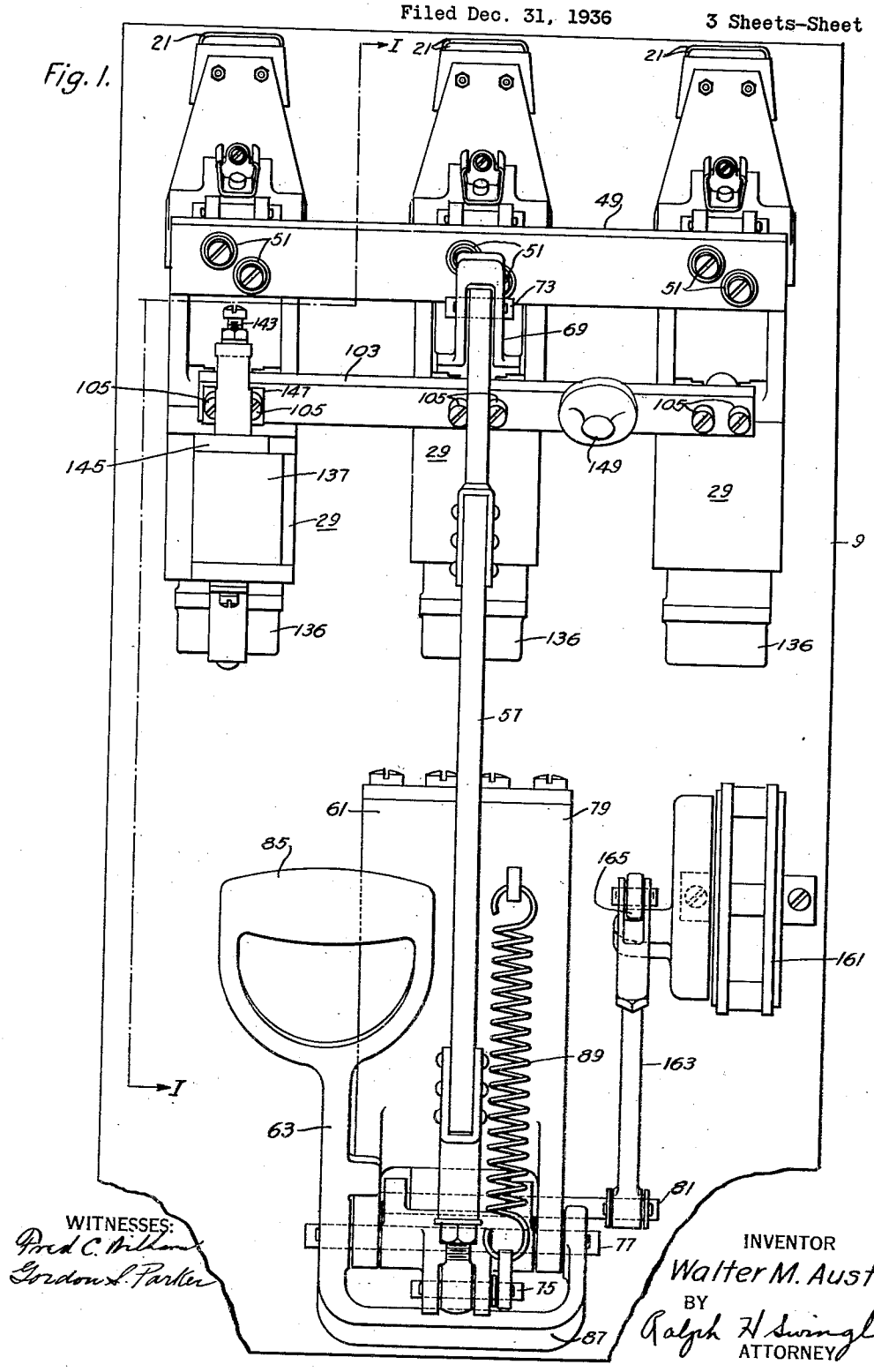
Oct. 24, 1939. W. M. AUSTIN 2,177,014

CIRCUIT BREAKER

Filed Dec. 31, 1936 3 Sheets-Sheet 1

Fig. 1.



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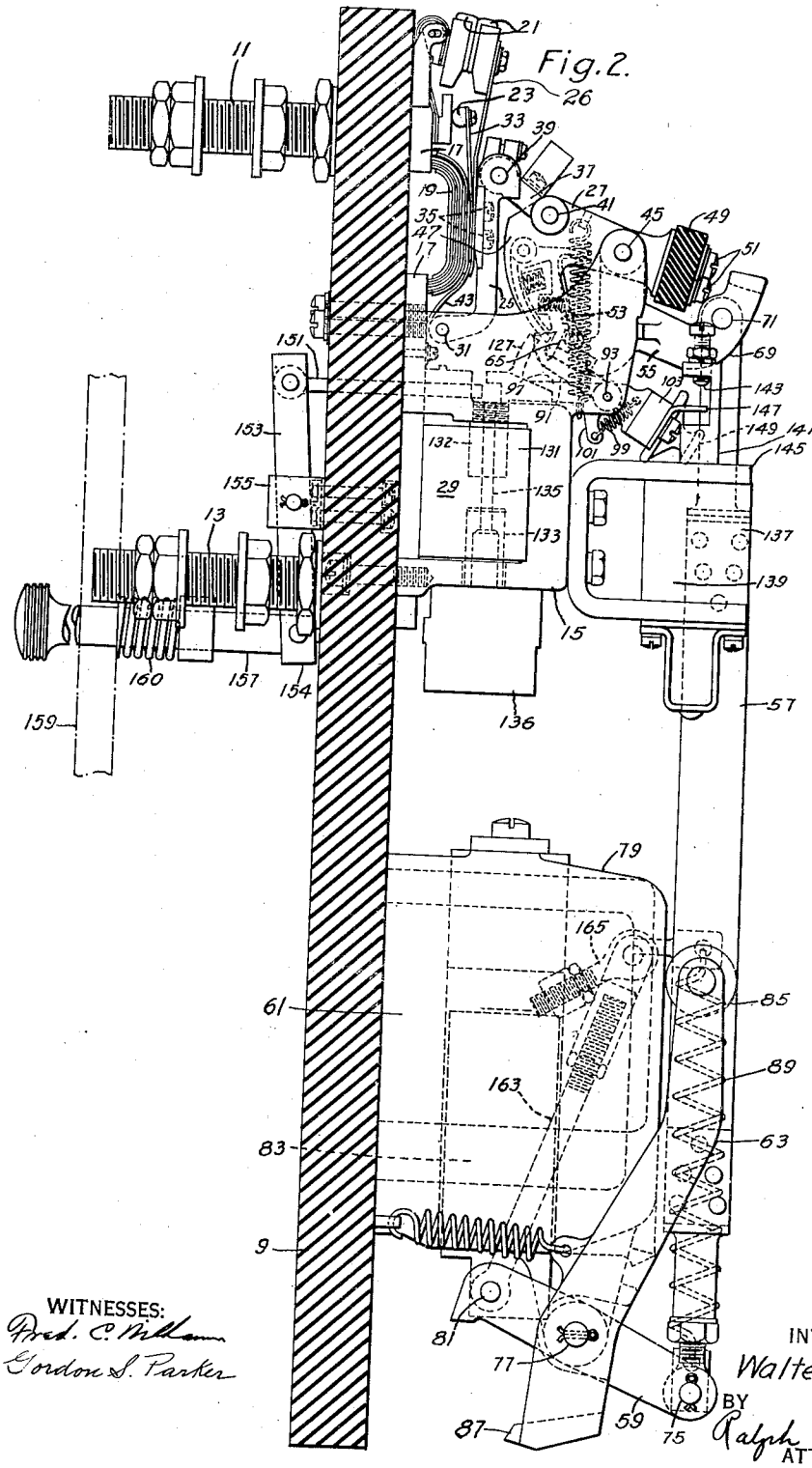
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CIRCUIT BREAKER

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Fig. 2.



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CIRCUIT BREAKER

Filed Dec. 31, 1936 3 Sheets-Sheet 3

Fig. 3.

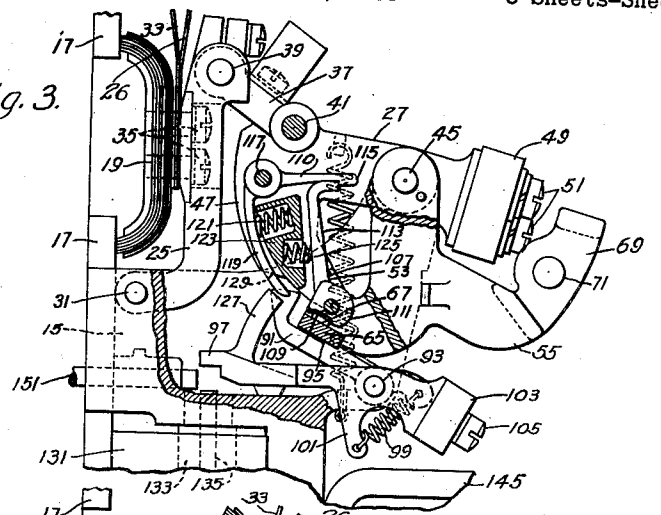


Fig. 4.

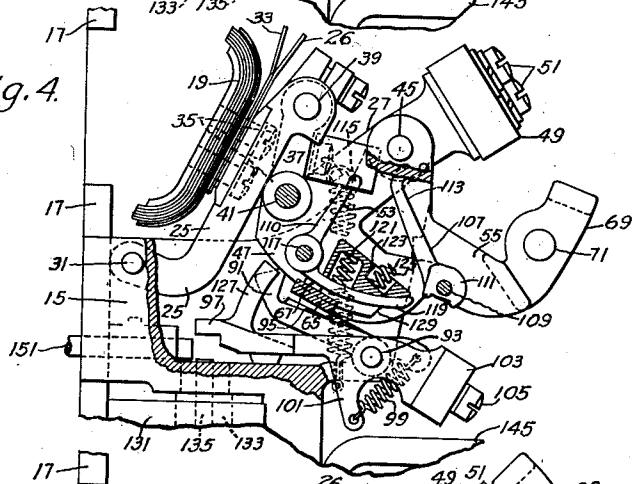
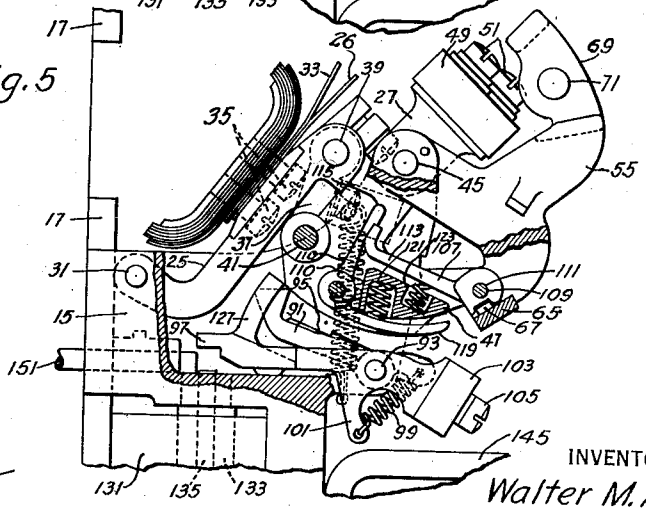


Fig. 5



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Patented Oct. 24, 1939 2,177,014

UNITED STATES PATENT OFFICE

2,177,014

CIRCUIT BREAKER

Walter M. Austin, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application December 31, 1936, Serial No. 118,588

16 Claims. (Cl. 200—89)

My invention relates to circuit breakers in general and more particularly to circuit breakers for use in locations where they may be subjected to jarring forces and heavy vibrations.

Particular instances of the types of service in which circuit breakers used for controlling lighting, power and control circuits are subjected to jarring forces and heavy vibrations; may be mentioned service on battleships, cruisers and the like war craft. Ordinary circuit breakers when used in such instances have opened under the jars caused by the firing of heavy guns or when the ship strikes an object or is struck by a shell, with the result that the electrical service has been severely crippled just when it is most needed.

Circuit breakers have been developed for such specialized service which embody shock proof latching means for holding the breaker in closed circuit position yet which will allow the same to open in response to overloads. These specialized breakers while partially solving the problem have not embodied the much desired trip free action, i. e., the movable contacts have not been able to open irrespective of the position of the control handle.

In the heat of battle or on other special occasions it may be desirable to prevent the breakers from opening and disrupting service on overloads. If the breaker embodies the desirable trip free action, holding the operating handle in closed circuit position is of no avail since the contacts separate irrespective of the position of the control handle.

In a trip free circuit breaker embodying auxiliary arcing contacts it is particularly desirable that the breaker be capable of being tripped at any point in the closing operation after the arcing contacts have engaged in order to fully protect the breaker and the circuits and apparatus which it controls.

It is accordingly an object of my invention to provide a circuit breaker structure embodying an improved simple and efficient latching arrangement which will prevent the breaker from opening in response to jarring forces and yet which will permit opening of the breaker in response to overload conditions.

Another object of my invention is to provide an improved circuit breaker structure embodying a simple and effective shock proof latching arrangement for cooperating with the trip device thereof and in which the movable contacts of the breaker are capable of opening upon the occurrence of overloads irrespective of the position of the operating member or handle.

Another object of my invention is to provide an improved circuit breaker structure in which the movable contacts are trip free of the operating mechanism and which is provided with a means which can be manually operated to prevent tripping of the breaker on overload.

Another object of my invention is to provide an improved circuit breaker embodying a simple shock proof latching arrangement cooperating with the trip device in which latches are so arranged that they cannot be manually reset until the circuit breaker operating mechanism is reset.

Another object of my invention is to provide an improved trip free circuit breaker structure that is capable of being tripped at any point in the closing operation after the auxiliary arcing contacts engage.

The novel features that I consider characteristic of my invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof will best be understood from the following detailed description of a specific embodiment thereof when read in connection with the accompanying drawings, in which

Figure 1 is a front view of the circuit breaker embodying the features of my invention;

Fig. 2 is a vertical sectional view of the circuit breaker shown in Fig. 1, taken on the line I—I thereof and looking in the direction of the arrows;

Fig. 3 is a fragmentary view partly in elevation and partly in section and with certain parts broken away, showing the center pole contact means and parts of the operating mechanism in their closed circuit position with the latches set in latching position;

Fig. 4 is a view similar to Fig. 3 showing the corresponding parts in a certain stage of the tripping operation, the movable contacts and the movable contact controlling yoke having moved to open circuit position, the latches being in their released position and the operating mechanism ready to start its movement to open circuit position; and

Fig. 5 is a view similar to Figs. 3 and 4 showing the corresponding parts in their final open circuit positions following the completion of the tripping operation.

Referring to the drawings, the multi-pole circuit breaker illustrated is mounted on a base 9 of insulating material. Each pole of the circuit breaker comprises, in general, a pair of terminal studs 11 and 13, a frame 15, main stationary contacts 17, a main movable brush contact 19, auxiliary arcing contacts 21 and 23, a pivoted switch arm 25, a pivoted actuating member 27 and an electro-magnetic trip means indicated generally at 29.

The above-mentioned elements are identical for each pole of the breaker with the exception of the pivoted actuating member 27, and, consequently, a detailed description of these ele-

ments for one pole only will be given. The upper terminal stud 11 is electrically connected to the upper main stationary contact 17 and to the stationary arcing contacts 21 and 23. The main movable contact 19 is of the semi-elliptic laminated brush type, the ends of which are adapted to engage the stationary contacts 17 to close the circuit between the same. The switch arm 25 is yoke shaped and has the lower ends of its legs pivotally supported by means of a pivot pin 31 transversely mounted between the side walls of the main frame 15. The movable arcing contacts 21 and 23 are secured to resilient switch members 26 and 33, the lower ends of which, together with the movable brush contact 19, are secured to a cross piece of the switch arm 25 by means of screws 35. The arcing contacts 21 and 23 are arranged so that they engage before the ends of the brush contact 19 engage the main stationary contacts 17 when the movable switch arm 25 is moved to closed circuit position, and arranged to separate after the ends of the brush contact 19 leaves the main stationary contacts 17 when the switch arm 25 is moved to the open circuit position so that any arc that is formed will always be drawn between the auxiliary arcing contacts. The upper ends of the legs of the switch arm 25 are pivotally connected to one end of a pivot link 37 by means of a pivot pin 39. The other end of the pivot link 37 is pivotally connected to its corresponding actuating member 27 by means of a pivot pin 41.

The circuit for each pole of the breaker is identical and extends from the upper terminal stud 11 to the upper stationary contact 17 and the stationary arcing contacts 21 and 23 to the movable arcing contacts 21 and 23, the movable brush contact 19, to the lower stationary contact 17 and flexible shunt conductor 43 to one terminal of the electromagnetic trip means 29, and through the coil thereof to the lower terminal stud 13.

The actuating member 27 for the center pole of the breaker comprises a yoke shaped lever which is pivotally supported between the upper ends of the main frame 15 by means of a pivot pin 45. The end of the actuating member 27 to which is connected the pivot link 37 has a depending tail portion 47 upon which is mounted a trip latch mechanism which will be hereinafter described.

The actuating members 27 for the two outer poles of the circuit breaker are substantially similar to the actuating member for the center pole, with the exception that they are not provided with depending tail portions. All of the actuating members 27 are secured for simultaneous movement together by means of an insulating tie bar 49 which extends across the upper ends of the members 27 and is secured to each by means of screws 51. It will thus be seen that movement of the center pole actuating member 27 will cause similar movements of the actuating members 27 for the outer poles of the breaker. Each of the actuating members 27 is biased in a counter-clockwise direction about its pivot pin 45 by means of a pair of springs 53, only one being shown. The springs 53 have their upper ends secured to lugs projecting from the sides of the actuating members 27, and their lower ends anchored to the sides of the main frames 15. The actuating members 27 are movable about their pivot pins 45 to open and to closed circuit position to cause the movable switch arms 25 to move to their open or to their closed circuit position to open or to close the circuits controlled by the breaker.

A common operating means is provided for moving the actuating members 27 to closed circuit position. The common operating means comprises, in general, a single pivoted operating member 55, an operating rod 57, a pivoted lever 59, an operating solenoid indicated generally at 61 and a manual operating handle 63.

The operating member 55 comprises a yoke shaped lever which is pivotally mounted between the upper ends of the frame 15 by means of the pivot pin 45. The sides of the yoke shaped operating lever are spaced apart a sufficient distance to permit the center pole actuating member 27 to lie between the same in the open circuit position of the actuating member 27, as shown in Fig. 4. The lower end of the operating lever 55 is provided with a cross piece 65 (Figs. 3–5) to which is secured a latch piece 67 adapted to be normally engaged by the latch mechanism carried on the depending tail portion of the center pole actuating member 27, the said latching mechanism which will hereinafter be described in detail is adapted to normally connect the center pole actuating member 27 to the operating member 55 for movement therewith. The operating member 55 is provided with a pair of parallel outwardly projecting curved legs 69 having aligned openings 71 to receive a pivot pin 73 which pivotally connects the operating member 55 to the upper end of the operating rod 57, as shown more clearly in Figs. 1 and 2. The lower end of the operating rod is pivotally connected by means of a pivot pin 75 to one end of the lever 59. The lever 59 is, in turn, pivotally supported by means of a fixed pivot pin 77 carried by the lower end of a frame 79 for the operating solenoid 61. The end of the lever 59 opposite that to which is connected the operating rod 57 is pivotally connected by means of a pivot pin 81 to one end of the movable core 83 of the operating solenoid 61.

The manual operating handle 63 is provided with a handle portion 85 at its upper end and its lower end is bent in the form of a U, which is provided with aligned openings for mounting the same on the fixed pivot pin 77, as best shown in Fig. 1. The bight 87 of the lower U-shaped portion is adapted to engage and move that end of the lever 59 which is connected to the movable core 83 of the solenoid, when the operating handle 63 is rotated in a clockwise direction about its pivot pin 77. It will thus be seen that the operating member 55 and the normally connected actuating members 27 may be moved clockwise about their pivot pins 45 to their closed circuit position either by means of the operating solenoid 61 or by manual clockwise rotation of the operating handle 63.

The operating member 57 is biased upwardly to open circuit position by means of a main spring 89, the upper end of which is anchored to the frame 79 of the operating solenoid 61 and the lower end of which is connected to the pivot pin 75. The main spring 89 biases the operating rod 57 upwardly and exerts an upward thrust on the pivot pin 73 to bias the operating member 55 in a counterclockwise direction about the pivot pin 45 toward its open circuit position, the full open circuit position of the operating member 55 being shown in Fig. 5.

Since both the operating member 55 and the normally connected center pole actuating member 27 are biased counter-clockwise about their pivot pin 45 to their open circuit position, some

means must be provided for holding the operating member in closed circuit position after it has been moved to such position by either the operating solenoid 61 or the operating handle 63. The means for holding the operating member 55 and the normally connected actuating member 27 in closed circuit position comprises a pivoted latch member 91 which is pivotally mounted on the main frame by means of a pivot pin 93. The latch member 91 is provided with a latch shoulder 95 (see Fig. 4) for engaging the cross piece 65 of the operating member 55 in the latching position of said latch member.

The electromagnetic trip means for the center pole of the breaker is provided with a pivoted trip lever 97 which is pivotally mounted on the pin 93 which supports latch member 91. The trip lever 97 is biased to a normal position against the upper end of the electromagnetic trip means by means of a light spring 99, which has its lower end secured to a depending projection 101 formed on the trip lever 97 and has its upper end secured to the upper end of the pivoted latch member 91. The spring 99 thus biases the trip lever 97 to its normal position, as shown in Fig. 3 and also biases the latch member 91 to its latching position, also shown in Fig. 3. The electromagnetic trip means for the two outer poles of the breaker are also provided with trip levers similar to the trip lever 97 of the center pole. The trip levers for all the poles are mechanically connected for simultaneous movement together by means of a trip bar 103 which extends across the upper ends of the trip levers 97 and is secured to each by means of screws 105 so that operation of any of the electromagnetic trip means will cause simultaneous movement of the mechanically connected trip levers 97 to their tripping position.

Referring to Figs. 3, 4 and 5, the trip latch mechanism which normally connects the center pole pivoted actuating member 27 with the pivoted operating member 55 comprises a main latch member 107 and a cooperating auxiliary latch member 110. The latch member 107 is pivotally mounted on a pivot pin 109 which extends transversely between the legs of the depending tail portion 47 of the yoke shaped actuating member 27. The head 111 of the latch member is provided with a recess forming a pair of oppositely disposed shoulders which engage the latch piece 67 of the operating member 55 in the latching position of the main latch member 107, as shown in Fig. 3. The latch member 107 has a projecting arm 113 which is adapted to be engaged and held in latched position by the hook shaped end 115 of the auxiliary latch member 110. The auxiliary latch member 110 is pivotally mounted on a pivot pin 117 which extends transversely between the legs of the tail portion 47 of the actuating member 27, and has a depending tail portion 119. The auxiliary latch member 110 is biased to latching position in which its hook-shaped end 115 engages and holds the main latch member 107, by means of a coiled compression spring 121 which is disposed in a recess formed in a cross piece 123 of the tail portion 47 of the actuating member 27. The main latch member 107 is biased to releasing position by means of a light coiled compression spring 125 seated in a recess in the cross piece 123. The auxiliary latch member 110 has a relatively light mass as compared with the mass of the main latch member 107 and the spring 121 is relatively strong so that the auxiliary latch member 110 is rendered substantially shock proof so that it will not move to released position in response to jarring forces or heavy vibrations applied to the base of the breaker.

The tail portion 119 of the auxiliary latch member 110 is adapted to cooperate with a projection 127 formed integral with the trip member 97 of the center pole of the breaker so that when the trip member 97 of the center pole or the connected trip members 97 of either of the outer poles are moved to tripping position, the projection 127 engages the end of the tail portion 119 and moves the latch member 110 in a counter-clockwise direction about its pivot pin 117 to its releasing position in which the hook-shaped end 115 disengages the long arm 113 of the main latch member 107 to release the same. When the main latch 107 is released, it is partially rotated in a clockwise direction about its pivot pin 109 by the bias of the spring 125 and by a component of the force exerted on the actuating members 127 by the biasing springs 53. When the latch member 107 is thus moved after release, it removes the left-hand shoulder of its head 111 from engagement with the latch piece 67 of the operating member 55 to effect release of the center pole actuating member 27, or disconnection of the same from the operating member 55. When the center pole actuating member 27 is thus released, it is moved to the open circuit position shown in Fig. 4 by the biasing force of the springs 53. It will be recalled that the actuating members 27 are all mechanically connected together by means of the tie bar 49 so that when the center pole actuating member 27 moves to its open circuit position following release thereof, the actuating members 27 for the outer poles of the breaker also move to their open circuit positions. The movement of the actuating members 27 to their open circuit position causes simultaneous movement of all of the switch arms 25 and movable contacts to their open circuit position to interrupt the circuits controlled by the breaker.

It will be noted that when the center pole actuating member 27 has been moved to open circuit position following a tripping operation, the main and auxiliary latches cannot be reset by reason of the fact that the auxiliary latch member 110 is held in its released position by the engagement of its tail portion 119 with the cross piece 65 of the operating member 55 as shown in Fig. 4, while said operating member is in its closed circuit position. This is a particularly desirable feature since if the latches are manually reset when the actuating members 27 are in their open circuit position, the parts may become jammed when the operating member 55 is released and moves to its open circuit position.

The tail portion 47 of the center pole actuating member 27 is provided with a cam surface 129 which, during movement of the actuating member to open circuit position following the release of the same, engages and moves the latch member 91 to its released position, as shown in Fig. 4. The movement of the latch member 91 to its releasing position causes the shoulder 95 thereof to be removed from its engagement with the cross piece 65 of the operating member 55 to allow the operating member to move to its open circuit position shown in Fig. 5 under the influence of the force exerted by the main spring 89. During the latter part of the movement of the operating member 55 to its open circuit posi-

tion, the latch piece 67 engages the right hand shoulder provided in the head 111 of the main latch member 107 and moves the latch member in a counter-clockwise direction about its pivot pin 109 to latching position to reengage the end of the long arm 113 under the hook-shaped end 115 of the auxiliary latch member 110 thus resetting the latch members and reestablishing the mechanical connection between the center actuating member 27 and the operating member 55. The breaker is now in reset and in open circuit position, and can be closed again either by energization of the operating solenoid 61 or by manually rotating the operating handle 63 in a clockwise direction.

When the operating member and normally connected actuating member 27 have been moved to their closed circuit position, the latch member 91 reengages its shoulder 95 with the cross piece 65 to latch the breaker in its closed circuit position. It will be noted that the point of engagement of the cross piece 65 of the operating member with the shoulder 95 of the latch member 91 is so positioned with respect to the pivot pin 93 of the latch member 91, that the force exerted by the springs 53 and also by the main spring 89 biases the latch member with a strong force to its latching position thus rendering the latch member 91 substantially shock-proof so that it will not be moved to released position in response to jarring forces or heavy vibrations applied to the base of the breaker. In order for the breaker to be tripped open by the release of the latch member 91 by a jarring force, it would be necessary for the operating member 55 to be moved past its closed circuit position, which is highly improbable, due to opening force exerted by the combination of the springs 53, the spring 89 and the relatively stiff resiliency of the contact brush 19.

The overload electromagnetic trip means for each pole of the breaker for moving the trip members 97 to tripping position comprises a solenoid coil 131, a stationary core 132, and a movable solenoid core 133. The movable core 133 has an extending pin 135 secured thereto which extends through an opening in the frame 15. The upper end of the pin 135 normally lies flush with the upper surface of the frame 15. When a current of predetermined magnitude flows through the solenoid coil 131, the magnetic force developed is sufficient to move the core 133 and pin 135 in an upward direction to cause the pin to engage its trip member 97 to move the same to tripping position, during which movement the projection 127 of the center pole trip member engages and moves the auxiliary latch member 110 to releasing position. Each of the overload electromagnetic trip means 29 is provided with a suitable adjustable oil dashpot device 136 for providing a predetermined time delay between the occurrence of an overload and the tripping operation. The device 136 may also include a suitable means for adjusting the air gap between the stationary core 132 and the movable core 133 to adjust the trip characteristic of the trip means.

An electromagnetic shunt trip means 137 is provided for electrically tripping the breaker. The shunt trip means 137 comprises a solenoid winding 139 and a solenoid core 141 to which is secured an adjusting screw 143. The shunt trip means 137 is mounted on a U-shaped bracket 145 secured to one of the frames 15. The trip bar 103 that connects the trip members 97 has an angular plate 147 secured thereto which is adapted to be engaged by the adjusting screw 143 when the electromagnetic shunt trip is energized to move the trip members to their tripping position.

A manual control handle 149 is also secured to the trip bar 103 so that the tripping members 97 may be manually moved to tripping position to trip the breaker.

In certain instances, such as in the heat of battle, it may be desirable to prevent the breaker from tripping open in response to overload conditions. For this purpose a manually controlled trip preventing means is associated with the electromagnetic trip means 29 of each pole of the breaker. The manually controlled overload trip preventing means comprises a plurality of pins 151, one for each pole of the breaker, which extend through openings provided therefor in the base 9. The right hand ends of the pins 151 normally lay to the left of and out of the path of the pins 135 of the electromagnetic overload trip means 29. The left hand end of the pins 151 are pivotally connected to a plate 153 which extends transversely across the base 9 and which is pivotally secured to the brackets 155 mounted on the base 9. One end of the plate 153 is provided with an extending leg 154 to which is pivotally connected an operating rod 157 which is adapted to project through an opening provided in the conventional mounting panel 159. A coil compression spring 160 is mounted on the rod 157 and is held in compressed condition between a collar 158 on the rod 157 and the panel 159 to bias the rod 157 to inoperative position. If it is desired to prevent tripping of the circuit breaker on overload, the rod 157 is pulled outwardly which rocks the plate 153 and causes the ends of the pins 151 to be interposed between the ends of the pins 135 of the electromagnetic overload trip means 29 and their corresponding trip levers 97, so that even though an overload occurs, the movable cores 133 cannot move their trip levers 97 to tripping position.

An auxiliary or interlock switch 161 is mounted on the base and is adapted to be sequentially operated by operation of the circuit breaker by means of a link connection 163 which connects the auxiliary switch control lever 165 with the pin 81 connecting the lever 59 with the movable core 83 of the operating solenoid 61. The auxiliary switch 161 is thus adapted to be operated with each operation of the circuit breaker.

The operation of the circuit breaker is briefly as follows. With the parts of the breaker in the position shown in Fig. 2, let it be assumed that an overload occurs in the circuits of any one of the poles of the circuit breaker. The electromagnetic overload trip means 29 of the pole on which the overload occurs draws up its movable core 133 and causes its pin 135 to engage and move its trip member 97 to tripping position. The movement of any one of the tripping members to tripping position causes the center pole trip member 97 to move to its tripping position during which the projection 127 thereof engages and moves the auxiliary latch member 110 to releasing position to effect release of the main latch member 107. The release of the main latch member 107 allows the mechanically connected actuating members 27 to move to their open circuit position under the influence of their biasing springs 53. As the center pole actuating member 27 moves toward its open circuit position, the cam surface 129 thereof engages and moves the latch member 91 to its releasing position to effect release of the operating member 55. When the operating member 55 is released, the main spring 89 causes the same

to rotate in a counter-clockwise direction about its pivot pin 45 to its open circuit or retrieving position. During the latter part of movement of the operating member 55 to its open circuit position, the latch piece 67 thereof engages a shoulder formed on the main latch member 107 and moves the main latch member to latching position to effect resetting of the latches to reestablish the mechanical connection between the center pole actuating member 27 and the operating member 55. The breaker may be tripped open in the same manner as described above in connection with the overload tripping operation, by manually moving the trip bar 103 to tripping position or by energizing the electromagnetic shunt trip means 137.

The breaker may be closed by energizing the operating solenoid 61 or by moving the operating handle 63 in a clockwise direction about the pivot pin 77. Either one of these operations causes the operating rod to move downwardly to effect clockwise rotation of the normally mechanically connected center pole actuating member 27 and operating member 55 to their closed circuit position in which the operating member 55 is held latched by means of the latch member 91. The movement of the center pole actuating member 27 to closed circuit position effects simultaneous movement of the actuating members 27 of the outer poles of the breaker to effect movement of all of the movable contacts to their closed circuit position. It should be noted that the breaker may be tripped at any point in the closing operation after the auxiliary arcing contacts 21—23 engage by reason of the fact that the tail piece of the auxiliary latch member 110 is of such length that some part of it is in position to be engaged by the projection 127 on the center pole trip member 97 during closing movement of the actuating and operating members.

When the circuit breaker is mounted for service on a battleship or the like war craft it may be desired, during the heat of battle or for some other particular purpose, to prevent an overload occurring in any or all poles of the circuit breaker from automatically tripping the breaker to open circuit position. To prevent such automatic tripping, it is merely necessary to pull out the manual trip preventing rod 157. Pulling out the control rod 157 causes all of the pins 151 which it controls to be interposed between all of the overload solenoid operated pins 135 and their corresponding trip levers 97.

It will thus be seen that I have provided an improved trip free circuit breaker structure embodying a simple and effective shock-proof latching arrangement which will prevent the breaker from opening in response to jarring forces and yet which will permit the trip devices of the breaker to effect automatic opening of the breaker in response to predetermined overload conditions. The arrangement of the latches and the structure of the actuating member and operating member prevents the latches from being reset except by resetting of the breaker operating mechanism and permits the breaker to be tripped to open circuit position at any point in the closing operation after the auxiliary arcing contacts have engaged. I have also provided an improved circuit breaker which embodies a means which can be manually held to prevent tripping of the breaker on overload when it is desired to prevent interruptions of the electrical circuits controlled by the breaker.

While I have shown and described the preferred embodiments of my invention in accordance with the patent statutes, it is to be understood that various changes in the structural details may be made without departing from the spirit of the invention. I desire, therefore, that the invention be limited only by the reasonable construction of the appended claims and the prior art.

I claim as my invention:

1. In a circuit breaker, a movable circuit controlling member biased to open circuit position, a movable operating member biased to open circuit position, a first latch means for normally connecting said circuit controlling member to said operating member for movement therewith, means for moving said operating member and through the same said normally connected circuit controlling member to closed circuit position, a second releasable latch means for normally holding said operating member in its closed circuit position, means for releasing said first latch means to allow said circuit controlling member to move to open circuit position, said circuit controlling member having means for releasing said second latch means during movement to open circuit position to allow said operating member to move to open circuit position, the movement of said operating member to its open circuit position resetting said first latch means to reestablish connection of said circuit controlling member to said operating member, and means associated with said latch means for preventing release of either of said latch means in response to jarring forces or vibrations.

2. In a circuit breaker, a pivoted switch member biased to open circuit position, an operating member pivoted about the same axis as said switch member and biased to open circuit position, a first releasable latch means for normally connecting said switch member to said operating member for movement therewith, means for moving said operating member and normally connected switch member to closed circuit position, a second releasable latch means for normally holding said operating member in its closed circuit position, means for releasing said first latch means in response to predetermined overload conditions to allow said switch member to move to its open circuit position, said switch member having means for releasing said second latch means during movement toward its open circuit position to allow said operating member to move to its open circuit position, said operating member during the last part of its opening movement causing resetting of said first latch means to reestablish connection of said switch member to said operating member, and means associated with both said latch means for preventing release thereof in response to jarring forces or vibrations applied to said breaker.

3. In a multi-pole circuit breaker, a plurality of pivoted circuit controlling members forming a plurality of poles, means connecting said members for simultaneous movement together, means biasing said members to open circuit position, a common operating member pivoted about the same axis as said members, means biasing said operating member to open circuit position, a first releasable latch means for normally connecting one of said circuit controlling members to said operating member for movement therewith, means for moving said operating member, and through said member the normally connected circuit controlling members, to closed circuit position, a second releasable latch means for holding said operating member in closed circuit position, a trip device comprising a plurality of

mechanically connected trip elements, one for each pole of the breaker, each responsive to predetermined overload conditions in the circuit of its pole for causing said trip device to effect release of said first latch means to allow said circuit controlling members to move to their open circuit position irrespective of the position of said operating member, said one circuit controlling member acting to release said second latch means during movement to open circuit position to allow said operating member to move to its open circuit position, said operating member when moved to open circuit position effecting resetting of said first latch means to reestablish the normal connection of said circuit controlling members to said operating member, and means cooperating with both of said latch means for preventing release of said latch means in response to jarring forces and vibrations applied to said breaker.

4. In a multi-pole circuit breaker, a plurality of pivoted circuit controlling members forming a plurality of poles, means connecting said members for simultaneous movement together, means biasing said members to open circuit position, a common operating member pivoted about the same axis as said members, means biasing said operating member to open circuit position, a first releasable latch means for normally connecting one of said circuit controlling members to said operating member for movement therewith, means for moving said operating member, and through said member the normally connected circuit controlling members, to closed circuit position, a second releasable latch means for holding said operating member in closed circuit position, a trip device comprising a plurality of mechanically connected trip elements one for each pole of the breaker, each responsive to predetermined overload conditions in the circuit of its pole for causing said trip device to effect release of said first latch means to allow said circuit controlling members to move to their open circuit position irrespective of the position of said operating member, manually operable means for releasing said first latch means, said one circuit controlling member acting to release said second latch means during movement to open circuit position to allow said operating member to move to its open circuit position, said operating member when moved to open circuit position effecting resetting of said first latch means to reestablish the normal connection of said circuit controlling members to said operating members, and means cooperating with both of said latch means for preventing release of said latch means in response to jarring forces and vibrations applied to said breaker.

5. In a circuit breaker, a movable circuit controlling member biased to open circuit position, a movable operating member biased to open circuit position, a first releasable latch means for normally coupling said circuit controlling member to said operating member for movement thereby, operating means for moving said operating member and normally connected circuit controlling member to closed circuit position, a second releasable latch means for normally holding said operating member in closed circuit position, a trip device operable in response to predetermined overload conditions in the circuit controlled by the breaker for releasing said first latch means to allow said circuit controlling member to move to its open circuit position, said circuit controlling member in moving to open circuit position effecting release of said second latch means to allow said operating member to move to its open circuit position, said operating member having means for automatically resetting said first latch means to reestablish connection between said circuit controlling member and said operating member following the release of said operating member, and manually operable means for preventing the operation of said trip device from releasing said first latch means, said latch means opposing movement of said members so that only a small force is required for said manually operable means to prevent tripping of the breaker by said trip device.

6. In a circuit breaker, a movable circuit controlling member, means biasing said member to open circuit position; a movable operating member, means biasing said operating member to open circuit position, a first releasable latch means for normally connecting said circuit controlling member to said operating member for movement thereby, operating means for moving said operating member and normally connected circuit controlling member to closed circuit position, a second releasable latch means for normally holding said operating member in closed circuit position, means for releasing said first latch means to allow said circuit controlling member to move to its open circuit position, said circuit controlling member in moving to open circuit position effecting release of said second latch means to allow said operating member to move to its open circuit position, said operating member when moved to its open circuit position effecting automatic resetting of said first latch means to reestablish connection between said circuit controlling member and said operating member, means for preventing resetting of said first latch means except by movement of said operating member to open circuit position and means for preventing resetting of said second latch means until said operating member moves to closed circuit position.

7. In a circuit breaker, a pivoted circuit controlling member movable to open and to closed circuit position to open and to close the circuit, means biasing said member to open circuit position, an operating member pivoted about the same axis as said circuit controlling member and biased to open circuit position, a pivoted main latch carried by said circuit controlling member having a latching position for engaging a cooperating latch piece carried by said operating member for connecting said circuit controlling member to said operating member for movement thereby, an auxiliary pivoted latch carried by said circuit controlling member biased to latching position in which it engages and holds said main latch in latching position, operating mechanism for moving said operating member and through said latch connecting means said circuit controlling member to closed circuit position, a second releasable latch having a latching position in which it engages and holds said operating member in closed circuit position, a trip device operable in response to predetermined conditions for engaging and moving said auxiliary latch to releasing position to release said main latch to allow said circuit controlling member to move to its open circuit position, the movement of said member to its open circuit position effecting movement of said second latch to releasing position to allow said operating member to move to its open circuit position, said operating member when so moved to its open circuit position effecting automatic resetting of said main and auxiliary latches to reestablish

connection between said circuit controlling member and said operating member and means for preventing resetting of said main and auxiliary latches except by the resetting opening movement of said operating member.

8. In a circuit breaker having main relatively movable contacts and cooperating auxiliary arcing contacts which open after the main contacts open and close before the main contacts close, a pivoted actuating arm connected to said contacts for moving the same to open and to closed circuit position, means biasing said actuating arm to open circuit position, an operating member pivoted about the same axis as said arm, a pivoted main latch carried by said arm having a latching position in which it engages a latch piece carried by said member, a second latch pivotally supported by said arm having a latching position to which it is biased for engaging and holding said main latch in latching position for normally connecting said arm to said member for movement therewith, operating means for moving said member and normally connected arm to closed circuit position, a tail piece carried by said second latch, a trip device including a trip member movable in response to predetermined overload conditions to engage and move said tail piece to release said latches and allow said arm to move to open circuit position irrespective of the position of said operating member, means for moving said operating member to open-circuit position following release of said arm, said latch piece effecting resetting of said latches when said member is moved to open circuit position to reestablish the normal connection of said arm to said member, said tail piece being of a length to permit said trip member to release said latches at any point in the closing movement of said arm and member after said arcing contacts engage.

9. In a circuit breaker, a stationary contact, a cooperating movable contact carried by a pivoted switch arm, a pivoted actuating member connected to said switch arm by a pivot link and movable to an open and to a closed circuit position to open and to close said contacts, means biasing said member to open circuit position, latch mechanism for releasably holding said member in closed circuit position comprising a main latch member pivotally mounted on a portion of said arm for engaging a fixed cooperating latch piece in its latching position, an auxiliary latch member of relatively small mass pivoted on said portion of said arm, having a latching position in which it engages and holds said main latch member in latching position to hold said actuating member in closed circuit position, a relatively strong spring for biasing said auxiliary latch member to its latching position so that it is rendered substantially shockproof, a trip device operable to move said auxiliary latch member to releasing position to release said main latch member and allow said actuating member to move to its open circuit position in which said portion and said latch members are moved out of the way of said switch arm and movable contact.

10. In a circuit breaker, a stationary contact, a pivoted switch arm carrying a cooperating movable contact, a pivoted actuating member pivotally connected to said arm and being movable to open and to closed circuit position to open and to close said contacts, means biasing said member to open circuit position, an operating member pivoted about the same axis as actuating member, a releasable latch mechanism for normally connecting said members for movement together comprising a main latch member pivoted on a portion of said actuating member having a latching position in which it engages a latch piece carried by said operating member, an auxiliary latch member of relatively light mass pivoted on said portion of said actuating member having a latching position in which it engages and holds said main latch member in its latching position to connect said actuating member to said operating member, a relatively strong spring for biasing said auxiliary latch member to its latching position whereby said latch member is rendered substantially shock proof, means for moving said operating member and normally connected actuating member to closed circuit position and releasably restraining said operating member in said position, a trip device operable to move said auxiliary latch member to releasing position to release said main latch member and allow said actuating member to move to its open circuit position, the said portion of said member and said latch members being moved out of the way of said switch arm and movable contact when said actuating member moves to open circuit position.

11. In a circuit breaker having relatively movable contacts, the combination of a pivoted actuating member movable to open and to closed circuit position to open and to close said contacts, a first spring means for biasing said member to open circuit position, an operating member pivoted about the same axis as said actuating member and biased in the same direction to open circuit position by a second spring means, releasable latch means having a latching position for normally connecting said members for movement together, means for rendering said latch means substantially shock proof so that jarring forces or vibrations applied to the breaker will not release the same, means for moving said operating member, and through the same said normally connected actuating member, to closed circuit position, a pivot latch member having a latch face for engaging a cooperating latch face on said operating member in the closed circuit position of the same for holding said member in said closed circuit position, a relatively light spring for biasing said latch member to latching position, the point of engagement of said latch faces being so located with respect to the pivot axis of said latch member that said spring means biases said latch member to latching position to render said latch member substantially shock proof, a trip device operable in response to predetermined overload conditions to release said latch means to allow said actuating member to move to open circuit position during which movement said member moves said latch member to releasing position to allow said operating member to move to open circuit position, said operating member when moved to open circuit position effecting resetting of said latch-means to reestablish the normal connection between said actuating member and said operating member.

12. In a circuit breaker having stationary main and arcing contacts and a pivoted switch arm carrying cooperating movable main and arcing contacts, a pivoted contact controlling member pivotally connected to said switch arm and movable to open and to closed circuit position to open and to close said contacts, means biasing said member to open circuit position, an operating member pivoted about the same axis as said contact controlling member and biased to open circuit position, a main latch member pivoted on said contact controlling member and having arms of

different length, the shorter of which has a pair of oppositely disposed shoulders for engagement with a latch piece carried by said operating member, an auxiliary latch member of relatively small mass pivoted on said contact controlling member having a latch portion for engaging and holding the longer arm of said main latch to hold the same in latching position in which it normally connects said contact controlling member to said operating member for movement therewith, said auxiliary latch member having a tail piece, a spring for biasing said auxiliary latch member to latching position with a relatively large force whereby said auxiliary latch member is rendered substantially shock proof, means for moving said operating member and normally connected contact controlling member to closed circuit position, a second pivoted latch member having a latch face for engaging a shoulder formed on said operating member for holding the same in closed circuit position, a light spring for biasing said second latch member to latching position, the point of engagement between said latch face and said shoulder being so located with respect to the pivot axis of said second latch member that the biasing forces of said normally connected members tending to move the same to their open circuit position biases said second latch member to its latching position so that it is rendered substantially shock proof, a trip device including a trip member movable in response to predetermined overload conditions to engage the tail piece of said auxiliary latch to move the same to releasing position to allow said contact controlling member to move to open circuit position in which said main and auxiliary latch members are out of the way of said switch arm, said member in moving to open circuit position effecting release of said second latch member, to allow said operating member to move to open circuit position, the latch piece on said operating member during the latter part of said opening movement engaging and moving one of the shoulders on the short arm of said main latch to effect resetting of said main and auxiliary latches to reestablish connection between said contact controlling member and said operating member, said tail piece of said auxiliary latch engaging said latch piece on said operating member when said contact controlling member is in open circuit position to prevent resetting of said main and auxiliary latches except by movement of said operating member to open circuit position, said tail piece also providing a means whereby said trip member can release said auxiliary latch at any point in the closing movement of said contact controlling and operating members after the arcing contacts engage.

13. In a circuit breaker, a movable circuit controlling member biased to open circuit position, an independently movable operating member for moving said circuit controlling member to open and to closed circuit position, shockproof latch means for normally connecting said circuit controlling member to said operating member for movement thereby comprising a pivoted main latch member carried by one of said members for engaging a cooperating latch piece carried by the other of said members in its latching position, a pivoted auxiliary latch member of relatively small mass carried by said one member having a latching position in which it engages and holds said main latch member in latching position and a relatively strong spring for biasing said auxiliary latch member to its latching position; and a trip device operable to release said latch means to allow said actuating member to move to its open circuit position.

14. In a multiple circuit breaker, a plurality of movable circuit controlling members connected for movement together and forming a plurality of poles, means biasing said members to open circuit position, a common movable operating member biased to open circuit position, a first releasable latch means for normally connecting said circuit controlling members to said operating member for movement thereby, means for moving said operating member and through said member the normally connected circuit controlling members to closed circuit position, a second releasable latch means for holding said operating member in closed circuit position, a trip device operable to effect release of said first latch means to allow said circuit controlling members to move to open circuit position irrespective of the position of said operating member, said members being operable during movement to open circuit position to release said second latch means to allow said operating member to move to open circuit position, said operating member when moved to open circuit position effecting resetting of said first latch means to reestablish the connection between said circuit controlling members and said operating member, and means rendering both of said latch means shockproof to prevent their release by jarring forces and vibrations.

15. In a circuit breaker, a movable circuit controlling member biased to open circuit position, a movable operating member biased to open circuit position, a first latch means for normally connecting said circuit controlling member to said operating member for movement therewith, means for moving said operating member and through the same said normally connected circuit controlling member to closed circuit position, a second releasable latch means for normally holding said operating member in its closed circuit position, means for releasing said first latch means to allow said circuit controlling member to move to open circuit position, said circuit controlling member having means for releasing said second latch means during movement to open circuit position to allow said operating member to move to open circuit position, the movement of said operating member to its open circuit position resetting said first latch means to reestablish connection of said circuit controlling member to said operating member.

16. In a circuit breaker, a movable circuit controlling member biased to open circuit position, an independently movable operating member for moving said circuit controlling member to open and to closed circuit position, shock-proof latch means for normally connecting said circuit controlling member to said operating member for movement thereby comprising a pivoted main latch member carried by one of said members for engaging a cooperating latch piece carried by the other of said members in its latching position, a pivoted auxiliary latch member of relatively small mass carried by said one member having a latching position in which it engages and holds said main latch member in latching position, and a relatively strong spring for biasing said auxiliary latch member to its latching position; and a trip device operable to release said latch means to allow said actuating member to move to its open circuit position irrespective of the position of said operating member.

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