

Feb. 25, 1947.

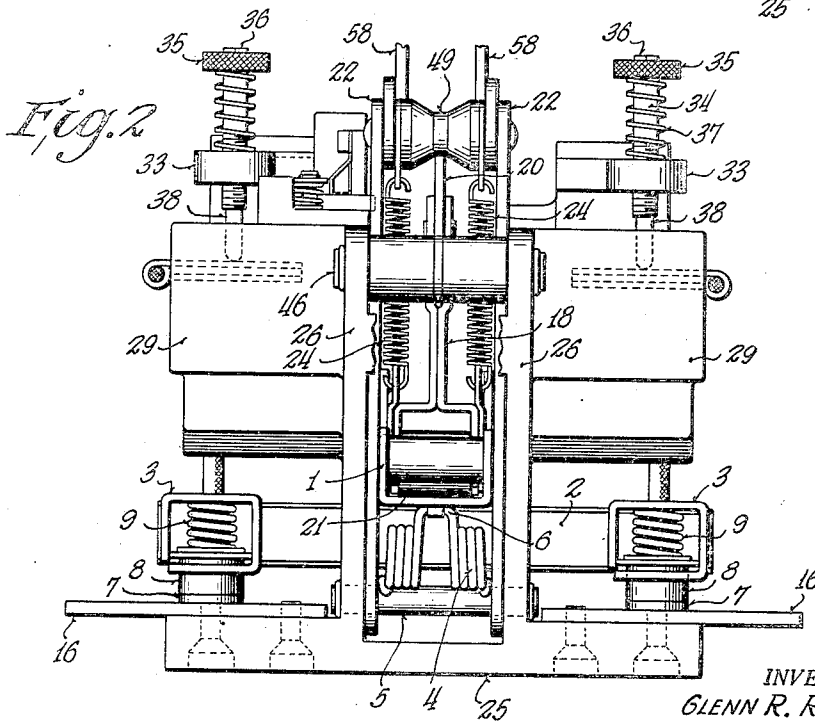
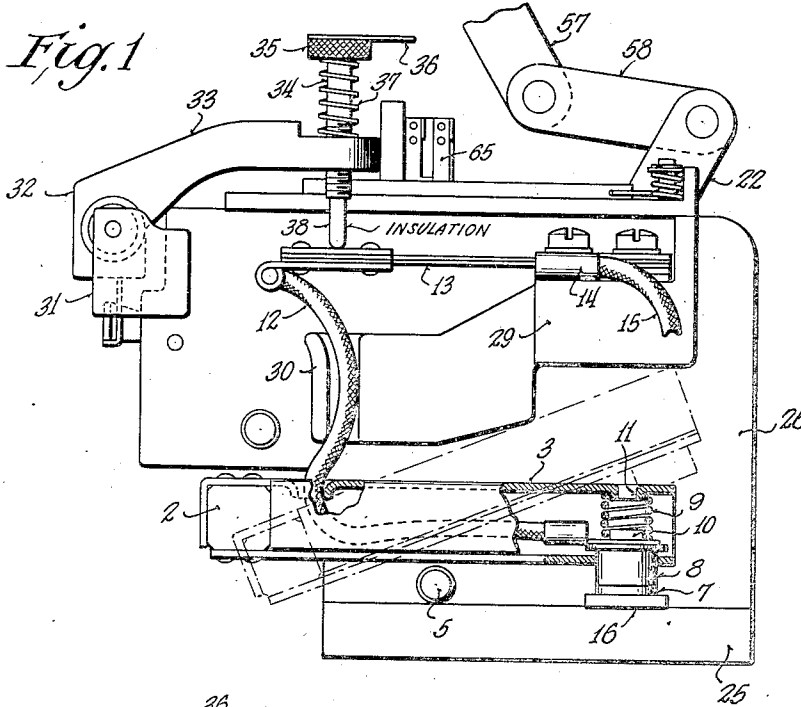
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2,416,407

SWITCH CONSTRUCTIONS

Filed March 15, 1943

5 Sheets-Sheet 1



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SWITCH CONSTRUCTIONS

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5 Sheets-Sheet 2

Fig. 3

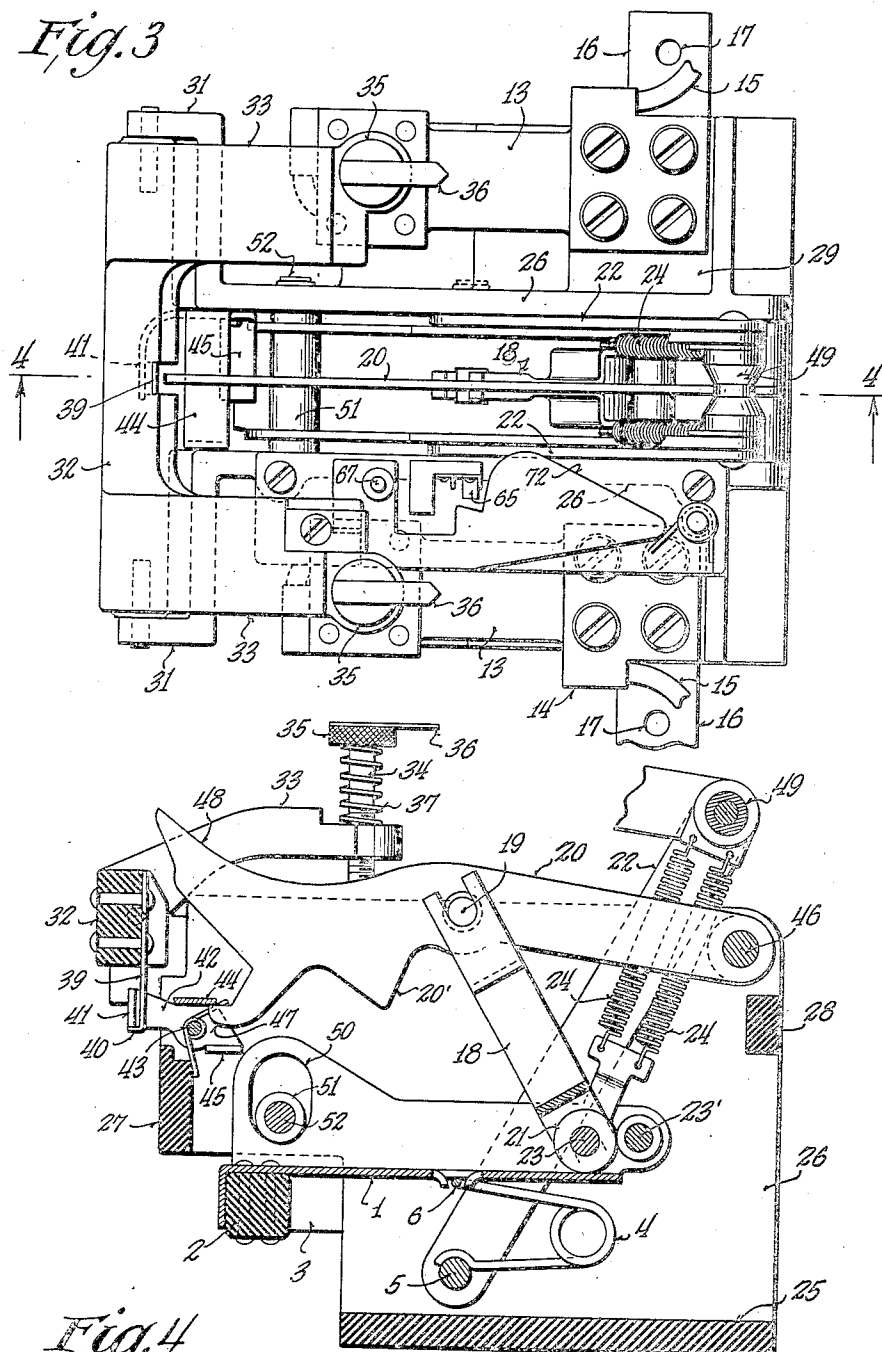


Fig. 4

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SWITCH CONSTRUCTIONS

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5 Sheets-Sheet 3

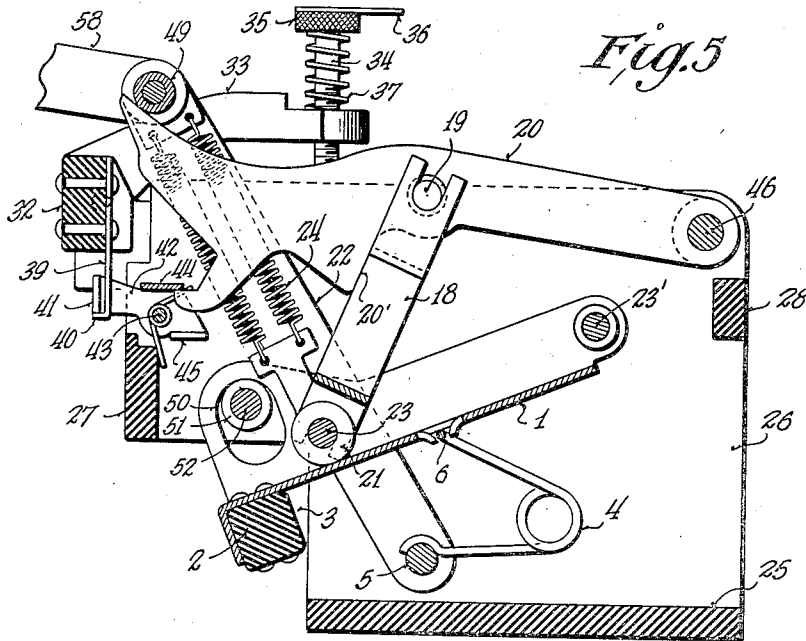


Fig. 5

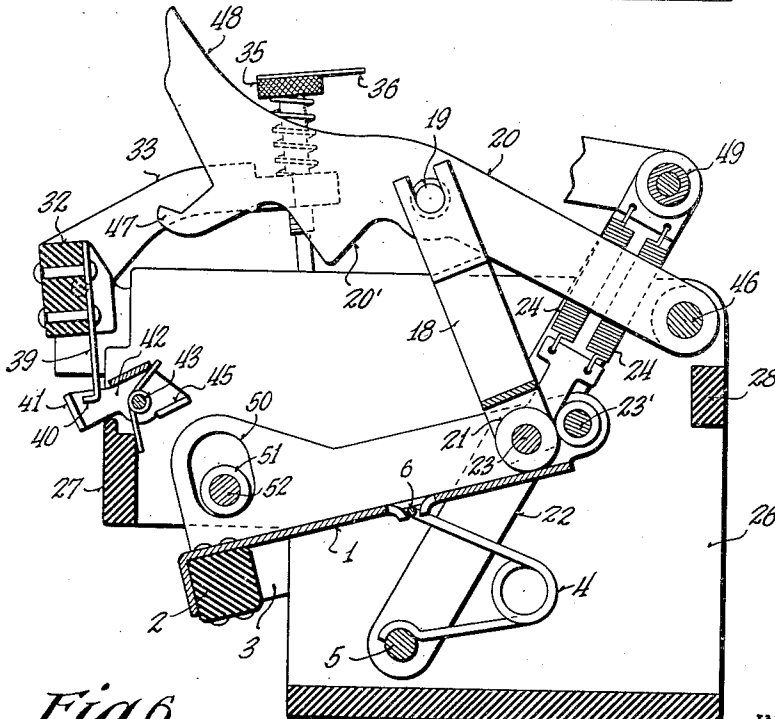


Fig. 6

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SWITCH CONSTRUCTIONS

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5 Sheets-Sheet 4

Fig. 7

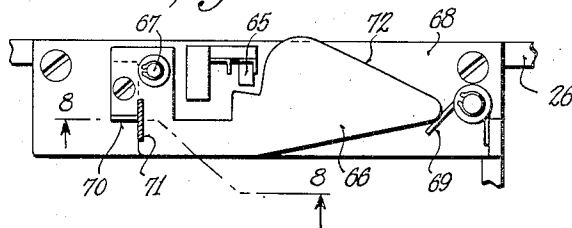


Fig. 8

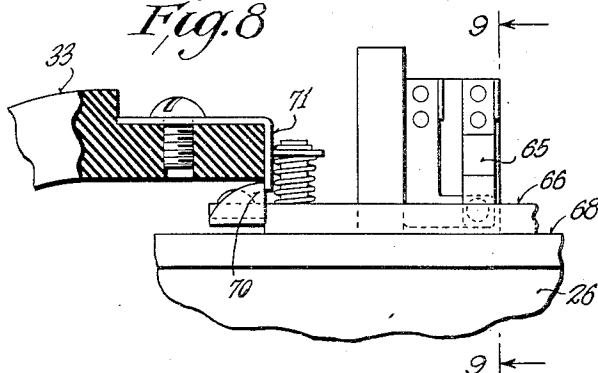


Fig. 9

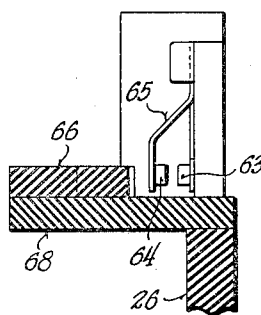


Fig. 10

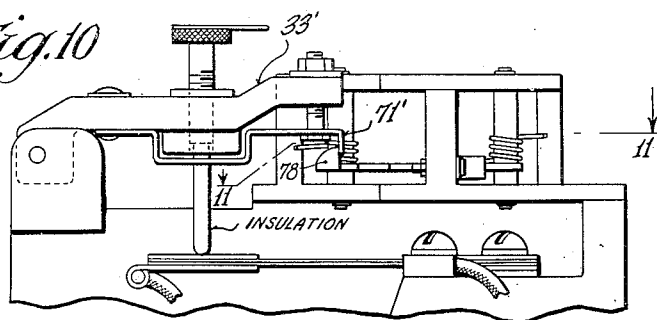
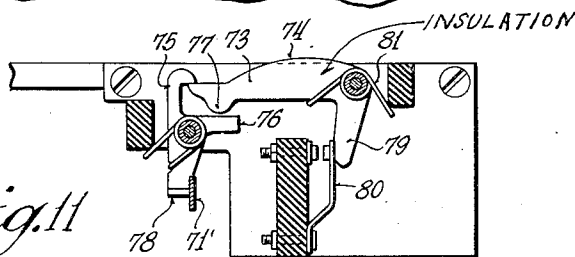


Fig. 11



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SWITCH CONSTRUCTIONS

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5 Sheets-Sheet 5

Fig. 12

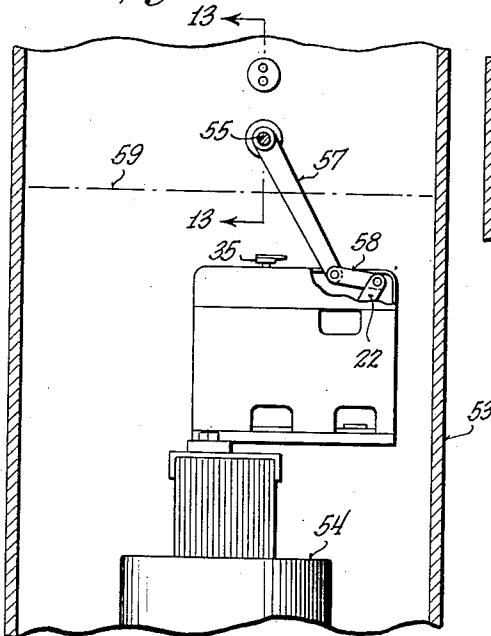


Fig. 13

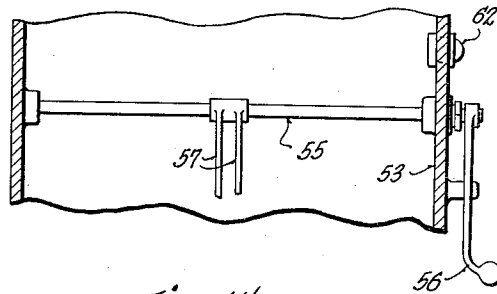


Fig. 14

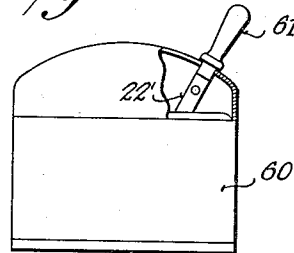


Fig. 15

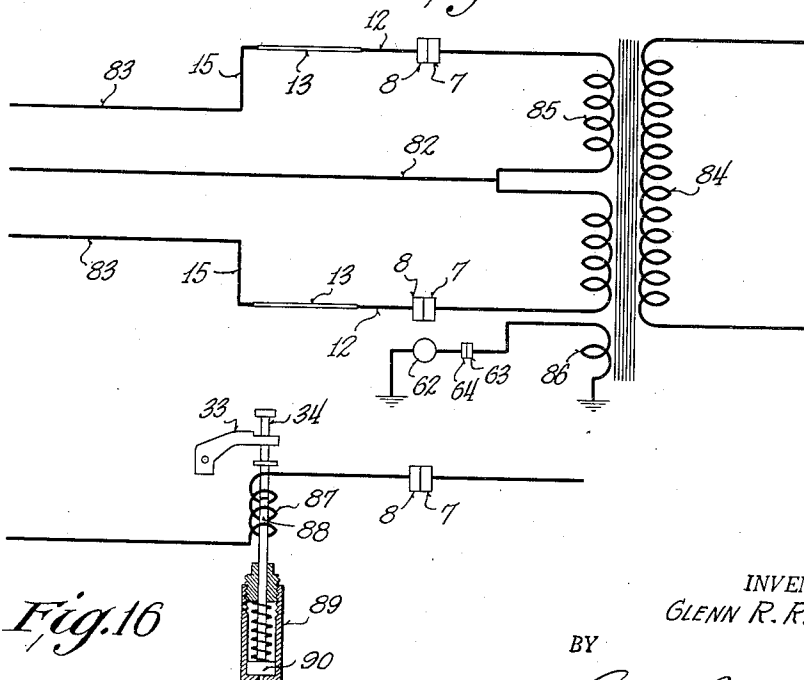
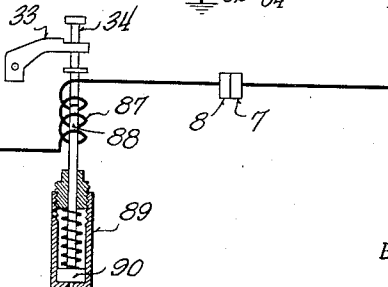


Fig. 16



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UNITED STATES PATENT OFFICE

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SWITCH CONSTRUCTION

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Application March 15, 1943, Serial No. 479,163

32 Claims. (Cl. 200—116)

1

This invention relates to a switch construction. In greater detail, this invention relates primarily to a switch construction of the circuit breaker type.

Objects of this invention are to provide a circuit breaker which has a quick make and a quick break, which has condition responsive means of the trip type, which is so constructed that it releases the circuit breaker so that the circuit breaker will open under predetermined conditions, and which is provided with a handle or other operating means for normally opening and closing the circuit breaker and for resetting the trip means, the trip means and the operating means being so related that the trip means will operate to release the circuit breaker irrespective of the position of the operating means and irrespective of any motion that the operating means may be executing at the time the trip means operates so that the trip means is trip free and will operate no matter whether the operating means is forcibly held in closed position or is being moved from one position to another.

Further objects are to provide a circuit breaker which is so constructed that the circuit breaker cannot be closed until the trip means has moved back to normal position, and in which the resetting of the trip means is accomplished by moving the operating means towards open position, such motion being followed by movement to closed position after the resetting of the trip means when it is desired to again close the circuit breaker after the occurrence of the predetermined condition.

Further objects are to provide a construction in which the trip means may be either thermostatically or magnetically or otherwise operated and which has either a quick action or a delayed action and which is adjustable so that the condition to which it will respond may be predetermined.

Further objects are to provide a circuit breaker which has a heavy contact pressure when it is closed, in which this heavy contact pressure is maintained during the operation of the circuit breaker until the instant at which the contacts are suddenly separated, thereby avoiding burning of the contacts under overload conditions.

Further objects are to provide a circuit breaker in which the mechanism is so arranged that it is easy to operate in opening and closing the circuit breaker and in resetting the trip means, and which is so made that there is no great wear on the parts during the opening and closing of the circuit breaker or during the resetting of the trip means as the mechanism is so arranged that

2

during resetting, for example, relatively small forces or pressures are exerted between the cooperating parts, thereby minimizing wear.

Further objects are to provide a circuit breaker in which the trip means is required to exert only a very small force in order to cause automatic operation, the construction providing an increased leverage for the trip means to operate a pivoted latch normally restraining the circuit breaker in closed position, the parts being so organized that the pull on the latch and on associated parts is approximately in line with the center point of the pivoted latch, the relation of the parts insuring relatching without any chance of wedging or jamming either the trip mechanism as a whole or any portion of the latch means.

In greater detail, further objects are to provide a switch construction in which the switch operating means is floating and is yieldingly pivoted at an intermediate point so that the pivot point does itself move or shift during the opening or closing of the switch means, the construction being such that heavy contact pressure is maintained up to the instant the switch means is suddenly opened, and the resiliently urged pivot construction cooperating with an actuator to secure quick opening and quick closing motion, the switch operating means having both translatory and rotational motion.

Further objects are to provide an auxiliary switch for a pilot light or other indicating means associated with the circuit breaker in such a manner that the indicating means will indicate the occurrence of a predetermined condition prior to the opening of the circuit breaker, and which is so related to the operating means that the operating means may be moved towards open position a sufficient amount to reset the auxiliary switch without opening the circuit breaker, so that the auxiliary switch may be restored to normal position, provided the condition to which it responds has ceased to exist without opening the circuit breaker, the auxiliary switch means for the indicating means being arranged to be automatically reset whenever the circuit breaker is reset.

Further objects are to provide a circuit breaker construction which is sturdy and is reliable in operation, which may be installed in a transformer case and submerged in the oil in the transformer case if desired, and which if a thermostatic trip means is employed, may be arranged to have the thermostatic means respond solely to the heat generated by current passing through the thermostatic means or to the combined action of the heat

in the oil from the transformer or other device as well as from the heat due to the current passing through the thermostatic means, or may be arranged to respond solely to the heat of the oil.

Embodiments of the invention are shown in the accompanying drawings, in which:

Figure 1 is a side elevation, partly broken away, showing the circuit breaker in closed position.

Figure 2 is an end view, with a part broken away, of the structure shown in Figure 1 looking from the righthand end of Figure 1.

Figure 3 is a plan view of the structure shown in Figure 1.

Figure 4 is a sectional view on the line 4—4 of Figure 3.

Figure 5 is a view, partly in section, showing the circuit breaker in its manually opened position.

Figure 6 is a view corresponding to Figure 5 showing the circuit breaker when it has been thermostatically opened.

Figure 7 is a detail plan view of the signal switch.

Figure 8 is an enlarged sectional view on the line 8—8 of Figure 7.

Figure 9 is a sectional view on the line 9—9 of Figure 8.

Figure 10 is a fragmentary side elevation of a further form of signal switch and associated parts.

Figure 11 is a sectional view on the line 11—11 of Figure 10.

Figure 12 is a fragmentary view, partly broken away, showing the circuit breaker mounted within the container for a transformer.

Figure 13 is a view approximately on the line 13—13 of Figure 12.

Figure 14 is a view of a modified mounting for the circuit breaker.

Figure 15 is a wiring diagram.

Figure 16 is a view, partly in section, of a further form of condition responsive means.

Before proceeding with the detailed description of this invention, it is to be understood that the circuit breaker may have either a single switch means or a plurality of switch means, a circuit breaker with a pair of switch means having been chosen for the sake of illustration. The circuit breaker chosen for illustration may be installed in a three wire, single phase system as indicated, or in a three phase system with the two switch means located in two lines of the three phase system in a well known manner, or, if desired, three switch elements could be used for the three phase circuit as the invention contemplates the use of a single or any number of switch elements as desired. Also it is to be noted that although a pilot lamp has been shown controlled by the auxiliary switch means, any other suitable type of indicating means could be employed.

Referring to the drawings, it will be seen particularly from Figures 2 through 6 that the circuit breaker is provided with an elongated switch operating member 1 which is a rectangular, channel-shaped member. This member is rigidly attached to a rectangular insulating shaft or bar 2 at its rear end which extends laterally in opposite directions and at its outer ends carries a pair of movable switch members indicated generally by the reference character 3.

This switch operating member and the movable elements 3 of the switch means constitutes a unitary and rigid structure. This unitary structure is supported by spring means 4 which may be in the form of a double coiled spring having its lower ends bearing against a transverse pivoted

pin 5 and its centrally located upper portion 6 bearing against the approximate center of the switch operating member 1 and forming the support for the unitary structure consisting jointly of the switch operating member 1 and the movable switch members 3. It is to be noted at this point that the switch operating means and the movable switch members 3 of the switch means constitute a unitary floating structure which has both motion of translation and of rotation, that is to say, it may move upwardly and downwardly and may rock about the portion 6 of the spring means.

The stationary contacts of the switch means are indicated at 7 in Figures 1 and 2 and it is to be noted that the movable contacts 8 of the switch means are carried by the switch elements 3 and are movable with respect to such elements. For example, the movable contacts 8 may be plungers having flanged upper portions located within the box like structure of the switch elements 3 and may be urged downwardly by means of spring 9 housed within the switch elements 3, such springs being centered as indicated in Figure 1 by reduced portions 10 of the members 8 and by inwardly pressed portions 11 of the members 3. These movable contacts 8 are connected by means of flexible leaders 12 with bi-metallic, thermally responsive members 13 at the free outer ends of such members, the inner ends of the bi-metallic members 13 being provided with terminal portions 14 for receiving the leads 15. The stationary contacts 7 are provided with terminal portions 16 provided with apertures 17 for receiving clamping means such as bolts for clamping leads thereto.

An actuator is provided for moving the switch operating means and the actuator consists of a lever 18 bifurcated at its upper end and pivoted as indicated at 19 to a carrier 20. The actuator 18 is also bifurcated at its lower end and is provided with a roller 21 which bears against and fits within the channel-shaped switch operating member 1. The actuator 18 is moved back and forth to opposite sides of the pivoted central portion of the floating switch operating means 1 by a main operating means. This main operating means consists of a pair of levers 22 located on opposite sides of the switch operating member 1 and pivoted on the pivot pin 5 at their lower ends. These levers are connected to the pivot 23 of the roller 21 of the actuator 18 by means of springs 24 which have suitable cross-heads at their upper and lower ends to facilitate attachment. The springs 24 are arranged in pairs on opposite sides of the actuator 18.

It is apparent from the description as thus far given that when the main operating means or lever 22 and the associated springs 24 are in the position shown in Figure 4, the actuator is held in its right-hand position as viewed in Figure 4 and consequently holds the outer end of the switch operating means in its lowermost position and holds the switch means in closed position, Figure 4 being a sectional view of the parts as shown in Figures 1, 2 and 3.

A stop is provided to limit the stroke of the actuator to the right as viewed in Figure 4. This stop may comprise a pin 23', with a suitable spacer thereon, riveted on the outer side of the side walls of the switch operating member 1 and serving not only as a stop to arrest the outward motion of the actuator, but also as means to prevent spreading of the side walls of the switch operating means 1. The stop for the stroke of

the actuator in the left-hand direction consists of a shouldered portion 20' formed on the carrier 20 which arrests the motion of the actuator 18 when it moves to the left as viewed, for instance, in Figure 5.

It is also apparent that when the switch operating lever is rocked to the left as shown in Figure 5, the center line of the spring means passes from the right-hand side of the pivot 13 of the actuator to the left-hand side thereof and consequently such actuator is rocked to the left as shown in Figure 5. The actuator acquires speed as it rocks towards the center point of the switch operating means 1, and at the instant it crosses the center, it is traveling at a high rate of speed. In addition to this, as soon as the actuator crosses over to the left of the center point of the switch operating means as shown in Figure 5, the spring means 4 immediately rocks the switch operating means and consequently the movable parts of the switch means 3 upwardly and opens the switch. The position of the parts in switch open position is shown in Figure 5.

It is apparent, therefore, that when the switch operating means is manually or otherwise rocked to switch open position, the switch opens with a quick break. On the other hand, it is apparent that when the switch operating means is rocked from the position shown in Figure 5 to the position shown in Figure 4, the reverse action takes place and the actuator, acquiring speed as it is rocked to the right from the position shown in Figure 5 to that shown in Figure 4, crosses the central point of the switch operating means 1 at a high rate of speed and as soon as it crosses center, the supporting spring means 4 immediately rocks the left-hand end of the switch operating means 1 upwardly and closes the switch with a quick closing stroke.

The parts thus far described are mounted upon an insulating base 25 which has a pair of upstanding walls 26 between which the switch operating means 1 is positioned and outside of which the switch members 3 are located. The walls may be joined at their rear portion by means of a transverse web 27 and at their forward portion by means of the transverse web 28, as shown in Figures 4 to 6. The insulating body portion is also provided with outwardly projecting parts 29 which carry the terminals 14 of the bi-metallic elements 13. These outwardly projecting portions 29 may be provided with slotted guiding portions 30, see Figure 1, for guiding and loosely holding the flexible leaders 12. The walls 26 of the body portion extend outwardly at their rear upper ends and are provided with rearwardly projecting portions 31, see Figure 3, between which is pivoted the trip shaft or rock shaft 32 which rigidly carries a pair of overhanging arms 33.

The arms 33 overhang the bi-metallic members 13 and are provided with screws 34 threaded therethrough and provided with manipulating knurled knobs 35 and pointers 36, such pointers, if desired, cooperating with scales not shown. In order to hold the screws yieldingly against inadvertent change of setting, springs 37 loosely surround the screws and bear against the heads 35 and the levers 33 as shown in Figures 1, 2 and 4. The lower ends of the screws are provided with insulating pins 38 which rest upon the free ends of the bi-metallic members 13. Obviously instead of insulating pins 38, the upper pads at the free ends of the bi-metallic members 13, see Figure 1, may be formed of insulating material.

The bi-metallic members 13 warp upwardly

under the influence of heat and thus raise the arms 33. Action of one or both of the bi-metallic elements will cause rocking of the rock shaft 32 in a counterclockwise direction, as viewed in Figures 1, 4, 5 and 6. The rock shaft 32, see Figures 4, 5 and 6, is provided with an arm 39 which is provided with a hook-shaped lower portion 40. The hook-shaped lower portion 40 normally retains a transverse portion 41 of a spring pressed lever 42 pivoted as indicated at 43 and spring urged in a counterclockwise direction. This spring pressed lever is provided with a transverse upper portion 44 and a transverse lower portion 45.

The carrier 20, see Figures 4, 5 and 6, is pivoted between the walls 26 upon the pivot pin 46 at its right-hand end, as viewed in such figures. At its left-hand end it is provided with a hook-shaped portion 47 which normally hooks beneath the transverse portion 44 of the lever 42 and is retained in such position against the action of the spring means 4 and 24. When, however, an overload occurs in either branch of the circuit connected through the bi-metallic members 13, such bi-metallic member warps upwardly and rocks the rock shaft 32, withdrawing the hook 40 from beneath the portion 41 of the lever 42, see Figure 4, and allowing the lever 42 to rock in a counterclockwise direction under the influence of its spring to thus release the carrier 20. The carrier 20 then instantly springs upwardly to the position shown in Figure 6 and causes the switch means to open as the carrier 20 and the actuator 18 spring upwardly and thus allow the switch operating member 1 and the switch means to pivot and rock upwardly to the position shown in Figure 6, thus causing sudden opening of the switch means.

It is to be noted that a very small force is required to be exerted by the bi-metallic members 13 as they act upon the outer effective portions of the overhanging levers 33 and thus have a multiplying action. Further, very little force is required as it will be seen from Figure 4, for instance, that the engagement between the hook portion 40 of the arm 39 and the portion 41 of the lever 42 is substantially directly downwardly beneath the center of the pivot point of the rock lever 32. Also the upward thrust of the catch portion 47 of the carrier 20 is located only a slight distance to the right of a plane passing vertically through the pivot 43 of the lever 42.

When the bi-metallic elements 13 cool, the rock shaft 32 will rotate in a clockwise direction but no damage is occasioned the hook portion 40 of the arm 39 for from an examination of Figure 6 it will be seen that as such hook portion rocks to the left, as viewed in Figure 6, upon cooling of the bi-metallic members, it merely encounters the transverse portion 41 of the lever 42 and remains in light engagement therewith, the force exerted being merely that due to the weight of the arms 33 and their associated parts. Obviously if desired a spring may be added urging the rock lever 32 towards restoring motion though the weight of the levers 33 and their associated parts is sufficient.

It is apparent also that when the carrier 20 is again depressed by means hereinafter described and is thereby moved backwardly to its reset position, the rounded lower part of the projecting portion 47 of the latch of the carrier 20 will engage the transverse portion 45 of the lever 42 and will rock such lever in a clockwise direction and allow the hook like portion 40 of the arm

39 to again latch beneath the transverse portion 41 of the lever 42, thus positioning the transverse portion 44 of the lever 42 above the portion 47 of the carrier 20. Thereafter when the carrier 20 is allowed to rise slightly, the portion 47 will again hook beneath the portion 44.

Upon examination of Figure 4, it will be seen that the turning moment exerted upon the lever 42 by the carrier 20 is relatively small and that the transverse portion 41 is spaced at a considerable distance outwardly from the pivot point of the lever 42. The result of this is that a very much reduced pressure is exerted between the transverse portion 41 and the hook 40 of the arm 30, the construction materially reducing friction and also reducing force required to be exerted by the bi-metallic elements 13.

In order to reset the carrier 20, a cam like portion 48 is formed on the free upper portion of the carrier 20. This cam-shaped portion extends upwardly in a sweeping arc as indicated and is adapted to be engaged by a roller 49 carried between the levers 22 and also forming a spacer for such levers. This roller member 49 may be provided with inwardly converging conical portions to assist in centering with reference to the carrier 20 and with a flat central portion adapted to engage the carrier 20 when the main operating levers or means 22 are rocked to the left, as shown in Figure 5.

Stop or limit means are provided for the switch operating means 1. This stop means or limit means also acts as a guiding means and may consist of a pair of slots 50 formed in the side walls of the switch operating member 1, see Figures 4, 5 and 6, which loosely receive a spacer 51 carried by a transverse pin 52 supported between the walls 26. In switch open position the spacer 51 engages the upper ends of the slots 50, as shown in Figure 5, when the switch is manually opened. When the switch is closed, or is in its automatically opened position as shown respectively in Figures 4 and 6, the spacer 51 engages the lower portion of the slots 50.

Any suitable means may be provided for rocking the switch operating levers 22 to the right or left. For instance, if the device is mounted within the casing 53 of a transformer indicated generally at 54 in Figure 12, the entire device may be mounted directly upon the transformer and a rock shaft 55 may extend outwardly from the transformer casing and may be provided with an outer operating handle 56 so that it may be rocked by means external of the transformer casing. This rock shaft may be provided with a pair of levers 57 connected by means of links 58 with the main operating levers or means 22.

The entire device, including the thermal elements 13, may be submerged below the oil level indicated at 59 in Figure 12 so that the switch is operated in oil and so that the thermostatic elements may be heated not only by the current passing therethrough but by the general temperature of the oil. The purpose of this is to allow the thermostatic elements to respond not only to a relatively sudden overload but to allow them to respond to the gradual rise of temperature of the oil which would result from a small and prolonged overload due to the heating of the transformer itself. Thus there may be afforded the double protection of opening of the switch upon the occurrence of an overload of reasonable magnitude or the opening of the switch from a prolonged small overload due to the heating of the transformer. It is obvious also that if de-

sired the main current need not pass through the thermal members and the thermal members could then respond merely to the heating of the oil if so desired, or the oil level could be so regulated that it was below the thermal members and then the thermal members would respond merely to the heat from the current passing there-through.

The device is also adapted to be mounted in the manner of a wall switch or motor control switch. For example as shown in Figure 14, it may be housed in a casing 60 and the main operating levers 22' corresponding to the levers 22 may be provided with an operating handle 61.

If desired, a signal lamp or other signal device can be provided to indicate that an overload or other abnormal condition exists prior to the opening of the circuit breaker. For example, a signal lamp 62 may be mounted on the transformer casing 53 so that it is visible from the outside thereof, as shown in Figure 13.

The signal switch may comprise a stationary contact 63 and a movable contact 64 carried by a light spring 65, see Figure 9. This signal switch is adapted to be closed by means of an insulating member 66 which is pivoted as indicated at 67, see Figure 7, on an insulating plate 68 carried by one of the side walls 26. The member 66 is urged by means of the spring 69 towards a position to close the signal switch. It is normally restrained from closing as it is provided with an upturned lip 70 which engages a downwardly extending arm 71 carried by one of the members 33. It is apparent that when an overload occurs, the members 33 are rocked upwardly and the arm 71 is withdrawn from engagement with the lip 70 to thereby allow the switch closing member 66 to move inwardly and close the signal switch, thereby giving an indication of overload. If the overload has ceased and the operator desires to reset the signal switch, this may be readily accomplished by rocking the main control levers 22 towards the open position of the circuit breaker but not sufficiently far to actually open the circuit breaker—in other words, not far enough to cause the actuator 13 to rock to the left in Figure 4. It is apparent from an examination of Figure 4 that a considerable range of movement is permitted the lever 22 before the actuator 13 is rocked towards circuit breaker open position. When the levers 22 are rocked towards circuit breaker open position, one of the levers will engage the cam face 72 on the member 66 and will move the member back to its initial position, thereby opening the signal switch. It is to be noted that the lip 70 has a curved rear face so that it will ride beneath the arm 71 of the lever 33 and will latch behind the arm 71.

It is also apparent that in addition to the action hereinabove described, after the circuit breaker has been automatically tripped due to overload, when the operator resets the circuit breaker by first rocking the handle towards the left as viewed in Figure 4, the signal switch will be automatically reset without any thought being required of the operator.

It is apparent that the signal switch could take other forms. For example as shown in Figures 10 and 11, it may comprise a bell crank lever 73 formed of insulating material provided with a cam surface 74 corresponding to the cam surface 72 of the member 66. This bell crank lever is normally latched by means of a latch member 75 which is spring urged towards unlatching position. This latch member 75 is provided with

a projecting arm 76 adapted to be engaged by a rounded foot portion 77 of the lever 73 so that when the lever 73 is rocked inwardly for resetting of the signal switch, the portion 77 will engage the portion 76 and swing the latch into latching position. The latch 75 will be held in latching position as it is provided with a lip 78 which is adapted to ride beneath and lock behind the arm 71' of the lever 33'. The lever 73 is provided with an arm 79 which is adapted to engage the movable portion 80 of the signal switch to close the signal switch when the lever is rocked inwardly by means of its spring 81.

Figure 15 is a diagrammatic view showing the manner in which the circuit breaker is connected in a single phase, three wire system. The neutral is indicated at 82 and the outer ends of the secondary are connected through the circuit breaker to the lines 83. The primary of the transformer is indicated at 84 and the secondary at 85. The secondary is centrally tapped as indicated. If desired, the transformer may be provided with an independent secondary winding as indicated at 86 to supply the signal lamp 62 through the signal switch. It is obvious that the signal switch could be supplied from the secondary 85 of the transformer.

Other forms of trip means can be employed instead of the thermostatic elements. For example, the electromagnetic device shown in Figure 16 could be employed which consists of a solenoid 87 adapted to draw a plunger 88 upwardly to thereby raise one of the levers 33 and cause the tripping of the circuit breaker. In the form of circuit breaker illustrated a pair of these electromagnetic devices would be employed, one for each arm 33. If desired, a dashpot consisting of a cylinder 89 and a piston 90 may be employed to delay the opening of the circuit breaker for any desired period, a suitable spring being provided for the return of the plunger and associated parts to normal position after operation. This dashpot is provided with an opening above the plunger and below the plunger and may be an air dashpot if desired or may be submerged in the oil in the transformer casing. Obviously the relative sizes of the cylinder and of the openings will determine the amount of delay afforded by the dashpot arrangement. Other time delay, of course, could be employed and it is to be distinctly understood that the circuit breaker could be made to respond to over or under voltage, overload, phase reversal, or any other desired condition.

The purpose of having time delay is to prevent the breaker from suddenly opening for any sudden and extremely transitory overload for instance, but to allow the breaker to open as promptly as desired for an overload of a period longer than that for which the time delay has been designed.

In addition to the adjustment of time delay by varying the size of the escape orifices with relation to the size of the cylinder 89, a certain amount of adjustment can be secured by adjusting the screws 34 of the arms 33.

It is to be understood that the circuit breaker can be made either with a double switch construction as illustrated or a single switch construction, or in any manner desired. Also it is to be understood that although it is shown in a single phase system, it can be used in a three phase system as the two switch means would be arranged in two of the lines and would thereby control the three phase system, or, if desired, three separate switch

elements could be used as the invention is not limited to any specific number of switch elements as obviously there could be one or a plurality of switch elements.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A circuit breaker comprising switch means and switch operating means constituting a floating unitary structure having both rocking and translatory motion and having a movable pivot point, spring means yieldingly supporting the said unitary structure at the pivot point, an actuator engaging said switch operating means and movable back and forth across the said pivot point and having both rocking and translatory motion, and two independent means for respectively controlling the rocking and translatory motion of said actuator.

2. A switch comprising switch means including a stationary and a movable contact, floating switch operating means connected as a unitary structure to said movable contact, said unitary structure having a pivot point, spring means pivotally supporting said unitary structure at said pivot point, a pivoted actuator coacting with said switch operating means and adapted to bear against said switch operating means first on one side of the pivot point of said switch operating means and then on the other side of said pivot point for moving said movable contact into open and closed position, a second spring means, and means for moving said actuator in opposite directions to open and closed positions through the agency of said second spring means.

3. A switch comprising switch means, switch operating means connected to said switch means for opening and closing said switch means by a rocking motion of said switch operating means, said switch operating means having a movable pivot point, spring means supporting said switch operating means adjacent said pivot point, a pivoted actuator coacting with said switch operating means for bodily depressing said switch operating means against the action of said spring means, said actuator being rockable back and forth to opposite sides of said pivot point to apply a depressing pressure to said switch operating means on opposite sides of said pivot point to rock said switch operating means to open and close said switch means, and means for operating said actuator to thereby open and close said switch means through the action of said spring means.

4. A switch comprising switch means, an elongated switch operating means connected to said switch means for opening and closing said switch means by a rocking motion of said switch operating means, said switch operating means having a movable pivot point, spring means supporting said switch operating means adjacent said pivot point, a pivoted actuator coacting with said switch operating means for bodily depressing said switch operating means against the action of said spring means, said actuator being rockable back and forth to opposite sides of said pivot point to apply a depressing pressure to said switch operating means on opposite sides of said pivot point to rock said switch operating means to open and close said switch means, means for limiting the motion of said elongated switch rocking means, and means for operating said actuator in opposite directions to thereby open and close said

switch means through the action of said spring means.

5. A switch comprising switch means, an elongated switch operating means connected to said switch means for opening and closing said switch means by rocking motion of said switch operating means, said switch operating means having a movable pivot point, spring means supporting said switch operating means adjacent said pivot point, a pivoted actuator coacting with said switch operating means for bodily depressing said switch operating means against the action of said spring means, said actuator being rockable back and forth to opposite sides of said pivot point to apply a depressing pressure to said switch operating means on opposite sides of said pivot point to rock said switch operating means to open and close said switch means, means for limiting the motion of one end of said elongated switch operating means, and means for rocking said actuator in opposite directions to thereby open and close said switch means through the action of said spring means.

6. A circuit breaker comprising switch means, switch operating means for opening and closing said switch means, said switch operating means comprising a floating lever pivoted intermediate its ends, spring means pivotally supporting said floating lever adjacent the pivot point of said floating lever, a normally stationary carrier biased towards motion away from said switch operating means, an actuator pivoted on said carrier and bearing against said switch operating means, main operating means for rocking said actuator from one side to the other of the pivot point of said switch operating means to open and close said switch means, and condition responsive means normally holding said carrier against motion and releasing said carrier upon the occurrence of a predetermined condition, whereby said switch operating means may be rocked to circuit open and circuit closed position by operation of said main operating means and may also be released for motion to open circuit condition upon release of said carrier.

7. A switch construction comprising switch means, floating switch operating means operatively coupled to said switch means and having a pivot point intermediate its ends, spring means bearing against said switch operating means at said pivot point and urging said switch operating means towards motion of translation, means including an actuator bearing against said switch operating means and opposing the action of said spring means and movable across the pivot point to opposite sides thereof, main operating means for moving said actuator back and forth across said pivot point whereby said spring means will selectively act in the same direction to both open and close said switch means depending on the position of said actuator.

8. A switch construction comprising switch means, floating switch operating means operatively coupled to said switch means and pivoted intermediate its ends, spring means bearing against said switch operating means adjacent said pivot point and urging said switch operating means towards motion of translation, means adjacent one end of said switch operating means for permitting limited motion only of such end, means including an actuator bearing against said switch operating means and opposing the action of said spring means and movable across the pivot point to opposite sides thereof, whereby said spring means will selectively act in the same direction to both open and close said switch

means depending on the position of said actuator, and means for moving said actuator back and forth across said pivot point.

9. A circuit breaker comprising switch means, floating switch operating means having both rocking and translatory motion and having a movable pivot point, means operatively connecting said switch means and said switch operating means, supporting means yieldingly supporting said switch operating means at the pivot point and arranged to cause both opening and closing of said switch means, an actuator engaging said switch operating means and movable back and forth across said pivot point and having both rocking and translatory motion, and two independent means for respectively controlling the rocking and translatory motion of said actuator.

10. A circuit breaker comprising switch means, floating switch operating means having both rocking and translatory motion and having a movable pivot point, means operatively connecting said switch means and said switch operating means, spring means yieldingly supporting said switch operating means at the pivot point and arranged to cause both opening and closing of said switch means, an actuator engaging said switch operating means and movable back and forth across said pivot point and having both rocking and translatory motion, main operating means for moving said actuator, and condition responsive means for releasing said switch operating means for switch opening movement.

11. A circuit breaker comprising switch means, floating switch operating means having both rocking and translatory motion and having a movable pivot point, means operatively connecting said switch means and said switch operating means, spring means yieldingly supporting said switch operating means at the pivot point and arranged to cause both opening and closing of said switch means, an actuator engaging said switch operating means and movable back and forth across said pivot point and having both rocking and translatory motion, main operating means for moving said actuator, and condition responsive means for releasing said switch operating means for translatory motion to open said switch means.

12. A circuit breaker comprising switch means and switch operating means constituting a floating unitary structure having both rocking and translatory motion and having a movable pivot point, spring means yieldingly supporting said unitary structure at the pivot point and arranged to cause both opening and closing of said switch means, an actuator engaging said switch operating means and movable back and forth across said pivot point and having both rocking and translatory motion, said spring means urging said switch operating means and said switch means towards switch open position, main operating means for moving said actuator back and forth across said pivot point, and condition responsive means for releasing said actuator and said switch operating means and said switch means for translatory motion to switch open position.

13. A circuit breaker comprising switch means and switch operating means constituting a unitary structure having both rocking and translatory motion, spring means supporting said unitary structure and urging said unitary structure towards translatory motion to switch open position, an actuator engaging said switch operating means and movable back and forth towards

opposite ends of said switch operating means and mounted for both rocking and translatable motion, said spring means when said actuator is adjacent one end of said switch operating means rocking said switch operating means in one direction and when said actuator is adjacent the other end of said switch operating means rocking said switch operating means in the other direction, main operating means for moving said actuator towards opposite ends of said switch operating means, and condition responsive means controlling the translatable motion of said switch operating means and said switch means.

14. A circuit breaker comprising switch means and switch operating means constituting a unitary structure having both rocking and translatable motion, spring means supporting said unitary structure and urging said unitary structure towards translatable motion to switch open position, an actuator engaging said switch operating means and movable back and forth towards opposite ends of said switch operating means and mounted for both rocking and translatable motion, said spring means when said actuator is adjacent one end of said switch operating means rocking said switch operating means in one direction and when said actuator is adjacent the other end of said switch operating means rocking said switch operating means in the other direction, main operating means for moving said actuator towards opposite ends of said switch operating means, and condition responsive means controlling the translatable motion of said actuator, said actuator when executing translatable motion releasing said switch operating means and said switch means for switch opening movement.

15. A circuit breaker comprising switch means, floating switch operating means having both rocking and translatable motion and operatively connected to said switch means, spring means supporting said switch operating means at a point intermediate the ends of said switch operating means and urging said switch operating means towards translatable motion for opening said switch means, an actuator engaging said switch operating means and movable back and forth from adjacent one end to adjacent the other end of said switch operating means across the point of support from said spring means and having both rocking and translatable motion, main operating means for moving said actuator, and condition responsive means for releasing said actuator for translatable motion to thereby release said switch operating means for translatable motion to switch open position.

16. A circuit breaker comprising switch means, floating switch operating means having both rocking and translatable motion and operatively connected to said switch means, spring means supporting said switch operating means at a point intermediate the ends of said switch operating means and urging said switch operating means towards translatable motion for opening said switch means, an actuator engaging said switch operating means and movable back and forth from adjacent one end to adjacent the other end of said switch operating means across the point of support from said spring means for rocking said switch operating means and having both rocking and translatable motion, main operating means for rocking said actuator to open and close said switch means, and condition responsive means for releasing said actuator and said switch operating means for translatable motion to switch open position.

17. A circuit breaker comprising switch means, switch operating means for opening and closing said switch means, said switch operating means comprising a floating lever pivoted intermediate its ends, spring means pivotally supporting said floating lever adjacent the pivot point of said floating lever, a normally stationary carrier biased towards motion away from said switch operating means, an actuator pivoted on said carrier and bearing against said switch operating means, main operating means for rocking said actuator from one side to the other of the pivot point of said switch operating means to open and close said switch means, and condition responsive means normally holding said carrier against motion and releasing said carrier upon the occurrence of a predetermined condition, whereby said switch operating means may be rocked to circuit open and circuit closed position by operation of said actuator and may also be released for motion to open circuit position upon release of said carrier, said carrier when released executing its opening motion without requiring motion of said main operating means.

18. A circuit breaker comprising switch means, floating switch operating means having both rocking and translatable motion and operatively connected to said switch means, spring means supporting said switch operating means and urging said switch operating means towards translatable motion for opening said switch means, an actuator engaging said switch operating means and movable back and forth from adjacent one end to adjacent the other end of said switch operating means for rocking said switch operating means and having both rocking and translatable motion, main operating means for rocking said actuator to open and close said switch means, condition responsive means for releasing said actuator and said switch operating means for translatable motion to switch open position, and mechanism interposed between said main operating means and said actuator for repositioning said actuator after release of said actuator when said main operating means is rocked towards switch open position.

19. A circuit breaker comprising switch means, switch operating means for opening and closing said switch means, said switch operating means comprising a floating lever pivoted intermediate its ends, spring means pivotally supporting said floating lever adjacent the pivot point of said floating lever, a normally stationary carrier biased towards motion away from said switch operating means, an actuator pivoted on said carrier and bearing against said switch operating means, main operating means for rocking said actuator from one side to the other of the pivot point of said switch operating means to open and close said switch means, and condition responsive means normally holding said carrier against motion and releasing said carrier upon the occurrence of a predetermined condition, said carrier and said main operating means having coacting portions for resetting said carrier when said main operating means is rocked to a predetermined position.

20. A circuit breaker comprising switch means, switch operating means for opening and closing said switch means, said switch operating means comprising a floating lever pivoted intermediate its ends, spring means pivotally supporting said floating lever adjacent the pivot point of said floating lever, a normally stationary carrier biased towards motion away from said switch operat-

ing means, an actuator pivoted on said carrier and bearing against said switch operating means, main operating means for rocking said actuator from one side to the other of the pivot point of said switch operating means to open and close said switch means, and condition responsive means normally holding said carrier against motion and releasing said carrier upon the occurrence of a predetermined condition, said carrier having a cam portion and said main operating means having a part engaging said cam portion when said main operating means is rocked to switch open position for resetting said carrier.

21. A circuit breaker comprising switch means, an elongated floating switch operating means having both pivotal and translatable motion, spring means pivotally supporting said switch operating means at a point intermediate its ends, a pivoted carrier, an actuator pivoted on said carrier and having an outer end bearing against said switch operating means and rockable towards opposite ends of said switch operating means for rocking said switch operating means to switch closed position and switch open position, said carrier being biased towards motion away from said switch operating means to allow translatable motion of said switch operating means to switch open position, condition responsive latch means normally latching said carrier against motion, and main operating means for rocking said actuator towards opposite ends of said switch operating means, said main operating means consisting of a pair of levers located on opposite sides of said switch operating means.

22. A circuit breaker comprising switch means, an elongated floating switch operating means having both pivotal and translatable motion, spring means pivotally supporting said switch operating means at a point intermediate its ends, a pivoted carrier, an actuator pivoted on said carrier and having an outer end bearing against said switch operating means and rockable towards opposite ends of said switch operating means for rocking said switch operating means to switch closed and switch open position, said carrier being biased towards motion away from said switch operating means to allow translatable motion of said switch operating means to switch open position, condition responsive latch means normally latching said carrier against motion, and main operating means for rocking said actuator towards opposite ends of said switch operating means, said main operating means consisting of a pair of levers located on opposite sides of said carrier, said actuator and said switch operating means, said carrier having a cam portion and said main operating means having a cam engaging portion for engaging said cam portion to reset said actuator when said main operating means is rocked towards switch open position.

23. A circuit breaker comprising switch means, floating and pivotally mounted switch operating means operatively connected to said switch means, a carrier pivotally mounted in spaced relation to said switch operating means, spring means pivotally supporting said switch operating means and urging said switch operating means towards said carrier to open said switch means, an actuator pivoted on said carrier and having a free end bearing against said switch operating means, main operating means connected by spring means with said actuator for imparting a quick rocking motion to said actuator towards opposite ends of said switch means to open and close said

switch means, and condition responsive means for releasing said carrier to thereby allow said switch operating means to move to switch open position independently of any motion of said main operating means.

24. A circuit breaker comprising switch means, channel-shaped switch operating means operatively connected to said switch means, spring means supporting said channel-shaped switch operating means at a point intermediate its ends for rocking motion and urging said switch operating means towards translatable motion, a carrier pivoted adjacent one end in spaced relation to said switch operating means, an actuator pivoted on said carrier and having an outer end provided with a roller guided within the channel of said switch operating means and movable past the pivot point of said switch operating means for rocking said switch operating means in opposite directions to open and close said switch means, main operating means consisting of a pair of levers located on opposite sides of said carrier, said actuator and said switch operating means and connected by spring means to said actuator at a point adjacent the outer portion of said actuator and adapted to move said actuator back and forth within the channel of said switch operating means with a quick motion, and condition responsive means normally latching said carrier against outward motion and releasing said carrier under a predetermined condition, whereby said carrier will move outwardly and will allow said switch operating means to execute translatable motion to open said switch means, said carrier having a cam portion spaced from the pivoted end thereof and adapted to be engaged by means carried by said main operating means for resetting said carrier.

25. A circuit breaker comprising switch means, channel-shaped switch operating means operatively connected to said switch means, said switch operating means having a rectangular channel-shaped cross-section, spring means supporting said channel-shaped switch operating means at a point intermediate its ends for rocking motion and urging said switch operating means towards translatable motion, a carrier pivoted adjacent one end in spaced relation to said switch operating means, an actuator pivoted on said carrier and having an outer end provided with a roller guided within the channel of said switch operating means and movable back and forth across the pivot point of said switch operating means for rocking said switch operating means in opposite directions to open and close said switch means, main operating means consisting of a pair of levers located on opposite sides of said carrier, said actuator and said switch operating means and connected by spring means to said actuator at a point adjacent the outer portion of said actuator and adapted to move said actuator back and forth within the channel of said switch operating means with a quick motion, and condition responsive means normally latching said carrier against outward motion and releasing said carrier under a predetermined condition, whereby said carrier will move outwardly and will allow said switch operating means to execute translatable motion to open said switch means, said carrier having a cam portion spaced from the pivoted end thereof and adapted to be engaged by means carried by said main operating means for resetting said carrier, said carrier when released by said condition responsive means being free to exe-

cute outward motion without requiring any motion of said main operating means.

26. A circuit breaker comprising switch means biased towards open position, main operating means for opening and closing said circuit breaker, a carrier biased towards outward motion for opening said switch means independently of said main operating means, a double latch arrangement consisting of a latch lever having a short effective lever arm for restraining said carrier against outward motion and a relatively long arm, the other portion of said double latch arrangement consisting of a pivoted member provided with a hook like arm normally engaging the relatively long arm of said latch lever to transmit force from said latch lever substantially directly radially to the pivot point of said pivoted member to prevent motion of said pivoted member from being transmitted to the long arm of said latch lever, and condition responsive means for disengaging the said hook like arm from the relatively long arm of said latch lever.

27. A circuit breaker comprising main switch means, automatic means effective to open said circuit breaker upon the occurrence of a predetermined condition and including movable condition responsive means, main operating means for opening and closing said circuit breaker and for resetting said automatic means, a normally open signal switch, a biased member for closing said signal switch, latch means normally holding said biased member in latched condition and being released by said condition responsive means on movement of said condition responsive means less than that required to open said circuit breaker, and means for resetting said biased member without actuating said circuit breaker.

28. A circuit breaker comprising main switch means, automatic means effective to open said circuit breaker upon the occurrence of a predetermined condition and including movable condition responsive means, main operating means for opening and closing said circuit breaker and for resetting said automatic means, a normally open signal switch, a biased member for closing said signal switch, and latch means normally holding said biased member in latched condition and being released by said condition responsive means on movement of said condition responsive means less than that required to open said circuit breaker, said main operating means having a portion for engaging and resetting said biased member on motion of said main operating means less than that required to operate said circuit breaker.

29. A circuit breaker comprising main switch means, automatic means effective to open said circuit breaker upon the occurrence of a predetermined condition and including movable condition responsive means, main operating means for opening and closing said circuit breaker and for resetting said automatic means, a normally open signal switch, a biased member located to the side of said main operating means, for closing said signal switch, and latch means normally holding said biased member in latched condition and being released by said condition responsive means on movement of said condition responsive means, said biased member having a cam portion projected into the path of said main operating means when said biased member is released, said cam portion being engaged by said main operating

means when said main operating means resets said automatic means to thereby reset said biased member by a sliding motion of said main operating means along said cam portion.

30. A circuit breaker comprising main switch means, automatic means effective to open said circuit breaker upon the occurrence of a predetermined condition and including movable condition responsive means, main operating means for opening and closing said circuit breaker and for resetting said automatic means, a normally open signal switch, a biased member for closing said signal switch, and latch means normally holding said biased member in latched condition and being released by said condition responsive means on movement of said condition responsive means, said biased member being movable in a plane at an angle to that of said main operating means and being located to the side of said main operating means and having a portion engaged by said main operating means for resetting said biased member when said main operating means resets said automatic means.

31. A switch construction comprising a switch unit pivoted intermediate its ends and including a movable contact, a cooperating contact, an actuator pivoted at one end and slidably engaging the switch unit at the other end, yielding spring means permitting relative movement between the pivot points of said switch unit and said actuator and supporting said switch unit at the pivot point of said switch unit and arranged to move said movable contact to open and closed position, and means for rocking said actuator back and forth across the pivot point of said switch unit for rocking said switch unit to move said movable contact into and out of engagement with said cooperating contact.

32. A switch construction comprising a switch unit pivoted intermediate its ends and including a movable contact, a cooperating contact, an actuator pivoted at one end and slidably engaging the switch unit at the other end, means for rocking said actuator back and forth across the pivot point of said switch unit for rocking said switch unit to move said movable contact into and out of engagement with said cooperating contact, and spring means for yieldingly holding said actuator in engagement with said switch unit during rocking motion of said actuator and arranged to move said movable contact to open and closed position.

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