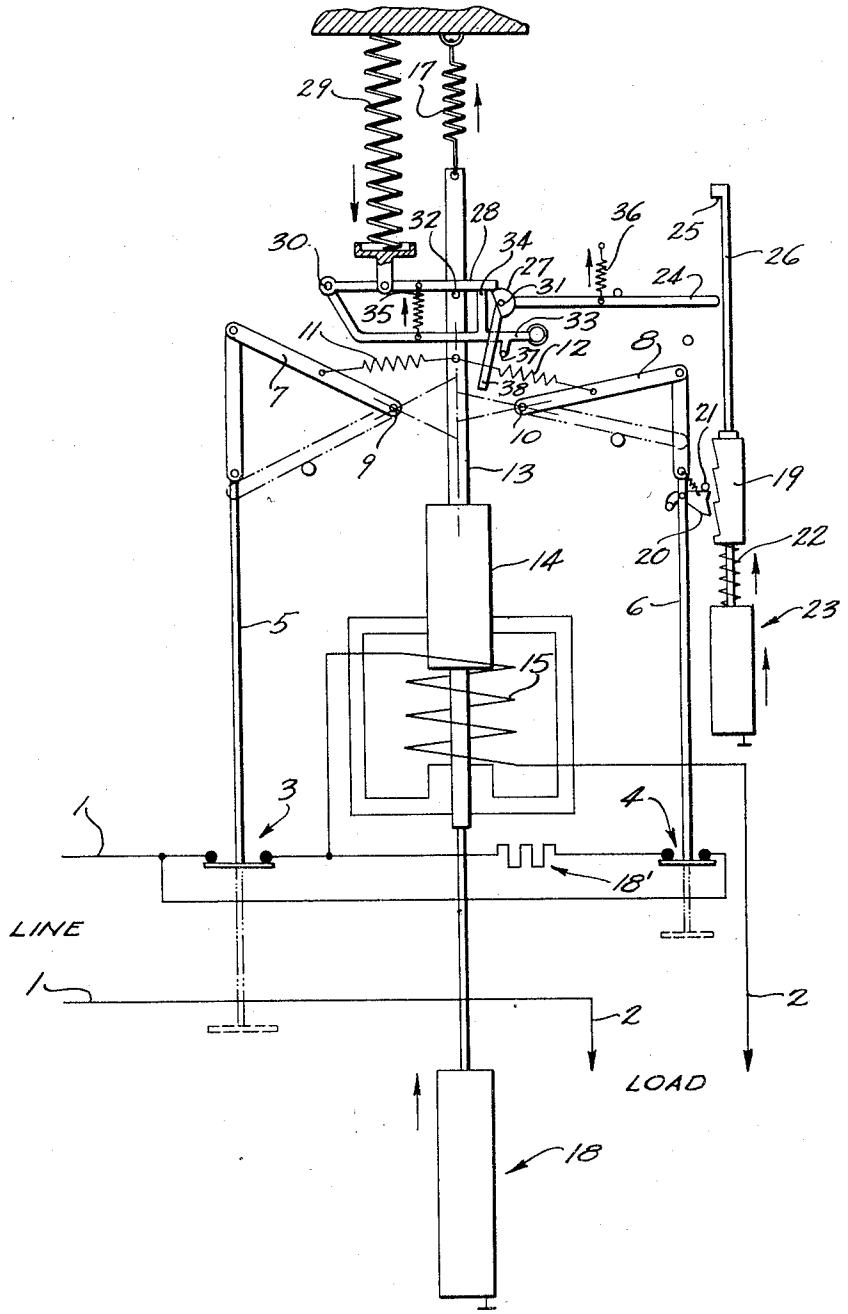
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CIRCUIT TESTING REPEATING CIRCUIT BREAKER

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CIRCUIT TESTING REPEATING CIRCUIT BREAKER

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This invention relates to a circuit testing repeating circuit breaker.

Objects of this invention are to provide a circuit breaker which is so made that after opening under overload it will ascertain the condition of the load circuit by testing or probing such circuit to find out if there still exists an overload condition before the load circuit is again directly connected to the supply circuit by means of the self-closing circuit breaker, which does not depend upon the balancing of voltages or currents, and which has no special relays or coils for ascertaining the condition of the load circuit but which utilizes its own opening coil in coaction with a testing or probing switch to prevent closing of the circuit breaker when the impedance of the load circuit is below a certain predetermined value.

More specifically, objects of this invention are to provide a self-closing circuit breaker which is so constructed that the circuit breaker closes a testing or probing circuit prior to closing the main circuit, and in which this probing circuit includes the opening coil and the load circuit, the arrangement being such that a reduced current is allowed to flow through the load circuit, such current being sufficient to actuate the opening coil in the event that a fault or other overload exists in the load circuit.

Further objects are to provide a circuit breaker having the above enumerated characteristics in which a delayed action means is provided for the probing or testing means and in which after the delayed action testing or probing means has functioned a predetermined number of times in a predetermined interval, means are provided which permanently lock the circuit breaker in open position and also prevent further functioning of the testing or probing means.

An embodiment of the invention is shown in the accompanying drawings, in which:

The single figure is a partly diagrammatic view showing the circuit breaker.

Referring to the drawing, it will be seen that the supply mains or supply lines are indicated by the reference character 1 and the load lines or load circuit by the reference character 2. The main switch of the circuit breaker is indicated generally by the reference character 3 and the auxiliary, testing or probing switch by the reference character 4. The main switch is operated by a main operating rod 5 and the auxiliary switch by auxiliary operating rod 6 which are respectively operated by means of a main lever 7 and an auxiliary lever 8 pivoted as indicated at 9 and 10. The levers 7 and 8 are actuated by means of over-center springs 11 and 12 whose outer ends are connected to such levers and whose inner ends are connected to a rod 13 extending upwardly from the operating plunger 14 of the circuit breaker. The plunger 14 is adapted to be drawn downwardly by means of the overload series coil 15 and is biased upwardly by means of the spring 17. It is connected to a time delay means indicated generally by the reference character 18 which is delayed in the direction indicated by the arrow.

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Normally the parts are in the position shown. However, when an overload occurs it will be seen that the opening or trip coil 15 will draw the plunger 14 downwardly, as viewed in the single figure of the drawing, and will move the over-center springs 11 and 12 past dead center and will cause the main and auxiliary switches 3 and 4 to open, thus disconnecting the load circuit 2 from the supply mains 1.

After the circuit breaker has opened, the biasing spring 17 slowly moves the plunger 14 upwardly in a slow manner due to the time delay means 18 and closes the testing or auxiliary switch 4 before the main switch 3 arrives at closing position. As soon as the auxiliary switch has closed, it will be seen that an auxiliary circuit is established through an impedance 18' and the opening coil 15 to the load circuit and a reduced voltage is impressed on the load circuit. If the load circuit is clear of any fault or overload, the circuit breaker will continue its closing motion and will close the main switch 3, the auxiliary or testing switch 4 remaining closed. However, if the fault is a permanent fault, it is apparent that as soon as the auxiliary switch closes, which occurs at a time prior to the arrival of the main switch at closing position, the auxiliary circuit through the impedance 18' would pass sufficient current through the opening coil 15 to cause the plunger 14 to move downwardly and open the auxiliary switch 4, the main switch 3 never having arrived at closed position.

This operation would continue indefinitely for a permanent fault except for the fact that integrating and lock-out means have been provided which will now be described.

The integrating means comprises the integrating or counting ratchet 19 and the spring pressed pawl 20 pivoted to the auxiliary rod 6 and normally held clear of the ratchet 19 by means of a stop 21. The integrating ratchet 19 is biased upwardly in any suitable manner as by means of

the spring 22 and a time delay means indicated generally by the reference character 23 is provided to delay resetting of the integrating means. On repeated operations of the circuit interrupter, it will be seen that the integrating means is moved downwardly a plurality of steps provided the successive operations occur with sufficient rapidity. When the integrating means has been moved downwardly to its lowest position, it will depress a lever 24 whose outer end is arranged to be engaged by a shouldered portion 25 carried by an extension rod 26 projecting upwardly from the integrating ratchet or counting ratchet 19. The lever 24 is rigid with a latch member 27 which normally restrains the downward motion of a lever 28. The lever 28 is spring pressed downwardly by means of a relatively heavy lock-out spring 29, which spring is much more powerful than the biasing spring 17. The spring 29 acts on the lever 28 and such lever is pivoted as indicated at 30. It is apparent that when the latch 27 which is pivoted as indicated at 31 has been rocked to releasing position by means of the integrating or counting means, that the lever 28 will be free to rock downwardly. It is arranged to engage a projecting member 32 carried by the rod 13 of the plunger 14 and to thus force the plunger downwardly thereby opening both the main switch 3 and the auxiliary or testing switch 4 and locking the circuit interrupter in open position.

It is to be noted that a lever 33 is also pivoted at 30 and is manually operable. This manually operable lever 33 is provided with an extension 34 which is normally held in engagement with the downwardly biased or spring pressed lever 28 by means of a spring 35. The manually operable lever 33 constitutes both a manual trip means and also a manual reset means.

When it is used as a reset means after the circuit breaker has been locked in open position, it is pushed upwardly and thereby pushes the lever 28 upwardly against the action of the spring 29. This rocks the latch 27 in a clockwise direction, the lever 28 passing above the latch. The latch 27 is spring biased in a counterclockwise direction by means of the spring 36.

It is to be noted that after lock-out has occurred, that when the reset lever 33 is moved upwardly, it will compress the spring 29 and position the lever 28 above the latch 27 and allow the opening spring 17 to move the plunger upwardly. This closes both the auxiliary and main switches and allows the pawl 20 to detach itself from the integrating ratchet 19 and allows the integrating means to reset itself.

When it is desired to manually trip and lock the circuit breaker in open position, the lever 33 is pulled downwardly and a projection 37 thereon engages a lever 38 which is rigid with the latch 27. This rocks the latch 27 in a clockwise direction and frees the lever 28, so that the lock-out spring 29 is now effective to lock the circuit interrupter in open position.

It is to be understood that no attempt has been made to show how the various switch parts are insulated from each other or from other portions of the apparatus. It is to be understood that any suitable and well known means can be employed. Also it is to be understood that no particular effort has been made to show guiding means for the various portions of the circuit breaker and that any suitable form of guiding means can be employed.

It will be seen that a novel form of circuit breaker has been provided by this invention which will test or probe the load circuit and which, if the impedance of the load circuit is too small will immediately open the test circuit. It will be seen further that during this testing or probing operation, that the main switch is not closed and consequently, due to the arrangement hereinabove described, a reduced voltage only is impressed on the load circuit for testing purposes. Obviously the voltage dropping member 18' could be a resistance for a direct current circuit and could be either a choke coil or a resistance for an alternating current circuit.

It will be seen further that integrating or counting means have been provided which respond to a predetermined number of operations of the circuit breaker occurring in rapid succession and which integrating means is effective to cause lock-out of the circuit breaker thereby holding both the main switch and the probing or testing auxiliary switch in open position.

It is to be noted particularly that no auxiliary relays or auxiliary equipment is required, but instead the opening coil of the circuit breaker itself is employed in conjunction with testing means to test or probe the load circuit.

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.

We claim:

1. A circuit breaker arranged to be connected between a supply circuit and a load circuit comprising main switch means controlling the connection of the supply circuit to the load circuit, auxiliary switch means, an operating plunger, mechanism connecting said plunger and said main and auxiliary switch means and arranged to open and close said main and auxiliary switch means when said operating plunger moves to switch open and switch closed position, biasing means biasing said plunger to switch closed position, said mechanism being arranged to close said auxiliary switch means prior to the closing of said main switch means, time delay means delaying the motion of said auxiliary switch means towards switch closed position, a magnet coil arranged to move said plunger to switch open position upon the occurrence of an overload, said coil being normally connected in series with said supply circuit and said load circuit, and an auxiliary circuit connected ahead of said main switch means to said supply circuit and including an impedance and said auxiliary switch means connected to said magnet coil and arranged to pass a limited current through said magnet coil and said load circuit upon continuing overload when said auxiliary switch is closed and said main switch is open to thereby cause said plunger to move to switch open position prior to closing said main switch means.

2. A circuit breaker arranged to be connected between a supply circuit and a load circuit comprising main switch means controlling the connection of the supply circuit to the load circuit, auxiliary switch means, an operating plunger mechanism connecting said plunger and said main and auxiliary switch means and arranged to open and close said main and auxiliary switch means when said operating plunger moves to switch open and switch closed position, biasing means biasing said plunger to switch closed position, said mechanism being arranged to close said auxiliary switch means prior to the closing of said

main switch means, time delay means delaying the motion of said auxliliary switch means towards switch closed position, a magnet coil arranged to move said plunger to switch open position upon the occurrence of an overload, said coil being normally connected in series with said supply circuit and said load circuit, an auxiliary circuit connected ahead of said main switch means to said supply circuit and including an impedance and said auxiliary switch means connected to said magnet coil and arranged to pass a limited current through said magnet coil and said load circuit upon continuing overload when said auxiliary switch is closed and said main switch is open to thereby cause said plunger to move to switch open position prior to closing said main switch means, normally inactive lock-out means, and counting means responsive to a plurality of closely successive circuit interrupting operations of the auxiliary switch for releasing said lock-out means for locking said operating plunger in switch open position.

3. A circuit breaker arranged to be connected between a supply circuit and a load circuit comprising main switch means controlling the connection of the supply circuit to the load circuit, auxiliary switch means, an operating plunger, mechanism connecting said plunger and said main and auxiliary switch means and arranged to open and close said main and auxiliary switch means when said operating plunger moves to switch open and switch closed position, biasing means biasing said plunger to switch closed position, said mechanism being arranged to close said auxiliary switch means prior to the closing of said main switch means, time delay means delaying the motion of said auxiliary switch means towards switch closed position, a magnet coil controlling said plunger and connected in series with said load circuit and being responsive to overload condition, counting means responsive to a plurality of closely successive operations of said auxiliary switch means, lock-out means controlled by said counting means for locking said circuit interrupter in open position, means including said auxiliary switch means for passing a limited current through said magnet coil on continued overload, and manually operable means for selectively tripping or resetting said lock-out means.

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