

[54] **CIRCUIT BREAKER ANTIPUMPING
CONTROL SYSTEM**

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335/24, 46, 157

[56]

References Cited

UNITED STATES PATENTS

3,183,416	5/1965	Circle	317/54
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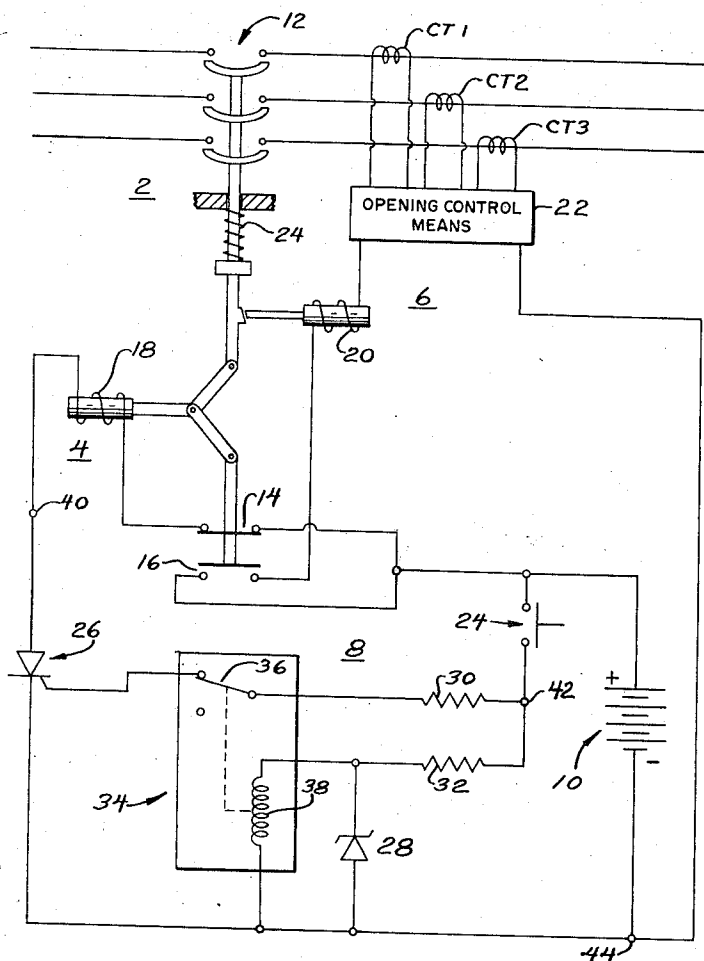
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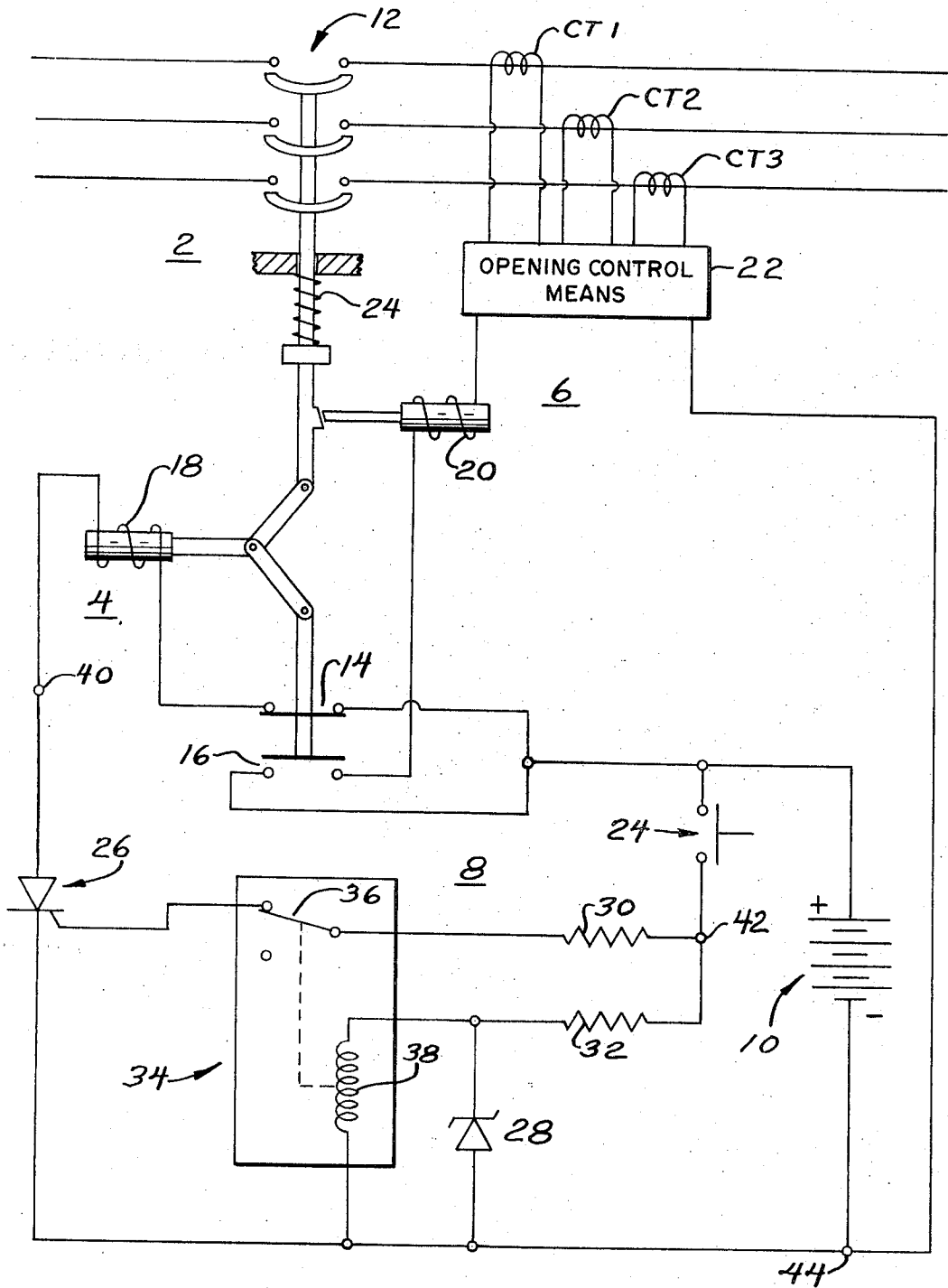
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ABSTRACT

An antipumping circuit breaker control system is provided in which a static switch causes a circuit breaker closing operation in response to closing of a manually operated close switch. A switch means is provided for momentarily providing an energizing circuit to the static switch so that it conducts to cause the closing operation and then opening the energizing circuit to the static switch and holding the energizing circuit open until the manually operated close switch is released.

4 Claims, 1 Drawing Figure





CIRCUIT BREAKER ANTIPUMPING CONTROL SYSTEM

BACKGROUND OF THE INVENTION

Circuit breakers are often provided with a manually operated closing control switch for initiating a contact closing operation and means for reopening the contact should the circuit breakers close in on a fault. Thus, if a circuit breaker is closed on a faulted line and the operator holds the closing control switch in its closed position, damaging repetitive opening and closing operations, commonly called pumping, may occur unless this action is prevented. For this reason, circuit breakers are often provided with anti-pumping circuits or mechanisms, or both, which permit only one contact closing operation each time the closing control switch is actuated.

One type of prior art circuit breaker protective device is known as an X-Y control. This includes an X relay for operating the circuit breaker closing coil and a Y relay which prevents repetitive operation of the X relay in the event the closing control switch is held in its closed position. Such mechanical relay schemes are not wholly satisfactory because false operation of the relay contacts may result as the result of mechanical vibration of the circuit breaker.

Another type of antipumping control is of an entirely static type and is disclosed in U.S. Pat. No. 3,530,339, assigned to the assignee of the instant application. This system is faster and less expensive than the older system described above, but due to its complexity is not satisfactorily reliable.

It is an object of the invention to provide a new and improved antipumping control circuit for a circuit breaker and which is simple, economical, compact and not subject to operational problems due to complexity or circuit breaker vibration.

SUMMARY OF THE INVENTION

The objects of the invention are accomplished by providing switch means for initiating a circuit breaker closing operation, a switch means for actuating closing means to cause a circuit breaker closing operation and another switch means for providing an energizing circuit to the actuating switch means and then opens the circuit to the actuating switch means so that a repetitive sequence of closing and opening operations of the circuit breaker cannot occur as long as the initiating switch means remains in a closed position.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE of the drawing schematically illustrates a circuit breaker antipumping control system according to the instant invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, a circuit breaker is shown as having main contacts 2, main contact closing means 4, main contact opening means 6, and a control circuit 8. A source of electrical energy which may comprise a battery 10 is connected to the closing means 4, opening means 6 and control circuit 8. The main contact means 2 includes the main contacts 12, normally closed auxiliary contacts 14 and normally open auxiliary contacts 16. The main contact closing means 4 includes a closing

coil 18 which is connected in series with auxiliary contacts 14 and a battery 10. The main contact opening means 6 includes a trip coil 20, opening control means 22, opening spring 24 and current transformers CT1, CT2, and CT3. The opening means 6 is of a type well known in the art and, upon sensing a fault current in an electrical system, the trip coil 20 is energized to permit the main contacts 12 to move to their open position as shown in the drawing under the opening force of spring 24. In the open position of the main contact means 2, the auxiliary contacts 14 are closed and the auxiliary contacts 16 are open and the auxiliary contacts 16 are closed. The main contact closing means 4 is also of a type well known in the art and, upon energization of the closing coil 18, the main contacts 12 will be moved to a closed position to thereby cause opening of the auxiliary contacts 14 and closing of the auxiliary contacts 16.

The control circuit 8 includes a close switch 24, a silicon controlled rectifier 26 and a switch means 34. The switch means 34 includes a single pole normally closed switch 36 and a switch operating coil 38. The switch means 34 may comprise a reed switch, but is not necessarily limited to this type of switch. The anode-cathode circuit of the silicon controlled rectifier 26 is connected in series between the positive (+) side of the battery 10 and the negative (-) side of the battery 10 through the auxiliary contacts 14 and the closing coil 18. The gate-cathode circuit of the silicon controlled rectifier 26 is connected across the battery 10 through the close switch 24, resistor 30 and the switch 36 when the latter is in its closed position shown in the drawing. The switch operating coil 38 is connected across the battery 10 through the close switch 24 and the resistor 32. The zener diode 28 is connected in shunt with the coil 38 to provide voltage regulation therefor.

When the main contacts 12 are open and the other elements of the circuit breaker have their conditions as shown in the drawing, the positive voltage from the battery 10 is applied to the anode of the silicon controlled rectifier 26. However, there will be no signal at the gate of the silicon controlled rectifier 26 from the positive side of the battery 10 while the close switch 24 is in its open position as shown in the drawing. To cause closure of the main contacts 12, the close switch 24 is moved to its closed position to complete an energizing circuit from the positive side of the battery 10 through the resistors 30 and the switch 36 to the gate of the silicon controlled rectifier 26. Moving the close switch 24 to its closed position also applies the positive voltage from the battery 10 to the switch operating coil 38. Applying the signal from the battery 10 to the gate of the silicon controlled rectifier 26 causes the silicon controlled rectifier 26 to conduct and complete an energizing circuit through the closed contacts 14 and the closing coil 18. This results in a closing operation of the main contact closing means 4 and moving of the main contacts 12 to their closed position. Application of the positive voltage from the battery 10 to the switch operating coil 38 causes the switch operating coil 38 to move the switch 36 to its open position just after the gating signal is applied to the gate of silicon controlled rectifier 26 to thereby open the circuit to the gate of silicon control rectifier 26. Once the switch 36 moves to its open position, a signal cannot again be applied to the gate of silicon controlled rectifier 26 until the close switch 24 is released to thereby de-energize the coil 38

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and permit the switch 36 to return to its closed position as shown in the drawing. Thus, if the main contacts 12 are closed in on a fault and the main contact opening means 6 immediately opens the contacts 12, the anode-cathode circuit of the silicon controlled rectifier will not again conduct even though the auxiliary contacts 14 again close. Since no gate signal will be again available until the close switch 24 is allowed to open, pumping of the main contacts 12 will not occur.

It can thus be seen that an extremely simple and compact antipumping control has been provided. Further, pumping prevention is obtained without any connection or use of the auxiliary contacts of the main contact means 2. This simplifies the connections of the control system and also makes it more reliable due to the elimination of vibration and other mechanical problems. The design of the anti-pumping control enables ready encapsulation of the control with terminal connections required only at points 40, 42, and 44 to the circuit breaker and battery 10.

While only a single specific embodiment of the invention has been shown herein, it will be realized that many modifications thereof are feasible without departing from the spirit and scope of the invention. It is accordingly intended that the scope of the invention is not to be limited to the specific embodiment disclosed.

I claim:

1. In a control system for a circuit breaker having main contacts movable between open and closed positions auxiliary contacts having closed and open positions respectively occurring when the main contacts are in their open and closed positions, a main contact closing coil, and a source of electrical energy, the combination comprising:

first switch means in circuit with the auxiliary contacts, the closing coil and the electrical energy source and having a conductive condition when the auxiliary contacts are in their closed condition for completing an energizing circuit to the closing coil whereby the main contacts move from their open to their closed position and the auxiliary contacts move from their closed to their open position; and Circuit means connected to said electrical energy source and the first switch means for actuating the first switch means to a conductive condition, said circuit means including a close switch and second switch means, said second switch means initially having a closed circuit condition in which the first

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switch means is actuated in response to operation of said close switch, and said second switch means thereafter having an open circuit condition preventing actuation of the first switch means when the second switch means has been continuously energized while the auxiliary contacts have been in their open position and then in their closed position.

2. The combination according to claim 1 further comprising:

main contact opening means; and wherein said close switch has a closed position while said main contact closing coil and opening means are operating to close and open the main contacts; said close switch and second switch means have an initial simultaneous position in which said close switch is in said closed position and the second switch means is in said closed circuit condition whereby the first switch means is actuated, the closing coil is energized and the main contacts are closed; and

said close switch and second switch means have a subsequent simultaneous position in which said close switch is in said closed position and said second switch means is in said open circuit condition whereby actuation of the first switch means is prevented, the closing coil is not energized and the main contacts remain open after they have been closed and re-opened.

3. The combination according to claim 1 wherein: said second switch means comprises a relay including a relay switch movable between said closed and open positions and a switch operating coil; said close switch and relay switch comprise an energizing circuit to the first switch means when both are in said closed positions; said close switch comprises an energizing circuit to the switch operating coil when the former is in said closed position; said relay switch being movable from said closed position to said open position in response to energization of the switch operating coil whereby the energizing circuit to the first switch means is interrupted.

4. The combination according to claim 3 wherein said first switch means comprises a static switch having a control electrode connected in series with the close switch and the relay switch.

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