

E. J. MURPHY.
CIRCUIT BREAKER.

APPLICATION FILED FEB. 2, 1912.

1,097,256.

Patented May 19, 1914.

Fig. 1.

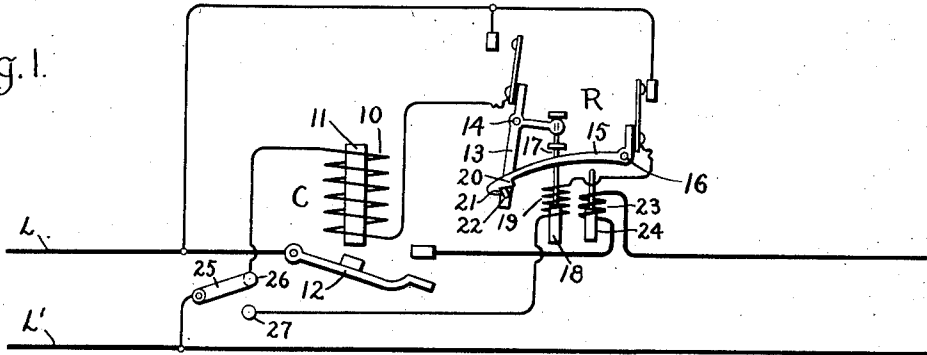


Fig. 2.

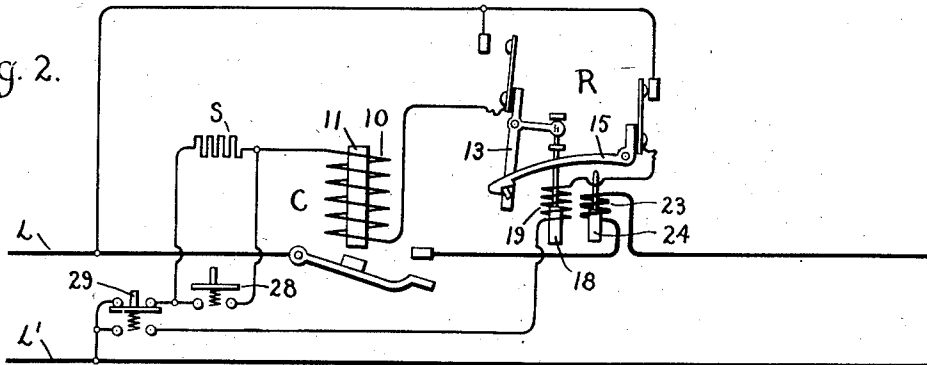
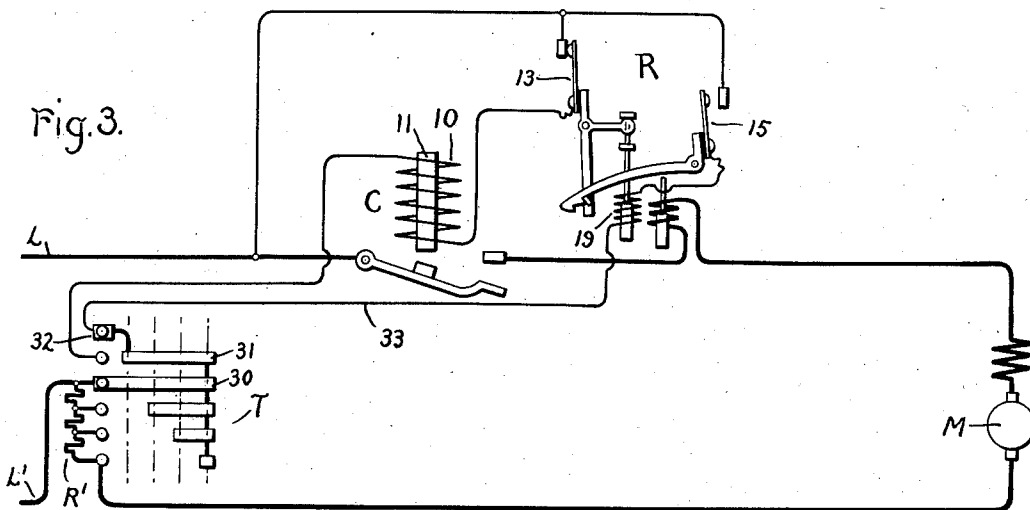


Fig. 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

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CIRCUIT-BREAKER.

1,097,256.

Specification of Letters Patent.

Patented May 19, 1914.

Application filed February 2, 1912. Serial No. 674,978.

To all whom it may concern:

Be it known that I, EDWIN J. MURPHY, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Circuit-Breakers, of which the following is a specification.

This invention relates to devices for controlling electric circuits and has for its object the provision of means whereby an electric circuit may be opened and closed in a reliable, safe and efficient manner.

My invention relates more specifically to devices for automatically opening an electric circuit upon the occurrence of predetermined circuit conditions such as an overload or abnormal decrease of voltage, means being provided whereby the circuit after once being opened cannot be again closed by the operator until after the circuit has been placed in a protected condition.

In one aspect my invention comprises a remote control circuit breaker so arranged that upon the opening of the circuit, the operator in order to close it must actuate a switch mechanism so that the parts of the circuit breaker are placed in a condition to be closed and in the other position of the switch mechanism the circuit breaker will close. This arrangement is of extreme importance in the control of electric motors where a resistance is inserted in the motor circuit during starting and is gradually cut out of circuit as the motor is brought up to running speed. By my arrangement the operator first moves the switch to a protective position and then moves it to the position in which the circuit breaker closes. Furthermore, by the use of my invention it is impossible for the operator to hold the circuit breaker closed while the overload or other abnormal circuit condition which caused the circuit breaker to open continues.

In carrying out my invention I employ an electro-magnetic contactor for closing the circuit and an electro-magnetic relay for controlling the energizing circuit of the contactor. This relay is so constructed and arranged that when the control switch is moved to one position, the actuating coil of the contactor is connected to one side of the line so that when the switch is moved to the other position the actuating coil of the contactor is energized to close the contactor.

To close the circuit breaker, therefore, the switch must first be moved to one position to cause the relay to move to the corresponding position and must then be moved to the opposite position to cause the relay to assume the corresponding position and close the contactor. Upon the occurrence of an abnormal circuit condition the circuit breaker will open and the operator must make this double movement of the switch mechanism in order to close it. Furthermore, while the relay is closed, the actuating coil of the relay is taking no current.

In the accompanying drawings illustrating my invention, Figure 1 is a diagrammatic representation of one form of my invention; Fig. 2 represents a slightly modified form; and Fig. 3 illustrates my invention applied to a motor control system.

Referring first to Fig. 1, C represents a contactor and R a relay, which taken together constitute the circuit breaker. The contactor consists of a winding 10 and a core 11 arranged to close the switch arm 12 on its contact to close the main line L L'. This relay consists of two switches, one being the main switch arm 13 pivoted at 14, while the other is an auxiliary switch arm 15 pivoted at 16. The switch arm 13 is operated by a rod 17 having at its lower end a core 18 co-operating with a winding 19. This core 18 is so arranged as to hold the switch in an open position as shown in the drawing by its weight when the winding 19 is deenergized. The switch arm 15 is of the bell crank lever form and has a long tail piece projecting over toward the switch arm 13. On the end of this projection are two shoulders 20 and 21, coöperating with a lug 22 on the arm 13. The construction is such that when the main switch arm 13 is closed, the tail piece will drop down until the shoulder 20 engages the lug 22, thereby holding the switch 13 closed. This, of course, presupposes that the switch 15 is not held in its closed position from any cause. In a similar manner, when the switch 13 is in the open position and the switch 15 is closed, the latter is held closed by the engagement of the lug 22 with the shoulder 21, as shown in the drawing. Auxiliary switch 15 is moved to closed position by the overload coil 23 provided with a core 24 which rises when overload occurs and strikes the tail of the switch 15 and moves it to closed position. A control switch 25 is pivoted so

as to occupy either one of two positions, in one of which it engages the contact 26 and in the other it engages the contact 27.

The operation of this arrangement is as follows: Assuming the parts to be in the position shown in Fig. 1, and it is desired to close the circuit breaker, the switch 25 is moved so as to engage the contact 27. This energizes the actuating coil 19 through the switch 15 and causes the main switch 13 to close. As soon as this closes, the auxiliary switch 15 is released and the tail 17 drops and locks the switch 13 in the closed position. The switch 25 must now be moved back into engagement with contact 26 so as to energize the coil 10 and close the contactor C. If now an overload should occur upon the line, the core 24 will lift so as to lift the tail and close the auxiliary switch 15 and allow the main switch 13 to open. To close the contactor, the operator will move the switch 25 into engagement with the contact 27, as before. This will close the auxiliary switch 13 and a movement of the switch over to contact 26 will close the contactor. From this arrangement it will be seen that the operator must always move the controlling switch to two positions in order to close the contactor. This makes it impossible for him to hold the contactor closed while there is an abnormal condition on the line, since the circuit will always be opened independently of the operator. As long as there is an overload on the line the switch 13 will not latch closed. The switch 13 can be closed and held closed by keeping the switch 25 on contact 27 but as soon as the switch is moved over to 26 to close, the overload device will operate to open the switch 13. It will therefore be impossible to hold the contactor closed while there is an overload. If, however, it is desired to open the contactor at any time, the switch 25 may be moved off of contact 26 so that by moving the switch 25 back and forth between contacts 26 and 27, the contactor can be opened and closed. It will be noted that the operating coil of the relay only takes current for an instant so that when it is once closed it does not consume current. Moreover, a very heavy operating current may be used since the instantaneous current, although heavy enough to burn out the coil if left on continuously or even for a relatively short time, will do no harm.

In Fig. 2, I have shown a modified arrangement for providing for the condition of failure of voltage. The arrangement differs from that shown in Fig. 1 merely in that the resistance S is connected in series with the winding 10 and a normally open switch 28 is provided for short circuiting the resistance. In order to close the contactor in this case, the switch 29, which is spring pressed into the position shown in the

drawing, must be pressed downward so as to close the circuit of the winding 19. This will close the switch 13 as before. When the switch 29 is released and the switch 28 is closed, the contactor will close through the energization of the winding 10 as before. The switch 28 may then be released. The releasing of the switch 28 places the resistance S in series with the winding 10 so that there will be sufficient current to hold the contactor C closed but not sufficient current to close it. If, therefore, the voltage on the line should fail and the contactor C should open while the switch 13 is closed, a return of voltage to the line will not cause the contactor C to close, but the operator must close the switch 28 to short circuit the resistance S before the contactor will close. Otherwise the circuit breaker operates in the same manner as that shown in Fig. 1.

In Fig. 3, I have shown my circuit breaker as it is used in a motor circuit. In this case the controller T brings the motor M up to starting speed by gradually cutting the resistance R' out of the armature circuit and the contactor C closes the motor circuit. In this case it will be seen that the controller must be brought to the first starting position shown in the drawing, in which all of the resistance R' is in the motor circuit before the contactor can be closed. In this first starting position the coil 19 will be energized from the line L' through the segments 30, 31 and 32, conductor 33, coil 19, switch 15, and back to line L. This moves the relay to the position shown in the drawing, and then by moving the controller to the next position the segment 31 engages with its corresponding contact on the controller, the winding 19 will be deenergized and the winding of the contactor energized through the switch 13 as before. This arrangement is no different from that shown in Fig. 1, but merely shows one practical application of my invention.

I have not described the details of construction of my relay nor have I claimed the same herein, since the construction of this relay forms the subject matter of my pending application, Serial No. 674,979, filed Feb. 2, 1912.

It should be understood, of course, that while I have shown my invention as embodied in concrete forms for purposes of illustration, I do not limit my invention thereto, since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

What I claim as new, and desire to secure by Letters Patent of the United States, is:—

1. The combination with an electromagnetic contactor, of a two-position relay provided with an overload coil for moving it to

one position, and an actuating coil for moving it to the opposite position, switch contacts closed in one position for controlling the actuating coil and in the other for controlling the energizing coil of the contactor, and a switch having corresponding positions for completing a circuit through either of said coils when the relay is in the proper position.

10 2. The combination with an electromagnetic contactor, of a relay having switch contacts for controlling said contactor, an actuating coil for closing said contacts, an overload coil for opening said contacts, a
15 switch having two operative positions, and connections whereby the actuating coil is energized to close the contacts when the switch is moved to one position and the contactor circuit completed through said
20 contacts and the switch when the latter is moved to the other position.

3. The combination with an electromagnetic contactor, of a two-position relay controlling the same comprising an actuating
25 coil for moving it to one position, an overload coil for moving it to the opposite position, and two switches respectively connected to the energizing coil of the contactor and the actuating coil of the relay, one of
30 said switches being closed and the other opened in each position, and a two-position switch for completing the circuit of either the contactor or the actuating coil of the relay through its corresponding relay switch.

35 4. The combination with an electromagnetic contactor, of a relay comprising an actuating coil, an overload device, contacts for controlling the energizing circuit of the contactor arranged to be closed by the energization of the said actuating coil, contacts
40 for controlling the actuating coil arranged to be closed by the operation of the overload device, and a two position switch arranged to complete the circuit through the actuating coil and its relay contacts in one position
45 and in the other position to complete a circuit through the energizing coil of the contactor and its relay contacts.

5. The combination with an electromagnetic contactor, of a relay switch biased to open position, an actuating coil for closing
50 said switch, a latch for holding the switch in closed position, a two position switch, and connections whereby said latter switch in one position completes the circuit of the actuating coil and in the other position closes the energizing circuit of the contactor through the relay switch contacts.

6. The combination with an electromagnetic contactor, of a relay switch biased to

open position, an actuating coil for closing said switch, a latch for holding the switch in closed position, a second relay switch, means whereby said latter switch is closed and the latch tripped to open the first switch
65 upon the occurrence of abnormal circuit conditions, a two position switch and connections whereby said switch in one position energizes the actuating coil through the switch contacts of the second relay switch
70 and in the other position closes the energizing circuit of the contactor through the first relay switch contacts.

7. The combination with an electromagnetic contactor, of a two-position relay provided with an overload coil for moving it to one position, an actuating coil for moving it to the opposite position, a switch contact closed in the position to which it is moved by the overload coil for controlling the actuating coil, switch contacts closed in the position to which it is moved by the actuating
80 coil for controlling the energizing coil of the contactor, and a switch having corresponding positions for completing the circuit through either of said coils in series with the contacts which control the coil.

8. The combination with an electromagnetic contactor, of an electromagnetically actuated relay having contacts controlling
90 the energizing circuit of the contactor, a two-position switch, and connections whereby the relay is actuated to close its contacts in one position of the switch and the winding of the contactor energized through said contacts in the other position of the switch, a holding resistance in the energizing circuit of the contactor and a switch for short circuiting said resistance.

9. The combination with an electromagnetic contactor, of a relay having switch contacts for controlling said contactor, an actuating coil for closing said contacts, an overload coil for opening said contacts, a switch having two operative positions, connections whereby the actuating coil is energized to close the contacts when the switch is moved to one position and the contactor circuit completed through said contacts and the switch when the latter is moved to the
110 other position, a holding resistance in the energizing circuit of the contactor, and a switch for short circuiting said resistance.

In witness whereof, I have hereunto set my hand this first day of February, 1912.

EDWIN J. MURPHY.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.