

Nov. 1, 1927.

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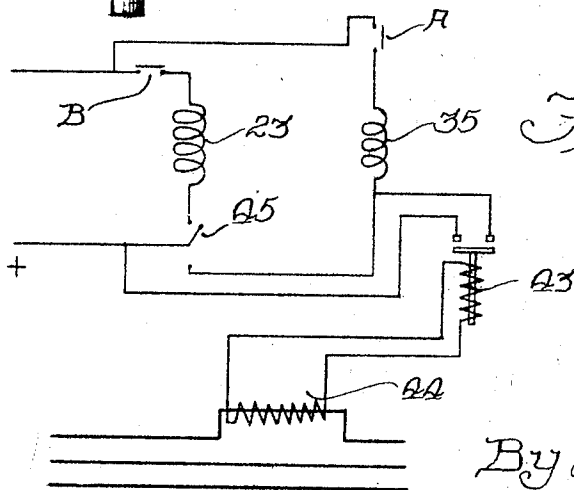
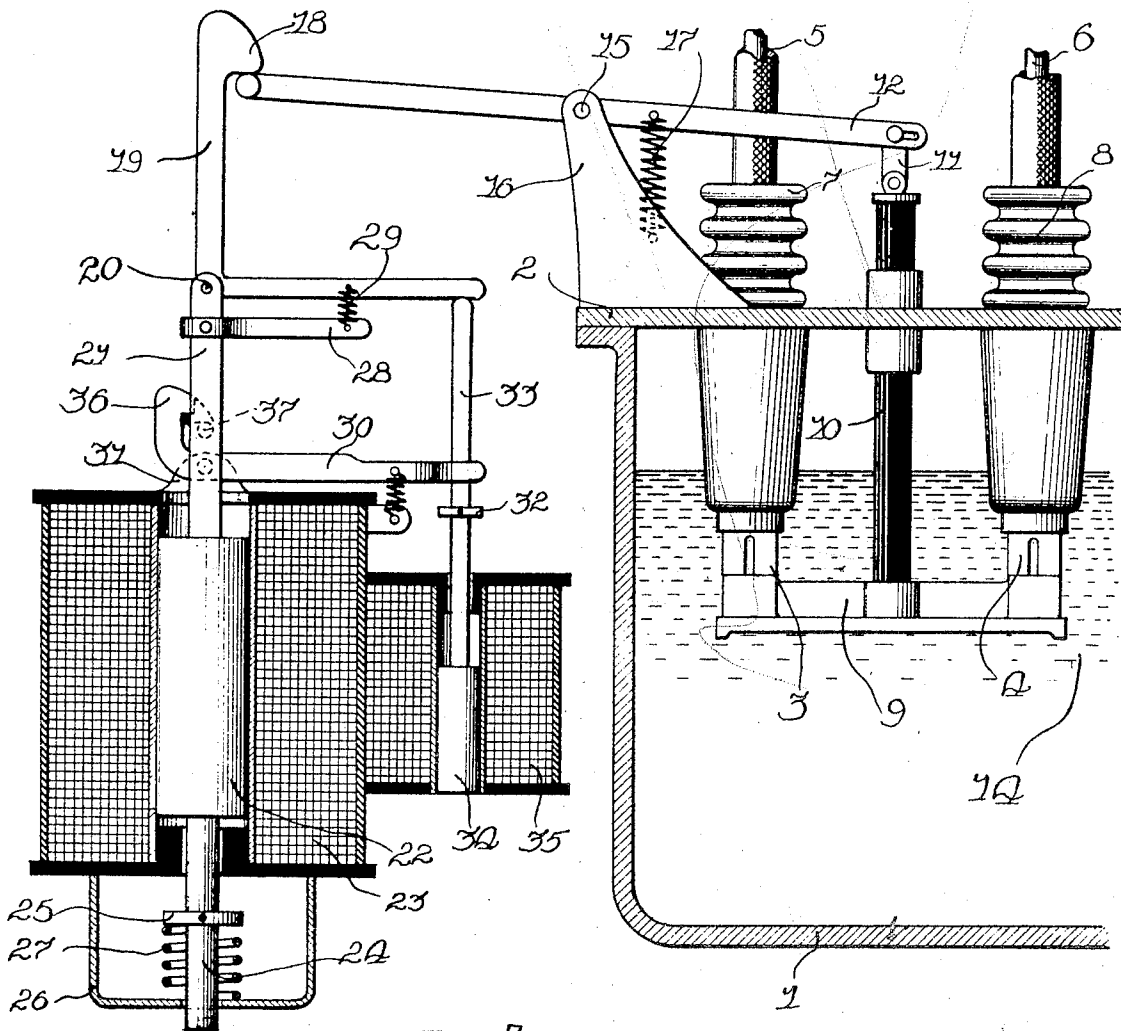
E. H. JACOBS

CIRCUIT BREAKER

Original Filed Aug. 4, 1919

2 Sheets-Sheet 1

Fig 1



Inventor
Ernest H. Jacobs
By Brown, Roettcher & Hiemer
Attorneys

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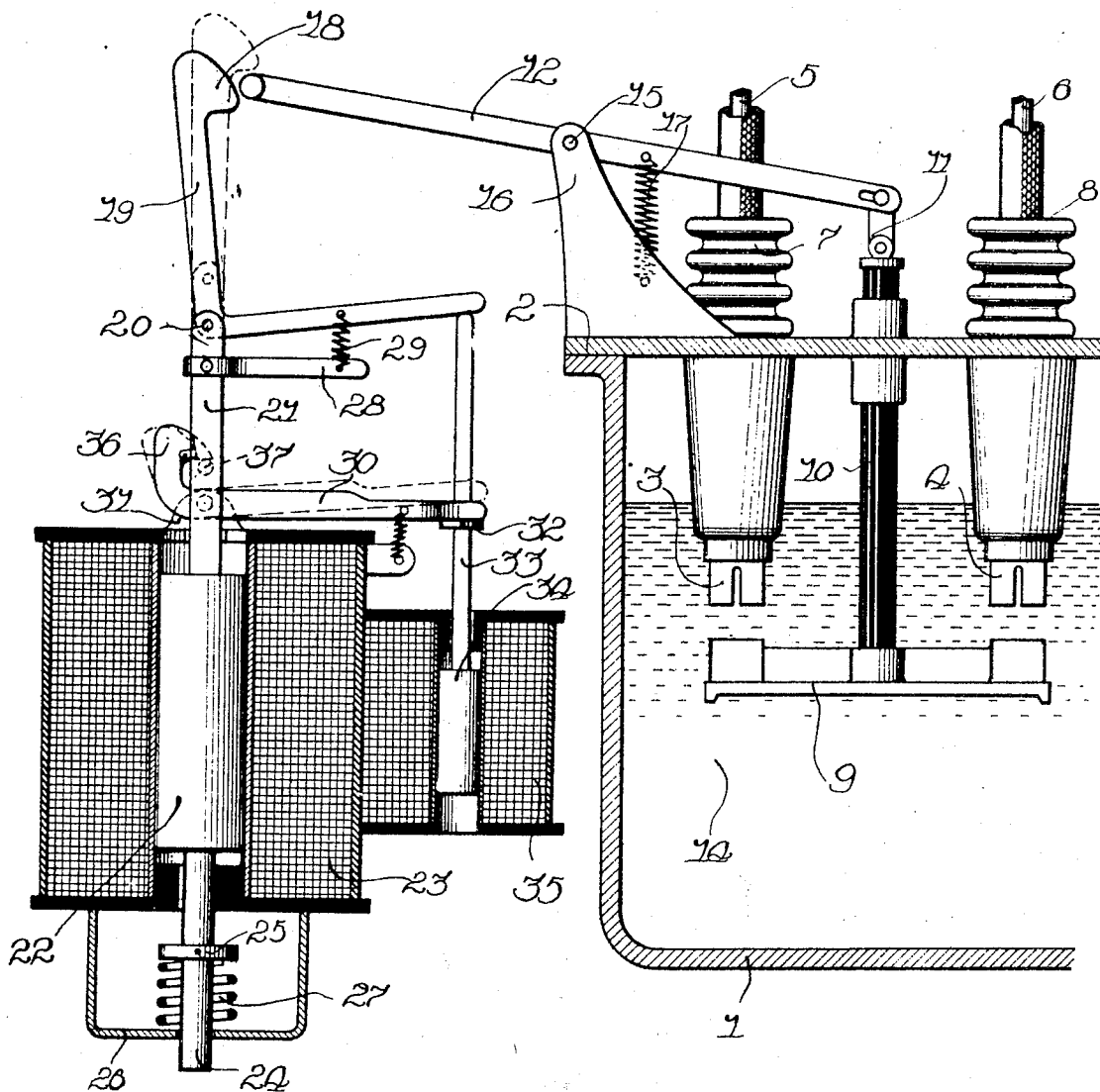
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2 Sheets-Sheet 2

Fig. 2



Inventor
Ernest H. Jacobs.
By Brown, Boettcher & Heimer
Attorneys

UNITED STATES PATENT OFFICE.

ERNEST H. JACOBS, OF CHICAGO, ILLINOIS, ASSIGNOR TO ELECTRICAL ENGINEERS EQUIPMENT COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CIRCUIT BREAKER.

Application filed August 4, 1919, Serial No. 315,150. Renewed July 7, 1927.

My invention relates to circuit breakers.

In the matter of interrupting heavy currents of electricity, either for normal switching or in the case of protective apparatus, the separation of the electrical contacts or conducting parts where the current is to be interrupted has been a difficult matter. The trend of development along this line has been towards improving the circuit breakers of the well known oil break type, wherein the circuit is opened and closed at contact points submerged in an insulating liquid. The efficiency of the circuit breaker depending largely upon the rapidity and simplicity with which the current flow can be interrupted, the breakers of the prior art and particularly those of the oil-break type have been handicapped by their complicated construction, involving a relatively great number of moving parts having a large inertia and a slowness of operation, which is highly undesirable. Such practical difficulties as those have prevented the adoption of the oil break type of breaker in as full a measure as the service requires. The interruption of the current flow immediately upon the occurrence of an overload has not only been exceedingly difficult, but has been beyond the performance of the average circuit breaker of the prior art.

My invention provides for over-coming the above difficulties and for securing other incidental advantages by:

- (a) Simplifying the operating mechanism of the circuit breaker.
- (b) Reducing the number of moving parts to a minimum
- (c) Decreasing the inertia of the moving parts, and
- (d) Increasing the speed of operation of the breaker.

In accordance with the teachings of my invention an overload relay controls the circuit of a trip coil whereby upon the occurrence of an overload the trip coil operates to interrupt the flow of current by opening suitable circuit breakers provided therefor. A manually operated switch is provided in the trip coil circuit in order that the trip coil may be operated manually to open the circuit breakers if so desired. A resetting coil circuit having a suitable switch therein controlling a resetting coil is adapted for

resetting or closing the circuit breakers when the overload has been relieved or it is otherwise desired to close the circuit.

Other advantages of my invention not hereinbefore set forth will appear from the following detailed description and the claims taken with an inspection of the accompanying drawings wherein I have illustrated one specific manner in which the invention may be embodied. The particular circuit breaker shown is merely illustrative and the details thereof may be varied.

Figure 1 is a vertical cross-sectional view of a circuit breaker embodying my invention showing the contact parts of engagement.

Figure 2 is a view similar to Figure 1, showing the contact parts separated, and

Figure 3 is a diagram of an electric circuit, employing circuit interrupting means embodying my invention.

Although in the accompanying drawings I have illustrated my invention embodied in connection with a typical oil switch I do not intend that the invention shall be limited to any particular type of circuit breaker. Referring first to Figures 1 and 2, the particular switch shown comprises a closed vessel 1, provided with a cover 2 through which project electrical conductors terminating in a stationary switch contact members 3 and 4. These contact members are of a form well known in the art and need not be specifically described here. The conductors 5 and 6 which are connected to the contact members 3 and 4 respectively are led through the cover 2 by means of suitable insulators 7 and 8 which insulators may be of any preferred type. These insulators are preferably sealed into the cover 2 so that the tight joint is maintained.

A movable switch member 9 adapted for reciprocation into and out of contact with the stationary contact members is guided for vertical movement through the cover 2 and connected at its upper free end through a link 11 to a lever arm 12.

The stationary switch contact members 3 and 4 together with the movable switch member 9 are submerged in a body of liquid 14, held in the closed container 1. In the construction of switches of this type oil is commonly employed as the medium for submerging the contacts although any other

suitable liquid of high insulating properties might be employed instead.

The lever arm 12 connected at its inner end to the insulated rod 10 is pivoted intermediate its length at 15 to a bracket member 16 extending upwardly from the cover 2 of the container 1. A tension spring 17 having its opposite ends connected to the lever arm 12 and the bracket member 16 respectively tends to force the insulated rod 10 downwardly and consequently the movable switch member 9 out of engagement with the stationary contact members 3 and 4, (Figure 2).

The outer free end of the lever arm 12 cooperates with the hook portion 18 of a bell crank lever 19. This bell crank lever 19 is pivoted at 20 to an arm 21 extending upwardly from the core 22 of a resetting or closing coil 23. A post 24 extending downwardly from the core 22 carries an annular collar 25 between which collar and a cage 26 is interposed a suitable coiled spring 27. This spring 27 normally retains the core 22, arm 21 and bell crank lever 19 in the raised position. The upright arm 21 carries an arm 28 extending at substantially right angles therefrom. A spring 29 secured to the arm 28 and at its opposite end to the substantially parallel arm of the bell crank lever 19 normally retains the hook portion 18 of the bell crank lever in engagement with the outer end of the switch operating lever 12.

A latch arm 30 is pivoted to an upright lug 31 extending from the resetting coil 23. This latch arm comprises an outwardly extending portion which cooperates with a collar 32 carried by a post 33 extending upwardly from the core 34 of a trip or opening coil 35 and a hook portion 36 which cooperates with a pin 37 extending from the upright arm 21 of the resetting coil 23 to retain this arm and consequently the core 22 in the depressed position against the tension of the coiled spring 27.

I will now describe with the aid of the circuit diagram shown in Figure 3, the operation of a particular embodiment of my invention. In this connection it is to be noted that although I have illustrated a three phase power circuit, the invention is not limited to any particular kind of circuit but is applicable generally to circuits of all kinds. The main line supplies an overload relay 43 through a suitable series transformer 44. Upon the occurrence of an overload in the main line, assuming the parts to be in the position shown in Figure 1, the overload relay 43 will immediately operate to close the circuit through the trip or opening coil 35 causing immediate upward movement of the core 34 thereof (Figure 2).

Upon this upward movement of the core 34 the upright post 33 carried thereby will

by reason of its engagement with the bell crank lever 19 swing this lever about its pivot 20 and consequently the hook portion 18 thereof out of cooperation with the lever arm 12. Simultaneous with the release of the outer end of the arm 12 this arm is swung about its pivot 15 by the spring 17, forcing the insulated rod 10 downwardly and the movable switch member 9 carried thereby, out of engagement with the stationary switch contact members 3 and 4 quickly interrupting the flow of current. Upon separating the movable contact 9 from the stationary contacts 3 and 4 to interrupt the flow of current the trip coil 35 is immediately deenergized allowing the core 34 thereof to again assume the position shown in Figure 1. The outer free end of the lever arm 12 has now assumed the position shown in Figure 2.

As the upward movement of the core 34 continues the collar 32 carried by the post 33 engages the latch arm 30, swinging this latch arm about its pivot and the hook portion 36 thereof out of engagement with the pin 37 projecting from the upright arm 21 of the core 22 of the resetting coil 23. The core 22 is immediately forced upwardly by the tension of the spring 27 moving the hook portion 18 of the bell crank lever 19 into cooperation with the elevated outer free end of the lever arm 12 as clearly shown in dotted lines in Figure 2.

A suitable switch 45 is provided for closing the circuit through the closing or resetting coil 23 when the overload in the main line has been relieved or when it is otherwise desired to close the circuit. Closing the circuit through the coil 23 energizes this coil and causes downward movement of the core 22 thereof, which core has been retained in an elevated position by the spring 27.

This downward movement of the core 22 causes the lever arm 12 to be swung about its pivot 15 and again into the position shown in Figure 1 by reason of the cooperation between the hook portion 18 of the bell crank lever 19 and the outer free end of the lever arm 12. As the core 22 approaches the end of its downward movement the pin 37 projecting from the upright arm 21 is sprung past the hook portion 36 of the latch arm 30, whereupon the core 22 is retained in the depressed position against the tension of the spring 27 until the circuit through the trip coil is again energized.

It is frequently desired to interrupt the flow of current independent of the occurrence of an overload to facilitate inspection and repairs. To this end the switch 45 (Figure 3) is adapted to close a circuit through the trip or opening coil 35 whereupon this coil is immediately energized and the movable contacts and stationary contact members are quickly separated to open the circuit.

cuit as has been described. In this case the closing or resetting coil is operated substantially as hereinbefore pointed out.

The circuits through the opening or trip coil 35 and the closing or resetting coil 23 controlled by the switch 45 are provided with auxiliary automatic switches A and B respectively. These switches are controlled directly by the condition of the oil switch, that is, the switch A is closed when the oil switch is closed and is opened when the oil switch is opened; the switch B being closed when the oil switch is open and opened when the oil switch is closed. Obviously, should the circuit through the resetting coil 23 be left closed for a considerable length of time after the oil switch has been reset or closed, by inadvertently failing to open the switch 45, the coil 23 might be damaged, at any rate a closed circuit at this time would be undesirable. The switches A and B have been provided to obviate such difficulties.

It will now be obvious that I have provided a novel and improved circuit interrupting device which, not only overcomes all of the disadvantages attendant upon the use of prior art devices, but secures other incidental advantages.

While I have described my invention in connection with the details of a particular embodiment, I do not intend thereby to limit the invention to such details as I am aware and contemplate that modifications and changes may be made without departing from the invention which is set out in the appended claims.

I claim:

1. In combination, an actuating member, contact means connected with said member for movement thereby, resetting means including a member having motion of translation, a latch having stationary pivotal support adjacent said member for holding same in retracted position, a second latch pivoted on said resetting member and engageable with said actuating member, and common means for tripping both said latches, said latches having an arm extending into the path of movement of said tripping means.

2. In combination, a movable switch member, a switch arm pivoted within its length and having pivotal connection at one end with said movable switch member, a coil having a core member, said core member having motion of translation, an arm extending from said core member and having motion of translation therewith, a bell crank lever pivoted to said arm and having a latched arm engageable with said first arm, a latch arm having stationary pivotal support adjacent the core arm and adapted for latching engagement with said arm to lock the core member in retracted position, a trip coil having a plunger for swinging said bell crank lever out of latching engagement with

said switch arm to free the movable switch member and permit it to move to open position free of the latch and resetting means, said plunger subsequently releasing said last latch arm, and spring means operable upon release of said last latch arm for projecting the latch arm of the bell crank lever into latching engagement with the switch arm.

3. In combination, a movable switch member, a switch arm pivoted within its length and having pivotal connection at one end with said member, a coil having a core member, said core member having motion of translation, an arm extending from said core member and having motion of translation therewith, a bell crank lever pivoted to said arm and having a latch arm engageable with said first arm, a latch arm having stationary pivotal support adjacent the core member and having a latch hook adapted for latching engagement with said arm to lock the core member in retracted position, a trip coil having a plunger for swinging said bell crank lever out of latching engagement with said switch arm to free the movable switch member and permit it to move to open position free of the latch and resetting means, said plunger subsequently releasing said last latch arm, spring means operable upon release of said last latch arm for projecting the latch arm of the bell crank lever into latching engagement with the switch arm, and spring means for swinging the latch hook of the latch arm for the core member into the path of movement of the co-operating latch means on the core arm to engage said means with said latch upon retracting the core member.

4. In combination, a movable switch member, an operating arm therefor, and latch and resetting means engageable with said arm to reset said switch member and hold same reset, said latch and resetting means comprising a coil provided with a plunger having motion of translation, a latch and resetting arm pivoted directly upon said plunger and having severable engagement with said operating arm, and a latch arm having stationary pivotal support on the coil and engageable with the plunger to hold same retracted.

5. In combination, a movable switch member, an operating arm for said member, latch and resetting means engageable with said arm to reset said switch member and hold same reset, said latch and resetting means comprising a coil provided with a plunger having motion of translation, a latch arm pivoted directly upon said plunger and having severable engagement with said operating arm, a latch arm having stationary pivotal support on the coil and engageable with the plunger to hold the same retracted, means for releasing said latch and resetting arm and subsequently said latch arm, and a

spring for projecting the plunger to engage said latch and resetting means with said operating arm upon tripping of the plunger and said plunger latch.

6. In combination, a switch normally biased to open position, electric actuating means, a mechanical transmission actuated thereby for closing said switch, locking means having separable engagement with said transmission to hold said switch closed and permit deenergization of said electric actuating means, and a readily severable connection interpolated in said transmission between the said locking means and said switch.

7. In combination, a switch normally biased to open position, electric actuating means, a mechanical transmission actuated thereby for closing said switch, locking means engaging said transmission to hold said switch closed and permit deenergization of said electric actuating means, a readily severable connection interpolated in said transmission between said locking means and said switch, electric means for severing said connection, and releasing said locking means, and resilient means associated with the portion of said transmission between said severable connection and said first mentioned electric actuating means tending to advance said portion and re-establish said connection.

8. In combination, an actuating member, contact means connected with said member for movement thereby, resetting means, a latch having stationary pivotal support for holding said resetting means in retracted position, a second latch pivoted on said resetting means and engageable with said actuating member and common means for tripping both said latches.

9. In combination, contact means, an actuating member therefore, resetting means, a latch for said resetting means, a second latch for said actuating member, and common means for tripping said first latch first and for thereafter tripping said second latch.

10. In combination, an actuating member, contact means connected with said member for movement thereby, a resetting member, a latch having stationary pivotal support for holding said resetting member in retracted

position, a second latch pivoted on said resetting member and engageable with said actuating member, a spring connected between the resetting member and said second latch for swinging same for engagement with said actuating member and common means for tripping both said latches.

11. In combination, a movable switch member, an operating member therefore, latch and resetting means for said operating member, said latch and resetting means comprising a coil provided with a plunger, a latch arm pivoted directly upon said plunger and having severable engagement with said operating means, a latch arm having stationary pivotal support and engageable with the plunger, means for releasing said latch and resetting means and said latch arm and means for projecting the plunger to engage said latch and resetting means with said operating means.

12. In combination, an actuating member, contact means connected with said member for movement thereby, resetting means, a latch having stationary pivotal support for holding said resetting means in retracted position, a second latch pivoted on said resetting means and engageable with said actuating member and common means for tripping both said latches, said tripping means tripping both said latches directly and within the operating range of said tripping means.

13. In combination, contact means, an actuating member therefore, resetting means, a latch for said resetting means, a second latch for said actuating member, and common means for tripping both said latches, said tripping means tripping both said latches directly and within the operating range of said tripping means.

14. In combination, contact means, an actuating member therefore, resetting means, a latch for said resetting means, a second latch for said actuating member, and common means for tripping said first latch first and for thereafter tripping said second latch, said tripping means tripping both said latches directly and within the operating range of said tripping means.

In witness whereof I hereunto subscribe my name this 24th day of July, A. D. 1919.

ERNEST H. JACOBS.