Oct. 18, 1949. J. T. LOGAN 2,485,394

CIRCUIT CLOSER

Filed March 17, 1945 2 Sheets-Sheet 1

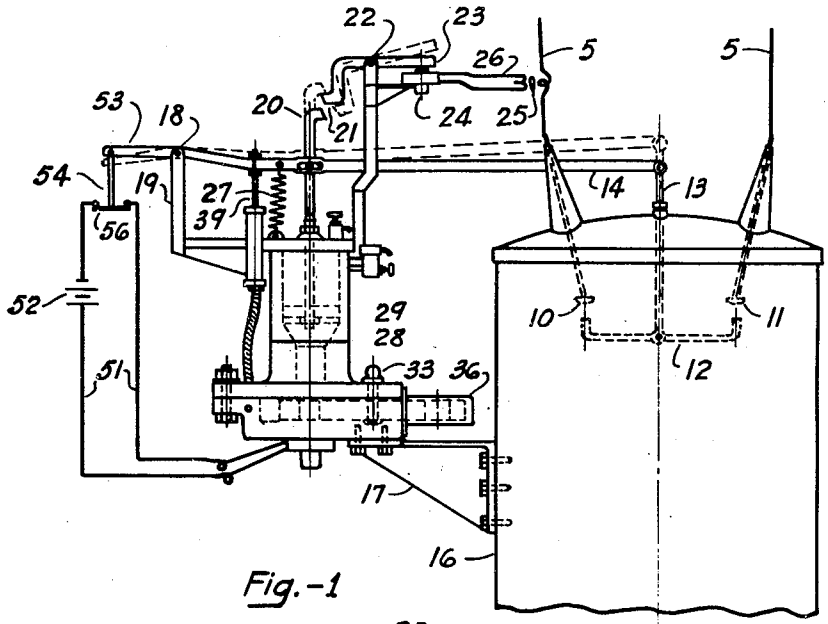


Fig.-1

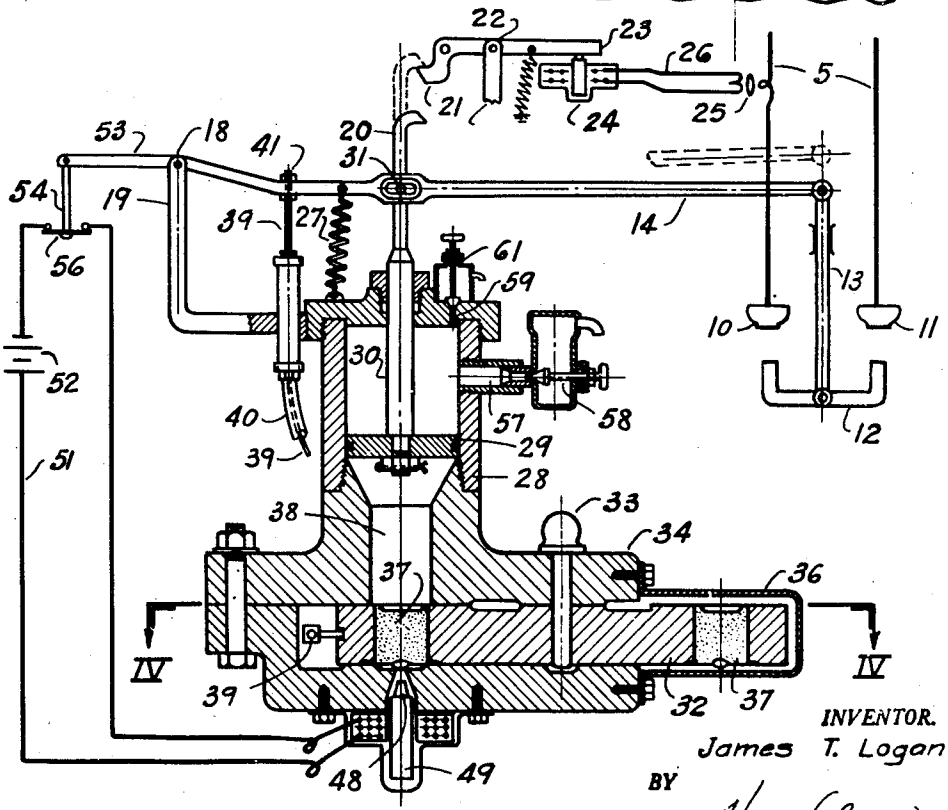


Fig.-2

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CIRCUIT CLOSER

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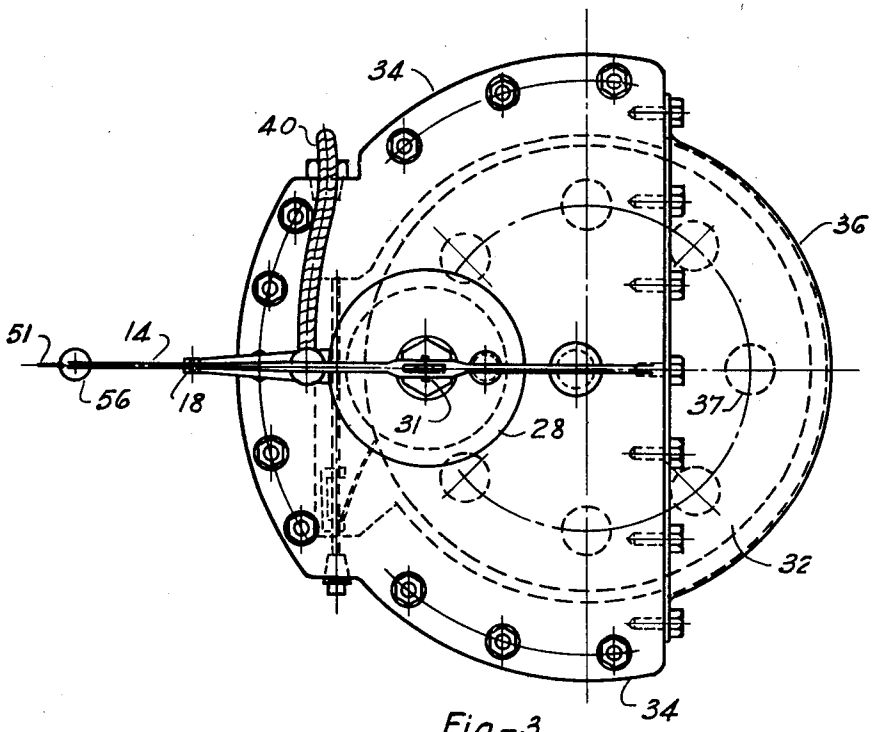


Fig.-3

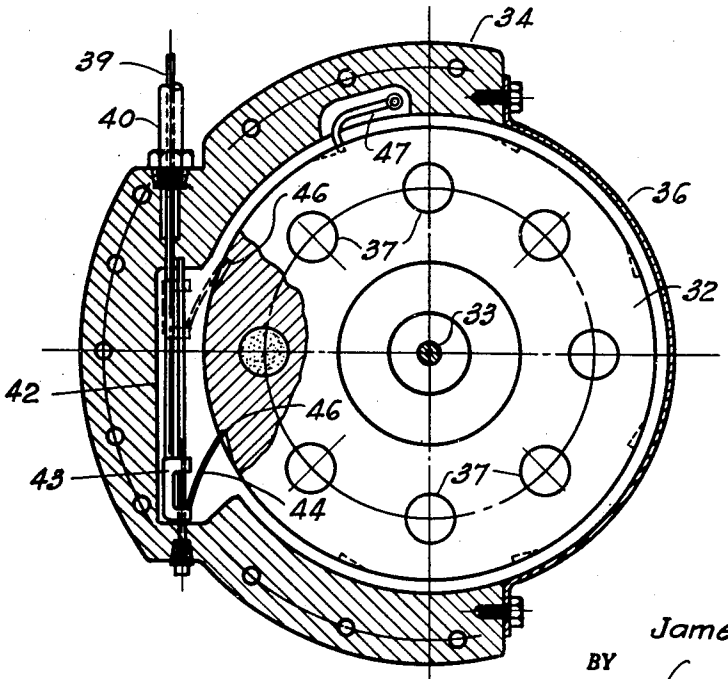


Fig.-4

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CIRCUIT CLOSER

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3 Claims. (Cl. 200—82)

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This invention relates to mechanism for operating a circuit breaker, such as is employed to control the flow of current in electric power circuits, and particularly to mechanism for reclosing a circuit breaker, after it has opened and interrupted the flow of current in a power circuit. A particular object of my invention is to provide an operating mechanism for reclosing a circuit breaker very quickly after it is opened which is simple, low in cost, and one which does not require a local power supply such as station service transformers, large storage batteries with their complicated means for "charging," compressed air storage systems, or the like.

A more specific object of my invention is to provide a closing mechanism in a circuit breaker operating means which shall include means for utilizing the stored energy of an explosive, such as gun powder, TNT, or other suitable explosive capable of being compacted in a relatively small cartridge and detonated at the proper time to utilize the power of the explosion in accomplishing the closing or the circuit breaker.

As is well known in the art to which my invention relates, circuit breakers, depending upon their voltage classifications or current ratings, have considerable mass in their moving elements and require large amounts of energy, particularly to close their contacts. Closing of their contacts, as accomplished by conventional methods, include manual means, springs, mechanism operated by compressed air, and electromagnetic means. Difficulties have been encountered in the design and use of all such means due to the fact that they are either too slow in response or are too complicated in construction. Where electromagnetic means are employed, or an electric motor is employed to operate the circuit breaker, when required, there is necessitated a continuous source of electric power outside the circuit being controlled. Where pneumatic or compressed air operated mechanism is used, there is required a motor driven air compressor installation, an air storage tank, heaters, and pressure control apparatus; all automatically controlled. With such an installation, from 150 to 250 lbs. per square inch of air pressure must be maintained in the storage tank some 525,000 odd minutes of the year, whereas it is actually needed probably not more than 5 minutes of the year. The pressure must be maintained continuously in order for the circuit breaker to be reclosed without delay after each opening.

In accordance with my invention, the source of energy for closing the circuit breaker comes

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from an explosive, such as gun powder, TNT, nitro-glycerin, or the like. The energy stored in the explosive is released from a shell or cartridge into a chamber or cylinder in a manner not greatly unlike those employed in fire arms. Instead of this stored energy being allowed to act against a projectile, in my apparatus it acts against a piston operatively connected to the reclosing member of the circuit breaker.

Apparatus embodying features of my invention is illustrated in the accompanying drawings, in which

Fig. 1 is a view in elevation showing my improved reclosing mechanism applied to a conventional circuit breaker;

Fig. 2 is a sectional view of the reclosing mechanism with the circuit indicated diagrammatically;

Fig. 3 is a plan view of the apparatus; and

Fig. 4 is a sectional view taken long the lines IV—IV of Fig. 2 and showing the magazine for holding the explosive charges.

Referring now to the drawings for a better understanding of my invention, I show a circuit breaker, including stationary contact members 10 and 11 which are adapted to be bridged by means of a cross head closing member 12 connected by a link 13 to an operating lever 14. The contact and closing members may be mounted in an enclosure 16, and the operating mechanism may be supported on the enclosure 16 by means of a bracket 17 or by any other suitable means.

The operating lever 14 is pivotally mounted at 18 on a stationary member 19. Connected to the lever 14 is a latch member 20 which is adapted to engage and hook over a trip member 21 pivotally mounted at 22, as shown in Figs. 1 and 2. The trip member 21 has an arm 23 extending laterally over a solenoid 24, which is included in a supervisory circuit 26, which may be energized by an overload as through a current transformer 25. The solenoid may also be operated by reason of some other abnormal condition in the main circuit, as is well understood. When the solenoid 24 is actuated, the trip member 21 is disengaged from the latch member 20 and the operating lever 14 moves downwardly to separate the closing member 12 from the contact members 10 and 11. This downward movement of the operating lever 14 may be aided by means of a spring 27.

Mounted beneath the operating lever 14 is a cylinder 28 having a piston 29 therein with a piston rod 30 which extends upwardly and is connected to the operating lever 14 at 31. The

lower end of the cylinder 28 is open for the admission of pressure beneath the piston 29. At 32 I show a magazine which is mounted to rotate beneath the cylinder 28 on a pin 33 which extends downwardly through a supporting housing 34. The magazine 32, as may be seen in Figs. 2 and 3, extends outwardly of the supporting housing 34 and a removable cover 36 gives access to the magazine and permits its removal, if necessary. The magazine 32 is adapted to contain a plurality of cartridges 37, each containing a suitable explosive, which cartridges may be positioned successively by step rotation of the magazine beneath the lower, open end, of the cylinder 28. A passage 38 through the housing 34 communicates with the lower end of the cylinder. The step by step rotation of the magazine 32 is accomplished by means of a flexible wire 39 encased in a guiding sheath 40 and connected to the operating lever 14 at 41. The wire 39 extends downwardly into the housing 34 and into a recess 42 in the housing extending alongside the magazine. Positioned in the recess 42 is a cross head 43 to which the wire 39 is connected and which carries a pawl 44. The pawl member 44 engages successively in notches 46 in the magazine 32 to advance the magazine and successively position the cartridges 37 beneath the passage 38 leading to the cylinder 28.

As will be seen from Figs. 1 and 2 of the drawing, each time the circuit 5 is opened by means of the bridging member 12 moving away from the contacts 10 and 11, the operating lever 14 moves downwardly, moving the wire 39 inwardly of the housing 34 to actuate the cross head 43 and pawl 44. When the operating arm 14 moves upwardly in a reclosing movement, the wire 39 is pulled upwardly by the lever 14, thus rotating the magazine 32 one step and positioning another cartridge 37 beneath the passage 38. At each step, a spring detent 47 drops into a notch 46 to position and hold the magazine 32 until the next closing movement of the operating lever 14.

The cartridges 37 are detonated by means of a firing pin 48 actuated by any suitable mechanism, such, for example as the core 49 of a solenoid, the coil of which is included in a circuit 51 which may be supplied from any suitable source of electrical energy, such as a battery 52. On the outer end of the operating lever 14, as seen in Figs. 1 and 2 of the drawing, is an arm 53 connected by a link 54 to a switch 56 included in the circuit 51. It will be seen that when the operating lever 14 moves upwardly toward closing position of the circuit breaker, the switch 56 will be opened and when the lever 14 moves downwardly in an opening movement, the switch 56 will be closed thereby energizing the solenoid and causing the firing pin 48 to detonate the cartridge 37.

Pressure in the cylinder 28 is released near the end of the upward stroke of the piston 29 through an orifice 57, the rate of release being controlled by means of a valve 58. Pressure above the piston 29 is relieved during the upward movement of the piston through a port 59 which may be adjusted as to size by means of a valve 61 to give a cushioning effect near the end of the upward travel of the piston. The air and gases remaining in the cylinder 28 at the end of the upward stroke of the piston 29 serve to cushion the downward movement of the piston when the circuit breaker is next opened.

From the foregoing it will be apparent that I have devised an improved means for operating a circuit breaker which is simple of construction and operation and which is adapted to utilize, in compact form, the stored energy in explosives for restoring an interrupted circuit. It will be appreciated that my improved apparatus is especially adapted for rural and low voltage distribution electrical circuits where the utilization of the more complicated, expensive operating means is not justified. By means of my invention, there is provided a simple interrupter, equipped with explosively operated mechanism which automatically closes and opens a circuit interrupter any number of times desired. It will further be seen from a consideration of the drawings that no attempt has been made to show the proportionate lengths of the portions of the lever arms 14 which would be utilized in actual practice, the intent being to show the manner of construction and of operation.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications, without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In an electric circuit breaker, a movable contact, a cooperating contact, a fluid actuated piston for moving said movable contact into engagement with said cooperating contact, a magazine for holding a plurality of explosive charges for generating and applying pressure to said piston, a pivotally mounted main operating lever laterally disposed with respect to the path of movement of said piston for operatively connecting said movable contact and said piston, means responsive to movement of said lever about its pivotal mounting for setting off one of said explosive charges in said magazine when said movable contact is moved out of engagement with its cooperating contact, and means actuated by movement of said lever about its pivotal mounting when said movable contact is being moved into engagement with said cooperating contact for moving said magazine so as to place another explosive charge in said magazine in a position to be set off in response to another separation of said contacts.

2. In an electric circuit breaker, a movable contact, a cooperating contact, a fluid actuated piston for moving said movable contact into engagement with said cooperating contact, a magazine for holding a plurality of explosive charges for generating and applying pressure to said piston, a main operating lever laterally disposed with respect to the path of movement of said piston for operatively connecting said movable contact and said piston, means responsive to movement of said lever for setting off one of said explosive charges in said magazine when said movable contact is moved out of engagement with its cooperating contact, and means actuated by movement of said lever for moving said magazine so as to place another explosive charge in said magazine in a position to be set off in response to another separation of said contacts.

3. In an electric circuit breaker, a movable contact, a cooperating contact, a fluid actuated piston for moving said movable contact into engagement with said cooperating contact, a magazine for holding a plurality of explosive charges for generating and applying pressure to said pis-

ton, a pivotally mounted main operating lever laterally disposed with respect to the path of movement of said piston for operatively connecting said movable contact and said piston, means including a switch and a solenoid controlled thereby for setting off one of said explosive charges in said magazine when said movable contact is moved out of engagement with its cooperating contact, said switch being operated by said lever, and means including a flexible wire, an enclosing sheath therefor, and a pawl operated by said wire for moving said magazine so as to place another explosive charge in said magazine in a position to be set off in response to another separation of said contacts, said wire being moved longitudinally through said sheath in response to movement of said lever.

JAMES T. LOGAN.

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