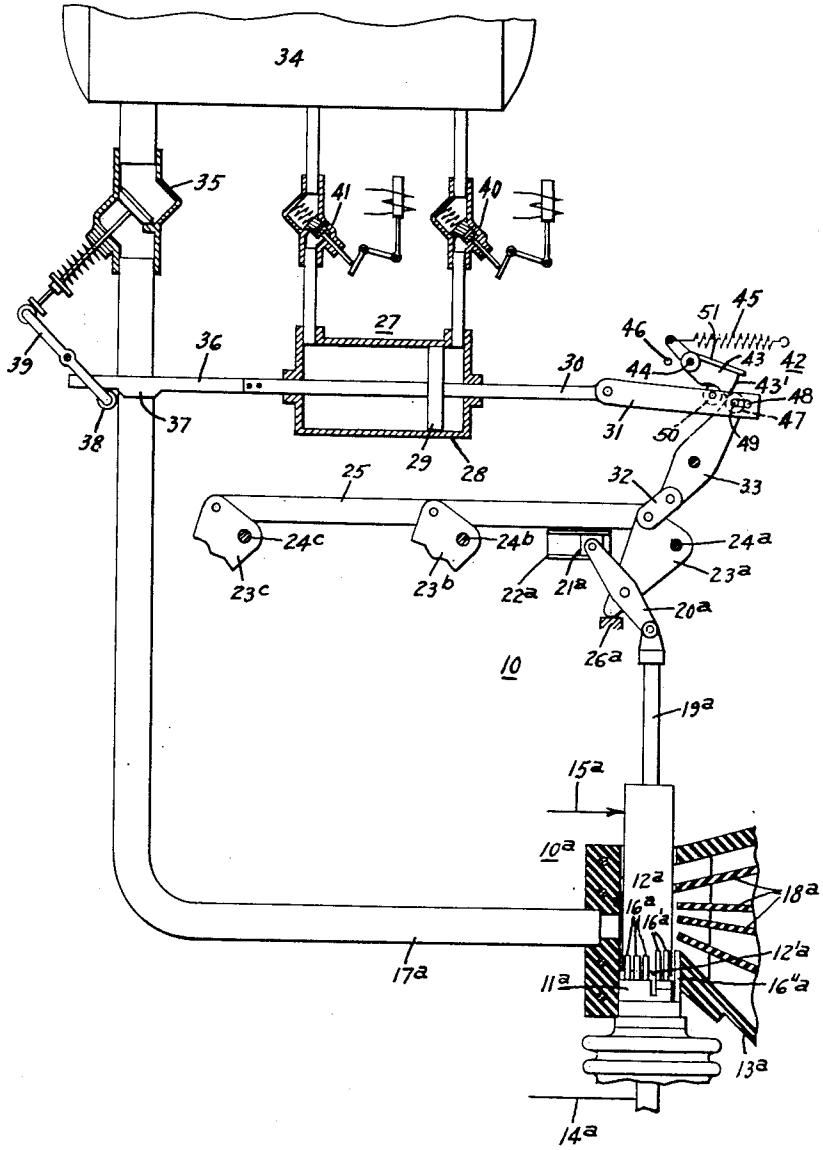
Aug. 3, 1943. J. D. GAYER 2,325,949

ELECTRIC CIRCUIT BREAKER

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Fig. 1.



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Fig. 2.

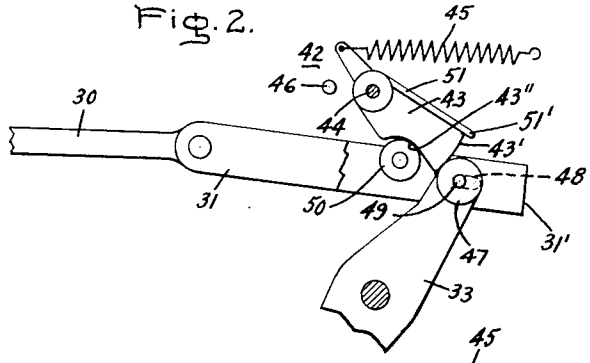


Fig. 3.

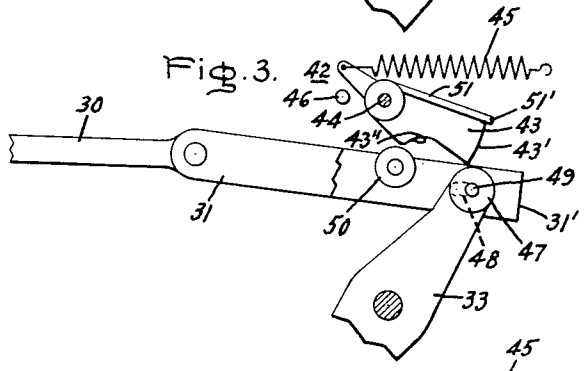


Fig. 4.

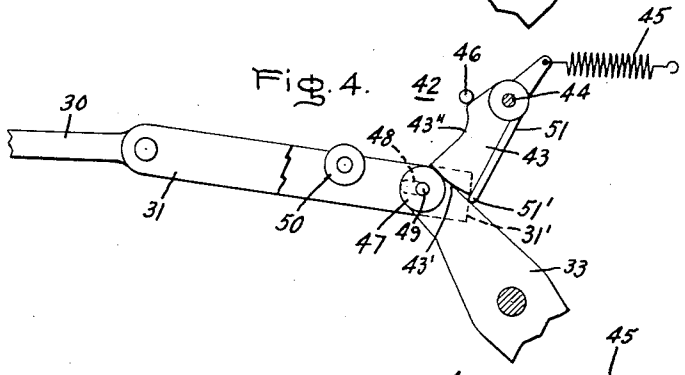
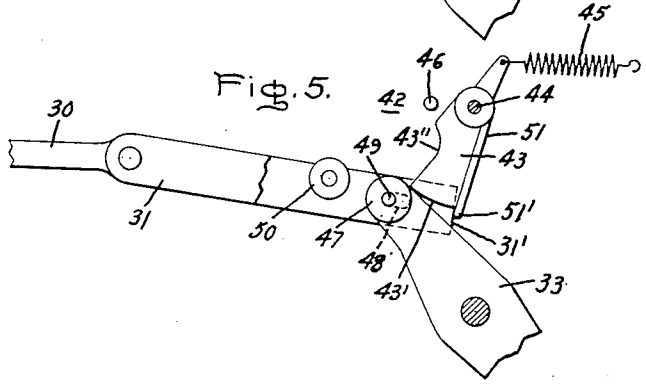


Fig. 5.



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UNITED STATES PATENT OFFICE

2,325,949

ELECTRIC CIRCUIT BREAKER

John D. Gayer, Springfield, Pa., assignor to General Electric Company, a corporation of New York

Application February 9, 1942, Serial No. 430,024

6 Claims. (Cl. 200—82)

My invention relates to electric switches such as circuit breakers and the like and more particularly to a restraining latch for restraining the movement of the contacts of electric switches.

It has been found that, due to vibration and other causes, the relatively movable contacts of a circuit breaker often tend to separate when the circuit breaker is closed or the contacts tend to move toward one another when the circuit breaker is open. To reduce the operating force required to operate a circuit breaker, the friction of the operating mechanism is usually held to a minimum value and, consequently, undesirable relative movement of the contcts may result in the open or closed position of the breaker with consequent danger to apparatus and perhaps even to human life. In the copending application of Carl Thumim et al., Serial No. 317,564, filed February 6, 1940, and assigned to the same assigneee as the present application, there is disclosed and broadly claimed a restraining means for holding the contacts of an electric switch in a predetermined position with means for releasing said restraining means when it is desired to operate the switch. Also, in the copending application of Carl Thumim et al., Serial No. 367,789, filed November 29, 1940, and assigned to the same assignee as the present application, there is disclosed an electric switch in which two restraining latches are provided for holding certain contacts of the switch in the open and in the closed position with means for releasing these latches at the proper time. It would be desirable to provide an electric switch with a single latching means which is capable of restraining the switch or circuit breaker in either its closed or its open position and which includes simple means for releasing the latching means at the desired time.

Accordingly, it is an object of my invention to provide a new and improved restraining means for the contacts of an electric switch.

It is another object of my invention to provide a single restraining means for holding the relatively movable contacts of an electric switch in a plurality of predetermined positions with means operative upon movement of said relatively movable contacts for releasing the restraining means.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention, reference may be had to the accompanying drawings in which Fig. 1 is a schematic diagram partly in section of an electric switch embodying my invention, and Figs. 2, 3, 4, and 5 are enlarged views of a portion of Fig. 1 indicating operating positions of the restraining means embodying my invention.

Although my invention is applicable to any types of switches having relatively movable contacts whether single-phase or polyphase, I have chosen for purposes of illustration to show my invention as applied to an air-blast circuit breaker of the fluid-operated type. Accordingly, in Fig. 1, I have shown my invention as applied to a polyphase circuit breaker 10, only the structure 10*a* associated with one set of contacts of the circuit breaker being shown since the other poles of the circuit breaker are identical. Where I have illustrated any operating mechanism for the various phases or poles which are identical for each phase or pole, such parts are hereinafter characterized by the same reference numeral with the letters *a*, *b*, or *c*, depending upon the particular phase or pole of the circuit breaker. Circuit breaker 10 is illustrated as of the cross-blast type and the pole 10*a* is illustrated as comprising a stationary contact 11*a* and a movable contact 12*a* arranged to be operated so as to draw an arc in an arc chute 13*a*. Contacts 11*a* and 12*a* are arranged to be connected to suitable line terminals 14*a* and 15*a*, respectively. The fixed contact 11*a* is provided with spring-pressed contact fingers 16*a* and longer arcing contact fingers 16'*a*, while movable contact 12*a* is provided with an arcing tip 12'*a* so that, when the contacts separate, an arc is drawn between arcing tips 16'*a* and 12'*a*. Immediately after separation of the contacts, one terminal of the arc is transferred by a blast of fluid, such as air, flowing in conduit 17*a* from contact fingers 16'*a* to the contact 16''*a* which is provided with a tip of arc-resistant metal. The fluid blast from conduit 17*a* upon opening of the circuit breaker drives the arc drawn into the arc chute 13*a* against the edges of a plurality of partitions 18*a* in the arc chute, which partitions are transverse to the arc gap and the ends of which extend close to the path of movement of the arcing tip 12'*a* of the movable contact 12*a*. The circuit breaker 10, only pole 10*a* of which is shown, is illustrated by way of example only, in order to describe my new and improved restraining means. This circuit breaker, briefly described heretofore, is not my invention but is disclosed and claimed in the joint application of David C. Prince, William K. Rankin, and Wilfred F. Skeats, Serial No. 303,126, filed

November 6, 1939, now Patent 2,284,842, and assigned to the same assignee as the present application.

Each of the movable contacts of the various poles or phases of circuit breaker 10, such as 12a, which alone is illustrated, is connected to corresponding individual operating rods, such as 19a. These operating rods, only 19a of which is illustrated, are connected to one end of suitable levers 20, which levers have the other ends thereof provided with crossheads 21 arranged to slide in guides 22. Only the mechanism including members 20a, 21a, and 22a of pole 10a is illustrated, however. Each of the levers 20 has an intermediate point thereon pivotally connected to bell cranks 23a, 23b, and 23c, respectively, which, in turn, are pivotally mounted on fixed supports 24a, 24b, and 24c. This arrangement of cranks 23 and levers 10 provides a straight-line motion of the contacts 12 in arc chutes 13. In order that the movable contacts 12 associated with all the poles of circuit breaker 10 are simultaneously actuated, bell cranks 23a, 23b, and 23c, are interconnected by a horizontally reciprocating operating rod 25. As illustrated, each of the bell cranks 23 is provided with suitable buffers, only 26a of which is illustrated, to cushion the closing and opening movements of the operating mechanism and movable parts of circuit breaker 10.

Any suitable means may be provided for producing relative movement between the contacts 11 and 12 of circuit breaker 10. In Fig. 1, this means is illustrated as a fluid motor, generally indicated at 27, including a cylinder 28 and a piston 29 operatively connected through a connecting rod 30, links 31 and 32, and a crank 33, with the bell cranks 23a, 23b, and 23c for operating the contacts of circuit breaker 10.

In order to operate fluid motor 27 as well as to supply a blast of fluid through conduits 17, only 17a of which is shown, for arc-extinguishing purposes, a source of fluid under pressure 34 is provided, which may preferably be air under pressure. This source of air under pressure 34 is connected through a suitable blast valve 35 to conduit 17a as well as to the corresponding conduits for the other poles of circuit breaker 10 and, to this end, a manifold (not shown) may be provided between these conduits 17 and blast valve 35. Blast valve 35 is preferably constructed as disclosed in copending application Serial No. 343,002, filed July 28, 1940, on behalf of Carl Thumim, now Patent 2,315,991 and assigned to the same assignee as the present application. Any suitable means may be provided for operating blast valve 35 although, in Fig. 1, I have illustrated this operating means as comprising a sliding bar 36 operatively connected to piston 29 of fluid motor 27 and having one or more cams, such as 37, mounted thereon. Movement of piston 29 causes cam 37 to engage a cam follower 38 to open blast valve 35 through pivotally mounted lever 39. As illustrated schematically in Fig. 1, cam 37 will produce a blast of the same duration during both the opening and closing movements of the circuit breaker. However, it may be desirable in certain cases to have no blast of fluid during the closing operation of the circuit breaker or to have a blast of shorter duration during such closing operation, in which case, an additional cam having a different operating face than cam 37, will be provided with means for rendering cam 37 ineffective to open the blast valve 35 during the closing operation of the circuit breaker. Such an arrangement is disclosed and claimed in United States Letters Patent 2,287,578, filed jointly for Carl Thumim and me, and assigned to the same assignee as the present application.

The source of fluid 34 is also connected with the respective ends of cylinder 28 through a solenoid-operated circuit-breaker opening valve 40 and a solenoid-operated circuit-breaker closing valve 41. It should be understood by those skilled in the art that opening valve 40 and closing valve 41 are preferably interlocked mechanically as in copending application Serial No. 317,564, referred to above, or interlocked electrically so that the opening valve 40 is given preference to permit opening of the circuit breaker even though a fault exists at the instant of closing of circuit breaker 10.

The restraining means of my invention, generally indicated at 42, comprises a single pivotally mounted member or latch 43 pivoted at 44 and biased to rotate in a clockwise direction by spring means 45. A suitable stop 46 is provided to limit the maximum clockwise rotation of latch 43. Restraint or latching of the contacts 12 of circuit breaker 10 and the operating mechanism associated therewith is obtained by engagement of the cam face 43' of latch 43 with the roller 47 attached to the end of crank 33 associated with link 31. With the latch 43 in the position indicated in Figs. 1 and 2, the contacts 12 and the operating mechanism are held or restrained in the position assumed when circuit breaker 10 is closed and vibration or the like cannot cause contact separation. In Fig. 4, on the other hand, the latch 43 is indicated in the position where face 43' thereof engages the roller 47 so as to hold or restrain the operating mechanism and the contacts 12 of circuit breaker 10 in the positon which these members assume when the circuit breaker is open and again vibration or the like cannot cause relative movement of the contacts 11 and 12.

In order to release latch 43 and permit movement of contacts 12 so as to open the circuit between terminals 14 and 15 when the mechanism is in the position indicated in Figs. 1 and 2, I provide a lost-motion mechanism between link 31 and crank 33 which comprises a slot 48 in link 31 and a pin 49 cooperating therewith and mounted in crank 33. Also latch 43 is provided with a cam face 43'' which cooperates with a roller 50 mounted on link 31. Upon initial movement of piston 29 to the left from the position indicated in Fig. 1, link 31 is moved to the left so that roller 50 operating on cam surface 43'' causes counterclockwise rotation of latch 43 to the position indicated in Fig. 3. Also, by virtue of the slotted connection between link 31 and crank 33, no movement of the contacts 12 of circuit breaker 10 has resulted until latch 43 is completely released and such movement is permitted. It should also be noted, that, with this slotted connection between link 31 and crank 33, blast valve 35 is opened to insure a blast of fluid adjacent relatively movable contacts 11 and 12 prior to any movement of the contacts as is disclosed and broadly claimed in the copending application, Serial No. 317,564, referred to above.

In order to release latch 43 from the restraining position indicated in Fig. 4 when the circuit breaker 10 is open, I again use the same tripping means, namely, the slotted connection between link 31 and crank 33 for release of latch 43. The end 31' of link 31 is adapted to engage the projecting tip 51' of the back plate 51 of latch 43,

With this arrangement, the initial movement to the right of piston **29** when the circuit breaker is open by virtue of the lost-motion connection between link **31** and crank **33** will cause the end **31'** of link **31** to rotate latch **43** in a counter-clockwise direction to the position indicated in Fig. 5, whereupon roller **47** is released so that subsequent closing movement of circuit breaker **10** may be permitted.

In view of the detailed description included above, the operation of my double-latched restraining means will be obvious to those skilled in the art. By means of a single latch **43**, I have provided an arrangement in which an electric switch may be held in either its open or its closed position without danger of movement of the relatively movable contacts due to vibration or the like. Furthermore, the lost-motion connection between link **31** and crank **33** effects the unlocking of latch **43** from either of its two restraining positions.

It will be apparent to those skilled in the art that my invention is not limited to the particular construction shown but that changes and modifications may be made without departing from the spirit and scope of my invention and I aim in the appended claims to cover all such changes and modifications.

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

1. In combination with an electric switch comprising a plurality of relatively movable contacts, means for producing relative movement between said contacts, a restraining means comprising a single movable member constructed so as to hold said relatively movable contacts in a plurality of predetermined positions, and means operative upon operation of said first-named means for releasing said restraining means at each of said predetermined positions of said relatively movable contacts.

2. In combination with an electric switch comprising a plurality of relatively movable contacts, means for producing relative movement between said contacts, a restraining means comprising a single movable member constructed so as to hold said relatively movable contacts in either the fully open or the fully closed position, and means operative upon operation of said first-named means for releasing said restraining means at either the fully open or the fully closed position of said electric switch.

3. In combination with an electric switch comprising a pair of relatively movable contacts, means for producing relative movement between said contacts, a single restraining means constructed so as to hold said relatively movable contacts in either the fully open or the fully closed position of said electric switch, and a lost-motion connection interposed between said first-mentioned means and one of said relatively movable contacts for releasing said restraining means at both the fully open and fully closed position of said electric switch.

4. In combination with an electric switch comprising a pair of relatively movable contacts, motive means for producing relative movement between said contacts, a single pivotally mounted restraining latch constructed so as to lock said electric switch open against closing movement due to vibration or the like when in one position and to hold said electric switch closed when in another position, and means including a lost-motion connection interposed between said motive means and one of said relatively movable contacts for releasing said restraining latch from either of its locking positions upon initial operation of said motive means.

5. In combination with an electric switch comprising a pair of relatively movable contacts, motive means for producing relative movement between said contacts, a single pivotally mounted restraining latch constructed so as to lock said electric switch open against closing movement due to vibration or the like when in one position and to hold said electric switch closed when in another position, and means including a lost-motion connection comprising a pin and slot arrangement interposed between said motive means and one of said relatively movable contacts for releasing said restraining latch from either of its locking positions upon initial operation of said motive means.

6. In combination with an electric switch comprising a pair of relatively movable contacts, a fluid motor for producing relative movement between said contacts, an operating mechanism for interrelating said fluid motor and one of said relatively movable contacts, a pivotally mounted latch including a pair of cam faces constructed so that one of said cam faces engages with said operating mechanism to lock said electric switch against closing movement due to vibration or the like when in the substantially fully open position and the other of said cam faces engages with said operating mechanism to lock said electric switch against opening movement when in the substantially fully closed position, and means including a lost-motion connection interposed between said fluid motor and one of said relatively movable contacts for causing disengagement of each of said cam faces from said operating mechanism in either of the locking positions of said latch upon initial operation of said motive means to permit subsequent relative movement of said contacts.

JOHN D. GAYER.