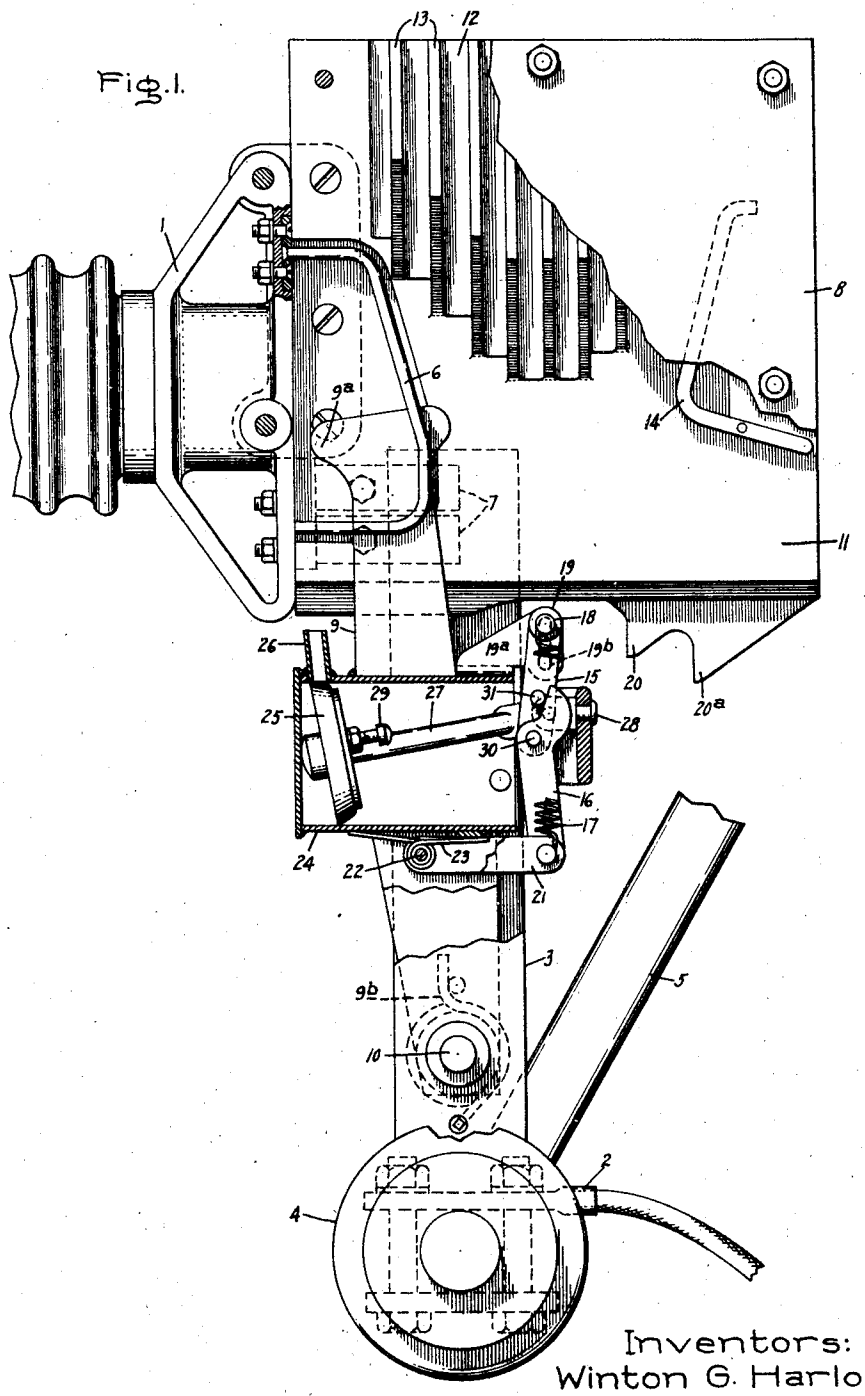
April 30, 1946. W. G. HARLOW ET AL 2,399,485

ELECTRIC CIRCUIT BREAKER

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Fig. 1.



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Fig. 2.

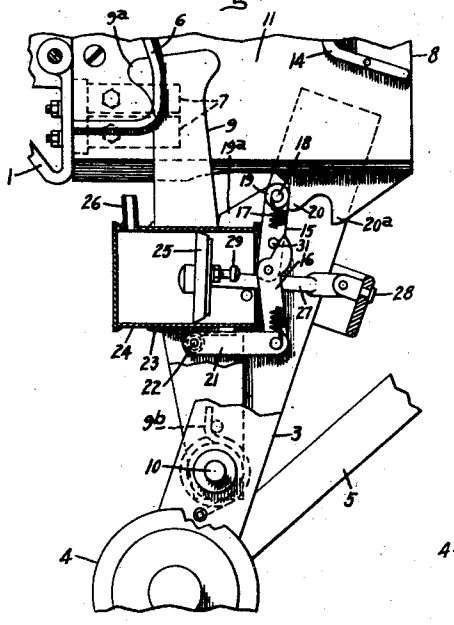


Fig. 3.

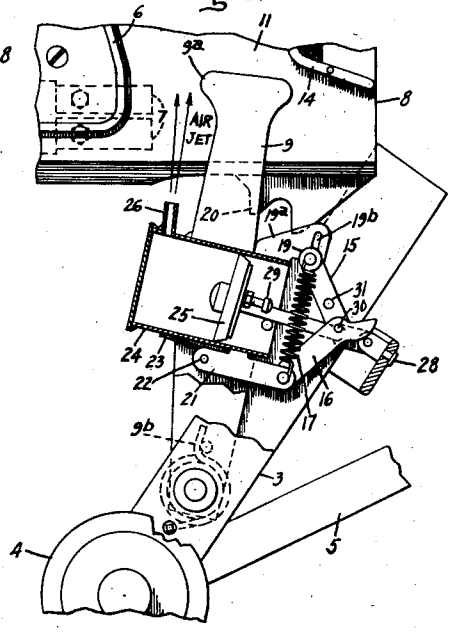


Fig. 4.

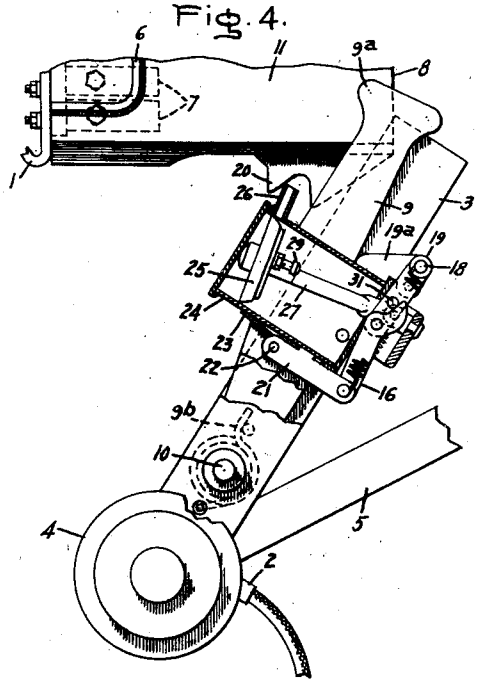
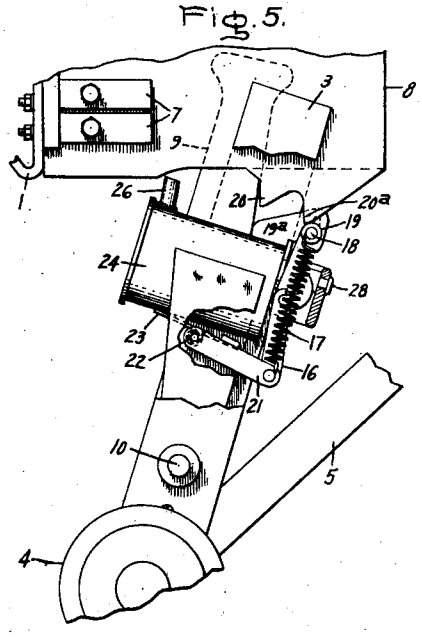


Fig. 5.



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UNITED STATES PATENT OFFICE

2,399,485

ELECTRIC CIRCUIT BREAKER

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Application December 26, 1942, Serial No. 470,264

7 Claims. (Cl. 200—148)

Our invention relates to electric circuit breakers, more particularly to air circuit breakers of the load-break disconnecting switch type for an intermediate voltage rating, such as 15,000 volts, capable of interrupting and efficiently clearing load power circuits, and has for its principal object the provision of an improved circuit breaker of the aforesaid type that is compact and rugged in construction, reliable and fast in operation, and that is capable of clearing medium voltage power circuits over a wide range of load currents, including minimum values of current.

Our invention will be more fully set forth in the following description referring to the accompanying drawings, and the features of novelty which characterize our invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Referring to the drawings, Fig. 1 is an elevational view, partly in section, of an air circuit breaker embodying the present invention in the closed circuit position thereof; Fig. 2 is an elevational view, partly in section, of the contact structure of the circuit breaker shown in Fig. 1 in an initial stage of the circuit opening operation; Fig. 3 is a similar view showing the breaker in a more advanced stage of the opening operation; Fig. 4 is a similar view showing the breaker in an open circuit position, and Fig. 5 is a similar view showing the breaker in a partially closed circuit position.

The air circuit breaker shown in Fig. 1 is adapted both to interrupt load currents (as well as low amperage magnetizing currents), and to disconnect the circuit generally in the manner of the air break disconnecting switch. The circuit breaker comprises a pair of relatively fixed terminals indicated at 1 and 2 arranged to be interconnected in the normal closed circuit position by a main current-carrying contact member 3. The contact member 3 is formed as a double blade contact that is secured to and mounted on a rotatable insulating shaft 4 for pivotal movement with respect to the upper fixed terminal 1. An operating handle 5 is connected to the insulating shaft 4 for rotating the same and causing the blade 3 to move toward and away from the fixed terminal 1.

The upper terminal 1 has connected thereto a fixed contact structure including an arcing contact 6 and main current-carrying finger-type contacts 7 arranged to be engaged by the blade 3 (Fig. 5). Also mounted on the fixed terminal is an arc extinguishing structure 8 comprising in the specific instance a narrow arc chute of a suitable type hereinafter described. The arcing contact 6 is mounted within the arc chute for coaction with an arcing contact 9 that is pivotally mounted on and carried by the main blade at 10, whereas the main current contacts 7 are disposed exteriorly of the arc chute at opposite sides thereof as also indicated by Fig. 5.

The arcing space or chamber within the arc chute comprises a narrow slot 11 that is open at the lower end of the chute for operation of the arcing contact 9 and also at the upper end at 12 for venting the arc gases. The sides of the arc chute are substantially closed and the main part of the arc chute is provided with arc extinguishing baffle structure indicated at 13 for cooling, lengthening and attenuating the arc stream as it moves upward into the chute. This movement of the arc is facilitated by arcing horns located at opposite ends of the arc chute, one of which is conveniently formed by the fixed arcing contact 6 and the other at 14 being close to the path of the arcing tip 9a of the arcing contact. However, our invention is not limited to a specific form of arc chute and further description thereof is unnecessary other than to point out that the chute may be of the interleaving baffle type disclosed in Letters Patent to L. J. Linde, No. 2,293,513 issued August 18, 1942 for Electric air circuit breaker. Also a muffler for the chute may be used if desired according to the above patent for increasing the current interrupting capacity.

The arcing contact is operatively related to the main blade so that when the handle 5 is rotated clockwise from the position shown in Fig. 1 to open the circuit breaker, the main contacts at 3 and 7 first part contact and move a predetermined distance toward open circuit position before parting of the arcing contacts occurs at 6 and 9. Since the arcing contact 9 is electrically connected to the blade 3 the circuit between the terminals will be opened at the arcing contacts rather than at the main contacts so that the arc to be extinguished is drawn within the chute 8 where it attaches to the arcing horns and is extinguished as it moves into the baffle structure.

To this end the arcing contact 9 is latched so that it does not immediately or completely follow the blade until the blade reaches a certain position whereupon the latch is tripped by means associated with the blade and spring biasing means, that is stressed during the initial movement of the blade, snaps the arcing contact away from its fixed contact 6. Coincident with this operation a strong jet of air is directed sub-

stantially transversely of the arc stream at the arcing contact so as to drive the arc upward within the chute, thereby to facilitate the interruption of large as well as small current arcs.

Specifically, the above results are brought about by providing the arcing contact with a latching toggle 15—16 that is arranged to be overset, as shown in Fig. 1, and resiliently held in said position by an overcenter spring 17. The upper end of the toggle link 15 is provided with a pin 18 guided for limited vertical reciprocal movement in a slot 19b formed in a lug 19a secured with respect to the arcing contact 9. The pin 18 also carries a roller 19 offset so as to be in alignment with a fixed catch 20 (and also a second fixed catch 20a) secured to the lower part of the arc chute along an edge thereof. The lower toggle link 16 is connected to a guide link 21 that is pivotally connected at 22 to the arcing contact and biased by a spring 23 in counterclockwise direction so as normally to hold the latching toggle 15—16 as a unit in its upper latching position.

For the purpose of controlling the latching toggle and for directing an air jet upward into the chute when the arcing contact is opened, a pneumatic device comprising a cylinder 24 and a piston 25 is operatively connected to the arcing and blade contacts. In the specific arrangement shown the cylinder 24, which is provided with an air jet nozzle 26, is mounted on and secured to the arcing contact 9 and coacts with the piston 25 connected through its operating rod 27 to an offset portion of the main blade 3 at 28. The piston rod 27 clears the toggle but an adjustable extension 29 carried by the piston is arranged so as to be substantially in alignment with the knee or central pivot 30 of the toggle. The toggle is held in the overset position shown in Fig. 1 by the spring 17 and a stop pin 31 that is arranged to be engaged by an extension of the link 16. Accordingly, when the knee of the toggle is moved sufficiently over center toward the right the spring 17 causes collapse of the toggle so that the roller 19 moves downward in the slot 19b sufficiently to clear both the catch 20 and the catch 20a.

The operation of the circuit breaker is as follows: Assuming that the circuit breaker is in the closed circuit position shown in Fig. 1, the opening operation is performed by rotating the handle 5 clockwise so as to open the circuit at the upper terminal 1. During the initial opening movement of the main blade 3, the arcing contact 9 remains in sliding engagement with the fixed contact 6. Before the arcing contact 9 moves away from the fixed contact, however, the toggle latch roller 19 has engaged the fixed catch 20 as clearly shown by Fig. 2. Since the toggle is still locked in its overset position further immediate movement of the arcing contact is restrained. The blade 3 continues to move clockwise stressing the arcing contact spring 9b and drawing with it the piston 25 which, incidentally, is thereby positioned within the cylinder 24 in readiness for a working stroke, i. e., a jet producing stroke.

As the blade 3 reaches a predetermined position in its opening stroke where it is safe to open the arcing contact without danger of the arc restriking to the main blade, the piston extension 29 engages the knee of the toggle and causes it to collapse as illustrated in Fig. 3. As the toggle collapses under influence of the spring 17 the latching roller 19 moves beneath the fixed catch 20 so as to release the arcing contact. Thereupon the arcing contact is snapped clockwise away from the fixed contact 6 by the biasing spring 9b that interconnects the arcing and blade contacts as shown. This snap action of the arcing contact quickly draws the arc across the lower end of the chute for transfer to the arcing horns.

As the arcing contact snaps open toward the blade, relative movement between the piston 25 and the cylinder 24 produces a working stroke of the piston as illustrated by Fig. 4 so as to force a sharp and vigorous jet of air from the nozzle 26 upward into the arc chute so as to traverse the arc stream at the arcing contact and force the arc upward along the arcing horns into the chute structure where it is extinguished. It will be noted, referring to Fig. 4, that the piston 25 closes off the nozzle opening 26 near the end of the working stroke. The trapped air at the left end of the cylinder therefore serves to cushion the opening shock of the arcing contact. Further opening movement of the breaker causes the arcing and blade contacts to move as a unit as indicated by Fig. 4 to the complete open circuit disconnecting position wherein the blade unit is in substantially horizontal position.

It will be noted that relative movement of the cylinder and piston from the position of Fig. 3 to that of Fig. 4 also causes resetting of the latching toggle to the original overset position shown by Fig. 1. Accordingly, when the circuit breaker is to be closed, counterclockwise movement of the handle 5 moves the reset contacts and pneumatic device as a unit as shown by Fig. 5 toward the closed circuit position. It will also be noted that toggle latch roller 19 during closing is forced downward by the cam-like surfaces at the rear of the fixed catch 20 and a second catch 20a. This movement of the toggle roller while the latch remains in its locked or overset position is made possible by the resiliently biased guide link 21 that permits the toggle to move downward as a unit as the roller 19 rides along the cam surfaces. Accordingly the blade unit can be moved without interference from the latching toggle to the fully closed circuit position shown in Fig. 1, in which position the spring 23 of the toggle guide link holds the toggle up behind the fixed catch 20.

The closing duty, as well as the opening duty, falls on the arcing contacts which close just prior to closing of the main contacts. In closing the breaker on a relatively high voltage circuit, an arc may be established at the arcing contacts before the contacts actually touch each other and before the roller 19 engages the fixed catch 20. In order to insure correct operation of the pneumatic device in case the switch is partially closed to a position where arcing would occur and then reopened, the second fixed catch 20a is provided. The location of this catch is such that it is engaged by the roller 19 before an arc can be established during a closing stroke. Accordingly, an extinguishing jet of air is directed from the pneumatic device when the latching toggle is tripped at the second catch 20a.

It should be understood that our invention is not limited to specific details of construction and arrangement thereof herein illustrated, and that changes and modifications may occur to one skilled in the art without departing from the spirit of our invention.

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

1. An electric circuit breaker comprising a pivotally mounted main contact blade, a relatively fixed coacting contact, an arcing contact pivot-

ally mounted on said blade and movable with respect to both said fixed and main contacts, spring means for biasing said arcing contact away from said fixed contact and toward said blade during a circuit opening operation, latching means including a toggle for said arcing contact arranged to engage a fixed part of said breaker for holding said arcing contact in engagement with said fixed contact during the initial circuit opening movement of said main contact blade, means associated with said blade for tripping said toggle and releasing said arcing contact, and a pneumatic device including a cylinder mounted on said arcing contact and a piston connected to said blade operated by said spring means and arranged to direct an arc extinguishing jet of air toward the arc stream in accordance with unlatching and opening movement of said arcing contact.

2. An electric circuit breaker comprising a pivoted main contact blade, a relatively fixed coacting contact, an arcing contact pivotally mounted on said main contact blade, spring means for biasing said arcing contact away from said fixed contact alongside said blade, latching means for holding said arcing contact in engagement with said fixed contact during the initial circuit opening movement of said blade, said latching means arranged to be tripped by and in accordance with predetermined opening movement of said blade, a piston and cylinder associated with said arcing contact and blade arranged to direct an arc extinguishing jet of air toward the arc stream in accordance with unlatching and opening movement of said arcing contact, and means connected to said piston for tripping said latching means after a predetermined opening movement of said blade.

3. An electric air circuit breaker comprising a pivotally mounted main contact blade, a relatively fixed coacting contact, an arcing contact pivotally mounted and movable with respect to both said fixed and main contacts, spring means for biasing said arcing contact away from said fixed contact and toward said blade, latching means including a toggle for said arcing contact arranged to be overset to engage a fixed part of said breaker for holding said arcing contact in engagement with said fixed contact during the initial circuit opening movement of said main contact blade, and means associated with said blade for tripping said toggle and releasing said arcing contact.

4. An electric air circuit breaker comprising a pivotally mounted main contact blade, a relatively fixed coacting contact, an arcing contact movable with respect to both said fixed and main contacts, spring means for biasing said arcing contact away from said fixed contact and toward said blade, latching means including a toggle for said arcing contact arranged to be overset to engage a fixed part of said breaker for holding said arcing contact in engagement with said fixed contact during the initial circuit opening movement of said main contact blade, means associated with said blade for tripping said toggle and releasing said arcing contact, and a pneumatic device including a cylinder and piston operatively related to both said arcing and blade contacts so that the initial opening movement of said blade sets said device in readiness for operation, said device being operated by said spring means upon tripping of said toggle for directing an arc extinguishing jet of air toward the arc stream at said arcing contact.

5. An electric air circuit breaker comprising a pivotally mounted main contact blade, a relatively fixed coacting contact, an arcing contact movable with respect to both said fixed and main contacts, spring means for biasing said arcing contact away from said fixed contact, a latching toggle connected to said arcing contact arranged to engage a relatively fixed catch for holding said arcing contact in engagement with said fixed contact during the initial circuit opening movement of said main contact blade, means associated with said blade for tripping said toggle and releasing said arcing contact, a pneumatic device operable by said spring means in accordance with relative movement between said arcing and blade contacts after said tripping operation, said device arranged thereupon to direct an arc extinguishing jet of air toward the arc stream at said arcing contact means for resetting said latching toggle prior to the closing operation, and a second relatively fixed catch arranged to be engaged by said toggle during closing for causing operation of said pneumatic device upon partial closing and reopening of said arcing contact.

6. An electric air circuit breaker comprising a pivotally mounted main contact blade, a relatively fixed coacting contact, an arcing contact movable with respect to both said fixed and main contacts, spring means for biasing said arcing contact away from said fixed contact, a latching toggle connected to said arcing contact arranged to engage a fixed catch on said breaker for holding said arcing contact in engagement with said fixed contact during the initial circuit opening movement of said main contact blade, means resiliently biasing said toggle towards its latching position, means associated with said blade for tripping said toggle and releasing said arcing contact, said releasing operation causing resetting of said toggle, a pneumatic device operated by said spring means in accordance with said releasing operation for directing an arc extinguishing jet of air toward the arc stream at said arcing contact, and a second fixed catch arranged to be engaged by said toggle when said arcing contact is in a partially closed position, said second catch causing tripping of said toggle and release of said arcing contact to operate said pneumatic device when said breaker is reopened before complete closure.

7. An electric air circuit breaker comprising a movable main member, a relatively fixed contact, an arcing contact movable with respect to both said fixed and main members, means for biasing said arcing contact away from said fixed contact, means for holding said arcing contact in engagement with said fixed contact during the initial opening movement of said main member, and a pneumatic device connected to said arcing contact arranged to direct an arc extinguishing jet of air toward the arc stream in accordance with the opening movement of said arcing contact, said pneumatic device having means for cushioning the opening movement of said arcing contact relative to said main member.

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