July 11, 1944. J. D. GAYER ET AL 2,353,453

ELECTRIC CIRCUIT INTERRUPTER

Filed Feb. 26, 1943

Fig. 1.

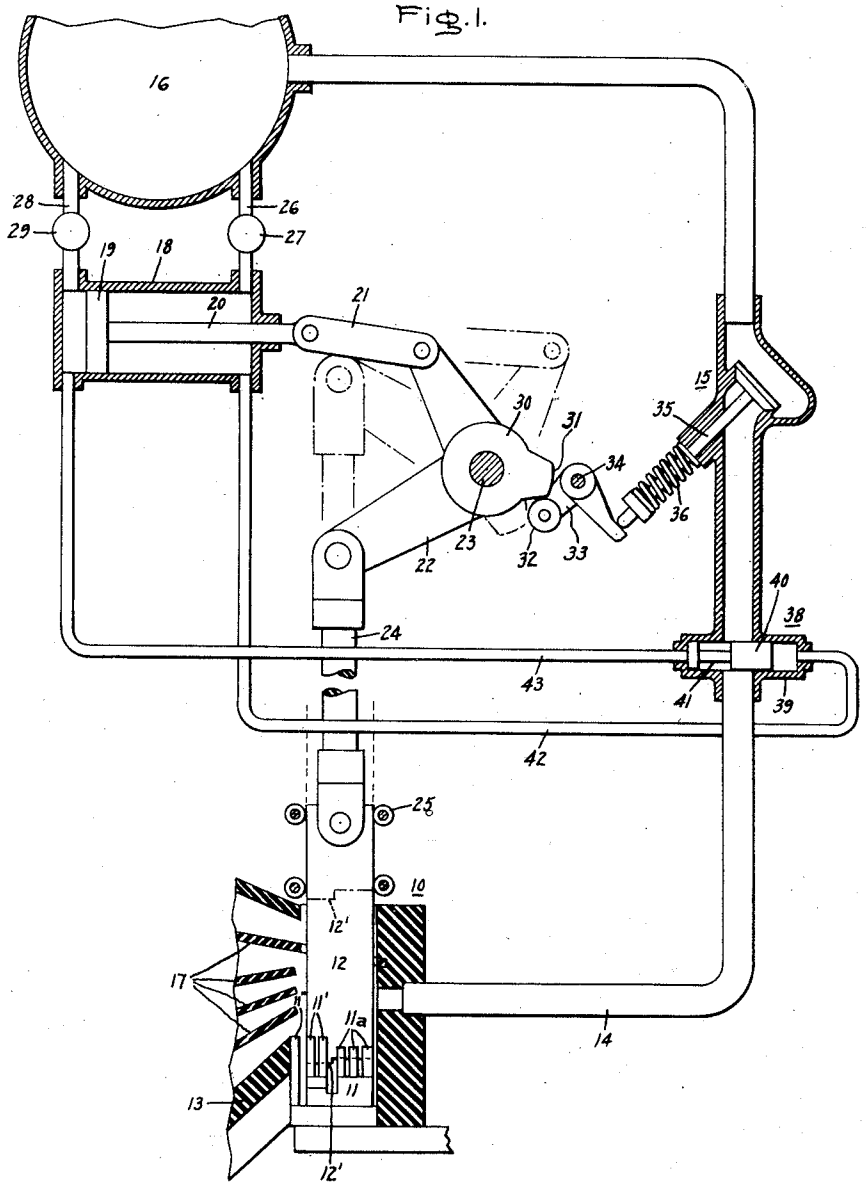
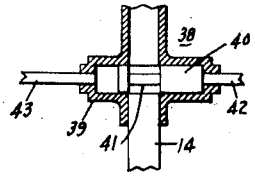


Fig. 2.



Inventors:
John D. Gayer,
Edward J. Frank,
Alexander C. Boisseau,
by Harry E. Dunham
Their Attorney.

Patented July 11, 1944 2,353,453

UNITED STATES PATENT OFFICE

2,353,453

ELECTRIC CIRCUIT INTERRUPTER

John D. Gayer and Edward J. Frank, Springfield, and Alexander C. Boisseau, Lansdowne, Pa., assignors to General Electric Company, a corporation of New York

Application February 26, 1943, Serial No. 477,248

6 Claims. (Cl. 200—148)

Our invention relates to electric circuit interrupters and particularly to improvements in electric circuit breakers of the fluid blast type. Specifically, our invention is an improvement on the invention disclosed and claimed in United States Letters Patent 2,287,578, Thumim et al., granted June 23, 1942, and assigned to the same assignee as the present application.

Circuit breakers which do not utilize oil or other inflammable liquid for arc extinguishing purposes, but instead employ a blast of fluid such as air or other gas, to extinguish the arc formed, have become quite popular in recent years. Many such fluid blast circuit breakers are designed with independently controlled opening and closing fluid blasts. The above mentioned United States Letters Patent is such an example.

Fluid blast circuit breakers, such as air blast circuit breakers, for example, require air storage facilities the size of which is mainly dependent upon the air used for the air blast for arc entinguishing purposes. From a cost standpoint it would be desirable to limit these facilities to a minimum and this can be accomplished by conserving the air required for the fluid blast. It has been discovered that during the circuit opening operation of a fluid blast circuit breaker it is preferable for the fluid blast to be in existence at the instant the contacts separate and continue for a longer period of time than would be required during the circuit closing operation where it is merely necessary to prevent the arc from striking and not necessary to extinguish the arc. Our invention is primarily concerned with new and improved means for controlling the fluid blast of circuit breakers employing a fluid or air blast for arc extinguishing purposes.

It is an object of our invention to provide a new and improved means for controlling the opening and closing fluid blasts of a fluid blast circuit breaker.

Further objects and advantages of our invention will become apparent as the following description proceeds 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.

For a better understanding of our invention, reference may be had to the accompanying drawing in which Fig. 1 is a schematic diagram partly in section, illustrating one embodiment of our invention, and Fig. 2 illustrates a portion of the embodiment of our invention shown in Fig. 1 in a different operating position than that illustrated in Fig. 1.

Although our invention is applicable to any fluid blast circuit breaker, single phase or polyphase, for purposes of clearness and simplicity in the disclosure, we have illustrated our invention schematically in Figs. 1 and 2 as applied to a fluid operating circuit breaker 10 of the cross gas-blast type, comprising a stationary contact 11 and a movable contact 12 arranged to be operated to draw an arc in an arc chute 13. It will be understood by those skilled in the art that contacts 11 and 12 which are relatively movable with respect to one another, are arranged to be connected with suitable line terminals not shown. The stationary or fixed contact 11 is provided with spring pressed contact fingers 11a and longer arcing contact fingers 11', while movable contact 12 is provided with an arcing tip 12' so that when the contacts separate an arc occurs between arcing tips 11' and 12'. Immediately after separation of the contacts one terminal of the arc is transferred by a blast of fluid such as air or any other gas issuing from conduit 14 which is suitably connected through blast valve 15 to be described hereinafter, with a source of fluid under pressure 16, from contact fingers 11' to the contact 11'' which is provided with a tip of arc resistant metal. The fluid blast from conduit 14 upon the opening of circuit breaker 10 drives the arc into the arc chute 13 against the edges of a plurality of partitions 17 which partitions are mounted in the arc chute 13, transverse to the arc gap and the ends of which extend close to the path of movement of the arcing tip 12' of movable contact 12. This circuit breaker 10 is illustrated by way of example only in order to aid in understanding our invention which is applied thereto. The circuit breaker described thus far is not our invention but is disclosed and claimed in United States Letters Patent 2,284,842, Prince et al., granted June 2, 1942, and assigned to the same assignee as the present application.

Any suitable means for producing relative movement between contacts 11 and 12 may be provided. We have chosen to illustrate this means in the drawing as a fluid operated motor comprising a cylinder 18 and a piston 19 which is adapted for reciprocal movement in cylinder 18. Piston 19 is operatively connected to movable contact 12 by means of a connecting rod 20, a link 21, bell crank 22 pivotally mounted at 23, and circuit breaker operating rod 24. Straight line motion of movable contact 12 is

obtained by virtue of guide means 25 provided on either side thereof. In order to operate the fluid motor comprising cylinder 18 and piston 19 fluid pressure tank or source 16 is connected to one end of cylinder 18 through conduit 26 and circuit breaker closing valve 27 which is only schematically shown. The other end of cylinder 18 is connected to fluid pressure source 16 by means of conduit 28 and circuit breaker opening valve 29. It will be understood that preferably circuit breaker closing valve 27 and circuit breaker opening valve 29 which are schematically illustrated, also have included therewith, or have associated therewith, dumping valves, not shown, which may be identical to the dumping valves disclosed and claimed in United States Letters Patent 2,292,095, Thumim, granted August 4, 1942, and assigned to the same assignee as the present application. Such dumping valves will, of course, permit high speed reversal of piston 19 in cylinder 18 by venting the respective ends thereof to atmosphere. It will be understood, of course, that valves 27 and 29 may be of the three-way type to permit venting one or the other ends of cylinder 18 to atmosphere.

In order to open blast valve 15 at a predetermined time during the opening stroke and closing stroke of circuit breaker 10 we provide a blast valve lifting device 30 rotatable with bell crank 22 about pivot 23. This valve lifting device comprises a cam face 31 for engaging with a roller 32 of bell crank 33 pivotally mounted at 34. The other end of bell crank 33 is adapted to engage the valve stem 35 of blast valve 15 which is suitably biased to the closed position as by means of spring 36. It has been discovered that a flow of fluid in arc chute or chamber 13 is desired prior to relative separation of contacts 11 and 12 and to this end operating rod 24 may be provided with a suitable lost motion connection such as is disclosed in the above mentioned Thumim patent so that movement of valve lifter 30 to open blast valve 15 will occur immediately upon operation of the fluid motor comprising cylinder 18 and piston 19 without any corresponding relative movement of contacts 11 and 12. For simplicity in the disclosure, this lost motion connection has been omitted.

In any valve lifting device for a fluid blast circuit breaker the primary considerations are that it shall positively function on each opening stroke, that it shall permit the flow of air or gas into the interrupting chamber or arc chute prior to separation or parting of the contacts, and that a definite or positive closing point of the valve shall be provided. The arrangement described thus far clearly fulfills all of these requirements in a simple form which is sturdy in construction and economical to manufacture.

In order to conserve storage apparatus for the fluid under pressure and permit the requirement of a minimum of such apparatus, it has been discovered that the fluid blast provided during the circuit breaker closing operation need not use as much fluid under pressure as the circuit interrupting fluid blast since it is merely necessary to prevent the arc from striking. Accordingly, we provide means for reducing the flow of fluid and consequently the fluid blast between blast valve 15 and arc chute 13 during a circuit closing operation. As illustrated this flow control means comprises a fluid operated metering valve generally indicated at 38 which comprises a cylinder 39 having reciprocably mounted therein a piston 40. Piston 40 has a notched out portion 41 which when positioned across conduit 14 as indicated in Fig. 2, does not substantially interfere with the flow of fluid in conduit 14. However, when piston 40 is in the position indicated in Fig. 1 the passageway is greatly restricted and consequently the fluid flow in conduit 14 and the fluid blast in the arc chamber is considerably reduced.

Flow control means or metering valve 38 may be operated in any suitable manner. We have illustrated in Fig. 1 fluid operated means for controlling metering valve 38. The right hand end of cylinder 39 is shown connected with the right hand end of cylinder 18 by means of conduit 42. Similarly the left hand end of cylinder 39 is connected with the left hand end of cylinder 18 by means of conduit 43. Whenever circuit breaker closing valve 27 is opened to cause the circuit breaker 10 to move to the closed position, fluid under pressure also enters the right hand end of cylinder 39 of metering valve 38 to force piston 40 to assume the position indicated in Fig. 1. On the other hand, when circuit breaker opening valve 29 is operated to the open position, fluid under pressure enters the left hand ends of both cylinders 18 and 39 thereby causing piston 40 to move to the position indicated in Fig. 2 so as to produce substantially no restriction in the flow of fluid between source 16 and the arc chute 13.

The operation of the fluid blast circuit breaker described above will be obvious to those skilled in the art in view of the detailed description included above. When the circuit breaker is in the closed position indicated by the solid lines in Fig. 1, the metering valve 38 will be in the position indicated in Fig. 1 greatly restricting the fluid passage between blast valve 15 and arc chute, or chamber 13. If circuit breaker opening valve 29 is now opened either manually or automatically in response to an abnormal current condition, fluid under pressure enters the left hand end of cylinder 18 causing piston 19 to move to the right so as to rotate valve lifter 30 and cause opening of blast valve 15. No movement of movable contact 12 will occur for a brief interval by virtue of the lost motion connection (not shown) included in operating rod 24. Simultaneously with the movement of piston 19 fluid under pressure will also be introduced through conduit 43 into the left hand end of cylinder 39 of metering valve 38, causing piston 40 to move to the right so as to permit unrestricted flow of the fluid blast from source 16 to the arc chute 13.

The fully open position of the circuit breaker movable contact 12 and operating mechanism is illustrated in dotted lines in Fig. 1. Assuming the circuit breaker is in the fully open position, the closing operation is initiated by opening circuit breaker closing valve 27 which will not only cause movement of piston 19, but will also cause movement of piston 40 to the position indicated in Fig. 1 to restrict substantially the flow of fluid from source 16 to arc chute 13 thereby conserving the fluid under pressure and consequently also reducing the fluid storage facilities required.

It will be apparent to those skilled in the art that our 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 our invention, and we aim in the appended claims to cover all such changes and modifications.

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

1. In an electric circuit breaker of the fluid blast type comprising means defining an arc chamber, relatively movable contacts separable to draw an arc in said chamber, a source of fluid under pressure for supplying a fluid blast to said arc chamber, valve means for controlling the flow of fluid from said source to said arc chamber, means for producing relative movement between said contacts, means responsive to relative movement of said contacts for operating said valve means to the same extent during both the opening and closing operations of said circuit breaker, and means for reducing the flow of said fluid to said arc chamber during the circuit closing operation.

2. In an electric circuit breaker of the fluid blast type comprising means defining an arc chamber, relatively movable contacts separable to draw an arc in said chamber, a source of fluid under pressure for supplying a fluid blast to said arc chamber, valve means for controlling the flow of fluid from said source to said arc chamber, means for producing relative movement between said contacts, means responsive to relative movement of said contacts for operating said valve means during both the opening and closing operations of said circuit breaker, and a metering valve operative during the circuit closing operation to reduce the flow of said fluid to said arc chamber.

3. In an electric circuit breaker of the fluid blast type comprising means defining an arc chamber, relatively movable contacts separable to draw an arc in said chamber, a source of fluid under pressure for supplying a fluid blast to said arc chamber, valve means for controlling the flow of fluid from said source to said arc chamber, means for producing relative movement between said contacts, means responsive to relative movement of said contacts for operating said valve means during both the opening and closing operations of said circuit breaker, and fluid operated flow control means for reducing the flow of said fluid to said arc chamber during the circuit closing operation.

4. In an electric circuit breaker of the fluid-blast type comprising a plurality of relatively movable contacts, means for producing relative movement between said contacts, a source of fluid under pressure, means including a valve associated with said source for producing a blast of fluid adjacent said contacts during both the circuit-interrupting and the circuit-closing operations of said circuit breaker, means for causing opening of said valve for a period of time during both said circuit interrupting and circuit closing operations to produce an opening and a closing fluid blast, and means for interfering with the flow of fluid between said valve and said contacts so as to reduce the amount of fluid under pressure used during a circuit closing operation as contrasted with the fluid used during a circuit interrupting operation.

5. In an electric circuit breaker of the fluid-blast type comprising a plurality of relatively movable contacts, a source of fluid under pressure, a fluid motor for producing relative movement between said contacts, means including a valve associated with said source for controlling a blast of fluid adjacent said contacts, means for opening said valve during both the circuit interrupting and the circuit closing operations of said circuit breaker, and a fluid operated metering valve connected to said fluid motor and adapted to be operated with said fluid motor so as to greatly reduce the flow of fluid to said contacts upon a circuit closing operation while permitting a maximum flow of fluid during a circuit interrupting operation.

6. In an electric circuit breaker of the fluid-blast type comprising an arc chute, a plurality of relatively movable contacts mounted in said arc chute, a source of fluid under pressure, a fluid motor for producing relative movement between said contacts, means including a valve interconnecting said source and said arc chute capable of producing a controlled blast of fluid adjacent said contacts, means for opening said valve during both the cricuit closing and the circuit interrupting operations of said circuit breaker, a metering valve connected between said valve and said arc chute and arranged when in one operating position to greatly reduce the fluid permitted to flow by said valve, said flow of fluid permitted by said valve being substantially unaffected by said metering valve when in another operating position, and means for operating said metering valve to one or the other of said operating positions in response to operation of said fluid motor so that the fluid blast during a circuit closing operation is considerably reduced as contrasted with the fluid blast during a circuit interrupting operation.

JOHN D. GAYER.
EDWARD J. FRANK.
ALEXANDER C. BOISSEAU.