Oct. 13, 1942. R. PAXTON 2,298,838

ELECTRIC CIRCUIT INTERRUPTER

Filed July 17, 1940

Fig. 3.

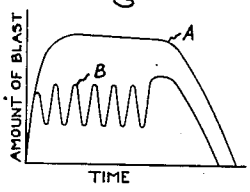


Fig. 1.

Fig. 4.

Fig. 2.

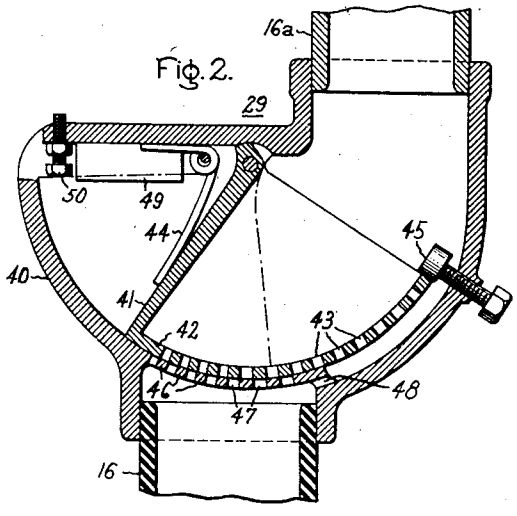
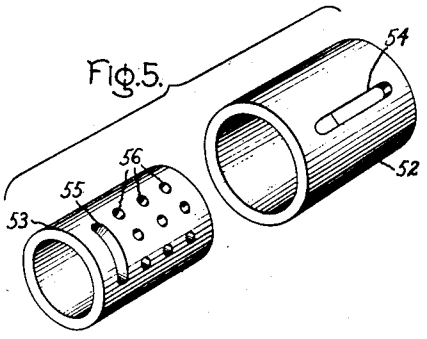


Fig. 5.



Inventor:
Robert Paxton,
by Harry E. Dunham
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Patented Oct. 13, 1942

2,298,838

UNITED STATES PATENT OFFICE

2,298,838

ELECTRIC CIRCUIT INTERRUPTER

Robert Paxton, Upper Darby, Pa., assignor to General Electric Company, a corporation of New York

Application July 17, 1940, Serial No. 345,955

8 Claims. (Cl. 200—148)

My invention relates to electric circuit interrupters and more particularly to such interrupters which depend for their operation upon a blast of fluid or gas under pressure.

In connection with electric circuit breakers, it is well known that the arc energy increases with increase in the length of the arc and that such increase in energy is often undesirable since it requires the dissipation of a considerable amount of heat during the arc-interrupting operation. Because of this increase in arc energy, there is a resultant excessive deterioration of insulating materials, excessive burning of the contacts and, particularly in connection with gas-blast circuit breakers, an excessive amount of gas is required.

Accordingly, it is an object of my invention to provide a fluid or gas-blast circuit breaker wherein excessive arc extension is eliminated and wherein oscillation of the arc roots at the contacts is produced to reduce the contact burning while, at the same time, reducing the difficulty of interrupting the circuit within as short a time as possible.

It is another object of my invention to provide a new and improved fluid-blast control means for an electric circuit breaker in which the interrupting efficiency is increased both by decreasing the amount of fluid necessary and by moderating the deterioration of the contacts and insulating materials.

Still another object of my invention is to provide for a fluid or gas-blast circuit breaker a uniform continuous fluid or gas-blast during the circuit interrupting period supplemented by a rapidly fluctuating intermittent blast.

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 drawing in which Fig. 1 is a schematic diagram partly in section of an electric circuit breaker embodying my invention, Fig. 2 is an enlarged cross-sectional view of the fluid-blast control means of Fig. 1, Fig. 3 is a graph to aid in understanding my invention, and Figs. 4 and 5 represent certain modifications of the fluid-blast control means of my invention.

For explanatory purposes, I have illustrated my invention as applied to a circuit breaker of the cross fluid-blast type, such as 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, and assigned to the same assignee as the present application now Patent No. 2,284,842 issued June 2, 1942. It will, of course, be understood by those skilled in the art that my invention is equally applicable to other types of circuit breakers which employ a fluid or gas blast for arc-extinguishing purposes.

Referring now to the drawing, I have illustrated my invention as applied to a fluid-blast circuit breaker **10** of the cross-blast type comprising a stationary contact **11** and a movable contact **12** arranged to be operated so as to draw an arc in arc chute **13**. The fixed contact **11** is connected to the line terminal **14** while the movable contact **12** is connected to the line terminal **15**. Fixed contact **11** is provided with spring-pressed contact fingers **11***a* 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, preferably air, issuing out of conduit **16** from contact fingers **11'** to the contact **11''** which is provided with a tip of arc-resistant metal. The fluid or gas blast from conduit **16** upon opening of the breaker drives the arc into the arc chute **13** against the edges of a plurality of partitions **17** 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'** of the movable contact **12**. The circuit breaker **10**, illustrated by way of example in order to describe my fluid-blast control means, is not my invention but is described and claimed in Patent No. 2,284,842, referred to above.

Any suitable means for producing relative movement between the contacts **11** and **12** of the circuit breaker **10** may be provided. In Fig. 1, I have disclosed an arrangement in which circuit breaker **10** is automatically operated by fluid pressure. Accordingly, I have shown a cylinder **18** with a piston **19** connected through a rod **20** to operate a lever **21** secured to the shaft **22**. The shaft **22** has attached thereto an arm of insulating material **23** for operating the movable contact **12** of the circuit breaker. Although circuit breaker **10** is described with respect to a single phase, it will, of course, be understood by those skilled in the art that it may just as well comprise a plurality of phases in which case a plurality of arms **23** would be provided for operating the movable contacts **12** of the various

phases. The arm 23 is shown provided with a pin 24 operating the member 25 secured to the outer end of movable contact 12. Member 25 is arranged to slide on a pair of rods 26, only one of which is shown in the drawing since the other is obscured from view thereby. It will be apparent that when the shaft 22 is rotated in a counter-clockwise direction, the arm 23 will move the contact 12 to the open position of the circuit breaker 10 and that, when the shaft 22 is rotated in a clockwise direction, the arm 23 will move the contact 12 to the closed position. The member 25 and the rods 26 constitute a kind of crosshead arrangement by which the movable contact 12 is reciprocated. This type of operating mechanism is described in detail in United States Letters Patent 2,218,797, granted October 22, 1940, upon the joint application of Leonard J. Linde and Torild Andersen, and assigned to the same assignee as the present application.

For operating circuit breaker 10 and also for supplying a blast of fluid or gas through conduit 16 for arc-interrupting purposes, I provide a source of fluid pressure 27 which may preferably be air under pressure. This source of air or fluid under pressure 27 is connected through a suitable blast valve 28, conduit 16*a*, and blast control means 29, which will be described in greater detail hereinafter, to conduit 16 so as to supply a blast of air adjacent contacts 11 and 12 of circuit breaker 10 for arc-extinguishing purposes. Blast valve 28 is normally biased to the closed position by means of spring 30 and is operated by means of solenoid 31 which may be energized at the desired time by any suitable control circuit.

The source of fluid 27 is also connected with the respective ends of cylinder 18 for operating circuit breaker 10 through a four-way control valve 32. This valve is arranged to control the closing of circuit breaker 10 by connecting source 27 with the right-hand end of cylinder 18 through conduit 33. For opening the circuit breaker, on the other hand, valve 32 is adapted to interconnect the source of fluid under pressure 27 with the left-hand end of cylinder 18 through conduit 34. Valve 32 is so constructed as to vent one end of cylinder 18 to atmosphere through conduit 35 whenever the other end of cylinder 18 is subjected to pressure from source 27. A suitable spring means 36 is provided to bias valve 32 to the closed position shown in Fig. 1. Valve 32 is arranged to be operated for opening circuit breaker 10 by means of an opening solenoid 37 which may be energized from any suitable control circuit. Similarly, valve 32 is arranged to be operated to control the closing of circuit breaker 10 by means of a closing solenoid 38 which may also be energized from any suitable control circuit. Blast valve solenoid 31, opening solenoid 37, and closing solenoid 38, are preferably controlled in a manner disclosed and claimed in Patent No. 2,255,496 issued September 9, 1941, to Bryce W. Wyman, and assigned to the same assignee as the present application.

In order to prevent excessive arc length and to produce oscillation of the arc and its roots, I provide blast-control means 29 preferably connected between blast valve 28 and arc chute 13. Blast control means 29 is shown in detail in Fig. 2 and comprises a valve body 40 having one end thereof connected to conduit 16 leading to arc chute 13 while the other end is connected to conduit 16*a* leading from blast valve 28. Conduit 16 is preferably formed of insulating material so as to eliminate the danger of high potential at the blast valve 28 or blast-valve control means 29. Pivotally mounted within valve body 40 is a vane 41 supporting a segmental extension 42 provided with a plurality of openings 43. Vane 41 is normally biased to the position shown by means of a suitable return spring 44 which holds vane 41 against adjustable stop 45.

The valve body 40 is provided with an integral segmental portion 46 provided with a plurality of openings 47 which, in certain positions, register with the openings 43 in extension 42 of vane 41. When the openings 43 and 47 are in registry, a large amount of air or fluid may pass through blast-control means 29. On the other hand, if the holes 43 and 47 are not in registry, the only fluid which may pass through blast-control means 29 is that which may pass through opening 48 which is designed so that only sufficient fluid may pass therethrough to transfer the arc to arcing contact 11'' without producing excessive elongation thereof as was the case in connection with prior art arrangements. Stop 45, which is in the form of an eccentric, may be adjusted so that, when the blast-control means 40 is in the position shown, the openings 43 and 47 are preferably in nonregistry. In order to cushion the operation of vane 41 when blast valve 28 is open so that a blast of fluid through conduit 16*a* is provided, any suitable damping means may be provided. For example, small adjustable openings may be provided in vane 41 and housing 40 to produce the well-known air buffing or dashpot effect by which means the velocity of vane 41 may also be controlled or, as illustrated in Fig. 2, a suitable resilient buffer means 49 may be provided. An adjustable stop 50 may also be provided to control the registry or nonregistry of openings 43 and 47 when vane 41 has been rotated in a clockwise direction to the dotted position of Fig. 2 upon operation of blast valve 28.

Whenever blast valve 28 is opened, a continuous supply of fluid or air from tank 27 will be by-passed through opening 48 which continuous supply is sufficient to maintain the arc within arc chute 13, yet not sufficient to cause excessive elongation thereof. At the same time, vane 41, which is automatically responsive to the blast pressure released by valve 28, is rotated in a clockwise direction so that the openings 43 and 47 are intermittently in registry and nonregistry, thereby modulating the velocity of the fluid and causing an intermittent or pulsating blast of fluid or air to be supplied through conduit 16 supplementing the continuous flow through opening 48. This results in producing oscillations of the arc and its roots and yet preventing excessive elongation of the arc so that rapid interruption thereof may be obtained. Spring 44 may be so proportioned that vane 41 is responsive only to some predetermined desirable blast pressure.

Since, in an elastic medium, such as air, rapid fluctuations thereof are quickly damped, it is desirable that blast-control means 29 be placed as close as possible to the relatively movable contacts 11 and 12 and, accordingly, in Fig. 1, conduit 16 is shown as being very short so that blast-control means 29 is close to arc chute 13.

Curve A of Fig. 3 illustrates the prior art method of releasing fluid to the arc to extinguish the same, which causes excessive elongation thereof. In curve B, on the other hand, I have shown my proposed method wherein a small continuous fluid blast is supplied through opening

48 of blast-control means 29 while a rapidly intermittent supply, as clearly shown by the curve, is obtained as openings 43 and 47 are in successive positions of registry and nonregistry. It will be observed that curve B illustrates the blast characteristic when the openings 43 and 47 are held in registry for a short interval near the end of the blast.

Although I have shown a particular blast-control means 29 which is automatically operative in response to the blast pressure without any external operating means, it will be understood by those skilled in the art that various means may be provided for producing an intermittent blast supplementing a continuous arc-extinguishing blast. In Figs. 4 and 5, I have shown a modification of the blast-control means 29 which must be mechanically operated by the moving parts of the circuit breaker. The blast-control means shown in Figs. 4 and 5 comprises a valve 51 including a cylindrical valve seat 52 and a cylindrical rotatable valve member 53 constructed so as to rotate within valve seat 52. Valve seat 52 is provided with an elongated opening 54 which would be connected to conduit 16 and arc chute 13 of Fig. 1. Valve member 53 is provided with an elongated slot 55 arranged perpendicularly with respect to slot 54 through which the continuous air blast would be supplied, and a plurality of rows of openings 56 for supplying the intermittent blast. The interior of valve member 53 would of course be connected to conduit 16*a* and blast valve 28. Suitable means 57 for rotating valve member 53 within cylindrical valve seat 52 are provided which might be connected to the arm 23 of circuit breaker 10 of Fig. 1 so as to cause operation thereof upon relative movement between contacts 11 and 12. The operation of the arrangement disclosed in Figs. 4 and 5 will be obvious to those skilled in the art and no further discussion will be included herewith.

While I have shown and described particular embodiments of my invention, it will be obvious to those skilled in the art that changes and modifications may be made to the arrangements disclosed and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope thereof.

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

1. An electric circuit breaker including a pair of relatively movable contacts separable to draw an arc therebetween, a source of fluid under pressure, means for introducing a blast of said fluid adjacent said arc for arc-interrupting purposes, and means for causing a plurality of variations in only a portion of said fluid introduced during an interrupting operation.

2. In an electric circuit breaker, an arc-confining structure, a pair of relatively movable contacts separable to draw an arc in said structure, a source of fluid under pressure, means for introducing a blast of said fluid adjacent said arc for arc-interrupting purposes, and means for causing only a portion of said fluid blast to be introduced adjacent said arc in a series of intermittent pulses.

3. In an electric circuit breaker, the combination of an arc-confining casing, a plurality of relatively movable contacts mounted within said casing, means for producing relative movement between said contacts to interrupt the current in an associated electric circuit, a source of fluid under pressure, means for introducing said fluid into said casing for arc-extinguishing purposes, and means responsive to the relative separation of said contacts for modulating the velocity of said fluid a plurality of times to aid in extinguishing said arc.

4. An electrical circuit breaker comprising a pair of relatively movable contacts separable to draw an arc therebetween, means for introducing a blast of fluid adjacent said contacts for arc-interrupting purposes, and means for so controlling said blast that said arc is subjected to a pulsating said last-mentioned means being operable by said blast of fluid upon operation of said first-mentioned means.

5. In an electric circuit breaker, the combination of an arc-confining casing, a plurality of relatively movable contacts mounted within said casing, means for producing relative movement between said contacts to interrupt the current in an associated electric circuit, a source of fluid under pressure, a blast valve for controlling the introduction of a blast of said fluid into said casing for arc-extinguishing purposes, and means responsive to the flow of fluid upon operation of said blast valve for producing a rapidly fluctuating intermittent blast in said casing.

6. In an electric circuit breaker, the combination of an arc-confining casing, a plurality of relatively movable contacts mounted within said casing, means for producing relative movement between said contacts to interrupt the current in an associated electric circuit, a source of fluid under pressure, a blast valve for controlling the introduction of a blast of said fluid into said casing for arc-extinguishing purposes, and means connected between said blast valve and said casing for causing a portion of said fluid to be introduced into said casing in a series of intermittent pulses, said last-mentioned means being operated by fluid from said source upon opening of said blast valve.

7. In an electric circuit breaker, the combination of an arc-confining casing, a plurality of relatively movable contacts mounted within said casing and separable to draw an arc therein, means for producing relative movement between said contacts, a source of fluid under pressure, a blast valve for controlling the introduction of a blast of said fluid from said source into said casing for arc-extinguishing purposes upon separation of said relatively movable contacts, and blast control means connected between said blast valve and said casing including a fluid-operated vane for producing a rapidly fluctuating intermittent fluid blast in said casing.

8. In an electric circuit breaker including a pair of relatively movable contacts separable to draw an arc therebetween, a source of fluid under pressure, means for introducing a continuous blast of fluid from said source adjacent said arc for arc-interrupting purposes, and means for producing a supplementary rapidly fluctuating blast adjacent said arc for preventing excessive elongation thereof during the circuit-interrupting operation.

ROBERT PAXTON.

CERTIFICATE OF CORRECTION.

Patent No. 2,298,838. October 13, 1942.

ROBERT PAXTON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 15, claim 4, after "pulsating" insert --force, whereby excessive elongation of said arc is avoided,--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of December, A. D. 1942.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

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