

Oct. 13, 1942.

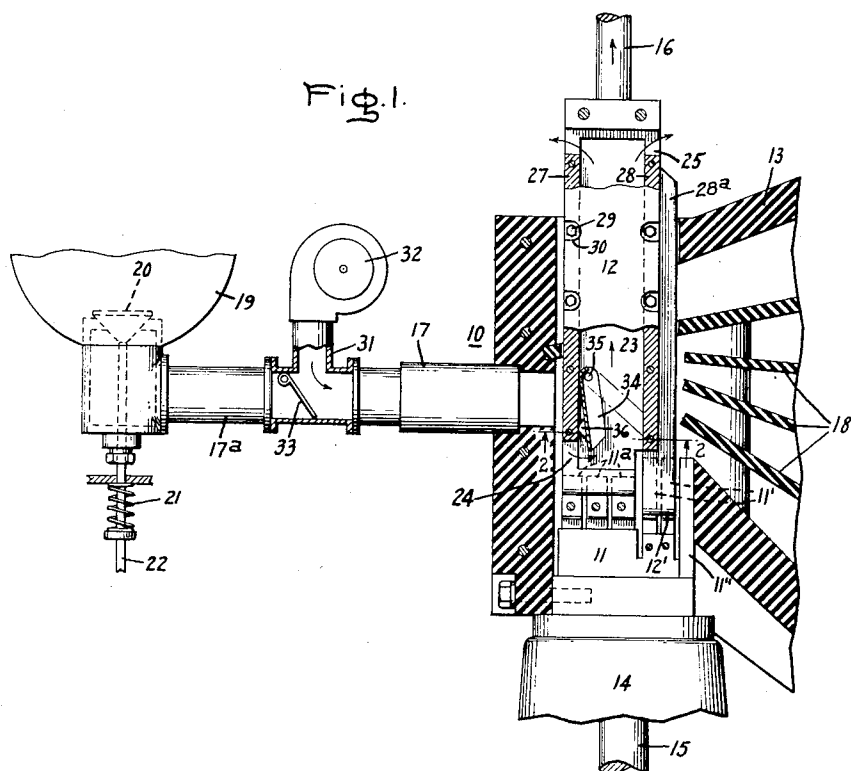
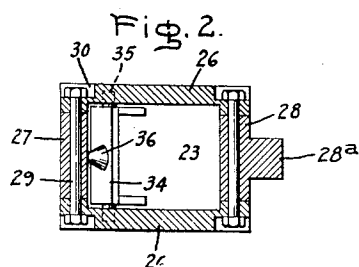
C. THUMIM ET AL

2,298,778

ELECTRIC CIRCUIT BREAKER

Filed Sept. 20, 1941

2 Sheets-Sheet 1



Inventors:
Carl Thumim,
Alexander C. Boisseau,
by *Harry E. Sunkens*
Their Attorney.

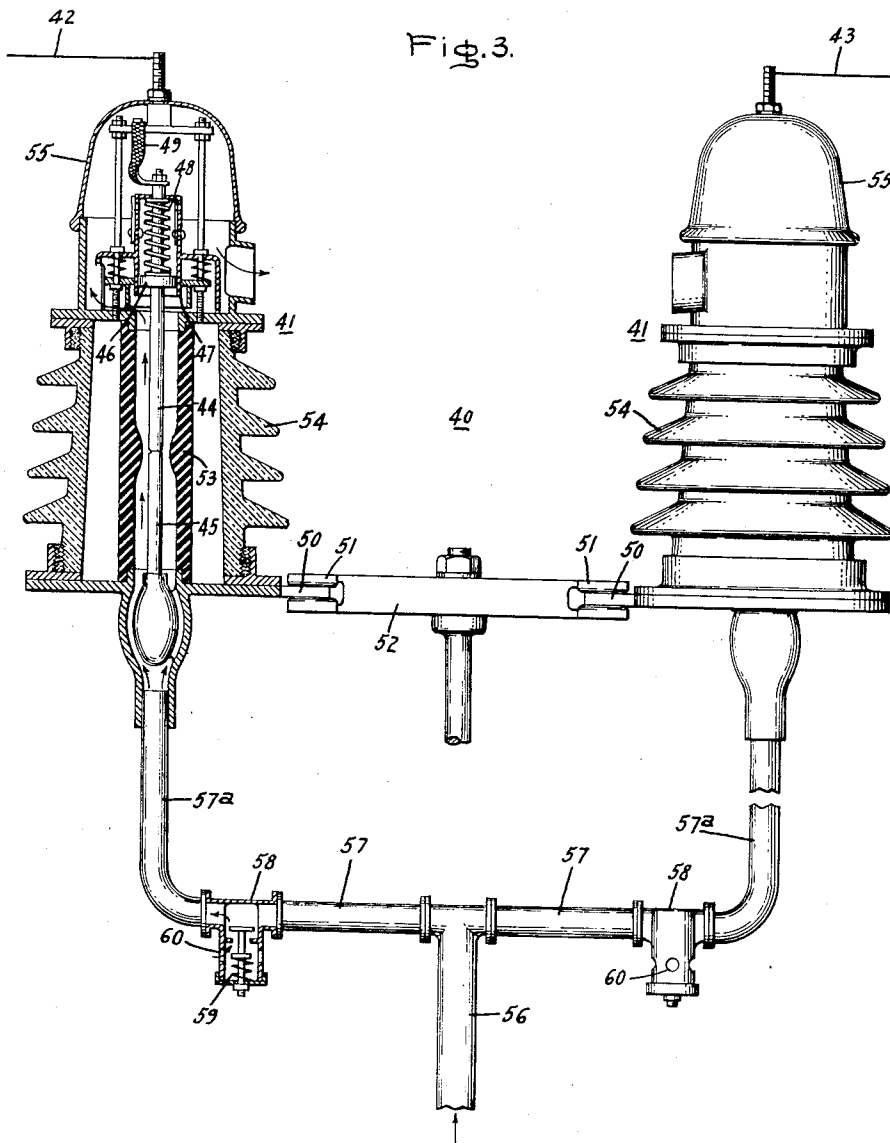
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ELECTRIC CIRCUIT BREAKER

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2 Sheets-Sheet 2



Inventors:
Carl Thumim,
Alexander C. Boisseau,
by *Harry E. Dunham*
Their Attorney.

UNITED STATES PATENT OFFICE

2,298,778

ELECTRIC CIRCUIT BREAKER

Carl Thumim, Yeadon, and Alexander C. Boisseau, Lansdowne, Pa., assignors to General Electric Company, a corporation of New York

Application September 20, 1941, Serial No. 411,622

10 Claims. (Cl. 200—148)

Our invention relates to electric circuit breakers and more particularly to circuit breakers of the fluid-blast type.

As the capacity of circuit breakers is increased, the conducting parts of such circuit breakers from which the heat generated by current traversing these parts is dissipated simply by radiation or conduction to other parts must necessarily increase in size particularly with increase in current ratings so that the dimensions and mass thereof become very large. Such increase in mass of the moving parts of a circuit breaker introduces difficulties when high-speed operation thereof is desired since the large masses necessitated by high current ratings require correspondingly large acceleration forces.

It is an object of our invention to provide a new and improved fluid-blast circuit interrupter for carrying very high currents in which the structure is small and light enough for economy and rapid acceleration and heavy enough to carry its continuous rated current within the permitted range of temperature rise.

It is another object of our invention to provide a new and improved circuit breaker in which particularly the movable parts thereof are subjected to the effects of a continuous cooling current of fluid, such as air.

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 drawings in which Fig. 1 is a schematic diagram partly in section illustrating one form of our invention as applied to a cross-blast type of circuit breaker, Fig. 2 is a sectional view taken on line 2—2 of Fig. 1, and Fig. 3 illustrates a modification of our invention as applied to a radial blast type of fluid-blast circuit breaker.

In Fig. 1, we have illustrated our invention as applied to a circuit breaker of the cross fluid-blast type such as 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 No. 2,284,842, issued June 2, 1942, and assigned to the same assignee as the present application. It will be understood, however, from the following description that our invention is equally applicable to other types of circuit breakers which employ a fluid blast for arc-extinguishing purposes.

Referring now to Figs. 1 and 2, the numeral 10 generally indicates a circuit breaker of the cross-blast type having relatively movable contacts including a stationary contact 11 and a movable contact blade or rod 12 arranged to be operated so as to draw an arc in an arc chute 13, the entire unit being suitably mounted on an insulator 14. The stationary or fixed contact 11 is connected to a line terminal 15 while the movable contact 12 is connected to a corresponding line terminal, not shown, by means of conductor 16. 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 the 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 17, 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 17 upon opening of the circuit breaker drives the arc into the arc chute 13 against the edges of a plurality of partitions or baffles 18 which 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 blade of rod 12. The circuit breaker 10 described thus far is not our invention but is described and claimed in Patent No. 2,284,842 referred to above.

Any suitable means for producing relative movement between contacts 11 and 12 of the circuit breaker 10 may be provided although, for the sake of simplicity in the drawings, such means have been omitted since they form no part of our invention.

In order to provide a blast of fluid at the contacts 11 and 12 for arc-extinguishing purposes upon operation of the circuit breaker 10, we provide a source of fluid under pressure 19 connected to conduit 17 through conduit 17a and a blast valve 20 which is biased to the closed position by spring means 21 and which may have any suitable means, such as a solenoid or fluid motor, connected to the operating rod 22 thereof for causing opening of blast valve 20. A suitable control means, not shown, to correlate the opening of blast valve 20 with the relative separation of contacts 11 and 12 will also be provided as is well understood by those skilled in the art. It should also be understood that a blast of fluid upon closing of the circuit breaker to prevent an arc from striking may also be desirable as well as a blast of fluid for arc extinguishing purposes

upon opening of the circuit breaker and accordingly blast valve 20 may be controlled to give a closing as well as an opening fluid blast.

In order to enable the conducting parts of circuit breaker 10, and particularly the movable conducting parts, to carry very high currents within the permitted range of temperature rise without greatly increasing the mass of such movable conducting parts and, consequently, reducing the operating speed of the circuit breaker, contact blade or rod 12 has been constructed as a hollow shell with a fluid passage 23 there-through. Fluid enters passage 23 through opening 24 at the lower end of contact blade 12 and leaves through openings 25 at the upper end thereof so that cool fluid, such as air, may be circulated to aid in the dissipation of heat produced by the heavy currents carried by circuit breaker 10. The hollow blade contact 12 is preferably constructed as best shown in Fig. 2 and comprises a pair of side plates 26 and end plates 27 and 28 fastened together by suitable fastening means, such as bolts 29. In order that the ends of bolts 29 do not interfere with the movement of contact blade 12, suitable recesses 30 in plates 29 are provided. End plate 28 of contact blade 12 has an extension 28a thereon which terminates into arcing tip 12' and which also acts as a guide for the contact blade 12 in its movement within arc chute 13.

Cooling medium, such as air, may be circulated through the passage 23 in hollow contact blade 12 merely by the chimney effect which causes the heated air to rise and escape through openings 25 so that cool air is drawn in at the bottom of contact blade 12. Such cool air may be drawn through an opening in conduit 17, or, as illustrated in Fig. 1, through a T-shaped conduit 31 interconnecting conduits 17 and 17a. In order to insure good heat transfer from contact blade 12, we prefer to provide a suitable forced circulation means generally indicated as fan or blower 32, for circulating a cooling stream of air or other gas through hollow contact blade 12 as indicated by the arrows in Fig. 1. It will be understood that any suitable prime mover and control means may be provided for operating fan or blower 32.

In order that none of the fluid blast from source 19 upon opening of blast valve 20 either during the circuit-interrupting or circuit-closing operation may be lost either through T-shaped conduit 31 or through passage 23 in hollow contact blade 12, suitable means, as described hereinafter, are provided to prevent such escape of the fluid blast. A suitable valve 33 is provided in T-shaped conduit 31 which is normally maintained in the open position either by suitable spring means or by gravity as indicated in Fig. 1. Upon opening of blast valve 20, however, the intense fluid blast released through conduits 17 and 17a closes valve 33, thus preventing the escape of such fluid blast through the conduit leading to blower 32. Also, we provide a suitable gate valve or damper 34 pivotally mounted at 35 in the passage 23 at the lower end of contact blade 12 to prevent the escape of a large portion of the fluid blast. This damper 34 is maintained in the open position at least while the circuit breaker is carrying current by any suitable means, such as gravity. Upon opening of blast valve 20, the intense fluid blast causes gate valve or damper 34 to move to the dotted position indicated in Fig. 1 to close the passage 23 through blade contact 12, thus permit-

ting the blast to have its maximum effectiveness in moving the arc drawn into the arc chute 13 for extinguishment of the same. The gate valve or damper 34 is of sufficient mass as to be unaffected by the cooling air from blower 32 when the circuit breaker is in the current-carrying position indicated in Fig. 1 so that it remains in the open position under these conditions. In order to insure closure of damper 34 immediately upon opening of blast valve 20, a suitable extension 36 is provided on damper 35 which prevents as complete an opening of passage 23 as might otherwise be provided.

In view of the detailed description included above, the operation of the circuit breaker 10 embodying our invention will be obvious to those skilled in the art and no further discussion thereof will be made.

Although we have illustrated our invention in Figs. 1 and 2 as applied to a fluid-blast circuit breaker of the cross-blast type, it is also applicable to other types of fluid-blast circuit breakers, such, for example, as the radial blast type of circuit breaker disclosed and claimed in copending application, Serial No. 376,215, filed January 27, 1941, upon an application of William K. Rankin, and assigned to the same assignee as the present application. Accordingly, in Fig. 3, we have schematically illustrated a modification of our invention as applied to a circuit breaker particularly adapted for high-voltage outdoor applications.

Referring now to Fig. 3, we have illustrated a circuit breaker generally indicated at 40 comprising a pair of identical interrupting heads 41 serially arranged between line terminals 42 and 43. The structural features of the interrupting head 41 associated with line terminal 42 is shown in section in order that these features which are somewhat schematically shown, may become apparent. These structural features, however, form no part of the present invention but are disclosed and claimed in the copending application, Serial No. 376,215, referred to above. Each of the interrupting units 41 includes a pair of relatively movable contacts 44 and 45, the former being a retractable pin-type contact while the latter is a stationary contact. Preferably, retractable pin-type contact 44 is suitably connected to a fluid motor which we have illustrated as comprising a piston 46 mounted for reciprocal movement in a cylinder 47. Suitable biasing means, such as spring 48, may be provided for constantly urging retractable pin-type contact 44 to the closed position to engage stationary contact 45. The contact structure of the interrupting heads 41 described thus far is in many respects similar to that disclosed and claimed in United States Letters Patent 2,084,885, granted June 26, 1937, upon an application of Josef Biermanns, and assigned to the same assignee as the present application.

In order to complete the circuit between line terminals 42 and 43, retractable pin-type contact 44 is connected to terminal 42 by means of a flexible lead 49 while stationary contact 45 is connected to a stationary disconnecting contact 50 which cooperates with a movable disconnecting contact 51. The interrupting head 41 associated with terminal 43 has identical disconnecting contacts 50 and 51. Any suitable means for opening disconnecting contacts 50 and 51 after the circuit has been interrupted by interrupting heads 41 may be provided and, as illustrated in Fig. 3, should rotate conducting

member 52 to isolate the electric circuit between terminals 42 and 43 after interruption of the circuit by interrupting heads 41.

The contacts 44 and 45 of interrupting heads 41 are separable within an interrupting chamber 53 which, in the present instant, is elongated and formed of a mechanically strong insulating material. The interrupting chamber 53 is mounted within a suitable insulating column 54 provided with a weatherproof hood 55.

Separation of contacts 44 and 45 is obtained by introducing fluid under pressure from a source, not shown, into conduit 56, which is connected by means of conduits 57 and 57a with the interrupting chamber 53. Upon introduction of such a blast of fluid, piston 46 is moved upwardly, moving contact 44 at the same time and the arc drawn between contacts 44 and 45 is extinguished by the radial blast of fluid surrounding the arc.

In order to increase the current-carrying capacity of the circuit breaker 40 without increasing the mass of movable contact 44 to the extent of slowing down the opening movement thereof, we provide a continuous cooling stream of air or other fluid through interrupting chamber 53 around contacts 44 and 45 whenever the circuit breaker is carrying current. As illustrated in Fig. 3, we have provided suitable valves 58 between conduits 57 and 57a which are normally biased to the open position by spring means 59 so that air or other cooling fluid may enter openings 60 thereof and pass through interrupting chamber 53 as indicated by the arrows in Fig. 3 to cool the conducting parts of circuit breaker 40 and particularly the moving conducting parts thereof. As illustrated in Fig. 3, this cooling stream of air is caused to flow by the well-known chimney effect but it should be understood by those skilled in the art that a suitable blower similar to that shown in Fig. 1 may be provided if desired. In either event, whenever a fluid blast is introduced into conduit 56, the blast pressure moves valves 58 to the closed position so that the effectiveness of the fluid blast from conduit 56 for arc extinguishing purposes is not impaired by the escape of such fluid through valve 58.

The operation of the radial blast circuit type interrupter of Fig. 3 will be obvious to those skilled in the art and no further description will be included herewith.

It should be understood that, although our invention is primarily concerned with cooling the moving parts of an air-blast circuit breaker of high current-carrying capacity, under certain conditions, such as in cold climates, a heating medium may be circulated instead of a cooling medium to prevent the condensation of moisture and the freezing thereof or for any other purposes.

By cooling the movable conducting parts of air-blast circuit breakers in the manner indicated above, not only is high-speed operation of high current-carrying capacity circuit breakers made possible but many other economic advantages are also obtained. For example, the overall dimensions of the circuit breaker are considerably reduced and the cost and the space occupied are accordingly diminished.

While we have illustrated specific embodiments of our invention, 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 and scope of our invention.

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

1. In a high-speed fluid-blast circuit breaker comprising stationary and movable current-conducting parts including relatively movable contacts, means for supplying a blast of fluid under pressure adjacent said relatively movable contacts during the circuit opening operation of said circuit breaker, means for circulating a fluid medium adjacent said current-conducting parts while said circuit breaker is carrying current, and means for rendering said last-mentioned means ineffective whenever said first-mentioned means operates to supply a blast of fluid adjacent said relatively movable contacts.

2. In a fluid-blast circuit breaker comprising stationary and movable current-conducting parts including relatively movable contacts, a source of fluid under pressure, means including a conduit and a blast valve for conducting fluid from said source adjacent said relatively movable contacts during the circuit-opening operation of said circuit breaker, means for introducing a fluid medium into said conduit to cool said current-conducting parts while said circuit breaker is in its current-carrying position, and means for preventing the fluid from said source from escaping through said last-mentioned means whenever said blast valve is opened to supply a blast of fluid adjacent said relatively movable contacts.

3. In a fluid-blast circuit breaker comprising stationary and movable current-conducting parts including relatively movable contacts, a fluid passageway in said movable current-conducting part, means for circulating a fluid medium through said fluid passageway to cool said movable current-conducting part while said circuit breaker is in the closed position to carry current, a source of fluid under pressure, means including a blast valve connected between said source and said relatively movable contacts for supplying a blast of fluid for arc-extinguishing purposes adjacent said relatively movable contacts during the circuit-interrupting operation of said circuit breaker, and means for closing said fluid passage through said movable conducting part in response to opening of said blast valve.

4. In a fluid-blast circuit breaker comprising stationary and movable current-conducting parts including relatively movable contacts, means for producing a blast of fluid adjacent said relatively movable contacts for arc-extinguishing purposes during the circuit-opening operation of said circuit breaker, means for cooling at least the movable current-conducting parts of said circuit breaker when said circuit breaker is in the current-carrying position so that the mass of said movable parts may be maintained at a minimum to permit high-speed operation of said circuit breaker, and means for preventing the effectiveness of said fluid blast from being impaired by said last-mentioned means.

5. In a fluid-blast circuit breaker comprising stationary and movable current-conducting parts including relatively movable contacts, a source of fluid under pressure, means connected to said source for producing a blast of fluid adjacent said relatively movable contacts during both the circuit-opening and circuit-closing operations of said circuit breaker, means for cooling the movable current-conducting parts of said circuit

breaker when said circuit breaker is in the current-carrying position so that the mass of said movable parts may be maintained at a minimum to permit high-speed operation of said circuit breaker, and means dependent upon the operation of said first-mentioned means for preventing said last-mentioned means from impairing the effectiveness of said fluid blast.

6. In a high-speed fluid-blast circuit breaker comprising stationary and movable current-conducting parts including relatively movable contacts, a source of fluid under pressure, means including a blast valve connected to said source for producing a blast of fluid from said source adjacent said relatively movable contacts during the circuit-opening operation of said circuit breaker, blower means for introducing a fluid medium adjacent said movable current-conducting parts to cool the same when said circuit breaker is carrying current, and means responsive to the operation of said blast valve for preventing fluid from said source from escaping through said blower means.

7. In a fluid-blast circuit breaker comprising stationary and movable current-conducting parts including relatively movable contacts, an arc-confining structure surrounding said relatively movable contacts, means including a valve biased to the open position for permitting a cooling fluid medium to enter into said arc-confining structure, said arc-confining structure being mounted in such a manner that circulation of said cooling medium adjacent said movable conducting parts to cool the same when said circuit breaker is carrying current is caused by convection, a source of fluid under pressure, and means associated with said source for producing a blast of fluid adjacent said relatively movable contacts for arc-extinguishing purposes during the circuit-opening operation of said circuit breaker and for moving said valve to the closed position to maintain the arc-extinguishing effect of said blast of fluid at a maximum.

8. In an electric circuit breaker of the fluid-blast type comprising relatively movable current-conducting parts, a fluid passageway in one of said relatively movable current-conducting parts, means for circulating a fluid medium through said fluid passageway to cool said one of said relatively movable current-conducting parts while said circuit breaker is in its current-carrying position whereby the mass of said one of said current-conducting parts may be maintained at a minimum to permit high-speed operation of said circuit breaker, means for introducing an arc-extinguishing fluid blast adjacent said relatively movable current-conducting parts dur-

ing the circuit-interrupting operation of said circuit breaker, and means for closing said fluid passage during the circuit-interrupting operation to prevent the escape of said arc-extinguishing fluid blast.

9. In an electric circuit breaker of the fluid-blast type comprising a stationary and a movable current-conducting part including relatively movable contacts, a fluid passageway in said movable current-conducting part, fan means for circulating a fluid medium through said fluid passageway to cool said movable current-conducting part while said circuit breaker is in its current-carrying position, a source of fluid under pressure, means including a blast valve connected between said source and said relatively movable contacts for producing a blast of fluid for arc-extinguishing purposes adjacent said relatively movable contacts during the circuit-interrupting operation of said circuit breaker, and a damper member in said fluid passageway continuously biased toward the open position but movable to the closed position in response to the introduction of said blast of fluid from said source upon opening of said blast valve to prevent the escape of said blast of fluid through said passageway during the circuit-interrupting operation of said circuit breaker, said damper member being unaffected by the operation of said fan means.

10. In an electric circuit breaker of the fluid-blast type comprising a stationary and a movable current-conducting part including relatively movable contacts, a fluid passageway in said movable current-conducting part, fan means for circulating a fluid medium through said fluid passageway to cool said movable current-conducting part while said circuit breaker is in its current-carrying position, a source of fluid under pressure, means including a blast valve connected between said source and said relatively movable contacts for producing a blast of fluid for arc-extinguishing purposes adjacent said relatively movable contacts during the circuit-interrupting operation of said circuit breaker, a damper member in said fluid passageway continuously biased toward the open position but movable to the closed position in response to the introduction of said blast of fluid from said source upon opening of said blast valve to prevent the escape of said blast of fluid through said passageway during the circuit-interrupting operation of said circuit breaker, and means responsive to the operation of said blast valve for preventing the escape of said blast of fluid through said fan means.

CARL THUMIM.

ALEXANDER C. BOISSEAU.

CERTIFICATE OF CORRECTION.

Patent No. 2,298,778.

October 13, 1942.

CARL THUMIM, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 29, for "of rod" read --or rod--; page 3, second column, after line 34, insert the following as line 1 of claim 3 -

-- 3. In an electric circuit breaker of the fluid- --;

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 24th day of November, A. D. 1942.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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