April 23, 1957 C. A. FAWDREY ET AL 2,790,050

FLUID-BLAST CIRCUIT BREAKER

Filed Aug. 4, 1954 2 Sheets-Sheet 1

Fig. 1.

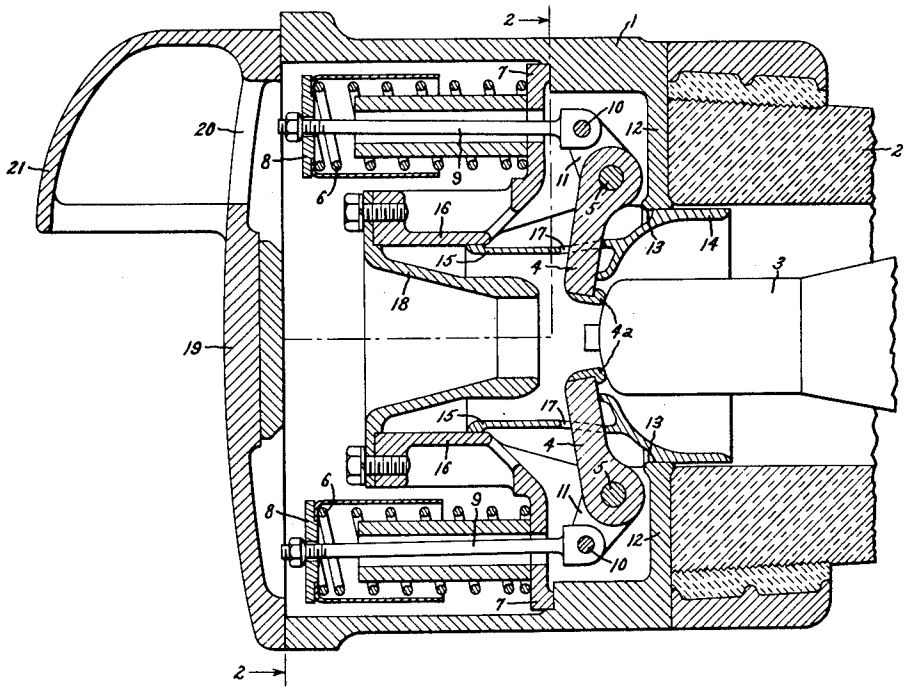
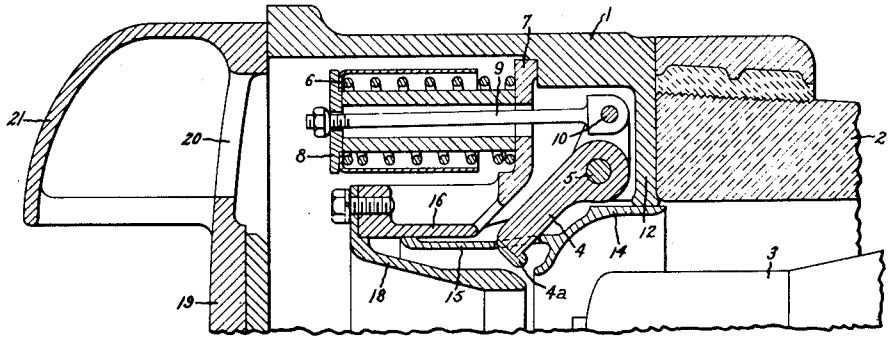



Fig. 3.



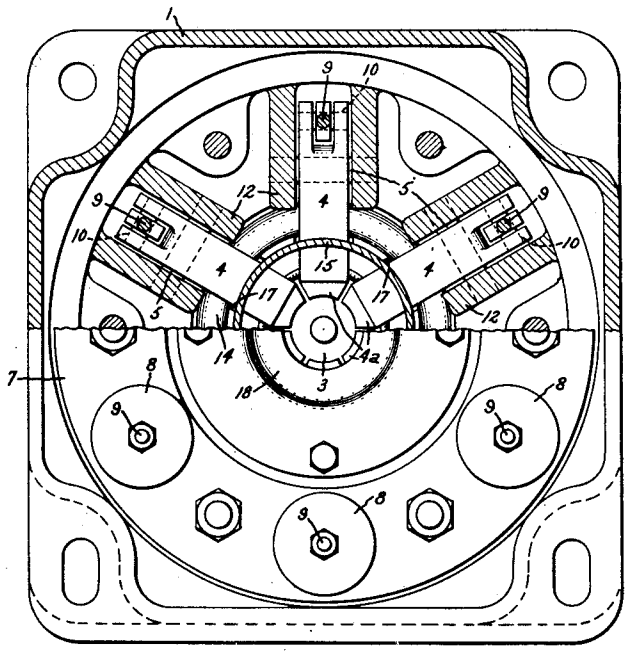

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Fig. 2.




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2,790,050

# FLUID-BLAST CIRCUIT BREAKER

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15 Claims. (Cl. 200—148)

This invention relates to fluid-blast electric circuit breakers of the kind in which relatively movable contacts are arranged within an arc extinguishing chamber or enclosure to which fluid, preferably air or gas, is supplied under pressure to interrupt the circuit through said contacts, and an annular piston which forms a movable nozzle or restricted passage or throat in the fluid stream is actuable by the application of pressure fluid to said chamber to separate said contacts. The contacts may conveniently comprise a plurality of spring-pressed contact fingers disposed radially round a central fixed contact.

According to the present invention, in a fluid-blast electric circuit breaker of the kind referred to, the movable piston when displaced under the action of the fluid pressure retracts the movable contact or contacts completely from the path of the fluid stream through the throat or nozzle. The piston is located in the fluid flow path on the upstream side of the contacts and the piston includes a portion in the open position of the circuit breaker shielding the movable contact(s) from the arc; for this purpose the arrangement preferably includes a throat member located on the downstream side of the contacts and the piston is movable to a position in which said portion thereof is located adjacent the upstream end of said throat member to form therewith a substantially continuous passage, preferably of a Venturi configuration. With arrangements according to the invention, in the open position of the switch or circuit breaker the movable contact(s) do not project into the fluid stream, the contour of the throat is unaffected by the desired shape of the movable contact members and the contact making parts of the movable contact members are relieved from burning due to the arc, the arc in the retracted position of the contact fingers and the piston being transferred to the piston or to a wall of the throat on the downstream side of the movable contact members.

In carrying out the invention the switch or circuit breaker may be of the otherwise well known form in which a fixed contact is arranged axially within a cylindrical insulating housing carrying at one end a contact member and contact assembly comprising a plurality of pivoted contact fingers located on radial planes of the bushing and distributed round said axis and normally projecting inwardly into engagement with an end surface of the fixed contact.

One embodiment of the invention will now be briefly described by way of example with reference to the accompanying drawings, in which

Fig. 1 is a longitudinal elevation in section showing a preferred arrangement of circuit breaker of the kind just above set forth,

Fig. 2 is a sectional elevation on the line II—II of Fig. 1, and

Fig. 3 is a sectional half elevation corresponding with Fig. 1, but showing the switch parts in the open circuit position.

The circuit breaker shown in the drawings is of the type wherein the contact arrangement is mounted within



a metal housing 1 secured to the open end of a ceramic insulating bushing 2 which is suitably supported at its other end (not shown) on a supporting structure including means for supplying fluid under pressure through control valve means to the internal passage within the bushing. This structure also supports a contact 3 in the form of an elongated rod mounted coaxially in the bushing 2. This contact 3 may be either a fixed interrupting contact or a movable isolating contact. A plurality of moving contact fingers 4 are pivotally mounted on pins 5 within the housing 1, for example six such fingers uniformly distributed round the bushing 2. The fingers 4 are biased into engagement with the end of the contact 3 by means of compression springs 6, which at one end (Fig. 1) bear against a pressure plate 7 and at the other end bear against discs 8 connected by means of tension rods 9 and pin joints 10 with bifurcated tail parts 11 of the contact fingers 4. The contact fingers 4 may carry tips such as 4a of high conductivity metal (e. g. silver).

The housing 1 includes a flange 12 having a mechanical central opening at 13 in which is slidably mounted a piston 14. The piston 14 is a trunk piston, that is to say includes an extension 15 which is slidably mounted within a cylinder 16 forming a central part of the pressure plate 7. Said part 15 includes openings such as at 17 through which the pivoted contact fingers 4 extend respectively.

A tubular exhaust member 18 is secured to the pressure plate 7 and extends within the part 15 of the piston into proximity with the free end of the fixed contact 3.

The housing 1 is completed by an end cover 19 having a discharge opening 20 and cowl 21.

In the closed condition shown in Fig. 1, the springs 6 bias the contact fingers 4 into engagement with the end of the fixed contact 3 and the piston 14 is positioned by said contact fingers so as substantially to close the annular fluid passage between said contact 3 and the flange 12. When fluid under pressure is supplied to the interior of the bushing 2 the pressure thereof will act on the piston 14 to displace the latter to the left hand in Fig. 1, whereby said piston by engagement of the surfaces of the openings 17 will displace the contact fingers 4 against the action of the springs into the positions shown by Fig. 3. The fluid under pressure then flows through the annular spaces between the piston 14 and the tip of the contact 3. As can be most clearly seen from Fig. 3 the form of the piston is such as to provide in conjunction with the member 18 a desirably contoured passage for the air, which passage is substantially uninterrupted. This passage is preferably of a Venturi configuration, i. e., it gradually converges from its upstream into a contracted central region and gradually diverges in a downstream direction from said central region. Furthermore, the contact fingers are completely withdrawn from said passage, being located, as will be seen from Fig. 3, radially without the curved inner surfaces of the piston 14.

Upon closure of the control valve referred to, the piston 14 and contact fingers 4 revert to the circuit closed positions shown in Fig 1.

It will be seen that in the multi-finger contact arrangement shown in the drawings, for a fluid blast circuit breaker, the driving piston 14 for the contact fingers is located in the fluid path on the upstream side of the contact fingers, and said piston forms also a fluid flow nozzle or throat which in the open position shields the contact fingers from the arc. Preferably, as is shown in the drawing, the throat formed by the piston is continued by a tubular member such as the throat member 18.

While we have shown and described a particular embodiment of our invention, it will be obvious to those

skilled in the art that various modifications may be made without departing from the true spirit of our invention.

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

1. In a fluid-blast circuit breaker, a first contact having an axis, a second contact mounted to extend generally radially with respect to said axis and having an inner end portion arranged to engage said first contact in circuit-closing relationship, a generally tubular piston movable in response to a fluid blast to separate said second contact from said first contact whereby to establish an arc, said piston having internal throat surfaces defining a flow passage for directing said fluid blast into said arc, said inner end portion of said second contact being located radially inwardly of said throat surfaces when said second contact is in circuit-closing position, and means responsive to contact-separating movement of said piston for retracting the inner end portion of said second contact into a position disposed radially outwardly of said internal throat surfaces.

2. In combination, a first contact, a plurality of movable contacts disposed in radially extending relationship about said first contact and having radially inner end portions projecting into circuit-closing engagement with said first contact, a generally tubular piston coupled to said movable contacts and movable in response to a fluid blast to separate said movable contacts from said first contact whereby to establish an arc, said piston having internal throat surfaces defining a flow passage for directing said fluid blast into said arc, said radially inner end portions of said movable contacts being located radially inwardly of said internal throat surfaces during initial contact separation, means responsive to contact-separating movement of said piston for retracting the radially inner end portions of said movable contacts into positions disposed radially outwardly of said internal throat surfaces.

3. In combination, a first contact having an axis, a tubular member mounted in spaced relationship to said first contact and defining a downstream throat, a second contact mounted to extend generally radially with respect to said axis and having an inner end portion arranged to engage said first contact in circuit-closing relationship, a generally tubular piston movable in response to a fluid blast on its upstream side to separate said second contact from said first contact, said piston having an upstream throat for directing said fluid blast into said downstream throat, said fluid blast being effective to move said piston into a circuit-open position in which said upstream throat is located adjacent said downstream throat and defines therewith a substantially continuous flow passage, said inner end portion of said second contact being located radially inwardly of said upstream throat when said second contact is in circuit closing engagement with said first contact, and means responsive to contact-separating movement of said piston for retracting the inner end portion of said second contact into a position disposed radially outwardly of the internal surface of said continuous flow passage.

4. The combination of claim 3 in which said continuous flow passage gradually converges from its upstream side into a contracted central region and gradually diverges in a downstream direction from said central region.

5. The combination of claim 3 in which, progressing in the direction of flow, said upstream throat gradually decreases in cross-sectional area and said downstream throat gradually increases in cross-sectional area.

6. In combination, a first contact, a second contact, means for urging said second contact toward engagement with said first contact, a tubular throat member mounted in spaced relationship to said first contact, a piston coupled to said second contact and movable toward said tubular member in response to a fluid blast whereby to separate said second contact from said first contact, said piston having a throat portion cooperating with said throat member to define for said fluid blast a flow passage which extends through said tubular member, said second contact projecting into said flow passage when near a position of engagement with said first contact, and means responsive to contact-separating movement of said piston for shifting said second contact out of projecting relationship to said flow passage and into a position which is substantially completely bypassed by said flow passage.

7. In combination, a first contact, a tubular exhaust member mounted in spaced relationship to said contact, a generally tubular piston axially movable from a first position adjacent said contact into a second position adjacent said tubular exhaust member, means for supplying a fluid blast to said piston thereby to move said piston from said first to said second position, said piston having internal surfaces defining a throat arranged to direct said fluid blast into said tubular exhaust member, a second contact coupled to said piston and arranged to extend generally radially into circuit-closing engagement with said first contact, a portion of said second contact being disposed radially inwardly of said throat when said second contact is in circuit closing engagement with said first contact, and means responsive to axial movement of said piston into said second position for separating said contacts and for retracting said second contact into a position disposed completely radially outside of the internal surfaces of said throat.

8. In combination, an axially extending first contact, a movable generally tubular piston having internal surfaces defining a throat surrounding said first contact and having generally radially extending apertures contained therein, a plurality of movable contacts mounted to extend through said apertures radially inwardly of said internal throat surfaces, and into circuit-closing engagement with said first contact, fluid blast means for moving said piston in a direction to separate said contacts, and means responsive to contact-separating movement of said piston to retract said movable contacts into positions disposed completely radially outside of said internal throat surfaces.

9. In combination, an axially extending first contact, a movable generally tubular piston having internal surfaces defining a flow passage, said piston being provided with a generally radially extending aperture; a movable contact finger mounted to extend through said aperture, into said flow passage, and into circuit-closing engagement with said first contact; fluid blast means operable to move said piston in a direction to separate said contact members thereby to establish an arc, said flow passage being arranged to conduct the fluid blast into arc-extinguishing relationship with said arc, and means responsive to contact-separating movement of said piston for retracting said contact finger into a position located completely radially outside of the internal surfaces of said flow passage.

10. In combination, an axially extending first contact, a movable generally tubular piston having internal surfaces defining a throat, said piston being provided with a generally radially extending aperture, a movable contact finger arranged to extend through said aperture radially inwardly of said internal throat surfaces, and into circuit-closing engagement with said first contact, a tubular exhaust member spaced from said first contact and having internal surfaces defining a second throat, fluid blast means operable to move said piston in a direction to separate said contact members, said contact-separating movement being effective to move said piston into position wherein said throats collectively define a substantially continuous flow passage, and means responsive to contact-separating movement of said piston for retracting said movable contact finger into a position located completely radially outside of the internal surface of said continuous flow passage.

11. The combination of claim 10 in which said continuous flow passage has a Venturi configuration.

12. In combination, a first contact, a second contact, means for urging said second contact toward engagement with said first contact, a tubular exhaust member mounted in spaced relationship to said first contact, a tubular piston coupled to said second contact and movable toward said exhaust member in response to a fluid blast whereby to separate said second contact from said first contact, said piston having a wall portion defining a throat for directing said blast into said exhaust member, said second contact when in closed position extending radially inwardly of said throat, said contact-separating movement of the piston being effective to move said piston into a position in which said wall portion effectively shields said second contact from the fluid blast whereby said fluid blast is directed into the exhaust member by a path which effectively bypasses said second contact.

13. In a fluid blast circuit breaker of the type having a plurality of radially extending pivotally-mounted contact fingers biased into circuit-closing engagement with an axially-extending contact, a piston movable in response to a fluid blast to separate said contact fingers from said axially-extending contact whereby to establish an arc, said piston having internal surfaces defining a flow passage which directs the fluid blast into said arc, said contact fingers when near closed position extending into said flow passage, and means responsive to contact-separating movement of said piston for retracting said contact fingers into a position located completely radially outside of the internal surfaces of said flow passage.

14. In a fluid blast circuit breaker of the type having a plurality of radially extending pivotally-mounted contact fingers biased into circuit-closing engagement with an axially extending contact, a piston movable in response to a fluid blast on its upstream side to separate said fingers from said axially extending contact whereby to establish an arc, said piston having internal surfaces defining a flow passage which tapers toward its downstream side, said flow passage being arranged to direct the fluid blast into said arc, said contact fingers when near closed position extending into said flow passage, and means responsive to contact-separating movement of said piston for retracting said contact fingers to positions located completely radially outside of the internal surfaces of said flow passage.



15. In combination, a first contact, a second contact, means for urging said second contact toward engagement with said first contact, a tubular exhaust member mounted in spaced relationship to said first contact, said second contact extending radially inwardly of said tubular exhaust member when engaging said first contact, a piston coupled to said second contact and movable to drive said second contact into a position located adjacent to but radially outside of said tubular exhaust member whereby to establish an arc between said contacts, and means for directing a fluid blast into said arc and into said tubular exhaust member substantially concurrently with said piston movement.

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