

April 19, 1960

B. P. BAKER
CIRCUIT INTERRUPTERS

2,933,575

Filed Oct. 22, 1956

3 Sheets-Sheet 1

Fig. 1.

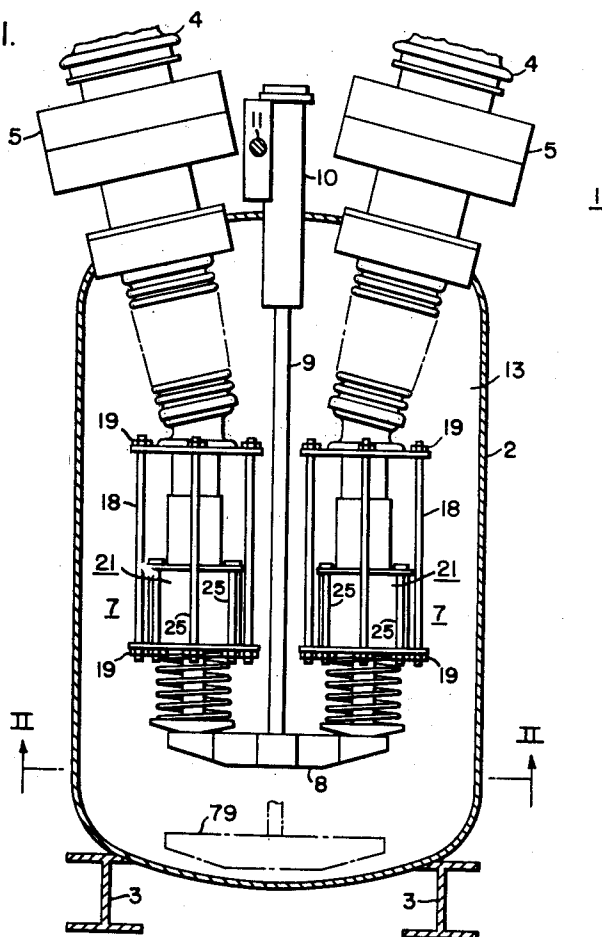
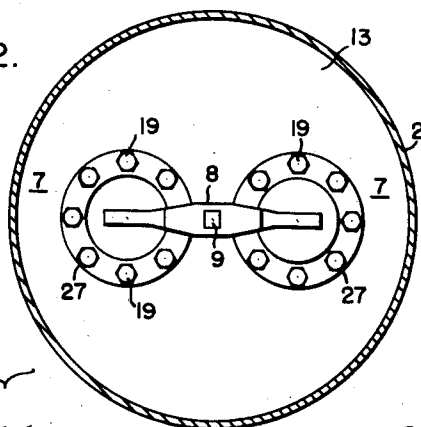


Fig. 2.



WITNESSES

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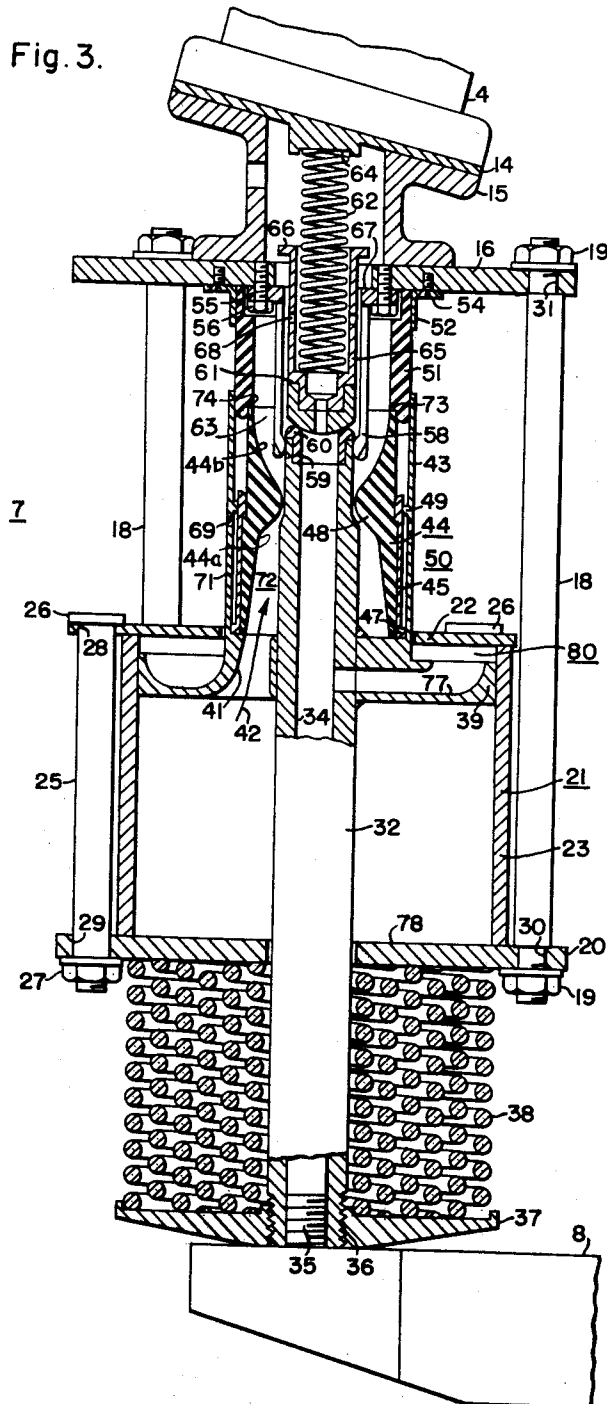
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Fig. 3.



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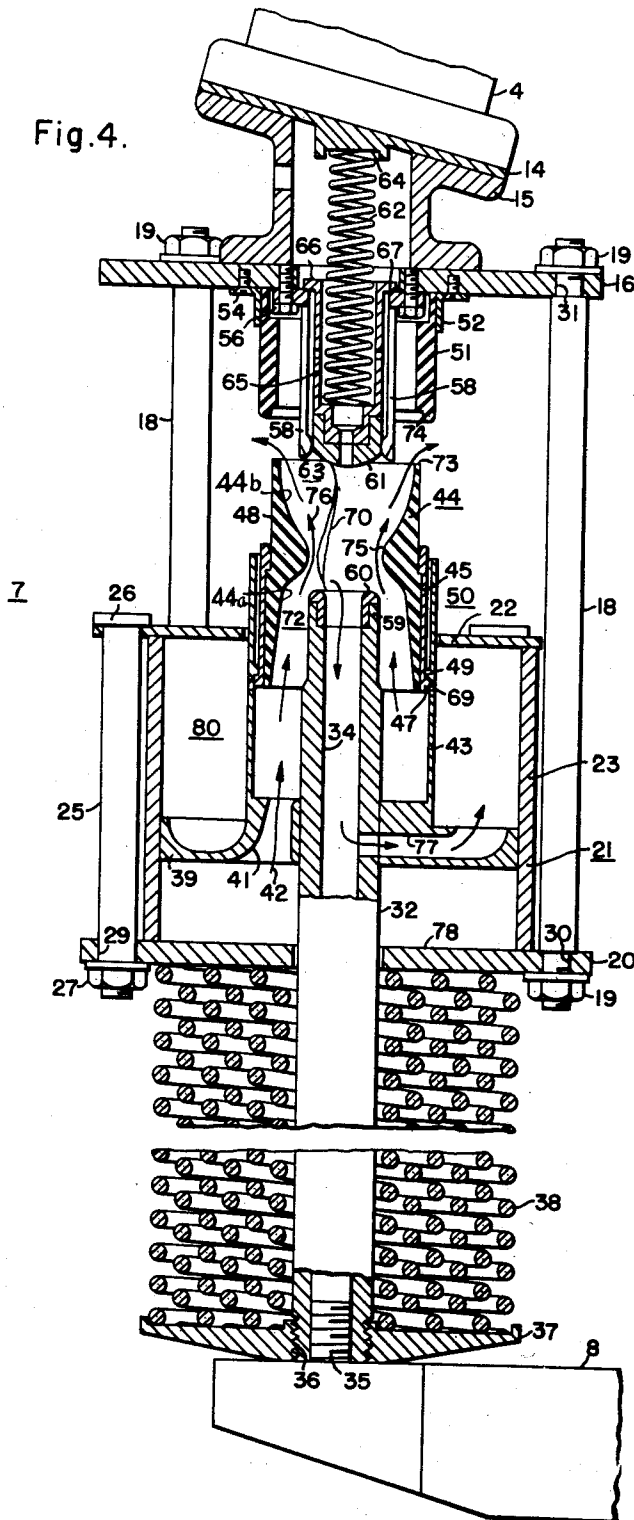
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Fig. 4.



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2,933,575

CIRCUIT INTERRUPTERS

Benjamin P. Baker, Monroeville, Pa., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application October 22, 1956, Serial No. 617,495

8 Claims. (Cl. 200—148)

This invention relates to circuit interrupters in general, and, more particularly, to circuit interrupters of the fluid-blast type.

A general object of the present invention is to provide an improved circuit interrupter of the fluid-blast type which will be more effective in operation than those heretofore used.

A more specific object of the invention is to provide an improved circuit interrupter wherein an arc is drawn within an orifice member, and in which the exhaust side of said orifice member is closed during the initial portion of the opening operation until the arc has attained a predetermined length.

Still a further object of the invention is to provide an improved arc-extinguishing structure which is self-contained and adapted for piston operation.

A further object of the invention is to provide an improved circuit interrupter of the type utilizing a piston operable within an operating cylinder, and in which the arcing pressure is communicated to the back side of the piston, with the operating cylinder being substantially closed, so that the arcing pressure may accelerate the opening, working stroke of the piston.

Another object of the invention is to provide an improved fluid-blast circuit interrupter in which application of the fluid blast at the established arc is delayed until the arc has attained a predetermined length during the opening operation.

Another object of the invention is to provide an improved fluid-blast circuit interrupter particularly adapted for use with a fluoride gas such as SF_6 or SeF_6 , or wherein the fluid is a mixture of one of the foregoing gases and one or more inert gases including nitrogen, air, argon, helium, and carbon dioxide.

Although the invention is particularly described as utilizing one of the foregoing gases, or mixtures, which have special utility in this invention, it is to be understood that the broader term "fluid" when used in the claims and in the specification, includes gases, liquids, vapors, and sprays.

In United States patent application filed June 7, 1956, Serial No. 590,066, by Benjamin P. Baker, and assigned to the assignee of the instant application, there is shown and described a compressed-gas circuit interrupter utilizing a dead-tank construction. Each of the three tanks for a three-phase interrupter of the foregoing type contains arc-extinguishing units depending from the lower interior ends of two terminal bushings which extend into each tank adjacent the upper end thereof. Each tank was illustrated as containing compressed air at a pressure of approximately 250 p.s.i. It is a further object of the present invention to obtain all of the advantages of a fluid-blast circuit breaker of the type set out in the aforesaid application, wherein the gas may be either SF_6 or SeF_6 or one of the foregoing gases admixed with one or more of the following gases, namely, nitrogen, air, argon, helium and carbon dioxide.

By such use of one or more of these latter gases, one

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may utilize such gas within a tank of the type set out in the foregoing patent application at a considerably reduced pressure, say approximately 50 p.s.i. with the tank wall thickness being correspondingly reduced. It is, therefore, a further object of my invention to improve upon the compressed-air circuit interrupter of the foregoing patent application in such an indicated manner to generally improve and make more efficient the operation of such circuit interrupters, as will be brought out hereinafter.

Still a further object of the invention is to provide an improved, self-contained arc-extinguishing unit employing a piston construction for compressed fluid flow, wherein the several parts are of simple construction, may be readily assembled, and disassembled, and will be economical to manufacture.

Further objects and advantages will readily become apparent upon reading the following specification, taken in conjunction with the drawings, wherein:

Figure 1 is a vertical, sectional view through a tank-type circuit interrupter embodying the principles of the invention, and shown in the closed-circuit position;

Fig. 2 is an inverted plan view taken through the circuit interrupter of Fig. 1 along the line II—II of Fig. 1, looking in the direction of the arrows;

Fig. 3 is a vertical, sectional view through the left-hand arc-extinguishing unit of the circuit interrupter of Fig. 1, the contact structure being likewise shown in the closed-circuit position; and

Fig. 4 is a view similar to that of Fig. 3, but illustrating the position of the several parts of the arc-extinguishing unit at a later point in the circuit interrupter opening operation.

Referring to the drawings, and more particularly to Fig. 1 thereof, the reference numeral 1 generally designates a three-phase circuit interrupter of the fluid-blast type. Although only one pole of the interrupter is shown in Fig. 1, it is to be understood that two other tanks 2 may be mounted upon the girders 3 in like manner, and the three tanks 2 being mechanically interconnected by means well-known in the art, and simultaneously actuated by any suitable common mechanism.

Extending downwardly within the tank 2 is a pair of terminal bushings 4 having secured to their lower interior ends a pair of identical arc-extinguishing units generally designated by the reference numeral 7. The bushings 4 are surrounded by current transformers 5 outside of the tank. Electrically interconnecting the two units 7 of the illustrated pole is a conducting bridging member 8, vertically actuated in a reciprocal manner by an insulating lift rod 9. The upper end of the lift rod 9 is connected to a straight-line linkage, not shown, disposed within a mechanism compartment 10. Extending longitudinally of the three tanks 2, and serving to simultaneously operate the three poles, is an operating rod 11 having a gasketed, sealed connection with the mechanism compartment 10 so that no fluid may escape lengthwise along the operating rod 11. As will be more fully explained hereinafter, the tank 2 may be filled with a suitable arc-extinguishing fluid 13, which, in the particular interrupter illustrated, is preferably an arc-extinguishing gas. Although the use of a gas 13 is very desirable, it is to be noted that the fluid 13 could be a liquid, since certain broader features of the invention have applicability regardless of the particular fluid employed.

It is preferred, however, to use as the fluid 13 sealed within the tank 2, either SF_6 or SeF_6 or one of the foregoing gases admixed with one or more of the gases including nitrogen, air, argon, helium and carbon dioxide.

Since these gases are relatively expensive, and since it is desired to use the gas repeatedly, it is found desirable to charge the tank 2 with such a gas, say at 50 p.s.i. and

to seal the opening about the operating rod 11 so that no gas leakage will be possible. When this is done, the initial pressure within the tank 2 will be maintained, and it will not be necessary during normal operation of the interrupter 1 to replenish the gas supply.

The particular construction of each arc-extinguishing unit 7 is more fully explained in connection with Figs. 3 and 4 of the drawings, which show the constructional details in an enlarged manner. With particular reference to Fig. 3, which shows the contacts closed, it will be observed that secured by any suitable means to the lower end of the terminal bushing 4 is a support plate 14. Secured to the support plate 14 is an adaptor 15, which, in turn, has secured thereto a second support plate 16. Secured to the support plate 16 by means of a plurality, in this particular instance four, insulating tie rods 18 and nuts 19 is a closure plate 20, which closes the lower end of a substantially closed puffer cylinder, generally designated by the reference numeral 21. As shown, the puffer cylinder 21 includes the lower closure plate 20, an upper closure plate 22 and an upstanding cylinder member 23.

The upper closure plate 22 is supported from the lower closure plate 20 by a plurality of, in this instance four, tie rods 25 having enlarged heads 26 and accommodating nuts 27. The upper closure plate 22 has suitable openings 28 to accommodate the tie rods 25. Also the lower closure plate 20 is provided with holes 29 for the tie rods 25, and in addition, the lower closure plate 20 has additional openings 30 provided therein to accommodate the lower ends of the insulated tie rods 18. Likewise, the upper support plate 16 has holes 31, through which the upper ends of the tie rods 18 extend.

Movable longitudinally through the substantially closed puffer cylinder 21 is a movable tubular contact 32 having a bore 34. The lower end of the movable contact 32 has the bore 34 closed by means of a plug 35. The lower end of the movable contact 32 is threaded as at 36, and has secured thereto, in threaded manner, a lower spider member 37 constituting a spring seat for a battery of compression springs 38.

As shown, the compression springs 38 are compressed in the closed-circuit position of the arc-extinguishing unit 7, being charged during the closing stroke by the conducting bridging member 8.

Secured, as by welding, to the movable contact 32 is a piston 39, which slides interiorly within the cylinder 23 and forces fluid, such as one of the foregoing gases, upwardly through a plurality of openings 41 in the direction of the arrow 42. The piston 39 preferably has integrally formed therewith an upstanding actuating cylinder 43, which surrounds an orifice member 44 preferably formed of suitable arc-resisting insulating material, which does not react with fluorine or fluoride gases, such as polytetrafluoroethylene, polychlorotrifluoroethylene or similar materials. The advantageous use of such a material is set forth and claimed in United States Patent 2,757,261, issued July 31, 1956, to Harry J. Lingal, Thomas E. Browne, Jr., and Albert P. Strom, and assigned to the assignee of the instant application.

The orifice member 44 includes a metallic casing 45 having a lower outwardly extending flange 47, and an interiorly disposed orifice liner 48 preferably made from the foregoing material. The elongated insulating orifice member 44 also includes a tapered entrance portion 44a, a restricted portion 75 and a tapered exhaust portion 44b.

The actuating cylinder 43 has an interiorly extending flange portion 49 which, after a predetermined travel, will engage the flange 47 of the orifice member 44. There is thus provided a lost-motion connection 50 between the piston 39 and the orifice member 44 so that the piston 39 may travel downwardly a predetermined distance, to thereby draw the arc to a predetermined length, before the lost-motion 50 is taken up, and the orifice member 44 is carried downwardly by the piston 39.

In the closed circuit position of the interrupter, as indicated in Fig. 3, the orifice liner 48 engages a downwardly extending tubular orifice stop 51, the latter being secured by a support flange 52 to the support plate 16 by a plurality of machine screws 54.

A stationary contact support 55, secured by bolts 56 to the support plate 16, has interiorly formed therewith a plurality of split stationary contact fingers 58, which engage the upper end 59 of the movable tubular contact 32. Preferably a tubular insert 60, composed of an arc-resisting material, is employed to prevent undue arc pitting on the tubular contact 32 and also to minimize arc erosion.

Movable interiorly within the stationary contact support 55 is a movable arcing follower member 61, biased downwardly by a compression spring 62, the upper end of which seats within a recess 64 provided by the support plate 14. The lower end of the compression spring 62 extends interiorly within a cylindrical portion 65 of the follower 61, which has at its upper end a radially outwardly extending stop flange portion 66. The stop flange 66 comes to rest, during the opening operation, upon the upper side 67 of the stationary contact support 55, thereby halting further downward travel of the follower member 61, as shown more clearly in Fig. 4 of the drawings. The cylindrical portion 65 of the follower 61 may have a plurality of small openings 68 therethrough. Also the actuating cylinder 43 may have a plurality of openings 69 to eliminate any dashpot action.

The operation of the circuit interrupter 1 will now be described. In the closed circuit position of the interrupter, as indicated in Figs. 1-3 of the drawings, the electrical circuit therethrough includes the terminal stud extending within the bushing 4, support plate 14, conducting adaptor 15, support plate 16, stationary contact support 55, contact fingers 58, movable contact 32, and through the conducting bridging member 8 to the other arc-extinguishing unit 7. The circuit extends through the other arc-extinguishing unit 7 in like manner to the other terminal bushing 4. When it is desired to open the electrical circuit passing through the interrupter, suitable mechanism, forming no part of the invention, is actuated and effects horizontal motion of the operating rod 11 across the tops of the tanks 2. Through the linkage, not shown, disposed within the mechanism compartment 10, this motion of the operating rod 11 is transmitted into downward travel of the insulating lift rod 9.

The downward travel of lift rod 9 effects corresponding downward travel of the bridging member 8, permitting the compression springs 38 to expand. This will react upon the spring base 37 to cause downward opening movement of the piston 39 and the movable contact 32.

During the initial downward opening movement of the movable contact 32, the follower member 61 will follow, thereby preventing any arcing occurring at the lower ends of the contact fingers 58. Thus, any arc, which is drawn, terminates at the lower end of the follower member 61 and not at the contact fingers 58. This will protect the contact fingers 58, and will maintain them in good condition so that in the closed-circuit position of the interrupter they will be in good condition and will carry the main current without heating.

When the movable contact 32 has moved downward to a sufficient extent, so that the flange 66 of the follower member 61 strikes the upper surface 67 of the contact support 55, further downward additional opening movement of the movable contact 32 will establish an arc 70, more clearly shown in Fig. 4, with the arc terminating at the insert 60 and at the follower member 61. During this time the orifice member 44 remains in its upward position, as indicated in Fig. 3, as a result of inertia, and also because of the provision of the openings 69, which prevent dashpot action within the actuating cylinder 43.

Following the establishment of the arc 70, the orifice

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member 44 will continue to remain in its upward position, abutting the orifice stop 51 because of the pressure conditions within the region 72. In other words, the raising pressure within the region 72 by the arc, as initially drawn, will tend to force the orifice member 44 upwardly, this raise in pressure also resulting from the downward working travel of the piston 39 within the puffer cylinder 23. As a result, the orifice member 44 will remain in its upward position, as shown in Fig. 3, until the lost-motion mechanical connection 50 is taken up, and the flange 49 of the actuating cylinder 43 strikes the flange 47, thereby causing a separation to occur between the upper end 73 of the orifice member 44 which constitutes a movable valve, and the lower end 74 of the orifice stop 51, which defines an annular valve seat. This will vent the exhaust side of the orifice member 44, and will provide a sudden release of gas pressure, thereby providing a high-pressure gas flow through the restricted part 75 of the orifice member 44, as indicated by the arrows 76. This fluid or gas flow will occur axially of the arc 70, and will quickly effect its extinction.

The arcing pressure within the region 72 will also act downwardly through the bore 34 of the movable contact 32, and through a plurality of passages 77, provided in the piston 39, to the upper non-working side of the piston 39. This action will accelerate the downward travel of the piston 39 and will assist the biasing action exerted by the compression springs 38. In other words, differential piston action will be present, and during the time of taking up of the lost-motion 50 the cross-sectional area of the movable contact 32, moving out of the puffer cylinder 21, will give a net result of the forces exerted of biasing the movable contact 32 downwardly.

Following arc-extinction, the compression springs 38 continue to expand until the piston 39 strikes the upper surface 78 of the closure plate 20, thereby preventing any additional downward opening travel of the movable contact 32. Further downward opening travel of the conducting cross-bar 8 will serve to produce a separation between the conducting cross-bar 8 and the movable contact 32, thereby inserting an isolating gap into the circuit. This condition is shown by the dotted lines 79 of Fig. 1. It will be apparent that there are thus provided two isolating gaps in the circuit, that is one between the cross-bar 8 and each arc-extinguishing unit 7.

From the foregoing description of the invention, it will be apparent that there is provided an improved fluid-blast circuit interrupter, self-contained and bringing about a circulating flow of fluid. A pressurized dead-tank construction is used, with the device designed for low pressure and completely sealed operation, except for a mechanical connection to an operator located outside of the tank 2. The particular construction of the present invention shown is suitable for the interruption of 230 kv. circuits with an interrupting capacity of 20,000,000 kva. The size and outside appearance is somewhat similar to the compressed-air circuit interrupter of the foregoing patent application Serial No. 590,066, but the tank of the present invention is filled with a gas, such as SF_6 , for example, at approximately 50 p.s.i. instead of with compressed air at 250 p.s.i. The tank wall is therefore thinner, and the improved dielectric strength and interrupting ability of the SF_6 , as compared to air, permits greater kv. and kva. to be interrupted in the same space.

The interrupters 7 are self-contained, including the contacts, interrupting orifice 44, piston 39 and cylinder 23 for gas circulation, and a driving spring 38 for the piston. The springs 38 bias the contacts to the open circuit position, and the operator located on the outside of the tank 2 holds the contacts in the closed position. Motion is transferred from the outside to the inside by the shaft 11 through a gas seal. The tank 2 is, therefore, completely sealed and charged with gas when installed. The blast of fluid for interruption is produced by the piston and cylinder during the opening operation and it

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is discharged from the interrupter 7 and to the inside of the tank 2. It is, therefore, a recirculating device, rather than a pump up and discharge breaker.

It will be noted during the initial portion of the opening operation, that the abutment by the orifice member 44 results in a closure of the exhaust side of the orifice. This condition is continued until the arc 70 has attained a predetermined length, and the lost-motion 50 is taken up. During the taking up of the lost-motion 50, pressure is being built up in the arcing chamber 72, and, when the arc is of the correct length to be interrupted, the orifice member 44 is carried downwardly with the piston 39, thereby opening up the exhaust region 63 of the orifice 48. This exhaust region 63 of the elongated orifice member 44 is in part defined by the tapered exhaust portion 44a of the orifice member 44 and the annular valve seat 51 encircling the relatively stationary contact structure. During the initial motion of the piston 39, it is compressing gas within the cylinder 23, which is suddenly allowed to escape freely through the restricted portion 75 of the orifice liner 48 to effect efficient arc-extinction. Also during the time of arcing, and even prior to opening of the valve portion 73 of orifice member 44, high-pressure gases from the arc 70 pass or exhaust through the tubular contact 32 and the passages 77 into the region 80 above the piston 39. This high pressure above the piston 39 assists the springs 38 in driving the contact 32 and piston 39 to the open contact position.

After arc-extinction, the cross-arm 8 disengages the spring spiders 37 and moves toward the bottom of the tank 2 to remove the voltage from the interrupters 7.

Certain features of the interrupter are set out and claimed in United States patent application, Serial No. 477,466, filed December 24, 1954, now United States Patent 2,924,690, issued February 9, 1960, to Thomas E. Browne, Jr., and Albert P. Strom, and assigned to the assignee of the instant application.

From the foregoing description, it will be apparent that there is provided an improved and more efficient circuit interrupter, self-contained, and in which the gas may be used over and over again because of the recirculating feature.

The holding of the pressure during the initial portion of the opening operation, while the arc is attaining a length most suitable for interruption, is believed to be desirable, since the most efficient use of the pressure is made at a time when arc-extinction is possible. This feature of the invention is believed to be very important, and results in highly efficient operation.

Although there has been shown and described a specific structure embodying the invention, it is to be clearly understood that the same was merely for the purpose of describing the invention, and that changes and modifications may readily be made therein by those skilled in the art without departing from the spirit and scope of the invention.

I claim as my invention:

1. A circuit interrupter of the fluid-blast type including a substantially closed puffer cylinder, a piston movable within said substantially closed puffer cylinder to generate pressure therein, an orifice member having a restricted portion, means mechanically connecting said orifice member to said piston by a lost-motion connection, means for drawing an arc through said orifice member from the exhaust side of the restricted portion thereof, the movement of said piston within said substantially closed puffer cylinder generating fluid pressure to exhaust through said orifice member to effect extinction of the arc therein, and means communicating the arcing pressure to the back side of said piston within said substantially closed puffer cylinder to accelerate the working travel of said piston.

2. A circuit interrupter of the fluid-blast type including a substantially closed puffer cylinder, a piston movable within said substantially closed puffer cylinder to generate pressure therein, an orifice member having a restricted

portion, means mechanically connecting said orifice member to said piston by a lost-motion connection, means for drawing an arc through said orifice member from the exhaust side of the restricted portion thereof, means for closing the exhaust side of said orifice member to conserve the build-up of fluid pressure generated by movement of said piston, said closing means being vented following the taking up of said lost-motion, the movement of said piston within said puffer cylinder generating fluid pressure to exhaust through said orifice member to effect extinction of the arc therein, and means communicating the arcing pressure to the back side of said piston within said substantially closed puffer cylinder to accelerate the working travel of said piston.

3. A fluid-blast circuit interrupter including a substantially closed relatively stationary puffer cylinder, a piston movable within said substantially closed puffer cylinder and having a movable orifice associated therewith, means for drawing an arc through said movable orifice, the movement of said relatively stationary piston within said substantially closed puffer cylinder forcing fluid through said movable orifice and against said arc, means biasing said movable piston within said relatively stationary puffer cylinder in a direction to force fluid toward the arc, and means communicating the arcing pressure with the non-working side of said piston within said substantially closed puffer cylinder to assist said biasing means.

4. The combination in a fluid-blast circuit interrupter of a substantially closed relatively stationary puffer cylinder, a piston movable within said substantially closed puffer cylinder and having a movable orifice associated therewith, a relatively stationary contact, a relatively movable contact movable with said piston and separable from said relatively stationary contact to establish an arc through said movable orifice, the movement of said piston within said substantially closed relatively stationary puffer cylinder forcing fluid through said orifice and against said arc, means biasing said movable piston within said puffer cylinder in a direction to force fluid toward the arc, and means communicating the arcing pressure with the non-working side of said piston within said substantially closed puffer cylinder to assist said biasing means.

5. A circuit interrupter of the fluid-blast type including an elongated insulating orifice having a tapered entrance portion, an intermediate restricted portion and a tapered exhaust portion, a relatively stationary contact structure, a movable tubular contact movable, during closing, through the restricted portion of said elongated orifice and into the tapered exhaust portion thereof into contacting engagement with said relatively stationary contact structure, piston means operable in accordance with opening movement of said movable tubular contact to force a blast of fluid under pressure through said orifice from the inlet side thereof into the exhaust portion thereof, means defining an annular valve seat encircling the relatively stationary contact structure, the end of the tapered exhaust portion of the orifice constituting a movable valve for engaging said annular valve seat in the closed-circuit position of the interrupter, means including said tapered exhaust portion of the orifice and said annular valve seat for defining an exhaust region for said orifice which is closed by said movable valve in the closed-circuit position of the interrupter, the movable tubular contact retracting from the relatively stationary contact structure through the restricted portion of the orifice during the opening stroke to draw an arc through the restricted portion of the orifice from the exhaust side thereof, means defining a lost-motion connection between the orifice and the movable tubular contact so that during opening the movable valve initially closes said exhaust region while said arc is drawn through the restricted portion of the orifice, the piston-generated blast of fluid exhausting at least partially through the movable tubular contact prior to opening of

said valve and opening of said exhaust region, the fluid pressure building up in the exhaust region prior to taking up said lost-motion and opening said valve, the arcing pressure acting through said movable tubular contact to accelerate operation of said piston means, the elongated orifice, following the taking up of said lost-motion, being carried by the movable tubular contact, thereby opening said valve and releasing the built-up fluid pressure within said exhaust region, and the piston-generated blast of fluid being directed through the restricted portion of the elongated orifice to effect arc extinction and also being directed over the relatively stationary contact structure to cool the same and blast the terminal of the arc positioned thereon.

6. A circuit interrupter of the fluid-blast type including an elongated insulating orifice having a tapered entrance portion, an intermediate restricted portion and a tapered exhaust portion, a relatively stationary contact structure, a movable tubular contact movable, during closing, through the restricted portion of said elongated orifice and into the tapered exhaust portion thereof into contacting engagement with said relatively stationary contact structure, piston means including a relatively stationary puffer cylinder and a piston movable therein, an actuating cylinder secured to and movable with the piston, said movable tubular contact being disposed concentrically within said actuating cylinder and also secured to said movable piston, the piston forcing a blast of fluid under pressure through said orifice from the inlet side thereof into the exhaust portion thereof, means defining an annular valve seat encircling the relatively stationary contact structure, the end of the tapered exhaust portion of the orifice constituting a movable valve for engaging said annular valve seat in the closed-circuit position of the interrupter, means including said tapered exhaust portion of the orifice and said annular valve seat for defining an exhaust region for said orifice which is closed by said movable valve in the closed-circuit position of the interrupter, the movable tubular contact retracting from the relatively stationary contact structure through the restricted portion of the orifice during the opening stroke to draw an arc through the restricted portion of the orifice from the exhaust side thereof, means defining a lost-motion connection between the orifice and the actuating cylinder so that during opening the movable valve initially closes said exhaust region while said arc is drawn through the restricted portion of the orifice, the piston-generated blast of fluid exhausting at least partially through the movable tubular contact prior to opening of said valve and opening of said exhaust region, the fluid pressure building up in the exhaust region prior to taking up said lost-motion and opening said valve, the arcing pressure acting through said movable tubular contact to accelerate operation of said piston means, the elongated orifice, following the taking up of said lost-motion, being carried by the actuating cylinder, thereby opening said valve and releasing the built-up fluid pressure within said exhaust region, and the piston-generated blast of fluid being directed through the restricted portion of the elongated orifice to effect arc extinction and also being directed over the relatively stationary contact structure to cool the same and blast the terminal of the arc positioned thereon.

7. A circuit interrupter of the fluid-blast type including an elongated insulating orifice having a tapered entrance portion, an intermediate restricted portion and a tapered exhaust portion, a relatively stationary contact structure projecting at least partially within the tapered exhaust portion of said elongated orifice, a movable tubular contact movable, during closing, through the restricted portion of said elongated orifice and into the tapered exhaust portion thereof into contacting engagement with said relatively stationary contact structure, piston means operable in accordance with opening movement of said

movable tubular contact to force a blast of fluid under pressure through said orifice from the inlet side thereof into the exhaust portion thereof, means defining an annular valve seat encircling the relatively stationary contact structure, the end of the tapered exhaust portion of the orifice constituting a movable valve for engaging said annular valve seat in the closed-circuit position of the interrupter, means including said tapered exhaust portion of the orifice and said annular valve seat for defining an exhaust region for said orifice which is closed by said movable valve in the closed-circuit position of the interrupter, the movable tubular contact retracting from the relatively stationary contact structure through the restricted portion of the orifice during the opening stroke to draw an arc through the restricted portion of the orifice from the exhaust side thereof, means defining a lost-motion connection between the orifice and the movable tubular contact so that during opening the movable valve initially closes said exhaust region while said arc is drawn through the restricted portion of the orifice, the piston-generated blast of fluid exhausting at least partially through the movable tubular contact prior to opening of said valve and opening of said exhaust region, the fluid pressure building up in the exhaust region prior to taking up said lost-motion and opening said valve, the arcing pressure acting through said movable tubular contact to accelerate operation of said piston means, the elongated orifice, following the taking up of said lost-motion, being carried by the movable tubular contact, thereby opening said valve and releasing the built-up fluid pressure within said exhaust region, and the piston-generated blast of fluid being directed through the restricted portion of the elongated orifice to effect arc extinction and also being directed over the relatively stationary contact structure to cool the same and blast the terminal of the arc positioned thereon.

8. A circuit interrupter of the fluid-blast type including an elongated insulating orifice having a tapered entrance portion, an intermediate restricted portion and a tapered exhaust portion, a relatively stationary contact structure projecting at least partially within the tapered exhaust portion of said elongated orifice, a movable tubular contact movable, during closing, through the restricted portion of said elongated orifice and into the tapered exhaust portion thereof into contacting engagement with said relatively stationary contact structure, piston means including a relatively stationary puffer cylinder and a piston movable therein, an actuating cylinder secured to and movable with the piston, said movable tubular contact being disposed concentrically within said actuating cylinder and also secured to said movable piston, the

piston forcing a blast of fluid under pressure through said orifice from the inlet side thereof into the exhaust portion thereof, means defining an annular valve seat encircling the relatively stationary contact structure, the end of the tapered exhaust portion of the orifice constituting a movable valve for engaging said annular valve seat in the closed-circuit position of the interrupter, means including said tapered exhaust portion of the orifice and said annular valve seat for defining an exhaust region for said orifice which is closed by said movable valve in the closed-circuit position of the interrupter, the movable tubular contact retracting from the relatively stationary contact structure through the restricted portion of the orifice during the opening stroke to draw an arc through the restricted portion of the orifice from the exhaust side thereof, means defining a lost-motion connection between the orifice and the actuating cylinder so that during opening the movable valve initially closes said exhaust region while said arc is drawn through the restricted portion of the orifice, the piston-generated blast of fluid exhausting at least partially through the movable tubular contact prior to opening of said valve and opening of said exhaust region, the fluid pressure building up in the exhaust region prior to taking up said lost-motion and opening said valve, the arcing pressure acting through said movable tubular contact to accelerate operation of said piston means, the elongated orifice, following the taking up of said lost-motion, being carried by the actuating cylinder, thereby opening said valve and releasing the built-up fluid pressure within said exhaust region, and the piston-generated blast of fluid being directed through the restricted portion of the elongated orifice to effect arc extinction and also being directed over the relatively stationary contact structure to cool the same and blast the terminal of the arc positioned thereon.

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