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Beatty

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[54] **GAS BLAST CIRCUIT BREAKER OF THE AXIAL BLAST TYPE**

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[73] Assignee: **General Electric Company**, Philadelphia, Pa.

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[52] **U.S. Cl.** ..... **200/148 B**, 200/148 R

[51] **Int. Cl.** **H01h 33/82**

[58] **Field of Search** ..... 200/148 B, 148 R

[56] **References Cited**

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[57] **ABSTRACT**

A gas-blast circuit breaker comprises arcing contacts connected in parallel with the usual current-carrying contacts and means for separating the arcing contacts to establish an arc therebetween after the current-carrying contacts have separated. One of the arcing contacts comprises an orifice through which the arc extends and through which a gas blast is developed by the opening of a blast valve downstream therefrom. The other arcing contact comprises a movable contact blocking flow through the orifice until the pressure downstream from the orifice has fallen in response to blast-valve opening to a sufficiently low level that critical flow will take place through the orifice immediately following separation of the arcing contacts and establishment of the arc therebetween.

9 Claims, 2 Drawing Figures

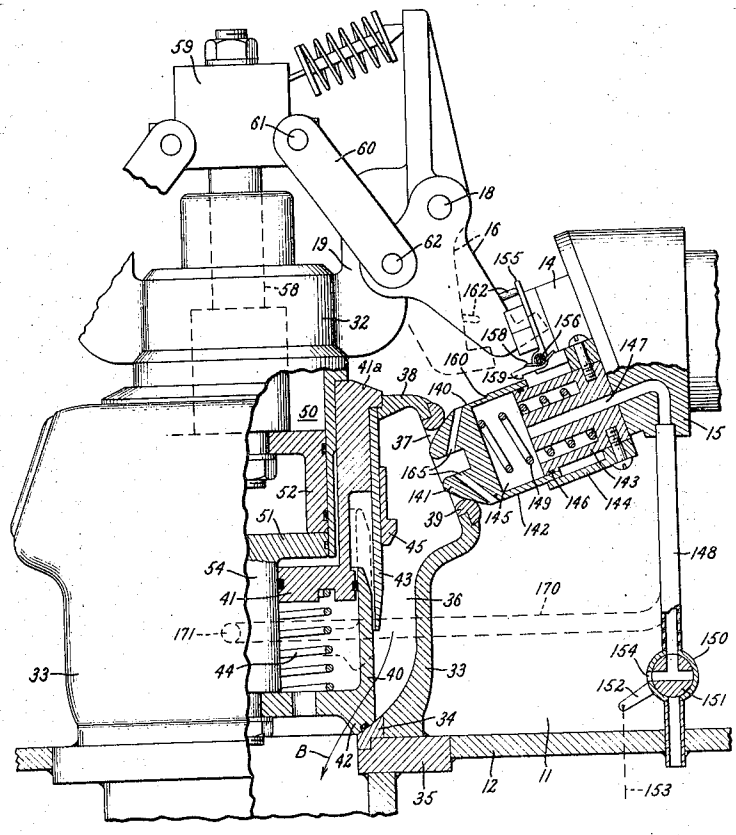


Fig. 1.

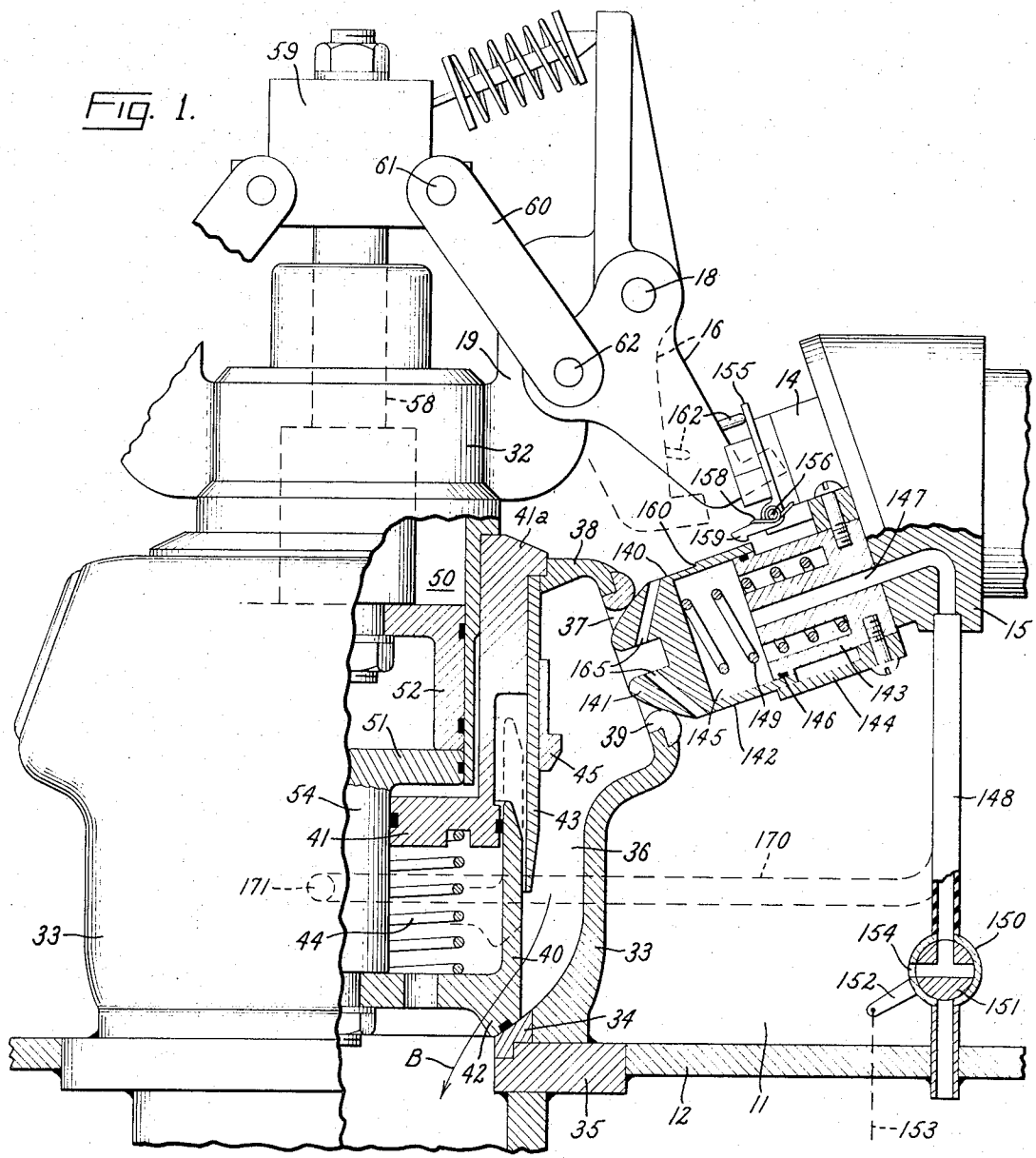
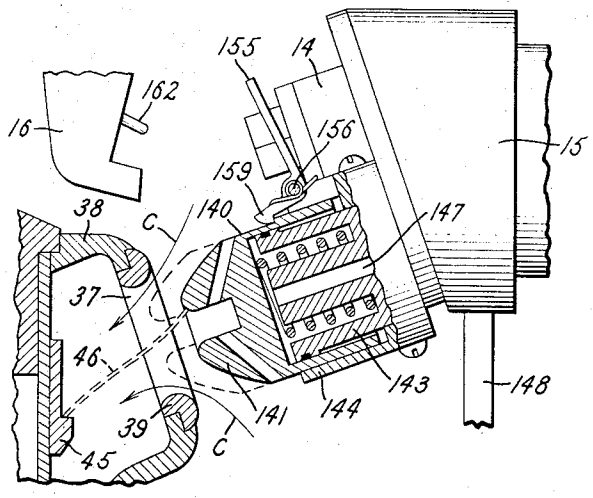

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Fig. 2.


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GAS BLAST CIRCUIT BREAKER OF THE AXIAL BLAST TYPE

BACKGROUND

This invention relates to a gas blast circuit breaker of the axial blast type and, more particularly, to means for improving the interrupting ability of such a circuit breaker.

The usual gas blast circuit breaker comprises means for establishing an electric arc across a gap between two electrodes and means for directing a high velocity blast of gas into the arcing region. The purpose of the gas blast is to cool the arc and to scavenge the arcing region of arcing products so as to increase the rate at which dielectric strength is built up across the gap when the current zero point is reached. By increasing this rate of dielectric recovery, it is possible to improve the ability of the gap to withstand the usual recovery voltage transient which builds up as soon as current zero is reached, thus improving the interrupting ability of the circuit breaker.

In an axial blast type of circuit breaker, there is typically provided an orifice through which the arc between the electrodes extends and through which the gas blast flows axially of the arc about the periphery of the arc. The purpose of the orifice is to guide the blast with respect to the arc and to impart the desired velocity to the blast.

In certain circuit breakers of this type, it is customary to initiate the arc in a position spaced a substantial distance upstream from the orifice and to utilize the blast to drive one terminal of the arc through the orifice onto an electrode positioned downstream from the orifice. The arc column then extends through the orifice and is subjected to the above-described axial blasting. Circuit breakers of this type are shown in my U.S. Pat Nos. 3,178,546 and 2,783,338 and in U.S. Pat No. 3,274,365 — Schneider, both assigned to the assignee of the present invention.

A disadvantage of this type interrupter is that following arc-initiation, a relatively long period, e.g., 3 or 4 milliseconds, is required to move the downstream arc terminal through the orifice into its position on the downstream electrode. During this relatively long period, the entire arc is situated upstream from the orifice and is generating upstream from the orifice considerable volumes of hot metal vapors and ionized gases. The presence of these considerable volumes of metal vapors and ionized gases upstream from the orifice makes it more difficult for the blast to quickly and effectively scavenge the arcing region.

Another disadvantage of this type interrupter is that a considerable period of time is required for flow through the orifice to rise to its maximum or critical rate. In this regard, the blast is initiated by opening a blast valve downstream from the orifice. This vents the space downstream from the orifice, causing the pressure in the space to fall; but the rate at which this pressure falls is limited by flow through the orifice into the downstream space.

SUMMARY

An object of my invention is to reduce the quantity of hot metal vapors and ionized gases developed by the arc in locations upstream from the orifice in a circuit breaker of the general type shown in my aforesaid patents.

Another object is to reduce the period during which the arc is burning and generating hot metal vapors and ionized gases upstream of the orifice before being forced into a position where it extends through the orifice and is subjected to an effective axial blast.

Another object is to establish a high rate of flow through the orifice within an extremely short time after the arc is initiated.

Still another object is to initiate the arc in a region closely adjacent that in which maximum flow takes place.

Still another object is to accomplish one or more of the above objectives in a circuit breaker of the type illustrated in my aforesaid patents with a minimum of structural changes to the circuit breaker.

In carrying out my invention in one form, I provide in parallel with the current-carrying contacts of the breaker a pair of separable arcing contacts which are maintained in engaged position when the circuit breaker is closed. Opening means separates the arcing contacts after the current-carrying contacts separate during an interrupting operation, thereby drawing an arc between the arcing contacts. The arc is subjected to a gas blast that forces the arc into a position where the arc extends through a flow passage surrounded by an orifice member that constitutes one of the arcing contacts. The gas blast is controlled by a blast valve located in an exhaust channel that communicates at its upstream end with the flow passage. The other of the arcing contacts is a member that engages the orifice member and acts while so engaged to restrict flow through the nozzle flow passage even though the blast valve has opened. The opening means for the arcing contacts delays separation of the arcing contacts until after the blast valve has opened and caused a large reduction in the pressure in said exhaust channel.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, reference may be had to the following description taken in connection with the accompanying drawing, wherein:

FIG. 1 is a sectional view through a portion of a circuit interrupter embodying one form of the invention. The interrupter is shown in the closed position.

FIG. 2 is a sectional view of a portion of the interupter of FIG. 1 showing the interrupter in an open position.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to FIG. 1, the circuit interrupter shown therein is of the sustained-pressure, gas-blast type described and claimed in my above-mentioned U.S. Pat. No. 2,783,338, assigned to the assignee of the present invention. Only those parts of the interrupter that are considered necessary to provide an understanding of the present invention have been shown in FIG. 1. In this respect, only the right hand portion of the interrupter has been shown in section inasmuch as the interrupter is generally symmetrical with respect to a vertical plane and the left hand portion is substantially identical to the right hand portion. As described in detail in my above-mentioned patent, the interrupter comprises a casing 12 which is normally filled with pressurized gas to define an interrupting chamber 11. Located within the interrupting chamber 11 are a pair of relatively movable contacts 14 and 16, which are

shown in solid-line form in FIG. 1 in their closed position of engagement. The contact 14 is relatively stationary, being mounted on a stationary conductive support 15; whereas the other contact 16 is mounted for pivotal motion about a fixed, current-carrying pivot 18. During an opening operation, the movable contact 16 is driven clockwise about the pivot 18 from its solid-line closed position of FIG. 1, through the dotted line partially-open position of FIG. 1, into its solid-line fully-open position of FIG. 2.

In prior circuit breakers of this general type, such as illustrated, for example, in my aforesaid U.S. Pat. No. 2,783,338, the contacts 14 and 16 have served both as current-carrying contacts and arcing contacts. However, in the illustrated circuit breaker contacts 14 and 16 serve only as current-carrying contacts. Serving as arcing contacts are another pair of relatively movable contacts 39 and 140 connected in parallel with the current-carrying contacts 14 and 16 and shown in FIG. 1 in a position of engagement. Contact 39 is a stationary annular orifice member, whereas contact 140 is a movable cup-shaped member that can be driven along a straight-line path into and out of its position of engagement with the annular contact member 39. During an opening operation, after the current-carrying contacts 14 and 16 have parted, as above-described, the cup-shaped contact 140 is moved to the right from its position of FIG. 1 toward that of FIG. 2 by means soon to be described. This movement separates contacts 140 and 39, thereby establishing an arc therebetween, which arc is later extinguished in a manner soon to be described in greater detail.

Cup-shaped contact member 140 comprises a base portion 141, which engages annular contact 39, and a generally cylindrically flange 142 projecting therefrom. For supporting the cup-shaped member 140 for linear motion into and out of engagement with annular contact member 39, I provide a metallic guide 143 that projects from support 15 and is slidably received within cylindrical flange 142. A plurality of fingers 144 of a springy conductive material make sliding contact with flange 142 about its outer periphery, thereby electrically connecting arcing contact 140 with current-carrying contact 14 through parts 143 and 15.

Behind cup-shaped contact member 140 is a control space 145 normally filled with pressurized gas at the same pressure as the pressure in chamber 11. A suitable O-ring seal 146 between guide 143 and flange 142 blocks communication between control space 145 and chamber 11 in this region. The gas within control space 145 develops a force on contact member 140 that biases the contact member to the left. This force together with that from a compression spring 149 is sufficient to hold contact member 140 in its closed position of FIG. 1 so long as the control space 145 is at the same pressure as chamber 11. The pressurized gas in chamber 11 biases movable contact 140 in an opening direction but this bias is not sufficient to move the movable contact out of its closed position so long as the control space is maintained at the pressure of chamber 11. However, when control space 145 is vented, the opening bias from the pressurized gas in chamber 11 drives the movable contact 140 to the right into its open position of FIG. 2.

For controlling the pressure in control space 145, a passage 147 communicating at one end with control space 145 is provided. At its opposite end, passage 147 communicates through an insulating tube 148 with a suitable auxiliary control valve schematically shown at 150. When the rotary element 151 of the auxiliary control valve is in its illustrated position of FIG. 1, it affords communication through port 154 between the pressurized gas in chamber 11 and control space 145. When rotary element 151 of the auxiliary control valve is rotated 90° clockwise from its position of FIG. 1, it vents to atmosphere the lines 147 and 148 and the control space 145, thus producing opening movement to the right of the movable contact 140, as described hereinabove. A suitable operator (schematically shown at 152, 153) for the auxiliary control valve 150 couples the auxiliary control valve to a main control valve (not shown) that is used for controlling the main operating mechanism 50 (soon to be described). The aforesaid Beatty U.S. Pat. No. 2,783,338 shows a typical form of such a main control valve at 71. The operator 152, 153 operates the auxiliary valve 150 into its venting position a predetermined period of time after the main control valve has operated, sufficient in duration to assure that the current-carrying contacts 14, 16 have been parted.

When the movable contact 140 enters its fully open position of FIG. 2, a latch 155 becomes active to hold the contact in its fully-open position. Latch 155 is biased in a counter-clockwise direction about a stationary pivot 156 by a torsion spring 158. When movable contact 140 enters its fully-open position, torsion spring 158 forces the latch in a clockwise direction, causing its projecting nose 159 to move behind a shoulder 160 on the contact member, thereby holding the contact member in its fully-open position.

Latch member 155 is held in a released position so long as the movable current-carrying contact member 16 is in its closed position by reason of an insulating actuating member 162 on the contact member 16. But when contact member 16 moves out of its closed position, the actuating member 162 moves out of engagement with the latch member and allows the latch member to be controlled by its torsion spring 158.

As shown in FIG. 1, the movable current-carrying contact 16 is supported by means of its current-carrying pivot 18 on a conductive bracket 19 that is preferably formed integral with a stationary cylinder 32. The cylinder 32 at its lower end is suitably supported from a generally cylindrical casting 33. The casting 33 at its lower end is suitably secured to a flange 35 rigidly carried by the stationary metallic casing 12.

For producing a gas blast to aid in extinguishing the arc that is established during the interruption operation, the cylindrical casting 33 contains a normally-closed exhaust passage or channel 36 leading from the interrupting chamber 11 to the surrounding atmosphere. The casting 33 at its upper end is provided with a tubular nozzle-type electrode 38 having an orifice portion at its outer end constituted by the annular contact member 39, which defines an inlet 37 to the exhaust channel 36. This inlet 37 is referred to hereinafter as the orifice opening. The flow of arc-extinguishing gas through the tubular nozzle 38 and the exhaust channel 36 is controlled by means of a cylindrically-shaped reciprocable blast valve member 40 located at the lower end of the exhaust channel 36. This blast valve member 40 normally occupies a solid-line, closed position wherein an annular flange 42 formed at its

lower end sealingly abuts against a stationary valve seat **34** carried by the exhaust casting **33.**

During a circuit-interrupting operation, the movable blast valve member **40** is driven upwardly from its solid-line, closed position of FIG. **1** through a partially-open intermediate position shown in dotted lines in FIG. **1.** Shortly thereafter the contacts **39** and **140** separate as shown in FIG. **2,** and this allows pressurized gas in the chamber **11** to flow at high speed through the orifice opening **37** in nozzle **38** and out the exhaust channel **36** past the then-open valve member **40** to atmosphere, as indicated by the dotted-line arrows C of FIG. **2** and B of FIG. **1.** The manner in which the gas blast acts to extinguish the arc will soon be described in greater detail.

At its upper end, the cylindrical valve member **40** surrounds a projecting tubular support **41** upon which valve member **40** is smoothly slidable. Tubular support **41** is fixed to the casting **33,** preferably, by means of bolts (not shown) clamping the flange **41***a* to the top of casting **33.** A compression spring **44** positioned between movable valve member **40** and the lower end of support **41** tends to hold valve member **40** in its closed position against valve seat **34.**

To protect support **41** and the upper end of valve member **40** from the harmful effects of arcing, a protective metallic tube **43** is positioned about these parts and is suitably secured to support **41.** Secured to the outer surface of this tube is a downstream probe or electrode **45,** preferably of a refractory metal, which projects radially from the tube **43** and transversely into the path of the gas blast flowing through the passageway **36.** As will soon appear more clearly, the downstream terminal of the arc is transferred to this electrode **45** during an interrupting operation and, after such transfer, the arc occupies a position generally corresponding to that shown at **46** in FIG. **2.**

For controlling the operation of movable blast valve **40** and movable contact **16,** a combined operating mechanism **50** is provided. This mechanism **50** is preferably constructed in the manner disclosed and claimed in my aforementioned U.S. Pat. No. 2,783,338, and its details form no part of the present invention. Generally speaking, this mechanism **50** comprises a valve-controlling piston **51** and a contact-controlling piston **52** mounted within the cylinder **32.** The valve-controlling piston **51** is coupled to the movable blast valve member **40** through a piston rod **54** suitably clamped to the valve member **40.** The contact-controlling piston **52,** on the other hand, is connected to the movable contact **16** through a piston rod **58** and a cross head **59** secured to the piston rod. A link **60** pivotally joined to the cross head **59** at **61** and to the movable contact **16** at **62** interconnects the cross head **59** and the movable contact **16.** When the valve-controlling piston **51** is driven upwardly, it acts to open blast valve member **40,** and, simultaneously, to drive contact-controlling piston **52** upwardly to produce opening movement of movable contact member **16.**

When movable contact **16** separates from contact **14** during this opening movement, the current previously flowing through contacts **14, 16** is transferred to arcing contacts **140, 39;** and substantially all of the current through the breaker then flows through arcing contact **140, 39.** Shortly after this current transfer occurs, the control space **145** behind the cup-shaped contact **140** is vented, as a result of which the high pressure air in chamber **11** that is biasing contact **140** to the right becomes effective to drive contact **140** to the right through its dotted-line position of FIG. **2** into its solid line fully-open position of FIG. **2.**

When movable arcing contact **140** separates from the other arcing contact **39,** an arc is initiated between the two arcing contacts at a point immediately adjacent the inlet **37** to exhaust channel **36.** The flow that is then taking place through inlet **37** immediately forces the downstream terminal of the arc through inlet **37** and onto downstream electrode **45.** The position of the arc when the contacts **39, 140** have fully separated is shown at **46** in FIG. **2.** The blast of pressurized gas that flows through inlet **37** about the arc acts to cool the arc and to effectively scavenge this region of arcing products, thus permitting the space between the contacts to recover its dielectric strength at a high rate when a natural current zero is reached.

Because the arc is initiated at a point immediately adjacent the inlet **37,** it will be apparent that there is essentially no period during the interrupting operation when the entire arc is situated upstream from the inlet. Thus, the volume of hot metal vapors and ionized gases generated in any location upstream from inlet **37** is considerably reduced as compared to prior circuit breakers where the entire arc burns for several milliseconds in an upstream location before its downstream terminal enters the inlet **37.** Such reduction in the upstream-generated arcing products enables the gas blast to more quickly and effectively scavenge the arcing region, thus helping to increase the maximum current that can be interrupted with a particular orifice size and pressure.

Another advantage of my arrangement as compared to those in the above-mentioned prior patents is that I have considerably reduced the time following blast-valve operation required for flow through the orifice **37** to rise to its maximum or critical rate. In this regard, it should be noted that critical flow through orifice **37** cannot be achieved until the pressure in exhaust channel **36** has fallen to a predetermined level. Opening of the downstream blast valve member **40** permits the pressurized gas in channel **36** to exhaust through the blast valve, thus reducing the pressure in channel **36;** but the rate of this pressure reduction is limited by the air flowing into the exhaust channel through orifice **37.** In the prior circuit breakers referred to hereinabove, flow into the exhaust channel has been essentially unrestricted, but I severly restrict such inflow with my arcing contact **140,** which remains in its blocking position of FIG. **1** for a short time after the blast valve member **40** opens. When the arcing contact **140** finally does move out of its blocking position of FIG. **1,** the pressure in the exhaust channel **36** has already fallen to such a level that critical flow through the orifice can immediately be established. Thus, as soon as the arc is established between the arcing contacts **39, 140,** it is exposed to critical flow through the inlet **37** which is precisely the location where the arc is then located. Reducing the usual delay in exposing the arc to this critical flow also helps to increase the maximum current that can be interrupted with a given pressure and orifice size.

The force for opening of the arcing contact **140** results not only from the previously-described venting of the control space **145** behind contact **140** but also from the inward flow of gas from chamber **11** through orifice

37. In addition, during high current interruptions, the opening force is augmented by local expansion of the flowing gas caused by energy input via the arcing process from the primary electrical circuit. Rightward movement of the arcing contact **140** will continue until it has reached its fully-separated position of FIG. **2**, just prior to which the aforementioned latch **155** snaps into place behind shoulder **160** on the outer surface of the contact. With the latch in place, the arcing contact **140** is restrained in an essentially fully-open position against any leftward force such as that from helical spring **149**. Finally, the blast valve recloses in the usual manner, allowing pressure within the exhaust passage **36** to return to tank pressure.

It should be noted that after the main contacts **14** and **16** part, the entire circuit breaker current passes for a brief period through the arcing contacts. A feature that helps the arcing contacts carry this current for the desired interval is the high force which is developed during this period for holding the contacts in engagement. A factor contributing to this high force is the rapid drop in pressure in the exhaust channel **36**, which occurs when the main blast valve **40** is open. This rapid pressure drop on the front face of contact **140** combined with the high pressure in the contact chamber **145** at the back of contact **140** results in a high hold-close force on contact **140**, which is maintained until the auxiliary control valve **150** is opened.

A circuit-breaker closing operation is effected by operating the main control valve (not shown) in the same manner as shown in my aforesaid U.S. Pat. No. 2,783,338, and this causes contact-controlling piston **52** to move downwardly from its open position, thereby driving movable main contact **16** clockwise into its closed position. This operation of the main control valve, acting through a suitable linkage (not shown) between the main and auxiliary control valves, also causes the auxiliary control valve **150** to be immediately restored to its illustrated position of FIG. **1**, thereby causing the control space **145** to be filled with pressurized gas at tank pressure. This filling of space **145** occurs before movable contact **16** can enter its fully-closed position. When movable contact **16** finally does enter its fully-closed position, the actuator **162** thereon engages and releases latch **155**, whereupon the pressurized gas in control space **145**, assisted by spring **149**, drives the movable electrode **140** to the left into its closed position where it engages stationary contact **39**.

Even though the current-carrying contacts **14** and **16**, upon parting, are bridged by a low resistance path through the engaged arcing contacts **39**, **140**, some minor arcing will still occur between contacts **14** and **16** upon parting. To scavenge the contact region of the resulting arcing products, I provide one or more small-diameter vent passages **165** through movable arcing contact **140** through which said arcing products can be exhausted despite the closed condition of the arcing contacts. Thus, cleaner gas is available for arc-extinguishing purposes when the arcing contacts **39**, **140** later part. It is to be understood that the flow through these vent passages is sufficiently limited as not to interfere significantly with the desired high rate at which the pressure drops in exhaust channel **36** upon opening of blast valve **40** at the start of an opening operation.

In a modified embodiment of my invention, I omit the separate control valve **150** and instead utilize the blast valve **40** for controlling the pressure in control space **145** behind the movable arcing contact **140**. Such control is made possible by extending the insulating line **148** over to the casting **33** (as indicated in dotted-line from at **170**) and connecting its end to communicate through a suitable port **171** with exhaust channel **36** in casting **33**. With this extension **170** present, when the blast valve **40** is opened to vent the exhaust channel **36**, it produces a corresponding venting of lines **170**, **148**, **147** and control space **145**, following which movable arcing contact **140** opens in generally the same way as described hereinabove. When the movable arcing contact **140** reaches its fully-open position, latch **155** acts to hold it open, thus permitting the blast valve **40** to close and restore pressure to spaces **36**, **170**, **148**, **147** and **145** without causing the arcing contact **140** to close. During a subsequent circuit-breaker closing operation, when the movable contact **16** reaches its fully-closed position, it acts through member **162** to trip the latch **155**, thereby releasing the movable arcing contact **140**, allowing the arcing contact to close under the bias of the pressurized gas in control space **145**.

To reduce the possibility of dielectrically-weak arcing products entering the line **170**, **148**, I locate the port **171** that communicates with exhaust channel **36** at a point in the exhaust channel that is angularly displaced 90° from the downstream electrode **45** and the nozzle opening **37**. For a plan view showing this displaced location, reference may be had to FIG. **5** of my copending application Ser. No. 267,945, filed June 30, 1972, which shows a port **138** in this same location. Locating the port **171** in this displaced location is advantageous because very little of the hot arcing products entrained in the main blast ever enter this displaced region. The hot arcing products (in passing through exhaust passage **36** and past the blast valve **40**) are confined almost entirely to the region generally aligned with downstream electrode **45** and nozzle opening **37**. In one form of my invention, I provide a filter and cooler (not shown) in the line **170** to assure that any gas entering the line **170** from the exhaust channel **36** will be dielectrically strong and clean. The aforesaid Application Ser. No. 267,945 shows such a filter at **150**.

For timing the opening of the arcing contact **140** to occur at the desired instant following separation of the main contacts **14**, **16**, a suitable orifice (not shown) is provided in the line **170** adjacent the exhaust channel **36**.

While I have shown and described particular embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects; and I, therefore intend herein to cover all such changes and modifications as fall within the true spirit and scope of my invention.

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

1. An electric circuit breaker of the axial-blast, gas blast type comprising:

a. a pair of separable current-carrying contacts through which most of the circuit-breaker current flows when said current-carrying contacts are engaged,

b. a pair of separable arcing contacts electrically connected in parallel with said current-carrying

contacts and maintained in an engaged position when the circuit breaker is closed,

c. opening means for separating said arcing contacts after said current-carrying contacts separate during an interrupting operation, thereby drawing an arc between said arcing contacts,

d. a nozzle having a flow passage,

e. an exhaust channel communicating at its upstream end with said flow passage,

f. a housing adapted to contain pressurized gas in which is located said current-carrying and arcing contacts, said flow passage, and said exhaust channel,

g. a normally-closed blast valve at the downstream end of said exhaust channel openable during said interrupting operation to produce through said nozzle flow passage and said exhaust channel a blast of gas that forces said arc into a position where the arc extends through said flow passage,

h. said nozzle comprising an orifice member substantially surrounding said flow passage and serving as one of said arcing contacts,

i. the other of said arcing contacts being a member that engages said orifice member when said circuit breaker is closed and acts while engaging said orifice member to restrict flow through said nozzle flow passage even though said blast valve has opened,

j. said opening means delaying separation of said arcing contacts until after said blast valve has opened and caused a large reduction in the pressure in said exhaust channel.

2. The circuit breaker of claim **1** in which:

a. between said exhaust channel and the space containing said current-carrying contacts there is an open passage through which flow can take place despite said arcing contacts being engaged, and

b. opening of said blast valve produces flow through said open passage that acts to carry into said exhaust channel arcing products produced by separation of said current-carrying contacts.

3. The circuit breaker of claim **1** in which:

a. said current-carrying contacts comprise a movable contact that is mounted for pivotal motion into and out of engagement with the other of said current-carrying contacts, and

b. said other arcing contact is a member that is mounted for substantially linear motion into and out of engagement with said orifice-member arcing contact.

4. The circuit breaker of claim **1** in which:

a. said opening means for separating said arcing contacts comprises:

i. a control space behind said movable arcing contact that is normally filled with pressurized gas and

ii. auxiliary control valve means operable to vent said control space,

b. the pressurized gas in said housing acting on said movable arcing contact to provide an opening bias force on said movable arcing contact that is effective upon venting of said control space to drive said movable arcing contact in an opening direction.

5. The circuit breaker of claim **1** in which:

a. releasable latching means is provided for holding said movable arcing contact in an opening position at the end of its opening travel, and

b. means is provided for releasing said latching means during a closing operation to initiate movement of said movable arcing contact toward a position of reengagement with said one arcing contact.

6. The circuit breaker of claim **4** in which:

a. releasable latching means is provided for holding said movable arcing contact in an open position at the end of its opening travel, and

b. means is provided for releasing said latching means during a closing operation to initiate movement of said movable arcing contact toward a position of reengagement with said one arcing contact.

7. The circuit breaker of claim **1** in which:

a. said opening means for separating said arcing contacts comprises:

i. a control space behind said movable arcing contact that is normally filled with pressurized gas and

ii. a control line pneumatically connected between said control space and said exhaust channel for venting said control space through said exhaust channel when said blast valve is opened to reduce the pressure in said exhaust channel,

b. the pressurized gas in said housing acting on said movable arcing contact to provide an opening bias force on said movable arcing contact that is effective upon venting of said control space to drive said movable arcing contact in an opening direction.

8. The circuit breaker of claim **7** in which:

a. closing of said blast valve at the end of an opening operation causes pressurized gas to flow through said control line from said exhaust channel to build up pressure in said control space behind said arcing contact,

b. releasable latching means is provided for holding said movable arcing contact in an open position at the end of its opening travel, and

c. said latching means also acts to hold said movable arcing contact in said open position when said blast valve is closed at the end of a circuit-breaker opening operation to build up pressure in said control space.

9. The circuit breaker of claim **8** in combination with means for releasing said latching means during a closing operation to initiate movement of said movable arcing contact toward a position of reengagement with said one arcing contact under the influence of the pressure within said control space.

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