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AIR BLAST CIRCUIT BREAKER

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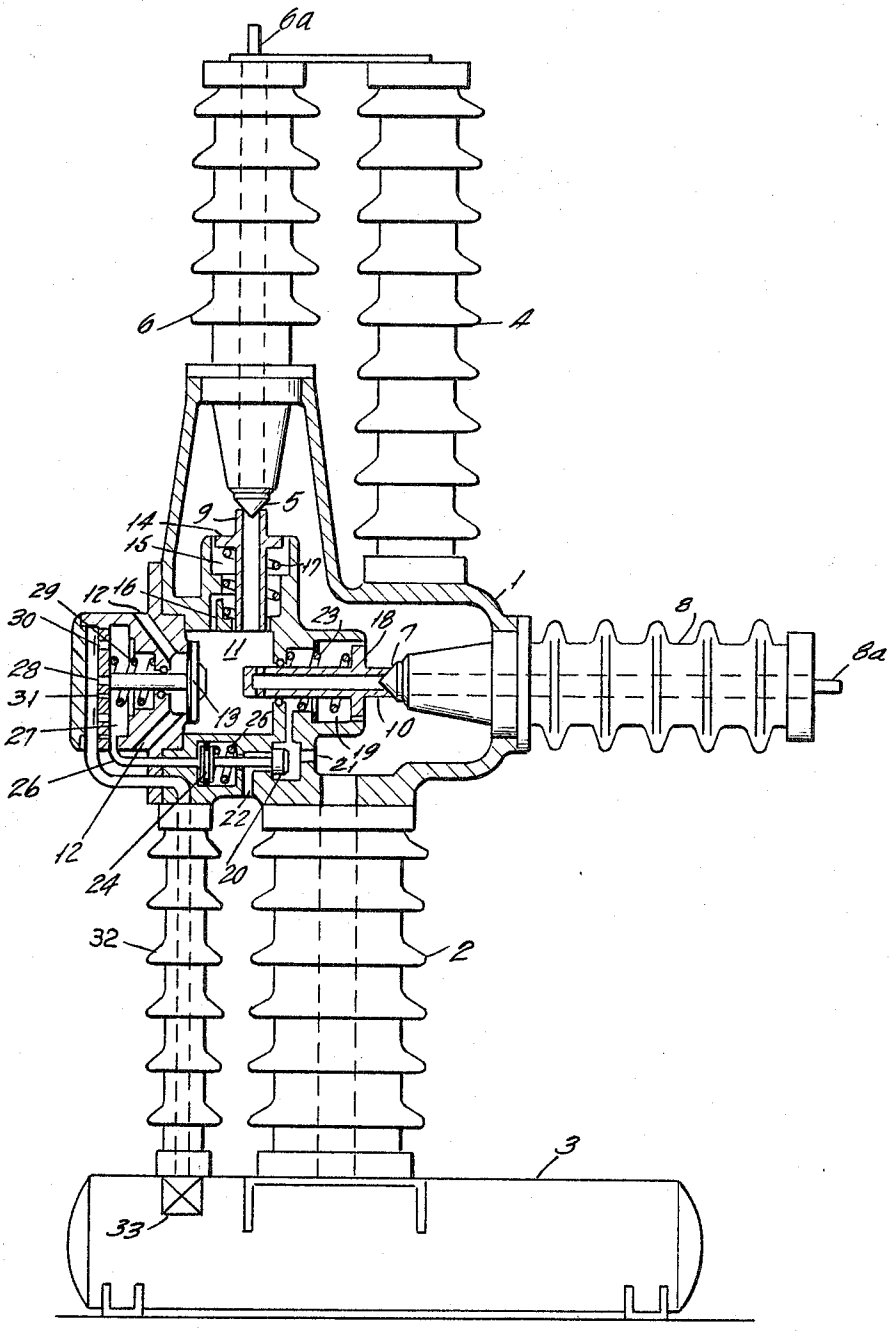

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AIR BLAST CIRCUIT BREAKER

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This invention relates to air blast circuit breakers, and more specifically relates to an air blast circuit breaker interrupter structure having two series connected breaking contacts, one of which has a parallel connected resistor wherein both of the contacts are subjected to a strong effective blast of extinguishing air.

Interrupters for gas blast circuit breakers are well known to the art and are usually provided with parallel connected resistors for keeping the voltages across the interrupting contacts within reasonable limits during interruption. The provision of a parallel connected resistor then requires a second series connected pair of contacts which will operate to break the resistor current after extinction of the main arc.

With such arrangements it is very difficult to obtain an effective blast of extinguishing gas for both the main and resistor contacts while, at the same time, maintaining the desired function of the main contacts.

In accordance with the present invention, the two sets of series connected contacts are carried within a container which is permanently filled with compressed gas wherein each movable contact is hollow and conducts a flow of compressed air therethrough under the control of a common blast valve. This blast valve then serves the dual function of a control valve for the operation of one of the pairs of contacts responsible for interrupting the resistor current, with the main interrupting contacts being opened only long enough to interrupt the arc and being thereafter closed with the resistor contacts remaining open to serve as an isolating contact for the system.

Moreover, and as indicated previously, both the main contacts and resistor contacts are subjected to an extremely powerful flow of extinguishing air during their operation.

In reclosing the interrupter, that contact now serving as an isolating contact, and which was responsible for the interruption of the resistor current, is closed. Thus, the function of opening the circuit and closing the circuit is distributed between the two contacts, whereby contact wear is decreased and the breaking capacity of the interrupter is increased.

Accordingly, a primary object of this invention is to provide a novel gas blast interrupter structure having series connected interrupter contacts.

Another object of this invention is to provide a pair of series connected contacts in a container which is permanently filled with compressed air, in which one of the contacts is connected in parallel with a resistor, and in which a gas blast for each of the contacts is provided through a common blast valve.

Still another object of this invention is to provide a novel contact arrangement for gas blast interrupters wherein the contact which interrupts resistor current further serves as an isolation contact for the circuit so that the main interrupting contact is immediately reclosed after interruption.

These and other objects of this invention will become apparent from the following description taken in connection with the drawing which shows a cross-sectional view of an interrupter structure constructed in accordance with the present invention.

Referring now to the drawing, the air blast circuit breaker shown therein includes a metal interrupter container **1** which is permanently filled with compressed air. The container **1** is supported atop a hollow insulator column **2** which is carried from a grounded compressed air container **3**. The compressed air from container **3** is in continuous communication with the interior of housing **1** through the hollow interior of insulator **2**.

The container **1** then carries two series conected breaking gaps. The first breaking gap includes a stationary contact **5** which is supported by a lead-through bushing insulator **6** which passes through the wall of the container **1**. The second pair of breaking gaps includes the stationary contact **7** which is carried at the end of lead-through bushing insulator **8** which passes through the wall of container **1**.

A resistor **4** is then connected in parallel with the pair of contacts which includes stationary contact **5**, one end of resistor **4** being connected to the container **1**, while the upper end is conected to terminal **6***a* which serves as one terminal for the circuit breaker. The other terminal for the circuit breaker clearly will be terminal **8***a* at the end of bushing insulator **8** and connected to contact **7**.

The movable contacts for the two series connected breaking gaps are each electrically connected to housing **1** and include the hollow contacts **9** and **10** which each communicate with space **11**. The space **11** may communicate with the outer assembly atmosphere by means of channels **12**. An air blast valve **13** is arranged to enclose channels **12** when the contacts **9** and **10** are closed, and engage their respective stationary contacts **5** and **7**.

A piston **14** is carried by the movable hollow contact **9**, and one side of piston **14** is exposed to the compressed air pressure in container **1**, while its other side is influenced by the pressure within space **15**. Space **15** is in permanent communication with space **11** through the channel **16**. A spring **17** biases hollow contact **9** into engagement with stationary contact **5** when the pressures on the opposite sides of piston **14** are equal.

The hollow contact **10** is connected to a piston **18** which has one side in communication with the pressure within container **1**, while its other and left-hand side is exposed to the pressure within space **19**.

A control valve **20** is arranged for selectively connecting space **19** to the pressure within container **1** through channel **21**, or to the open air through channel **22** when valve **20** is moved to the right. A spring **23** biases movable hollow contact **10** into engagement with stationary contact **7**.

Control valve **20** is moved by a piston **24** connected thereto which is normally held in the left-hand position shown by biasing spring **25**. Piston **24**, which is carried in a suitable cylinder has its left-hand surface in communication with conduit **26** which extends into cylinder **27**. The cylinder **27** carries a piston **28** which is connected to blast valve **13**.

The blast valve **13** is normally closed by means of spring **29** which seats on the right-hand side of piston **28**. The piston **28** has openings therethrough which are provided with non-return valve members **30**, whereby air flow may occur through the openings in piston **28** from space **27** through the piston surface, although it cannot occur in the reverse direction since valves **30** will then close.

A very narrow leakage channel **31** is formed in piston **28**. An air control conduit **32** extends upwardly from grounded container **3** with air pressure being selectively applied to conduit **32** by means of a control valve **33**. The conduit **32** extends upwardly and into communication with the left-hand surface of piston **28**.

The operation of the structure shown in the drawing

is as follows: In order to open the air blast circuit breaker contacts, the valve **33** is operated to apply compressed air to conduit **32**. This fills the space to the left of piston **28** with compressed air to open blast valve **13**. The space **11** is then emptied of compressed air through channels **12** so that the space **15** below piston **14** is also emptied of compressed air. The pressure in container **1** then forces the hollow contact **9** downwards so that the main breaking gap contacts **5** and **9** open with a strong blast of compressed air playing on the arc drawn between the contacts.

When the air blast valve **13** reaches its fully open position, compressed air from conduit **32** can now flow into conduit **26** whereby piston **24** is moved to the right. Therefore, the control valve **20** will shut off channel **21** and open channel **22** so that space **19** is vented to the open air. Piston **18** is thus forced to the left together with the hollow contact **10** by means of the pressure in container **1**, whereby the second breaking gap including contacts **7** and **10** are opened. This operation occurs after contacts **5** and **9** have extinguished the main arc so that contacts **7** and **10** extinguish only the current flowing through resistor **4**. Moreover, the breaking gap including contacts **7** and **10** is exposed to a powerful blast of high pressure gas so that, even if the resistor current is high, it will be efficiently extinguished.

During the actual breaking action, the compressed air or gas will flow continuously from the space to the left of piston **28** to the space to the right of the piston through the narrow channel **31** in piston **28**. Thus, pressure is gradually equalized on the two sides of the piston so that it will eventually return to its left-hand position under the action of the spring **29** to automatically reclose blast valve **13**. Once the blast valve **13** closes, the space **11** is rapidly filled with compressed air through the hollow contacts so that the space **15** will be brought up to the same pressure as that on the other side of piston **14**. The hollow contact **9** will then be reclosed by spring **17** with only the hollow contact **10** remaining in the open position, since the control valve **20** is still in its right-hand end position. Therefore, the contacts **7** and **10** serve as the isolating contact for the system.

In order to close the circuit breaker, the valve **33** is operated to vent conduit **32** to open air. The space to the left of piston **24** is thereby rapidly emptied through conduit **26** and the non-return valves **30**. Spring **25** will then move control valve **20** to the left so that the space **19** behind piston **18** is once again connected to the pressure of the air in container **1**. The same pressure is thus obtained on both sides of piston **18** so that spring **23** returns contact **10** to the closed position for reclosing the circuit connected between terminals **6***a* and **8***a*.

With the foregoing structure, it is seen that the opening and closing operations are divided between contact pairs **9** and **5**, and **7** and **10**, respectively. Thus, wear on the contacts is more evenly distributed. At the same time, contacts **7** and **10** serve as isolating contacts, thus eliminating the need for auxiliary isolating switches.

It is possible to arrange the structure of the drawing so that both gaps will open simultaneously. More specifically, with the present invention, the conduit **26** is connected to cylinder **27** in such a way that contacts **5** and **9** will open before contacts **7** and **10**. If, however, conduit **26** is connected directly to conduit **32** instead of through the operating piston **28** of the blast valve, both contact pairs will be simultaneously operated for superior breaking operation for short line faults.

Moreover, with this type of operation, the load on the resistor is decreased so that the resistor can be made smaller.

Although this invention has been described with respect to its preferred embodiments, it should be understood that many variations and modifications will now be obvious to those skilled in the art, and it is preferred, therefore, that the scope of the invention be limited not by the specific disclosure herein but only by the appended claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. A gas blast circuit breaker interrupter structure comprising a conductive housing, a high pressure gas supply permanently connected to said conductive housing to maintain the interior of said conductive housing at high pressure, first and second stationary contacts supported on the interior of said conductive housing and in insulated relation with respect to each other and to said conductive housing, first and second hollow movable contacts positioned within said conductive housing normally engaging said first and second stationary contacts, and mounted for movement out of engagement therewith, a resistor permanently electrically connected between said first stationary contact and said first movable contact, and a blast valve in the wall of said container; said second contacts being connected in series with said first contacts; said first and second hollow contacts defining respective flow paths from interior portions of said conductive housing to the interior surface of said blast valve whereby high pressure gas flows through said first and second hollow movable contacts when said blast valve is opened; and an operating means connected to said first and second hollow movable contacts for moving said first and second hollow contacts between engaged and disengaged positions with respect to said first and second stationary contacts respectively.

2. The device substantially as set forth in claim **1** wherein said operating means includes time delay means connected to said second movable contact for delaying movement thereof to its said disengaged position until said first movable contact is moved to its said disengaged position.

3. The device substantially as set forth in claim **2** wherein said operating means further includes reclosing means connected to said first contact for automatically reclosing said first contact immediately after its movement to its said disengaged position.

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