United States Patent

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[33] **Great Britain**
[31] **38289/67**

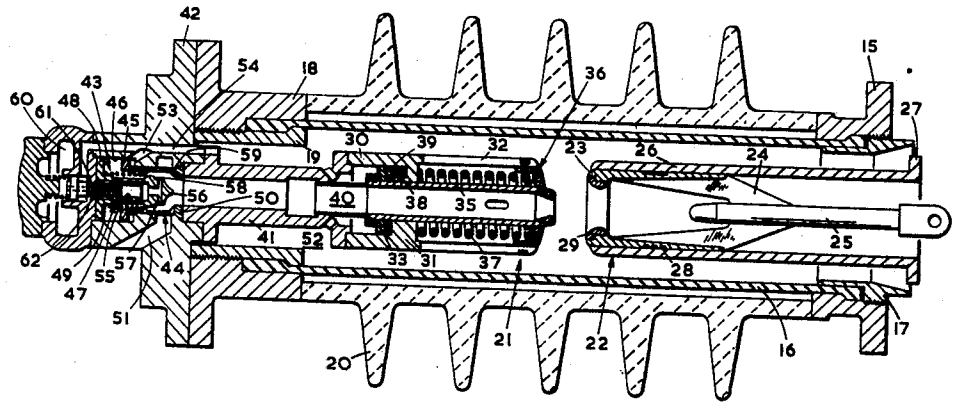
[54] **DUAL GAS-BLAST CIRCUIT INTERRUPTER IN WHICH ONE OF TWO EXHAUST VALVES OPERATES AUTOMATICALLY**
6 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **200/148**
[51] **Int. Cl.** **H01h 33/80**
[50] **Field of Search** 200/148.2, 148

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Primary Examiner—Robert S. Macon
Attorney—Stevens, Davis, Miller and Mosher

ABSTRACT: A gas-blast interrupter unit has a hollow fixed contact and a hollow movable contact which, when engaged with the fixed contact provides a continuous passage. An exhaust valve is associated with the movable contact. A further exhaust valve is associated with the fixed contact and arranged to be opened automatically as a result of a reduction of pressure which occurs in the continuous passage when the other exhaust valve is opened. Thus, when the contacts begin to open, pressurized gas blasts through both the fixed and movable contacts and through their respective exhaust valves. A delay chamber is operable to restore the further exhaust valve to its closed position automatically after a predetermined time interval sufficient for arc extinction to take place.



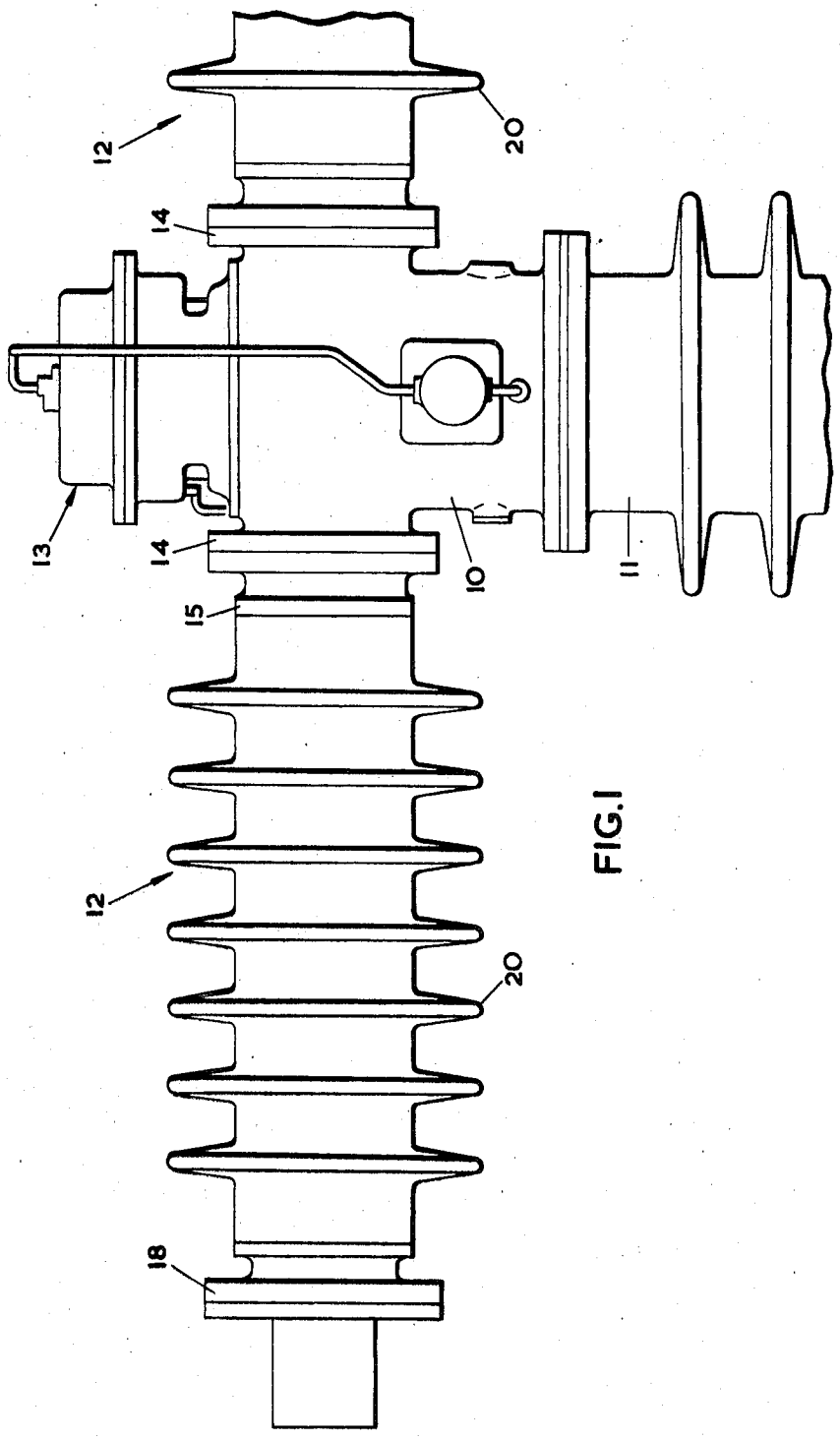


FIG.1

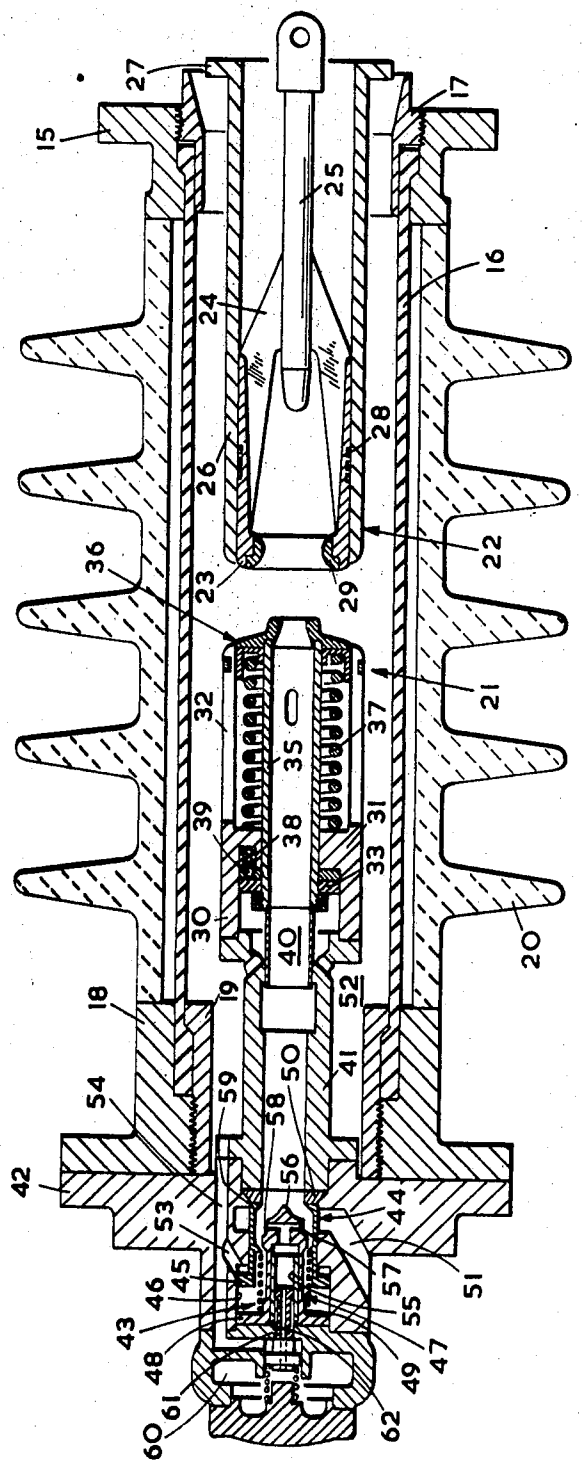

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FIG.2

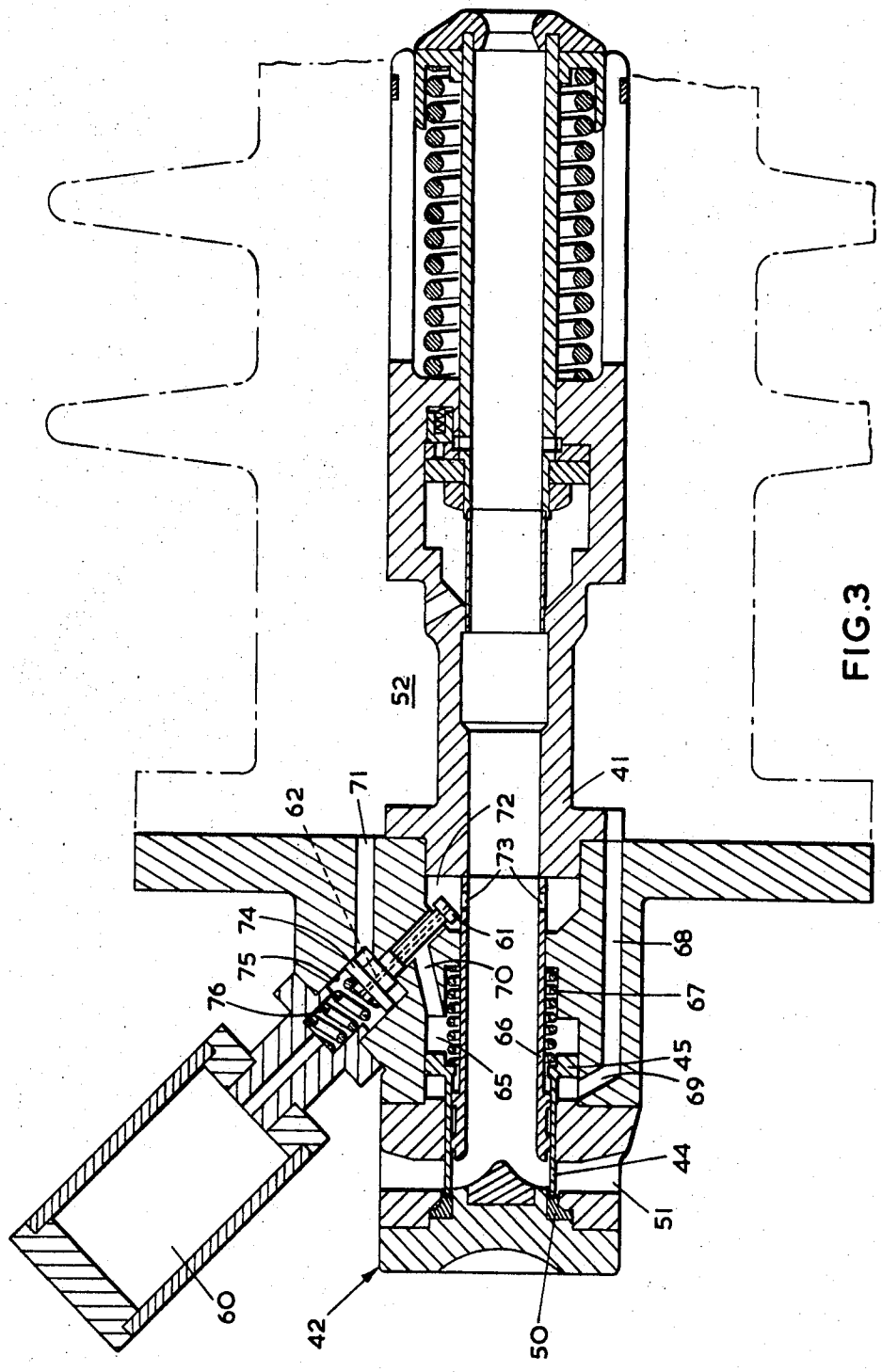


FIG.3

DUAL GAS-BLAST CIRCUIT INTERRUPTER IN WHICH ONE OF TWO EXHAUST VALVES OPERATES AUTOMATICALLY

This invention relates to gas-blast electric switchgear.

According to this invention gas-blast electric switchgear has an interrupter unit including a pair of relatively movable hollow contacts which cooperate together to provide a continuous passage when engaged, an exhaust valve associated with one of the contacts and operable to rapidly reduce gas pressure in the continuous passage, a further exhaust valve associated with the other contact and arranged to be opened automatically as a result of such a rapid reduction of gas pressure in the continuous passage and subsequently to be closed automatically upon the expiration of a predetermined time interval, the arrangement being such that, when the contacts begin to open, pressurized gas is permitted to blast through the interior of both contacts and through their respective exhaust valves.

In order that the invention will be readily understood, and further features made apparent, one embodiment of interrupter unit and a modification thereof constructed in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a general view of part of gas-blast electric switchgear apparatus in accordance with this invention;

FIG. 2 is a sectional elevation of an interrupter unit of the switchgear apparatus of FIG. 1; and

FIG. 3 is a sectional elevation of an alternative fixed contact arrangement for the interrupter unit of FIG. 2.

Referring to FIG. 1 of the drawings, the switchgear comprises a center casing 10 which is mounted on a support insulator 11, and which has a pair of interrupter units (indicated generally at 12) mounted symmetrically one on each side of it. The center casing 10 also has an exhaust valve (indicated generally at 13) mounted on top of it. The axis of the center casing in the embodiment described is vertical, but it will be understood that it may be at an angle to the vertical. The two interrupter units 12 are identical, and for convenience only one is shown in detail.

Referring now to FIG. 2, the interrupter unit has a flange 15 which is bolted onto a flange 14 (see FIG. 1) of the center casing 10.

A resin-bonded glass-fiber tube 16 is secured to the flange 15 by means of a threaded sleeve 17 and the other end of the tube 16 is secured to a flanged end member 18 by means of a threaded sleeve 19. A cylindrical porcelain shield 20 is mounted coaxially with the glass-fiber tube 16 and is held in compression between the flanges 15 and 18. The compressive stress to which the porcelain shield 20 is subjected by the tension in the tube 16, may be adjusted by screwing the threaded sleeve 19 into or out of the flange 18 to increase or reduce the tension respectively. The fixed and movable contacts 21 and 22 respectively of the unit are contained within the tube 16.

The movable contact 22 is formed as a hollow cylinder 23 supported by radial struts 24 from a central rod 25 and sliding in a fixed tube 26 bolted to the center casing 10 via a flange 27. The sliding surface of the cylinder 23 is provided with piston-ring contacts 28, and an insert 29 is provided at the contact end of the cylinder 23, which insert forms a contact throat and affords a contact surface for abutment with the fixed contact 21. The movable contact is associated with the exhaust valve 13 (FIG. 1). The actuating mechanism for the movable contact 22 and the exhaust valve may be of any suitable kind, and may, for example, be similar to that described in the specification of our Pat. No. 1,080,354.

The fixed contact 21 comprises a cylindrical housing 30 formed with an end wall 31 from which project a series of circumferentially arranged fingers 32. An annular piston 33 slides in the cylindrical housing 30 and is connected on one side thereof, by a tube 35, to an arcing contact 36.

The arcing contact 36 is supported by the fingers 32 when the fixed contact 21 is disengaged from the movable contact 22 as shown in FIG. 2 and is capable of limited sliding movement with respect to said fingers, the movement being controlled by the piston 33. The arcing contact 36 is normally urged to its fully extended position, as shown in FIG. 2, by a compression spring 37, said contact 36 being moved towards its retracted position when the movable contact 22 is actuated to engage the fixed contact whereupon the fingers 32 are separated from the arcing contact 36 and forced outwardly by the end of the cylinder 23 so as to grip the cylinder 23, the arcing contact being in contact with the throat 29.

A one-way valve 38 is located in the wall 31 of housing 30, the valve being operable to close the aperture 39 when the piston 33 begins to move towards its retracted position; this creates a pressure vacuum on the right-hand side of the piston 33 thus providing a resistance to movement of the arcing contact 36 which in turn ensures that the movable and fixed contacts remain in engagement after initial engagement of the movable and fixed contacts has been established. The valve 38 also allows the arcing contact 36 to move freely with the movable contact 22 during initial opening movement of the latter by allowing high pressure gas to flow from the housing 30 through aperture 39 into the bore of the tube 35.

The other side of the piston 33 has a further tube 40 connected thereto which is slidably mounted in the bore of a tubular housing 41 which is bolted to the cylindrical housing 30 and extends toward the flange 18 of the interrupter unit. A further flanged housing 42 is bolted onto the flange 18 and carries an exhaust valve arrangement generally denoted 43 for the fixed contact 21.

The exhaust valve arrangement 43 comprises a primary sleeve valve member 44 having a piston part 45 at one end which is slidable in a closed bore 46 of the housing 42, and a secondary valve member 47 having a piston 48 which is also slidable in the bore 46; the two pistons are normally urged away from each other by a compression spring 49. The sleeve valve member 44 is movable from a closed position, as shown in FIG. 2, in which it seals against a sealing ring 50 carried by the adjacent end of the tubular housing 41, thus shutting off an exhaust port 51 formed in the housing 42, and an open position uncovering said port. The right hand end of the bore 46 communicates with the annular space 52 between the tube 16 and the fixed and movable contacts 21, 22 via a port 53 and a passage 54. The secondary valve member 47 has a tube 55 extending from the piston 48 to within the sleeve valve member 44 and a shaped end portion 56 having passages 57 communicating with the bore of the tube 55. The end portion 56 is provided with an annular sealing projection 58 adapted to engage a corresponding projection 59 carried by the sleeve valve member 44. The bore of the tube 55 of the valve member 47 communicates with a delay chamber 60 via a shuttle valve 61 having a metering bore 62. The shuttle valve member being spring loaded into the position shown in FIG. 2.

In operation of the interrupter unit, assuming the contacts 21, 22 are closed and thus a continuous passage is formed by the tubular contact members, and assuming that the annular space 52 is fully pressurized from a pressure source within the center casing 10, if now the interrupter unit is required to open the exhaust valve 13 is opened and the actuating mechanism for the movable contact 22 is tripped.

The opening of exhaust valve 13 causes an immediate pressure drop in the continuous passage and therefore a pressure differential is set up across the piston 45 of sleeve valve member 44 which causes the latter to move automatically to its open position against the action of the compression spring 49, and the projection 59 of valve member 44 seals against the projection 58 of valve 47. Thus, when the contacts 21, 22 begin to open, which opening occurs after the valve member 44 has opened, due to the arcing contact 36 moving with the movable contact 22 under the action of compression spring 37 during the initial movement of said movable contact, gas may blast from the space 52 through the two contacts 21 and 22, thus extinguishing the main arc, and out through their respective exhaust valves. Gas also begins to drain at a controlled

rate from the delay chamber 60 through metering port 62 and passages 57 of the valve member 47 to the exhaust port 51, and when the pressure in the delay chamber has dropped to a predetermined value, the shuttle valve member 61 moves to the left against the spring loading, due to the pressure in passage 54, thus allowing the pressure in passage 54 to be directed against the left hand side of piston 48. This causes the piston 48 and hence the valve members 47 and 44 to move to the right until the valve member 44 seals against its sealing ring 50 thus closing the exhaust port 51. It will be appreciated that the closing of exhaust port 51 will be delayed by the delay chamber 60 for a length of time sufficient to enable the main arc to be extinguished. The exhaust valve 13 is then closed and hence pressure is reestablished throughout the interrupter unit. When the pressure has been reestablished in the tube 41, the pressure of both sides of piston 48 is therefore equalized and the piston moves to the left under the action of compression spring 49. The pressure in the delay chamber 60 will build up via the metering bore 62 and the shuttle valve member will return to the position shown under the spring loading. The complete exhaust valve arrangement 43 is thus reset to its initial position.

Referring now to FIG. 3 of the drawings, an alternative arrangement of exhaust valve 43 is shown which avoids the use of the two valve members 44 and 47 of FIG. 2. Thus in this arrangement only the sleeve valve member 44 is provided and its piston 45 is slidable in an annular chamber 65 formed by the exhaust valve housing 42 and a sleeve 66 which forms an extension of the bore of the tubular housing 41. The sleeve valve member 44 is movable between its closed position where it engages the annular sealing ring 50, which in this case is mounted in the end of said valve housing 42, closing the exhaust port 51 formed in said housing, and its open position uncovering said port. The valve member 44 is urged to its closed position by a compression spring 67, and to its open position by gas pressure via the space 52 between the tube 16 and the fixed and movable contacts, and passages 68 and 69 which communicate with the left-hand end of the chamber 66. The right-hand end of the chamber 66 can also communicate with annular space 52 via a passage 70, the shuttle valve 61 of the delay chamber 60 and a passage 71. The delay chamber 60 communicates with a further annular chamber 72 formed between the housing 42 and sleeve 66 via the metering bore 62 of the shuttle valve 61 and thence through to the bore of sleeve 66 via apertures 73.

The shuttle valve has a piston 74 which is slidable in a bore 75 which opens into the passage 71 and a compression spring 76 acts between the delay chamber 60 and the piston 74.

Thus, in operation of this exhaust valve arrangement, when the contacts 21, 22 of the interrupter unit are closed thus providing a continuous passage, and the unit is fully pressurized gas pressure on the two sides of piston 74 of shuttle valve 61 is equalized as is the pressure on the two sides of piston 45 of sleeve valve member 44.

These valves are thus in the positions as shown in FIG. 3 due to the action of their respective compression springs 76 and 67. If now the exhaust valve 13 opens and the actuating mechanism for the movable contact 22 is caused to operate, gas pressure in the continuous passage falls rapidly and thus the pressurized gas in the right hand side of the piston 45 of sleeve valve member 44 drains rapidly through the passage 70 and space 72 permitting this valve to open automatically against the action of the compression spring 67. Thus, when the contacts begin to open, gas can blast from the space 52 through the contacts and their respective exhaust valves. At the same time the pressurized gas in the delay chamber 60 begins to drain through the metering bore 62 of the shuttle valve 61 at a controlled rate until it falls sufficiently for the shuttle valve member to move to a position in which it shuts off the space 72 by the pressure in passage 71 acting against the action of compression spring 76. This movement of the shuttle valve member 61 places the passage 70 in communication with the space 52 via passage 71, and hence the pressure on the two sides of piston 45 is again equalized and the valve 44 returns pneumatically to its closed position assisted by the compression spring 67. The exhaust valve 13 is now closed so that pressure can be reestablished throughout the unit and as soon as the pressure on both sides of the piston 74 of shuttle valve 61 equalizes, the valve will return to its initial position under the action of compression spring 76.

We claim:

1. Gas-blast electric switchgear including an interrupter unit comprising a chamber having a continuous filling of pressurized gas, disposed within said chamber a pair of relatively movable hollow contacts which cooperate together to provide a continuous passage when engaged and which when disengaged provide respective exhaust passages for gas blasting through the gap between the contacts, an exhaust valve connected between a low-pressure region and the interior of one of the contacts and operable to cause a rapid reduction of gas pressure in the continuous passage prior to disengagement of the contacts, and a further exhaust valve connected between the low-pressure region and the interior of the other contact and having operating means automatically effective to open the further exhaust valve in response to such a rapid reduction of gas pressure in the continuous passage and to reclose the further exhaust valve upon the expiration of a predetermined time interval.

2. Gas-blast electric switchgear as claimed in claim 1, wherein the further exhaust valve includes a sleeve valve member having an integral piston part, the cylinder space on one side of said piston part being in communication with pressurized gas and the cylinder space on the other side of said piston part being in communication with the continuous passage prior to the opening of the further exhaust valve so that, upon a rapid reduction of gas pressure in the continuous passage, the sleeve valve member moves to uncover an exhaust port so as to place the continuous passage in communication with the exhaust port, and thus open the further exhaust valve.

3. Gas-blast electric switchgear as claimed in claim 2, wherein the further exhaust valve includes a chamber, the interior of which is in communication with the interior of said other contact through a metering bore formed in a shuttle valve member, the arrangement being such that, due to controlled drainage through the metering bore during said predetermined time interval, the pressure within the chamber falls to such an extent that, at the end of said predetermined time interval, the shuttle valve member moves to place one side of a piston in communication with pressurized gas which causes movement of the piston and results in movement of the sleeve valve member to close the exhaust port.

4. Gas-blast electric switchgear as claimed in claim 3, wherein, in order to uncover the exhaust port, the sleeve valve member moves away from said other contact and into engagement with a secondary valve member which is integral with said piston.

5. Gas-blast electric switchgear as claimed in claim 4, wherein the secondary valve member includes a tube which slidably contains the shuttle valve member so that the metering bore is in communication with the interior of the tube which is in communication with the exhaust port when the sleeve valve member is in its open position in engagement with the secondary valve member.

6. Gas-blast electric switchgear as claimed in claim 3, wherein in order to uncover the exhaust port, the sleeve valve member moves towards said other contact against the action of spring means urging it into its closed position, and wherein movement of the shuttle member at the end of said predetermined time interval closes the communication between said other side of said piston part and the continuous passage and places said other side in communication with pressurized gas so that the sleeve valve member is moved into its closed position by the spring means.