Nov. 6, 1951 A. LATOUR 2,574,334

AIR-BLAST CIRCUIT-BREAKER

Filed July 23, 1947 5 Sheets-Sheet 1

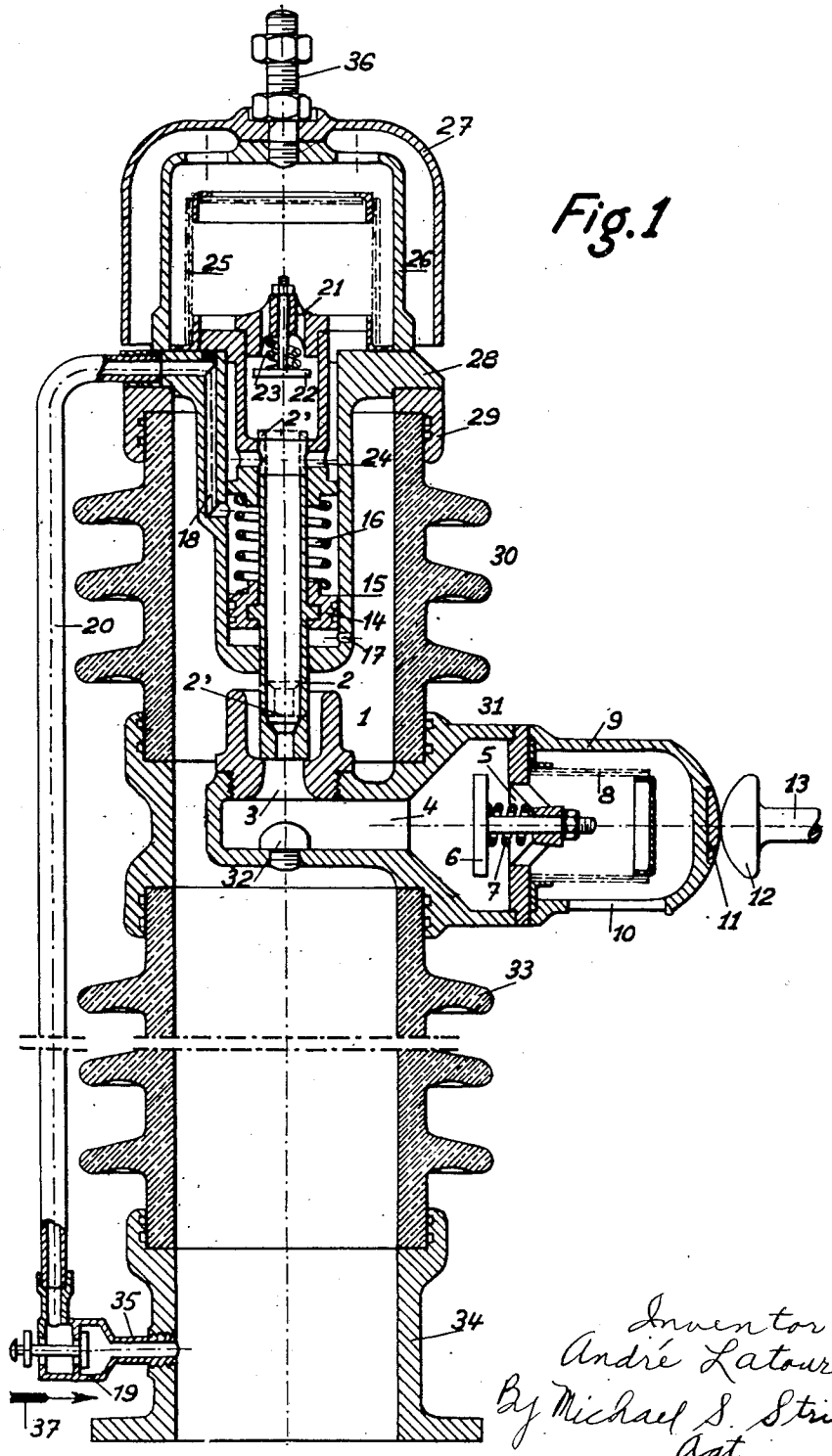

Fig. 1

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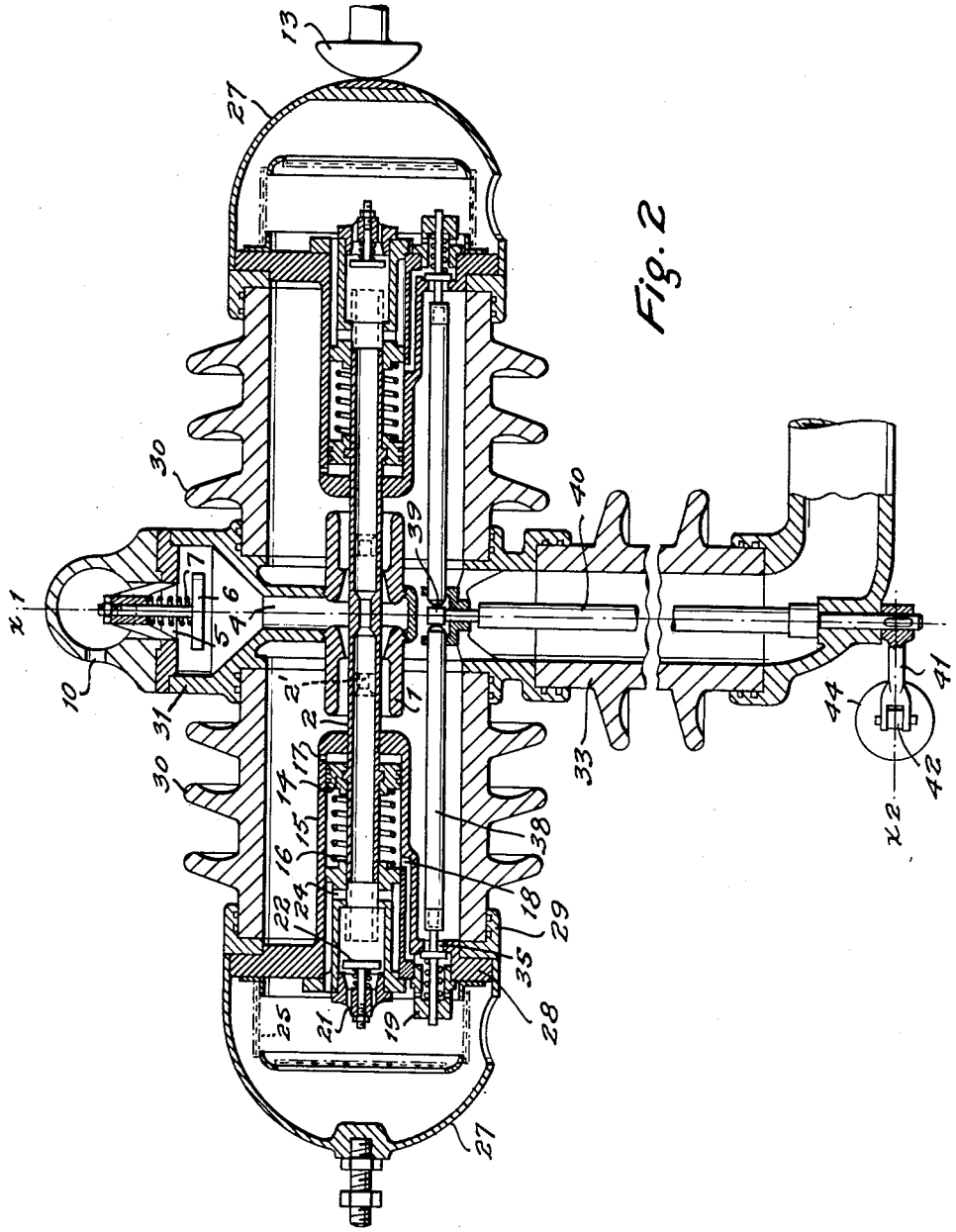

Fig. 2

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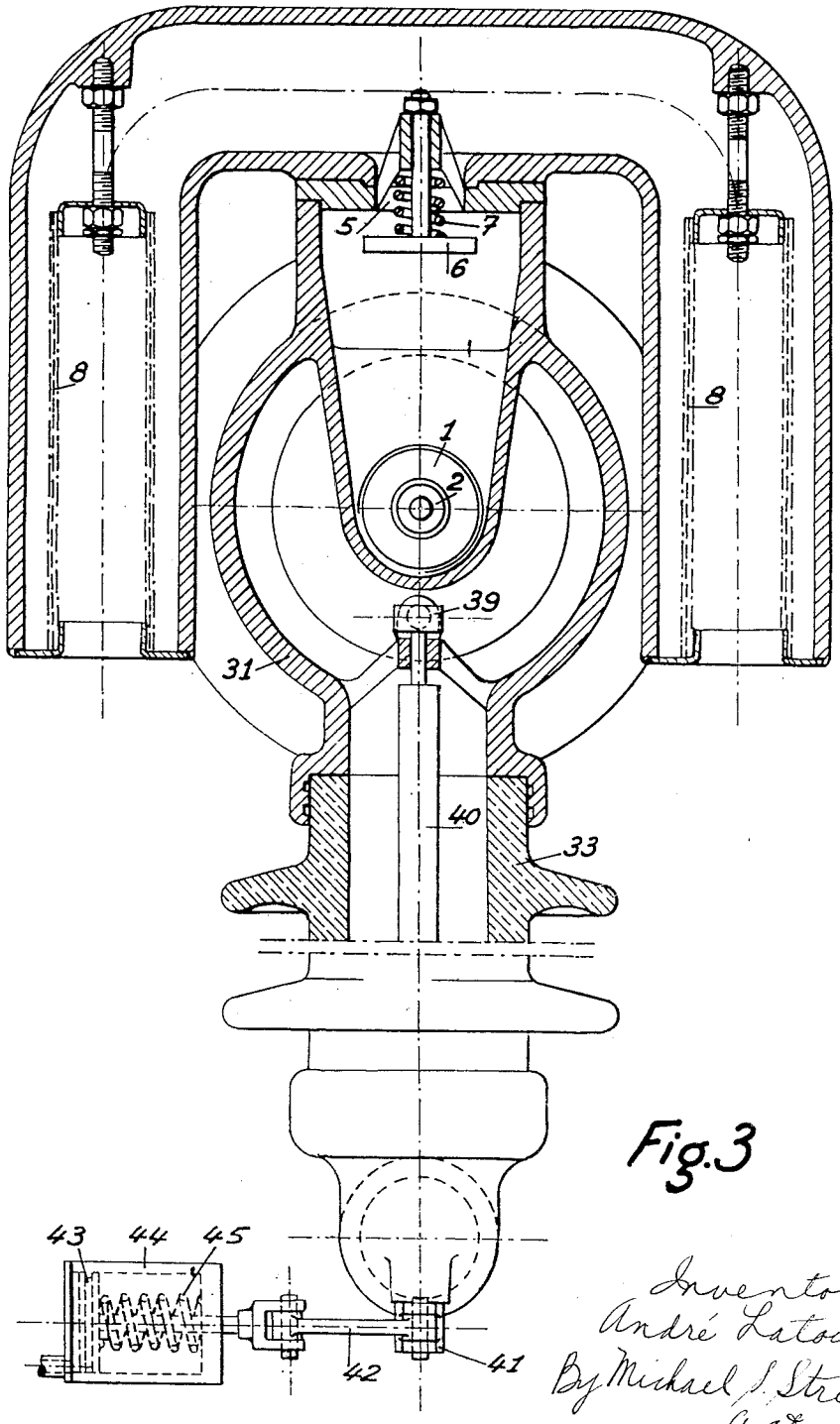

Fig. 3

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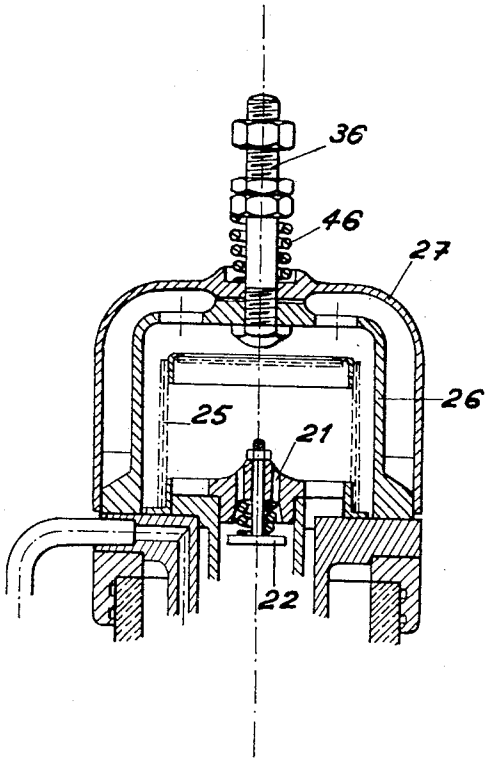
Fig. 4



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AIR-BLAST CIRCUIT-BREAKER

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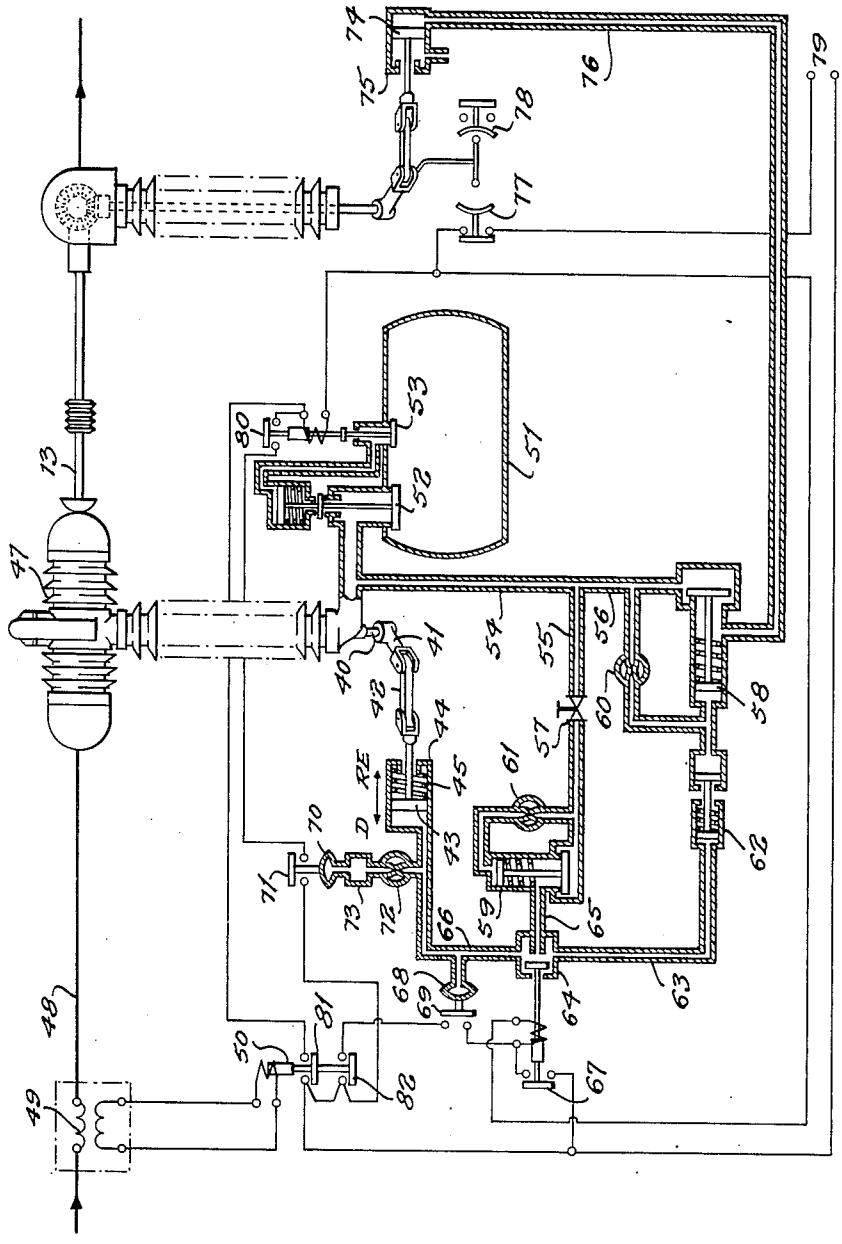

Fig. 5

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AIR-BLAST CIRCUIT BREAKER

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4 Claims. (Cl. 200—148)

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The present invention relates to gas blast circuit breakers, and more particularly to gas blast circuit breakers with a movable hollow contact element and a spring loaded valve arranged coaxially to the movable contact element.

It is an object of the present invention to provide a high voltage circuit breaker in which the steps of interruption and closing are obtained by particularly simple and economical means of construction.

It is another object of the present invention to provide means to improve the action of the circuit breaker and to render its adjustment and upkeep more easy.

According to the present invention the gas blast circuit breaker comprises a chamber arranged at the end of the movable contact element opposite to the contact-making face thereof; an aperture arranged in a wall of the chamber and connecting the same with the atmosphere, said aperture being arranged in the path of the movable contact so as to be closed by the same in the contact-breaking position thereof; a seat for the valve arranged in the wall of the chamber at a distance apart from the aperture; resilient means urging the valve away from the seat; and openings in said chamber connecting said valve seat to the atmosphere, whereby the valve is closed by the gas blast entering the chamber through the hollow contact element and is opened when the gas blast is cut off from the chamber by the closing movement of the contact element.

In a preferred embodiment of the present invention a second chamber is arranged at the end of the hollow of a stationary contact element turned away from the contact-making face thereof and is provided with a valve similar to that mentioned hereinabove.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 shows an axial section of a circuit-breaker with a single movable contact.

Fig. 2 shows an axial section of a circuit-breaker with two movable contacts, more especially for very high voltages.

Fig. 3 shows in its upper portion a section along the line X_1—X_2 of Fig. 2 and in its lower portion a side elevation taken at right angles to Fig. 2.

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Fig. 4 shows an exhaust pot for an outdoor installation.

Fig. 5 shows an assembly of a circuit-breaker and the auxiliary control elements according to the invention and permitting a rapid reclosure.

In Fig. 1, 1 represents a stationary hollow contact element arranged in the form of a nozzle and 2 a movable hollow contact element of tubular shape. The forward orifice 3 of the contact 1 opens into a chamber 4, called the exhaust chamber, which communicates with the atmosphere through the orifice 5. This orifice can be closed more or less completely by a valve 6, which is normally kept in open position by a spring 7. A cylinder 8 formed by one or several layers of fine metal gauze collects the gases leaving the orifice 5 and allows them to filter into a hood 9 only after having suitably cooled them. An aperture or opening 10 formed at the lower part of the hood allows the gases to pass freely to the atmosphere. The hood 9 is preferably provided with a contact piece 11 on which can rest the contact head 12 of a disconnecting switch 13.

The movement of the movable contact 2 shown at 2' in open position is effected by a piston 14 sliding in a cylinder 15 and returned by a spring 16 which determines the pressure of contact of the movable contact 2 on the stationary contact 1. The front face of the piston 14 can be subjected to the action of compressed gas by means of one or more apertures 17 provided in the wall of the cylinder. The rear face of the piston may be subjected, if desired, either to the action of atmospheric pressure or to the action of the compressed gas through the intermediary of a duct 18 connected through an insulating tube 20 to a distributor 19.

The central passage of the movable contact 2 communicates with the atmosphere on the one hand by an orifice 21 which may be shut by a valve 22, kept normally in open position by a spring 23, and on the other hand by one or more orifices 24, which are closed by the movable contact 2 in the opening movement thereof.

The two kinds of orifices 24 and 21 open into an exhaust pot 25 protected from weather influences by hoods 26 and 27. The cylinder 15 bears at its upper end a flange 28 forming a cover fixed to the insulator 30 by a collar 29. An insulator 30 is, on the other hand fixed to a collar 31 carrying the stationary contact 1. The part 32 is an easily replaceable arcing-electrode. The whole is supported by an insulator 33, through the interior of which the compressed gas can be introduced by means of the duct 34, which at the

same time feeds the distributor 19 through the pipe 35. Current enters through a terminal and leaves by the disconnecting switch 13, or vice versa.

The operation of this device is as follows:

When the breaker is closed no blast can happen in the chamber 4, or in the movable contact 2, no matter what may be the pressure in the interior of the insulator 30.

Through the intermediary of duct 34 the piston 14 is subjected on the front thereof to the pressure of the gas passing through the apertures 17 and on the rear face to atmospheric pressure transmitted by the duct 18, the tube 20 and the distributor 19 which at this moment is in the position shown on Fig. 1. The piston 14 thus moves upwards, compressing the spring 16, and carries along with it the movable contact 2 into position 2' in which the movable contact closes the orifices 24.

In this position, the compressed gas flows rapidly through the stationary contact 1, the exhaust-chamber 4, the orifices 5 and 10 and on the other hand, through the central duct of the movable contact 2, the orifice 21 and the hoods 26 and 27. Thus a very strong blast is produced and the arc formed by the parting of the contacts 1 and 2 is rapidly extinguished. As soon as the blast occurs the valves 6 and 22 are urged to close, but, these, because of their mass, have not been able to travel their closing distance before the short time necessary to extinguish the arc. When the valves 22 and 6 are closed, the blast is interrupted and the compressed gas is maintained without appreciable leakage within the insulator 30, thus securing as long as necessary the breaking of the circuit and the insulation between the contacts.

The final opening of the circuit is secured by the opening of the disconnecting switch 13.

When this operation is terminated, the interior of the insulator 30 may be brought to atmospheric pressure by a device not shown in the drawing. Thus the contacts close, the valves reopen and the device is ready for a fresh operation.

If, on the contrary, leaving the disconnecting switch 13 in closed position, a closing of the circuit is intended, it suffices to actuate the distributor 19 in the direction of the arrow 37.

This may be done by hand, or after a predetermined lapse of time automatically by means of any mechanical, pneumatic, or electric device. Under such conditions, the piston 14 is subjected on both faces to the same pressure and may be rapidly moved by the force of the spring 16. Thus, the movable contact returns to its initial position in contact with the stationary contact 1, closing thereby the inlet of compressed gas into the chamber and opening the apertures 24 through which the residual compressed gas escapes immediately into the atmosphere. Thereafter the valves 6 and 22 are no longer subjected to any pressure and are reset by their respective springs.

The device is then ready for a new operation which may be obtained by the reverse movement of the distributor 19 and that as often as required. The distributor 19 could likewise be located on one of the parts under voltage, for instance the flange 28, and actuated pneumatically or mechanically by a device at the interior or exterior of the insulator 30. An example of such a design will be given hereinafter.

It will be noted that in the closing movement a blast of very short duration is created, as soon as the movable contact 2 has uncovered the apertures 24. This feature involves an advantage because the ionized vapors produced by the closing arc and which may disturb a subsequent break are eliminated.

Another advantage of the described invention resides in the easy accessibility of the contacts. The movable contact and its whole mechanism are easily removable as soon as the cover 28 has been unscrewed from the collar 29. The stationary contact 1 and the arcing contact 32 are then easily removable by means of a tube spanner.

Figs. 2 and 3 show another embodiment of the invention more particularly characterized in that two breaking elements are used which are identical and the similar to those of Fig. 1. The exhaust chamber 4 and the parts which are following to the chamber in direction of the blast (valve 5 and exhaust pot 8) are single and serve for both breaking elements. The part 1, which is in Fig. 1 designed as a stationary contact, is provided in the present case only as a nozzle and made, for instance, of insulating material. The contact is, therefore, achieved by the placing end to end of the two movable contacts 2. Objection may be made that in this position, they do not allow the relief of the chamber 4 from pressure, but in fact, the relief of the pressure in chamber 4 begins as soon as the movable contacts have been entered the necks of the nozzles 1, respectively, and by reason of its rapidity, it is generally completed at the moment when the contacts meet each other. Should it be otherwise it would be sufficient to provide grooves on the contacting surfaces of both contacts.

The parts mounted in the interior of the two insulators 30 joined by the common collar 31 may be supported, without exceeding the scope of the present invention, by a single co-axial insulator, as shown in Fig. 1.

However, the device as shown in Figure 2 is supported through the common collar 31 by an insulator 33 placed at a right angle to the insulators 30 and serving as a duct for the compressed gas. This embodiment of the invention is particularly advantageous because the total height of the breaker is reduced and the accessibility of the contacts and all the parts connected therewith is greatly facilitated.

The two protecting hoods 27 are arranged at the outer ends of the insulators 30, respectively, and the disconnecting switch like the switch 13 shown in Fig. 1 is connected to one of these hoods.

This device operates substantially in the same manner as the device shown in Fig. 1.

The distributor 19 is actuated by an insulating push rod 38 actuated by a cam 39 integral with an insulating shaft 40. The rotation of this shaft may be obtained by any means, but preferably by means of an arm 41 actuated by a connecting rod 42, driven by a piston 43, which is moved pneumatically in a cylinder 44 against the force of a spring 45 shown in Figs. 3 and 5.

Referring now to Fig. 3 the exhaust takes place from the upper part of the device, downwards through a cylinder 8 of metallic gauze which the hot gases penetrate in a centripetal direction before reaching the atmosphere. This embodiment prevents the entrance of atmospheric impurities into the breaker.

A more effective design is shown in Fig. 4 and may be applied to any exhaust device. In this embodiment, the exhaust gases after having

passed through the metallic gauze cylinder 25 lift a hood 27, the rim of which engages the lower portion of a member 26 enclosing the cylinder 25 and provided with apertures for the gas. By the lifting of the hood 27 a spring 46 is compressed, and the exhaust gases escape into the atmosphere. When the exhaust is interrupted, the hood 27 falls back on its seat thus forming a tight protection against atmospheric impurities.

In Fig. 5 a device according to the invention is shown together with the accessories thereof. The interrupting device, as shown for instance in Figs. 2 and 3 is represented by 47. The disconnecting switch 13, is shown in closed position, 49 is a current transformer controlling a tripping relay 50. The breaker 47 is supplied with compressed gas from the reservoir 51, through a pneumatic valve 52 controlled by an electro-valve 53. A shunt pipe 54 starting at the valve 52 supplies through a duct 55 a device securing a rapid reclosing of the breaker without intervention of the disconnecting switch and on the other hand through a duct 56 the pneumatic control of the disconnecting switch. A cock 57 actuated manually or mechanically allows to eliminate, if desired, the reclosing device. 58 and 59 are pneumatic valves having their opening temporized by calibrated throttles 60 and 61 the cross-sections of which are calculated as functions of the dead space of the cylinders controlling said valves, so that the pressure necessary to actuate these valves is only reached after a predeterminated lapse of time. The dead space situated behind the piston of the valve 58 may be brought to atmospheric pressure by the discharge or decompressing valve 62 which opens when a certain pressure exists in the duct 63.

64 is a valve, which, when actuated, closes the supply duct for compressed air 65 and connects the ducts 63 and 66 to atmospheric pressure. In Fig. 5, this valve is represented as an electro-valve closing the gas supply when its electro-magnet is energized and maintained energized by the contact 67. It is, however, evident that any other control means such as pneumatic or mechanical ones, may be used.

68 is a manometric device closing a contact 69 when the pressure has become sufficiently strong in the duct 66.

A similar device 70, opens a contact 71, when actuated by the pressure prevailing in a chamber 73, this pressure being transmitted to the chamber with a convenient delay by a throttle 72. The operation of the piston 43 has been explained hereinabove in connection with Fig. 2. This piston controls when moving, in the direction of the arrow RE, the rapid reclosing and when moving in the direction of the arrow D the release of the breaker.

The movement of the disconnecting switch 13 is controlled by a piston 74 sliding in a cylinder 75. The opening of the disconnecting switch is obtained by supplying compressed gas to one face of the piston through the valve 58 and the duct 76, and its closing by supplying the compressed gas to the other face of the piston through a closing valve or an electro-valve (not shown). At the end of its opening stroke, this device opens an auxiliary contact 77 and at the end of its closing stroke an auxiliary contact 78, bringing the closing valve into rest position. An auxiliary source 79 supplies low voltage current to the different circuits of the arrangement.

As explained hereinabove, the breaker may be utilised as ordinary circuit-breaker or as a circuit-breaker with rapid reclosure.

In the first case, the cock 57 is closed, the operation being as follows:

When an excess current occurs on the line 48, the current transformer energizes the relay 50, which closes the contact 81, which in turn actuates the electro-valve 53, which opens the main valve 52. The contact 82 closes at the same time, but remains inoperative because of the contact 69 which is open. The circuit breaker 47 is set under pressure, the contacts part rapidly, the arc is extinguished, the open contacts close the exhaust orifices, as more fully explained hereinabove. Thus the current is interrupted in the line 48 and the relay 50 opens at once its contacts. The electro-valve 53 remains nevertheless open, because the magnet coil thereof is still energized by current flowing through the maintaining contact 80. After a certain time, however, predetermined by the retarding throttle 60, the valve 58 opens and actuates the disconnecting switch which at the end of the stroke thereof opens the contact 77 and cuts the supply of the electro valve 53, so that the latter closes and causes hereby the closing of the main valve 52 and connects the circuit-breaker 47 and all ducts to atmospheric pressure. Hereupon the contacts of the breaker reclose which involves no inconvenience as the disconnecting switch is still open.

In the second case, when the rapidly reclosing device is to be used the cock 57 remains open and the operation is the same as in the first case up to the moment when the contacts of the breaker 47 part. But as the retardation of the throttle 61 is shorter than the retardation of the throttle 60, the valve 59 opens before the opening of valve 58. The opening of the valve 59 supplies the pressure to the ducts 63 and 66. The pneumatic valve connects through the duct 63 the control chamber of the valve 58 to atmospheric pressure and prevents it from opening as long as the pressure does not disappear in the duct 63. The compressed gas flowing through the pipe 66 drives the piston 43 in the direction of the arrow RE and through rotation of the rod 49 causes the closing of the contacts of the circuit-breaker 47, in a fully compressed gas atmosphere, as has been explained hereinabove in connection with Fig. 2. The effect of this closure is, as already mentioned, the rapid opening of the valves 6 and 22 (Fig. 2) thus allowing for a subsequent new blast.

If the fault in the line 48 has disappeared, the closing of the contacts of the breaker is not followed by any abnormal current and the relay 50 keeps its own contact open. After a certain time, determined by the throttle 72 supplying the volumetric chamber 73, the manometric device 70 opens the contact 71. Hereby, the electro-valve 53 and the valve 52 are closed and the arrangement returns to the initial position thereof without any actuation of the disconnecting switch.

If, however, the fault in the line persists, the closing of the contacts of the breaker restores the abnormal current, which then actuates the relay 50 once more.

Thus this relay closes its contacts 81 and 82. The closing of contact 81 has no consequence, the electro-valve being already supplied by its own contact 80. But the closing of 82 acts on the magnet-coil of the valve 64, because the contact 69 is closed as soon as the duct 66 is under pressure. Thus the electro-valve 64 opens and stays open owing to the current supplied by contact 67. This valve shuts off the compressed gas

supply 65 and connects the ducts 63 and 66 to the atmosphere. This causes a backward stroke of the piston 43 in direction of the arrow D and a new trip of the breaker 47 which by the opening of the contacts interrupts the short circuit.

Furthermore the pneumatic valve 62 closes, thus permitting the valve 58 to open after a time predetermined by the throttle 60. The opening of the valve 58 causes the opening of the disconnecting switch 13 which at the end of the stroke thereof opens the contact 77 and so puts the electro-valves 64 and 53 out of action. By so doing the whole arrangement returns to its initial position. If the line 48 is to be closed again it suffices to send, by a device not shown in the drawings, for instance an electro-valve, compressed gas to that face of the piston 74 which corresponds to the closing position. The contact 77 is reclosed and the breaker is ready for a new operation.

What I claim is:

1. A gas blast circuit breaker with a movable hollow contact element and a spring-loaded valve arranged coaxially to the movable contact element, comprising in combination, a chamber arranged at the end of the movable contact element opposite to the contact making face thereof; an aperture in said chamber for engagement of the end of the movable contact element opposite to the contact making face thereof; a seat for the valve arranged in said chamber opposite to said aperture; resilient means urging the valve away from said seat; and openings in said chamber connecting said valve seat to the atmosphere, whereby the valve is closed by the gas blast entering said chamber through the hollow contact element and is opened when the gas blast is cut off from said chamber by the closing movement of said contact element.

2. A gas blast circuit breaker with a movable hollow contact element and a spring-loaded valve arranged coaxially to the movable contact element, comprising in combination, a chamber arranged at the end of the movable contact element opposite to the contact making face thereof; an aperture in said chamber for engagement of the end of the movable contact element opposite to the contact making face thereof; a seat for the valve arranged in said chamber opposite to said aperture; resilient means urging the valve away from said seat; openings in said chamber connecting said valve seat to the atmosphere; orifices arranged in the wall of said movable hollow contact element; and a stationary duct leading to the atmosphere and adapted to communicate with said orifices when the movable contact element is in contact closing position, said orifices being closed when the movable contact element moves into the opening position.

3. A gas blast circuit breaker with a stationary hollow contact element; a movable hollow contact element and two spring-loaded valves arranged, respectively, coaxially to the movable contact element and to the hollow of the stationary contact element, comprising in combination, a first chamber arranged at the end of the movable contact element opposite to the contact making face

thereof; an aperture in said first chamber for engagement of the end of the movable contact element opposite to the contact making face thereof; a first seat for the valve arranged coaxially to the movable contact element, said first seat being arranged in said first chamber opposite to said aperture; openings in said first chamber connecting said first valve seat to the atmosphere; a second chamber arranged at the end of the hollow of said stationary contact element turned away from the contact making face thereof; a second seat for the valve arranged coaxially to the hollow of the stationary contact element; resilient means urging away the valves from said seats, respectively; and openings in said second chamber connecting said second seat to the atmosphere, whereby the valves are closed when the gas blast enters said chambers, respectively, through the movable hollow contact element and the hollow of the stationary contact element and are opened when the gas blast is cut off by the closing movement of said movable contact element.

4. A gas blast circuit breaker with a stationary hollow contact element, a movable hollow contact element and two spring-loaded valves arranged, respectively, coaxially to the movable contact element, comprising in combination, a first chamber arranged at the end of the movable contact element opposite to the contact making face thereof; an aperture in said first chamber for engagement of the end of the movable contact element opposite to the contact making face thereof; a first seat for the valve arranged coaxially in the movable contact element, said first seat being arranged in said first chamber opposite to said aperture; openings in said first chamber connecting said first valve seat to the atmosphere; a second chamber arranged at the end of the hollow of said stationary contact element turned away from the contact making face thereof; a second seat for the valve arranged coaxially to the hollow of the stationary contact element; resilient means urging away the valves from said seats, respectively; openings in said second chamber connecting said second seat to the atmosphere; orifices arranged in the wall of said movable contact element; and a stationary duct leading to the atmosphere and adapted to communicate with said orifices when the movable contact element is in contact closing position, said orifices being closed when the movable contact element moves into the opening position.

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