Feb. 5, 1952 A. LATOUR 2,584,888

OPERATING MEANS FOR ELECTRIC SWITCHES

Filed Jan. 23, 1947 4 Sheets-Sheet 1

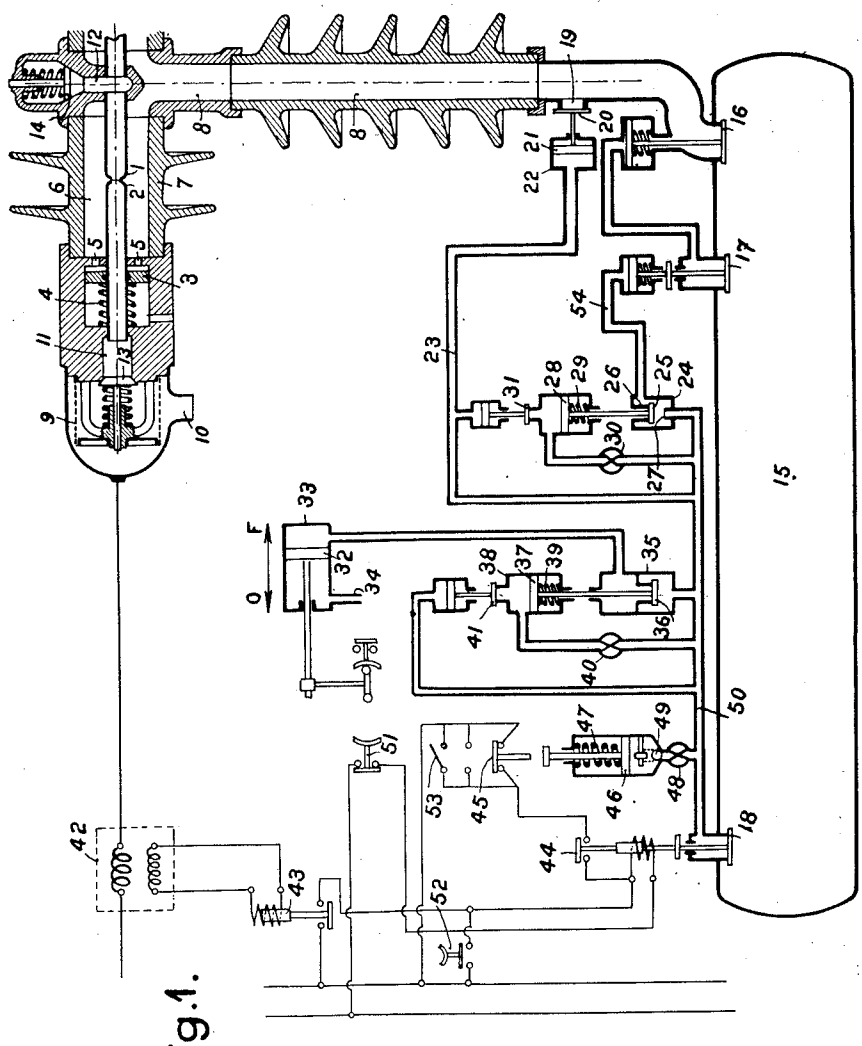


Fig. 1.

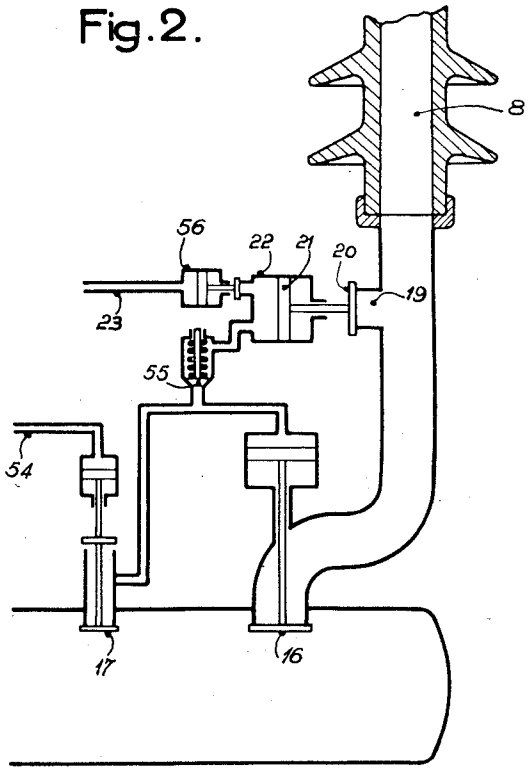
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Fig. 2.



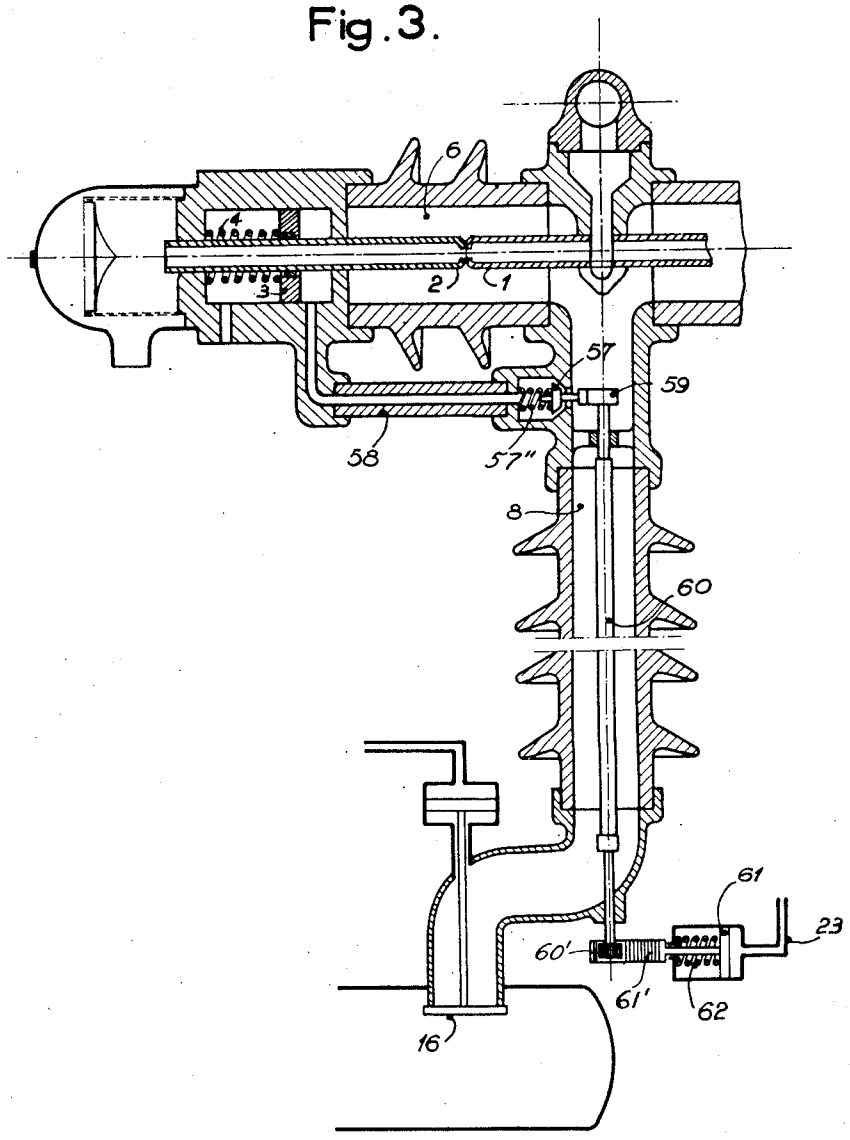
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Fig. 3.



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OPERATING MEANS FOR ELECTRIC SWITCHES

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Fig. 5.

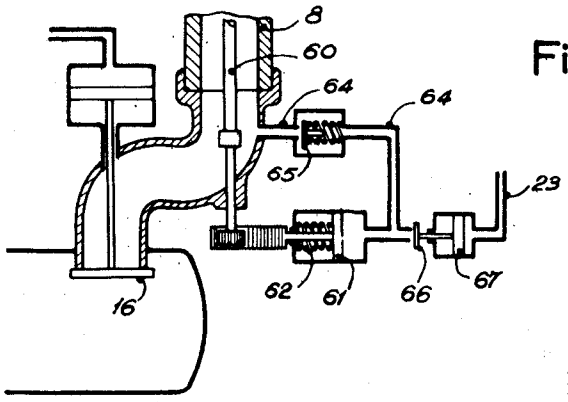


Fig. 4.

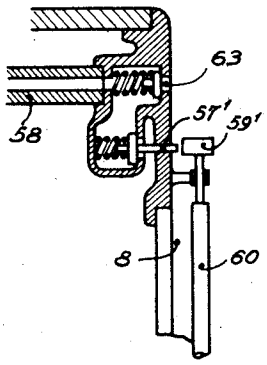
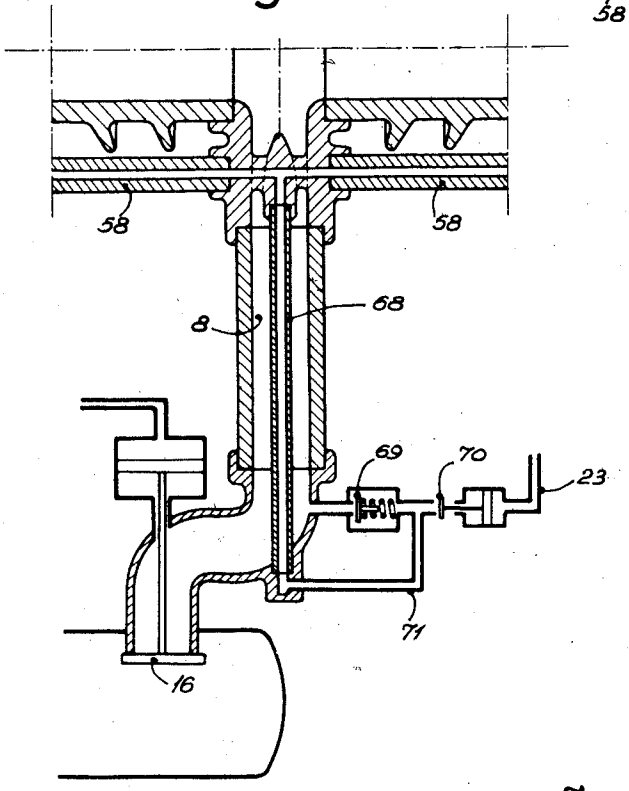


Fig. 6.



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Patented Feb. 5, 1952 2,584,888

UNITED STATES PATENT OFFICE

2,584,888

OPERATING MEANS FOR ELECTRIC SWITCHES

André Latour, Grenoble, France

Application January 23, 1947, Serial No. 723,726
In France December 4, 1942

Section 1, Public Law 690, August 8, 1946
Patent expires December 4, 1962

4 Claims. (Cl. 200—82)

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The present invention relates to a pressure gas switch and more particularly to a switch operating with compressed air.

It is an object of the present invention to economize in the use of compressed gas.

It is another object of the present invention to limit the time period of the flow of the compressed gas between the contacts of the switch to the time necessary for the extinction of the arc and to prevent the reclosing of the contacts so as to avoid a re-formation of the arc after the ceasing of the flow of the compressed gas.

It is a further object of the present invention to control the dielectric strength between the contacts of the switch in the open position thereof.

A pressure gas switch according to the present invention comprises a stationary contact and a movable contact interconnected in an electric circuit, an enclosure structure surrounding an arc extinguishing member into which the contact making ends of the contacts extend, a cylinder adjacent the chamber, a piston reciprocable in the cylinder and rigidly secured to the movable contact for moving the same between a contact making position and a circuit break position and having one side intercommunicating with the chamber, conduit means for connecting the chamber to a blast pressure source to supply the extinguishing blast and to move the piston and the movable contact in circuit break position, the means including a valve for admitting gas emanating from the source to the chamber and an exhaust valve in the cylinder for maintaining after the closure of the gas admitting valve in the chamber a residual pressure sufficient to keep the piston in circuit breaking position for a predetermined period of time.

Other characteristic features of the invention will be evident more clearly from the following description given with reference to the accompanying drawings which show by way of example, not limitative, some methods of carrying the invention into effect. On these drawings:

Fig. 1 shows in partial axial section a circuit breaker according to the invention, the various pneumatic elements being shown diagrammatically;

Fig. 2 shows a modification of a part of Fig. 1;

Fig. 3 shows a modification of another part of Fig. 1;

Fig. 4 shows a modification of a part of Fig. 3;

Fig. 5 shows another modification of a part of Fig. 3; and

Fig. 6 shows another modification of the switch shown in Fig. 1.

In Fig. 1 the left side of a pole is shown, the right hand side being identical and disposed symmetrically relatively to the entry of compressed air. The insulating member, for example a disconnecting switch, mounted in series with the pole, is not shown. 1 and 2 are respectively the stationary and movable contacts or electrodes having a tubular structure and a similar shape. The movable contact 2 is integral with a piston 3 urged toward the stationary contact 1 by a spring 4. The face of the piston 3 turned toward the stationary electrode communicates through openings 5 with a break chamber 6 formed by a hollow insulator 7 connected to a hollow column 8. The opposite face of the piston 3 communicates with the atmosphere. The exhaust openings 11 and 12 are open to the atmosphere through the usual gas cooling and de-ionization means, for example, through perforated metal sheets 9 and the conduit 10. The exhaust orifices 11 and 12 are respectively closed by valves 13 and 14 the springs of which are calibrated in such a manner that the counter pressure of the valves cannot modify to any appreciable extent the speed of discharge of the gas at the entry of the electrodes 1 and 2. Preferably, the valves are calculated to yield to a pressure lower than or at most equal to $\frac{52}{100}$ of the pressure utilized in the chamber 6.

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The supply of the chamber 6 with compressed air is effected in known manner starting from the reservoir 15, through the blower valve 16 actuated pneumatically by the electro-valve 18 with the interposition of the pneumatic relay 17 which, however, can be dispensed with. On the exhaust pipe of the blower valve 16 an orifice 19 is provided which is closed by a valve 20 controlled pneumatically by a piston 21 sliding in a cylinder 22. In the absence of compressed air in the cylinder 22, the valve 20 yields easily to any pressure transmitted by the orifice 19 and thus permits an opening of the break chamber 6 to the atmosphere. When, however, compressed gas is let into the cylinder 22 by the electro-valve 18 and the pipe 23, the valve 20 is strongly urged against its seat and keeps the pressure in the chamber 6.

The re-closing of the blower valve 16 is effected with lag, independently of the electro-valve 18, by a pneumatic device known as a decompressing obturator 24, comprising essentially a valve 25 moving between two seats 26 and 27 which, respectively, communicate with the atmosphere and the outlet of the electro-valve 18. The valve 25 is actuated by a piston 28 which is opposed by a spring 29 holding the valve 25 against its seat 26. The cylinder in which the piston 28 slides is supplied with compressed air through a calibrated orifice 30 and atmospheric pressure can be immediately restored in the cylinder by means of a valve 31 which is pneumatically actuated.

The motor of the insulating member or disconnecting switch mounted electrically in series to the main contacts 1, 2 is diagrammatically shown as a piston 32 sliding in a cylinder 33.

The piston 32 supposed to cause the opening of the insulating member when it moves from right to left, the closing being effected by the opposite motion. This latter movement is effected pneumatically over the pipe 34 by means of a valve or electro-valve (not shown). The opening movement is effected by means of a delayed pneumatic valve 35 comprising essentially a flap valve 36 actuated by a piston 37 moving in a cylinder 38 and actuated by a spring 39 which holds the valve on its seat in the absence of compresed gas in the cylinder 38. The cylinder 38 is fed with compressed gas through a calibrated orifice 40 and atmospheric pressure can be very rapidly restored in the cylinder 38 by means of a valve 41 which is pneumatically actuated.

The release of the circuit breaker is effected in the usual manner by a current transformer 42 acting on an indirect relay 43 the closing of which feeds the electro-magnet of the electro-valve 18. The latter comprises a holding contact 44 which feeds the electromagnet of the electro-valve independently of the relay 43 through the contact 45. This latter is under the influence of a retarding device released by the closure of the electro-valve 18 and the stroke of which is proportional to the time of the total closing of the electro-valve 18 during the operation of the circuit breaker. The retarding device comprises a pneumatic arrangement which includes a piston 46 sliding in a cylinder and held against an abutment by the action of a spring 47 acting in opposition to the force produced by the compressed air admitted to the cylinder by the electro-valve 18, through a calibrated orifice 48. A retaining valve 49 prevents the piston 46 from descending again when the electro-valve 18 closes and connects the pipe 50 with the atmosphere. The electric circuit of the electro-valve 18 is, moreover, broken by a contact 51 when the motor driving the insulating member reaches the end of its opening stroke.

The operating times for the various retarding devices, counting from the opening of the electro-valve 18 are such that the opening period of the valve 25 is less than the opening period of the contact 45 which in turn is less than the opening period of the valve 36. These conditions are satisfied by making the choke orifices 30, 40 and 48 controllable by means not shown in the drawing.

The opening of the circuit breaker can also be effected independently of the relay 43, for example, by means of a push button 52. If desired, the automatic closing device can be put out of service; it suffices for that purpose to close the contact 45.

The operation of the circuit breaker is as follows:

When a fault occurs in the mains, the transformer 42 excites the relay 43 the contact of which closes and thus brings about the opening of the electro-valve 18 which puts the pipe 50 under pressure. The effect of this is:

1. To block the various decompression valves 20, 31 and 41 in the closed position thereof;

2. To cause the immediate opening of the pneumatic relay 17 and the blower valve 16;

3. To release the starting of the retarding devices driven by the chokes 30, 40 and 48, respectively.

The effect of opening of the blower valve 16 is to put the chamber 6 very rapidly under pressure, to displace the movable contact 2, to open

the valves 13 and 14 so as to permit the rapid discharge of the compressed gas through the contacts 1, 2 and to extinguish the breaking arc. As soon as the latter has disappeared the current in the mains and the transformer 42 is interrupted and the contact of the relay 43 opens once more. The electro-valve 18 remains, nevertheless, open because the holding contact 44 thereof is closed as long as the piston rod 46 which moves relatively slowly, has not yet opened the contact 45. Previously, the retarding device controlled by the choke 30 has acted, the valve 25 moves rapidly from the seat 26 thereof so as to abut against the seat 27 thus closing the inlet for compressed air and putting the pipe 54 in communication with the atmosphere. The result is the closing of the pneumatic relay 17 and the blower valve 16. The pressure then drops in the chamber 6 and the valve 13 and 14 close again. From this moment a certain pressure remains in the chamber which acts on the piston 3, thus preventing the contacts 1, 2 from closing again.

After a predetermined period of time, the rod of piston 46 lifts the contact 45 and, since the switch 53 is open, breaks the circuit to the electro-valve 18 so that the latter closes again and puts the pipe 50 in communication with the atmosphere. The movable contact 45 having left the lower stationary contacts cooperating therewith remains in a middle position between the lower and upper stationary contacts in spite of the spring 47 because the valve 49 opposes any flow of gas. However, a second operation of the electro-valve 18 has the effect to put the movable contact 45 in touch with the upper stationary contacts. The effect of putting the pipe 50 into communication with the atmosphere is: 1. To release the valves 31 and 41 thus bringing back the retarding devices corresponding thereto to zero position. It should be understood that in these conditions the valve 36 has not sufficient time to operate and that consequently the insulating member actuated by the piston 32 remains in the closed position; 2. To release the valve 20 and thus cause the disappearance of the residual pressure in the chamber 6 thus re-closing the main contacts 1, 2.

At this moment two cases are to be considered:

In the first case the re-closing of the contacts 1, 2 is followed by no appreciable demand for current. In these conditions the relay 43 and the electro-valve 18 remain inactive. The piston 46 slowly returns to the initial position thereof because of gas leakages. Thereafter the system is back again at the starting point.

In the second case the re-closing of the contacts 1, 2, is followed by a supply of current of the same value as that which caused the first release. Thereafter the relay 43 closes the contact thereof and the electro-valve 18 operates a second time. In consequence thereof the same sequence of operations results as previously, that is to say:

1. Blocking of the decompression valves 20, 31 and 41 in closed position;

2. Opening of the pneumatic relay 17 and the blower valve 16;

3. Release of the starting of the retarding devices controlled by the chokes 30, 40 and 48.

As regards the latter it should be noted that the movable contact 45 which at the moment of the second operation of the electro-valve 18 is in the opening position between the pairs of lower and upper stationary contacts, closes again very

rapidly on the upper pair so that the electro-valve 18 is fed by the holding contact 44 thereof independently of the relay 43.

The operation of the valve 25 which causes the closing of the blower valve 16 will not now be followed by the re-closing of the electro-valve 18 because the contact 45 is locked in one of the closing positions thereof. Consequently the valve 36 has sufficient time to operate. The opening of the valve 36 causes the movement of the piston 32 driving the insulating member which when it reaches the end of the stroke thereof, causes the opening of the contact 51 thus effecting the closing of the electro-valve 18.

To prevent too great a flow through the electro-valve 18, the cylinder 22, as shown in Fig. 2, may be fed by means of the pneumatic valve 17 through the stop valve 55. The electro-valve 18 feeds then only the cylinder 56 controlling a decompressing valve of cylinder 22, the volume of cylinder 56 being much smaller than that of cylinder 22.

The residual pressure which is maintained on the forward face of the piston 3 controlling the opening of the contacts 1, 2 can, as shown in Fig. 3, be independent of the pressure in the chamber 6. For this purpose the chamber 6 and the cylinder of piston 3 are not in direct communication with each other. The cylinder of the piston 3 is fed, starting with the entry of the gas into the column 8, through a tubular insulator 58 and a valve 57 actuated by a cam 59 driven by the insulating shaft 60. Furthermore, the escape ports are open to the atmosphere through the usual coolers. The position of the valve 57 is dependent upon the position of a piston 61 which, when compressed gas is sent by the electro-valve 18 shown in Fig. 1 into the conduit 23, compresses the spring 62 and causes by means of a rack 61' and pinion 60' the shaft 60 and the cam 59 to rotate so that the valve 57 abuts against the seat thereof through the pressure of a spring 57''. The valve 57 is moved from the seat thereof when the conduit 23 is connected to atmospheric pressure, the action of the spring 62 returning the piston 61.

When the electro-valve 18 opens causing successively the opening consecutively of the blower valve 16 and the subjection of the chamber 6 to pressure, the conduit 23 is put under pressure and the piston 61 moves to compress the spring 62. The result is a rotation of the cam 59 which allows the valve 57 to abut against the seat thereof. However, the latter is subjected to the pressure of compressed gas in the conduit 8 so that the valve 57 opens thus allowing the gas to act on the piston 3 which it drives against the spring 4, thus causing the separation of the contacts 1, 2. When the valve 16 closes again so that the pressure is lowered in the chamber 6 and the column 8, the valve 57 returns to the seat thereof and opposes an outflow of the compressed gas from the cylinder of the piston 3 so that the latter remains in the position separating the contacts 1, 2, in spite of the drop in pressure which results from the closing of the valve 16 and the flowing out of the gas through the contacts 1 and 2. When the electro-valve 18 re-closes the conduit 23 empties and the piston 61 acted upon by the spring 62 returns to its initial position causing the rotation of the cam 59 and the opening of the valve 57. The compressed gas acting on the piston 3 can then pass through the conduit 8, chamber 6 and contacts 1 and 2 which close again because the action of the spring 4 is no longer balanced by the compressed gas acting on the piston 3.

This device is not independent of the residual pressure prevailing in the conduit 8. This fact does not lead, as a rule, to any inconvenience because at the moment when it is desired to operate the closing of the contacts the pressure in conduit 8 has practically entirely disappeared. Nevertheless, it is possible to obtain a complete independence as shown by Fig. 4 in which it will be seen that the admission and outlet of compressed gas to and from the insulator 58 are actuated by two different valves 63 and 57^1, the latter being dependent on the cam 59^1 and opening directly to the atmosphere.

Instead of actuating the piston 61 by the compressed gas coming from the electro-valve 18, it is also possible, as shown in Fig. 5 to actuate the piston 61 by the compressed gas coming from the blower valve 16. For that purpose, a conduit 64 obstructed by a valve 65 is connected to the outlet of the blower valve 16 and opens in front of the piston 61. The communication with the atmosphere of the piston 61 is obtained by means of a decompression valve 66 actuated by the electro-valve 18 by means of the pipe 23 and a piston 67. The operation of this device is as follows: when the electro-valve 18 opens, the pipe 23 is put under pressure and the valve 66 actuated by the piston 67, is held in closed position. Almost simultaneously the blower valve 16 opens putting the conduit 8 under pressure. The compressed gas lifts the valve 65 from its seat and acts on the piston 61 which it drives against the action of the spring 62. When the valve 16 closes again and the pressure drops in the conduit 8, the compressed gas continues to hold the piston 61 in position because it cannot escape by the valve 65 or by the decompression valve 66 which is held in closing position as long as the electro-valve 18 is open. Only when the latter closes again, putting the conduit 23 in communication with the atmosphere, the valve 66 is released allowing the compressed gas to escape freely and thus permitting the spring 62 to return to the piston 61 to its initial position.

The control of the pressure at the front face of the piston 3 can also be obtained in a purely pneumatic manner. Fig. 6 is an example thereof. In this figure, the insulators 58 leading to the pistons 3 (not shown in Fig. 6) receive the compressed gas through the intermediary of an insulating tube 68, which is fed from the outlet of the blower valve 16, by a pipe 71 and a valve 69. A decompression valve 70 actuated by the electro-valve 18 by means of the conduit 23 enables the pipe 71 to be put in communication with the atmosphere. The operation of this device is as follows: when the electro-valve 18 opens, the pipe 23 is put under pressure and the valve 70 is held in closed position. Almost simultaneously the blower valve 16 opens putting the conduit 8 under pressure. The compressed gas lifts the valve 69 and acts on the piston 3 (not shown in Fig. 6) by the tubes 71, 68 and 58 to cause the separation of the contacts (not shown). When the valve 16 re-closes and the pressure drops in the conduit 8, the compressed gas cannot escape through the valves 69 and 70 and maintains its action on the piston 3 (not shown in Fig. 6) until the electro-valve 18 re-closing puts the pipe 23 in communication with the atmosphere. Then the valve 70 connects the conduit 71 and the cylinder of piston 3 (not shown) to the atmosphere so that the latter

is pushed back by the spring 4 (not shown in Fig. 6) which results in the closing of the contacts.

The arrangements shown in Figs. 4 and 6 which provide the control of the pressure on the forward face of the piston 3 independently of the pressure which exists in the chamber 6, are particularly advantageous when, for reasons of di-electric strength between the contacts, it is necessary to retain a certain pressure residually which can be effected by obstructing, as hereinbefore explained, the exhaust orifices by means of the valves 13 and 14 shown in Fig. 1.

The tubes 58 have been described as insulators and thus can be made of insulating material preferably a ceramic material. They can also be made of a semi-conducting layer (for example by a cathodic process) in such a way as to form resistance elements shunting the breaking arcs.

It is obvious that the invention can be applied to any type of circuit breaker with compressed gas action in which the movement of the mobile contact is effected by the compressed gas acting in opposition to a closing spring no matter what may be the number of breaks in series, the form and the disposition of the contacts. In particular it applies to single break apparatus with or without an insulating nozzle, with one or two tubular contacts, with one or two solid contacts, the details being adapted to suit the particular case or the applications under consideration, without exceeding the scope of the present invention.

What I claim is:

1. In a pressure gas switch comprising a stationary contact and a movable contact interconnected in an electric circuit, in combination, an enclosure structure surrounding an arc extinguishing chamber into which the contact making ends of said contacts extend, a cylinder adjacent said chamber, a piston reciprocable in said cylinder and rigidly secured to said movable contact for moving the same between a contact making position and a circuit break position and having one side intercommunicating with said chamber, conduit means for connecting said chamber to a blast pressure source to supply the extinguishing blast and to move said piston and said movable contact into circuit break position, said means including a valve for admitting gas emanating from said source to said chamber, and an exhaust valve in said cylinder for maintaining after the closure of said gas-admitting valve in said chamber a residual pressure sufficient to keep said piston in circuit breaking position for a predetermined period of time.

2. In a pressure gas switch comprising a stationary contact and a movable contact interconnected in an electric circuit, in combination, an enclosure structure surrounding an arc extinguishing chamber into which the contact making ends of said contacts extend, a cylinder adjacent said chamber, a piston reciprocable in said cylinder and rigidly secured to said movable contact for moving the same between a contact making position and a circuit break position and having one side intercommunicating with said chamber, conduit means for connecting said chamber to a blast pressure source to supply the extinguishing blast and to move said piston and said movable contact into circuit break position, said means including a valve for admitting gas emanating from said source to said chamber; an exhaust valve in said cylinder for maintaining after the closure of said gas-admitting valve in said chamber a residual pressure sufficient to keep said piston in circuit breaking position, and means operable to connect said chamber to the atmosphere during a predetermined period of time after the closure of said gas-admitting valve.

3. In a pressure gas switch comprising a stationary contact and a movable contact interconnected in an electric circuit, in combination, an enclosure structure surrounding an arc extinguishing chamber into which the contact making ends of said contacts extend, a cylinder adjacent said chamber, a piston reciprocable in said cylinder and rigidly secured to said movable contact for moving the same between a contact making position and a circuit break position and having one side intercommunicating with said chamber, conduit means for connecting said chamber to a blast pressure source to supply the extinguishing blast and to move said piston and said movable contact into circuit break position, said means including a valve for admitting gas emanating from said source to said chamber, an exhaust valve arranged in said cylinder for maintaining in said chamber a residual pressure sufficient to keep the piston in circuit breaking position, and means interconnected to said exhaust valve for releasing said residual pressure after a predetermined period of time after the closing of said gas-admitting valve.

4. In a pressure gas switch comprising a stationary contact and a movable contact interconnected in an electric circuit, in combination, an enclosure structure surrounding an arc extinguishing chamber into which the contact making ends of said contacts extend, a cylinder adjacent said chamber, a piston reciprocable in said cylinder and rigidly secured to said movable contact for moving the same between a contact making position and a circuit break position and having one side intercommunicating with said chamber, conduit means for connecting said chamber to a blast pressure source to supply the extinguishing blast and to move said piston and said movable contact into circuit break position, said means including a valve for admitting gas emanating from said source to said chamber, an exhaust valve connecting said chamber to the atmosphere surrounding said structure and arranged to be moved between a closed position wherein a residual pressure is maintained in said chamber and against said piston for keeping said movable contact disengaged from said stationary contact following circuit break and an open position for interconnecting said chamber to the atmosphere, and means operable to actuate said valve and to move the same into the closed position and to maintain it therein for a predetermined period of time after the closure of said gas-admitting valve and to open the same after the expiration of said period.

ANDRÉ LATOUR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,904,577	Uebermuth	Apr. 18, 1933
2,306,186	Rankin	Dec. 22, 1942