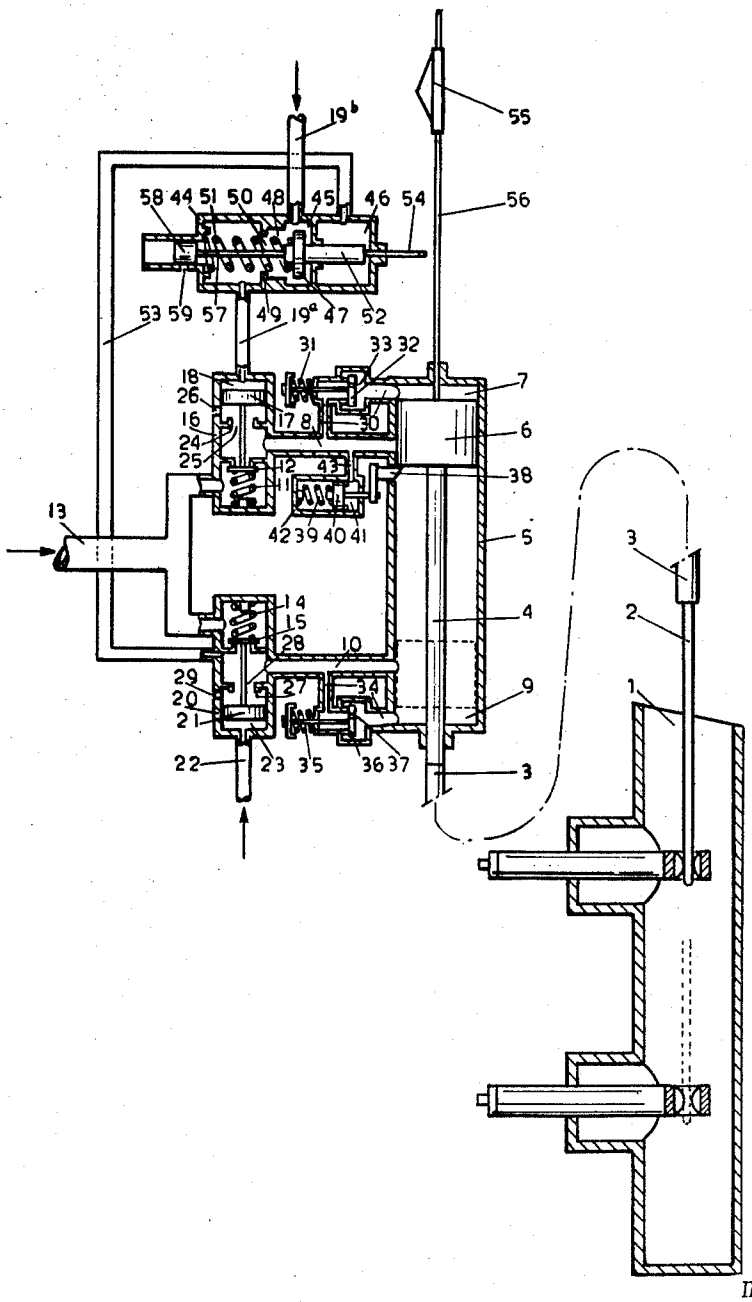
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CIRCUIT-BREAKERS FOR HIGH VOLTAGE PROVIDED WITH A PNEUMATIC DRIVING MECHANISM

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CIRCUIT-BREAKERS FOR HIGH VOLTAGE PROVIDED WITH A PNEUMATIC DRIVING MECHANISM

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The invention relates to a circuit-breaker for high voltage having a pneumatic driving mechanism and of the type in which a movable switching member is mechanically coupled with a piston, movably accommodated in a double acting main cylinder connected to the pneumatic main circuit by two compressed air control conduits. A valve biased to closed position is provided in each of said conduits and controlled by a piston provided in an auxiliary cylinder connected to a control. One of said valves is adapted to be opened on a pneumatic command in its control conduit for closing the circuit-breaker and the other one is adapted to be opened on a pneumatic command in the other control conduit for opening the circuit-breaker.

The invention has for its primary object to solve in a simple manner the problem of preventing, in a pneumatically controlled circuit-breaker of the above described type, the repetitive opening and closing of the circuit breaker during the occurrence of a closing command. In other words, the circuit breaker, after it has been closed, may be immediately opened by an opening command received in the meantime and, for instance, coming from the safety device and, if the closing command is still maintained, the circuit breaker may be immediately closed again, the opening and closing being repeated as long as the closing command is maintained. Thus in conventional circuit breakers a closing command is put into effect as long as a previously given opening command is in force. According to the invention this problem is solved by means of an auxiliary valve provided in the control conduit for closing the circuit-breaker. The auxiliary valve is normally open and is so constructed and so controlled by pressure in the opening control conduit, by a member fixed to and moving together with the piston of the main cylinder, and by the control conduit for closing the circuit-breaker as to be moved from the open into the closed position either by over-pressure in said opening control conduit or, during the closing stroke of said piston, by said member fixed to the piston. The auxiliary valve is kept in the closed position either by over-pressure in said opening control conduit or by over-pressure in the control conduit for closing the circuit-breaker.

The invention will be further elucidated with the aid of the drawing which illustrates a sectional view of the parts, essential to understanding the improvements, of a circuit-breaker according to the invention.

In the drawing 1 represents a circuit-breaker for high voltage, of which the switching rod 2 is connected through an insulator 3 with a piston rod 4 of the piston 6 mounted for reciprocation in a double acting cylinder 5. The chamber 7 above the piston communicates with a closing conduit 8 and the chamber 9 below the piston is connected with an opening conduit 10 of a pneumatic main circuit for the supply of compressed air to the cylinder 5 when the circuit-breaker has to be closed and opened, respectively. The closing conduit 8 is connected to the main supply conduit 13 through a valve 12 which is kept closed in the position of rest by a spring 11 and the opening conduit 10 is connected to said conduit 13 through a valve 15 kept closed in the position of rest by a spring 14. The valve 12 is opened by a piston 17 movably

mounted in a cylinder 16. To that end the cylinder space 18 is connected to a control conduit 19*a*, 19*b* for the closing operation, through which conduit compressed air is supplied after a closing command has been given. The valve 15 provided in the opening conduit 10 of the main circuit is opened by means of its piston 21 movably mounted in a cylinder 20, when after the issue of an opening command compressed air is supplied to the cylinder space 23 through the control conduit 22. The cylinder 16 is provided with a partition 24 having an opening 25 adapted to be closed in an air-tight manner by the piston 17 and having a smaller diameter than the piston 17. In the wall of the cylinder 16 is a vent 26 which may be closed by the piston 17. Similarly there is in the cylinder 20 a partition 27 having an opening 28 adapted to be closed in an air-tight manner by the piston 21 and having a smaller diameter than the piston 21. The cylinder 20 is also provided with a vent 29 adapted to be closed by the piston 21.

In the uppermost position of the piston 6 the chamber 7 of the cylinder 5 is connected to the closing conduit 8 of the main circuit through a conduit 30 provided with a check-valve 32 opening towards the chamber 7 and loaded by a spring 31, said check-valve having a small aperture 33. In the lowermost position of the piston 6 the chamber 9 of the cylinder 5 is connected to the opening conduit 10 of the main circuit through a conduit 34 provided with a check-valve 36 loaded by a spring 35 and having a small aperture 37. In the uppermost position of the piston 6 the latter is held by a locking pin 38 adapted to be withdrawn by means of a piston 40 loaded by a spring 39. To that end the space 41 of the cylinder 42 is connected with the closing conduit 8 by a conduit 43.

The described pneumatic driving mechanism for closing and opening the circuit-breaker operates as follows:

If the circuit-breaker has to be closed, compressed air is supplied to the space 18 of the cylinder 16 through the conduit 19*b*, *a* after a closing command has been given. Owing thereto the piston 17 is forced against the partition 24 which is provided with a fitting seat, the opening 26 is closed and the valve 12 is opened. Thereby the conduit 13 of the main circuit, in which over-pressure obtains, is brought into communication with the closing conduit 8 and compressed air flows through the check-valve 32 into the chamber 7 of the main cylinder and at the same time compressed air is supplied to the space 41 of the cylinder 42 through the conduit 43, whereby the piston 40 is moved to the left and the locking pin 38 is removed.

The piston 6 is then moved downwards and after the direct connection between the closing conduit 8 and the cylinder chamber 7 has been established said piston is driven with great velocity into the position, in which the circuit-breaker is closed.

The air contained in the cylinder chamber 9 is, during said movement of the piston 6, at first discharged to the atmosphere through the opening conduit 10 and the opening 29 provided in the wall of the cylinder 20. However, as soon as the conduit 10 has been closed by the piston 6, the said air must escape through the conduit 34 provided with the clock-valve 36. Since in that case the check-valve 36 is closed said air has to flow through the small aperture 37, so that the piston 6 is braked by an air cushion, when approaching the end of its closing stroke. If in the meantime the closing command has ended, whereby the over-pressure in the conduit 19*b*, *a* has disappeared, the piston 17 is forced upwards by the spring 11 and the valve 12 is closed again.

If it is desired to open the closed circuit-breaker again, compressed air is supplied through the conduit 22 owing to an opening command, whereby the piston 21 is moved upwards, the openings 28 and 29 are closed and the valve 15 is opened. Due thereto, compressed air from

the main conduit 13 is supplied below the piston 6 through the conduits 10 and 34 and the piston is moved upwards. The piston pushes the locking pin 33 away, so that the piston is able to pass. Also during opening, the piston is caught near the end of its stroke by an air cushion due to check-valve 32. After the opening command has ended the valve 15 is closed again by the spring 14 and the conditions as illustrated in the drawing are restored.

It is observed that the closing process and the opening process require very little time, say some tenths of a second. Consequently, it can easily happen that a closing command is given while there is still trouble in the electric network. The safety device will then issue an opening command immediately after the closing of the circuit breaker. After the circuit-breaker has been opened again, the operator may still maintain the closing command, for instance by keeping his finger on the push-button for closing the circuit-breaker. In such case, the circuit-breaker would be closed again and thereafter opened once more by the pneumatic driving mechanism described hereabove, and the closing and the opening operations of the circuit-breaker would continue till the operator releases the push-button for the closing command. In such manner the circuit-breaker could be closed and opened many times in a short period of a few seconds. Also it is conceivable that with the circuit-breaker closed, the safety device issues an opening command and the operator keeps the push-button for closing the circuit-breaker pressed down at the same time, so that the circuit-breaker is closed again and immediately thereafter is opened once more. Now, in order to prevent the so-called pumping-action of the circuit-breaker in the situations referred to hereabove, an auxiliary valve 47 is inserted in the control conduit 19*b*, *a*.

The auxiliary valve 47 is enclosed in a housing 44 provided with chambers 45 and 46, which are separated from one another in an airtight manner. Valve 47, formed as a piston slide valve, is mounted in chamber 45 and is adapted to be forced into a cylinder 48, which is open at one end, and to close an opening 50 surrounded by a seat 49. In the position of rest the valve 47 is held in the shown position outside the cylinder 48 by a spring 51 and the chamber 45 forms an open connection between the parts 19*a* and 19*b* of the control conduit for closing the circuit-breaker. The stem of the valve is constructed as a plunger 52 projecting into the chamber 46. This chamber is connected by a conduit 53 to the opening control conduit 10 of the main circuit. Attached to the plunger 52 is a thin stem 54 protruding to the outside and adapted to cooperate with a cam 55 provided on a rod 56 which is connected to the piston 6. The valve 47 is further coupled by a rod 57 with a slide valve 58, which in the position of rest keeps an opening 59 closed. The described auxiliary valve operates as follows:

If a closing command is given the valve 12 is opened in the ordinary way, since the valve 47 is in its opened position. Consequently, the circuit-breaker is closed. Just before the piston 6 reaches the end of its closing stroke the valve 47 is forced into the cylinder 48 by the cam 55 striking rod 54, so that the control conduit 19*a*, *b* is closed, and the compressed air contained in the supply part 19*b* of said conduit presses the valve 47 against its seat 49. At the same time the opening 59 is opened, so that the discharge part 19*a* of said control conduit is vented and the valve 12 is closed again by the spring 11. Thereby the closing command is made inactive. If an opening command is given, first the valve 15 is opened by the pressure in the conduit 22 and thereupon compressed air is supplied from the conduit 13 through the conduit 53 to the chamber 46, so that also in that case the valve 47 is forced into the cylinder 48 and against the seat 49, since the plunger 52 is pushed out of the chamber 46. Consequently, an opening command also inactivates a closing command, which immediately follows. Thus the circuit-breaker can only be closed once in abnormal cases.

Moreover the length of time of the closing command no longer affects the actions of the circuit-breaker.

What I claim is:

1. An electric circuit-breaker for high voltages, comprising a switching member movable between an open position in which it contacts no more than one of a pair of spaced contacts to a closed position in which it bridges said pair of contacts, said open position corresponding to opening of the circuit breaker and said closed position corresponding to closing of the circuit breaker, a pneumatic main circuit, a double acting main cylinder, a main piston mounted for reciprocation in said main cylinder and mechanically coupled to said movable switching member, said piston dividing said main cylinder into two active chambers, an individual compressed air conduit connecting said pneumatic main circuit to each of said chambers, a valve provided in each of said individual compressed air conduits, said valves being biased to close said conduits, a pneumatic control conduit connected to each of said individual compressed air conduits for introducing air pressure pneumatic commands to respectively close and open the circuit breaker, auxiliary cylinders connected to said control conduits, pistons provided in said auxiliary cylinders and coupled to said valves to move the valves to open their respective individual compressed air conduit upon air pressure resulting from a pneumatic command in the respective control conduit, an auxiliary valve provided in the control conduit which introduces pneumatic commands for closing the circuit breaker, and a control member mounted on said piston for reciprocation therewith, said auxiliary valve being normally biased to open the said closing control conduit but being movable to close the control conduit by engagement with said control member during movement of said switching member and connected main piston to said closed position.

2. An electric circuit breaker according to claim 1 wherein a branch conduit connects said control conduits, said branch conduit being so arranged with respect to said auxiliary valve as to provide pressure to move the auxiliary valve to close its associated control conduit upon reception of a pneumatic pressure signal in the other control conduit for moving the switching member to its open position.

3. An electric circuit breaker according to claim 2 further comprising a housing enclosing said auxiliary valve and separating said control conduit for closing the circuit breaker into parts, said housing having an inlet and an outlet opening connected to said parts, a valve seat in said housing controlling communication between said inlet and outlet openings, said auxiliary valve being movable against said seat to close communication between said parts of the control conduit, a port in said housing to atmosphere and communicating with one of said control conduit parts through said outlet opening, a second auxiliary valve in said housing movable to close and open said port, the movement of said second auxiliary valve to open said port serving to open to the atmosphere the part of the said control conduit connected to said outlet opening after the first auxiliary valve has been closed, said branch conduit being connected to said housing, an auxiliary piston in said housing exposed to the pressure obtaining in said control conduit for opening the circuit breaker through said branching conduit, a member fixed to said auxiliary piston and protruding from the housing for engagement by said control member, said second auxiliary valve and said auxiliary piston being coupled to the valve body of the first auxiliary valve.

4. An electric circuit breaker according to claim 3 wherein said housing includes a cylinder portion surrounding said seat and open at one end, the valve body of the first auxiliary valve being formed as a piston valve slideably movable into said cylinder and against said seat.

No references cited.