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[54] **DIFFERENTIAL VALUE SAFETY DEVICE FOR COMPRESSED GAS CIRCUIT INTERRUPTERS**

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[51] **Int. Cl.**.....**H01h 33/54**

[58] **Field of Search**.....200/148 R, 148 D, 148 E

[56] **References Cited**

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[57] **ABSTRACT**

Safety device for a multibreak gas-blast circuit breaker supplied from a common pressure gas source through a gas line distribution system. A leaking branch of this system is automatically isolated by the safety device detecting a pressure difference between the feeded branches while the undamaged part of the circuit breaker remains in operation. The safety device comprises balanced three way valve means.

6 Claims, 3 Drawing Figures

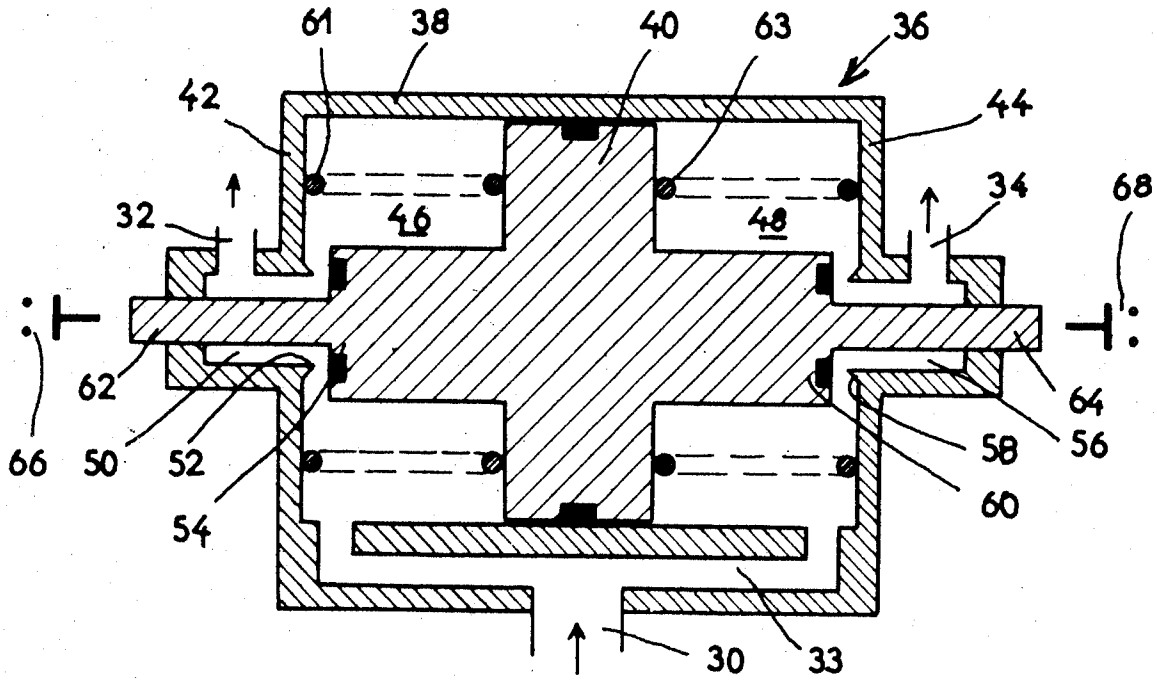


Fig.1

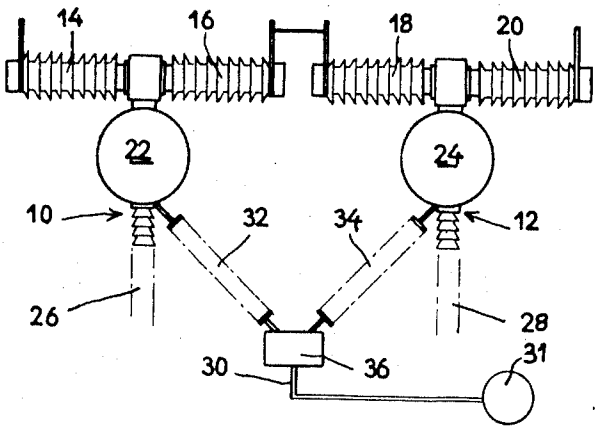


Fig.3

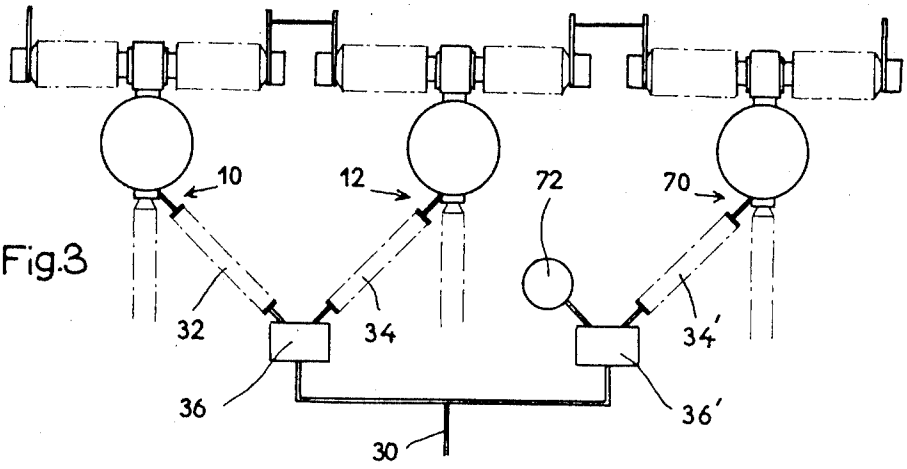
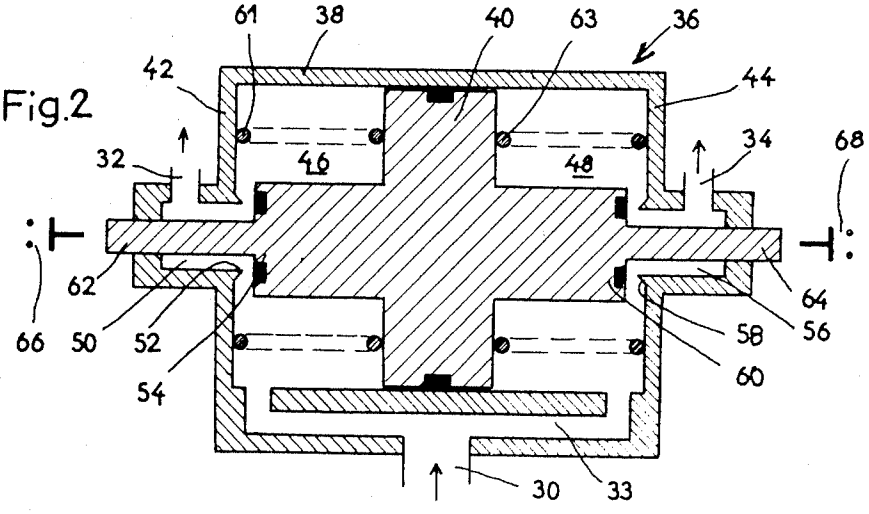


Fig.2



DIFFERENTIAL VALUE SAFETY DEVICE FOR COMPRESSED GAS CIRCUIT INTERRUPTERS

This invention relates to an electrical installation comprising a plurality of gas blast circuit interrupters supplied from a common pressure gas source by a branching distribution system having a safety device for isolating any faulty part of the distribution system.

Constantly increasing capacities and voltages of electricity networks require an increasing number of gas blast circuit breakers or interrupters for a given installation, and advantageously, these circuit breakers are supplied by a common pressurizing station through a pressure air or gas distribution system. Protection systems are known which detect normal or accidental pressure drops and operate corresponding interlocks to prevent misoperation, and valves for isolating the faulty part of the pressurizing circuit. The known facilities are complicated and cannot be used to isolate a heavily leaking single module or element of a circuit breaker while allowing the undamaged modules to continue in operation so as to provide a temporary service. If one pole of a circuit breaker has two or more modules, the insulation of the undamaged modules may be enough to withstand the ordinary voltage, and so it would be advantageous if the undamaged modules remain in operation for instance in opened position of the circuit breaker. Advantageously, indicating means are associated with the safety device.

It is an object of this invention to obviate these disadvantages and to provide a simple and effective safety device for isolating a faulty part of the system.

Another object of the invention is to provide a multibreak circuit breaker wherein a leaking part may be isolated, the remaining undamaged parts still being in operation.

The safety device comprises a valve so disposed in a branching zone of the distribution network as to be able to shut off either of the branches from the branching or junction zone if a predetermined pressure difference arises between the pressures in the branches downstream of the valve. In normal operating conditions of the installation, the downstream pressures balance one another so that the valve is maintained in a position corresponding to normal supply of the two branches.

Other advantages and features of the invention will be disclosed by the following description of an embodiment shown in the accompanying drawing wherein:

FIG. 1 is a diagrammatic view of a two-module circuit breaker having a safety device according to the invention;

FIG. 2 is a view in axial section and to an enlarged scale of the safety device shown in FIG. 1; and

FIG. 3 is a view similar to FIG. 1 showing an installation having an odd number of modules.

Referring to FIG. 1, one pole of an electric circuit breaker has two modules 10, 12 which are connected in series with one another electrically; each module has a pair of arc extinguishing chambers 14, 16 and 18, 20 respectively mounted on a respective spherical pressure gas or air reservoir 22, 24 in turn mounted on a respective insulator 26, 28. The reservoirs 22, 24 are supplied from a compressed air source 31, inter alia a pressurizing station, through a line 30 which splits into two branches 32, 34 in a junction or splitting device 36. Each branch or line 32, 34 is connected to its respective reservoir 22, 24 to supply the same with compressed air. If the device 36 is at a potential near ground potential, the lines 32, 34 must be insulating and are therefore embodied by conventional hollow insulators. An installation of this kind is known and it will just be recalled that the compressed air for operating the contacts of the chambers 14 – 20 and/or for blowing the arcs drawn therebetween at tripping is taken from the reservoirs 22, 24, which thereafter receive a makeup of pressure gas through the lines 30, 32, 34.

Referring to FIG. 2, the device 36 to which the lines 30, 32, 34 are connected is embodied by a cylinder 38 in which a piston 40 can move; the same co-operates with each end 42, 44 of the cylinder 38 to bound two chambers 46, 48 which are in permanent communication via a channel 33 with line 30. Chamber 46 communicates with line 32 via an orifice 50 with which cylinder end 42 is formed and which serves as a seat 52 of a valve whose moving member (lid) 54 is rigidly secured to piston 40. In a symmetrical manner, chamber 48 communicates with line 34 via an orifice 56 which serves as a valve seat 58, the moving member (lid) 60 of the valve being on the opposite surface of the piston 40. Compression springs 61, 63 interposed between the cylinder ends 42, 44 and the respective piston surfaces bias the piston into a central equilibrium position in which both of the lids 54, 60 are open. The piston 40 is extended at each end by rods 62, 64 which project outside the cylinder 38 and which are adapted to operate position detectors 66, 68 respectively shown by way of example as ordinary contacts which are operated when the piston 40 is in a position such as to close either the orifice 50 or the orifice 56. In the normal operating position shown in FIG. 2, the two detector contacts 66, 68 and the lids 54, 60 are all open.

The safety device according to the invention operates as follows:

The reservoirs 22, 24 are supplied with compressed air through the lines 30, 32, 34 when the piston 40 is in the central position shown in FIG. 2. The piston experiences the pressures in the chambers 46, 48 and the force of the springs 61, 63 which, provided that the pressures in the chambers 46, 48 are equal, maintain the piston in its central equilibrium position. If the circuit breaker trips, so that pressure gas is taken from the reservoirs 22, 24, the resulting pressure drop is transmitted to the chambers 46, 48 via the lines 32, 34. The cross-section of the line 30 is too small for instantaneous recharging of the reservoirs 22, 24, but since the installation is symmetrical and the modules 10, 12 operate simultaneously, no appreciable pressure difference of a nature able to move the piston 40 arises between the chambers 46 and 48. The valves 54, 60 therefore stay open and the reservoirs 22, 24 recharge normally.

In the event of an appreciable gas leakage from either module, for instance, the module 12 or its line 34, the pressure drop caused by the leakage is transmitted to the corresponding chamber 48 of the cylinder 38, whereas chamber 46 remains at its normal pressure. Because of the pressure difference acting on it, the piston 40 moves to the right in FIG. 2, and lid 60 engages with its seat 58. Communication between line 30 and line 34 is therefore interrupted, so that emptying of

the complete installation is obviated and the fault prevented from spreading to other modules. The cross-section of the seat **58** is sufficient to ensure that the piston **40** remains in the closure position until restoration of pressure in the line **34**. The undamaged module **10** is completely unaffected by the operation of the safety device **36** and continues to be supplied in the normal way through line **30**. Of course, the conventional protective devices (not shown) of the faulty module **12** detect the event and cause the corresponding interlocks to operate so that, for instance, there can be no actuation of the faulty module **12**. The cutting out of circuit of the module **12** is indicated by closure of the contact **68** by the rod **64**, which moved with the piston **40**, some sort of warning device being actuated. The safety device according to the invention is operated by any appreciable pressure difference between the modules **10** and **12** and therefore by any abnormal operation of either of the modules, the faulty module being automatically isolated.

The invention is of course of use in apparatus having any number of modules, for instance, a safety device **36** is in FIG. **2** associated with each pair of modules. If the number of modules is odd, for instance, if there are three modules **10**, **12** and **70** as shown in FIG. **3**, two safety devices **36**, **36'** are used. The device **36** is associated with the modules **10** and **12** in the manner hereinbefore described and the device **36'** is associated with the module **70**. To this end, line **34'** supplies the reservoir of module **70** and the other line of device **36'** communicates with a buffer reservoir **72**. The two devices **36**, **36'** are connected to the line **30**, for instance, by a branch. The pressure in the reservoir **72**, which forms a dead volume, provides a reference value with which the pressure in the module **70** is continuously compared in the manner hereinbefore described. Any abrupt pressure drop, for instance, because of a leakage in module **70**, operates the safety device **36'**, the piston thereof moving in the direction for closing the line **34'**. Of course, the whole system is devised to preclude any accidental closure of the line **34'** in normal operation, for instance, during the pressure drop following upon an opening of the module **70**.

What is claimed is:

1. In a multi-break gas blast circuit interrupter of the type comprising per pole a plurality of serially arranged interrupting sections, at least a pair of compressed gas storage tanks supplying said interrupting sections with compressed gas, and a pair of gas supply conduits respectively connecting said pair of storage tanks to a common source of compressed gas; differential valve means inserted between said gas supply conduits and said source, said valve means being responsive to the pressure differential of said gas supply conduits and adapted to interrupt the compressed gas flow from said source to the lower pressure one of said storage tanks when said pressure differential exceeds a predetermined value.

2. A differential valve adapted for connecting a pair of gas supply conduits to a common source of compressed gas, comprising a valve body defining a cylindrical pressure chamber, a pair of opposed outlets for said chamber adapted for connection to said gas supply conduits, respectively, an inlet for said chamber adapted for connection to said common source, a pair of valve seats, one for each outlet, a piston adapted for reciprocating sliding movement in said chamber, a pair of opposed valve members secured to said piston and cooperating with said valve seats, respectively, and arranged to close said outlets selectively in response to said sliding movement of said piston, and bias means to maintain said piston normally in an intermediate position in said chamber causing opposed faces of said piston to be in pressure relation with said gas supply conduits, respectively, whereby a pressure differential in said gas supply conduits exceeding a predetermined value causes said piston to apply the valve member associated with the lower pressure gas supply conduit against the associated valve seat interrupting the compressed gas flow from said source to said lower pressure conduit.

3. A device as set forth in claim **2**, said bias means comprising a pair of springs acting between said piston and said valve body.

4. A device as set forth in claim **2**, further comprising electrical signalling means secured to said piston.

5. A gas supply and security system for use with a gas blast circuit interrupter having a pair of compressed gas storage tanks supplied by a common source of compressed gas, said system comprising differential valve means in fluid communication with said common source, and a pair of gas supply conduits connecting said differential valve means to said storage tanks, respectively, said valve means being responsive to the pressure differential of said gas supply conduits and adapted to provide normally a free fluid communication between said storage tanks and said common source and to interrupt the compressed gas communication between said source and the storage tank having the lower pressure when said pressure differential exceeds a predetermined value.

6. A system as set forth in claim **5**, said valve means comprising a control piston having opposed faces normally in pressure relation with said gas supply conduits, respectively, bias means maintaining said piston in an intermediate normal position, and a pair of valve means operatively connected to said piston and adapted to selectively interrupt the compressed gas flow from said source to said gas supply conduits in response to sliding movement of said piston.

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