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COMPRESSED AIR CIRCUIT BREAKER WITH A PLURALITY OF SERIES CONNECTED BREAKING GAPS

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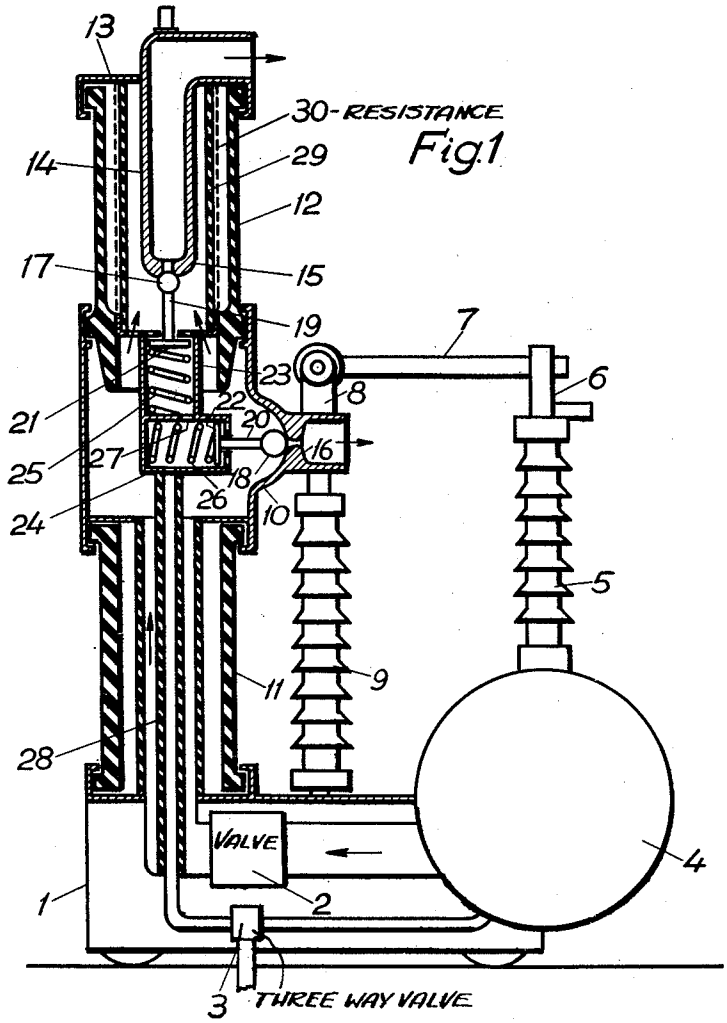

Fig.1

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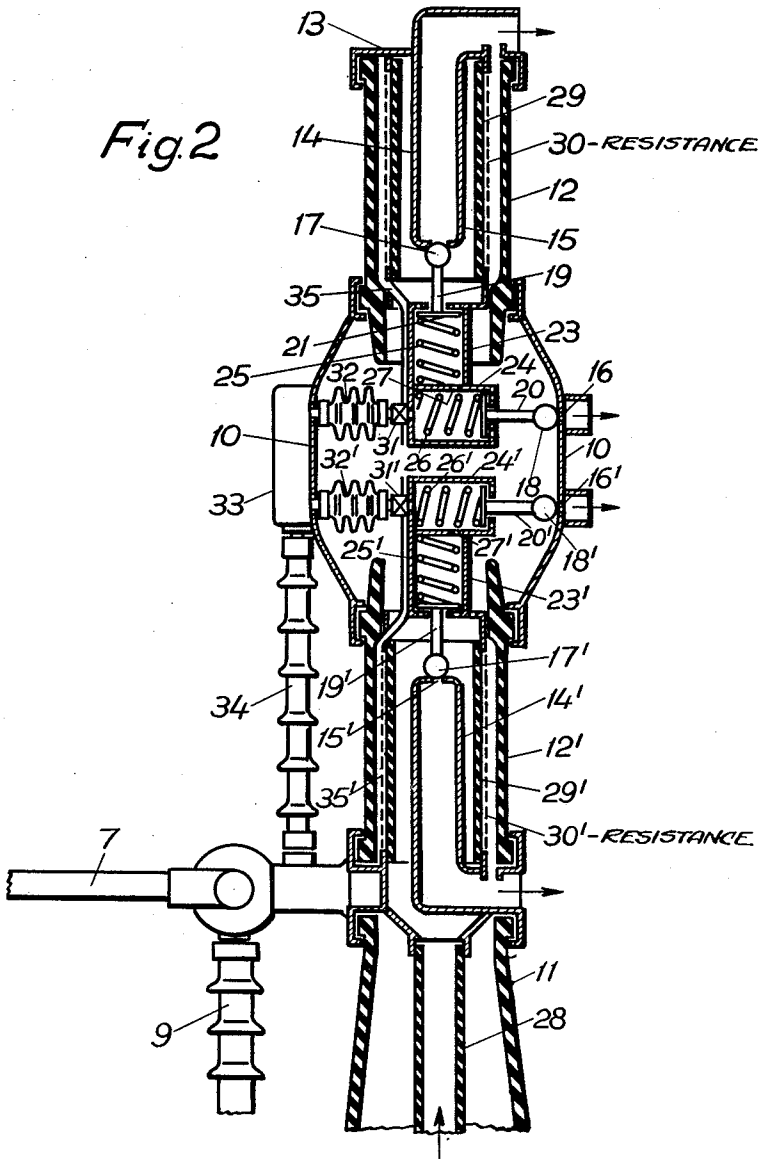
Fig. 2



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COMPRESSED AIR CIRCUIT BREAKER WITH A PLURALITY OF SERIES CONNECTED BREAKING GAPS

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7 Claims. (Cl. 200—145)

1

This invention relates to compressed air circuit breakers with a plurality of series connected breaking gaps.

In high tension circuit breakers, the breaking ability is increased by providing the breakers with a plurality of breaking gaps. After breaking, the contacts or metallic members in contact with them are separated by air gaps under atmospheric pressure, and the creeping distance between these parts along the insulators carrying them must thus be dimensioned with respect to the voltage difference between these parts and the insulating strength of the air under atmospheric pressure.

The present invention has for its object to provide a circuit breaker in which the outermost contacts of the series-connected gaps are separated by a single insulating cylinder having an unbroken insulating external surface, the insulation between the contacts being effected by air under pressure.

According to the present invention, the movable contacts of the two breaking gaps are insulatingly carried within an insulating cylinder or within a space in communication with said cylinder, which space, after the interruption, remains filled with air under pressure. The insulating distance between the contacts can therefore be considerably smaller than if they were separated by air under atmospheric pressure.

On the accompanying drawing, Fig. 1 shows the circuit breaker according to the invention with two series connected breaking gaps, and Fig. 2 shows such a circuit breaker with four series connected breaking gaps.

In the form shown in Fig. 1, the bottom casing 1 of the circuit breaker contains the extinguishing air valve 2 for controlling the supply of extinguishing compressed air, and also contains a three-way air valve 3 for the control of the operating air. On this bottom casing 1, there is also mounted a compressed air container 4, which carries the disconnecting switch insulator 5, which at its upper end carries the stationary contact 6 of the disconnecting switch. The other contact 7 of the disconnecting switch is pivoted in a support 8, attached to the metal casing 10, and is operated by the insulator 9, which serves as an operating shaft rotated by the operating mechanism of the breaker, which mechanism is not shown on the drawing.

The metal casing 10 is carried by an insulator 11 fastened to the bottom casing 1, and the casing 10 in turn carries an insulating cylinder 12, which is closed at its upper end by a cap 13,

2

through which a pipe 14 is passed. This pipe 14 is, at its lower end, shaped to form a stationary contact 15 for one of the breaking gaps of the contact breaker. The stationary contact 16 of the other breaking gap is attached to or formed in the wall of the casing 10.

The movable contacts 17 and 18 of the breaking gaps are of spherical form and are attached to rods 19 and 20 respectively, which rods are at their opposite ends attached to operating pistons 21 and 22 respectively, said pistons being movable in operating cylinders 23 and 24. These pistons 21, 22 are provided with helical springs 25 and 26 respectively, which tend to press the movable contacts 17, 18 against the corresponding stationary contacts 15, 16 respectively. The operating cylinder 24 is, through a passage or port 27, in communication with the cylinder 23 for the purpose explained below. The operating cylinder 24 is also connected by a pipe line 28 with the three-way operating valve 3 for the operating air.

In the insulating cylinder 12 which is generally made of porcelain, an insulating tube 29, suitably made of an organic material, is provided, and this tube 29 is at its lower end closed by a perforated wall which serves as the support for the operating cylinders 23 and 24. These cylinders may, of course, be mounted in some other suitable or convenient manner directly to the insulating cylinder 12 or to the insulator 11, and the essential feature is that they are insulated from the parts 10 and 14.

In order to increase the creeping distance between the casing 10 and the operating cylinders 23 and 24, the casing 10 may be attached to the insulating cylinder 12 at a distance from its lower end, so that a part of this insulator projects into the casing 10.

The said insulating tube 29 serves, on the one hand, to relieve the insulating cylinder 12 from the pressure exerted by the compressed air and the pressure generated by the arcs, but the same tube may, on the other hand, also serve to carry a by-pass resistance 30, coupled in parallel with the contact gaps 15, 17. In operation, the circuit breaker actuates in the following manner:

When opening the circuit breaker, the extinguishing valve 2 and operating valve 3 are simultaneously opened, and as soon as there is sufficient pressure in the circuit breaker, the operating three-way valve 3 is turned so that the operating cylinders 23 and 24 are brought into communication with the atmosphere. The compressed air in the circuit breaker then acts on

the operating pistons 21, 22 so that they are moved inwardly in the cylinders 23, 24, and the movable contacts 17 and 18 are thus separated from the stationary contacts 15, 16. As soon as the operating piston 22 has passed the communicating passage 27 between the cylinders 23 and 24, the compressed air in the circuit breaker acts on the lower side of the piston 21 so that the breaking gap 15, 17 is again closed by the action of the spring 25, due to the fact that the air pressure is now equal on both sides of the piston. The breaking gap 16, 18, however, remains open as long as the cylinder 24 is in communication with the atmosphere. As the breaking gap 16, 18 has for its purpose only to interrupt the reduced current passing through the by-pass resistance 30, the opening in the contact 16 may, as shown be considerably smaller than the opening in the contact 15, which means a considerable reduction in the consumption of compressed air.

When the circuit breaker has thus been opened, full insulation against the voltage is obtained and the disconnecting switch 6, 7 may then be opened by a suitable mechanism actuating the insulating shaft 9, but not shown in the drawing.

In closing the circuit breaker, compressed air is again delivered to the operating cylinders 23 and 24, the breaking gap 16, 18 being then closed by the spring 26 acting on the piston 22.

Fig. 2 shows a circuit breaker with four series connected breaking gaps. In this figure, corresponding parts are designated by the same reference numerals as in Fig. 1, and corresponding parts in the two lower breaking gaps, with their operating mechanisms, are designated by the same reference numerals as the upper breaking gaps, but with an index applied to each reference numeral.

This form of the circuit breaker differs from the form shown at Fig. 1 in that four breaking gaps are provided in the casing 10, instead of two, as in Fig. 1.

The three-way operating valve 3 is replaced in Fig. 2 by two operating valves 31, 31', which valves are actuated by a suitable gear 33 through the medium of an insulating shaft 34 from the operating insulating shaft 9. The inner ends of the operating cylinders 24, 24' are, through the operating valves 31, 31', brought into communication with the atmosphere through the pipes 35, 35'.

I claim as my invention:

1. A compressed air circuit breaker comprising a pair of series connected breaking gaps, a metal casing, an insulating cylinder carried by said casing, insulating means supporting the casing, a metal top cap on said cylinder, a metal member depending from said cap, the stationary contact of one of said gaps being located at the lower end of said depending member and the stationary contact of the other gap being formed in said metal casing, and insulating means supporting the moveable contacts of said gaps within the space formed by said metal casing and insulating cylinder.

2. A compressed air contact breaker according to claim 1, comprising operating pistons carrying two movable contacts, operating compressed air cylinders for the pistons, and means whereby the cylinders are insulated from the said casing.

3. A compressed air contact breaker according to claim 1, in which the insulating cylinder has one end secured to said casing and its opposite end carrying the said depending member and the first stationary contact.

4. A compressed air contact breaker according to claim 1, comprising an insulating tube within the said cylinder, operating compressed air cylinders and operating pistons carrying said movable contacts, and means whereby said cylinders and pistons are carried by the end of the said insulating cylinder secured to the said casing.

5. A compressed air circuit breaker according to claim 1, comprising operating compressed air cylinders, operating pistons mounted in said cylinders and carrying the movable contacts, the said air cylinders being mounted within the metal casing, and said depending member being in the form of a metal cylinder.

6. A compressed air circuit breaker according to claim 1, comprising operating compressed air cylinders and operating pistons mounted in the metal casing and carrying the movable contacts, a pipe line and three-way valve for the supply of air through said pipe line to one of the cylinders, and a communicating passage between the two cylinders to permit closing of one of the gaps while the other remains open due to the air pressure within the metal casing.

7. A compressed air circuit breaker with a plurality of series connected breaking gaps, a metal casing enclosing said breaking gaps, insulating cylinders secured to said casing, the stationary contacts of a part of said breaking gaps being carried by said insulating cylinders, the stationary contacts of the outer breaking gaps being formed in the wall of said casing, and the movable contacts of all the breaking gaps being mounted within said metal casing and being insulated therefrom.

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