COMPRRESSED GAS CIRCUIT BREAKER WITH QUICK OPENING CONTACTS

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The present invention relates to a switching device, working in the impulse manner, for compressed gas circuit breakers operating with a closed gas circuit, in which the breaker arc is quenched by a quenching gas, particularly SF$_6$, stored in a high pressure chamber, the circuit breaking gases being caught up in a low pressure chamber, and in which the breaker piece, counteracting a switch-on spring, and the blast valve are rigidly connected with each other by a common, compressed gas operated drive piston guided in a drive cylinder.

In compressed gas circuit breakers with single or multiple interruption it is usual to have the breaking points for the interruption of the load open up only for short periods, if one or several voltage interruption points are present which are connected electrically in series with the load interrupting points and safeguard insulation of the breaker from high voltage in the off position of the breaker. Hereby, the voltage interrupting points may be constructed for instance as so-called series interrupters. A compressed air operated circuit breaker with a series interrupter has become known in which the load interrupting points are designed as a switch device opening for short periods and whereby the movable, pin-shaped breaker piece is connected to a compressed air operated piston which simultaneously carries a part serving as the valve member of a blast valve arranged directly at the arc sector of the breaker. In this known design, however, it is of disadvantage that the regulating valve required for operating the movable breaker piece in impulse-like manner is connected with the switching device via a long regulating line which traverses the entire support insulator, thus causing comparatively long switching periods which are undesirable especially in cases of quick reclosing of the circuit. This disadvantage is particularly significant when, for instance, sulphur hexafluoride SF$_6$ is used as the quenching and regulating medium instead of air.

The present invention is based upon a simple solution to attain short switching periods, particularly for compressed gas circuit breakers using SF$_6$ as the quenching and regulating medium. According to the invention, it is therefore proposed to provide an auxiliary valve switchable in the axial direction of the movable breaker piece, this valve serving to close off the regulating chamber of the drive cylinder against the regulating valve due to its being automatically taken along in the last part of the breaking motion and subsequently held there pneumatically, whereby the regulating chamber communicates with the high pressure chamber via an opening in the drive cylinder.

One practical embodiment of a switching device according to the invention is illustrated in the accompanying drawing, the single view being a central vertical section.

With reference now to the drawing a support insulator is designated by 1 which serves simultaneously to divide the breaker vessel which is not represented in detail, into a low pressure chamber 29 and a high pressure chamber 30. Embedded in support insulator 1 is flange 2 to which the fixed contact carrier 3 is screwed with pressure tight. Into the latter the packing ring 3a of the blast valve is inserted and the nozzle-shaped, fixed breaker contact piece 4 tightly screwed in. The tubular current conductor is designated as 5 which, via part 3, is in electrical contact with breaker part 4. Moreover, support insulator 1 is connected by ribs 1a to an annular flange 16 which is connected to cylinder 7 via plate 6. In cylinder 7 slides drive piston 8 which on the one hand carries tubular piece 9 and on the other receives the movable breaker contact piece 10 which rests on the top of drive piston 8 by means of a collar and is fixed in position by ring 18 beneath the piston which is expediently designed as a retaining ring for instance. Breaker piece 10 lies within the tubular piece 9 and, at its upper end, carries contact cup 11 as well as the axially movable burner piece 12 which is loaded by compression spring 13. The breaker piece 10 which forms the movable contact member of the circuit breaker includes a tubular portion 10b which depends from drive piston 8 thus extending into cylinder 7 and terminating in an end cap 14a. The tubular portion 10b is guided in sliding contact 17 which serves to transmit the current between the breaker piece 10 and the guide cylinder 14a, the latter and the guide part 14 being tightly screwed together. The top of cylinder 14a is rigidly connected with sleeve 15 which simultaneously serves for mounting of baffle plates 16 which surround the tubular depending portion 10b of the movable contact member and against which strikes the lower end face of drive piston 8. Openings 28 of cylinder 14a connect chamber 27b within this cylinder with chamber 27c within cylinder 7, while the openings 14b in guide part 14 connect chamber 27a with chamber 27c. Further, in guide part 14 which serves as an outlet for the lower end of drive cylinder 7, this part including an elbow duct 27a. Packing ring 23 is inserted at one end of the elbow which is in alignment with the axis of movement of piston 10 and valve plate 20 of the auxiliary valve slides in it via rod 21. The valve plate 20 is adapted to seat on ring 23 and also has a contact surface 20a and is loaded by spring 22 while switch-on spring 19 within and adjacent the inner wall of cylinder 7 is supported between drive piston 8 and guide part 14. The latter has ribs 14c carrying the valve housing 14d for the regulating valve. The regulating or control valve member is designed as a sleeve 24, with ribs carrying the actuating rod 24a which is slidable in part 14d. Sleeve 24 is designed as a valve at both ends and works together with packing rings 25 and 26 respectively, which are inserted in the guide housing 14d and in the other end of the elbow duct 27a. Cylinder 7 has an opening 7a through which the high pressure chamber 30 communicates with chamber 27c. The mode of operation of the new arrangement is the following:

In the position as drawn, the breaker device and the blast valve are closed. Chamber 29 also the support insulator 1 as well as the interiors of the tubular body 6 and guide housing 14d are filled with low pressure gas; chambers 30, 27a, 27b and 27c are filled with high pressure gas. The electrical circuit of the breaker device extends
through conductive parts 5, 3, 4, 11, 10, 17, 14a and 14. For breaking, sleeve 24 is moved to the right by means of actuating rod 24a through a drive mechanism known as such and not illustrated in detail. This causes the right end of sleeve 24 to contact packing ring 26 while the lower end of sleeve 24 moves away from packing ring 25. In this right end position the regulating chamber 27a and therewith chambers 27b and 27c are connected with the low pressure side of the regulating valve, i.e. with the interior of guide housing 14d so that the previously existing high pressure in chambers 27a, 27b, 27c is brought down to low pressure. Through the high pressure exist-
ing on its annular upper end, drive piston 8 is forced to move downwards, whereupon the tubular body 9 moves away from packing ring 3a so that the blast valve already opens before the contact cup 11 leaves the fixed breaker piece 4. In the further course of motion, first the contact cup 11 disengages from the nozzle-shaped breaker piece 4 which, however, still stays closed for a short period of time through burner piece 12 which is being pressed upwards by the effect of spring 13, whereby burner piece 12 for a short while takes over the conduction of the breaking current. In this manner the high pressure gas is already active at the start position before the contact separation takes place. With the further motion of drive piston 8 and thus the movable breaker piece 10, the latter takes burner piece 12 along by the collar at its lower end. The arc now forming between parts 4 and 12 is blasted and the high pressure gas from chamber 30 streams through the nozzle shaped breaker piece 4 into the low pressure chamber 29. The lower end position of drive piston 8, in which the quenching of the arc occurs also, is reached as soon as it strikes baffle plates 16, the impact being softened by their influence. First, however, the movable breaker piece 10 with its end cap 10a strikes against the contact surface 20a of the valve plate 20 and pushes it downwards until it reaches its lower end position in contact with packing ring 23. In this manner the regulating chamber 27a is closed off against chambers 27b, 27c which now will fill up again with high pressure gas from chamber 30 through the opening 7a of cylinder 7. As soon as this is nearly accomplished, the drive piston 8 is brought back to its upper end position, as drawn, by the switch-on spring 19 so that the breaker device closes again and blasting stops when tubular body 9 hits against packing ring 3a. The valve plate 20 of the auxiliary valve thereby remains firmly pressed against packing ring 23 in its lower end position under the effect of the high pressure gas from the upper end of the valve plate 20 from chamber 27b via the openings 14b. As already mentioned above, the voltage insulation of the breaker in off position is taken over by a voltage interrupter connected electrically in series with the load interrupter and not illustrated, which opens in the known manner before the load interrupter commences its closing motion. This voltage interrupter also takes over the closing of the breaker. In this process sleeve 24 of the regulating valve is brought back to its left end position as drawn, permitting high pressure gas from chamber 30 into chamber 27a so that, due to pressure equalization on both sides of the valve plate 20, the latter moves upwards under the effect of spring 22 into the drawn position. The circuit breaker device is then again ready for the next cycle.

The new arrangement is not limited to the illustrated embodiment. It can be expedient in certain cases to arrange the regulating valve 24 in the same axial direction instead of perpendicular to the axis of the breaker device as illustrated. Also, several of such breaker devices may be connected electrically in series thus obtaining a breaker with multiple interruption. In this case one common regulating valve may be provided for each two neighboring circuit breaker devices whereby a voltage interrupter may also replace one of the breaker devices. Due to their arrangement, the movable parts and packing rings in the high pressure chamber are advantageously withdrawn from the attack of the breaker gases. Another advantage results from the arrangement of the circuit breaker nozzle contact at the support insula-
tor whereby the blast valve goes away from the points of the upper side of the low pressure chamber when checking.

I claim:
1. In a compressed gas actuated circuit breaker having a closed gas circuit, the combination comprising means providing a high pressure chamber filled with an arc extinguishing gaseous medium such as defined in claim 2 wherein said regulating valve member is constituted by a sleeve through which the outlet from said high pressure chamber is connected to said valve seat engaging said auxiliary valve member, and said valve seat being located outside of said breaker chamber and in communication with said auxiliary valve member, said valve seat being located outside of said breaker chamber and in communication with said auxiliary valve member.
drive cylinder is placed in communication with a low pressure space.

4. A compressed gas actuated switch as defined in claim 1 wherein said support insulator is provided with ribs which support a flange ring on which said drive cylinder is mounted within said high pressure chamber.

5. A compressed gas actuated switch as defined in claim 1 wherein said movable contact member includes a portion depending from said drive piston and extending into said drive cylinder, and which further includes a stationary guide cylinder arranged within said drive cylinder for guiding the movement of said depending portion of said movable contact member in reaching said auxiliary valve member.

6. A compressed gas actuated switch as defined in claim 5 wherein said guide cylinder is provided with baffle plates surrounding said depending portion of said movable contact member for contact by the end face of said drive piston.

7. A compressed gas actuated switch as defined in claim 1 wherein said regulating valve controlling the outlet from said drive cylinder is located along the axis of movement of said drive piston.

No references cited.

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