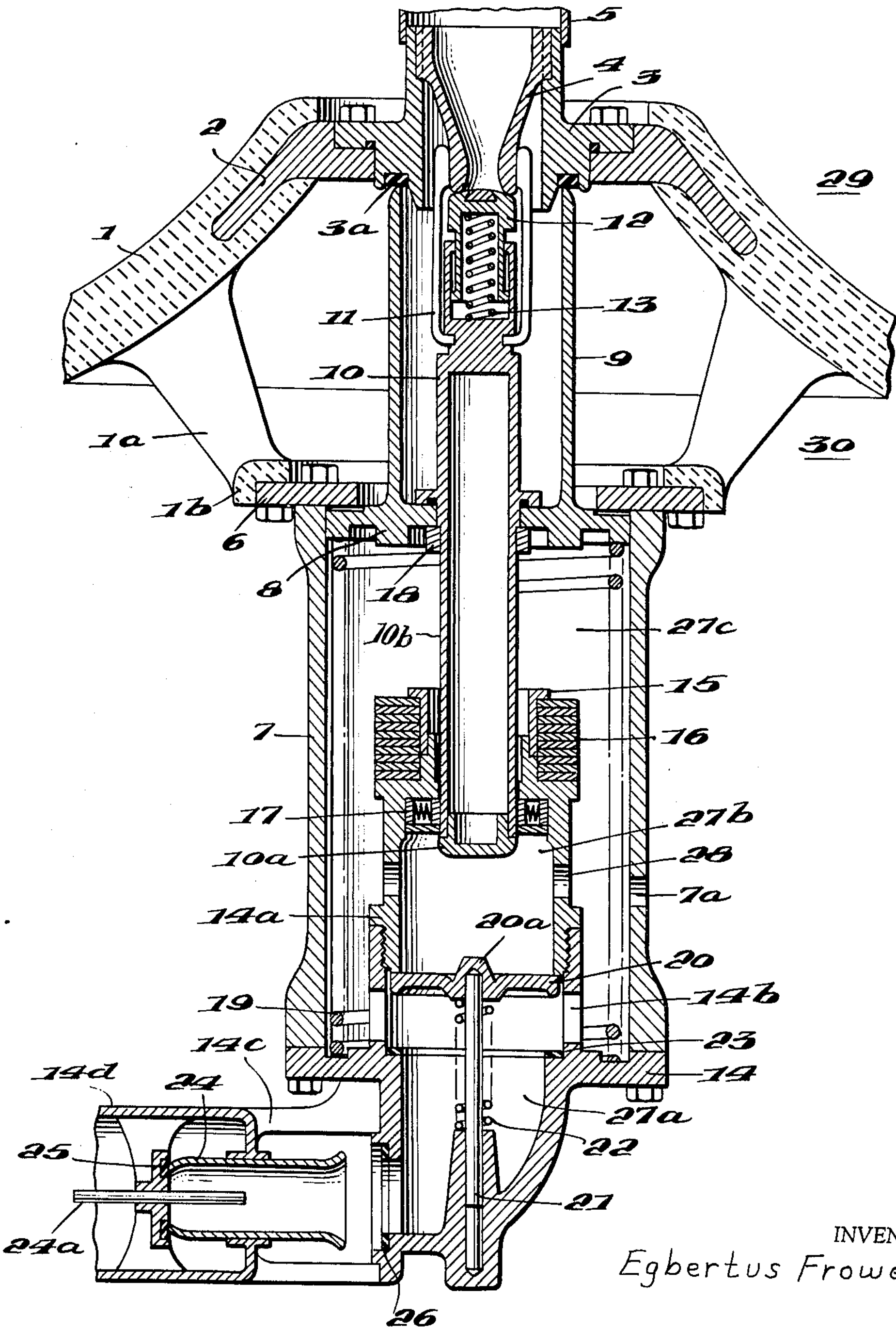
Feb. 22, 1966 E. FROWEIN 3,236,983

COMPRESSED GAS CIRCUIT BREAKER WITH QUICK OPENING CONTACTS

Filed Oct. 3, 1963



INVENTOR
Egbertus Frowein

BY Pierce, Schiffler & Parker
ATTORNEYS

United States Patent Office

3,236,983

Patented Feb. 22, 1966

1

2

3,236,983

COMPRESSED GAS CIRCUIT BREAKER WITH QUICK OPENING CONTACTS

Egbertus Frowein, Nussbaumen Aargau, Switzerland, assignor to Aktiengesellschaft Brown, Boveri & Cie., Baden, Switzerland, a joint-stock company

Filed Oct. 3, 1963, Ser. No. 313,671

Claims priority, application Switzerland, Nov. 8, 1962, 13,044/62

7 Claims. (Cl. 200—148)

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 shiftable 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 pressure tight. Into the latter the packing ring **3***a* 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 **1***a* to an annular flange **1***b* 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 **10***b* which depends from drive piston **8** thus extending into cylinder **7** and terminating in an end cap **10***a*. The tubular portion **10***b* is guided in sliding contact **17** which serves to transmit the current between the breaker piece **10** and the guide cylinder **14***a*, the latter and the guide part **14** being tightly screwed together. The top of cylinder **14***a* is rigidly connected with sleeve **15** which simultaneously serves for mounting of baffle plates **16** which surround the tubular depending portion **10***b* of the movable contact member and against which strikes the lower end face of drive piston **8**. Openings **28** of cylinder **14***a* connect chamber **27***b* within this cylinder with chamber **27***c* within cylinder **7**, while the openings **14***b* in guide part **14** connect chamber **27***a* with chamber **27***c*. Further, in guide part **14** which serves as an outlet for the lower end of drive cylinder **7**, this part including an elbow duct **27***a*. 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 glides in it via rod **21**. The valve plate **20** is adapted to seat on ring **23** and also has a contact surface **20***a* 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 **14***c* carrying the guide housing **14***d* for the regulating valve. The regulating or control valve member is designed as a sleeve **24**, with ribs carrying the actuating rod **24***a* which is slidable in part **14***d*. 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 **14***d* and in the other end of the elbow duct **27***a*. Cylinder **7** has an opening **7***a* through which the high pressure chamber **30** communicates with chamber **27***c*. 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** above the support insulator **1** as well as the interiors of tubular body **9** and guide housing **14***d* are filled with low pressure gas; chambers **30**, **27***a*, **27***b* and **27***c* 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 left 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 existing 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 switching point before 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 presses 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 reaching the upper side of the valve plate **20** from chamber **27c** 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 insulator which makes for good accessibility of the breaker parts from 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 SF_6, means providing a low pressure chamber separated from said high pressure chamber by a support insulator, a fixed contact member in the form of a nozzle mounted by said support insulator and through which the compressed gas can flow in passing from said high pressure chamber to said low pressure chamber for collection in the latter, a drive cylinder mounted in said high pressure chamber, the wall of said cylinder being provided with an aperture placing the interior and exterior of said cylinder in communication with each other, a compressed gas actuated drive piston mounted for sliding movement in said drive cylinder, said drive piston including thereon a movable contact member normally engageable with said fixed contact member by means of a loading spring which normally maintains said drive piston at one end of said cylinder and a blast valve sleeve surrounding said movable contact member and normally engaged with a seat closing off communication between said high pressure chamber and the junction between said normally engaged fixed and movable contact members, a regulating valve located within said high pressure chamber and including a valve member movable from an initial position to a position closing off normal communication between an outlet from the other end of said drive cylinder and said high pressure chamber and establishing communication between said outlet and a low pressure space thereby to establish a pressure differential on opposite sides of said drive piston causing it and said movable contact member and said blast valve sleeve to move together in the direction to open said blast valve and then disengage said movable contact member from said fixed contact member, an auxiliary valve normally spring loaded to an open position and which also controls said outlet from said cylinder, said auxiliary valve member being thereafter actuated to a closed position by movement of said drive piston in the direction to effect disengagement of said contact members and effecting a reclosure of said cylinder outlet whereupon the interior of said drive cylinder is refilled with gas from said high pressure chamber through said aperture in the wall thereof to effect a pressure equalization on opposite sides of said drive piston, and said drive piston and blast valve sleeve and movable contact member are then restored to their respective initial positions by said loading spring while said auxiliary valve remains temporarily in its closed position by the gas pressure within said drive cylinder, said regulating valve member being thereafter restored to its initial position to equalize the pressure on said auxiliary valve member whereupon the latter is restored to its normal open position by its spring loading.

2. A compressed gas actuated circuit breaker as defined in claim **1** wherein said outlet from the other end of said drive cylinder is constituted by a 90° elbow type of duct, one end of said elbow duct being aligned with the axis of movement of said drive piston and including a valve seat engageable by said auxiliary valve member, and the other end of said elbow duct including a valve seat for said regulating valve member which moves in a direction perpendicular to the axis of said drive piston.

3. A compressed gas actuated circuit breaker as defined in claim **2** wherein said regulating valve member is constituted by a sleeve through which the outlet from said 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.

KATHLEEN H. CLAFFY, *Primary Examiner.*

ROBERT S. MACON, *Examiner.*