June 14, 1966 S. GIAMMONA ETAL 3,256,414

OPERATING MECHANISM FOR ELECTRICAL CIRCUIT BREAKER OF THE GAS BLAST TYPE

Filed March 29, 1963

Fig. 1.

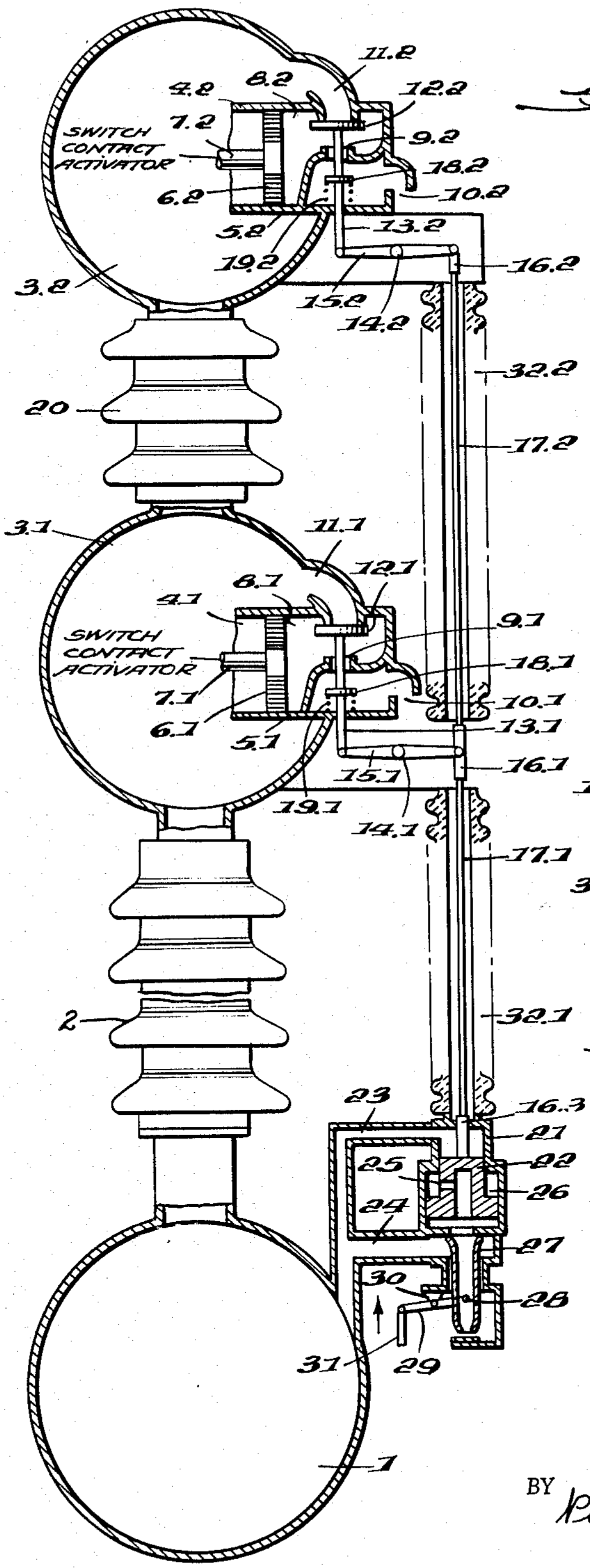


Fig. 3.

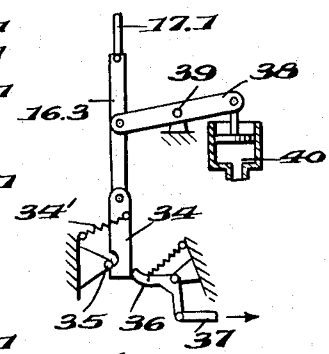
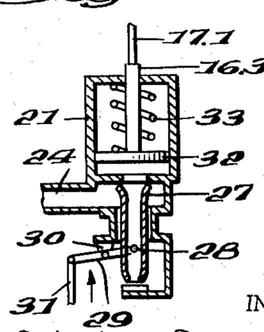


Fig. 2.



INVENTORS

Salvatore Giammona

Karl Holzinger

Friedrich Honlinger

BY Pierce, Scheffler & Parker

ATTORNEYS

United States Patent Office

3,256,414

Patented June 14, 1966

3,256,414

OPERATING MECHANISM FOR ELECTRICAL CIRCUIT BREAKER OF THE GAS BLAST TYPE

Salvatore Giammona and Karl Holzinger, Nussbaumen, and Friedrich Honlinger, Baden, Switzerland, assignors to Aktiengesellschaft Brown, Boveri & Cie, Baden, Switzerland, a joint-stock company

Filed Mar. 29, 1963, Ser. No. 268,887
Claims priority, application Switzerland, Mar. 30, 1962, 3,929/62; Apr. 26, 1962, 5,027/62
4 Claims. (Cl. 200—148)

This invention relates to an improvement in an operating mechanism for a gas blast circuit-breaker with one or more interruption points where the valves for the pneumatic operation of the arc extinction chambers are located on live parts of the breaker and are controlled from the earthed lower part of the breaker by way of insulated rods.

Airblast circuit-breakers are known where the valves for the pneumatic operation of the switching elements are located in the immediate vicinity of the switching contacts and are thus on the live part of the breaker. This results in short switching times and a low consumption of pressure gas, because the supply pipes and chambers between the live parts and the earthed lower part of the breaker which have to be filled with compressed air can be dispensed with. With this conventional type of airblast breaker the valves are actuated either pneumatically or hydraulically by way of control pipes or mechanically with insulated rods. The constant increase in the system short-circuit currents results in an endeavor to construct the ciruit-breaker so as to reduce as much as possible the switching times, particularly the breaking time of the circuit-breaker. In this connection the rapid transmission of the switching orders from the lower part of the breaker to the switch chambers is particularly important. Pneumatic and hydraulic transmissions are, however, restricted in this respect. Moreover, such systems require a relatively large amount of space and are subject to disturbances, because of the additional pipes and control elements. The known types of mechanical transmission systems also possess certain disadvantages due to the fact that the switching valves located on the live parts of the breaker have powerful springs which are connected by insulating rods to pneumatic pistons in the lower part of the breaker, these pistons when in the position of rest being subjected on both sides to a gas pressure whilst during a switching operation the gas is exhausted from one side whereby the valve is opened against the direction of flow by means of the piston and insulating rod. The insulating rod has thus to transmit the entire opening force and must therefore be of correspondingly robust construction. Its mass which has to be accelerated is relatively large, so that the switching time is detrimentally affected.

In order to avoid the aforementioned disadvantages it is now proposed according to the invention that always at least one switching valve, actuated by compressed gas and opening in the direction of flow, is connected by way of a tension rodding elastically prestressed in the closed position to devices on the lower part of the breaker in such a manner that these devices effect the opening and closing of the switching valves. With this arrangement, during the breaking operation, the pressure gas acts directly on the valve whilst the insulating rodding can follow freely without having to transmit the opening force. It can therefore be constructed in the form of a low-mass flexible element whereby the breaking time is considerably reduced.

FIG. 1 shows a constructional example of the new

arrangement, the device at the lower part of the breaker being a differential piston.

FIG. 2 shows the device at the lower part of the breaker in the form of a spring loaded pressure gas piston.

FIG. 3 shows a further modified form where the device at the lower part of the breaker is constructed as an interlock.

FIG. 1 shows a gas blast circuit-breaker the lower part of which is constructed in the form of a pressure gas container. By way of the hollow supporting insulator **2** which forms the earth insulation, the pressure gas container **1** is in pneumatic communication with the intermediate container **3.1** which is under voltage. Reference number **4.1** indicates the actuating device for the switching point or points which are not shown and are associated with the container **3.1**. The actuating device **4.1** comprises a casing **5.1** in which a piston **6.1** is located which by means of a piston rod **7.1** is connected to a movable switch contact, not shown in the drawing. Casing **5.1** has a chamber **8.1** which communicates with the atmosphere by way of openings **9.1** and **10.1**. The inlet conduit **11.1** connects container **3.1** with chamber **8.1** and in the position shown in the figure is closed by the disc **12.1** of the switching valve. Valve disc **12.1** is connected to the insulating rod **17.1** and **17.2** at the point **16.1** by way of the valve rod **13.1** and lever **15.1** which is pivoted at **14.1**. Valve rod **13.1** is also provided with a spring plate **18.1** against which a recall spring **19.1** abuts. In the selected constructional example a further intermediate container **3.2** is provided above container **3.1**. These containers **3.1** and **3.2** are in pneumatic communication with each other by means of the insulator **20**. Container **3.2** contains like container **3.1** a driving device **4.2**, casing **5.2** with piston **6.2**, piston rod **7.2**, chamber **8.2**, openings **9.2** and **10.2**, as well as a switching valve with a valve disc **12.2** which closes the inlet conduit **11.2** and is linked by way of valve rod **13.2** and lever **15.2**, pivoted at **14.2**, to the insulating rod **17.2** at the point **16.2**. Valve rod **13.2** carries the spring plate **18.2** against which spring **19.2** abuts. The switching points which are not shown and are associated with containers **3.1** and **3.2** can be connected electrically in series in a known manner, whereby multiple interruption is obtained. The insulating rod **17.1**, which for instance consists of a flexible synthetic material with glass fibre reinforcement, has at its lower end a holder **16.3** by means of which it is connected to the differential piston **22** located in casing **21**. The space above the differential piston **22** is connected by a pipe **23** to the pressure gas container **1**, whilst the space underneath the piston **22** can be shut off by the sleeve valve **27** and is in communication with container **1** by way of pipe **24**. Sleeve valve **27** carries a pin **28** to which a double-armed lever **29** pivoted at **30** is connected. The sleeve valve **27** is actuated by rodding indicated at **31** and connected in a known manner to a control device which is not shown. The differential piston **22** has a narrow hole **25** through which air can enter or leave the chamber **26**. The insulating rods **17.1** and **17.2** are arranged inside the hollow insulators **32.1** and **32.2**.

The arrangement operates as follows:

It is assumed that the circuit-breaker is in the closed position. In order to open the breaker, rodding **31** is moved upwards as indicated by the arrow. This causes sleeve valve **27** to be moved into its lower end position by means of lever **29**. Whilst previously the space below the larger surface of the differential piston **22** was in communication by way of sleeve **27** with the atmosphere, pressure gas now passes from container **1** through pipe **24** underneath piston **22** and the interior of sleeve **27** is shut off from the atmosphere. The closing force acting on valve discs **12.1** and **12.2** is thus suspended. This closing force, in the closing position of the breaker, starting from piston **22** subjected on its upper side to pressure gas from pipe **23**, is transmitted by way of elastically prestressed insulating rods **17.1** and **17.2**, levers **15.1** and **15.2**, valve rods **13.1** and **13.2** to valve discs **12.1** and **12.2**. The pressure gas in containers **3.1** and **3.2** thus acts through conduits **11.1** and **11.2** on valve discs **12.1** and **12.2** in the downward direction with increasing speed, whereby chambers **8.1** and **8.2** are filled and pistons **6.1** and **6.2** are moved to the left so that the switch contacts are opened. In their lowest position, valve discs **12.1** and **12.2** close the openings **9.1** and **9.2** by means of which chambers **8.1** and **8.2** were previously in pressure-free communication with the atmosphere by way of openings **10.1** and **10.2**. During the opening operation described above, insulating rods **17.1** and **17.2** move upwards whereby their flexible prestressing can be equalized to the extent that the differential piston **22** to which they are connected follows. The acceleration of piston **22** is assisted by the excess surface, because the narrow borehole **25** only enables space **26** to be filled appreciably towards the end of the movement, a compression damping effect being achieved during the last part of the stroke. The length of the insulating rods **17.1** and **17.2** and a stop provided for the piston **22** in casing **21**, are expediently so selected that valve discs **12.1** and **12.2** which in their lower limiting position close the openings **9.1** and **9.2** maintain a certain flexible prestressing of the insulating rods by way of the valve rods **13.1** and **13.2** and levers **15.1**, **15.2**.

For closing the circuit breaker, sleeve valve **27** is moved upwards by means of rodding **31** and lever **29** back into the position shown in the drawing. The space below the larger surface of piston **22** is thus connected to the atmosphere and relieved of its gas pressure. Due to the pressure prevailing on the upper smaller surface of piston **22** and partly due to the pressure in space **26**, the piston moves downwards and by means of insulating rods **17.1** and **17.2** causes levers **15.1** and **15.2**, valve rods **13.1** and **13.2**, and valve discs **12.1** and **12.2** to return to the position shown. Chambers **8.1** and **8.2** are exhausted, so that pistons **6.1** and **6.2** can move to the right and the switch contacts are closed by suitable means, such as for instance springs. Since, as already described, the insulating rods **17.1** and **17.2** also in the open position of the breaker are subjected to a certain flexible prestress, for the closing operation it is only necessary to achieve a slight flexible deformation in order to reduce the closing time. The return springs **19.1** and **19.2** can be comparatively weak, so that they have practically no retarding effect on the switching operations. They merely serve to ensure that when the breaker is filled with pressure gas, e.g. initial assembly or after an overhaul, the valve discs **12.1** and **12.2** are certain to be in the upper end position so that pressure gas cannot escape, for instance through the openings **9.1**, **10.1** and **9.2**, **10.2**.

For outdoor installations it is advisable to arrange the insulating rods **17.1** and **17.2** inside the hollow insulators **32.1** and **32.2** which are expediently filled with compressed gas. Levers **15.1** and **15.2**, for instance on a common shaft, which is supported in a pressure-tight manner inside a fitting of the hollow insulators, can then be constructed with laterally displaced arms in such a manner that one arm is outside the fitting in the open-air and the other arm inside the pressure-gas filled fitting.

Another form of device in accordance with the invention at the lower part of the circuit-breaker for actuating the insulating rods is illustrated in FIG. 2.

Parts corresponding to those of FIG. 1 are designated by the same reference numerals. The insulating rod **17.1** is connected by means of the holder **16.3** to a piston **32** which is located in a casing **21** and is subjected to the pressure of a spring **33**. The space below the piston is connected to container **1** by means of a pipe **24**. Sleeve

valve **27**, as well as elements **28** to **31** correspond to those of FIG. 1.

The method of operation is as follows:

In the position shown, corresponding to the closed position of the breaker, the insulating rod **17.1** is flexibly prestressed by the pressure spring **33**. In order to open the breaker, sleeve valve **27** moves into the lower end position in the manner already described in connection with FIG. 1, whereupon piston **32** moves upwards due to the effect of the incoming pressure gas. To close the breaker, sleeve valve **27** is returned to its former position whereby the space below the piston **32** is exhausted, so that the piston and insulating rod, due to the effect of spring **33**, are returned to the position shown in the figure. This arrangement enables a simple form of piston to be used and the pipe **23** shown in FIG. 1 can be dispensed with. By limiting the stroke of the piston **32** it is possible, as in the case of FIG. 1, to maintain the insulating rod elastically prestressed when in the opening position.

FIG. 3 shows a further modified form of operating mechanism on the lower part of the breaker. In this case, the insulating rod **17.1** is pivotally connected by way of the holder **16.3** to a retaining latch **34**. This latch **34** is provided with a recess which engages a fixed pin **35** and in the interlocking position is held there by an arm of an angle-lever **36**. The other arm of the angle-lever **36** is connected by a rod **37** to a tripping device, not shown, which can for instance be an electro-magnetic tripping mechanism. Moreover, a lever **38** supported on a pivot **39** is connected to the holder **16.3**, this lever being connected to a recall device **40** which in this case is shown as a pressure gas piston.

This arrangement operates as follows. The position shown corresponds to the closed position of the breaker. For opening the breaker, rod **37** is moved to the right by the tripping device, as indicated by the arrow. The left arm of the angle-lever **36** thus releases the retaining latch **34** which due to the tensile force of the insulating rod **17.1** slips off the pin **35** so that the insulating rod moves upwards and the breaker opens in the manner already described in connection with FIG. 1. For closing the breaker, pressure gas is supplied to the underside of the piston of the recall device whereupon the insulating rod is moved downwards by lever **38**. In the lower end position, parts **34**, **35**, **36** are again interlocked, for which purpose recall spring **34'** attached to latch **34** and lever **36** is provided. Immediately after the breaker has closed, recall device **40** is exhausted again by means of a control valve which is not shown.

What we claim is:

1. The combination with a circuit breaker of the gas blast type including a hollow insulator column having one end in communication with a supply container of pressurized gas and the other in communication with a container structure housing gas pressure responsive actuating means for the circuit breaker contacts, and wherein said container structure is under voltage and continuously filled with the pressurized gas from said supply container, of an operating mechanism for controlling said gas pressure responsive contact actuating means, said operating mechanism comprising a normally closed switching valve supported by said container structure, said switching valve including a movable valve member having one side thereof continuously subject to the gas pressure within said container structure and which always tends to move said valve member in the valve opening direction which is likewise the direction which gas flows through said valve to effect operation of said gas pressure responsive contact actuating means, a rod of insulating material, means applying a tension force to said rod, linkage means interconnecting said rod with said movable valve member, said linkage means translating said tension force in said rod to a force acting on said movable valve member in such direction as to maintain said movable valve member in its closed position overcoming the counter valve opening force applied by the pressurized gas acting on the valve member, and means for releasing said tension force in said insulating rod thereby to allow said valve member to shift from its closed to its open position in response to the gas pressure within said container structure.

2. On operating mechanism for gas pressure responsive contact actuating means of a circuit breaker as defined in claim 1 wherein said means for applying and for releasing said tension force on said insulating rod is comprised of a fluid motor of the piston-cylinder type, said piston being connected to said insulating rod and being also a differential piston having one smaller end face thereof in continuous communication with said pressurized gas supply container and the opposite larger end face thereof communicable with said pressurized supply container through a control valve to effect movement of said differential piston in the rod tension releasing direction.

3. An operating mechanism for gas pressure responsive contact actuating means of a circuit breaker as defined in claim 1 wherein said means for applying and for releasing said tension force on said insulating rod is comprised of a fluid motor of the piston-cylinder type, said piston being connected to said insulating rod and spring loaded on one side by a compression spring to exert tension on said rod, and valve-controlled means for applying a fluid

pressure to the opposite side of said piston to release the rod tensioning force exerted by said spring.

4. An operating mechanism for gas pressure responsive contact actuating means of a circuit breaker as defined in claim 1 wherein said means for applying and for releasing said tension force on said insulating rod is comprised of a fluid motor of the piston-cylinder type having the piston connected to said insulating rod for applying the rod tensioning force, and a releasable latch mechanism holding said rod in its tensioned state.

References Cited by the Examiner

UNITED STATES PATENTS

2,491,112	12/1949	Jansson	200—148 X
2,783,338	2/1957	Beatty	200—148
3,037,738	6/1962	Jackson et al.	251—174 X
3,075,060	1/1963	Strom	200—148

FOREIGN PATENTS

1,052,502	3/1959	Germany.

KATHLEEN H. CLAFFY, *Primary Examiner.*

ROBERT K. SCHAEFER, *Examiner.*

P. E. CRAWFORD, *Assistant Examiner.*