Aug. 1, 1967 D. FLOESSEL ET AL 3,334,207

GAS BLAST CIRCUIT-BREAKER WITH STATIONARY SPACED TUBULAR CONTACTS AND PISTON ACTUATED CONTACT BRIDGE INCLUDING BLAST VALVE ACTUATED THEREBY

Filed July 23, 1964

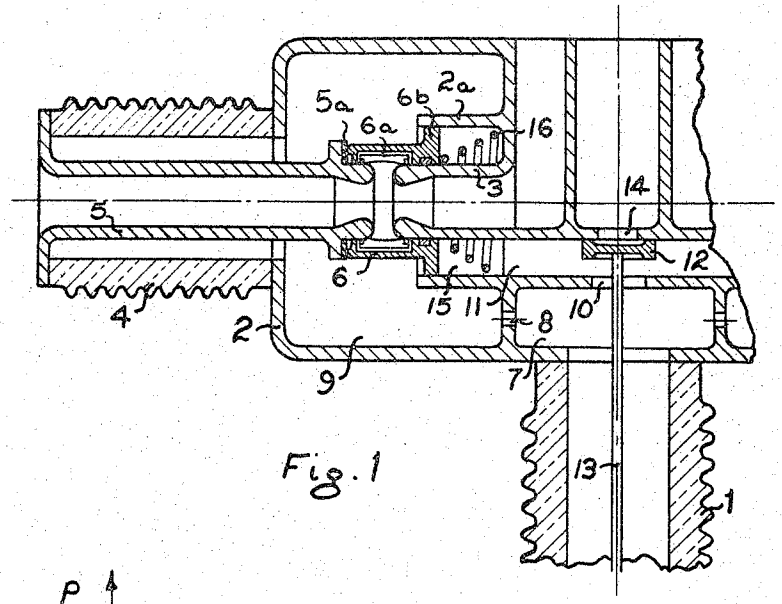

Fig. 1

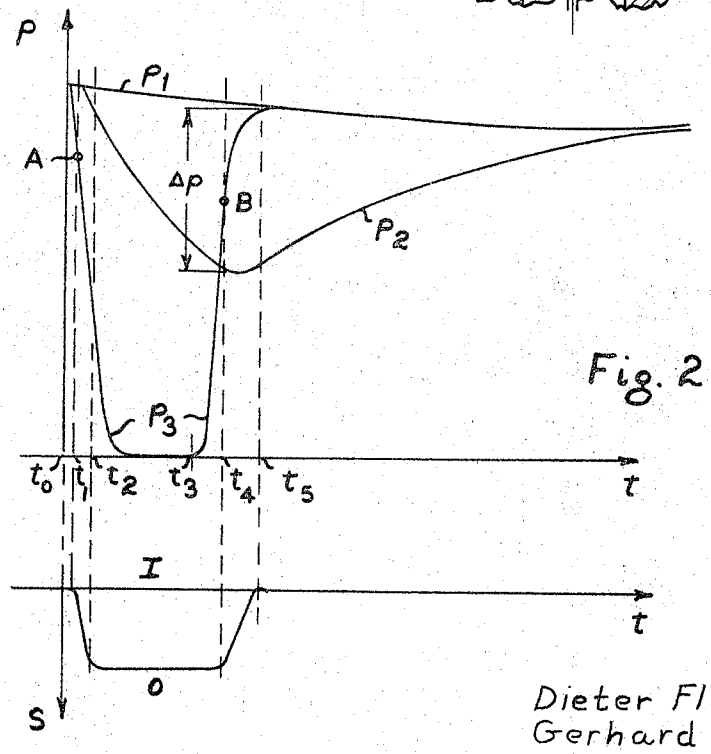

Fig. 2

INVENTORS

Dieter Floessel

Gerhard Mauthe

BY Pierce, Scheffler & Parker

ATTORNEYS

United States Patent Office

3,334,207

Patented Aug. 1, 1967

3,334,207

GAS BLAST CIRCUIT-BREAKER WITH STATIONARY SPACED TUBULAR CONTACTS AND PISTON ACTUATED CONTACT BRIDGE INCLUDING BLAST VALVE ACTUATED THEREBY

Dieter Floessel, Fislisbach, and Gerhard Mauthe, Neuenhof, Switzerland, assignors to Aktiengesellschaft Brown, Boveri & Cie, Baden, Switzerland, a joint-stock company

Filed July 23, 1964, Ser. No. 384,663
Claims priority, application Switzerland, July 31, 1963, 9,513/63
3 Claims. (Cl. 200—148)

ABSTRACT OF THE DISCLOSURE

A gas blast circuit-breaker comprises two tubular, axially spaced load breaking contacts which are electrically connected and disconnected by means of a tubular contact bridge actuated by a piston and cylinder unit. The tubular contacts are located in a switch chamber which is gas pressurized. When the contact bridge is actuated by establishing a pressure differential on the piston thereby to disconnect the contacts, it also opens a blast valve which permits the pressurized gas in the switch chamber to flow into and through the contacts to atmosphere. To reclose the contacts, a pressure differential in the opposite direction is established on the piston and this is accomplished by effecting a time-delayed refilling of the switch chamber with the pressurized gas.

The present invention relates to electrical circuit-breakers of the gas blast type and is an improvement upon the circuit-breaker construction disclosed and claimed in a co-pending application Ser. No. 291,765, filed July 1, 1963, and in which the applicant is one of the joint applicants of the present application.

The co-pending application Ser. No. 291,765, which has now matured into Letters Patent No. 3,240,910 granted Mar. 15, 1966, is directed to a gas blast circuit-breaker with multiple interruption having impulse-operated power interrupting points which are located in switch chambers that are constantly subjected to a gas pressure and where each switching point is provided with two coaxial nozzle tubes a fixed distance apart through which pressure gas flows in opposite directions for extinguishing the arc, a movable bridging switch piece that connects the nozzle tubes being provided which is connected to a pressure-operated driving piston and indirectly to a valve seat, one of the nozzle tubes being provided with a valve disc that together with the valve seat forms the blast-valve for the pressure gas. A control valve is used for controlling the bridging switch piece by which, at the end of the driving piston for the bridging piece furthest away from the switch chamber, the pressure gas is allowed to escape for opening the circuit breaker and is supplied with pressure gas for the closing operation, the end of the piston nearest to the switch chamber being subjected continuously to the pressure in the switch chamber. A strong closing spring is therefore required when it is desired to obtain a rapid closing movement with a minimum amount of pressure gas. Since, moreover, the closing spring has to be compressed for the opening operation so that the effective surface of the driving piston has to be made much larger than is desirable, it would be an advantage to be able to dispense with this spring.

In accordance with the present invention, this is achieved in that for the purpose of switching in the bridging piece, one end of its driving piston is subjected to the

practically constant control pressure and the other end to the pressure in the switch chamber, whereby for the opening operation the pressure in the switch chamber is temporarily reduced by throttling means located in the supply pipe to the switch chamber.

The accompanying drawings show a constructional example for the purpose of explaining the invention.

FIG. 1 shows the switch chamber of the gas blast circuit-breaker in a sectional view; and the variation in pressure and the movement of the switching piece are shown in the diagrams in FIG. 2.

In FIG. 1, reference numeral **1** indicates a hollow insulator on which the switch chamber **2** is mounted. The latter is constructed as a double switch chamber, only part of the right-hand half chamber being shown in the drawing, both half chambers being, however, symmetrical. In each half chamber there is a switching point comprising a nozzle tube **3** connected electrically to the switch chamber, a nozzle tube **5** mounted in a hollow insulator **4**, and a bridging switch element **6**. Element **6** in the form of a tulip contact is provided with contact fingers **6***a* arranged around the periphery and a driving piston **6***b* which slides within the cylindrical projection **2***a*. The left end of the bridging switch piece is constructed in the form of a valve seat which together with the sealing ring **5***a* fixed to the nozzle tube **5**, forms a blast valve. The interior of the supporting insulator **1** is in communication with the chamber **7**, and a filling opening **8** provides a communication with the actual arc extinguishing chamber **9**. As is obvious from the drawings, this filling opening **8** is relatively small as compared with the volume of the switch chamber **9** and consequently imparts a time delayed characteristic to the filling operation. An opening **10**, which is large when compared with the opening **8**, and is also large, as is evident from the drawing, as compared with the volume of the cylinder part **15** in which piston **6***b* slides, connects chamber **7** with chamber **11**. Reference numeral **12** indicates the valve plate of the control valve, which is actuated by the rod **13**. The lower end of a valve rod **13** is connected to a driving mechanism of a known kind but not shown in the drawing. Chamber **11** is provided with an opening **14** which communicates with the outside air and in the position shown in the figure is closed by the valve plate **12**. The interior of each nozzle tube **5** and **3** is connected with the outside atmosphere. Driving piston **6***b* shuts off the annular space **15** formed by the parts **2***a* and **3**, the space **15** being in communication with chamber **11**.

The method of operation of the arrangement is as follows:

In the position shown, the switching point is closed, chambers **7**, **9**, **11** being filled with pressure gas which is supplied from a pressure gas reservoir (not shown) by way of the hollow insulator **1**. For the opening operation, valve rod **13** and thus also valve disc **12** are pulled rapidly downwards. Chambers **15**, **11** are thus connected to the outside air, by way of opening **14** which has been freed, and are thus without pressure because at the same time opening **10** has been closed by the valve disc **12**. The pressure of the gas in chamber **9** acting on the driving piston **6***b* causes the bridging switch piece **6** to move to the right whereby the opening arc which occurs between the switch pieces **5** and **6** and then between the switch pieces **5** and **3** is subjected to a pressure gas blast and extinguished. A drop in gas pressure thus occurs in chamber **9**. Subsequently, a voltage isolator switch not shown in the drawing and arranged electrically in series with the switch point **3**, **5**, **6** isolates the circuit-breaker in the open position in a known manner, so that switch point **3**, **5**, **6** can be closed again after the isolator switch contacts have opened. This is achieved by moving the valve plate

12 by means of valve rod 13 rapidly upwards into the position shown. This causes chambers 11, 15 to be filled rapidly by way of opening 10 with pressure gas again, whilst space 9 is refilled at a much slower rate through the comparatively small opening 8, so that a force directed towards the left acts temporarily on the driving piston 6*b* whereby the bridging switch piece 6 is quickly returned into the position shown. The movement of the bridging switch piece is shown in the lower part of FIG. 2 and above this the pressure variation in the chambers 7, 9, 15, both as a function of the time. Curve p_1 indicates the pressure in chamber 7, p_2 the pressure in chamber 9 and p_3 the pressure in chamber 15. At the instant t_0, valve plate 12 (FIG. 1) uncovers the opening 14, so that the pressure p_3 in chamber 15 drops rapidly. Bridging switch piece 6 at the instant t_1 when the pressure p_3 has decreased down to point A, begins to move downward from its end position I (FIG. 2, lower diagram), whereupon pressure p_2 commences to drop, due to pressure gas flowing from chamber 9 through the nozzle tubes 3, 5 into the open air, until at the instant t_2 it reaches its other end position O (open position). At the instant t_3 the return movement of the valve plate 12, already referred to commences, whereupon the pressure p_3 in chamber 15 again increases rapidly. At the point B on the p_3-curve, pressure p_3 exceeds pressure p_2 at the instant t_4, whereupon the bridging switch piece 6 starts its closing movement, this being completed at the instant t_5. In the meantime, the pressure difference of p_3 over p_2 has attained its maximum value "Δp." The control pressure p_1 in chamber 7 decreases only slightly during the switching operation, because chambers 11, 15 as well as the opening 8 which acts as a throttle point can be kept comparatively small. For the initial filling of the circuit-breaker with pressure gas, a weak spring 16 is provided in chamber 15 which serves only for the purpose of pressing the bridging piece 6 lightly against the sealing ring 5*a* so as to keep the blast valve closed. A comparatively weak spring is adequate for this purpose, so that the disadvantages in connection with an arrangement where the switching-in operation is achieved solely by means of a strong closing spring, are avoided.

We claim:

1. In a circuit-breaker of the gas blast type, the combination comprising a switch chamber, first and second stationary coaxially positioned tubular nozzle contact members located in confronting spaced relation in said switch chamber and which establish a switching point for said circuit-breaker, the interiors of said nozzle contact members being vented to atmosphere, a tubular contact member surrounding said nozzle contact members and mounted for sliding movement thereon, said slidable contact member bridging the space between said nozzle contact members in a closed position of said switching point and being disengaged from said first nozzle contact member in an open position of said switching point, said slidable contact member being provided on one end thereof with a piston slidable within a cylinder surrounding said second nozzle contact member and with one side of said

piston subject to the gas pressure within said switch chamber, the other end of said slidable contact member together with a sealing ring secured to and surrounding said first nozzle contact member establishing a blast valve openable to discharge compressed gas stored in said switch chamber into the space between said nozzle contact members and through the latter to atmosphere, conduit means including a filling opening therein which is relatively small as compared with the volume of said switch chamber, said opening constituting a throttling aperture for effecting a time-delayed filling of said switch chamber with compressed gas from a supply source, and conduit means including control valve means operable in one position to vent the interior of said cylinder to atmosphere and thereby establish a pressure differential on said piston of such direction as to effect movement of said piston and slidable contact member to a position opening said blast valve to discharge compressed gas from said switch chamber and also opening said switching point, said control valve means being thereafter operable to another position to place the interior of said cylinder at the opposite side of said piston in communication with said source of compressed gas through a filling opening which is relatively large as compared with the volume of said cylinder thereby to effect a non-delayed filling of said cylinder, said delayed and non-delayed refilling of said switch chamber and cylinder respectively thereby serving to establish a temporary pressure differential on said piston in the opposite direction and which thereby effects movement of said piston and slidable contact member in the opposite direction to reclose said switching point and blast valve.

2. A circuit-breaker of the gas blast type as defined in claim 1 wherein said control valve means is constituted by one valve member operable between two outlet ports such as to open one port and simultaneously close the other, one of said ports when open serving to place the interior of said cylinder in communication with the atmosphere and the other of said ports serving as said filling opening to place the interior of said cylinder in communication with said source of compressed gas for the now-delayed filling thereof.

3. A circuit-breaker of the gas blast type as defined in claim 1 and which further includes a relatively weak spring biasing said piston in such direction as to maintain said blast valve closed during the initial filling of said switch chamber with compressed gas.

References Cited

UNITED STATES PATENTS

2,665,351	1/1954	Forwald	200—148
3,240,910	3/1966	Floessel	200—148

FOREIGN PATENTS

1,271,190	7/1961	France.

ROBERT K. SCHAEFER, *Primary Examiner.*

R. S. MACON, *Examiner.*