United States Patent [19]

Heutschi et al.

[11] **3,924,088**

[45] **Dec. 2, 1975**

[54] **GAS-BLAST POWER SWITCH FOR HIGH VOLTAGE**

[75] Inventors: **Hans Heutschi,** Kappel near Olten, Switzerland; **Peter Krebs,** Harleysville, Pa.

[73] Assignee: **Sprecher & Schuch AG,** Aarau, Switzerland

[22] Filed: **Sept. 18, 1874**

[21] Appl. No.: **507,254**

[30] **Foreign Application Priority Data**

Oct. 11, 1973 Switzerland 14467/73

[52] **U.S. Cl.** ..... **200/148 A;** 200/150 G

[51] **Int. Cl.²** **H01H 33/88**

[58] **Field of Search** ..... 200/148 A, 150 G

[56] **References Cited**

UNITED STATES PATENTS

3,639,712	2/1972	Balmat et al.	200/148 A
3,786,215	1/1974	Mauthe	200/148 A
3,839,613	10/1974	Tsubaki et al.	200/148 A

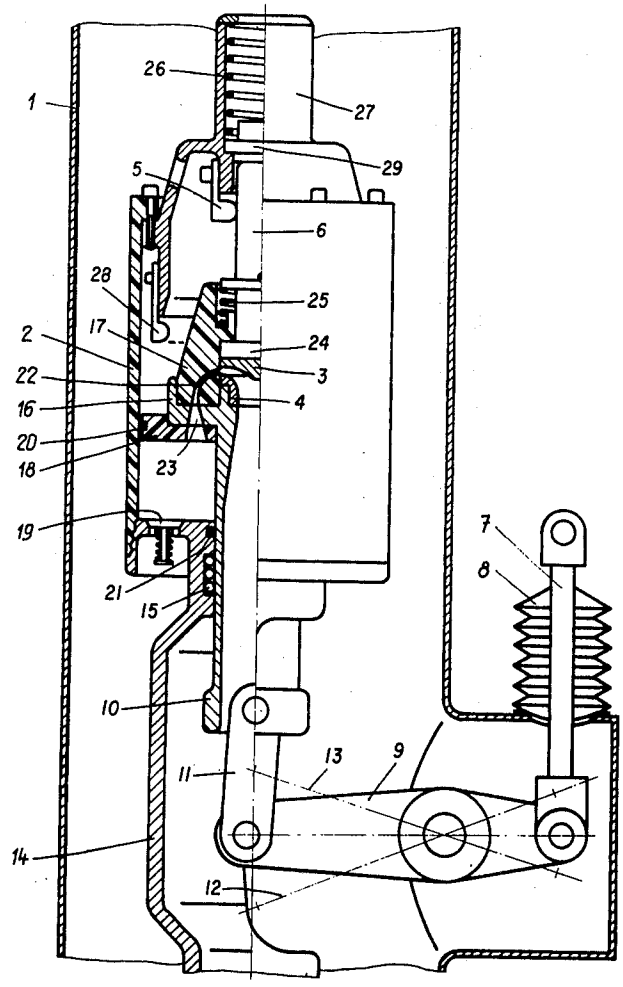
Primary Examiner—Robert S. Macon

Attorney, Agent, or Firm—Waters, Schwartz & Nissen

[57] **ABSTRACT**

A gas-blast power switch for high voltages incorporating a housing filled with gas within which there is arranged a series connection of a power interrupter and a disconnecting switch, a pump device equipped with a pump cylinder and pump piston and positively connected with a switch drive. The pump device during cut-off conveys gas into the power interrupter and during cut-on sucks-up gas. The housing is subdivided into two compartments separated by a wall, one compartment housing the power interrupter and the other the disconnecting switch. The power interrupter is formed of a ring contact pair surrounded by a ring gap nozzle arranged in the wall, the ring contact pair in its open state receiving at least the 2.5-fold phase voltage of the high voltage network, the gap of the ring gap nozzle being bounded at least at one side by an electrical insulating material, the disconnection path of the disconnecting switch being designed at least for the test voltage of the power interrupter, and the contacts of the power interrupter separate during cut-off between 20 and 50 percent of the pump piston stroke and the contact of the disconnecting switch separate at the earliest during 80 percent of the pump piston stroke.

6 Claims, 1 Drawing Figure



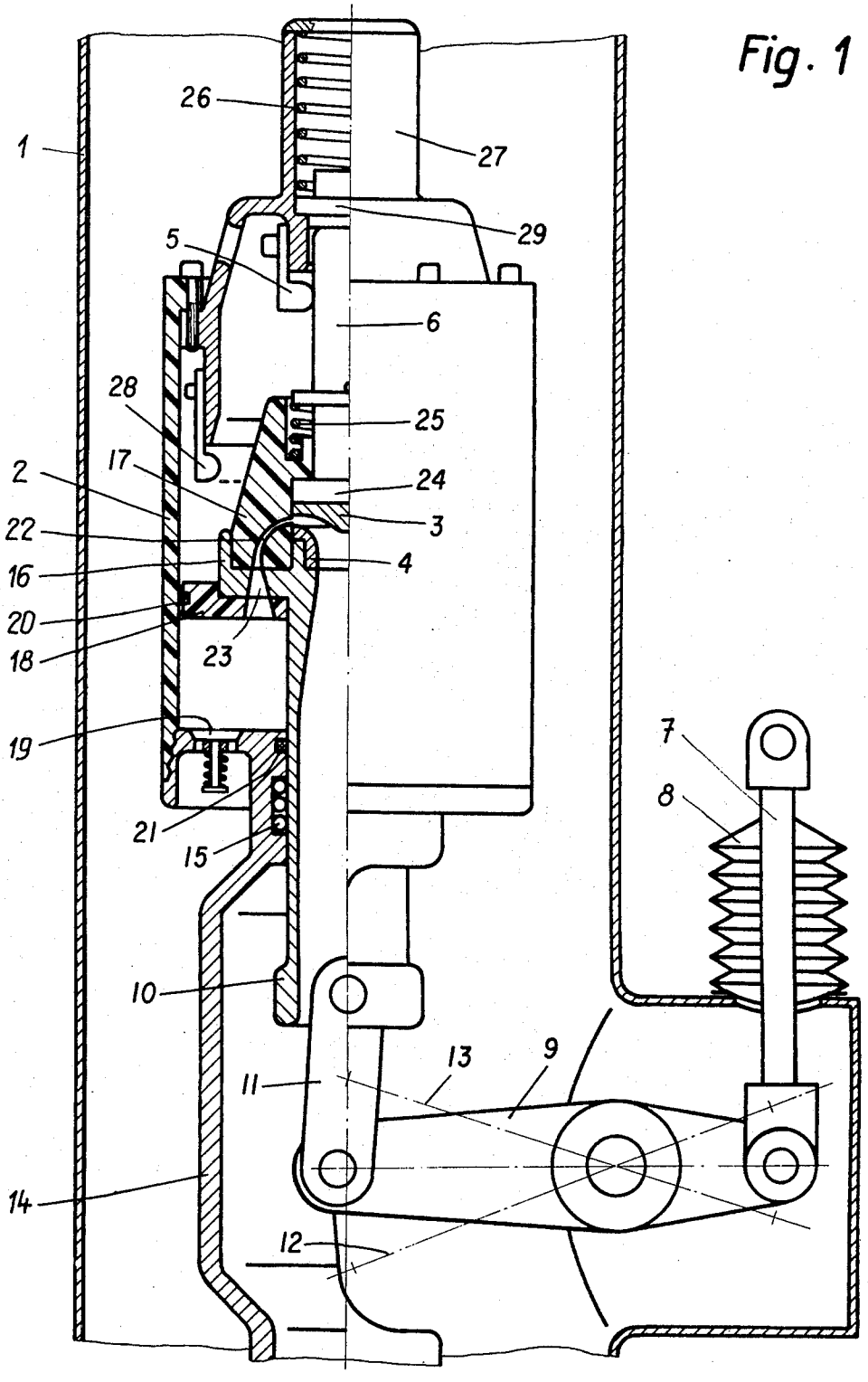


Fig. 1

GAS-BLAST POWER SWITCH FOR HIGH VOLTAGE

BACKGROUND OF THE INVENTION

The present invention relates to a gas-blast power switch for high voltages of the type comprising a gas-filled housing in which there is arranged in series a power interrupter and a disconnecting switch, a pump device equipped with a pump cylinder and a pump piston and positively connected with a switch drive, and wherein during cut-off gas is conveyed into the power interrupter and during cut-on gas is sucked up.

In German Pat. publication No. **1,790,047** there is taught to the art a gas-blast switch equipped with a switching pin with which there is combined the movable part of a blower valve. The stationary part of the blower valve is a nozzle body composed of insulating material which is located between the stationary switching element cooperating with the switching pin and the cut-off position of the switching pin and the side of which confronting the fixed switching element or piece is separated therefrom by a gas path. With this arrangement, during a cut-off movement, initially the arc is drawn through the gas path formed by the disconnection path and only after reaching the length of the positive extinguishing distance is such blown with compressed gas. This arrangement is disadvantageous because a relatively great deal of gas is required for extinguishing the arc and for flushing the compartment or space filled with the ionized gases. It is for this reason that this arrangement is also unsuitable for gas-blast switches operating with a self-blowing or extinguishing action where the gas required for extinguishing and flushing is compressed during the cut-off movement. For the brief compression there is required a very high drive energy and thus an uneconomically large drive.

In the German petty Pat. No. **6,608,446** there is taught a power switch with arc extinguishing and which is constituted by a stationary and a movable contact. At least one of these contacts is of tubular-like construction. The ring-shaped contact surfaces separate during a cut-off movement. Between the contact surfaces there appears the cut-off arc which is blown by an extinguishing agent flowing in the direction of the tube axis. The blowing gap is formed by the ring-shaped contact surfaces of the contacts. A disadvantage of this arrangement is that the width of the blowing gap is identical with the extinguishing distance. With this constructin it is only possible to increase the flow velocity in the blowing gap by increasing the pressure of the extinguishing agent. This measure however requires the use of an uneconomically large drive.

SUMMARY OF THE INVENTION

It is therefore a primary object of the present invention to provide an improved construction of gas-blast switch for high voltages which is not associated with the aforementioned drawbacks and limitations of the prior art constructions.

Another and more specific object of the present invention aims at the provision of a gas-blast switch, the pump device of which need only convey a relatively small quantity of the extinguishing agent or means during the cut-off movement, and which can be equipped with an economically small drive.

Now in order to implement these and still further objects of the invention which will become more readily apparent as the description proceeds the invention contemplates subdividing the housing into two spaces or compartments by means of a wall, one of the compartments housing the power interrupter and the other compartment the disconnecting switch. The power interrupter is formed of a ring contact pair surrounded by a ring gap nozzle arranged in the wall, the ring contact pair in its open state receives at least the **2.5**-fold phase voltage of the high voltage network, the gap of the ring gap nozzle being bounded at least at one side by an electrical insulating material. The separation path of the disconnecting switch is dimensioned at least for the checking or testing voltage of the power switch, and the contacts of the power interrupter during cut-off separate between **20** and **50** percent of the pump piston stroke and the contacts of the disconnecting switch no sooner than at **80** percent of the piston stroke.

The wall partitioning the housing can at least partially consist of an electrically insulating material. In the wall between both compartments there can be arranged a follower piston carrying the one contact of the power interrupter and the one contact of the disconnecting switch.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawing wherein the single FIGURE illustrates a longitudinal sectional view through a gas-blast power switch designed according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawing the gas-blast power switch shown in the single Figure is coaxially arranged in a tubular-shaped metal casing or capsule **1** which is grounded and filled with, for instance, sulphur hexafluoride (SF_6)-insulating gas. In the housing **2** formed of electrically insulating material there are arranged the power interrupter with both contacts **3** and **4** and the disconnecting switch or circuit breaker with its contacts **5** and **6** in series. The power interrupter and disconnecting switch are actuated by a not particularly illustrated standard switch drive arranged externally of the metal casing **1** and connected directly or via a lever with the actuation rod **7.** This actuation rod **7** is introduced by means of a bellows in a gas tight fashion into the metal casing or capsule **1.** The actuation rod **7** engages with the insulating lever **9.** At the other end of the insulating level **9** there is connected the bracket **11** which interconnects the insulating lever **9** with the switching tube **10.** The insulating lever **9** is shown in FIG. **1** in an intermediate position. Both terminal positions of such lever are indicated by the dash-dot central lines **12** and **13.**

The switching tube **10** is connected via the sliding contact location **15** with the conductor or line **14** intended to carry the current and voltage. The switching tube **16** carries the contact **4** of the power interrupter and which contact is formed of a suitable contact material. The switching tube **10** is provided at its upper end with the cylindrical portion forming the one contact of the parallel disconnector. Between the contact **4** of the

power interrupter and the contact **16** of the parallel disconnector there is secured at the switching tube **10** the nozzle body **17** formed of electrically insulating material. The switching tube **10** additionally carries the piston **18** of the pump device or mechanism and which piston is formed of electrically insulating material. The pump compartment or chamber bounded by the housing **2** serving as the pump cylinder of the pump device is closed by the check valve **19** with respect to the gas compartment within the metal casing **1.** The seals **20,** 21 are arranged between the stationary and movable parts of the pump device.

Within the nozzle body **17** there is arranged a ring gap nozzle **22** which is in communication with the pump chamber or compartment of the pump device. When the power interrupter is closed the mouth of the ring gap nozzle **22** is closed by the contact **3,** when the power interrupter is opened it is located between both contacts **3** and **4.** The relationship or ratio of the spacing of the contacts **3, 4** of the open power interrupter to the gap width of the ring gap nozzle **22** is in a range of about **1** to **10** and preferably amounts to the value **4.** The cross-section of the channel **23** leading to the ring gap nozzle **22** decreases in the direction of the mouth of the ring gap nozzle **22.**

In the nozzle body **17** there is arranged the follower or servo piston **24** carrying the one contact **3** of the power interrupter and the one contact **6** of the disconnector or disconnecting switch. A spring **25** retains the contacts **3** and **4** of the power interrupter in the open position. A spring **26** delivers the contact pressure of the power interrupter in the closed position and a part of the cut-off or disconnecting energy during the cut-off movements. The power switch can be connected with the plug-like constructed cylindrical portion **27** at further non-illustrated conductors.

In the single FIGURE there is illustrated the power switch in an intermediate position. At the start of a cut-off movement initially there separate the contacts **16** and **28** of the parallel disconnector provided for carrying the rated current. In the pump device or mechanism there begins the compression of the SF_6-gas. The mouth of the ring gap nozzle **22** remains closed by the contact **3** up to **40** percent of the total stroke movement of the pump piston **18,** because the force of the spring **26** is greater than the force of the spring **25.** Upon continuation of the cut-off movement the contacts **3** and **4** separate under the action of the spring **26,** as soon as the contact **6** separates from the follower piston **29** of the spring **26.** Due to the now free mouth of the ring gap nozzle **22** the pre-compressed gas flows with a very high velocity into the separation or disconnection path of the power interrupter formed by the contacts **3** and **4** and extinguishes the arc burning at that location. At about **83** percent of the total stroke of the pump piston **18** there now also separate the currentless contacts **5,6** of the disconnecting switch. The cut-off movement is thus terminated. The cut-off or disconnection path of the power interrupter located between the contacts **3** and **4** is designed for the **2.5**-fold phase voltage of the high voltage network. In this path or distance only the arc is to be extinguished. On the other hand the disconnection path formed by the contacts **5** and **6** is designed for the entire testing or checking voltage. This disconnection path is separated from the disconnection path of the power interrupter by the wall formed by the piston **18,** the switching tube **10,** the nozzle body **17** and by the follower piston **24** guided in such wall. Hence, the disconnection path of the disconnector switch is always located at the region of new grade, non-ionized or -contaminated extinguishing gas. The disconnection switch also can be equipped with a snap device which brings about a rebounding of at least the one contact of the disconnecting switch after the contact separator and thus a more rapid attainment of the required separation distance. By virtue of such measure it is possible to additionally save upon drive energy because during the separation movement of the disconnecting switch no further compression of the gas is required.

During the cut-in movement initially the contacts **5** and **6** of the disconnecting switch are closed, then the contacts **3** and **4** of the power interrupter and finally the contacts **16, 18** of the parallel disconnector. During the cut-in or switching-in movement the pump space or compartment formed by the housing **2** and the switching tube **10** is filled with fresh gas via the check valve **19.** The springs **25** and **26** are likewise stressed during the switching-in movement.

Particular advantages of the described gas-blast power switch reside in the high cut-off capacities with a relatively small drive energy.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto, but may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. A gas-blast power switch for high voltage comprising a gas filled housing, a power interrupter and disconnector switch connected in series and arranged in said housing, a pump device equipped with a pump cylinder and a pump piston and positively connected with a switch drive, said pump device during cut-off conveying gas into the power interrupter and during cut-on sucking-up gas, the improvement comprising a wall for partitioning the housing into two compartments, the power interrupter being arranged in one compartment and the disconnecting switch in the other compartment, said power interrupter comprising a ring contact pair surrounded by a ring gap nozzle arranged in said wall, said ring contact pair receiving in the open state of its pair of contacts at least **2.5**-fold phase voltage of a high voltage network, said ring gap nozzle having a gap bounded at least at one side by electrically insulating material, said disconnecting switch being provided with contacts and having disconnecting path which is designed at least for the test voltage of the power switch, the contacts of the power interrupter during cut-off separating between **20** and **50** percent of the pump piston stroke and the contacts of the disconnecting switch separating no earlier than at **80** percent of the pump piston stroke.

2. The gas-blast power switch as defined in claim **1,** wherein said wall which partitions said housing at least partially consists of electrically insulating material.

3. The gas-blast power switch as defined in claim **2,** further including a follower piston arranged in said wall between both compartments and carrying one contact of the power interrupter and one contact of the disconnecting switch.

4. The gas-blast power switch as defined in claim **3,** wherein said wall partitioning said housing is displace-

able therein and serves as the piston of the pump device.

5. The gas-blast power switch as defined in claim **3,** wherein the ratio of the spacing of the contacts of the open power interrupter to the gap width of the ring gap nozzle is greater than **1** and smaller than **10.**

6. The gas-blast power switch as defined in claim **5,** wherein the series connected power interrupter and disconnecting switch are bridged by a parallel disconnector switch intended to carry the rated current of the power switch, said parallel disconnector switch having contacts, and wherein during the cut-off the contacts of the parallel disconnector switch initially separate, and during the cut-in movements are the last to close, and wherein the contacts of said parallel disconnector switch coaxially enclose the contacts of the power interrupter.

* * * * *