April 18, 1933. W. UEBERMUTH 1,904,577

GAS BLAST CIRCUIT INTERRUPTER

Filed Oct. 30, 1931

Fig. 1.

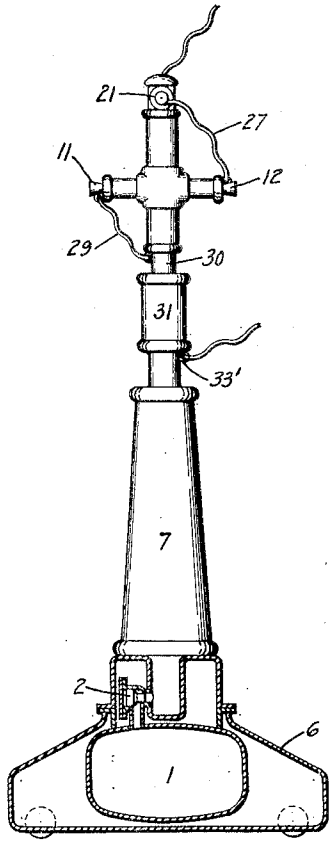
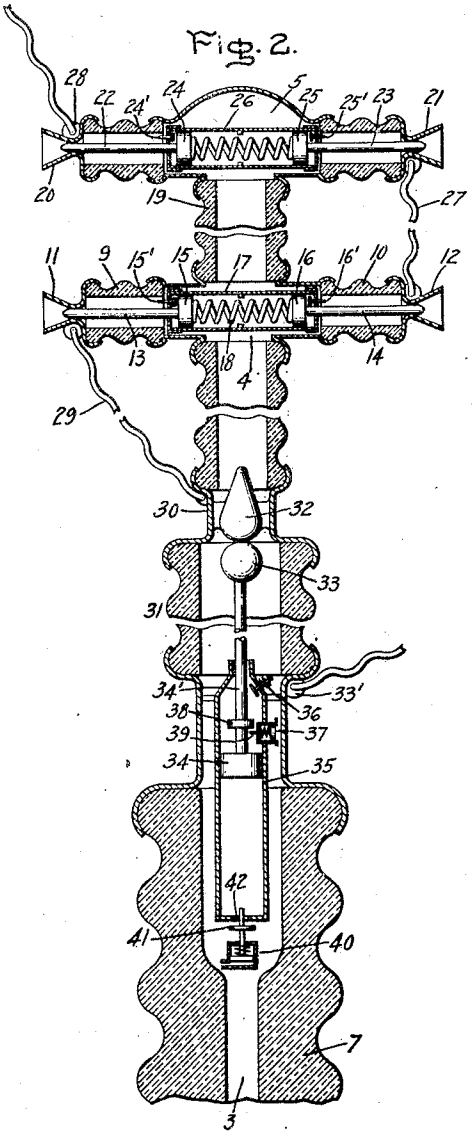


Fig. 2.



Inventor:
Werner Uebermuth,
by Charles O'Connor
His Attorney.

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UNITED STATES PATENT OFFICE

WERNER UEBERMUTH, OF BERLIN-OBERSCHONEWEIDE, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

GAS BLAST CIRCUIT INTERRUPTER

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My invention relates to gas blast circuit interrupters of the type wherein the arc gap is traversed by a high velocity gas jet causing extinguishing of the arc, and has for its object the provision of an improved gas blast circuit controlling unit having arcing contacts and means for interposing a dielectric in series with said contacts upon decrease of the gas flow between said contacts.

This application is a continuation-in-part of my copending application Serial No. 525,311 filed March 25, 1931 for gas-blast circuit interrupters.

In the operation of gas-blast circuit interrupters of the aforesaid type, it has heretofore been proposed to limit the opening of arcing contacts between which the gas jet is directed to extinguish the arc so as to insure high gas velocity across the arc, and to increase the dielectric strength of the gap after interruption of the arc and prior to discontinuance of the gas blast by further separation of the arcing contacts. With this arrangement the arc gap may be limited in cross section, thereby maintaining high gas velocity through the arc gap, the additional dielectric preventing reestablishment of the arc when the gas flow ceases. In order to carry out this mode of operation it is at once apparent that special operating means for causing separation of the arcing contacts at a variable rate is required. It has also been proposed in the above type of switch to utilize a plurality of arcing contacts connected in series, the compressed gas being simultaneously directed to each individual set of contacts when the circuit is opened. This arrangement in high tension circuits, however, necessitates appreciable separation of the contacts due to the fact that the dielectric strength of the arc gaps, although sufficient to prevent reestablishment of arcing during the gas blast, may be insufficient to prevent voltage breakdown when the blast ceases.

In accordance with my invention, a source of gas pressure is utilized to cause separation of the arcing contacts and extinguishing of arcing, the arcing contacts being in series with a disconnecting switch arranged to open without arcing after opening of the arcing contacts. The arcing contacts, which may be opened only to the extent necessary to extinguish the arc by the gas blast, are thereafter closed, the open disconnecting contacts preventing reestablishment of the arc.

My invention will be more fully set forth in the following description referring to the accompanying drawing, and the features of a novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Referring to the drawing, Fig. 1 is an elevational view, partly in section, of a gas-blast circuit controlling unit embodying my invention and Fig. 2 is an enlarged displaced and fragmentary view, partly in section, of the switch structure.

The gas-blast circuit controlling unit illustrated in Fig. 1 comprises a gas tank 1, containing a suitable gas as air or carbon dioxide, under pressure and a controlling valve 2, actuated in any suitable manner, as by a solenoid (not shown), for admitting gas under pressure to the gas passage 3 (Fig. 2) and the transversely arranged switching chambers 4 and 5. The tank 1 is suitably mounted in the base structure 6, the upper switch chambers being suitably insulated therefrom by an insulating supporting shell 7 in which the passage 3 is formed.

Referring more particularly to Fig. 2, the switch chambers 4 and 5 are shown for the purpose of clarity having their longitudinal axes in the same plane. The lower switch chamber 4 is formed by a pair of hollow insulating members 9 and 10 having mounted at the outer ends thereof the stationary nozzle-like electrodes 11 and 12 respectively, coacting with the movable rod electrodes 13 and 14 in a manner well known in this type of switch. Movable electrodes 13 and 14 are provided with the operating pistons 15 and 16 respectively, the pistons being mounted within a cylinder 17 and resiliently biased apart and towards closed circuit position by the conducting spring 18 electrically connecting the electrodes. The cylinder 17 is closed except as hereinafter described at its

opposite ends so that adequate pressure within the switch chamber 4 is effective to force the pistons 15 and 16 towards each other against the bias of the spring causing opening of the contacts 11—13 and 12—14. Reduction of the pressure below this value of course causes the spring 18 to return the electrodes 13 and 14 to the closed circuit positions.

The switch chamber 5 is similar to the switch chamber 4, the structure forming the same being mounted upon the hollow insulator 19 interconnecting the chambers 4 and 5. The switch contact structure is a duplicate of that previously described, the stationary nozzle-like contacts 20 and 21 coacting with the movable electrodes 22 and 23 respectively in the manner previously described. Since the switch chamber 5 is subjected to the same pressure as chamber 4, the operating pistons 24 and 25 for the electrodes 22 and 23 mounted within the cylinder 26 are actuated with the pistons 15 and 16 causing practically simultaneous opening of the four sets of contacts. Non-return or one-way valves 15′, 16′ and 24′, 25′ are suitably mounted in the cylinder walls opposite the gas pressure sides of the contact pistons 15, 16, 24 and 25 respectively. These valves are arranged so that they are immediately opened by predetermined pressure externally of the cylinders 17 and 26 but are closed immediately upon reduction of this pressure so as to exert a retarding or dashpot action on the return of the contacts to the closed circuit position.

The arcing contacts are suitably connected in series, as by the conductor 27, one of the switch terminals being indicated at 28 and the other being connected by the flexible conductor 29 to a terminal 30 of the disconnecting switch, forming part of the switch unit generally indicated at 31.

The disconnecting switch as illustrated in Fig. 2 is mounted within the passage 3 through which the gas flows from the reservoir 1 to the arcing contacts, and comprises a pair of coacting disconnecting contacts 32 and 33. The stationary disconnecting contact 32 which is electrically connected to the terminal 30 is suitably positioned within the passage and is preferably formed so that it presents minimum resistance to the flow of gas. The movable contact 33 is suitably connected to the terminal structure 33′ and is actuated by a piston 34 mounted for reciprocal movement within a cylinder 35 likewise positioned within the main gas passage. The upper side of the piston 34 may be subjected to pressure by opening of the non-return valve 36. This valve is normally biased closed and admits gas into the upper part of the cylinder 35 only in response to predetermined pressure in the passage 3.

For the purpose of preventing separation of the disconnecting contacts until the blast of gas across the arcing contacts has been substantially completed, there is provided means comprising a pressure actuated latch 37 coacting with a lug 38 on the piston rod 34′. When a predetermined pressure exists in the passage 3, the latch piston 37 is forced inwardly against its biasing means so that a pin 39 extends beneath the lug 38 preventing downward or opening movement of the contact 33. When the said pressure decreases below the predetermined value the latch biasing means moves the pin 39 out of the path of lug 38 so that free reciprocation of the piston 34 within its cylinder may take place.

A pressure actuated valve 40, mounted at the lower end of the cylinder 35 for a purpose hereinafter described, is normally positioned and biased so that its valve member 41 is in the open position with respect to opening 42 in the lower end of cylinder 35. When a predetermined pressure exists within the main gas passage, valve 40 is actuated to close the opening 42, and upon decrease of this pressure below said value the valve is again opened.

The operation of the circuit controlling unit is as follows:

Assuming that the circuit is closed with the switch in the position illustrated in Fig. 2, the circuit is interrupted by opening the gas controlling valve 2 by suitable means and admitting the gas from the pressure tank 1 through the gas supply pipe 3 to the switch chambers 4 and 5. Immediately the movable electrodes 13, 14, 22 and 23 are moved to open circuit position directing blasts of gas through the corresponding arc gaps formed upon separation of the contacts. As previously pointed out, the separating distance of the arcing contacts need be merely sufficient to cause interruption of the arc by the gas blast and to preclude reestablishment of arcing during gas flow across the contact surfaces. Since valve 2 is open for a brief interval which is sufficient for interrupting arcing by the gas blast, the movable arcing electrodes tend to return under the influence of the biasing springs to the closed position. However, the non-return valves 15′, etc., check the closing movement by reason of the gas entrapped ahead of the pistons so that an appreciable factor of safety is provided in the opening of the disconnecting contacts as presently described. If desired, adjustable throttling passages (not shown) may be suitably provided in parallel with the non-return valves so that a close regulation of the retarding action may be had. It shall be understood, of course, that in limited separation of the arcing contacts the ratio of compression of the gas between the movable contact pistons in the cylinders 17 and 26 is comparatively

small so that gas entrapped at high pressure in front of the pistons exerts an appreciable retarding action. Or, if desired, each cylinder 17 and 26 may be suitably provided with a connection to atmosphere intermediate its ends so that no pressure is exerted on the rear faces of the pistons by reason of compression of gas.

When the full gas pressure exists within the main passage, the valve 36 is immediately opened admitting gas under pressure to the upper side of the piston 34. Separation of the disconnecting contacts due to downward movement of the piston is however prevented by the pressure actuated latch 39 which locks the piston against downward movement as long as the gas blast pressure continues. However, upon decrease of this pressure below a predetermined value the latch 39 releases the piston 34 and the valve 36 closes with the result that a supply of compressed gas is entrapped in the upper end of the cylinder 35. Expansion of the gas due to the stored energy therein causes immediate separation of the disconnecting contacts, thereby interposing sufficient dielectric in the circuit so that the arcing contacts may be closed at will. Compressed gas at full pressure is prevented from acting on the lower side of the piston 34 by reason of the valve 40 which opens only upon decrease of pressure so that the forces acting on piston 34 are not counterbalanced.

Closing of the circuit through the disconnecting contacts is effected by admitting gas at reduced pressure to the main gas passage, this pressure being insufficient either to open the non-return valve 36 or to close the valve 40. Consequently only the lower side of the piston 34 is acted upon by the gas pressure and the switch closed.

It will be noted in connection with the arrangement above described that coupling or operating means for the movable electrodes are avoided to a great extent, thereby facilitating opening of the contacts at high speed. Furthermore, the valve 2 may be disposed adjacent the switch chambers 4 and 5, if desired, so that operation of the contacts is practically coincident with the opening of the gas controlling valve.

It should be understood that my invention is not limited to specific details of construction and arrangement thereof herein illustrated, and that changes and modifications may occur to one skilled in the art without departing from the spirit of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A circuit interrupter of the gas-blast type comprising a source of gas pressure, arcing contacts separable to form an arc gap of limited length through which gas is directed at high velocity from said source, disconnecting switch contacts in series with said arcing contacts, and means opening said disconnecting switch contacts subsequent to opening of said arcing contacts and in response to decrease of the gas blast pressure.

2. A circuit interrupter of the gas-blast type comprising a source of gas pressure, arcing contacts separable to form a restricted arc gap through which gas is directed at high velocity from said source extinguishing arcing, disconnecting switch contacts in series with said arcing contacts, and gas pressure means opening said disconnecting switch contacts upon decrease of the gas blast preventing reestablishment of arcing.

3. A circuit interrupter of the gas-blast type comprising a source of gas pressure, arcing contacts separable to form an arc gap through which gas is directed at high velocity from said source, said arc gap being substantially constant during the gas blast, disconnecting switch contacts in series with said arcing contacts, means maintaining said disconnecting switch contacts closed during said blast, and means instantly opening said disconnecting switch contacts in response to cessation of said blast.

4. A circuit interrupter of the gas-blast type comprising a source of gas pressure, a switch chamber containing arcing contacts, means normally biasing said contacts towards closed circuit position, means controlling a blast of gas from said source to said chamber, means directing the blast pressure within said chamber so as to open said arcing contacts and extinguish arcing, said arcing contacts being returned by said biasing means to closed circuit position upon decrease of the blast pressure, disconnecting switch contacts connected in series with said arcing contacts, and means separating said disconnecting switch contacts prior to closing of said arcing contacts.

5. A circuit interrupter of the gas-blast type comprising a source of gas pressure, a switch chamber containing arcing contacts, means normally biasing said contacts towards closed circuit position, means controlling and directing a blast of gas from said source to said chamber for causing opening of said arcing contacts, said means likewise directing gas between the contacts, disconnecting switch contacts connected in series with said arcing contacts, means separating said disconnecting switch contacts subsequent to opening of the arcing contacts, and means retarding return of said arcing contacts to closed circuit position upon decrease of said blast pressure.

6. A gas-blast circuit controlling unit comprising a source of gas pressure, a switch chamber having mounted therein arcing contacts, means controlling a blast of gas from said source to said chamber causing separation of the arcing contacts and interruption of the arc therebetween, resilient means bias-

ing the movable arcing contacts towards closed circuit position in response to decrease in the blast pressure, a disconnecting switch connected in series with said arcing contacts, and means entrapping gas at said blast pressure opening said disconnecting switch after said blast.

7. A circuit interrupter of the gas-blast type comprising a switch chamber having arcing contacts at opposite ends thereof, movable arcing contacts having operating pistons mounted within said chamber, said pistons normally biased apart and towards closed circuit position, a source of gas pressure arranged to be in communication with said chamber causing opening movement of the arcing contacts and a blast of gas across the arc gap formed between the same, and means interposing a dielectric in series with said contacts after interruption of arcing and prior to engagement thereof.

8. A circuit interrupter of the gas-blast type comprising a source of pressure, arcing contacts subject to a blast of gas from said source, a disconnecting switch connected in series with said arcing contacts, and means delaying opening of said disconnecting switch until said arcing contacts have been subjected to said gas blast comprising a piston and cylinder, and valve structure arranged to entrap gas at the blast pressure and release the energy stored in said gas only upon decrease of said blast pressure causing opening of said disconnecting switch.

9. A circuit interrupter of the gas-blast type comprising a source of pressure, arcing contacts subject to a blast of gas from said source, and a disconnecting switch connected in series with said arcing contacts including a movable contact operatively connected to a piston mounted within a cylinder, a valve at one end of said cylinder admitting gas at the blast pressure to said piston, a pressure responsive latch preventing circuit opening movement of said piston during continuance of said blast pressure and a valve at the opposite end of said cylinder closing the same during continuance of said blast pressure, decrease of said blast pressure causing closing of said first-named valve and release of said latch so that the gas entrapped in that part of said cylinder causes movement of said piston and opening of the disconnecting switch.

In witness whereof I have hereunto set my hand.

WERNER UEBERMUTH.