

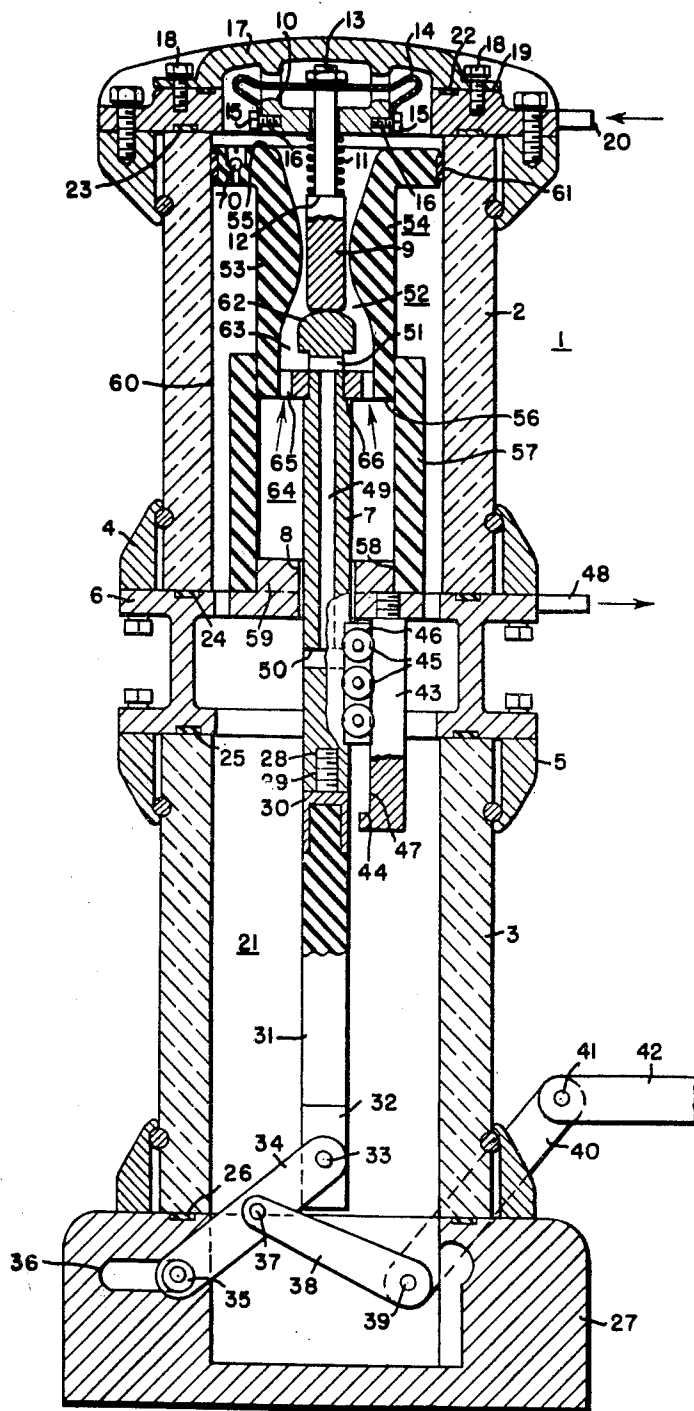
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PUMPED-GAS CIRCUIT INTERRUPTER

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PUMPED-GAS CIRCUIT INTERRUPTER

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This invention relates to pumped-gas circuit interrupters and, more particularly, to pumped-gas circuit interrupters employing piston structures to effect gas flow toward the established arc.

A general object of the present invention is to provide an improved pumped-gas circuit interrupter, which will be more effective than pumped-gas circuit interrupters heretofore employed in the industry.

A more specific object of the present invention is to provide an improved pumped-gas circuit interrupter utilizing a differential piston to effect gas flow toward the established arc, and in which the established arcing pressure is employed to speed up the opening motion of the differential piston.

Another object of the invention is to provide an improved circuit interrupter of the type utilizing an enclosed, heavy gas, such as sulfur hexafluoride (SF_6), in which gas flow toward the arc is assisted by utilization of the arcing pressure, so that additional external driving force exerted on the gas-moving piston is rendered unnecessary.

Still a further object of the present invention is to provide an improved gas-flow circuit interrupter employing a differential piston, which is driven, in part, by an auxiliary operating mechanism.

Another object of the invention is to provide an improved circuit interrupter employing a tubular movable contact adapted for ventilation for the cooling thereof, in which the apertures opening into the interior of the ventilated, tubular contact are closed off by valve action during the opening operation, by an orifice structure connected by a lost-motion connection with said movable contact.

Still a further object of the present invention is to provide a simplified pumped-gas circuit interrupter of relatively few parts, of simple construction, and adaptable for a long, trouble-free operational life.

Still a further object of the invention is to provide a completely enclosed, gas-containing, interrupting structure utilizing a piston for gas flow against the established arc, in which differential piston action is employed to assist the driving force exerted on the gas-flow piston especially during high-current interruption, when otherwise considerable back pressure, exerted upon the piston, would be encountered.

Further objects and advantages will readily become apparent upon reading the following specification, taken in conjunction with the appended drawing, the single figure of which illustrates a vertical sectional view through an enclosed, pumped-gas circuit interrupter embodying the principles of the present invention, with the contact structure illustrated in the closed-circuit position.

Referring to the figure of the drawing, the reference numeral 1 generally designates a pumped-gas circuit interrupter including a pair of upstanding, cylindrical casing members 2, 3 formed of insulating material of the requisite strength and clamped by annular support rings 4, 5 to an intermediately disposed contact support plate

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6. A tubular movable contact 7 is guided through an opening 8 provided in the contact support plate 6, and makes abutting contact, as shown in Fig. 1, with a resiliently mounted, relatively stationary contact 9 in a substantially enclosed arcing chamber. The stationary rod contact 9 is supported, in depending fashion, from a bracket housing 10, a contact compression spring 11 being interposed between the lower surface of the bracket housing 10 and a shoulder 12 formed along the stationary rod contact 9. The upper extremity of the relatively stationary contact 9 is reduced, and threaded, for the accommodation of a nut 13, which serves to clamp an apertured flexible connector 14 to the upper end of the stationary contact 9. The other ends of the flexible connector 14 are secured by machine screws 15 to the side walls 16 of the bracket housing 10. Preferably, the bracket housing 10 is integrally cast with a top cover casting 17. The top cover casting 17 is secured by machine screws 18 to a ring-shaped contact plate 19, the latter having a laterally jutting terminal pad 20. The terminal pad 20 may be apertured for the reception of bolts connecting a line conductor fixedly in place.

Since the interior 21 of the pumped-gas circuit interrupter 1 contains a suitable arc-extinguishing gas, gaskets 22, 23 may be associated with the cover casting 17 and the ring-shaped contact plate 19. Additional gaskets 24, 25 may be employed between the abutting surfaces of the insulating cylindrical casings 2, 3 and the intermediately disposed contact support plate casting 6. An additional gasket 26 may likewise be utilized, being disposed between the lower end of the lower cylindrical casing 3 and a metallic support casting 27, which serves to support the entire interrupting structure.

Preferably, however, a relatively heavy gas, such as sulfur hexafluoride (SF_6) is utilized within the interior 21 of the interrupter 1. Although sulfur hexafluoride is indicated as a preferred gas, other gases may be employed, or even air. In addition, such gases may be employed either at atmospheric pressure within the interrupter 1, or at lower, or higher pressures than atmospheric, as deemed desirable in view of the interrupting applications to be encountered.

The tubular movable contact 7 has its lower end bored and threaded, as at 28, to accommodate the stud portion 29 of a rod-end 30, the latter being threadedly secured to the upper extremity of an insulating operating rod 31. Another rod-end 32 is threadedly secured to the lower end of the insulating operating rod 31. The rod-end 32 is pivotally connected, as at 33, to a floating guide link 34, the latter having rollers 35 associated with its other end adapted to move laterally in a guide slot 36, formed in the base casting 27.

Pivotally connected intermediate the ends of the floating guide link 34, as at 37, is an actuating crank-arm 38, the other end of which is keyed to a laterally extending drive shaft 39. The drive shaft 39 projects through the side of the base casting 27 by means of a gas-tight seal, not shown, and has secured to the outer, external end thereof an external crank-arm 40. The other end of the crank-arm 40 is pivotally connected, as at 41, to an operating link 42, the latter being actuated by any suitable operating mechanism, forming no part of the present invention.

Threadedly secured into the contact support plate 6, and depending downwardly therefrom, is a conducting contact bracket 43 having a lug 44 formed at the lower end thereof. A plurality of pairs of roller current collectors 45 are mounted through a pair of apertured plates 46. The roller collectors 45 are disposed between the side of the moving contact rod 7 and the vertical side 47 of the contact bracket 43. As set out more extensively and claimed in U.S. patent application filed Decem-

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ber 20, 1956, Serial No. 629,604, now United States Patent 2,866,045, issued December 23, 1958 to Winthrop M. Leeds, and assigned to the assignee of the instant application, such pairs of contact rollers 45 serve to transmit the current from the movable contact 7 to the contact bracket 43, and through the contact support plate 6 to the other terminal pad 48 of the interrupter 1.

As illustrated in Fig. 1, the movable contact rod 7 has a ventilating duct or passage 49 provided partially therethrough. The lower end of the ventilating passage 49 communicates through laterally located openings 50 to the region 21 interiorly of the lower casing 3. The upper end of the ventilating passage 49 communicates, by additional openings 51, to the region 52 disposed interiorly of an insulating orifice structure 53, constituting an integral part of a differential piston, generally designated by the reference numeral 54. As shown, the upper end of the differential piston 54 includes a relatively large cross-sectional-area surface 55 and a lower smaller cross-sectional-area surface 56. The lower smaller cross-sectional area 56 forms a gas-pumping piston, which reciprocates longitudinally within an upstanding insulating pumping cylinder 57, the latter being threadedly connected, as at 58, to a threaded boss portion 59 of the contact support plate 6.

The outer periphery of the larger cross-sectional-area surface 55 moves, with a relatively tight fit, along the inner wall 60 of the upper cylindrical insulating casing 2, constituting an operating cylinder, a piston ring 61 preferably being provided.

The opening operation of the pumped-gas circuit interrupter 1 will now be described. During the opening operation, suitable operating mechanism, not disclosed, and forming no part of the present invention, serves to move the operating link 42 to the left, as viewed in Fig. 1. This leftward movement of operating link 42 effects counterclockwise, opening, rotative movement of the interiorly disposed crank-arm 38. This action causes floating link 34 to drive insulating operating rod 31 downwardly in a straight line, resulting from the aforesaid straight-line linkage. The downward opening movement of insulating operating rod 31, in turn, drives movable contact 7 and upper head portion 62 thereof downwardly. Because of the lost-motion connection 63 between movable contact 7 and orifice structure 53, initially, the movable contact 7 will move independently downwardly. This will effect the sealing up of the lateral openings 51, thereby closing off the upper end of the ventilating passage 49 interiorly of tubular movable contact 7. Additional downward driving motion exerted on movable contact 7 will carry the orifice structure 53 therewith, and will begin to compress the gas within the region 64 interiorly of operating cylinder 57. Following the take-up of the "wiping" motion of stationary contact 9, an arc will be established between the separated contacts 7, 9. During the existence of relatively high-amperage currents flowing through the established arc, drawn between contacts 7, 9, this high pressure will serve to act upon the upper larger surface area 55 of the differential piston 54, assisting thereby the external operating mechanism, not shown, in driving the lower gas-pumping piston 56 within operating cylinder 57. This latter motion, of course, compresses gas within region 64, within operating cylinder 57, and forces this compressed gas through the openings 65 of piston 56 into region 52, adjacent the established arc between contacts 7, 9, effecting the extinction of the same.

During the interruption of relatively low-amperage currents, where the pressure generated at the established arc will be relatively low, reliance is largely based upon the external operating mechanism, to cause the downward, opening movement of the differential piston structure 54. It is only in the medium current and relatively heavy-current range, where additional driving effort is needed to overcome the back-pressure, that the differen-

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tial piston 54, driven by the high arcing pressure, will assist the external operating mechanism in effecting rapid downward movement of the gas-pumping piston 56.

During the closing operation, the operating link 42 is moved toward the right, as viewed in Fig. 1. Through the straight-line linkage shown, the operating rod 31 is raised, and the movable contact 7 is forced upwardly into engagement with the relatively stationary contact 9, the compression spring 11 providing the desired contact pressure. The orifice structure 53 and the differential piston 54 are carried upwardly with the movable contact 7 by the shoulder 66 thereon. A check valve 70 may be employed in the differential piston 54 to provide for entrance of gas behind piston 55 when operating at no load or light currents. The lost-motion 63 seals passage 49 through movable contact 7 during the opening stroke. However, when the breaker is closed, check valve 70 closes, but excess pressure above the piston 55 can vent through contact 7, since passage 49 will be open during the closing stroke.

It is important to realize that if this structure were associated with a liquid-type breaker, during the closing operation pre-striking between the approaching contacts 7, 9 would generate pressure, which would act downwardly upon the large surface area 55 tending to stall the closing movement of the interrupter. Failure of such a breaker might result. However, where gas is employed, instead of liquid, the resiliency of the gas is such as to permit the movable contact 7 to be driven to the closed position, to fully engage stationary contact 9 at the end of the closing operation, unimpeded by the downward force exerted upon the large surface area 55 of differential piston 54 caused by the arcing pressure resulting from pre-striking during such a closing operation.

The application of pumped-gas circuit breaker designs to 5 to 15 kv. class of circuit breakers interrupting currents of 20,000 amperes or more appears to be uneconomical with prior art devices, because of the very heavy driving forces required to pump a heavy gas, such as sulfur hexafluoride (SF_6), against the back pressure developed by these high-current arcs. Something simpler than the powerful hydraulic drive used in large high-voltage breakers, such as is set out in patent application Serial No. 693,309, filed October 30, 1957, by Albert P. Strom, and assigned to the assignee of the instant application, is desired.

The present invention overcomes the above objections since it is concerned with a simple pump-type breaker, particularly suitable for indoor service, which, for example, would normally be expected to interrupt only 5,000 to 10,000 amperes. By incorporating a differential piston 54, so as to use the pressure of the hot gases emerging from the nozzle 53, from which the arc is drawn, back-pressure on the gas-driving piston 56 is overcome, and high velocity of the moving contact 7 and pumping orifice piston 56 is maintained, without providing additional accelerating force.

Some important advantages of the present invention over a compressed-gas breaker are:

- (1) No auxiliary pumps and reservoirs are needed.
- (2) Quiet operation is obtained.
- (3) Total enclosure is suitable for use in contaminated or explosive atmospheres.

It is to be observed that the ventilating duct 49 extending through the hollow, moving contact 7 increases the continuous current-carrying capacity in the closed position of the interrupter 1. The lost-motion 63 provided enables the picking up of the orifice piston 56 and consequent sealing off this interior passage 49 during the pumping cycle of the interrupter.

From the foregoing description, it will be apparent that there is provided an improved pumped-gas circuit interrupter, particularly adapted for interrupting relatively heavy currents without the necessity of utilizing heavy

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external driving springs. The employment of the differential piston 54 enables the arcing pressure to be used, to assist the external operating mechanism in forcing the piston 56 and the movable contact 7 in the opening direction. Thus, relatively high back-pressure forces on the piston 56 during heavy-current interruption are easily overcome, and the external operating mechanisms may consequently be relatively light.

As mentioned, the use of gas within the interrupter 1 insures the complete closing of the interrupter, even though some pressure may be generated during pre-striking during the closing stroke, whereas in the case of liquid-type breakers, such pre-striking during the closing stroke, generating pressure, might prevent the moving contact 7, and the piston structure 54, from moving to the completely closed-circuit position.

Although there has been illustrated and described a specific structure, it is to be clearly understood that the same was merely for the purpose of illustration, and that changes and modifications may readily be made therein by those skilled in the art, without departing from the spirit and scope of the invention.

I claim as my invention:

1. The combination in a pumped-gas circuit interrupter of means defining a substantially enclosed arcing chamber, a pair of separable contacts one of which is movable which are separable to establish an arc within said substantially enclosed arcing chamber, a relatively stationary pumping cylinder, a differential piston having a relatively large cross-sectional position area exposed to the pressure within said arcing chamber and a relatively small cross-sectional piston area movable within said relatively stationary pumping cylinder, said differential piston also having an orifice portion interconnecting the two piston areas of different cross-sectional area, a ventilating passage extending through the movable contact, a lost-motion connection between the movable contact and said differential piston, the movable contact carrying the differential piston therewith following the take-up of the lost motion, and the take-up of the lost-motion sealing off the ventilating passage through the movable contact.

2. A pumped-gas circuit interrupter including an insulating hollow cylindrical casing, a closure cap structure closing one open end of said cylindrical casing and supporting a relatively stationary contact therein, a contact support plate disposed adjacent the other open end of said cylindrical casing, line-terminal means associated with said closure-cap structure and electrically connected to the relatively stationary contact, means defining an open-ended operating pump cylinder supported from said contact support plate and having the open end thereof projecting interiorly within said other open end of the cylindrical casing toward the relatively stationary contact, said operating pump cylinder having a closed end immediately adjacent the contact support plate with a contact opening therein, a movable contact carrying a differential pumping piston and reciprocally movable through the contact opening in the closed end of the pump cylinder, connecting means electrically connecting the movable contact to said contact support plate, second line-terminal means associated with said contact support plate, said differential pumping piston having a relatively large surface piston area sliding along the inner surface of the hollow cylindrical casing, said differential pumping piston also having a smaller surface pumping area which is smaller in area than the aforesaid large surface piston area and reciprocally operable within said operating pump cylinder, said differential pumping piston also having an orifice portion interconnecting the piston areas of different cross-sectional area, the movable contact engaging the relatively stationary contact through said orifice portion in the closed-circuit position of the circuit interrupter with the large surface piston area of the differential pumping piston positioned rearwardly of the tip

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portion of the relatively stationary contact, and the volume of gas between the large surface piston area of the differential piston and said closure-cap structure being small to increase the driving effort during the opening operation.

3. A pumped-gas circuit interrupter including an insulating hollow cylindrical casing, a closure cap structure closing one open end of said cylindrical casing and supporting a relatively stationary contact therein, a contact support plate disposed adjacent the other open end of said cylindrical casing, line-terminal means associated with said closure-cap structure and electrically connected to the relatively stationary contact, means defining an open-ended operating pump cylinder supported from said contact support plate and having the open end thereof projecting interiorly within said other open end of the cylindrical casing toward the relatively stationary contact, said operating pump cylinder having a closed end immediately adjacent the contact support plate with a contact opening therein, a movable contact carrying a differential pumping piston and reciprocally movable through the contact opening in the closed end of the pump cylinder, means defining a lost-motion mechanical connection between the relatively movable contact and said differential pumping piston, connecting means electrically connecting the movable contact to said contact support plate, second line-terminal means associated with said contact support plate, said differential pumping piston having a relatively large surface piston area sliding along the inner surface of the hollow cylindrical casing, said differential pumping piston also having a smaller surface pumping area which is smaller in area than the aforesaid large surface piston area and reciprocally operable within said operating pump cylinder, said differential pumping piston also having an orifice portion interconnecting the piston areas of different cross-sectional area, the movable contact engaging the relatively stationary contact through said orifice portion in the closed-circuit position of the circuit interrupter with the large surface piston area of the differential pumping piston positioned rearwardly of the tip portion of the relatively stationary contact, and the volume of gas between the large surface piston area of the differential piston and said closure-cap structure being small to increase the driving effort during the opening operation.

4. A pumped-gas circuit interrupter including an insulating hollow cylindrical casing, the gas within the insulating casing comprising the heavy gas sulfur hexafluoride, a closure cap structure closing one open end of said cylindrical casing and supporting a relatively stationary contact therein, a contact support plate disposed adjacent the other open end of said cylindrical casing, line-terminal means associated with said closure-cap structure and electrically connected to the relatively stationary contact, means defining an open-ended operating pump cylinder supported from said contact support plate and having the open end thereof projecting interiorly within said other open end of the cylindrical casing toward the relatively stationary contact, said operating pump cylinder having a closed end immediately adjacent the contact support plate with a contact opening therein, a movable contact carrying a differential pumping piston and reciprocally movable through the contact opening in the closed end of the pump cylinder, connecting means electrically connecting the movable contact to said contact support plate, second line-terminal means associated with said contact support plate, said differential pumping piston having a relatively large surface piston area sliding along the inner surface of the hollow cylindrical casing, said differential pumping piston also having a smaller surface pumping area which is smaller in area than the aforesaid large surface piston area and reciprocally operable within said operating pump cylinder, said differential pumping piston also having an orifice portion interconnecting the piston areas of different cross-sectional

area, the movable contact engaging the relatively stationary contact through said orifice portion in the closed-circuit position of the circuit interrupter with the large surface piston area of the differential pumping piston positioned rearwardly of the tip portion of the relatively stationary contact, and the volume of gas between the large surface piston area of the differential piston and said closure-cap structure being small to increase the driving effort during the opening operation.

5. A pumped-gas circuit interrupter including an insulating hollow cylindrical casing, a closure cap structure closing one open end of said cylindrical casing and supporting a relatively stationary contact therein, a contact support plate disposed adjacent the other open end of said cylindrical casing, line-terminal means associated with said closure-cap structure and electrically connected to the relatively stationary contact, means defining an open-ended operating pump cylinder supported from said contact support plate and having the open end thereof projecting interiorly within said other open end of the cylindrical casing toward the relatively stationary contact, said operating pump cylinder having a closed end immediately adjacent the contact support plate with a contact opening therein, a movable contact carrying a differential pumping piston and reciprocally movable through the contact opening in the closed end of the pump cylinder, connecting means electrically connecting the movable contact to said contact support plate, second line-terminal means associated with said contact support plate, said differential pumping piston having a relatively large surface piston area sliding along the inner surface of the hollow cylindrical casing, check-valve means associated with the large surface piston area for unimpeded no-load operation, said differential pumping piston also having a smaller surface pumping area which is smaller in area than the aforesaid large surface piston area and reciprocally operable within said operating pump cylinder, said differential pumping piston also having an orifice portion interconnecting the piston areas of different cross-sectional area, the movable contact engaging the relatively stationary contact through said orifice portion in the closed-circuit position of the circuit interrupter with the large surface piston area of the differential pumping piston positioned rearwardly of the tip portion of the relatively stationary contact, and the volume of gas between the large surface piston area of the differential piston and said closure-cap structure being small to increase the driving effort during the opening operation.

6. A pumped-gas circuit interrupter including an upstanding elongated interrupting structure including a pair of axially-aligned, hollow insulating casings, a contact support plate disposed intermediately of said hollow insulating casings, a closure-cap structure surmounting the upper of the two casings, line-terminal means associated with said closure-cap structure, a relatively stationary contact depending downwardly from said closure-cap structure and projecting downwardly within the upper casing, means defining an open-ended operating pump cylinder supported from said contact support plate and having the open end thereof projecting upwardly interiorly within the upper casing toward the relatively stationary contact, said operating pump cylinder having a closed end immediately adjacent the contact support plate with a contact opening therein, a movable contact carrying a differential pumping piston and reciprocally movable through the contact opening in the closed end of the pump cylinder, connecting means electrically connecting the movable contact to said contact support plate, second line-terminal means associated with said contact support plate, said differential pumping piston having a relatively large surface piston area sliding along the inner surface of the upper cylindrical casing, said differential pumping piston also having a smaller surface pumping

area which is smaller in area than the aforesaid large surface piston area and reciprocally operable within said operating pump cylinder, said differential pumping piston also having an orifice portion interconnecting the piston areas of different cross-sectional area, the movable contact engaging the relatively stationary contact through said orifice portion in the closed-circuit position of the circuit interrupter with the large surface piston area of the differential pumping piston positioned upwardly of the tip portion of the relatively stationary contact, the volume of gas between the large surface piston area of the differential piston and said closure-cap structure being small to increase the driving effort during the opening operation, and an insulating operating rod connected to the movable contact and extending downwardly through the lower insulating casing to ground potential.

7. A pumped-gas circuit interrupter including an upstanding elongated interrupting structure including a pair of axially-aligned, hollow insulating casings, a contact support plate disposed intermediately of said hollow insulating casings, a closure-cap structure surmounting the upper of the two casings, line-terminal means associated with said closure-cap structure, a relatively stationary contact depending downwardly from said closure-cap structure and projecting downwardly within the upper casing, means defining an open-ended operating pump cylinder supported from said contact support plate and having the open end thereof projecting upwardly interiorly within the upper casing toward the relatively stationary contact, said operating pump cylinder having a closed end immediately adjacent the contact support plate with a contact opening therein, a movable contact carrying a differential pumping piston and reciprocally movable through the contact opening in the closed end of the pump cylinder, means providing a lost-motion mechanical connection between the relatively movable contact and said differential pumping piston, connecting means electrically connecting the movable contact to said contact support plate, second line-terminal means associated with said contact support plate, said differential pumping piston having a relatively large surface piston area sliding along the inner surface of the upper cylindrical casing, said differential pumping piston also having a smaller surface pumping area which is smaller in area than the aforesaid large surface piston area and reciprocally operable within said operating pump cylinder, said differential pumping piston also having an orifice portion interconnecting the piston areas of different cross-sectional area, the movable contact engaging the relatively stationary contact through said orifice portion in the closed-circuit position of the circuit interrupter with the large surface piston area of the differential pumping piston positioned upwardly of the tip portion of the relatively stationary contact, the volume of gas between the large surface piston area of the differential piston and said closure-cap structure being small to increase the driving effort during the opening operation, and an insulating operating rod connected to the movable contact and extending downwardly through the lower insulating casing to ground potential.

8. A pumped-gas circuit interrupter including an upstanding elongated interrupting structure including a pair of axially-aligned, hollow insulating casings, the gas within the upstanding interrupting structure comprising the heavy gas sulfur hexafluoride, a contact support plate disposed intermediately of said hollow insulating casings, a closure-cap structure surmounting the upper of the two casings, line-terminal means associated with said closure-cap structure, a relatively stationary contact depending downwardly from said closure-cap structure and projecting downwardly within the upper casing, means defining an open-ended operating pump cylinder supported from said contact support plate and having the open end thereof projecting upwardly interiorly within the upper casing toward the relatively

stationary contact, said operating pump cylinder having a closed end immediately adjacent the contact support plate with a contact opening therein, a movable contact carrying a differential pumping piston and reciprocally movable through the contact opening in the closed end of the pump cylinder, connecting means electrically connecting the movable contact to said contact support plate, second line-terminal means associated with said contact support plate, said differential pumping piston having a relatively large surface piston area sliding along the inner surface of the upper cylindrical casing, said differential pumping piston also having a smaller surface pumping area which is smaller in area than the aforesaid large surface piston area and reciprocally operable within said operating pump cylinder, said differential pumping piston also having an orifice portion interconnecting the piston areas of different cross-sectional area, the movable contact engaging the relatively stationary contact through said orifice portion in the closed-circuit position of the circuit interrupter with the large surface piston area of the differential pumping piston positioned upwardly of the tip portion of the relatively stationary contact, the volume of gas between the large surface piston area of the differential piston and said closure-cap structure being small to increase the driving effort during the opening operation, and an insulating operating rod connected to the movable contact and extending downwardly through the lower insulating casing to ground potential.

9. A pumped-gas circuit interrupter including an up-standing elongated interrupting structure including a pair of axially-aligned, hollow insulating casings, a contact support plate disposed intermediately of said hollow insulating casings, a closure-cap structure surmounting the upper of the two casings, line-terminal means associated with said closure-cap structure, a relatively stationary contact depending downwardly from said closure-cap structure and projecting downwardly within the upper casing, means defining an open-ended operating pump cylinder supported from said contact support plate and having the open end thereof projecting upwardly interiorly within the upper casing toward the relatively stationary contact, said operating pump cylinder having a closed end immediately adjacent the contact support plate with a contact opening therein, a movable contact

carrying a differential pumping piston and reciprocally movable through the contact opening in the closed end of the pump cylinder, connecting means including contact roller guide means depending from said contact support plate and assisting in obtaining reciprocal motion of the movable contact for electrically connecting the movable contact to said contact support plate, second line-terminal means associated with said contact support plate, said differential pumping piston having a relatively large surface piston area sliding along the inner surface of the upper cylindrical casing, said differential pumping piston also having a smaller surface pumping area which is smaller in area than the aforesaid large surface piston area and reciprocally operable within said operating pump cylinder, said differential pumping piston also having an orifice portion interconnecting the piston areas of different cross-sectional area, the movable contact engaging the relatively stationary contact through said orifice portion in the closed-circuit position of the circuit interrupter with the large surface piston area of the differential pumping piston positioned upwardly of the tip portion of the relatively stationary contact, the volume of gas between the large surface piston area of the differential piston and said closure-cap structure being small to increase the driving effort during the opening operation, and an insulating operating rod connected to the movable contact and extending downwardly through the lower insulating casing to ground potential.

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