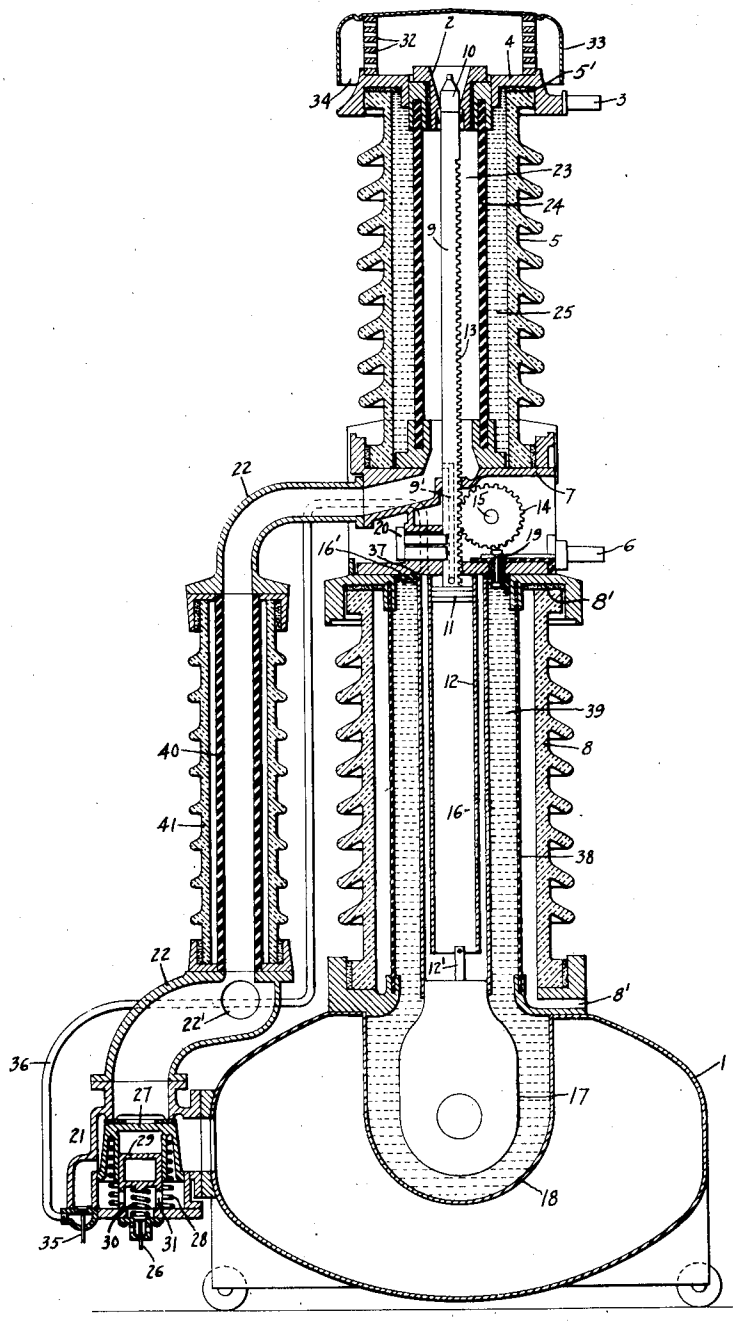
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ELECTRIC CIRCUIT INTERRUPTER

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ELECTRIC CIRCUIT INTERRUPTER

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My invention relates to electric circuit interrupters, more particularly to high voltage circuit interrupters of the gas-blast type wherein a gas-blast is directed across the arc upon opening of the circuit, and has for its principal object the provision of an improved circuit interrupter of the aforesaid type which shall be compact in design, rugged in construction, and efficiently insulated for high voltages.

My invention will be more fully set forth in the following description referring to the accompanying drawing, and the features of 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, the single figure thereof is an elevational view partly in section of a high voltage gas-blast circuit interrupter embodying my invention.

Heretofore high voltage gas-blast circuit interrupters have been proposed wherein a supporting insulator carries the mechanism for actuating the movable contact structure, the switching or blast chamber and the stationary contact structure being mounted above said mechanism. This arrangement, however, involves comparatively large dimensions, particularly in height, for voltages of the order of 100 and 200 kv.

In accordance with my invention, the height of the structure and the consequent size are reduced by locating the contact actuating means as for example a cylinder and piston wholly or partially within the supporting insulator and by designing the supporting insulator as a bushing of the type adapted to contain an efficient insulating liquid, as oil.

Referring more particularly to the drawing, there is illustrated a gas-blast circuit interrupter comprising a storage reservoir 1 for the supply of compressed gas mounted so as to support the vertically arranged circuit interrupting structure having the stationary contact structure 2 at its upper end. The contact 2 is electrically connected to the terminal 3, the terminal structure including a contact supporting end plate 4 which is carried at the upper end of a cylindrical insulator 5 of ceramic material.

The other terminal 6 is electrically connected in the circuit in a manner hereinafter described and is mounted on an intermediate conducting housing structure 7 which supports the insulator 5 as illustrated. The structure 7 is in turn carried by the high voltage cylindrical or shell-like insulator 8 of ceramic material which is mounted on the upper portion of the gas reservoir 1.

The movable contact structure coacting with the contact 2 comprises a rod contact 9 adapted to engage at its contact portion 10 the inner contact surface of the nozzle-shaped contact 2. At the lower end of rod contact 9 is mounted a piston 11 movable within an operating cylinder 12 depending from the structure 7. For the purpose of synchronizing the individual phases of a multiphase circuit interrupter, the rod contact 9 is provided with gear teeth 13 coacting with pinion 14 connected to an actuating shaft 15 common to the other phases.

The cylinder 12 in the present instance is mounted within and concentrically of a second cylinder 16 which is insulated at 16' with respect to the structure 7 and carries at its lower end in alinement a current transformer 17 closing that end of the cylinder. As illustrated, the current transformer extends within the gas reservoir 1 and is housed in a metallic casing 18 welded or otherwise suitably secured to the reservoir casing 1. If desired, the outer cylinder 16 and current transformer may be covered with a layer of suitable insulating material as paper impregnated with a synthetic resin.

The concentric tubes 12 and 16 comprise the current conductors to the current transformer, the tube 16, which is electrically connected at 19 to the terminal 6, forming the supply conductor to one terminal (not shown) of the current transformer, and the inner conducting cylinder 12 forming with connection 12' a supply conductor to the other terminal (not shown) of the current transformer. With this concentric conductor arrangement the electro-dynamic forces are balanced.

The cylinder 12 which is electrically connected to the intermediate conducting structure 7 is electrically connected to the movable rod contact 9 through the wiping contacts 20. Accordingly, in the closed circuit position illustrated the circuit between the main terminals 3 and 6 comprises the stationary contact structure 2, movable rod contact 9, wiping contacts 20, conducting structure 7, inner conducting cylinder 12, current transformer 17, outer conducting cylinder 16, and terminal connection 19.

The opening mechanism for the circuit interrupter comprises valve structure 21 and the main gas conduit 22 for controlling the admission of gas from the reservoir 1 to the switching or blast chamber 23 which is formed within the insulator

5 by a tubular insulating member 24 of strong fibrous material. The insulating cylinder member 24 which is interposed between the intermediate structure 7 and the upper stationary structures 2 and 4 is adapted to relieve the outer comparatively brittle insulating shell 5 of stresses incident to the circuit interrupting operation. For insuring that the main loads are taken off the insulator 5 and are borne by the insulating tube 24, a resilient connection such as a gasket of suitable material may be provided at 5' between the insulator 5 and plate 4. Since the tube 24 is rigidly secured as illustrated to the parts 4 and 7, the load stresses are transmitted directly to the mounting at 7 through said tube. For the purpose of more efficiently insulating the aforesaid structure for high voltage operation, the annular space between the insulators 5 and 24 is filled with a high grade insulating oil 25.

In effecting the circuit opening operation, a valve 26 of the valve structure 21 is opened by upward pressure from any suitable means, a manual or remote controlled electrical device being contemplated for operating the opening valve. Immediately upon opening the valve the pressure at the underside of the piston 27 is relieved and the pressure of the gas within the reservoir 1 acting on the piston causes it to open quickly against the bias of its closing spring 28. It will be understood that with the piston 27 normally closed as indicated, the gas pressure on opposite sides of the piston tends to equalize by reason of a small bleed vent (not shown) admitting gas under pressure to the lower side of piston 27. The piston 27 is guided for reciprocal movement on a stationary member 29, in which is disposed a spring 30, tending to close the valve 26. Communication between the main valve housing of the structure 21 and the pressure-relief passage controlled by valve 26 is by way of ports 31 which are closed by the piston 27 when the same is moved to its fully open position. Accordingly, after a single operation of the valve 26, resulting in opening of valve 27 and gas discharge from the reservoir through the conduit 22, the valve 27 is closed under bias of spring 28 in readiness for another operation.

The gas discharge from the reservoir not only fills the chamber 23 with gas under pressure in readiness to exhaust through the nozzle contact 2 upon withdrawal of the rod contact 9, but also acts on the upper side of contact piston 11 by way of port 9'. Accordingly, coincident with downward movement of the rod contact 9 under the influence of the gas pressure acting on piston 11, the gas-blast is directed from the chamber 23 radially across the arc and through the nozzle contact 2.

The nozzle-like passage formed by the contact 2 may exhaust into a muffler arrangement comprising a plurality of stacked and spaced rings 32 mounted on the terminal conductor 4 and disposed within an inverted or dome-like casing 33 communicating with atmosphere through an annular passage 34.

The circuit closing operation is effected merely by admitting gas under pressure to the lower side of the piston 11. This is accomplished in the present instance by means of a valve 35 controlling the admission of gas from reservoir 1 to the conduit 36 which is connected at 37 so as to be in communication with the annular space between the cylinders 12 and 16. The cylinder 12 which is open at its lower end, therefore is in communication with the source of gas pressure when valve 35 is opened, resulting in upward movement of the piston 11 and closing of the rod contact 9. The concentric cylinders 12 and 16 therefore serve two main purposes, namely that of providing conducting leads for the current transformer 17 and that of providing a simplified gas conduit to the closing side of the piston 11.

As in case of insulator 5, the insulator 8 is protected from operating stresses by means of a strong insulating cylinder 38 disposed between the intermediate structure 7 and reservoir 1. A resilient gasket may likewise be provided at 8' between the insulator 8 and structure 7. The insulator 38, including the casing 18 extending into the reservoir, is filled as illustrated with oil or other suitable insulating liquid 39 so that the current transformer and associated conductors are adequately insulated. The annular space between the insulators 8 and 38 is connected to atmosphere as at 8'.

The main gas conduit 22 comprises an intermediate insulating section having a strong inner insulating cylinder 40 and an outer ceramic insulator 41. For the purpose of simultaneously supplying gas to similar circuit interrupter units, the main conduit 22 may be connected as at 22' to the gas conduits of the other units.

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. An electric circuit interrupter comprising a source of fluid pressure, a high voltage shell-like insulator mounted in vertical position, relatively movable contact structure and means forming a switching chamber for said contact structure mounted at the upper end of said insulator, contact actuating means including a piston and cylinder extending within and longitudinally of said insulator, a second cylinder of larger diameter arranged concentrically of said piston cylinder, the space between said cylinders forming a fluid passage to said piston, and means for admitting fluid under pressure from said source to said space at one end of said high voltage insulator.

2. An electric circuit interrupter of the gas-blast type comprising relatively movable contact structure, contact actuating means including a piston and cylinder, a second cylinder of larger diameter arranged concentrically of said first-named cylinder, said cylinders being of conducting material, and a current transformer electrically connected to said contact structure through said cylinders.

3. An electric circuit interrupter of the gas-blast type comprising a high voltage insulator, relatively movable contact structure mounted on said insulator, contact actuating means including a piston and cylinder extending within and longitudinally of said insulator, a second cylinder of larger diameter arranged concentrically of said first-named cylinder, said cylinders being of conducting material, and a current transformer in alinement with said cylinders and electrically connected through the same to said contact structure.

4. An electric circuit interrupter of the gas-blast type comprising a compressed gas supply reservoir, a high voltage insulator mounted on said reservoir in vertical position, relatively movable contact structure and means forming a

switching chamber for said contact structure mounted at the upper end of said insulator, contact actuating means including a piston and cylinder extending within and longitudinally of said insulator, a second cylinder of larger diameter arranged concentrically of said piston cylinder, the space between said cylinders communicating with the interior of said piston cylinder, means for admitting gas under pressure from said reservoir to said space and to said switching chamber for effecting circuit controlling operations, and a current transformer depending within said reservoir and electrically connected to said contact structure through said cylinders.

5. An electric circuit breaker comprising relatively movable contact structure, an insulating supporting structure therefor comprising a cylinder composed of mechanically strong fibrous insulating material, an insulating shell of ceramic material of larger diameter disposed concentrically of said cylinder, the annular space between said cylinder and shell containing an insulating fluid, a mounting for said insulating supporting structure to which said cylinder is secured at one end, and resilient means interposed between said mounting and shell arranged with respect to said cylinder so that all load stresses are taken by said cylinder.

6. An electric circuit breaker comprising relatively movable contact structure, an insulating housing for said structure comprising a cylinder of mechanically strong fibrous insulating material, an insulating shell of ceramic material of larger diameter surrounding said cylinder, an insulating oil in the space between said cylinder and shell, and a mounting at one end of said insulating housing to which said cylinder is rigidly secured, said shell resiliently connected with respect to said mounting so that all load stresses are transmitted to said mounting by said rigidly connected cylinders.

7. An electric circuit breaker comprising relatively movable contact structure, operating mechanism therefor, a pair of insulating housings for said contact structure, metallic housing structure for said operating mechanism intermediate said insulating housings, each insulating housing comprising a cylinder of mechanically strong fibrous material rigidly secured at one end to said housing, and an insulating shell of ceramic material of greater diameter surrounding said cylinder, the space between said cylinders and shells containing an insulating liquid, and resilient means for cushioning said ceramic shells with respect to said metallic structure arranged so that all load stresses are transmitted to said housing structure by said cylinders.

8. A high voltage electric circuit breaker comprising relatively movable contact structure, a tubular supporting housing for said structure, a current transformer mounted in said housing, and means connecting the high voltage primary of said current transformer in series with said contact structure, comprising a pair of concentrically arranged conductors directly connecting said contact structure and current transformer, said concentrically arranged lead conductors extending longitudinally and concentrically of said tubular housing.

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