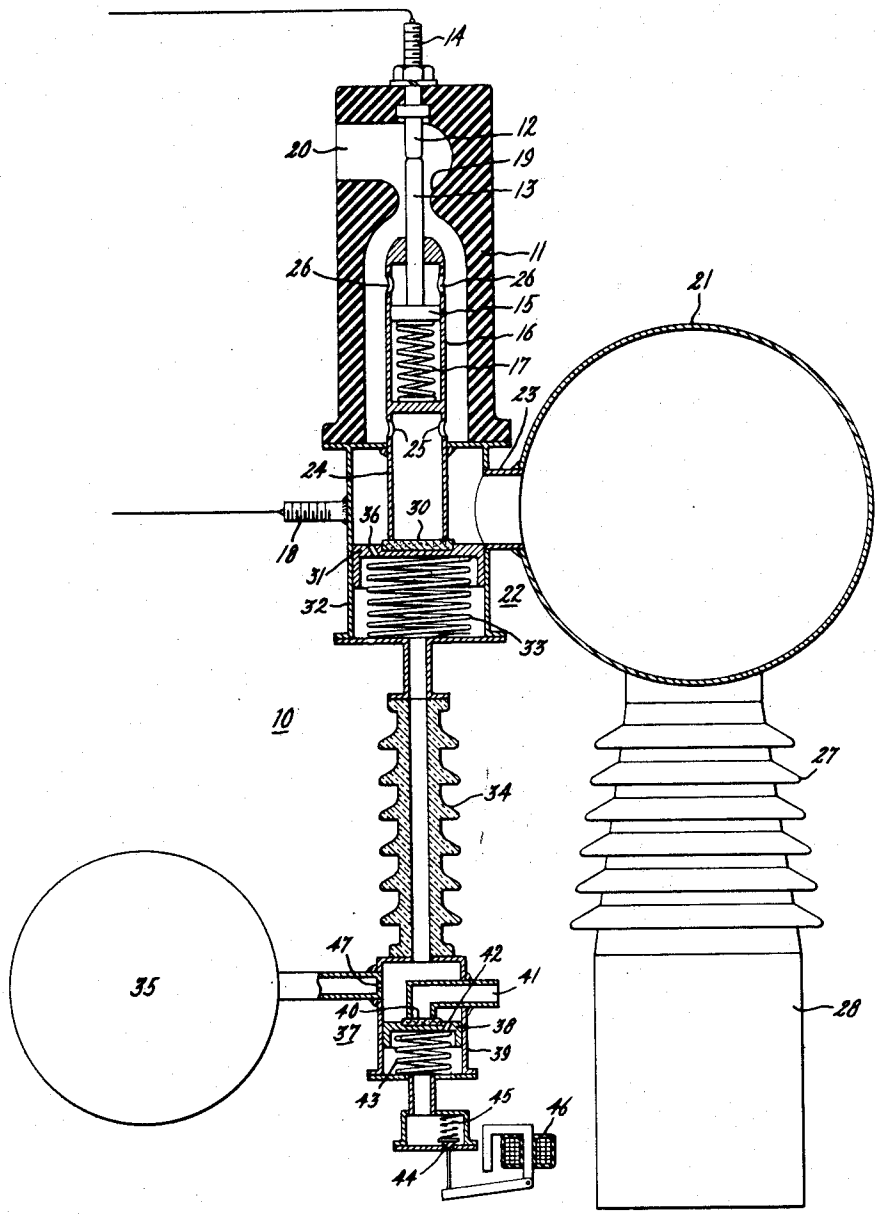
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ELECTRIC CIRCUIT INTERRUPTER

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ELECTRIC CIRCUIT INTERRUPTER

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My invention relates to electric circuit interrupters and more particularly to fluid blast circuit interrupters in which the arc gap is traversed by a high velocity blast of fluid, such as air, to cause extinguishment of the arc drawn.

In fluid blast circuit interrupters and particularly air or gas blast circuit breakers for high voltage applications, it has been the usual practice to provide a source of gas under pressure such as a gas container or storage reservoir, which comprises a part of the circuit breaker and often is formed as an integral part of the frame work upon which the circuit breaker is built. A blast of gas under pressure for arc extinguishing purposes is released from such source which gas has heretofore been required to traverse an insulating tube of sufficient length to withstand the voltage to ground between the relatively movable contacts of the circuit breaker and the source of fluid under pressure. For very high voltages this insulating tube is of considerable length and in these cases the construction entails inefficiency in that time is taken for the gas or fluid to pass from the source to the contacts where the fluid blast is desired. In addition, with a considerable distance to be traversed there is a loss of pressure due to pipe friction and the like. Moreover, the insulating tube carrying the fluid from the source to the contacts is expensive to construct satisfactorily and being of considerable volume entails using up a corresponding amount of fluid under pressure in filling this tube before fluid is available to extinguish the arc drawn. In addition, during an interrupting operation the pressure drop in the fluid flowing from the source to the contacts may cause condensation of moisture in the insulating tube with the resultant danger of arcing between the parts of the circuit interrupter at high potential and the parts at ground potential because of this moisture in the insulating tube.

It is an object of my invention to provide a new and improved gas blast circuit breaker in which all danger of arcing due to condensation of moisture in the parts connecting high and low potential portions of the apparatus is substantially eliminated.

It is another object of my invention to provide a fluid blast circuit breaker having improved efficiency of performance due to increased speed of operation and better utilization of the available gas pressure combined with simplification in the number and construction of its constituent components.

Further objects and advantages of my invention will become apparent as the following description proceeds 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.

For a better understanding of my invention reference may be had to the accompanying drawing, in which the single figure thereof is a schematic diagram, partly in section, of a fluid blast circuit interrupter embodying my invention.

Referring now to the drawing, I have illustrated a fluid or gas blast circuit interrupter generally indicated at 10 comprising an insulating arc extinguishing chamber 11 within which are mounted a pair of relatively movable contacts 12 and 13. Contact 12 has been illustrated as a stationary or fixed contact which is electrically connected to a line terminal 14. Contact 13, on the other hand, has been illustrated as a movable rod contact operatively connected to a piston 15 reciprocatingly mounted within a cylinder 16, which in turn is supported within arcing or arc extinguishing chamber 11. A suitable spring 17 biases contacts 12 and 13 to a closed position. Movable contact 13 is electrically connected through cylinder 16 and associated conducting apparatus with the line terminal 18. Insulating arcing chamber 11 is also provided with a portion of reduced cross section or a nozzle 19 which connects the interior of arcing chamber 11 to atmosphere through an opening 20.

Mounted closely adjacent to arcing chamber 11 so as preferably to be at substantially the same potential as contact 13 for example, I have provided a reservoir 21 which contains fluid, such as air or gas, under pressure. Reservoir 21 is connected to arcing chamber 11 through a valve generally indicated at 22 to be described in greater detail hereinafter. Upon opening of valve 22 fluid under pressure from reservoir 21 enters arcing chamber 11 through conduits 23 and 24, the latter of which is provided with openings, such as 25. This fluid will produce an arc extinguishing blast through nozzle 19 adjacent relatively movable contacts 12 and 13. Cylinder 16 is provided with openings, such as 26, so that fluid under pressure entering these openings from arc extinguishing chamber 11 may cause relative separation of contacts 12 and 13 in a manner well understood by those skilled in the art. Upon opening of main blast valve 22, as will be described in greater detail hereinafter, fluid under pressure from reservoir 21 will enter arcing chamber 11 as well as cylinder 16 and due to the pressure drop which results, condensation of moisture may occur in the fluid passageways such as in conduits 23 and

24. However, since reservoir 21, conduits 23 and 24, and the relatively movable contacts are substantially at the same potential there is no danger of undesirable arcing by virtue of such condensation of moisture.

Since the fluid blast circuit breaker described thus far is particularly adapted for high voltage application, I have illustrated the arcing chamber, interrupting contacts, reservoir 21, and blast valve 22, as supported upon a suitable insulator 27 which in turn may be mounted on a grounded frame work 28.

My invention is particularly concerned with an arrangement for operating blast valve 22 from a point of low potential, such as ground potential, without the necessity of any mechanical connection to blast valve 22. Furthermore, my invention is concerned with an arrangement for replenishing the fluid under pressure in reservoir 21 without any danger of moisture condensation which would cause arcing between the high potential portions and the low potential portions of the system.

To eliminate the necessity of a mechanical connection, main blast valve 22 has been illustrated as of the balanced pressure type. Although this balanced pressure type of valve may comprise any of the well known forms of valves, such for example as are disclosed in United States Letters Patents 1,912,024, 2,310,130 or 2,315,991, I have chosen to illustrate blast valve 22 as of the type disclosed in Patent 1,912,024 in which operation of the valve is obtained by releasing the pressure on one side of the piston. It should be understood, however, that operation of blast valve 22 might equally well be obtained by some other variation of pressure such as disclosed in Patent 2,315,991 referred to above.

As illustrated in the drawing, main blast valve 22 comprises a valve member 30 adapted for sealing engagement with the end of conduit 24. This valve member 30 is furthermore mounted on a piston 31 which is reciprocable in a cylinder 32. A suitable spring 33 biases valve member 30 mounted on piston 31 to the closed position. Under steady state conditions, the forces acting on piston 31 by virtue of the fluid under pressure, substantially neutralize each other and the force of spring 33 is the only force urging valve member 30 to the closed position. The lower end of cylinder 32 is connected through an insulating tube 34 of considerable length, to a source 35 of fluid under pressure which is preferably maintained at ground potential, or in any event, at a substantially lower potential than the potential of valve 22. Piston 31 of main blast valve 22 is provided with a small passage 36 interconnecting the cylinder 32 below piston 31 with the space above piston 31 so as to balance the pressures operating on the upper and lower surfaces of the piston under steady state conditions. If the pressure on the lower side of piston 31 were suddenly released the pressures acting on piston 31 would be unbalanced and opening of valve member 30 would occur. To accomplish this I provide a control valve 37 also of the balanced pressure type and illustrated in the drawing as substantially identical with main blast valve 22. Control valve 37 comprises a piston 38 reciprocatingly mounted in cylinder 39. A valve member 40 mounted on the upper end of piston 38 controls the connection of insulating tube 34 with atmosphere through a conduit 41. A small passageway 42 in piston 38 permits the pressures on piston 38 above and below the piston to be balanced under steady state conditions, in which case a spring 43 is provided to force valve member 40 into sealing engagement with conduit 41. Control valve 37 is operated in the same manner as blast valve 22 and such operation is accomplished by releasing the pressure below piston 38 through operation of a pilot valve 44 which is biased to the closed position by means of a spring 45. Pilot valve 44 may be operated by any suitable means, such for example as the electromagnetic means 46 illustrated in the drawing. Control valve 37 and pilot valve 44 are preferably mounted in any suitable manner (not shown) with the grounded frame work 28 of the circuit breaker 10. In order to prevent the escape of any substantial amount of fluid under pressure from source 35 to atmosphere through conduit 41 when control valve 37 is open, I provide an orifice 47 between source 35 and insulating tube 34 which is made as small as is conveniently practicable.

It will be evident that although I have illustrated control valve 37 which is in effect a pilot valve for blast valve 22, as controlling the operation of only a single pole of a circuit breaker, it will be obvious that it could equally well be used to control the operation of the plurality of poles of a polyphase circuit breaker. Also if the circuit breaker employed a plurality of sets of relatively movable contacts connected in series with one another, control valve 37 might be used to control a blast of fluid for both sets of contacts.

Under steady state conditions as indicated in Fig. 1, fluid under pressure from source 35 will flow through the restricted openings 47 and 36 so that reservoir 21 is maintained at the same pressure as source 35. Due to the balancing of pressures on either side of pistons 31 and 38, springs 33 and 43, respectively, maintain valve members 30 and 40 in the closed position. Upon opening of pilot valve 44, the pressure below piston 38 of control valve 37 is released so that valve member 40 moves away from conduit 41 with the result that the pressure below piston 31 of main blast valve 22 is also rapidly released to cause valve member 30 to move away from conduit 34, whereupon fluid under pressure from reservoir 21 is supplied to arcing chamber 11. Any condensation of moisture between reservoir 21 and arcing chamber 11 will cause no undesirable arcing, since the parts are at substantially the same potential. Furthermore, no condensation within insulating tube 34 will occur with the consequent danger of arcing between the high potential portions of the apparatus and the grounded portions of the apparatus. As soon as pilot valve 44 is closed the pressures on piston 31 of blast valve 22 and on piston 38 of control valve 37 proceed to balance and neutralize each other so that the springs 33 and 43 force valve members 30 and 40 to their closed positions. The pressure in reservoir 21 is built up by the flow of fluid through orifice 47 and small passageway 36.

It will be observed that the insulating means 34 defining the fluid passageway extending between source 35 and reservoir 21 serves a dual purpose, i. e., it provides the means for replenishing the fluid in reservoir 21 from source 35 and furthermore is the agency by which main blast valve 22 is controlled through variation of pressure in insulating tube 34.

It will be apparent to those skilled in the art that my invention is not limited to the particular construction shown, but that changes and

modifications may be made without departing from the spirit and scope of my invention, and I aim in the appended claims to cover all such changes and modifications.

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

1. In a fluid blast circuit breaker, an insulating supporting member, a pair of relatively movable contacts supported by said member, a reservoir for fluid under pressure, valve means for causing a blast of fluid from said reservoir to be produced adjacent said contacts for arc extinguishing purposes during a circuit interrupting operation, said reservoir and valve means being at substantially the same potential as at least one of said contacts, a source of fluid under pressure maintained at a potential substantially lower than the potential of said reservoir and valve means, insulating means defining a fluid passageway connected between said reservoir and said source for supplying said reservoir with fluid under pressure, and means for controlling said valve means solely by controlling the fluid conditions in said passageway.

2. In a fluid blast circuit breaker, an insulating supporting column, a pair of relatively movable contacts supported by said column, a reservoir for fluid under pressure supported by said column, valve means for causing a blast of fluid from said reservoir to be produced adjacent said contacts for arc extinguishing purposes during a circuit interrupting operation, said reservoir and valve means being at substantially the same potential as at least one of said contacts, a source of fluid under pressure maintained at a potential substantially lower than the potential of said reservoir and valve means, insulating means defining a fluid passageway connected between said reservoir and said source for supplying said reservoir with fluid under pressure, and means for controlling said valve means solely by controlling the fluid conditions in said passageway.

3. In a high voltage fluid blast circuit breaker, an insulating supporting column, a pair of relatively movable contacts mounted on said column, a reservoir for fluid under pressure mounted on said column, valve means for causing a blast of fluid from said reservoir to be produced adjacent said contacts for arc extinguishing purposes during a circuit interrupting operation, said reservoir and valve means being at substantially the same potential as at least one of said contacts, a source of fluid under pressure maintained at a potential substantially lower than the potential of said reservoir and valve means, insulating means defining a fluid passageway connected between said reservoir and said source for supplying said reservoir with fluid under pressure, and means for controlling said valve means solely by controlling the fluid conditions in said passageway.

4. A fluid blast electric circuit interrupter for controlling an associated electric circuit comprising an insulating supporting member, an arc extinguishing chamber supported by said member, a pair of relatively movable contacts mounted in said chamber, a reservoir for fluid under pressure supported adjacent to said chamber so as to be at substantially the same potential as at least one of said contacts, means including a balanced pressure type of blast valve interconnecting said reservoir with said chamber to produce a blast of arc extinguishing fluid from said reservoir adjacent said contacts during a circuit interrupting operation, insulating means sufficient to withstand the potential of said associated circuit defining a fluid passageway connected to said blast valve, a control valve for causing a variation in the pressure of the fluid in said passageway to initiate operation of said blast valve, a source of fluid under pressure, and means including said fluid passageway for interconnecting said reservoir and said source.

5. A fluid blast electric circuit interrupter for controlling an associated electric circuit comprising an insulating supporting member, an arc extinguishing chamber supported by said member, a pair of relatively movable contacts mounted in said chamber, a reservoir for fluid under pressure supported adjacent to said chamber so as to be at substantially the same potential as at least one of said contacts, means including a balanced pressure type of blast valve interconnecting said reservoir with said chamber to produce a blast of arc extinguishing fluid from said reservoir adjacent said contacts during a circuit interrupting operation, a source of fluid under pressure from which the fluid in said reservoir is adapted to be replenished following a circuit interrupting operation, means including insulating means defining a fluid passageway interconnecting said source and said reservoir, and a control valve connected to the end of said passageway adjacent said source to cause upon operation thereof a variation in the fluid pressure in said passageway to unbalance the balanced pressures of said blast valve and cause opening thereof.

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