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CONTROL FOR PRESSURE OPERATED SWITCHES

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Fig. 1.

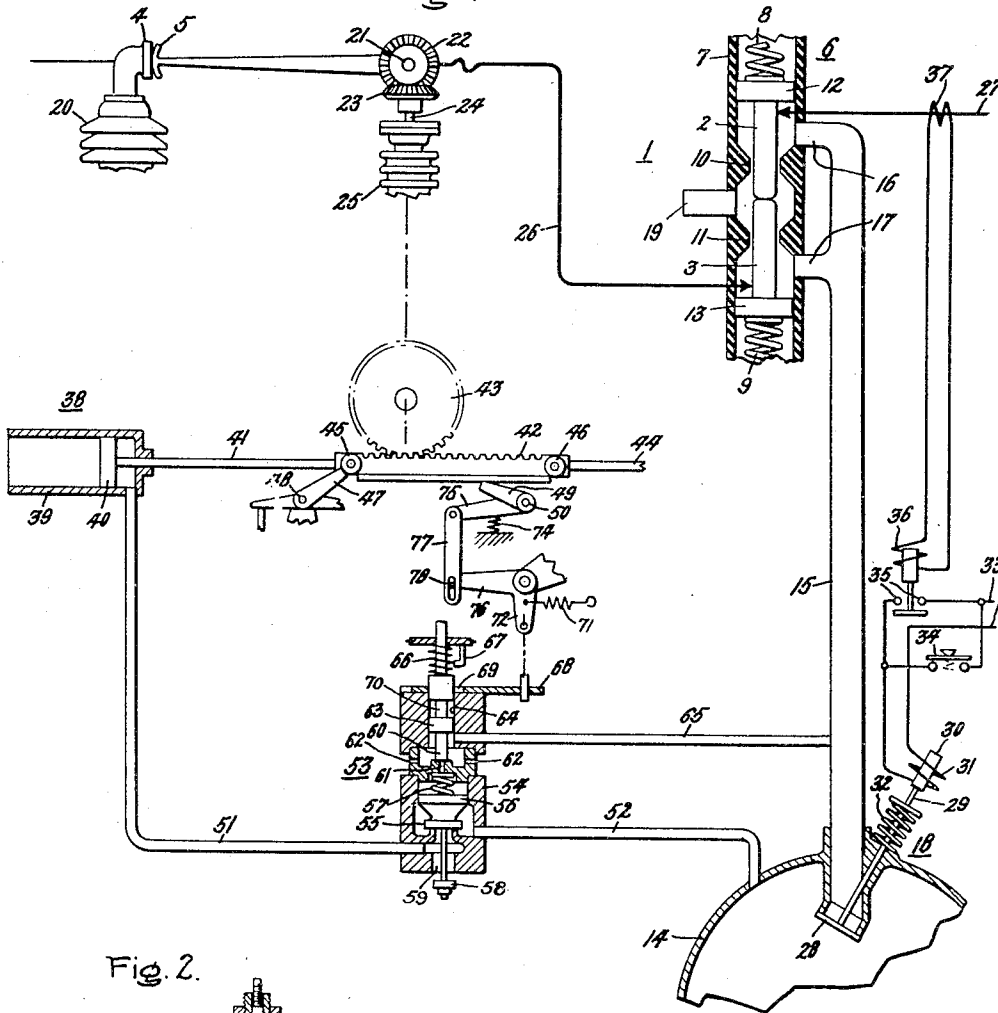
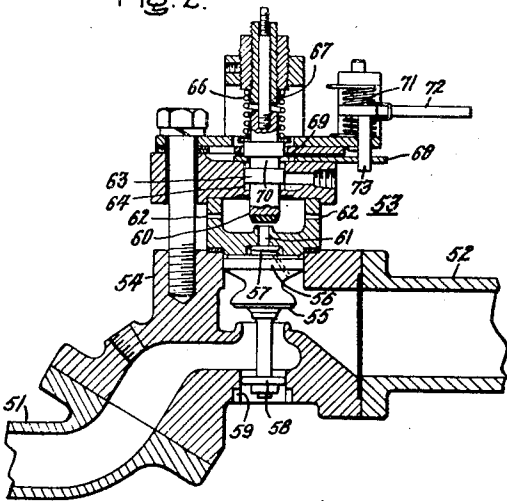


Fig. 2.



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CONTROL FOR PRESSURE OPERATED SWITCHES

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3 Claims. (Cl. 200—82)

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Our invention relates to a control arrangement and particularly to a control arrangement for a fluid operated electric switch or circuit breaker.

In a fluid operated electric circuit breaker a source of fluid under pressure is usually connected to a fluid motor through a control valve for controlling the operation of the circuit breaker. Such control valves have been used for causing opening of the switch or circuit breaker in which case the valve is often designated as the switch or circuit breaker opening valve. It is essential that the control arrangement embodying such a circuit breaker opening valve be designed to cause opening of the valve at the proper time, to maintain the valve in the open position even though the opening means no longer actuates the valve to the open position, and finally to insure that the valve is not permitted to close until the switch or circuit breaker reaches its fully open position. Many complicated arrangements have been used heretofore to control such a fluid motor.

Our invention is particularly concerned with such a control arrangement and it is the principal object of our invention to provide a new and improved control arrangement for the fluid motor of a fluid operated switch.

It is another object of our invention to provide a simple and compact control valve interconnecting a source of fluid under pressure and a switch or circuit breaker fluid motor with means for controlling the same in a positive and accurate manner.

Further objects and advantages of our invention will become apparent as the following description proceeds and the features of novelty which characterize our invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of our invention reference may be had to the accompanying drawing in which Fig. 1 is a schematic diagram partly in section, of a control arrangement embodying our invention, and Fig. 2 is a sectional view of a commercial embodiment of the control valve portion of a control arrangement schematically illustrated in Fig. 1 with the control valve in the latched open position.

Although our invention is applicable to any fluid operated circuit breaker, we have chosen to specifically illustrate our invention in Fig. 1 as applied to an electric circuit breaker of the fluid operated, fluid blast type such as is disclosed in the copending application Serial No. 565,834, Boisseau, Beall, Frank and Lowery filed concurrently with the present application and assigned to the same assignee as the present application. Although a polyphase circuit breaker has been shown in the copending Boisseau, Beall, Frank and Lowery application referred to above we have

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chosen, for the purpose of simplifying the disclosure, to illustrate our invention in connection with one pole of a polyphase circuit breaker or a single phase circuit breaker.

Referring now to Fig. 1 of the drawing, there is illustrated an electric circuit breaker generally indicated at 1 comprising a pair of relatively moving arcing contacts 2 and 3 and a pair of relatively moving isolating or disconnecting contacts 4 and 5, serially arranged with respect to each other. The arcing contacts 2 and 3 have been illustrated as a part of a fluid blast interrupting unit 6 which may be constructed in the manner disclosed and claimed in copending application, Serial No. 570,006, Boisseau and Beall, filed December 27, 1944, and assigned to the same assignee as the present application. Interrupting head or unit 6 comprises an insulating chamber 7 within which relatively movable arcing or interrupting contacts 2 and 3 are mounted. Both contacts 2 and 3 have been illustrated as movable contacts biased to the closed position by means of springs 8 and 9, respectively. In the closed position of the circuit breaker shown in Fig. 1, contacts 2 and 3 are in electrical engagement and the contact 2 extends through a nozzle 10 while the contact 3 extends through a nozzle 11. Associated with contact 2 is a fluid motor comprising the piston 12. Similarly associated with the contact 3 is a fluid motor comprising the piston 13. Pistons 12 and 13 are reciprocal within cylinders suitably mounted in arc extinguishing chamber 7.

In order to interrupt the current flowing through arcing contacts 2 and 3 fluid under pressure is supplied from a source illustrated as a tank 14 through a blast conduit 15 to arcing chamber 7, conduit 15 being branched as indicated at 16 and 17 so as to supply fluid under pressure ahead of each nozzle 10 and 11, respectively. The flow of this fluid under pressure which is preferably air, is controlled by a blast valve generally indicated at 18 closely associated with tank 14. When blast valve 18 is opened contacts 2 and 3 are retracted through nozzles 10 and 11 and a blast of fluid through each nozzle quickly extinguishes the arc drawn between contacts 2 and 3. The fluid blast exhausts to atmosphere through conduit 19.

Since arcing or interrupting contacts 2 and 3 are of the so-called retractable pin type which reclose as soon as fluid under pressure is shut off relative to arcing chamber 7, it is necessary to provide isolating or disconnecting contacts 4 and 5. Isolating contact 4 is indicated as a stationary contact suitably supported on an insulating support 20 and preferably electrically connected to a suitable circuit to be controlled. Disconnecting or isolating contact 5, on the other hand, really comprises a contact arm pivotally mounted

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about a horizontal axis 21. Contact arm 5 is the movable contact and the pivoted end thereof is provided with a bevel gear 22 which meshes with bevel gear 23 mounted on a rotatable shaft 24. Shaft 24 is rotated from the grounded supporting structure below through a rotatable insulating member 25.

Isolating contact arm 5 is electrically connected to movable arcing contact 3 by means of a conductor 26. Movable arcing contact 2 is connected with power line or circuit 27 in order to control the power flowing therein.

Blast valve 18 has been illustrated as comprising a valve member 28 connected by a valve stem 29 with the armature 30 of a solenoid including a winding 31. A suitable spring 32 normally biases valve member 28 to the closed position indicated in Fig. 1. Winding 31 for controlling the operation of blast valve 18 is connected to a source of control power 33 through manually controlled switch 34 or the contacts 35 of a relay including a winding 36. The contacts 35 and the switch 34 are connected in parallel with each other so that closure of switch 34 or bridging of contacts 35 would energize winding 31 and cause opening of blast valve 18. Winding 36 of the associated relay is connected to the secondary winding 37 of a current transformer associated with power line 27. In the event of an abnormal current condition on power line 27, such as might be caused by a fault condition, winding 36 of the associated relay is energized sufficiently to cause contacts 35 to close whereupon blast valve 18 is opened and an arc is drawn and extinguished in arcing chamber 7. The same operation may be initiated by manually actuating switch 34.

It is obvious that after arcing contacts 2 and 3 have operated to interrupt the circuit, isolating contacts 4 and 5 must be separated if the circuit is to remain open and this operation of isolating contacts 4 and 5 must occur before arcing contacts 2 and 3 have reclosed. In order to cause relative separation of isolating or disconnecting contacts 4 and 5 we have provided a second fluid motor generally indicated at 38, the term second fluid motor being applied to distinguish it from the fluid motors in interrupting unit 6. Fluid motor 38 comprises a cylinder 39 having mounted therein a piston 40 which is connected by rod 41 with a rack 42. Rack 42 is adapted to engage a spur gear 43 mounted on rotatable insulator 25. It is obvious from Fig. 1 that when piston 40 is moved to the left shaft 24 and bevel gear 23 are rotated so as to move disconnecting arm 5 to its open position. Rack 42 may also be connected by a connecting rod 44 with another fluid motor in the manner disclosed and claimed in copending application Serial No. 529,670, Boisseau, filed April 5, 1944 and assigned to the same assignee as the present application. In accordance with the disclosure in the above mentioned copending Boisseau application, Serial No. 529,670, the rack 42 is preferably provided with rollers 45 and 46, one mounted near each end of rack 42. Roller 45 forms part of a lock-closed means for circuit breaker 10 and cooperates with a locking member 47 pivotally mounted at 48 and preferably operated in a manner disclosed and claimed in the above mentioned Boisseau application. Roller 46, on the other hand, forms a part of a lock-open means which includes a locking member 49 pivotally mounted at 50. Suitable means (not shown) and constructed in accordance with the above mentioned Boisseau application may be provided for re-

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leasing lock-open means including locking arm 49 and lock-closed means including locking arm 47 respectively, prior to opening and closing of the circuit breaker 1.

In order to operate fluid motor 38 and consequently to cause relative separation of isolating or disconnecting contacts 4 and 5 cylinder 39 is connected with source 14 by conduits 51 and 52 and a switch controlling valve generally indicated at 53. Switch controlling valve 53 is schematically illustrated in Fig. 1, a commercial embodiment thereof being illustrated in Fig. 2. The corresponding parts of Figs. 1 and 2 are designated by the same reference numerals, however.

Switch controlling valve 53 comprises a main valve body 54 within which is reciprocatingly mounted the valve member 55 connected to a piston 56. This valve and piston combination is of the so-called balanced pressure type of valve in which fluid under pressure acting on both sides of piston 56 is normally substantially balanced so that the valve is held in the closed position by means of a spring 57. Fluid under pressure from conduit 52 is permitted to flow past piston 56 or through a bleed orifice in the piston to balance the pressure on both sides of the piston under certain conditions. When the valve is in the closed position shown in Fig. 1 a suitable member 58 opens an escape port 59 to atmosphere whereby cylinder 39 is vented to atmosphere through conduit 51.

Operation of valve member 55 is controlled by means of a pilot valve 60 which controls a port 61 for venting the pressure on one side of piston 56, illustrated as the upper side in the drawings, to atmosphere through ports such as 62. Whenever pilot valve 60 is in the open position indicated in Fig. 2 the pressure on the upper side of piston 56 is substantially reduced to atmospheric pressure so that fluid under pressure from conduit 52 thereby lifts and maintains valve member 55 in the open position shown.

Since it is usually desired to operate disconnecting contacts 4 and 5 sequentially with arcing contacts 2 and 3, we have disclosed pilot valve 60 as being operable in response to the flow of fluid under pressure in blast conduit 15. Accordingly, pilot valve 60 is connected to a piston 63 reciprocal in a cylinder 64 which cylinder is connected to blast valve conduit 15 by means of a conduit 65. Whenever blast valve 18 is open, fluid under pressure flowing in conduit 15 will also flow through conduit 65 and into cylinder 64 to move piston 63 upwardly and consequently to open pilot valve 60 with the resultant opening of control valve member 55. Pilot valve 60 is normally biased to the closed position by means of a spring 66 and the opening movement thereof is limited by a stop 67.

It is essential that once circuit breaker opening valve 53 has opened that it remains open until the circuit breaker opening operation is completed. In accordance with our invention, therefore, we provide a latching means which automatically latches pilot valve 60 in the open position once it has been opened. It should be understood that although we have disclosed fluid means for initiating opening of valve 53, other means for initiating such opening operation might be employed. The latching means of our invention comprises a sliding plate 68 having an elongated opening or slot 69 therein. Opening 69 is sufficiently large to permit piston 63 to move therethrough. Piston 63 is provided with an intermediate portion of reduced cross section indi-

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cated at 70 so that when sliding plate 68 is moved toward the right to the position indicated in Fig. 2 upon opening of pilot valve 60, sliding plate 68 moves into the undercut portion or portion of reduced cross section 70 as indicated in Fig. 2 and latches pilot valve 60 in the open position which, in effect, latches the main control valve member 55 in the open position. In accordance with our invention plate 68 is normally biased to the latching position indicated in Fig. 2 by a spring 71 acting on a pivotally mounted bell crank 72 with a pin 73 connecting one arm of bell crank 72 and sliding plate 68. With this arrangement it will be obvious that whenever pilot valve 60 is open spring 71 will rotate bell crank 72 so that pin 73 causes plate 68 to slide to the latching position shown in Fig. 2.

Circuit breaker opening valve 53 must not be closed until the circuit breaker 1 has attained its fully open position which means that disconnecting contact arm 5 is in its fully open position. When disconnecting contact arm 5 is fully open, lock-open member 49 is moved to its locking position in engagement with roller 46 by virtue of spring 74 acting on crank arm 75 rotatable with member 49. In accordance with our invention crank arm 75 is connected with the arm 76 of bell crank 72 by means of a link 77 having a lost motion connection 78. With this arrangement, whenever locking arm 49 is permitted to move into engagement with roller 46 thereby locking disconnecting arm 5 in its fully open position, bell crank 72 is rotated about its pivot to move slidable plate 68 toward the left whereupon spring 66 moves pilot valve 60 to the closed position. Accordingly, main valve 55 closes to cut off the flow of fluid under pressure to the second fluid motor 38, thereby completing a breaker opening operation. For, during the opening movement of contact 5 the blast valve 28 will have been closed and the interrupting contacts 2 and 3 thereupon return to their normally biased-closed position.

With the above described arrangement it will be obvious that a very simple and compact control arrangement for fluid motor 38 is provided comprising an opening control valve 53 which is pneumatically opened and which, once opened, is positively held in the open position until the isolating switch of the circuit breaker has attained its fully open position. Then only is the means for holding the control valve in the open position rendered ineffective and the valve is permitted to close.

In view of the detailed description included above, the operation of the control arrangement of our invention will be obvious to those skilled in the art and no further description will be included herewith.

It will be apparent to those skilled in the art that our 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 our invention and we aim in the appended claims to cover all such changes and modifications.

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

1. In an electric circuit interrupter comprising a pair of relatively movable arcing contacts and a pair of relatively movable isolating switch contacts serially arranged with said arcing contacts, a first fluid motor for causing relative movement

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of said arcing contacts, a second fluid motor for causing relative movement of said isolating contacts, a source of fluid under pressure, means including a blast valve for interconnecting said source and said first fluid motor, means including a switch opening valve for interconnecting said source and said second fluid motor, means for opening said blast valve, means responsive to the opening of said blast valve for opening said opening valve, a latch for holding said opening valve in the open position, means for causing said latch to perform said latching function upon operation of said last mentioned means, and means operative when said isolating contacts reach their open position for releasing said latch with the resultant closing of said opening valve.

2. In an electric switch comprising a plurality of relatively movable contacts, a fluid motor for causing relative movement of said contacts, a source of fluid under pressure, means including a switch controlling valve for interconnecting said source and said fluid motor to cause relative movement of said contacts, said valve comprising a cylinder and a piston and having a passage connecting the portions of said cylinder on either side of said piston for equalizing the pressure on either side of said piston when said valve is closed, fluid operated means for releasing the pressure on one side of said piston to open said valve, a latch comprising a sliding plate for engaging a portion of said fluid operated means to hold said valve in the open position and arranged to perform its latching function upon operation of said fluid operated means, and a pin inserted in an opening in said plate and operative in accordance with the movement of said contacts for moving said sliding plate from its latching position with the resultant closing of said valve.

3. In an electric circuit interrupter comprising a pair of relatively movable arcing contacts and a pair of relatively movable isolating switch contacts serially arranged with said arcing contacts, a first fluid motor for causing relative movement of said arcing contacts, a second fluid motor for causing relative movement of said isolating contacts, a source of fluid under pressure, means including a blast valve for interconnecting said source and said first fluid motor, means including a switch opening valve for interconnecting said source and said second fluid motor, means for opening said blast valve, means responsive to the opening of said blast valve for opening said opening valve, a latch comprising a sliding plate for holding said opening valve in the open position, means for causing said latch to perform said latching function upon operation of said last mentioned means, and means operative when said isolating contacts reach their open position for releasing said latch with the resultant closing of said opening valve.

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The following references are of record in the file of this patent:

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