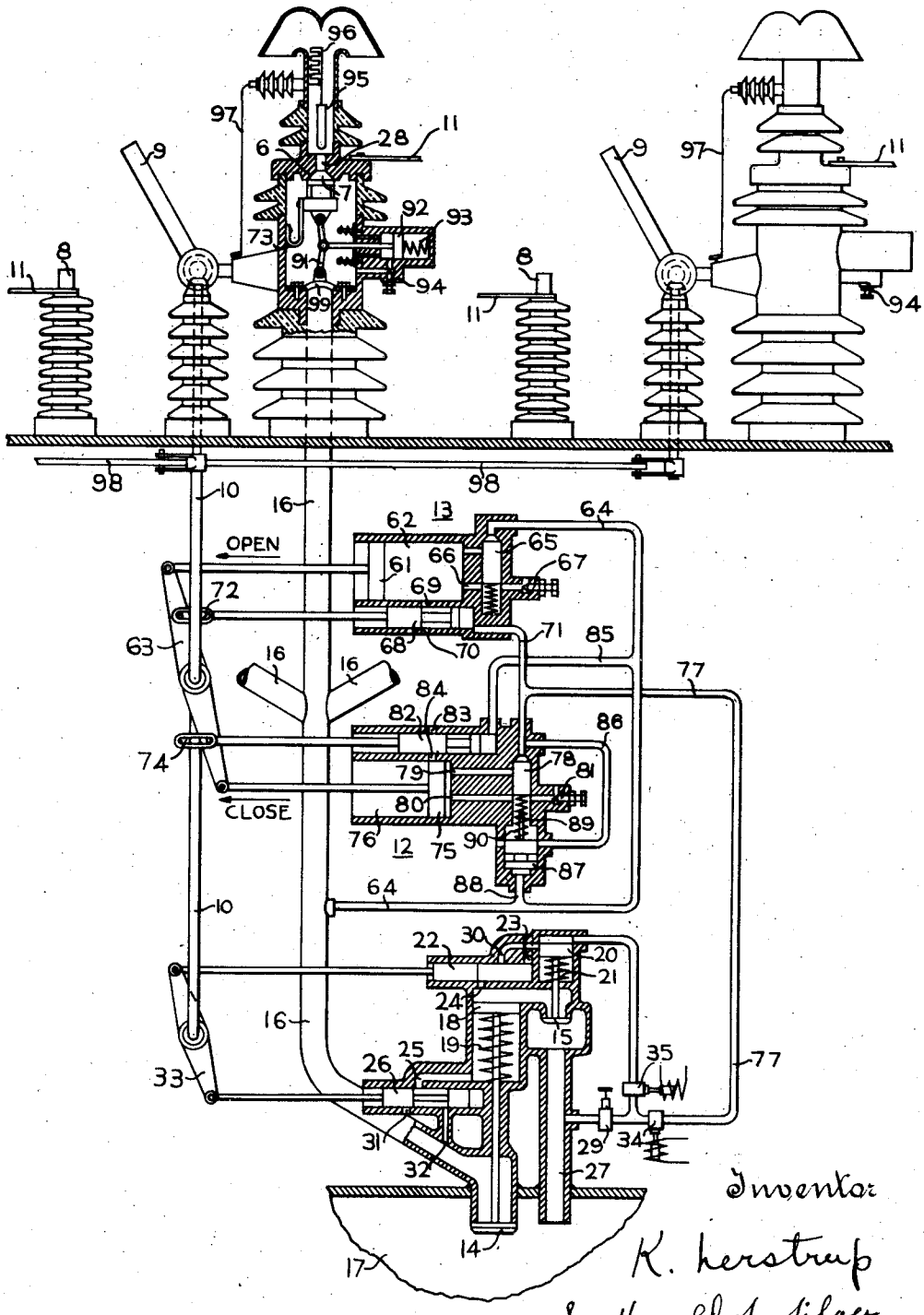
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FLUID OPERATED SWITCH CONTROL

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FLUID OPERATED SWITCH CONTROL

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1

This invention relates in general to circuit breakers and control therefor of the type in which fluid under pressure is utilized to operate the circuit breaker both to open and to closed positions of the circuit making and breaking contacts.

In prior art fluid pressure operated switches improper operation can occur because of fluid under pressure in the feed pipes connecting the contact operating motors with the source of fluid pressure. This may cause an operation or partial operation without the main control valve having been energized.

It is therefore an object of the present invention to provide a fluid pressure operated switch and control therefor that will avoid the above disadvantage.

It is also an object of this invention to provide a fluid pressure operated switch with an improved control preventing improper operation of the switch because of fluid pressure in the feed pipes.

It is also an object of this invention to provide a fluid pressure operated switch with an improved control whereby fluid pressure in the feed pipes to the switch operator is discharged when such operator is to be maintained operatively deenergized.

It is a further object of this invention to provide a fluid pressure operated switch with an improved mechanical interlock that will prevent fluid pressure being transmitted to the switch operator for closing the switch contacts and also will discharge the fluid pressure in the feed pipes to such closing operator, when fluid pressure is transmitted to the operator for opening the switch contacts.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the accompanying drawing, in which the single figure is a diagrammatic showing of a circuit breaker and control therefor embodying the present invention.

As shown in the drawing, the circuit breaker consists essentially of a fixed arcing contact 6 and a movable contact 7 connected in series with disconnect contacts 8 and 9 in a circuit indicated by conductors 11. The movable arcing contact 7 is actuated to open position by the breaking of a toggle formed by links 91, one end of which is anchored to the circuit breaker frame by a spider member 99. The toggle 91 is broken by movement of piston 92 to the right as viewed in the drawing. The piston 92 is biased by spring 93

2

to hold the arcing contacts 6, 7 in the closed position shown. The toggle 91 is electrically paralleled by shunt 73.

When the arcing contacts 6, 7 are separated, the arc drawn therebetween is blasted through the orifice 28 against auxiliary contacts 95, thereby connecting the resistance 96 in circuit with the arc. The effect of the resistance 96 and the deionization and cooling provided by the blast of air through the orifice 28, quickly extinguishes the arc and interrupts the circuit through conductors 11. After the arc is extinguished at the arcing contacts 6, 7, the disconnect contacts 8, 9 are opened thereby isolating the conductors 11. Opening of the disconnect contact 9 effects closure of the blast valve 14, thereby permitting the spring 93 to reclose the arcing contacts 6, 7. The circuit is closed by closing the disconnect contacts 8, 9.

Separate fluid operated motors 12 and 13 are provided for closing and opening actuation, respectively, and these motors are interlocked with each other and with the blast valve operation to provide for rapid operation, especially when the breaker is closed and immediately reopened or opened and immediately reclosed. In high voltage circuit breakers of the type used for outdoor installations, the disconnect contact 9 and its operating members are necessarily large and heavy and therefore have great inertia. These members are not only rapidly operated, but also provision is made for absorbing their kinetic energy and for preparing for an immediate reverse operation.

The circuit breaker is shown with all parts thereof and of the pneumatic control system in the open circuit position. A closing operation is initiated by energization of the closing solenoid valve 34, thereby permitting air under pressure from tank 17 and feed pipe 27 to be fed to pipe 77. Air under pressure in pipe 77 acts through pipe 71 on the slide valve 68 of the opening motors 13. A slot 72 in the operating link of slide valve 68 permits the slide valve 68 to be moved to the left, thereby opening port 69 in cylinder 62 to atmosphere through port 70. This permits discharging of any air under pressure in cylinder 62 of opening motor 13 tending to provide an opening impulse.

Pressure air in pipe 77 also opens check valve 78 against the bias of its spring 90 and feeds air under pressure to the cylinder 76 through the passage 79. Opening of check valve 78 closes the port 80 and the passage through the needle valve 81, so that the air pressure in cylinder 76

is available for movement of piston 75. This air pressure moves piston 75 to the left, rotating shaft 10 to close the movable disconnect contact 9. The impact of stopping the closing movement of contact 9 is cushioned by action of opening piston 61 in opening cylinder 62. As closing movement of the contact 9 takes place, a pin on the operating link 63 moves in the slot 72 of the slide valve 68 and further movement of shaft 10 and link 63 moves the slide valve 68 to the right as viewed in the drawing, thereby closing port 70. Further movement of the piston 61 is utilized to cushion the impact of stopping the closing mechanism by compressing the remaining air in cylinder 62 to a degree adjusted by the amount of air bled through the passage 66 past the needle valve 67.

Closing movement of the shaft 10 also moves link 33 to reset the operating mechanism of the blast valve 14 for an opening operation. Closing movement of the shaft 10 moves slide valve 22 to the right as viewed in the drawing, closing the ports 24 and 30. This closes the space above pistons 18 and 20 of the main and pilot valves 14 and 15 in readiness for an opening operation. Movement of link 33 also moves slide valve 26 to the left as viewed in the drawing closing the air passage 32 and opening the space underneath piston 18 to atmosphere through passage 25 and port 31. The valve operating mechanism is now ready for an opening operation. Slide valve 82 is moved by a pin in the operating link 63 acting in the slot 74 to open ports 83 and 84. This bleeds out air behind the closing piston 75 and prepares closing motor 12 for proper functioning during an opening operation. The breaker is now closed.

To open the breaker, solenoid valve 35 is energized placing pressure air from pipe 27 on top of piston 20 of the pilot valve 15. Opening of the pilot valve 15 places pressure air from pipe 27 on top of piston 18 of the main blast valve 14. The pipe 27, the opening controlled by valve 15 and the passageway from this valve to the piston 18 all have relatively large cross-sectional areas so that opening of the blast valve takes place immediately upon opening of the pilot valve 15. Opening of the blast valve 14 places pressure air in the manifold 16 and also in the chamber containing the arcing contacts 6, 7.

While the pressure is being built up in the contact chamber, substantially full contact pressure is maintained on the arcing contacts until separation actually begins, due to the action of spring 93 and toggle links 91. Pressure from the contact chamber acts through valve 94 upon piston 92 to break the toggle 91, thereby separating the arcing contacts. The needle valve 94 is adjusted to assure opening of the arcing contacts only after there is a predetermined air pressure in the contact chamber. The arc formed at the separating arcing contacts 6, 7 is then extinguished by the blast of air in the manner previously described.

The disconnect contact 9 is opened a predetermined time after opening of the arcing contacts. Air from the blast tube 16 flows through the feed pipes 64 and 88 and acts on piston 87, raising the same until the projection 89 is stopped against the check valve 78 holding the same closed. In this position of piston 87, the pipe 86 is opened to atmosphere. The diameter of piston 87 is greater than that of valve 78. Thus, the action of piston 87 not only prevents closing air from opening the check valve 78 and being applied to the piston 75, but also discharges any closing air pressure retained in the pipe 77 which might be available to initiate a closing operation even

though the valve 34 is not opened. This interlock is especially advantageous on a close-open operation, where opening takes place immediately after closure.

Air under pressure in feed pipe 64 is also fed through pipe 85 to the slide valve 82. This action maintains the ports 83 and 84 open until the pin or member 63 has moved to the end of the slot 74. The closing motor is thereby prevented from arresting the action of the opening motor during the first part of its opening stroke. Pressure air from the blast tube 16 is also fed through pipe 64 to check valve 65 of opening motor 13. Movement of check valve 65 closes the port 66 and permits pressure air to build up in cylinder 62, thereby moving piston 61 to the left and opening disconnect contact 9.

In order to conserve blast air and to rapidly prepare the operating system for immediate reclosing of the disconnect contacts, opening movement of the shaft 10 acting through link 33 moves the slide valve 22 to the left as viewed in the drawing, first opening port 30 to permit pressure air from above piston 20 to discharge to atmosphere through the port 23. This permits pilot valve 15 to be immediately closed by action of its biasing spring 21. Further movement of slide valve 22 to the left opens port 24 permitting air above the piston 18 of the main blast valve to be exhausted to atmosphere through port 23. To aid in rapidly resetting the blast valve 14, opening movement of the shaft 10 and link 33 moves slide valve 26 to the right closing the port 31 and opening the port 32 so that pressure air is applied through passageway 24 to the underside of the piston 18. This aids the spring 19 to rapidly close the blast valve 14, thereby conserving the air pressure in tank 17 and resetting the blast valve for an opening operation.

During the opening movement of the shaft 10, slide valve 82 is moved to the right when the pin on link 63 moves to the end of slot 74 and slide valve 82 therefore provides for the cushioning action of piston 75 in the same manner as described with regard to the action of piston 61 and the slide valve 68 during the closing operation. The cushioning action of piston 75 is regulated by the needle valve 81.

Only one pole of the circuit breaker has been referred to in describing the operation, however the blast tube 16 and the operating link 98 on shaft 10 may extend to the other poles of the breaker and operate the contacts thereof at the same time.

Solenoid valves 34 and 35 are placed close to the main stop valve 29 so that operation or partial operation can not occur when valve 29 is shut because of air stored in the pipes between valves 34 or 35 and valve 29.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. In combination, a pair of relatively movable switch contacts, a fluid pressure operated motor for opening said contacts, a fluid pressure operated motor for closing said contacts, a source of fluid under pressure, connecting passageways between said source and said motors, a valve in one of said passageways for controlling the flow of

fluid therethrough, and means for venting said one of said passageways between said source and said valve when the other of said passageways is supplying fluid under pressure to the other of said motors.

2. In combination, a pair of relatively movable switch contacts, a fluid pressure operated motor for opening said contacts, a fluid pressure operated motor for closing said contacts, a source of fluid under pressure, connecting passageways between said source and said motors, a valve in one of said passageways for controlling the flow of fluid therethrough, and fluid operated interlocking means for maintaining said valve closed and for venting said one of said passageways between said source and said valve when supplying fluid under pressure to the other of said motors.

3. In combination, a pair of relatively movable switch contacts, a fluid pressure operated motor for opening said contacts, a fluid pressure operated motor for closing said contacts, a source of fluid under pressure, connecting passageways between said source and said motors, a cylinder having one end connected to one of said passageways and the other end connected to the other of said passageways, a first piston in said one end of said cylinder comprising valve means controlling the flow of said fluid in said one of said passageways, and a second piston of a cross-sectional area greater than that of said first piston in said other end of said cylinder comprising valve means controlling the venting of said one of said passageways.

4. In combination, a pair of relatively movable switch contacts, a fluid pressure operated motor for opening said contacts, a fluid pressure operated motor for closing said contacts, a source of fluid under pressure, connecting passageways between said source and said motors, a first valve in one of said passageways for controlling the flow of fluid therethrough, a discharge vent in said last mentioned passageway between said first valve and said source, a second valve for controlling said discharge vent, and means interlocking said valves whereby said second valve maintains said first valve in closed position when said discharge vent is open.

5. In combination, a pair of relatively movable switch contacts, a fluid pressure operated motor for opening said contacts, a fluid pressure operated motor for closing said contacts, a source of fluid under pressure, connecting passageways between said source and said motors, a first valve in one of said passageways for controlling the flow of fluid therethrough, a discharge vent in said last mentioned passageway between said first valve and said source, a second valve for controlling said discharge vent, and a projecting member on said second valve positioned to hold said first valve closed when said discharge vent is open to atmosphere.

6. In combination, a pair of relatively movable switch contacts, a fluid pressure operated motor for opening said contacts, a fluid pressure operated motor for closing said contacts, a source of fluid under pressure, connecting passageways between said source and said motors, a pair of valves in said closing motor passageway, means providing for operation of said opening motor upon presence of fluid under pressure in said opening motor passageway independently of whether one of said valves in said closing motor passageway is in open or closed position, said means comprising venting means in said closing motor passageway between said valves for discharging fluid under pressure therefrom.

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