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CIRCUIT CONTROLLING SYSTEM

Arthur Uhde, Berlin-Reinickendorf, Germany,
 assignor to General Electric Company, a corporation of New York

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This invention relates to a circuit controlling system, more particularly to an arrangement for insuring a predetermined sequence of operation of a plurality of switches, such as a power circuit breaker and a disconnect switch connected in series therewith.

In circuit controlling systems of the character above referred to, the power circuit is interrupted by the power circuit breaker, the disconnect switch normally functioning as a current carrying part of the circuit and being opened only after the power breaker is opened for the purpose of isolating the breaker with respect to another part of the circuit. Various interlocking arrangements, both mechanical and electrical and either manually or remotely controlled, have heretofore been used for insuring this desired sequence of operation of the power breaker and disconnect switch.

In accordance with the present invention, the interlocking arrangement in a circuit controlling system of the above described character comprises a source of fluid pressure, which in the case of gas blast circuit breakers, for example, may constitute the main source for the gas blast, and fluid actuated means operatively related with respect to two or more switches, such as a power breaker and a disconnect switch.

This invention will be more fully set forth in the following description referring to the accompanying drawing, and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Referring to the drawing, Fig. 1 is a partly diagrammatic illustration of a circuit controlling system embodying the present invention; Fig. 2 is a diagrammatic illustration of the valve in one controlling position thereof, and Fig. 3 is a similar view showing another controlling position.

In the circuit controlling system illustrated, the main circuit or busbar B is connected to a branch or feeder circuit F through a disconnect switch 1 and a power circuit breaker generally indicated at 2. The power breaker may be of any suitable type for interrupting power currents. The disconnect switch may also be of any well known type for isolating a high tension circuit and is operated; that is, closed or opened, only when the power breaker in series therewith is open.

The interlocking arrangement for insuring such operation comprises a source of fluid pressure, generally indicated at 3, which may be either hydraulic or pneumatic, as desired. The source of pressure is operatively connected to an operating cylinder 4 of the disconnect switch through selec-

tively actuated valves 5 and a main valve 6, which is generally indicated as operatively connected to the power breaker 2.

The valves 5 which control transmission of fluid pressure to opposite sides of the piston 4' for causing either opening or closing of the disconnect switch may be directly manually operated, as indicated at 7, or may be remotely controlled by means of push buttons 8 arranged selectively to energize the valve operating solenoids 8'. If desired, the fluid conduit 5' leading to the valves 5 may be directly connected to the main valve 6, such as by a connection indicated in dotted lines at X. With this arrangement the valve 6, which is open when the power breaker 2 is open and vice versa, prevents transmission of fluid pressure to the cylinder 4 for operating the disconnect switch when the power breaker is closed.

Positions of the main valve 6 are diagrammatically illustrated by Figs. 2 and 3, Fig. 2 illustrating the open or fluid pressure transmitting position of the valve and Fig. 3 the closed position thereof wherein the passages leading to the disconnect switch communicate with an exhaust passage, to atmosphere in the case of a pneumatic system.

For the purpose of positively blocking the operation of the disconnect switch 1, regardless of whether the disconnect switch is actuated by fluid pressure or by manual means, when the power breaker is closed, fluid actuated means comprising a cylinder 9 having a piston 9' is connected to the source of fluid pressure through the main valve 6. The piston 9' is normally biased by a spring 9'' towards the operating rod 1' of the disconnect switch, so that in the absence of fluid pressure in the cylinder the piston rod 10 blocks movement of the disconnect switch. As diagrammatically illustrated, spaced lugs 11 on the disconnect switch operating rod coact with the piston rod 10 so that when the disconnect switch is in either the open or closed position, and in the absence of fluid pressure in the cylinder 9, movement of the rod 1' is blocked.

Opposite the piston spring 9'' the cylinder 9 is arranged to be in communication through conduit 12 with the source of pressure through the valve 6. This part of the cylinder is likewise preferably in communication with the conduit 5' leading to the disconnect switch operating cylinder. Accordingly, when the power breaker 2 is opened, causing opening of the valve 6, the fluid pressure transmitted to the lower side of the piston 9' raises the piston against the bias of its spring so that the rod 10 is in a nonblocking position. In this position, the piston 9' likewise un-

covers the opening to the conduit 5' so that fluid pressure is transmitted directly to the valves 5, thereby allowing operation of the disconnect switch as desired. It will likewise be noted that when the power breaker 2 is closed, the valve 6 accordingly being closed, the piston 9' not only blocks the operation of the disconnect switch but closes the opening to the conduit 5' leading to the disconnect operating cylinder 4. In this case, the conduit 12 communicates with atmosphere through the valve 6 and exhaust 14 as illustrated by Fig. 3.

If desired, the disconnect switch 1 may be provided with manual operating means indicated at 13 independently of the fluid pressure operating means. In this case operation of the disconnect switch is also positively blocked by the piston rod 10 when the power breaker 2 is open.

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. In a circuit controlling system including a power circuit breaker and a disconnect switch in series therewith, interlocking means for insuring a predetermined sequence of operation of said breaker and switch comprising a source of fluid pressure, fluid actuated means for controlling the operation of said disconnect switch, and means actuated by and in accordance with the operation of said power breaker for controlling transmission of fluid pressure between said source and said fluid actuated means.

2. In a circuit controlling system including a power circuit breaker and a disconnect switch in series therewith, interlocking means for insuring a predetermined sequence of operation of said breaker and switch comprising a source of fluid pressure, fluid actuated means for blocking the operation of said disconnect switch, and a valve actuated by and in accordance with the operation of said power breaker for controlling transmission of fluid pressure between said source and said blocking means.

3. In a circuit controlling system including a plurality of switches, interlocking means for insuring predetermined sequence of operation of said switches comprising a source of fluid pressure, fluid actuated means for controlling the

operation of one of said switches, and a valve actuated by and in accordance with the operation of another of said switches for controlling transmission of pressure from said source to said fluid actuated means.

4. In a circuit controlling system including a power circuit breaker and a disconnect switch in series therewith, interlocking means for preventing opening of said disconnect switch until after opening of said power breaker comprising a source of fluid pressure, a piston arranged to be biased towards a blocking position with respect to said disconnect switch, and a valve operatively connected to said power breaker for controlling transmission of fluid pressure from said source to said piston.

5. In a circuit controlling system including a power circuit breaker and a disconnect switch in series therewith, interlocking means between said breaker and switch comprising a source of fluid pressure, a piston normally biased towards a position blocking operation of said disconnect switch in the absence of fluid pressure, and a valve operatively connected to said power breaker and arranged to transmit fluid pressure from said source to said piston for moving said piston to a nonblocking position when said power breaker is open.

6. In a circuit controlling system including a power circuit breaker and a disconnect switch in series therewith, fluid pressure means for operating said disconnect switch comprising a source of pressure, a piston operatively connected to said disconnect switch and selectively operated valves for controlling transmission of fluid pressure from said source to said piston for causing opening and closing of said disconnect switch, interlocking means between said disconnect switch and power breaker comprising a second piston normally biased in the absence of fluid pressure to a position blocking operation of said disconnect switch and a valve operatively connected to said power breaker for directing fluid pressure from said source to said blocking piston for moving said piston to a nonblocking position in accordance with opening of said power breaker, and means forming a fluid passage between said piston and selectively operated valves, said passage being closed by said piston in the blocking position thereof and being in communication with said source in the nonblocking position of said piston.

ARTHUR UHDE.