Feb. 4, 1941. H. VERSE 2,230,735

PNEUMATIC RECLOSING MECHANISM FOR CIRCUIT BREAKERS

Filed Nov. 7, 1938 2 Sheets-Sheet 1

Fig. 1.

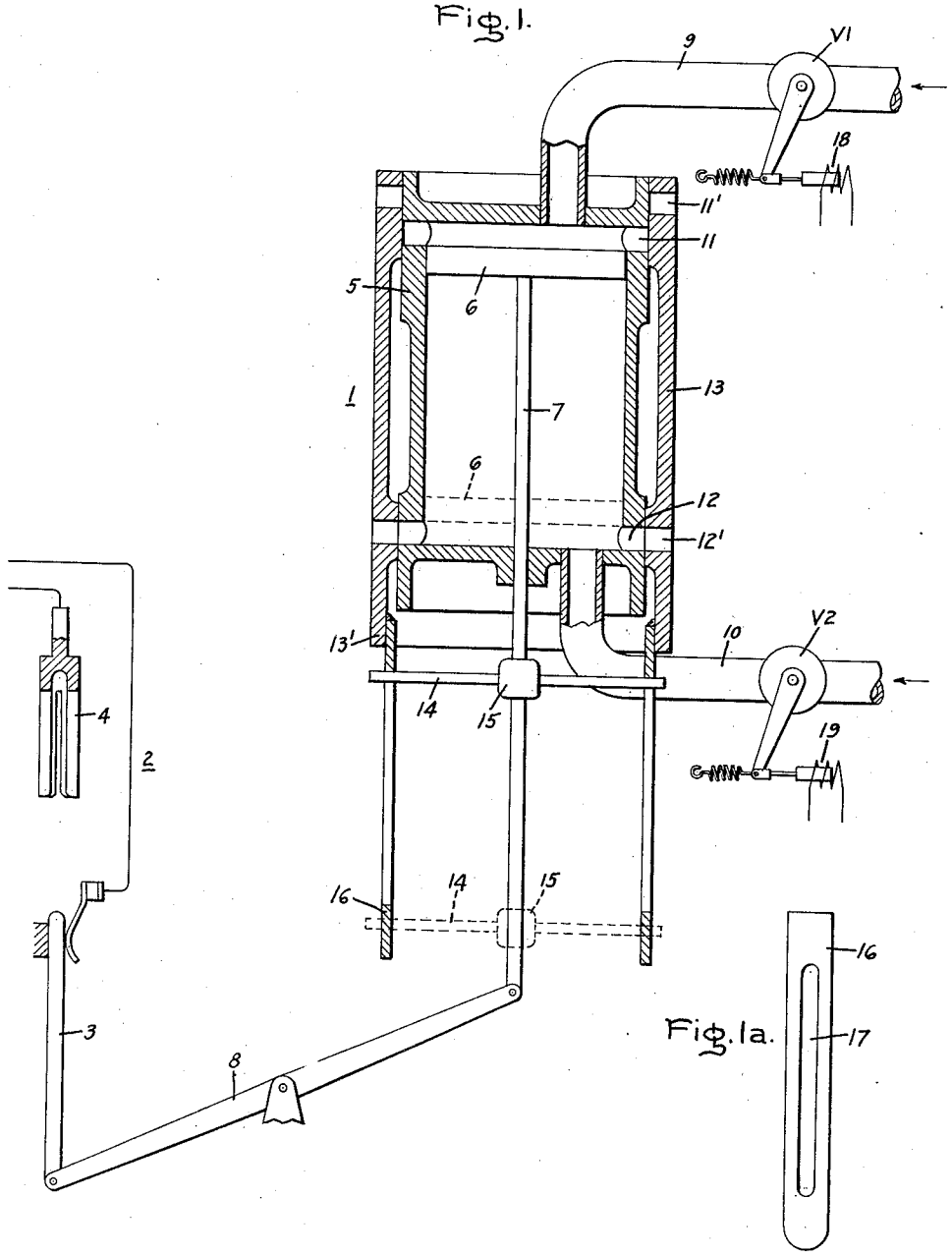


Fig. 1a.

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Fig. 2.

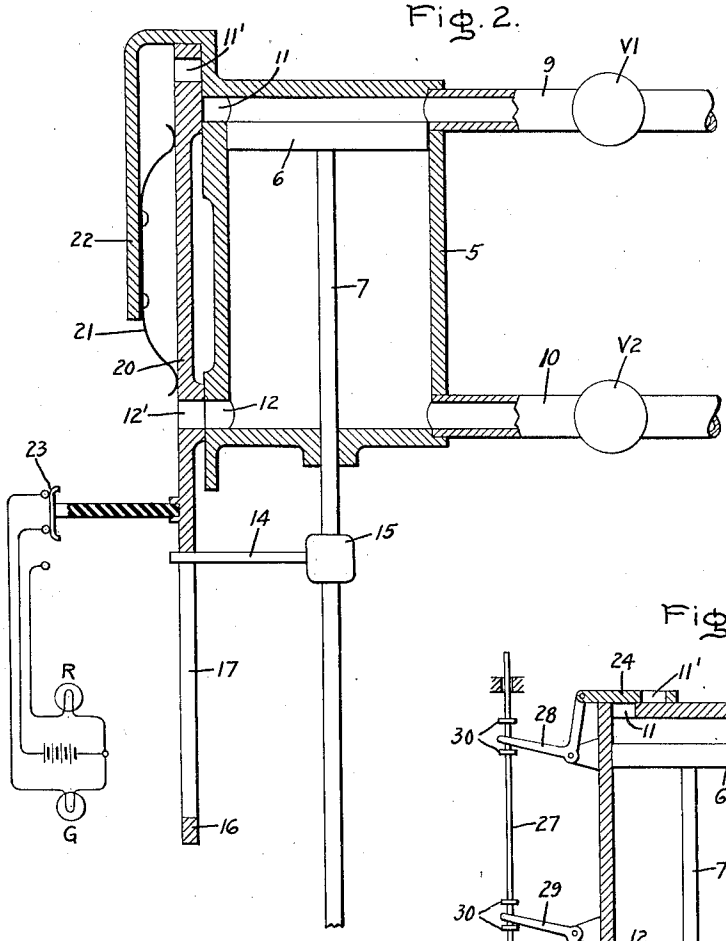
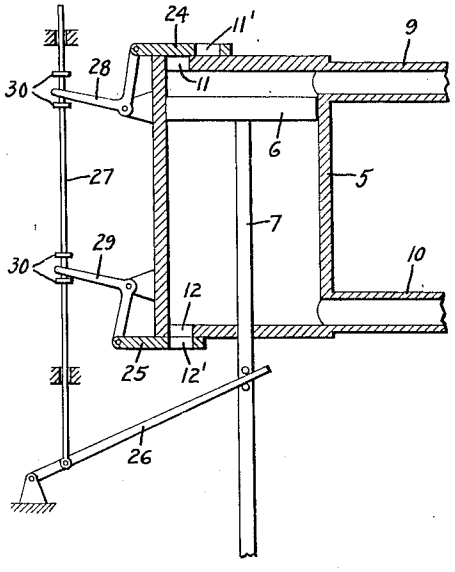


Fig. 3.



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PNEUMATIC RECLOSING MECHANISM FOR CIRCUIT BREAKERS

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Application November 7, 1938, Serial No. 239,353
In Germany December 23, 1937

3 Claims. (Cl. 200—82)

My invention relates to high speed reclosing mechanisms for circuit breakers, and more particularly to those of the pneumatic type having application, for example, to gas blast circuit breakers.

Electric circuit breakers are often required which permit of very rapid reversal of the switch movement, as, for example, where it is desired immediately to reclose the circuit breaker after the interruption of a short circuit. In circuit breakers of this character, it is, therefore, highly desirable that the factors tending to retard the speed of the reclosing movement, such as back pressure, mass of the reciprocating parts, etc., be eliminated or reduced in so far as is possible.

In the case of gas blast circuit breakers wherein pneumatic operating means is often employed because of the available pressure source, the reclosing mechanisms heretofore available are inherently slow as to reclosing. As commonly used, a single three-way cock or valve is in communication through fluid conduits with opposite ends of the piston cylinder for both applying pressure to the piston and venting the cylinder. This arrangement necessarily involves a considerable amount of resistance or back pressure when the residual gas in the piston cylinder is being discharged during the reversal or reclosing movement. Furthermore the back pressure in this design can be reduced only to a limited extent, since the pressure connections between the cylinder and valve are necessarily of appreciable length and the valve passages are, of course, restricted in cross section due to practical considerations in the valve design.

In accordance with my invention, rapid reversal of the switching movement is obtained by means of one or more valves, such for example as slide valves, that are operatively related to the switch operating pneumatic motor, such as a cylinder and piston, so as directly to control the exhaust ports. The valve controlled ports can be of comparatively large cross section and can exhaust directly to atmosphere so that no appreciable back pressure can exist. With this arrangement the residual gas in the piston cylinder can be displaced rapidly with negligible retarding effect during the switch reversing movement.

My invention will be more fully set forth in the following description referring to the accompanying drawings, 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 drawings, Fig. 1 is an elevational view, partly in section and partly diagrammatically shown, of a pneumatic reclosing mechanism embodying the present invention; Fig. 1*a* is a detail view of structure shown in Fig. 1; Fig. 2 is a view similar to Fig. 1 showing another form my invention may assume, and Fig. 3 is an elevational sectional view of a further modification of my invention.

The mechanism shown by Fig. 1 comprises essentially a pneumatic operating device or motor 1, an electric circuit breaker 2 actuated thereby, and fluid pressure controlling valves V1 and V2 for applying fluid pressure to the motor. The circuit breaker per se which may be of any suitable type, such as gas blast, oil, etc., forms no part of the present invention aside from its cooperation with and relationship to the motor 1 and is shown in simplest form wherein a reciprocally guided rod contact 3 coacts with a fixed socket contact 4.

Referring more particularly to the pneumatic device 1, a fixed cylinder 5 is provided with a piston 6 that is directly connected through the piston rod 7 and a pivoted lever 8 to the circuit breaker, so as to cause circuit opening and closing movement of the breaker in response to reciprocal movement of the piston. The cylinder 5 is adapted to be in communication with a source of pressure at its opposite ends through the valve controlled conduits 9 and 10.

The cylinder 5 is provided at its opposite ends with exhaust ports 11 and 12, respectively, for venting the gas at the low pressure side of the piston during a working stroke. For the purpose of controlling these exhaust ports in accordance with the position and operation of the piston 6, valve means coact directly with the cylinder exhausts and the piston for opening the exhaust ports at the end of the cylinder opposite the piston substantially at the completion of a circuit controlling stroke. Accordingly, the motor is in immediate readiness for a quick return stroke of the piston.

As shown in a specific form by Fig. 1, the valve means comprises a slide valve 13 of the sleeve type concentrically mounted on the fixed cylinder for reciprocal movement thereon. The valve 13 is also provided with exhaust passages 11' and 12' for coacting respectively with the cylinder exhaust ports 11 and 12. These exhaust ports and corresponding valve passages can, if desired, be spaced circumferentially at opposite

ends of the cylinder so that the total or effective exhaust passage area is quite large. Accordingly, in view of the fact that the exhaust path to atmosphere through the valve passages is of negligible length, there is eliminated the possibility of appreciable back pressure at the low pressure side of the piston.

For the purpose of relating the valve 13 to the piston and circuit breaker in the manner above described, a lost motion connection, such as a pin and slot arrangement between the valve and the piston rod 7, can readily be employed. A pin or bar 14 fixed at 15 to the piston rod is operable within slots in a pair of depending valve extension members 16. Fig. 1a is a detail view of one of the extension members which are suitably secured to the overhanging flange 13' of the valve. The pin 14 during the greater part of a working stroke is free to slide in the slots 17 until a predetermined point indicated by the dotted line positions of the piston and pin is reached. The pin then engages the members 16 at the lower part of the slots to move the valve 13 so as to uncover one set of ports and close the other set. The reverse operation takes place on the return stroke.

Referring more particularly to the operation, and assuming that the device is in the open circuit position shown in Fig. 1, the circuit breaker closing operation is initiated by opening the closing valve V1 in any suitable manner, as by a remote controlled operating solenoid 18. Gas under pressure is then admitted to the upper closed end of the cylinder 5 and the piston 6 is moved to the lower dotted line position to close the circuit breaker 2. Substantially at the completion of the circuit closing stroke, the lost motion connection above described causes downward movement of the sleeve valve 13 so as to close the exhaust ports 12 and open the ports 11. The device is accordingly in readiness for a high speed reclosing stroke which can be initiated by opening the valve V2, as by an operating solenoid 19.

It should be understood that the control means for the valves V1 and V2 can be suitably interlocked by methods well known in the art, such control means per se forming no specific part of the present invention. In practice the valve V1 would be open for a brief interval so as to be closed when the piston 6 reaches the lower position indicated. Even in the event that the valve V1 is somewhat late in closing, the large exhaust area at the ports 11 would prevent the building up of appreciable back pressure within the cylinder.

It will be noted that when the reclosing operation is initiated by the valve V2, the reciprocating mass to be accelerated does not include the valve 13, and in fact only the essential elements comprising the piston and movable contact structure need be accelerated throughout substantially the entire reclosing stroke. The operation of the valve at the end of the stroke does not retard the reclosing stroke by reason of the high speed of the moving parts at this point. Therefore, the pneumatic reclosing device embodying my invention has inherently high speed reclosing characteristics since the mass of the reciprocating parts is reduced to the essential elements and the back pressure at the low pressure side of the piston is practically eliminated.

The arrangement shown in Fig. 2 is essentially the same except that a flat slide valve 20 instead of a sleeve valve is used for controlling the exhaust ports 11 and 12 of the cylinder 5. The slide valve 20 is guided and resiliently biased into seating engagement with the cylinder 5 by means of a spring 21 secured to an overhanging flange 22 of the fixed cylinder structure. The pin and slot connection at 14 and 16 is substantially the same as that previously described, as is the arrangement of the operating valve V1 and V2.

For the purpose of indicating the valve and circuit breaker positions, a simple signal switch 23 can be connected to the valve member 16 so as to operate signal means, such as lamps indicated at R and G.

Fig. 3 illustrates another form wherein the piston 5 is provided with individual slide valves 24 and 25 operated through the piston rod 7. The piston rod 7 is connected through a lever 26 and link 27 to individual cranks 28 and 29 for operating the slide valves 24 and 25, respectively, generally in the manner above described. The link 27, which is suitably guided for vertical movement, is provided with spaced stops 30 for operating the cranks 28 and 29 in the manner desired. As in the previous cases, the valves 24 and 25 function to open the cylinder at the low pressure end immediately prior to the reclosing stroke and vice versa.

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. Pneumatic reclosing mechanism for an electric circuit breaker comprising an operating cylinder having a reciprocally operable piston for actuating said circuit breaker, said cylinder having exhaust ports in the walls at the opposite ends thereof, at least one of said exhaust ports having a large cross sectional area for permitting high speed reversal of said piston and corresponding reclosing movement of said circuit breaker, means for applying fluid pressure at the opposite sides of said piston, valve means coacting directly with said cylinder for controlling said exhaust ports so that reversal of said piston is not appreciably retarded by back pressure in said cylinder, and a lost motion connection between said piston and said valve means for opening an exhaust port at one end of said cylinder substantially at completion of a circuit controlling piston stroke toward the opposite end of said cylinder, said means also causing closing of the exhaust port at the piston end of said cylinder.

2. Pneumatic reclosing mechanism for an electric circuit breaker comprising an operating cylinder having a reciprocally operable piston for actuating said circuit breaker, said cylinder having exhaust ports at opposite ends thereof, means for applying fluid pressure at the opposite sides of said piston, a slide valve coacting directly with said cylinder for directly controlling said exhaust ports so that reversal of said piston is not appreciably retarded by back pressure in said cylinder, said slide valve being arranged to close the exhaust at one end of said cylinder while venting the opposite end, and a lost motion operative connection between said piston and slide valve for controlling said exhaust ports in accordance with circuit controlling operations.

3. Pneumatic reclosing mechanism for an electric circuit breaker comprising an operating cylinder having a reciprocally operable piston for actuating said circuit breaker between open and closed circuit positions, said cylinder having ex-

haust ports laterally disposed at opposite ends thereof and arranged directly to vent to atmosphere, means for applying fluid pressure at opposite ends of said cylinder to said piston, a sleeve valve concentrically mounted on said cylinder for directly controlling said exhaust ports so that reversal of said piston is not appreciably retarded by back pressure in said cylinder, and means operatively relating said sleeve valve to said piston for actuating said valve substantially at the completion of a circuit controlling stroke for opening the exhaust at one end of said cylinder and closing the exhaust at the opposite end.

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