PUBLISHED
MAY 18, 1943.
BY A. P. C.

H. STEGELITZ ET AL
CIRCUIT BREAKER FLUID PRESSURE OPERATED SYSTEM
Filed Oct. 16, 1941

Serial No.
415,288

2 Sheets-Sheet 1

Fig. 1.

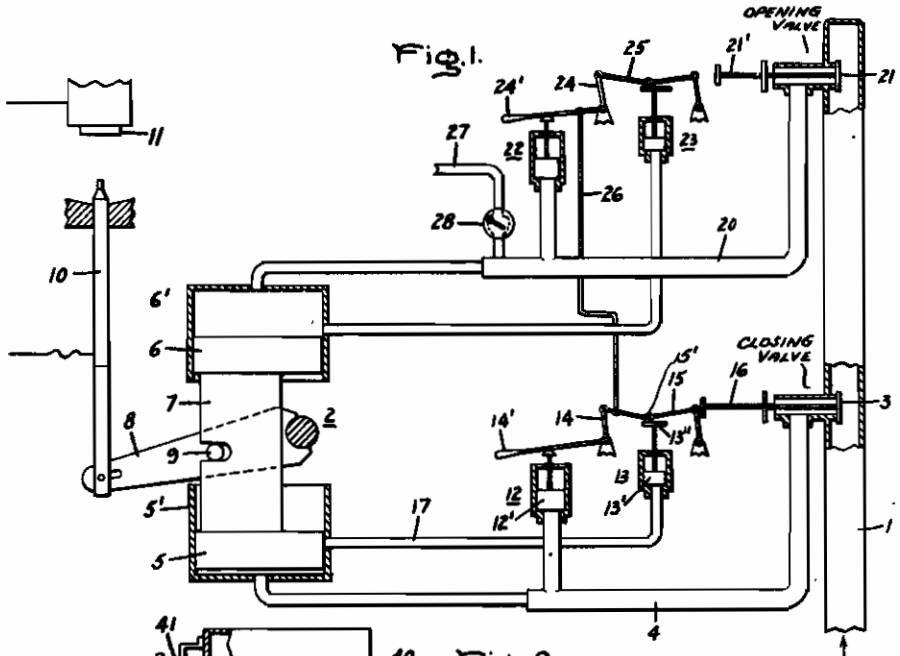
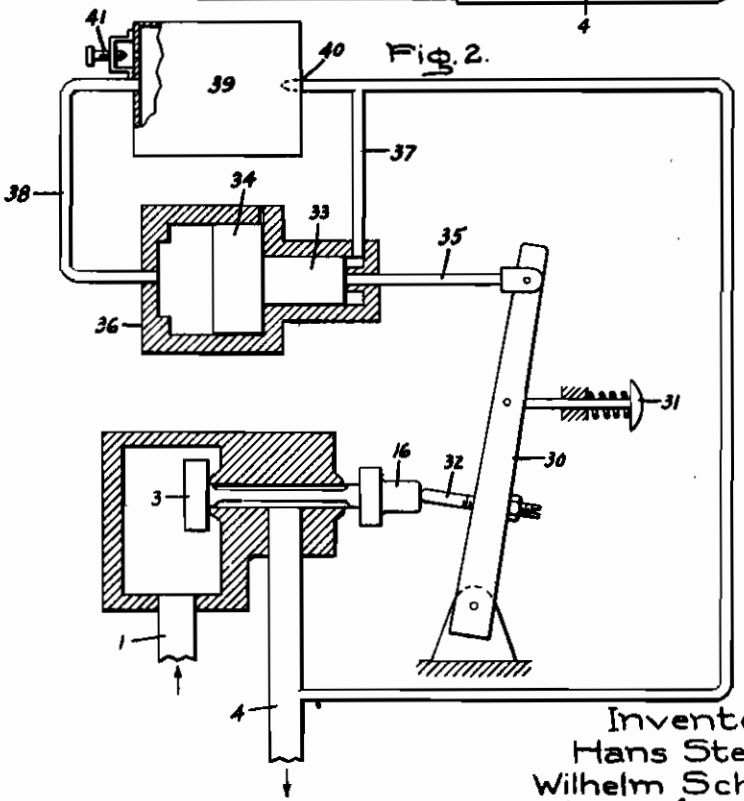


Fig. 2.



Inventors:
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Wilhelm Schreiner;
by Harry E. Dunham
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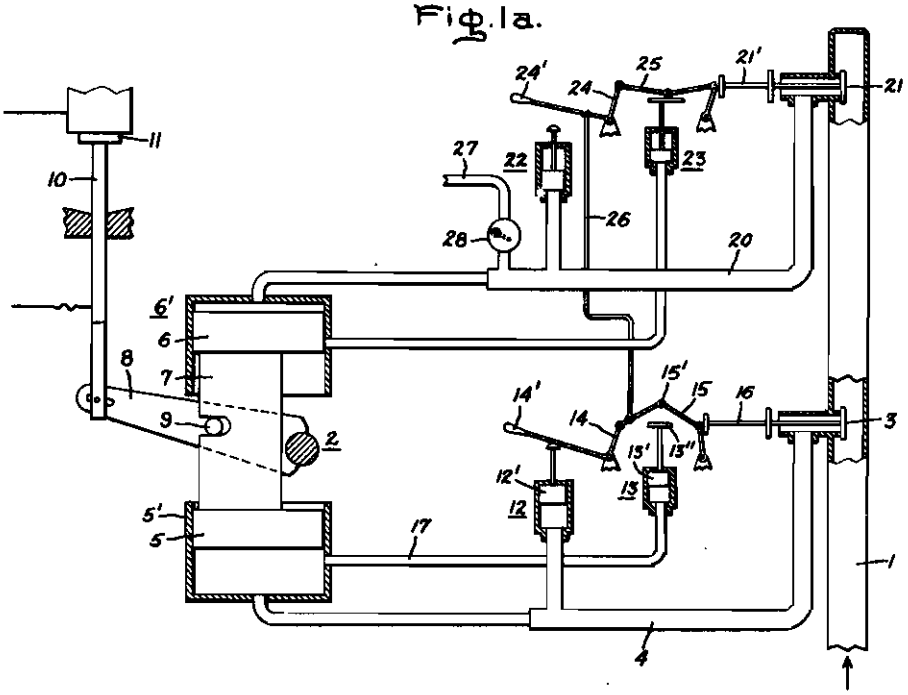
Fig. 1a.



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ALIEN PROPERTY CUSTODIAN

CIRCUIT BREAKER FLUID PRESSURE OPERATED SYSTEM

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Application filed October 16, 1941

Our invention relates to circuit breaker fluid pressure operated mechanisms, such as, for example, pneumatically actuated mechanisms for operating the contacts of an electric circuit breaker between open and closed circuit positions.

It has been recognized that the operating mechanism for closing a large capacity electric circuit breaker, for example, should include a so-called "seal" for automatically insuring continuation of the operating impulse throughout substantially the entire closing stroke of the breaker, and for discontinuing the impulse substantially at that point. Burning of the breaker contacts due to incomplete closure is therefore precluded and the usual trip-free feature assures short circuit protection. Methods heretofore used have generally included electric relays and auxiliary circuits which have not always worked satisfactorily and which often complicate the operating mechanism.

The principal object of our invention is the provision of an improved fluid-operated mechanism of the piston type for electric circuit breakers wherein the opening and closing control valves for admitting fluid pressure to the actuating piston are provided with interlocking means for rendering inoperative means for opening the closing valve when the opening valve is operated and for providing trip-free operation of said circuit breaker.

Our invention will be more fully set forth in the following description referring to the accompanying drawing, 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.

This application is a continuation of our application Serial No. 192,804, filed Feburary 26, 1938 for "Fluid Pressure Operated Mechanism."

Referring to the drawing Fig. 1 is a partly diagrammatic layout of a pneumatically operated mechanism for actuating an electric circuit breaker in accordance with the present invention, Fig. 1*a* is a similar view illustrating the mechanism at the end of the closing stroke and Fig. 2 is a similar view illustrating a modification of the pneumatic seal for carrying through the actuating impulse.

The pneumatic system illustrated by Fig. 1 comprises a suitable source of fluid pressure, such as a conduit 1 connected to a gas reservoir (not shown), circuit breaker means adapted to be actuated by fluid pressure, such as a double-acting piston generally indicated at 2, and a main valve 3 for controlling the fluid connection 4 between the source and the actuating piston structure.

As shown the piston structure 2 comprises a pair of pistons 5 and 6 rigidly interconnected at 7 for reciprocal operation within the cylinder portions 5' and 6' respectively. The piston structure is operatively connected in any suitable manner such as by a link 8 and pin 9 to the movable contact structure 10 of an electric circuit breaker. The circuit breaker may be of any suitable type and in the present case wherein a source of gas pressure is available, the gas blast type may advantageously be used. As shown, the circuit breaker is in the open position, the contact 10 being elevated during the closing operation to engage the fixed contact structure at 11. In the arrangement so far described it will be apparent that opening of the main valve 3 admits fluid pressure by way of the connection 4 to the lower piston 5 so as to close the breaker.

For the purpose of "sealing" this operating impulse an auxiliary pressure responsive device 12 is disposed in communication with the fluid connection 4 and is operatively related to the valve 3 through a suitable mechanical connection for holding the valve open. Likewise, a second auxiliary pressure responsive device 13 adapted to be placed in communication with the connection 4 after predetermined movement of the piston 5 is located with respect to the aforesaid mechanical connection so as to render the same inoperative and permit closing of the valve 3 when the circuit breaker has substantially completed its closing stroke.

To this end the pressure responsive device 12 comprises a piston 12' directly in communication with the fluid pressure connection 4 and operatively connected through a bell-crank 14 and toggle linkage 15 to the main valve stem 16. The pressure responsive device 13 likewise includes a piston 13' having an extension 13'' for engaging the knee 15' of the toggle and serving as a support for holding the same in thrust-transmitting position.

It will therefore be apparent that when the valve 3 is initially opened in response to any suitable operation or impulse, such as by manual operation at 14', or by suitable and well-known remote control means, the fluid pressure in connection 4 operates simultaneously the pistons 5 and 12'. As the piston 5 moves upward to close the breaker the piston 12' through toggle linkage 15 forces the valve stem 16 toward the open position and holds it in that position as long as the piston 12'

is under fluid pressure and the toggle 15 is in the thrust-transmitting position. When, however, the closing stroke is substantially completed as shown by Fig. 1*a* the piston 5 uncovers the port in the cylinder 5' communicating with the conduit 17 for admitting pressure to the piston 13'. This causes upward or buckling movement of the toggle knee 15 and subsequent collapse of the toggle thereby rendering the pressure responsive device 12 inoperative with respect to the main valve 3 and permitting closing of the valve under influence of the conduit pressure or other suitable biasing means.

The pneumatic operating means above described therefore is effective to seal a pneumatic actuating impulse, once initiated, through a predetermined operation, and automatically to discontinue the impulse upon completion of the operation.

The means for opening the breaker, although shown as pneumatically operated, can obviously be selected in accordance with the particular breaker requirements. For example, the breaker can be opened by the usual compression spring that is unlatched in response to a tripping impulse. In the pneumatically operated means shown the upper or opening piston 6 is also adapted to be in communication with the pressure source 1 through a fluid connection 20 controlled by a valve 21. In this case opening of the valve 21 causes downward movement of the piston structure and opening of the breaker.

For the purpose of carrying through the actuating impulse in the manner above described, the valve 21 has also associated therewith fluid pressure responsive devices 22 and 23 similar to the devices 12 and 13 respectively. The operating piston of the device 22 is in communication with the fluid connection 20 and the piston of the device 23 is in communication with the cylinder 6' for receiving a delayed pressure impulse in the manner above described. The device 22 coacts with the bell-crank 24 which is in turn adapted to be operatively connected to the valve stem 21 through a thrust transmitting toggle 25. The toggle 25 in the reset position shown is spaced from the valve stem 21' for a reason presently described.

For the purpose of interlocking the closing and opening operations so that the breaker cannot be inadvertently closed after the opening operation has been initiated there is provided a mechanical connection 26 between the bell-crank lever 24 and the toggle 15. Accordingly, when the bell-crank lever 24 is rotated clockwise in response to an initial impulse and admission of fluid pressure to the opening piston 6, the knee 15' of the toggle 15 is raised to the collapsed position so that an actuating impulse cannot be transmitted to the valve 3. When, however, the breaker is opened and the mechanism in the position shown, buckling of the toggle 15 at the end of the closing stroke is not sufficient to cause opening of the valve 21 by reason of the lost motion between the toggle 25 and the valve stem 21'.

The opening operation may be initiated, either manually as at 24' or by suitable remote control means such as an auxiliary pressure line 27 having a one-way valve 28 relating to the fluid connection 20. It will be apparent that when the remote control means is operated to admit gas under pressure to the line 27, the device 22 will be operated to open the valve 21 in the manner previously described. At the same time, the rod 26 will be lifted, causing collapse of the toggle 15 and closing of the valve 3. Thus, even though the piston 5 may not have reached the end of its closing stroke, actuation of the remote control means can be effective to cause premature reversal of the piston from an intermediate point in the closing stroke.

It will be noted that a fluid-operated mechanism as described permits trip-free operation of the breaker during closing by reason of the collapsible connection to the closing valve 3, and also prevents "pumping" or repeated reclosures of the breaker in addition to the interlocking feature above described. By trip-free operation is meant instantaneous release of the actuated means permiting it to return to its original position notwithstanding the fact that the closing operation is incomplete. This is accomplished by collapsing the toggle 15 thereby permitting valve 3 to close. The compressed gas acting on piston 5 is thus cut off and the piston cylinder simultaneously vented to atmosphere through pipe 4 as shown by Fig. 1*a*.

In the modification shown by Fig. 2 a time-delay device is used in lieu of the piston controlled connection for automatically effecting closure of the main valve. In this case the valve 3 controlling communication between the source 1 and fluid connection 4 is adapted to be actuated by a lever 30 having suitable actuating means, such as, for example a push button shown at 31. The lever 30 can be adjustably related to the valve stem 16 as at 32.

For the purpose of sealing the valve 3 after operation of the push button, a differential piston having two portions 33 and 34 is connected as at 35 to the lever 30. The differential piston operates within a housing 36, one end of which forms a cylinder for the piston portion 33 connected at 37 with the main fluid connection 4. The other part of the housing forms a cylinder for the large piston 34, that is adapted to be in communication at 38 with the connection 4 through a time-delay device 39. The device 39 may comprise simply a fluid reservoir, the entrance of which at 40 can be suitably restricted in combination with an adjustable escape at 41, so that fluid pressure builds up in the cylinder of piston 34 only after a predetermined time.

The operation of this device is believed to be apparent from the above description, the first opening of the valve 3 transmitting pressure to the first fluid responsive device at 33 for sealing open the valve 3, and the large portion 34 of the differential piston, or the second fluid responsive device, serving after a predetermined time to return the lever to its initial position thereby permitting closing of the valve 3 under bias of the spring at 31.

It should be understood that our 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 our invention.

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WILHELM SCHREINER.