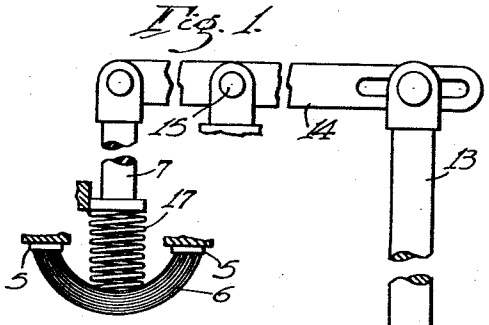
Jan. 13, 1948. J. M. CUMMING 2,434,549

FLUID PRESSURE OPERATED CIRCUIT BREAKER

Filed April 21, 1945

Fig. 1.



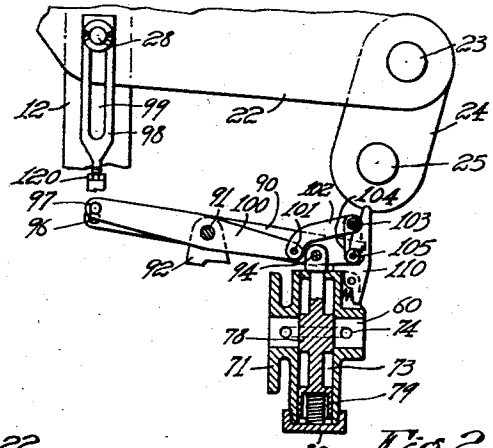


Fig. 2.

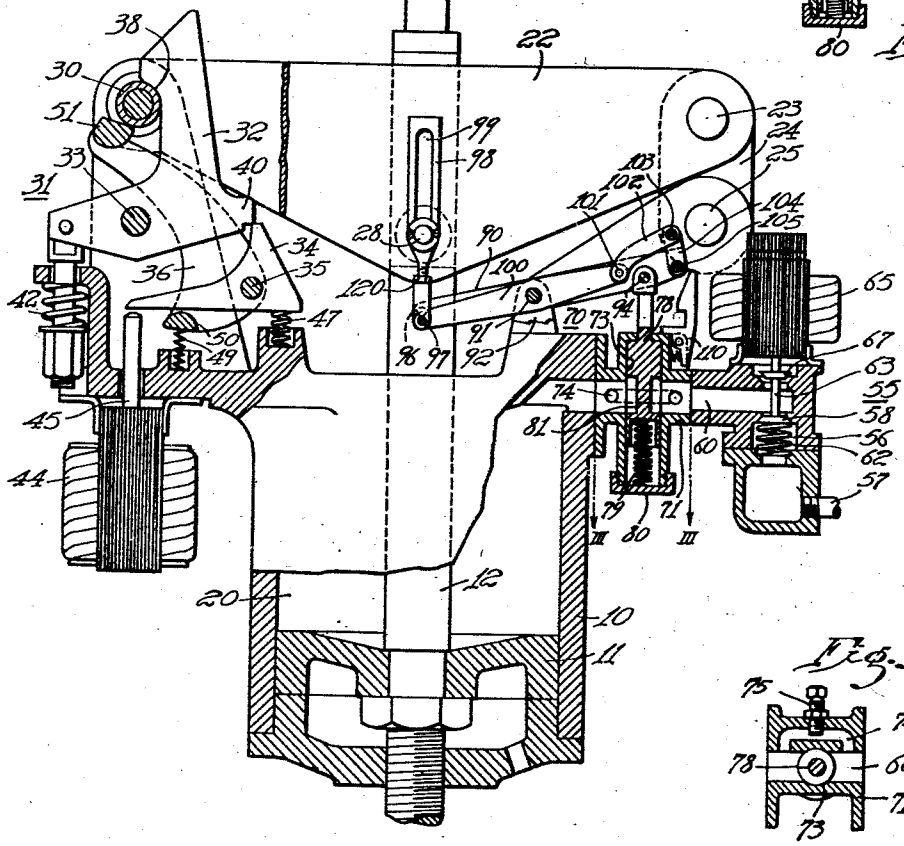
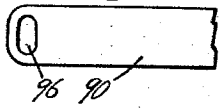


Fig. 3.

Fig. 4.



WITNESSES:

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FLUID PRESSURE OPERATED CIRCUIT BREAKER

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10 Claims. (Cl. 200—82)

1

This invention relates to fluid pressure operative circuit breakers and, more particular, to control valve means for controlling the operation of such a circuit breaker.

Fluid pressure operative circuit breaker equipments designed for use in controlling high tension power circuits generally involve heavy movable parts which must be adapted for rapid operation. Compressed air at a pressure of approximately 150 to 350 pounds per square inch is frequently employed as the power medium for actuating circuit breakers of this type. Such a circuit breaker mechanism must be, for certain classes of 60-cycle service, capable of effecting an open-close-open operation within a time interval of 17 cycles. Because of the power and speed of operation required for such a circuit breaker, it is desirable to provide a mechanism having maximum simplicity and ruggedness of design.

In a circuit breaker of the class embodying a spring for opening the contact elements and a piston subject to compressed air for closing the contact elements, in order to prevent excessive shock to the circuit breaker mechanism during operation of the actuating piston, it has been proposed to provide control valve means functioning to restrict or reduce the rate of the supply of compressed air to the piston cylinder during initial movement of the piston. This control valve means is designed to move quickly from a throttling position to an open position, to permit quick final build-up in pressure, following a predetermined initial movement of the piston, and preferably at the point in its traverse corresponding to the initial touching of the contact elements of the circuit breaker. In this way, the position is prevented from acquiring such a velocity as might result in damaging shocks during operation of the circuit breaker, while full operating force becomes available for overcoming any resistance to final closing of the breaker. Control valve mechanisms heretofore provided have proved successful in service, but occasionally difficulty has been experienced in insuring positive operation of such a control valve without variation in operating speed resulting from friction.

It is, accordingly, an object of my invention to provide an improved control or throttle valve

2

mechanism for a fluid pressure actuated circuit breaker in which rugged and simple features of construction are combined to promote positive operation and to minimize the effect of friction on the speed of operation of the mechanism.

It is another object of the invention to provide an improved throttle valve mechanism of the above type which may readily be installed or built into a circuit breaker equipment of existing design without requirement of extensive alterations.

Other objects and advantages of the invention will appear in the following more detailed description thereof, taken in connection with the accompanying drawing, in which:

Figure 1 is a diagrammatic view, partly in section, of the operating portions of a fluid pressure operated circuit breaker equipment having associated therewith a preferred form of control valve mechanism constructed in accordance with the invention;

Fig. 2 is a fragmentary sectional view of the control valve mechanism shown in a closed position corresponding to the open position of the circuit breaker;

Fig. 3 is a sectional view taken substantially along the line III—III of Fig. 1; and

Fig. 4 is an enlarged detail fragmentary view of the operating lever of the control valve mechanism shown in Fig. 1.

Referring to the drawing, in Fig. 1 there is illustrated in diagrammatic form a portion of a single pole unit of a fluid-pressure-operated circuit breaker, comprising a suitable frame structure (not shown) supporting stationary contact elements 5 in the power circuit to be controlled, a movable resilient contact element 6 cooperative therewith and secured to a rod 7, a cylinder 10 having mounted therein an operating piston 11, and a piston rod 12, the upper end 13 of which is pivotally connected to the rod 7 through the medium of a beam 14 fulcrumed on a stationary pin 15. A coil spring 17 is mounted in cooperative relationship with the movable contact element 6 for urging that element toward an open circuit position. The piston 11 is responsive to the pressure of air admitted to a pressure chamber 20 for actuating the piston rod 12, beam 14 and rod 7 to move the contact element 6 into circuit closing engagement with the stationary contact ele-

ments 5, in opposition to the force exerted by opening spring 17 and contact spring 6.

For maintaining the circuit breaker elements just described in circuit closing position, the circuit breaker apparatus is further provided with a transversely disposed beam 22, one end of which is journaled on a pin 23 carried by a link 24 that is in turn pivotally connected to a pin 25 carried by the frame structure. The beam 22 is operatively connected by means of a pin 28 to the piston rod 12 at a point above the cylinder 10, and also carries, at the end opposite the pin 23, a roller 30 which is adapted to be engaged by a suitable latch mechanism, generally indicated as 31, for holding the beam 22 and the asscciated elements of the circuit breaker in the circuit closing position, as shown in Fig. 1.

The latch mechanism 31 may be of any suitable design and, as illustrated, comprises a main latch member 32 journaled on a stationary pin 33 secured to the frame structure, a release pawl 34 pivotally connected to the frame structure by means of a pin 35 for cooperation with the latch member 32, and an auxiliary latch member 36 adapted for cooperation with the pawl 34. The main latch member 32 has a surface 38 adapted for latching engagement with the roller 30, and an extension 40 adapted for interlocking engagement with a portion of the pawl 34 for a resisting clockwise movement of the main latch member about pin 33 under the force tending to raise the end of the beam 22 carrying the roller, and thus tending to effect disengagement of the latch member 32 from the roller. For biasing the main latch member 32 in a counterclockwise direction, there is provided a spring 42, which is interposed between a suitable lug on the frame structure and the head of a link pivoted to the latch member.

For tripping the latch mechanism 31, there is provided a trip coil 44, which is adapted to be energized through the medium of a suitable trip control circuit (not shown) for causing upward movement of an armature carrying a plunger 45 that is operatively aligned with a portion of the pawl 34. The pawl 34 is normally urged into the position shown in Fig. 1 by means of a spring 47, which is adapted to yield upon operation of the pawl by the trip plunger 45. The auxiliary latch member 36 is inoperative when the parts are positioned as shown in Fig. 1, but serves to hold the pawl 34 out of interfering engagement with latch member 32 when the beam 22 and other operating elements of the circuit breaker are in circuit opening position. A coil spring 49 is interposed between a portion of the cylinder structure 11 and a lug 50 on the auxiliary latch 36, and acts to tilt the latter in a clockwise direction about pin 35, causing the lug 50 to carry the pawl 34 in the same direction, when the end of the beam 22 carrying roller 30 is swung upwardly during a circuit breaker opening operation. It will be noted that a lug 51 carried on the upper end of auxiliary latch 36 is adapted to be engaged by the free end of the beam 22, when that beam is moved to the circuit closing position as shown in Fig. 1. With the auxiliary latch member 36 thus held down, the spring 47 is permitted to maintain the pawl 34 in interlocking engagement with the main latch member 32.

For controlling the supply of fluid under pressure to the chamber 20, there is provided a magnet valve assembly, generally indicated at 55, comprising a casing having a valve chamber 56 communicating with a fluid supply pipe 57, which may be connected to any suitable source of fluid

under pressure. Within chamber 56 is mounted an inlet valve 58 for controlling communication from the valve chamber to a passageway 60 leading to the pressure chamber 20. The supply valve 58 is normally urged toward a seated position by a coil spring 62 mounted in the valve chamber 56, and is provided with a valve stem 63 which extends upwardly and terminates in an armature portion (not shown) movably disposed within a magnet coil 65 carried by the frame structure. The magnet coil 65 is adapted to be energized through the medium of a suitable control circuit (not shown) which may be arranged in any approved and well known manner for insuring the desired automatic operation of the circuit breaker equipment. The valve stem 63 also carries a discharge valve element 67 which is operative to vent the passageway 60 to atmosphere when the supply valve element 58 is in its seated position, as shown in Fig. 1. Upon energization of the magnet coil 65, the stem 63 is shifted downwardly to close the valve element 67 while opening the supply valve 58 to effect supply of fluid under pressure to the pressure chamber 20 above the piston 11.

It is not deemed necessary to illustrate the control circuits for the magnet coils 44 and 65, but it will be understood that any suitable circuit breaker controlling system may be provided to furnish the usual features of automatic operation well known in the circuit breaker art. For example, the trip coil 44 may be arranged for energization in response to development of a fault in the main circuit controlled by the circuit breaker, or alternatively to be subject to manual control. If the circuit breaker equipment includes means for effecting a quick reclosing operation following an opening operation in response to a fault, the circuit for energizing the magnet coil 65 may be arranged to initiate energization thereof instantaneously upon tripping of the circuit breaker apparatus, to thus insure a subsequent reclosing operation with minimum loss of time.

According to the invention, a throttle valve assembly, indicated generally by the reference character 70, is provided for controlling the rate of supply of fluid under pressure through the passageway 60 to the piston chamber 20 at a rate determined in accordance with the operation of the circuit breaker. The throttle valve assembly includes a casing section 71 interposed between the magnet valve assembly 55 and the cylinder 10, and having a suitable bore 73 disposed substantially vertically and in intersecting relation with respect to the passageway 60, which, as shown diagrammatically in Fig. 1, extends through the casing section 71 to the piston chamber 20. A restricted bypass 74 is formed in the casing section 71, as is best shown in Fig. 3, for permitting flow of fluid around the bore 73 at a rate determined by adjustment of a screw-threaded valve element 75. Slidably mounted in the vertical bore 73 is a valve element 78, which is urged upwardly under the force of a coil spring 79 that is interposed between the lower end of the valve element and a cap 80 carried by the casing section 71. With the valve element 78 held in its uppermost position, as shown in Fig. 1, a channeled portion 81 thereof is disposed in registration with the passageway 60 so that flow of fluid under pressure is virtually unrestricted. On the other hand, when the valve element 78 is shifted to its lowermost position, as is best shown in Fig. 2, flow of fluid under pressure through the

passageway 60 is limited to the flow area of the bypass 74.

The throttle valve element 78 is arranged for operation in accordance with operation of the piston rod 12 and associated elements of the circuit breaker. For this purpose, a linkage mechanism is provided for operatively connecting the valve element 78 to the piston rod 12, comprising a main lever 90 which is pivotally mounted intermediate its ends on a pin 91 carried by a pair of lugs 92 projecting from the cylinder casing 10. One end of the main lever 90 is pivotally connected by means of a pin 94 to an upper extension of the valve element 78, and the opposite end of the lever is provided with a slot 96 (see Fig. 4) through which extends a pin 97 that is carried on the lower end of a substantially vertically disposed link member 98. The link member 98 has an elongated slot 99 for receiving the outer end of the pin 28 carried by the piston rod 12, thus constituting a lost motion connection between the piston rod and the lever 90. Also fulcrumed on the pin 91 is an operating lever 100 which is shorter in length than the main lever 90 and has one end connected to the pin 97. The other end of the operating lever 100 is pivotally connected by means of a pin 101 to an element 102, the outer end of which is connected by means of a pin 103 to a link 104 which is, in turn, operatively connected to pin 105 on the extreme end of the main lever, outwardly of pin 94. Suitable rollers may preferably be mounted on the pins 105 and 103. It will be noted that in the normal position of the levers 100 and 90 the pins 97, 101 and 103 are not in alignment, and that if the operating lever 100 is tilted counterclockwise about the pin 91, relative to lever 90, the roller carried by pin 103 will be advanced outwardly, or to the right as viewed in Fig. 1.

A spring-pressed latch member 110 is pivotally mounted on the casing section 71 in operative alignment with the rollers carried by pins 105 and 103. As is best shown in Fig. 2 of the drawing, when the levers 90 and 100 are moved to a position corresponding to the circuit opening position of the circuit breaker, the roller on pin 105 is disposed in interlocking engagement with the latch member 110 while the other roller on pin 103 lightly engages the upper surface of the latch member. It will thus be apparent that upon relative movement of the operating lever 100 with respect to main lever 90, the roller on pin 103 will be moved outwardly to release the latch member 110 from the roller carried by pin 105, thus permitting spring 80 to shift the valve element 78 to its uppermost position. It should be noted that the latch 110 positively latches the throttle valve in its restricting position, independently of frictional forces, and is positively released by the linkage 100—102 prior to any movement of the valve element 78.

In operation, if the circuit breaker equipment is disposed in its circuit closing position, as shown in Fig. 1, the pin 28 carried by piston rod 12 is held in engagement with the lower end of the slot in link member 98 and thus holds the associated levers 90 and 100 in such a position as to maintain the throttle valve element 78 in its full open position, and free of any cooperation with the latch member 110. At the same time the beam 22 is disposed in a substantially horizontal position with the roller 30 in latching engagement with the main latch member 32, so that the circuit breaker is positively held in the circuit

closing position against the force tending to open the contact elements.

If it is desired to effect an opening operation of the circuit breaker, the magnet coil 44 is energized through the medium of the usual controlling circuit, as already explained, whereupon the plunger 45 is quickly raised to disengage the pawl 34 from the main latch member 32. Due to the relatively small area of contact between the inclined surface 38 of the main latch member and the roller 30 the spring 42 is unable to resist the slight clockwise movement of the latch required to release the beam 22, which is consequently moved upwardly about the pin 23, while rod 12, beam 14, and rod 7 are at the same time actuated by the spring 17 to effect disengagement of the contact element 6 from the elements 5.

The piston 11 is carried upwardly during the upward movement of the piston rod 12, but if the circuit breaker is equipped for a quick reclosing operation, the operation of the usual auxiliary reclosing means (not shown) results in energization of the magnet coil 65 in time to operate the supply valve 58 for admitting fluid under pressure to the piston chamber 20 before piston 11 has reached its uppermost position. Upon the resultant supply of fluid under pressure to chamber 20, the upward motion of the piston 11 will be reversed prior to any engagement between pin 28 and the upper end of the slotted link 98, so that the throttle valve 78 remains in its full open position. Unrestricted flow of fluid under pressure through passageway 60 to piston chamber 20 is thus insured for supplying the added force needed for reversing the movement of the mechanism and causing quick reclosure of the circuit breaker.

If the fault in the controlled circuit has not been removed at the time when the reclosure of the circuit breaker occurs, however, the trip coil 44 will again be energized and coil 65 will be deenergized for venting the piston chamber 20 to atmosphere, thereby rendering spring 17 again operative to open the circuit breaker. It will be understood that suitable dump valve means may be provided for augmenting the discharge of fluid under pressure from piston chamber 20 in order to promote quick upward movement of the piston 11. One form of such dump valve and a suitable control circuit for the complete mechanism is shown in my Patent No. 2,361,178, issued October 24, 1944. For the purpose of discussing the present invention, however, it is not deemed necessary to show such a dump valve and control circuit.

Assuming that the circuit breaker is moved to its circuit opening position, with the contact element 6 held out of engagement with contact elements 5 under the force exerted by spring 17, it will be apparent that the beam 22 will be disposed in the position shown in Fig. 2 of the drawing. At the same time, the operating piston 11 will be in its uppermost position within cylinder 11, while the pin 28 carried by the piston rod 12 will be disposed at the upper end of the slot 99 of the link 98. With the link 98 thus maintained in the position shown in Fig. 2, the valve element 78 will be latched in its lower or closed position, as shown, so that the communication through passageway 60 is limited to the bypass 74.

If the controlling circuit for the circuit breaker is now energized in the usual manner to cause a closing operation, the consequent energization of the magnet coil 65 of magnet valve device 55

effects unseating of the supply valve element 58 against the force of spring 62, while discharge valve 67 is moved to seated position. Fluid under pressure is then supplied from the usual source by way of pipe 57, valve chamber 56, past the unseated valve element 58, and through passageway 60 and restricted bypass 74 to the piston chamber 20. The piston 11 is thereby moved downwardly for operating the rod 12, beam 14 and rod 7 to bring the movable contact element 6 toward the contact elements 5. It will be understood that although sufficient fluid under pressure is quickly supplied by way of the communications just described, including the restricted bypass 74, to effect prompt closing movement of the various circuit breaker elements, the increase in pressure of fluid in chamber 20 is nevertheless so controlled as to prevent the piston 11 and the movable elements from acquiring an excessive velocity during the initial operation. As the piston 11 continues its downward movement, the pin 28 carried by piston rod 12 approaches the lower end of slot 99 in link 98 and at a predetermined point in the stroke of the piston 11, the pin 28 forces the link 98 downwardly. As hereinbefore mentioned, the exact point at which the pin 28 moves the link 98 downwardly during a circuit breaker closing operation, may be determined as desired by proper adjustment of the link 98, it being noted that this member comprises two screw-threaded parts which may be locked together by means of a set nut 120.

Upon initial downward movement of the link 98 and pin 97 carried thereby, the operating lever 100 is tilted in a counterclockwise direction about pin 91, the main lever 90 remaining stationary while pin 97 moves in the slot 96. This relative movement of operating lever 100 results in operation of the link 102 and roller 103 to force outwardly the spring-pressed latch element 110, thus releasing the pin 105 and lever 90 to permit quick upward movement of the throttle valve element 78 under the force exerted by spring 79. The valve element 78 thus assumes its open position substantially instantaneously to continue the supply of fluid under pressure to the piston chamber 20 at an increased rate of flow by way of the channeled portion 81 of the valve element, which is now in registration with the passageway 60, as shown in Fig. 1. Pressure of fluid in chamber 20 is thus increased quickly by the supply of fluid under pressure at the maximum rate so that sufficient force is exerted on the piston 11 to move it to its full circuit breaker closing position, regardless of the increase in resistance to such movement that may be caused during final closing operation of the contact elements 6 and 5.

It will be understood that the control valve mechanism 70 is thus tripped in time to effect movement of the valve element 78 to its open position, as shown in Fig. 1, just prior to the possible reopening operation of the circuit breaker that may be initiated in case the circuit breaker is closed on a fault. Consequently, the control valve mechanism 70 will remain in the open position during a subsequent automatic reopening operation of the circuit breaker, as already explained, to render instantly available the full pressure required to insure such reclosing operation in a minimum interval of time.

From the foregoing description, it will be seen that an auxiliary control valve mechanism constructed in accordance with the invention may be embodied in any type of fluid pressure operated

circuit breaker to afford adequate protection to the operating portions of the equipment during rapid movement under the high fluid pressures required. My improved control valve mechanism is simple in construction and comprises relatively few sturdy operating elements which are adapted to respond smoothly and substantially without variation in speed, due to friction or other cause, throughout a long service life.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a fluid pressure operated circuit breaker having relatively movable contact means, a cylinder, a piston operative upon an increase in fluid pressure in said cylinder for moving said contact means to a circuit closed position, and means for moving said contact means to an open circuit position, the combination of supply valve means operative to supply fluid under pressure through a communication to said cylinder, throttle valve means interposed in said communication having a position for restricting flow therethrough and an open position for permitting maximum flow, means for biasing said throttle valve means toward open position, and a positive latch for releasably holding said throttle valve means in the restricting position, and a member movable independently of the throttle valve means for releasing said latch during movement of said piston to permit said biasing means to move said throttle valve means to open position.

2. In a fluid pressure operated circuit breaker having relatively movable contact means, a cylinder, and a piston operative upon an increase in fluid pressure in said cylinder for moving said contact means, the combination of supply valve means operative to supply fluid under pressure through a communication to said cylinder, throttle valve means interposed in said communication having a position for restricting flow therethrough and an open position for permitting maximum flow, means for biasing said throttle valve means toward one position, a positive latch for holding said throttle valve means in the other position, and a latch release member operative upon predetermined movement of said contact means for releasing said latch to permit said biasing means to move said throttle valve means toward said one position.

3. In a fluid pressure operated circuit breaker having relatively movable contact means, operating mechanism including a cylinder, a piston operative upon an increase in fluid pressure in said cylinder for moving said contact means to a circuit closed position, and means for moving said contact means to an open circuit position, the combination of supply valve means operative to supply fluid under pressure through a communication to said cylinder, throttle valve means interposed in said communication having a position for restricting flow therethrough and an open position for permitting maximum flow, means for biasing said throttle valve means toward open position, a latch element for releasably holding said throttle valve means in the restricting position, and one or more links engageable with said latch element and connected to a movable part of the operating mechanism for moving said latch to unlatched position upon predetermined movement of said contact means toward the closed circuit position.

4. A fluid pressure operated circuit breaker having contact means movable to open circuit position and to closed circuit position, an operating

cylinder, a piston operative upon supply of fluid under pressure to said cylinder for moving said contact means, fluid pressure control means including a passage for supplying fluid under pressure to said cylinder, valve means biased toward one position and movable to another position to control the rate of flow of fluid under pressure through said passage, a latch releasably operative to hold said valve means against the bias thereon, a link movable in response to movement of said contact means for shifting said valve means against its bias, and a second link also movable in response to movement of said contact means but movable prior to movement of the first said link for releasing said latch means.

5. A fluid pressure operated circuit breaker having contact means movable to open circuit position and to closed circuit position, an operating cylinder, a piston operating upon supply of fluid under pressure to said cylinder for moving said contact means, fluid pressure control means including a passage for supplying fluid under pressure to said cylinder, valve means biased toward an open position and movable to a throttling position to control the flow of fluid under pressure through said passage, a latch operative to hold said valve means in throttling position, a link having a lost motion connection with said piston for shifting said valve means to throttling position so as to reduce the rate of supply of fluid under pressure to said cylinder during initial movement of said contact means from the open circuit position, and a second link having a lost-motion connection with the first said link and operative to release said latch after said piston has been moved through a predetermined portion of a stroke.

6. A fluid pressure operated circuit breaker having contact means movable to open circuit position and to closed circuit position, an operating cylinder, a piston operative upon supply of fluid under pressure to said cylinder for moving said contact means to closed circuit position, springs means operative to move said contact means to open circuit position, fluid pressure control means including a passage for supplying fluid under pressure to said cylinder, valve means biased toward an open position and movable to a throttling position to control the flow of fluid under pressure through said passage, a latch releasably operative to hold said valve means in throttling position, a link connected through a lost-motion connection with said piston for shifting said valve means to throttling position so as to reduce the rate of supply of fluid under pressure to said cylinder during initial movement of said contact means from the open circuit position, and a second link having a lost-motion connection with the first said link and operative to release said latch after said piston has been moved through a predetermined portion of a stroke in closing said contact means, said lever means being inoperative to move said valve means out of open position during a partial stroke of said piston in effecting a quick reclosing operation of said contact means.

7. A fluid pressure operated circuit breaker having contact means movable to open circuit position and to closed circuit position, an operating cylinder, a piston operative upon supply of fluid under pressure to said cylinder for moving said contact means to closed circuit position, spring means operative to move said contact means to open circuit position, fluid pressure control means including a passage for supplying fluid

under pressure to said cylinder, valve means biased toward an open position and movable to a throttling position to control the flow of fluid under pressure through said passage, a positive latch operative to hold said valve means in throttling position, lever means cooperative with said piston for shifting said valve means to throttling position so as to reduce the rate of supply of fluid under pressure to said cylinder during initial movement of said contact means from the open circuit position, and means operative to release said latch after said piston has been moved through a predetermined portion of a stroke in closing said contact means to cause said valve means to be moved to open position.

8. A fluid pressure operated circuit breaker having contact means moving to open circuit position and to closed circuit position, an operating cylinder, a piston operative upon supply of fluid under pressure to said cylinder for moving said contact means to closed circuit position, spring means operative to move said contact means to open circuit position, fluid pressure control means including a passage for supplying fluid under pressure to said cylinder, a valve biased toward an open position and movable to a throttling position to control the flow of fluid under pressure through said passage, a positive latch operative to hold said valve in throttling position, and lever means cooperative with said piston and connected to said valve for shifting it to the throttling position to reduce the rate of flow of fluid under pressure to said cylinder during initial movement of said contact means from the closed circuit position, a lost-motion connection between parts of said lever means so that the part thereof connected to said valve may remain stationary while the other part thereof moves said latch to released position.

9. In a fluid pressure operative circuit breaker of the type including movable contact means, means for moving said contact means to an open circuit position, a movable abutment operative upon an increase in the pressure of fluid in a chamber for moving said contact means to a closed circuit position, and supply valve means operative to supply fluid under pressure to said chamber, the combination therewith of throttle valve means interposed between said supply valve means and said chamber, said throttle valve means comprising a spring, a valve element biased by said spring toward an open position for permitting supply of fluid to said chamber at a maximum rate, a latch for releasably holding said throttle valve means in a throttling position to reduce the rate at which fluid under pressure can be supplied to said chamber, lever means having a lost-motion operative relative to said movable abutment for permitting retention of said valve element in the throttling position only when said abutment is shifted to a position corresponding to the open circuit position of the contact means, said lever means having a second lost-motion connection therein so as to be operative to release said latch upon a predetermined movement of said abutment for closing said contact means.

10. In a fluid pressure operated circuit breaker having relatively movable contact means, a cylinder, and a piston operative upon an increase in fluid pressure in said cylinder for moving said contact means, the combination of supply valve means operative to supply fluid under pressure through a communication to said cylinder, throttle valve means interposed in said communication having a position for restricting flow there-

through and an open position for permitting maximum flow, means for biasing said throttle valve means toward one position, a member movable in response to movement of said contact means for moving said throttle valve means to the other position, a positive latch for holding said throttle valve means in the other position, and means operative upon predetermined movement of said contact means while said throttle valve means remains stationary for releasing said latch to permit said biasing means to move said throttle valve means toward said one position.

JAMES M. CUMMING.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,379,178	Peek	June 26, 1945
2,381,307	Peek et al.	Aug. 7, 1945
2,384,801	Cumming et al.	Sept. 18, 1945
1,641,131	Baker	Aug. 30, 1927
1,714,545	Burns	May 28, 1929