Oct. 30, 1945. H. J. WEBB ET AL 2,387,960

OPERATING MECHANISM

Filed Oct. 10, 1942

Fig. 2.

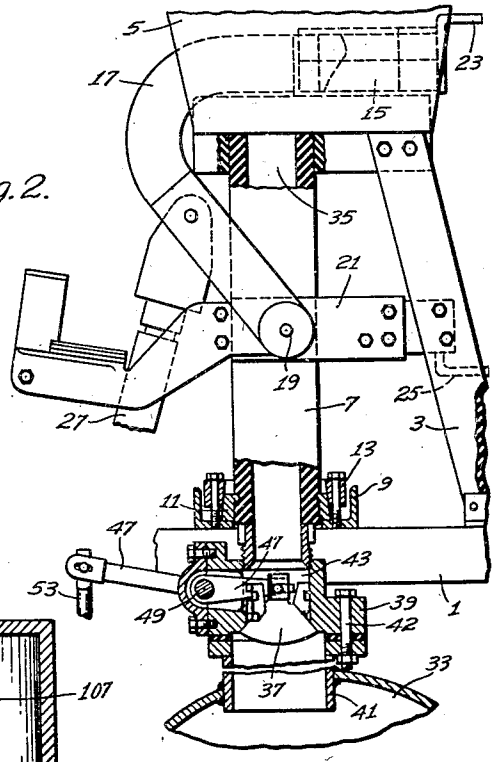
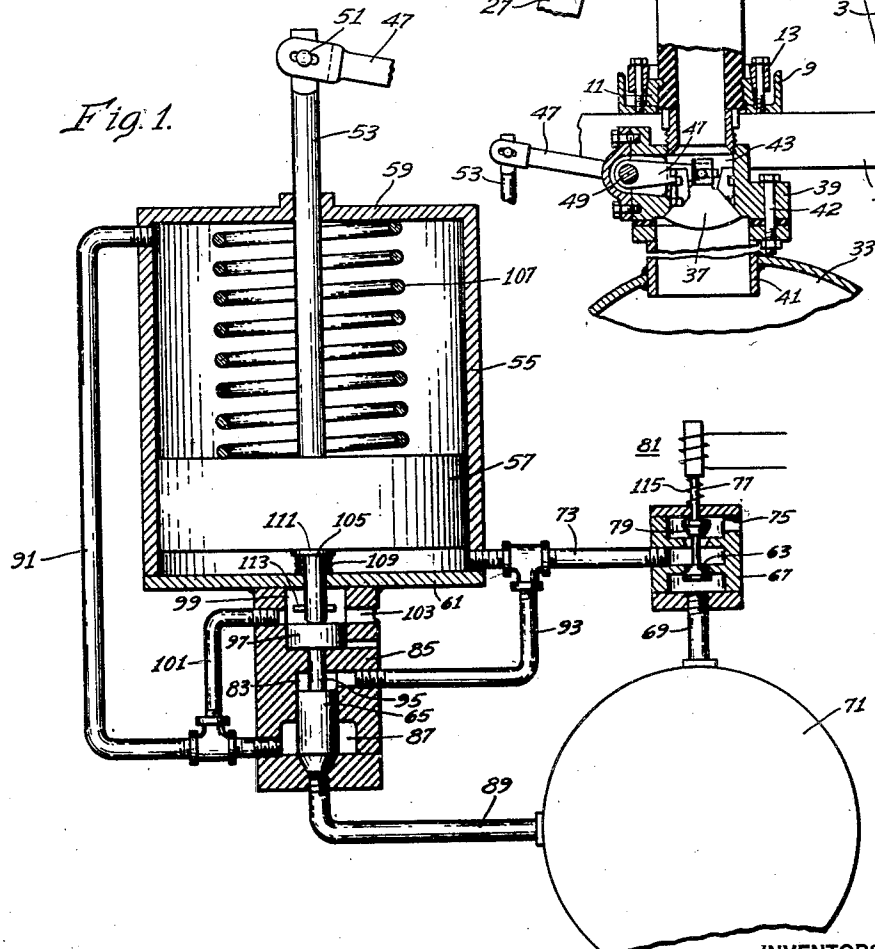


Fig. 1.



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Patented Oct. 30, 1945

2,387,960

UNITED STATES PATENT OFFICE

2,387,960

OPERATING MECHANISM

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Application October 10, 1942, Serial No. 461,562

14 Claims. (Cl. 121—38)

This invention relates to improvements in circuit interrupters, and more particularly to fluid pressure operated structures for controlling the flow of arc extinguishing blasts of gas in circuit interrupters of the gas blast type.

One object of the invention is to provide a circuit interrupter with an improved fluid pressure operating mechanism for a blast valve for controlling an arc extinguishing gas blast.

Another object of the invention is the provision of a circuit interrupter of the gas blast type with a separate fluid pressure operated mechanism for effecting high speed opening and closing of the blast valve.

Another object of the invention is the provision of an improved compressed air operating mechanism operable in each direction by compressed air to quickly actuate an element between two opposite positions, the mechanism having a very simple air operating system which utilizes only a single pilot valve for controlling operation of the mechanism in both directions.

Another object of the invention is the provision of a circuit interrupter of the gas blast type with an improved fluid pressure operated blast valve mechanism wherein fluid pressure will be applied to operate the blast valve for controlling the arc extinguishing gas blast, to open and to closed positions by a single electromagnetically operated valve.

Another object of the invention is the provision of an improved fluid pressure operated mechanism which is simple, fast and reliable in operation, and inexpensive to manufacture.

The novel features that are considered characteristic of the invention are set forth in particular in the appended claims, the invention itself, however, both as to structure and operation, together with additional objects and advantages thereof will best be understood from the following detailed description when read in conjunction with the accompanying drawing, in which:

Figure 1 is an elevational view, partly in section of a blast valve operating mechanism for a circuit interrupter of the gas blast type.

Fig. 2 is an elevational view in reduced scale and partly in section showing a portion of the contact structure of a circuit interrupter and the blast valve for controlling the arc extinguishing gas blast.

The circuit interrupter to which the improved blast valve operating mechanism is adapted to be applied is of the type disclosed in U. S. Patent No. 2,288,472 issued June 30, 1942, to John B. MacNeill and A. H. Bakken, and assigned to the assignee of the instant invention.

Referring to the drawing, a part of the supporting framework for supporting the interrupter mechanism is designated by the reference numeral 1. Rising from the framework 1 is a pair of insulating supports 3, only one of which is shown. The upper ends of the supports 3 carry an arc extinguishing structure 5, the lower portion only of which is shown. The arc extinguisher 5 is also supported by a tubular conduit and insulator 7, the lower end of which extends through a suitable opening in a channel member 9 carried by the cross members of the frame 1. The tubular support 7 is secured to the channel member 9 by means of a pair of cooperating clamp rings 11 and 13, the outer one of which rings is bolted to the channel member.

The arc extinguisher 5 houses the interrupter contact structure comprising a stationary contact 15 and a cooperating movable contact 17. The movable contact 17 is pivotally supported at 19 to a conducting bracket 21, which may be supported on the tubular insulator 7 and the insulating support members 3. The stationary contact 15 is provided with a terminal connector 23 for making an external connection to the interrupter, and the conducting bracket 21 is provided with a similar terminal connector 25. The electrical circuit through the interrupter extends from the terminal 23 through the stationary and movable contacts 15 and 17, the conducting bracket 21 and the terminal connector 25.

The movable contact 17 is actuated to open and closed positions by means of an insulating operating rod 27 which, in turn, is operated by a suitable compressed air operated mechanism, not shown herein. The operating mechanism may be of any suitable type, preferably comprising a cylinder having a piston therein and to which compressed air is admitted by means of suitable control valves to effect the opening and closing movements of the movable contact 17.

During the opening operation of the interrupter, an arc is drawn between the contacts 15 and 17 across the discharge end 35 of the tubular insulator 7 which, in addition to serving as a support for the arc extinguisher 5, also serves as a conduit to direct a blast of arc extinguishing gas from a storage tank 33 upon the arc in the arc extinguisher 5. The arc extinguishing blast from the tank 33 is controlled by a blast valve 37 disposed within a valve housing 39 secured by means of bolts 42 to a short, flanged conduit 41 extending from the tank 33. The valve

housing 39 has a through passage 43 therein in axial alignment with the conduit 41 and with the insulating conduit 7. The valve 37 is adapted to seat against the lower side of the housing 39 to seal the passage 43.

In order to conserve compressed gas and to obtain as many arc extinguishing blasts as possible from a single charging of the tank 33, it is desirable that each arc extinguishing blast be of as short a duration as is possible, and that the valve be quickly closed as soon as the arc is extinguished. The arc is extinguished shortly after the contacts separate and a considerable time before the moving contact reaches full open position. In actual practice, the blast valve 37 may be open for a very brief duration and then may be quickly reclosed. In order to obtain this quick automatic opening and closing of the valve 37, the valve operating mechanism, shown in Fig. 1 of the drawing, is provided.

Operation of the valve 37 for controlling the blast of air is effected by a rocker arm 47, operatively connected to the valve and secured to a cross shaft 49 journalled in the valve housing 39. The portion of the rocker arm extending outside the valve housing is connected by means of a pin and slot connection 51 to the upper end of a piston rod 53 extending into an operating cylinder 55 and secured at its lower end to an operating piston 57. The top 59 of the cylinder is formed integral with the cylinder walls, and the bottom of the cylinder is closed by means of a plate 61 suitably secured to the cylinder, as for instance, by welding.

The piston 57 is movable vertically in the cylinder 55 to open and close the valve 37 by means of compressed gas admitted to the lower end and to the upper end of the cylinder respectively by the control of a single electromagnetically operated pilot valve 63. Compressed air is admitted to the lower end of the cylinder 55 when the pilot valve is opened, thereby operating the blast valve to open position. When the pilot valve closes, compressed air is automatically admitted to the upper end of the cylinder 55 through a pneumatically operated valve 65 and the compressed air quickly returns the blast valve to closed position. The valve 63 is mounted in a valve housing 67 which is divided into three chambers. The lower chamber is connected by means of a pipe 69 to a compressed air reservoir 71, which may or may not be the same as, or connected to, the reservoir 33 of Fig. 2. The center chamber is connected by means of a pipe 73 to the lower end of the operating cylinder 55 below the piston 57, and the upper chamber of the housing 67 is connected by a port 75 to atmosphere. The inlet valve 63 is mounted on the lower end of a valve stem 77 upon which is also mounted an exhaust valve 79. The valve 63 is adapted to be operated to the open position and the valve 79 is adapted to be simultaneously operated to the closed position by energization of an electromagnet indicated generally at 81. Opening of the valve 63 connects the lower end of the cylinder 55 to the source 71 of compressed gas, and closing of the valve 79 closes the exhaust port 75.

The pneumatically operated valve 65 is mounted in a cylinder 83 formed in a housing 85 secured to the closure plate 61. The lower end of the cylinder 83 is enlarged to form an inlet chamber 87 which is connected by means of a pipe 89 to the air reservoir 71. The inlet chamber 87 is also connected to the upper end of the operating cylinder 55 by means of a pipe 91. The upper end of the valve cylinder 83 is connected by means of a pipe 93 and the pipe 73 to the middle chamber of the pilot valve housing 67.

The valve 65 is mounted on the lower end of a valve stem 95 which extends through an opening in housing 85 and has an exhaust valve member 97 reciprocably movable in a cylinder 99 formed in the upper end of the housing 85. The cylinder 99 is connected by means of a pipe 101 and the pipe 91 to the upper end of the operating cylinder 55, and is connected to atmosphere by a port 103 in alignment with the pipe 101. When the interrupter contacts and the operating piston 57 are in the closed position, as shown in the drawing, the valve 65 is held in the closed position and the valve 97 is held in the open position by means of a plunger 105 slidably mounted in the bottom closure plate 61 of the cylinder 55, the plunger 105 being held in the position shown by the piston 57 which is biased to the closed position by a spring 107 coiled about the operating rod 53 and compressed between the upper portion 59 of the cylinder and the top of the piston 57. The spring 107 also serves to maintain the blast valve 37 (Fig. 2) in closed position when the valves 63 and 65 are closed, shutting off the supply of compressed gas from the reservoir 71. A spring 109 surrounding the plunger 105 within the cylinder 99 and compressed between a head 111 on the upper end of the plunger, and the plate 61 serves to move the plunger upwardly upon upward or opening movement of the piston. A pin 113 extending through an opening in the plunger below the plate 61 is provided to limit the upward travel of the plunger.

The operation of the device is described as follows: When the electromagnet 81 is energized, simultaneously with the initiation of an opening operation of the breaker by means of a well known protective relay (not shown) upon the occurrence of an overload in the circuit controlled by the interrupter, the valve 63 is opened and the valve 79 closed. Opening of the valve 63 admits compressed gas from the reservoir 71 through the pipe 69, the valve 63 and the pipe 73 to the cylinder 55 below the piston 57 to operate the piston upwardly and open the blast valve 37. At the same time, opening of the valve 63 also admits compressed gas to the cylinder 83 above the pneumatic valve 65 through the pipe 93. Since the area of the top of the valve 65 is greater than the area of the bottom, the pressure applied to the top thereof will maintain the valve 65 closed during the opening movement of the piston 57. As the piston 57 moves upwardly the gas in the cylinder above the piston is exhausted to atmosphere through the pipes 91 and 101, the cylinder 99 and the exhaust port 103. As soon as the circuit is interrupted, the magnet 81 is deenergized whereupon a spring 115 operates the valves 63 and 79, respectively, to the closed and open positions. This shuts off the supply of compressed air to the cylinder 55 and to the top of the valve 65 and at the same time connects these parts to atmosphere through the valve 79 and the exhaust port 75. The pressure beneath the piston 57 and on the top of the valve 65 is thereby relieved, and the compressed air acting on the lower end of the valve 65 immediately forces this valve upwardly admitting compressed air through the pipe 91 to the cylinder 55 above the piston 57. At the same time, upward movement of the valve 65 moves the valve 97 upwardly to close the exhaust port 103 and the pipe 101. The compressed air admitted to the cylinder drives the piston 57 quickly downwardly to close the

blast valve 37. As the piston 57 approaches its closed position, the bottom thereof engages head 111 of the plunger 105, which was raised by the spring 109 as the piston 57 moved upwardly, and thereby thrusts the valves 97 and 65 downwardly to close the valve 65 and open the exhaust port 103.

From the foregoing description, it will be apparent that there is provided an improved operating mechanism of the fluid pressure type comprising a piston reciprocably movable within a cylinder. Fluid pressure for operating the piston is admitted alternately to opposite ends of the cylinder to operate the piston quickly in opening and closing directions, by means of two separate inlet valves, one of which is operated by an electromagnet and the other inlet valve is operated automatically by fluid pressure under the control of the magnetically operated valve and the piston.

It will be obvious that the operating mechanism may be used to operate other mechanisms, for instance, by providing a suitable connection, the mechanism may readily be adapted to operate the movable contact of the circuit interrupter to open and close the circuit.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details thereof may be made without departing from some of the essential features of the invention, and that come within the scope of the appended claims.

We claim as our invention:

1. An operating mechanism comprising a fluid motor operable between two extreme positions, an inlet valve operable to admit fluid under pressure to said motor to cause operation of said motor to a first extreme position, a second inlet valve operable by fluid pressure mechanically independently of said first named inlet valve to admit fluid under pressure to said motor for operating said motor to a second extreme position, and means operable by the motor when said motor moves to said second extreme position to positively close said second named inlet valve.

2. An operating mechanism comprising a cylinder and a piston movable therein between two extreme positions, a source of fluid under pressure, an inlet valve operable to admit fluid under pressure to said cylinder to operate the piston to one of said extreme positions, a second inlet valve operable to admit fluid under pressure to said cylinder to operate said piston to a second extreme position, and means operated by the piston to maintain the second named inlet valve in closed position when the piston is in said second extreme position, said second named inlet valve being maintained in closed position during movement of the piston to said first extreme position by fluid pressure admitted thereto by opening of the first named inlet valve.

3. An operating mechanism comprising a cylinder and a piston movable therein to two extreme positions, a source of fluid under pressure, an inlet valve operable to admit fluid under pressure to said cylinder for operating the piston to one of said extreme positions, a second inlet valve operable by fluid pressure to admit fluid under pressure to the cylinder for operating the piston to a second of said extreme positions, means controlled by the piston for maintaining said second valve closed when the piston is in said second position, and a connection for admitting fluid under pressure from said first named inlet valve to said second named inlet valve for maintaining said second named valve in closed position during movement of the piston to said first extreme position.

4. An operating mechanism comprising a cylinder and a piston movable therein to a first and a second extreme position, a source of gas under pressure, an inlet valve operable to admit gas under pressure to one end of said cylinder for moving said piston to said first extreme position, a second inlet valve operable to admit gas under pressure to the other end of said cylinder for moving the piston to said second extreme position, a connection for applying gas pressure to one side of said second named inlet valve for operating said second inlet valve to open position, means operable by said piston for maintaining said second named inlet valve in closed position while said first named inlet valve is in closed position, and a connection for admitting gas under pressure to the other side of said second named inlet valve when said first named inlet valve is opened for maintaining said second named inlet valve closed during movement of the piston to said first extreme position.

5. An operating mechanism comprising a cylinder and a piston movable therein between a first and second position, a closing control valve operable to admit fluid pressure to said cylinder for moving the piston to said first position, means for applying fluid pressure to one end of said closing control valve to operate said closing valve to open position, means operable by the piston for holding said closing control valve in closed position while said piston is in said first position, said means being operable upon movement of said piston to said second position to permit opening of said closing control valve, and an opening control valve operable to admit fluid pressure to the cylinder for moving the piston to said second position and for simultaneously admitting fluid pressure to the other end of the closing control valve for holding said closing control valve in closed position during movement of the piston to said second position.

6. An operating mechanism comprising a cylinder and a piston movable therein to a first and to a second position, a source of fluid under pressure, an inlet valve operable to admit fluid pressure to said cylinder for moving the piston to said first position, means for applying continuous fluid pressure to said inlet valve tending to operate said inlet valve to open position, a member extending into said cylinder and engageable by the piston to hold said inlet valve in closed position against the fluid pressure, and a second inlet valve operable to admit fluid pressure to the cylinder for moving the piston to said second position, said second named inlet valve also admitting fluid pressure to the first named inlet valve to hold said first named inlet valve closed during movement of the piston to said second position.

7. An operating mechanism comprising a cylinder and a piston movable therein between a first and second extreme position, a source of fluid under pressure, means biasing said piston to said first extreme position, an inlet valve for admitting fluid pressure to one end of said cylinder to effect movement of the piston to said first extreme position, means controlled by said piston during movement thereof to said first extreme position for closing said inlet valve, said means being effective when the piston is in said first extreme position to maintain said inlet valve in closed position, and a second inlet valve operable to simultaneously admit fluid pressure to the other end of the cylinder and to the first named inlet valve

to effect movement of the piston to said second extreme position and to maintain said first named inlet valve in closed position during movement of the piston to said second extreme position.

8. An operating mechanism comprising a piston movable between two extreme positions, a cylinder within which said piston moves, an electromagnetically operable valve for admitting fluid pressure to one end of the cylinder to effect movement of the piston to one extreme position, and a pneumatically operated valve for admitting fluid pressure to the other end of said cylinder to effect movement of said piston to a second extreme position, said piston in said second position holding said pneumatically operated valve closed, and said electromagnetically operated valve being effective when opened to admit fluid pressure to maintain the pneumatically operated valve in closed position during movement of the piston to said one extreme position.

9. An operating mechanism comprising a cylinder and a piston movable therein between two extreme positions, a source of gas under pressure, an inlet valve operable to admit gas pressure to one end of said cylinder to effect movement of said piston to one position, one end of said inlet valve having a smaller area than the other end, means connecting said source of gas under pressure to the smaller end of said inlet valve for applying a continuous gas pressure tending to open said valve, means in said cylinder engageable by said piston for holding said inlet valve closed when the piston is in said one position, said means permitting said gas pressure to open the inlet valve when the piston moves to a second position, and a second inlet valve operable to admit gas pressure to the other end of said cylinder to effect movement of said piston to said second position, said second inlet valve being effective when operated to admit gas pressure to the larger end of the first named inlet valve to maintain said first named inlet valve closed during the movement of the piston to said second position.

10. In a circuit interrupter, an operating mechanism comprising a fluid motor having a normal position and operable to do work in two directions, a source of fluid pressure, an inlet valve for controlling the admission of fluid pressure to said motor for operating said motor in both directions, a single electromagnet for controlling said valve, said valve when open admitting fluid pressure to the motor to operate said motor in one direction, means separate from said valve and operable upon closure of said valve to admit fluid under pressure to the motor for operating said motor in the other direction, and spring means to maintain said motor in said normal position when said inlet valve is closed, said motor in said normal position preventing operation of said separate means.

11. In a circuit interrupter, an operating mechanism comprising a fluid motor having a normal position, a source of fluid under pressure, means including a single electro-magnetically operable valve for controlling the admission of fluid pressure to the motor to effect movement of said motor, said valve when open admitting fluid pressure to said motor to effect movement of said motor away from said normal position, and means separate from said valve and operable automatically upon closure of said valve to admit fluid pressure to the motor to operate said motor to said normal position, said motor in said normal position preventing operation of said separate means.

12. In a circuit interrupter, an operating mechanism comprising a piston and a cylinder in which said piston operates, said piston having a normal position in one end of the cylinder, an electromagnetically operable valve for controlling the admission of fluid pressure to the cylinder to effect movement of the piston, said valve being effective when open to admit fluid pressure to one end of the cylinder to effect movement of the piston from the normal position to the other end of the cylinder, and means separate from said valve and automatically operable upon closure of said valve to admit fluid pressure to the other end of said cylinder, to move the piston back to said normal position, and means engageable by the piston in the normal position to prevent operation of said separate means.

13. In a circuit interrupter, an operating mechanism including a piston, a cylinder within which said piston moves, an electromagnetically operable valve for admitting fluid pressure to one end of the cylinder to effect movement of the piston in one direction, a pneumatically operable valve for admitting fluid pressure to the other end of said cylinder to effect movement of the piston in the other direction, said electromagnetically operated valve being effective to admit fluid pressure to maintain the pneumatically operated valve in closed position during movement of the piston in said one direction, and means operated by said piston when said piston is operated in said other direction to close said pneumatically operated valve, said piston and said means maintaining said pneumatically operated valve closed when said electromagnetically operated valve is closed.

14. An operating mechanism comprising an operating piston and a cylinder within which said piston is movable to a first and second extreme position, spring means normally restraining said operating piston in said second extreme position, a source of fluid under pressure, means including an inlet valve operable to admit fluid under pressure to said cylinder for moving said operating piston to said first extreme position, a second inlet valve automatically operable by fluid pressure upon closure of said first named inlet valve to admit fluid under pressure to said cylinder for moving said operating piston to said second extreme position, means operable by said operating piston when said piston is moved to said second extreme position for closing said second inlet valve, and said spring means being effective when said operating piston is in said second extreme position and said first inlet valve is closed to hold said second inlet valve closed.

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