Sept. 3, 1935. O. C. WRIGHT 2,013,428

FLUID PRESSURE CONTROL

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Fig. 2.

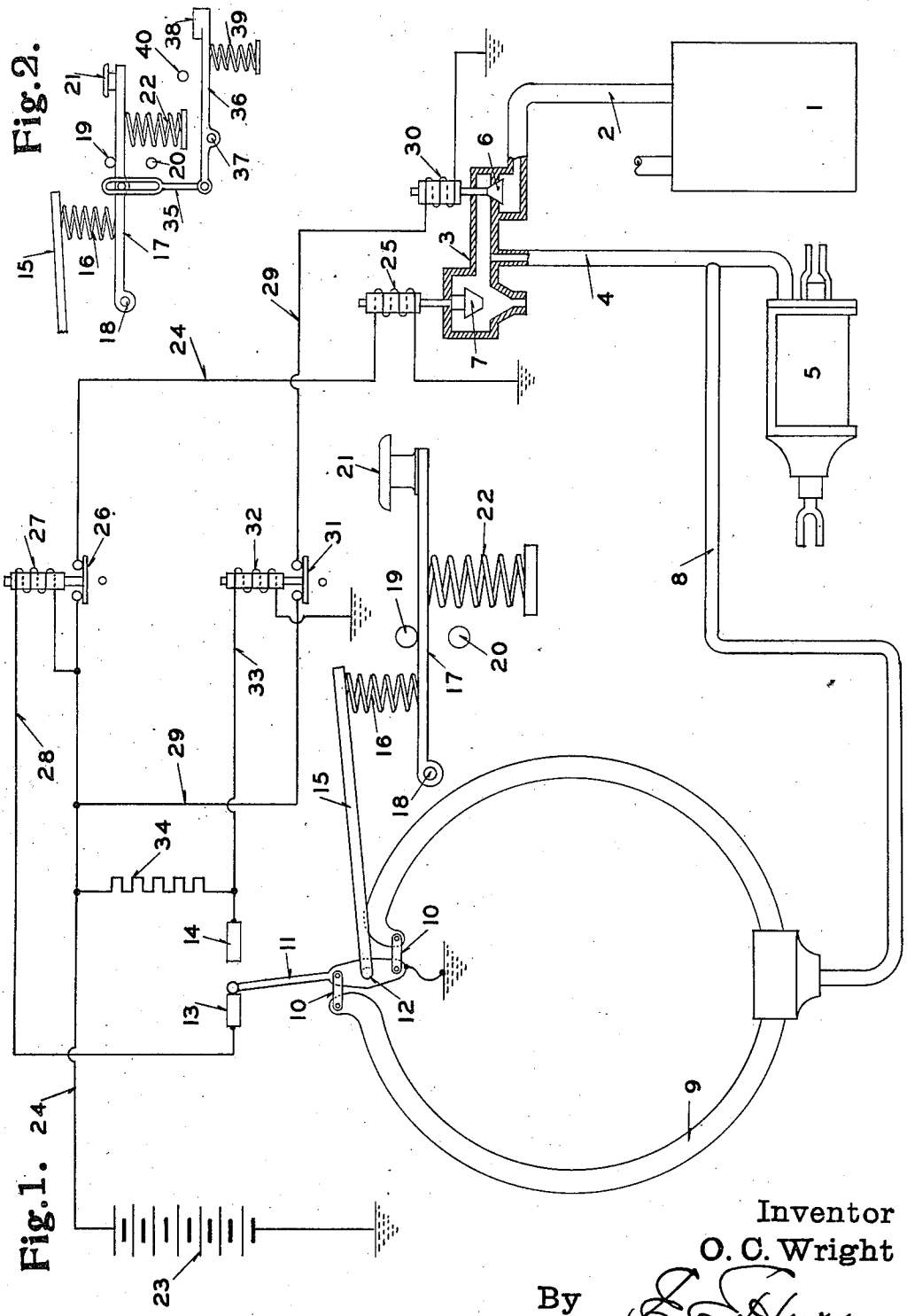


Fig. 1.

Inventor
O. C. Wright

By

Att'y.

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FLUID PRESSURE CONTROL

Orville C. Wright, St. Louis, Mo.

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8 Claims. (Cl. 303—20)

My invention relates to a fluid pressure control and particularly to a control such as may be adapted for use in applying the brakes of a street car, automobile, or other motor driven vehicle.

One object of my invention is to secure the maximum speed of response in both brake application and release. This result is obtained by the use of electrically-operated valves controlled by a contact movable under two opposing forces, one of which is varied manually, and the other by the pressure of the brake applying fluid.

Another object of my invention is to secure automatic application of the maximum brake pressure, that is, what is known in the art as emergency application, in the event of the failure of the valve actuating current.

The accompanying drawing illustrates my invention diagrammatically. Figure 1 shows one form of fluid pressure control mechanism as applied to the brake cylinder of a street car or similar vehicle; and Figure 2 is a fragmentary view showing a modification.

A reservoir 1 supplies the compressed air or other actuating fluid through a pipe 2 to a valve casing 3 which communicates through a pipe 4 with the brake cylinder 5. In the valve casing are an application valve 6 and a release valve 7, the former being biased toward open position and the latter toward closed position. These valves are actuated by electromagnetic means hereinafter described. Leading from the pipe 4 is a pipe 8 supplying pressure to a tubular spring 9 of annular form acting as a pressure gauge of the type known as a Bourdon tube. The ends of the tube are connected by links 10 to a contact arm 11 pivoted at 12. The end of the contact arm moves between two stationary contacts 13 and 14. As the contact arm is itself grounded, it functions to ground either of the stationary contacts with which it engages. When fluid under pressure is supplied to the gauge, it tends to separate the ends connected by the links to the contact arm and thus swing the arm on its pivot toward the contact 13, while the resiliency of the tube tends to move the ends toward each other and so swing the arm toward the contact 14. Secured to the arm 11 is a lever 15 bearing on a spring 16, the tension of which may be varied by moving a lever 17 on its pivot 18. Lever 17 is movable between stops 19 and 20 by means of a handle or treadle 21, being normally held against the stop 19 by a spring 22 of sufficient strength to overcome the tension of spring 16. The parts are so proportioned and adjusted that the maximum tension of spring 16, when lever 17 is against stop 19, is just sufficient to overcome the tension of tube 9 and hold the contact arm against contact 13.

A source of E. M. F., such as battery 23, is grounded at one terminal, the other being connected by line wire 24 to ground. Line 24 includes a solenoid 25, which, when energized, moves release valve 7 to open position, as shown. Line 24 includes a circuit breaking switch 26 biased toward open position. This switch is closed by a solenoid 27 contained in line 28 connected at one end to line 24 and at the other to contact 13. When arm 11 is in contact with 13, current will be supplied to solenoid 27 holding switch 26 in closed position and so supply current to solenoid 25 to hold the release valve in open position. When arm 11 moves out of contact with 13, switch 26 will open, breaking line 24 and so allowing the release valve to close. Leading from line 24 is a branch 29 passing through a solenoid 30 for closing the application valve 6. This line is grounded and includes a circuit breaking switch 31. This switch is biased toward open position and is closed by a solenoid 32 included in a line 33 grounded at one end and connected at the other to contact 14. Current is supplied to line 33 from the battery 23 through a resistance 34 of such value as to permit the passage of sufficient current to actuate solenoid 32 but to prevent undue drain on the source of E. M. F. when arm 11 is in contact with 13. Contact of 11 with 14 short circuits line 33, deenergizing solenoid 32, thus opening switch 31 to break line 29 and allow the supply valve to open.

In the operation of my device, the parts being in the position shown, to apply the brakes, lever 17 is depressed, lessening the tension of spring 16. As the maximum tension of this spring is just sufficient to overcome the tension of tube 9, this will permit the tube to move arm 11 out of contact with 13. This breaks circuit 28, deenergizing solenoid 27 opening line 24, thus permitting the release valve to close. Further depression of lever 17, with consequent decrease in tension of spring 16, permits tube 9 to move arm 11 into contact with 14, short-circuiting line 33 to deenergize solenoid 32, thus opening switch 31 to deenergize solenoid 30 and permit the application valve to open. This will supply fluid under pressure to the brake cylinder 5, and at the same time through pipe 8 to the gauge tube 9. As soon as sufficient pressure is admitted to the tube to overcome its tension, arm 11 will be moved out of contact with 14, closing the application valve 6, thus bringing the braking system to what is known as lap position. The pressure at

which this will occur will depend upon the amount of depression of lever 17 and the resultant tension of spring 16 and may be varied from minimum to maximum braking force. To release the braking pressure, lever 17 is allowed to rise under pressure of spring 22. This increases the tension of spring 16, moving arm 11 into contact with 13 and so opening the release valve. In case lever 17 is allowed to rise into contact with stop 19, the valve will remain open until the entire content of the brake cylinder is discharged. If the lever is allowed to rise less than this distance, the tube 9 will overcome the combined pressure of the fluid in it and the lessened tension of the spring 16 before the cylinder is reduced to atmospheric pressure and will move arm 11 out of contact with 13 to bring the system again into lap position, in this case by the closing of the discharge valve rather than by the closing of the application valve, as in the brake applying operation. If at any time the current supply fails, the application valve will open or remain open and the release valve will close or remain closed, thus insuring emergency application of the brakes when this occurs.

In Figure 2, I have shown a modification, particularly adapted to use in connection with an automotive braking system, in which, when the control is completely released, the brake will not be released but will be applied with a pressure less than the emergency or full pressure application. In the modification a link 35 is provided, having a pin and slot connection with the lever 17. This link is pivoted to a lever 36 fulcrumed at 37 and actuated by pressure at its end 38. In this construction the part 21 will preferably be in the form of a toe pedal and the part 38 in the form of a heel plate located adjacent thereto so that both may be operated by the same foot of the motorman. A spring 39 normally holds lever 36 against a stop 40. The spring 39 must be of sufficient strength to overcome the tension of spring 22.

In this form of my device, when the lever 36 is depressed by pressure of the motorman's heel on plate 38, link 35 is raised to such a position that the pin and slot connection will not interfere with the movement of the lever 17 between stops 19 and 20, and the operation of the system will be as above described. When, however, pressure on the heel plate is released, spring 39 will move lever 36 against stop 40, lowering link 35 to such position that the pin will contact with the end of the slot before lever 17 has been raised into contact with stop 19. This will result, when pressure on toe pedal 21 is released, in bringing the valves to lap position with a predetermined pressure, less than full pressure, in the cylinder 5.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a device of the class described, the combination with a source of fluid supply, of a pressure chamber, application and release valves controlling the flow of fluid from said source to said chamber, electromagnetic means including a pair of contacts governing the operation of said valves, a member movable between said contacts, said member cooperating with one of said contacts to control the movement of one of said valves and with the other contact to control the movement of the other valve, means biasing said member toward one of said contacts, the action of said biasing means being modified by the pressure in said chamber, yielding means biasing said member toward the other contact, and manually-operated means for varying the tension of said yielding means.

2. In a device of the class described, the combination with a source of fluid supply, of a pressure chamber, application and release valves controlling the flow of fluid from said source to said chamber, electromagnetic means including a pair of contacts governing the operation of said valves, a member movable between said contacts, said member cooperating with one of said contacts to control the movement of one of said valves and with the other contact to control the movement of the other valve, means biasing said member toward one of said contacts, the action of said biasing means being opposed by the pressure in said chamber, yielding means biasing said member toward the other contact, and manually-operated means for varying the tension of said yielding means.

3. In a device of the class described, the combination with a source of fluid supply, of a pressure chamber, application and release valves controlling the flow of fluid from said source to said chamber, electromagnetic means including a pair of contacts governing the operation of said valves, a member movable between said contacts, said member cooperating with one of said contacts to control the movement of one of said valves and with the other contact to control the movement of the other valve, a tubular gauge biasing said member toward one of said contacts, said gauge being connected with the pressure chamber, and spring means biasing said member toward the other contact, said spring means being manually variable.

4. In a device of the class described, the combination with a source of fluid supply, of a pressure chamber, application and release valves controlling the flow of fluid from said source to said chamber, electromagnetic means including a pair of contacts governing the operation of said valves, a member movable between said contacts, said member cooperating with one of said contacts to control the movement of one of said valves and with the other contact to control the movement of the other valve, means biasing said member toward one of said contacts, the action of said biasing means being modified by the pressure in said chamber, manually variable means biasing said member toward the other contact, and automatically operating means for limiting the action of said manually variable means to bring the valves to a predetermined lap position at an intermediate brake pressure.

5. In a device of the class described, the combination with a source of fluid supply, of a pressure chamber, application and release valves controlling the flow of fluid from said source to said chamber, a pair of contacts, a member movable between said contacts, two opposing forces acting on said member, one of said forces being varied by the pressure in the chamber and the other being variable by manual means, a main electric circuit including magnetic means for operating one of said valves, a branch circuit including magnetic means for operating the other valve, and a pair of relay circuits for opening and closing said main and branch circuits through the engagement of said member with said contacts.

6. In a device of the class described, the combination with a source of fluid supply, of a pressure chamber, application and release valves controlling the flow of fluid from said source to said

chamber, a pair of contacts, a member movable between said contacts, two opposing forces acting on said member, one of said forces being varied by the pressure in the chamber and the other being variable by manual means, a main electric circuit including magnetic means for operating one of said valves, a branch circuit including magnetic means for operating the other valve, a pair of relay circuits for opening and closing said main and branch circuits through the engagement of said member with said contacts, and a resistance connecting one of said relay circuits to the main circuit.

7. In a device of the class described, the combination with a source of fluid supply, of a pressure chamber, application and release valves controlling the supply fluid from said source to said chamber, electrical means for operating said valves including a pair of contacts, a member movable between said contacts, a tubular gauge connected to said member, the elasticity of said gauge biasing said member toward one of said contacts, resilient means for moving said member toward the other contact, said resilient means being sufficient to overcome the elastic biasing force of the tube, said tube being supplied with chamber pressure operating against its inherent elasticity, and manually-operated means for reducing the tension of said resilient means.

8. In a device of the class described, the combination with a source of fluid supply, of a pressure chamber, application and release valves controlling the supply of fluid from said source to said chamber, a main circuit including a source of E. M. F. for actuating one of said valves, a branch circuit for actuating the other valve, a pair of contacts, a relay circuit connected to one of said contacts for opening and closing the main circuit, a second relay circuit connected to the other contact for opening and closing the branch circuit, a member movable between the contacts, and two opposing forces acting an said member, one of said forces being varied by the pressure in the chamber and the other being varied by manual means.

O. C. WRIGHT.