Jan. 3, 1928. 1,654,602

J. S. REYNOLDS

CONTROL VALVE

Filed Feb. 7, 1924

Fig. 1

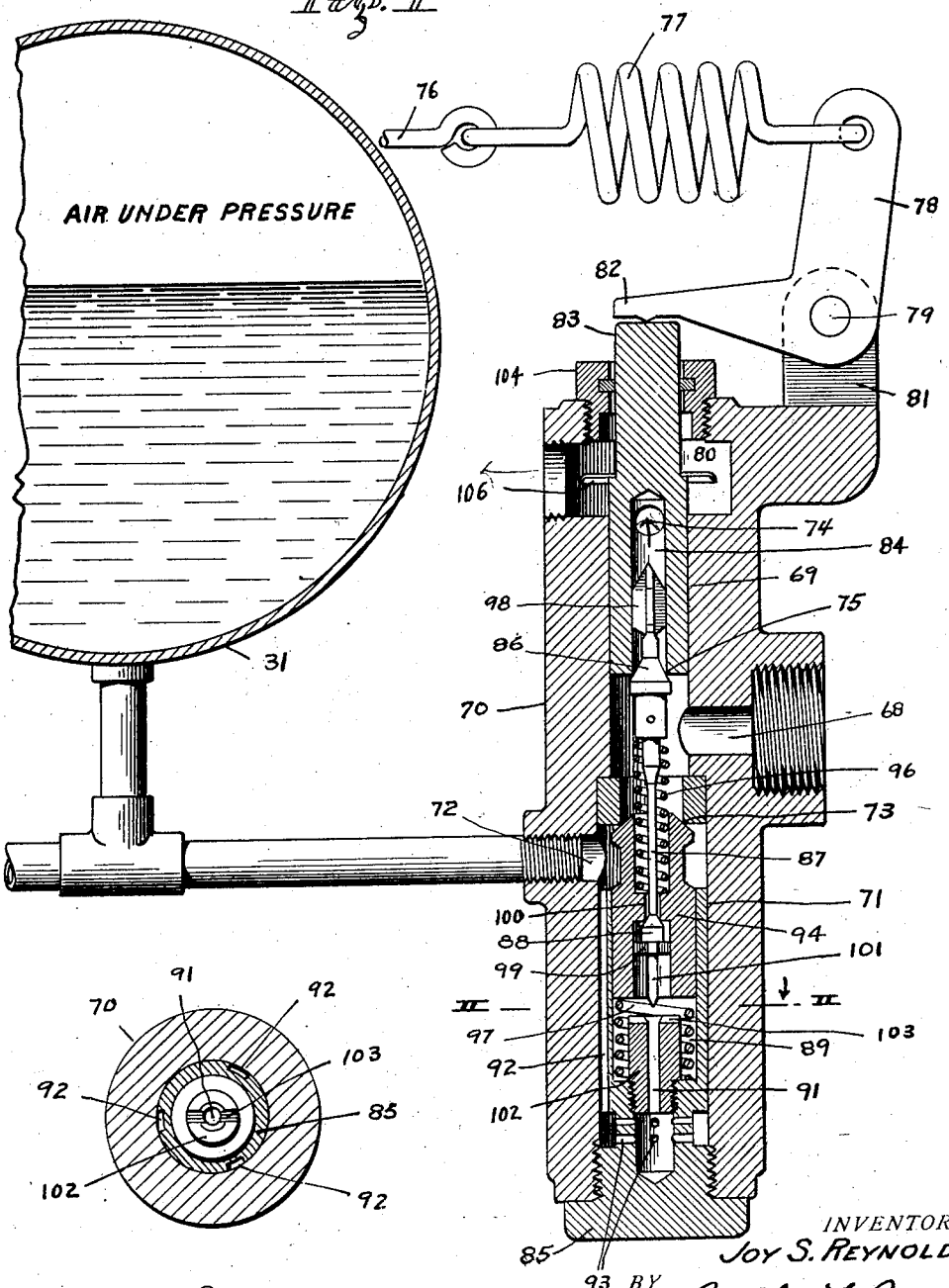


Fig. 2.

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UNITED STATES PATENT OFFICE.

JOY S. REYNOLDS, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-HALF TO JOY S. REYNOLDS, OF DETROIT, MICHIGAN, AND ONE-HALF TO CHARLES A. BALCOLM, OF SAN FRANCISCO, CALIFORNIA.

CONTROL VALVE.

Application filed February 7, 1924. Serial No. 691,223.

The present invention is an improved control valve and is an improvement on a device shown in Letters Patent of the United States, Number 1,474,164, issued to me on November 13th, 1923.

The objects of this invention include:

(1) The provision of a control valve, for interposition on a circuit wherein liquid pressure is accumulated and intermittently applied to work, which will quickly respond to manual control in one direction and as quickly respond to pressure equalization to move in the opposite direction.

(2) A control valve of the character described which is so constructed that the working parts may be withdrawn from a bore as a unit.

(3) A control valve in which the moving parts are mounted between resilient members in floating relation whereby the parts are free to accommodate themselves to their respective seats or co-acting parts, thus providing a permissible limit of range and avoiding necessity of adjustment.

In this specification and the annexed drawings, the invention is illustrated in the form considered to be the best, but it is to be understood that the invention is not limited to such form because it may be embodied in other forms, and it is also to be understood that in and by the claims following the description it is desired to cover the invention in whatever form it may be embodied.

In the accompanying drawing, Figure 1 is a vertical central cross-section of my invention, and

Fig. 2 is a section of Fig. 1 taken on line II—II.

Referring to the drawing the numerals indicate the respective parts

At 69, I show a bore which is a reduced portion of a bore 71 in a valve casting 70. The bore 71 is threaded to engage a plug 85. At 68, I show a discharge port through which liquid passes to a work line and at 72 I show an intake passage through which liquid under pressure is admitted to bore 71 from a pressure tank 31.

The function of the control valve is to admit liquid under pressure from tank 31 past a valve seated at 73 to a brake line connected to outlet 68, and under conditions release said liquid from said brake line by return through passage 68, thence past a valve seated at 75, through a port 74, to the source of supply, thus completing the liquid circuit.

The control valve is manipulated to admit liquid pressure from tank 31 to the brake line by a pull rod 76 connected at one end to a foot pedal, hand lever or the like, and at the opposite end to one end of an elbow lever 78 pivoted at 79 in a bracket 81 on the casting 70. The end 82 of the elbow lever 78 remote from spring 77 is designed to depress a plunger 83 slidable in bore 69. This plunger is centrally bored to form a passage 84 communicating with a port 74 and the lower end of said bore forming the valve seat 75. The downward movement of plunger 83 is communicated to a valve 86 secured to a stem 87 integral with a valve 88, which last named valve is thus unseated. The unseating of this valve releases liquid from a chamber 89 faster than it can be replaced through a passage 91 which connect with passage 72 through fluted passages 92 and ports 93, thus releasing pressure behind a piston 94.

The cross-sectional area of piston 94 is greater than that of the seat 73, therefore the valve will be forced from its seat by pressure at 72, and liquid will pass seat 73, through passage 68, to the brake line, until pressure in the brake line rises to a degree at which the pressure on the inner end of the plunger 83, transmitted through elbow lever 78, will overcome the urge of spring 77.

When the spring 77 is thus overcome, the stretch of said spring permits the rise of plunger 83. Valve 86 follows the plunger up, being urged to its seat 75 by pressure, and also by a spring 96. As the stem 87 of valve 88 is connected to valve 86, it will rise at the same time and seat, preventing further passage of liquid from chamber 89.

Pressure is promptly accumulated in

chamber 89, through passage 91, ports 93, and passages 92, from passages 72, thereby balancing pressure on the opposite ends of piston 94.

When so balanced, this piston 94, urged by a spring 97 and the flow of liquid at 72, seats and closes communication between pressure tank and the brake line connected to passage 68. So long as the tension on spring 77 remains unchanged, the pressure in the brake line acting on plunger 83 will balance the effect of spring 77, and said pressure will be retained in said line, maintaining the brake application.

To effect a release of said brakes, a backward movement of the foot pedal relieves the tension of the spring 77, through pull rod 76, lessening the resistance of arm 82 on plunger 83. At this time, pressure in the brake line acting on the lower end of said plunger 83 lifts it and unseats valve 86 (because valve 88 serves as a stop limiting the upward movement of valve 86,) releasing liquid from the brake line through passage 84 and port 74 to a chamber 80 connected to the source of supply. This release takes place, however, only until such time as the pressure in the brake line (acting on the bottom of plunger 83) balances with the remaining tension on spring 77. It will be seen that the release of pressure on the brakes will be directly proportionate to the releasing movement of the foot pedal by the driver.

The same is true when brakes are applied. A forward pull on rod 76 increases tension of springs 77 and brakes will be applied until pressure in the line balances said tension, the degree of said application being directly proportionate to the travel of the foot pedal.

This makes my invention adaptable to conventional automobile controls, as the action, re-action and resistance correspond to that produced by mechanical means.

The valve 86 is provided with a reduced portion which extends into bore 84 and is fluted as indicated at 98 to form a guide for centering the valve.

The valve 88 is also provided with a similar fluted guide 99 for the opposite end of the valve stem.

It will be seen that the speed with which piston 94 moves (to seat or unseat valve at 73) depends on the proportionate cross-sectional area of the bore 91 and of a bore 100 in said piston.

Bore 100 must be the larger to effect an opening. The greater the difference in these bores, the quicker will be the opening action, but the closing action would be correspondingly slower if other means were not provided. As quick action is required in both opening and closing operations, I provide means for diminishing temporarily the area of bore 91 and automatically increasing said area in time to effect quick operation when needed.

At 101, I show a pin which is preferably an extension of the valve stem 87 which is tapered at its outer end and adapted to enter the bore 91. This pin is a very important feature of my invention as it coacts with the manual control to effect a sudden brake application and is automatically operated to effect a sudden closing of valve at 73, in response to pressure equalization. I will now describe the action of this member under both conditions:

Assuming that a sudden brake application is to be made, a sudden pull on rod 76 will depress arm 82 of the elbow lever, and this depresses plunger 83, valve 86 (in contact therewith), forcing pin 101 into bore 91, thereby greatly diminishing the area of said bore. The downward movement of the valve stem unseats valve 88, opening passage 100. At this time, pressure at 72 forces piston 94 downward and liquid is displaced quickly behind said piston through passage 100.

As the length of pin 101 is not sufficient to keep passage 91 closed when valve 88 returns to its seat, it will be seen that, when pressure in the brake line equalizes with the tension of spring 77, the full area of passage 91 will be effective to cause a sudden rise of piston 94 to seat 73.

I prefer to form passage 91 in a separate member 102 threaded into plug 85. At 103, in said member, I show a screw driver slot, which also serves to prevent a close of communication between passage 91 and chamber 89 when the piston 94 abuts the member 102. This prevents any possibility of fluid lock.

It will be seen that all the moving parts may be withdrawn from the valve casting 70 by removing plug 85 and a plug 104. The plug 104 serves as a stop for engaging a shoulder 106 on plunger 83 and limiting the upward movement thereof.

I claim:

1. A control valve comprising inlet and discharge chambers, said chambers connected by a passage, a main valve adapted to control said passage, said valve mounted on and moved by a piston, an auxiliary valve adapted to control a channel from the discharge to a space behind said piston, a subsidiary valve mounted in the piston and adapted to control a waste from the discharge, said subsidiary valve adapted by its movement to operate said auxiliary valve, all of said valves being so arranged in said passage that they may be withdrawn from one end of said passage as a unit.

2. A control valve comprising inlet and discharge chambers, said chambers connected by a passage, a main valve adapted to control said passage, said valve mounted on and moved by a piston, an auxiliary valve

adapted to control a channel from the discharge to a space behind said piston, a subsidiary valve mounted in the piston and adapted to control a waste from the discharge, said subsidiary valve adapted by its movement to operate said auxiliary valve, and said auxiliary valve adapted to serve as a stop for limiting the travel of said subsidiary valve, all of said valves being so arranged in said passage that they may be withdrawn from one end of said passage as a unit.

In testimony whereof I affix my signature.

JOY S. REYNOLDS.