N. FILIBERTO.

STEAM PRESSURE REDUCING AND CONTROLLING VALVE.

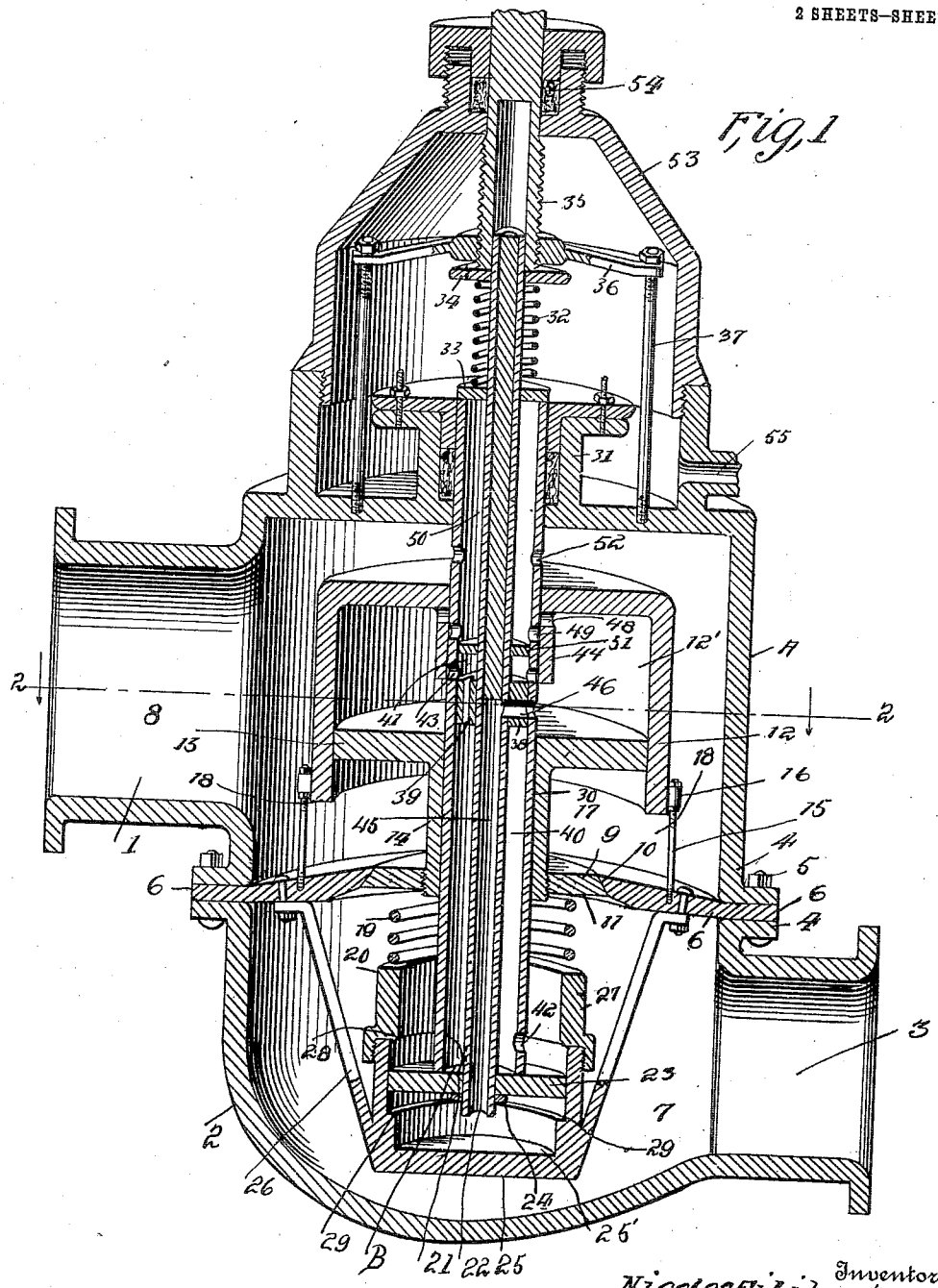
APPLICATION FILED FEB. 25, 1910.

971,435.

Patented Sept. 27, 1910.

2 SHEETS—SHEET 1.

Fig. 1



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2 SHEETS—SHEET 2.

Fig. 2.

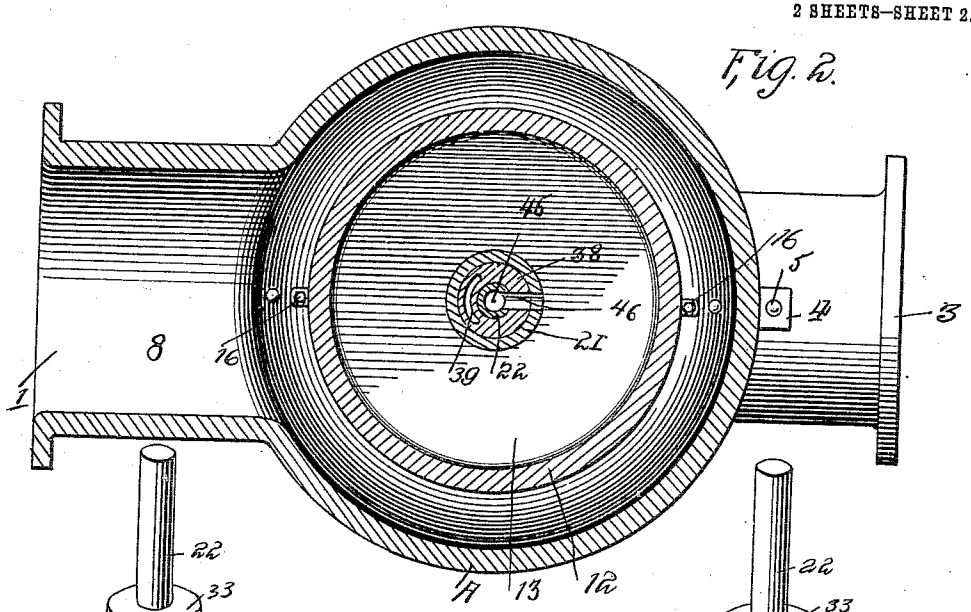


Fig. 3.

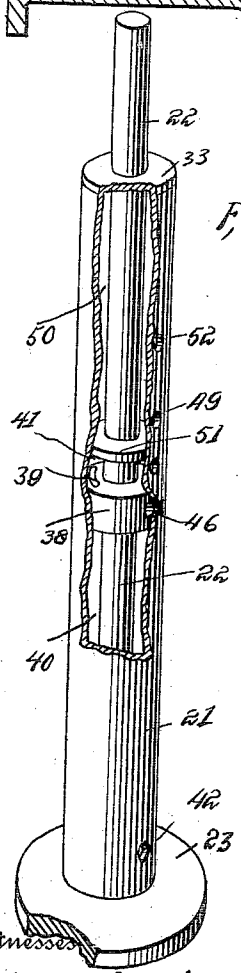
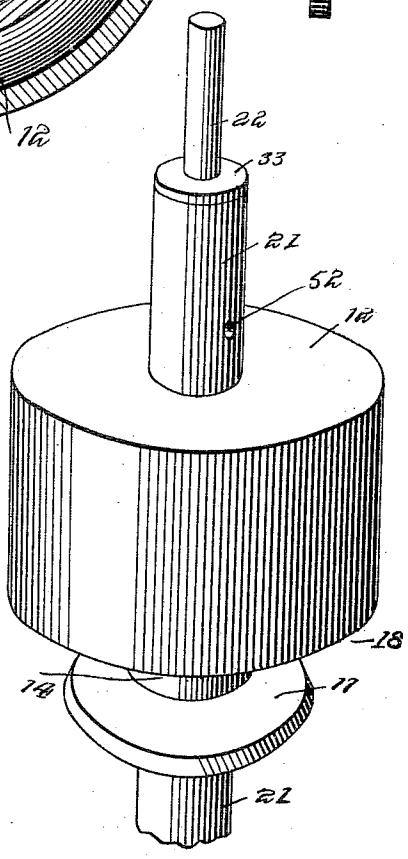


Fig. 4.



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UNITED STATES PATENT OFFICE.

NICOLAS FILIBERTO, OF BROOKLYN, NEW YORK.

STEAM-PRESSURE REDUCING AND CONTROLLING VALVE.

971,435. Specification of Letters Patent. Patented Sept. 27, 1910.

Application filed February 25, 1910. Serial No. 546,020.

To all whom it may concern:

Be it known that I, NICOLAS FILIBERTO, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Steam-Pressure Reducing and Controlling Valves, of which the following is a specification.

This invention relates to a control and reducing valve adapted to be used for steam or other elastic fluid, and the primary object of the invention is to provide a valve of this character in which the movable parts are extremely sensitive to the pressure of the fluid so that a nice adjustment can always be effected and yet the possibility of leakage around the moving parts is reduced to a minimum.

Another object of the invention is to improve and simplify the construction and operation of devices of this character so as to be comparatively simple and inexpensive to manufacture and keep in repair, reliable and efficient in use and readily adjusted for operating it at different pressures.

With these objects in view, and others as will appear as the description proceeds, the invention comprises the various novel features of construction and arrangement of parts which will be more fully described hereinafter and set forth with particularity in the claims appended hereto.

In the accompanying drawings, which illustrate one embodiment of the invention; Figure 1 is a perspective sectional view of the reducing valve, the section being taken longitudinally thereof. Fig. 2 is a horizontal section on line 2—2 of Fig. 1. Fig. 3 is a perspective view of the spring weighted balance valve for controlling the pressure acting on the main piston. Fig. 4 is a perspective view of the main piston and valve.

Similar reference characters are employed to designate corresponding parts throughout the several views.

Referring to the drawings, A designates the body of the valve which has a hollow cylindrical structure provided at one side with an outlet port 1 and open at its bottom. Secured to the bottom of the casing is a hollow bottom section 2, which has an inlet port or passage 3. The body and bottom sections are both provided with annular flanges 4, between which is clamped by bolts 5 a diaphragm 6, which divides the valve casing into separate chambers 7 and 8, the diaphragm being dished upwardly and having a central opening at 9. The diaphragm at the opening is formed into a seat 10, with which engages a valve disk 11 that controls the passage of fluid from the chamber 7 to the chamber 8.

Arranged within the body section 1 of the casing and supported over and on the diaphragm 6 is a cylinder 12, in which is mounted a main piston 13, the same being formed with a depending tubular portion 14, on which the valve disk 11 is threaded. The upper end of the cylinder is steam tight and the lower end is open, the piston 13 being movable freely back and forth adjacent the open end of the cylinder. The cylinder 12 is supported on the diaphragm by threaded rods or screws 15, anchored at their lower ends on the diaphragm and having their upper ends secured in lugs 16 on the cylinder. It will thus be seen that the cylinder is supported separately from and independently of the body section of the casing. An annular chamber 17 is formed between the piston 13 and valve 11 that communicates with the chamber 8 through an annular port or opening 18 formed between the bottom edge of the cylinder 12 and top surface of the diaphragm. The piston 13 and valve 11 constitute a unitary body which is moved by fluid pressure acting on different areas of said structure. The bottom surface of the valve 11 is exposed to the full inlet pressure and is smaller than the area of the top face of the piston, which is exposed to the steam at a pressure that determines the open position of the valve and the under side of the piston is of less area than the upper side and is exposed to the fluid at the discharge or outlet pressure, so that the combined pressure of the fluid acting on the under side of valve 11 and under side of the piston will be balanced by the pressure of the fluid acting on the upper side of the piston 13 when the valve is open to permit fluid to pass through the apparatus at the desired pressure. The valve 11 is held normally against its valve seat in opposition to gravity by a helical spring 19,

that has its upper end bearing against the valve and its lower end resting on an abutment 20.

The opening and closing movements of the valve are controlled by a reciprocatory controlling valve designated generally by B, which consists of a hollow body or tube 21 in which is arranged a tubular rod or stem 22, which has its lower end passing through a piston 23 that is held against the lower end of the tube 21, by a nut 24 on the rod or stem, so that the parts are rigidly connected together as a unitary structure, the piston being mounted to reciprocate in a cylinder 25 that is supported in the chamber 7, by brackets 26, secured to the under side of the diaphragm 6. The cylinder 25 is closed at its bottom and has a ring 27 screwed on the upper end thereof that provides a shoulder 28, for limiting the upward movement of the piston 23, the downward movement thereof being limited by an annular shoulder 29. The ring 27 constitutes the abutment 20 for the valve seat spring 19. The controlling valve B reciprocates in the tubular portion 14 of the main piston 13, in an opening 30 in the head of the cylinder 12, and in a stuffing box 31 on the top of the body section of the casing. The upper end of the controlling valve passes out of the stuffing box and the rod 22 projects out of the tubular body 21 of the said controlling valve so as to be equipped with a weighting spring 32, which has its lower end bearing on a washer or disk 33, that closes the upper end of the tubular body 21 and through which the rod 22 passes. The upper end of the spring bears on a washer 34 disposed under an adjusting screw 35, which is threaded in a yoke 36 supported by rods 37 on the top of the body section of the casing. This screw can be turned in any suitable manner and thereby vary the tension of the spring 32 which determines the pressure to which the fluid is to be reduced. In the tubular body 21 of the controlling valve is arranged a disk 38 which has a vertical passage 39 through which the space or chamber 40 below the disks communicates with the chamber 41 above the disk, and the lower end of the chamber 40 is connected by a port 42 in the tube 21 with the inlet chamber 7. The chamber 41 is adapted to communicate by means of ports 43 with the cylinder chamber 12′. The cylinder 12 is provided with an annular wall 44 at the ported portion of the tube 21, so that the effective area of each port 43 will be determined by the position of the controlling valve with respect to the lower edge of wall 44, by which the ports are adapted to be covered or uncovered. When the ports are uncovered, the cylinder chamber 12′ is in direct communication with the inlet chamber 7 through the port 42, chamber 40, of the controlling valve, passage 39, chamber 41, and ports 43. The lower end of the rod 22 is hollow to form a passage 45, which has its upper end in communication with the chamber 12′ through a port 46, formed in the tube 22, disk 38, the tubular body 21, and the lower end of the passage 45 is in permanent communication with the chamber 25′, in the cylinder 25. It will thus be seen that fluid at the same pressure will act on the under side of the piston 23 and the upper side of the piston 13. The portion of the upper face of the piston 23, extending outwardly from the lower end of the tubular body 31, is of different area from the bottom face of the piston, but is exposed to the full inlet pressure in the chamber 7, so that this pressure combined with the tension of the spring 32, must be opposed by the pressure of the fluid in the chamber 25′ acting to urge the controlling valve upwardly and the balancing of these two pressures determines the extent to which the ports 43 will be uncovered to admit fluid to the chamber 12′ for acting on the main piston 13.

If the acting pressure on the controlling valve becomes excessive, the space of the main cylinder above the piston 13 will be cut out of communication with the inlet chamber by the ports 43 being completely closed and at the same time communication will be established between the cylinder space and the discharge port of the casing, this outlet being provided by means of ports 48 arranged in the internal boss 44 of the cylinder 12 that are adapted to communicate with ports 49 in the tubular body 21 of the controlling valve, which ports open into a chamber 50 in the controlling valve separated from the chamber 41 by a ring or disk 51 and this chamber 50 has ports 52 which communicate with the outlet or discharge chamber 8 surrounding the cylinder 12. Thus when the ports 43 are closed by the upward movement of the controlling valve, the fluid in the cylinder 12 above the piston 13 can pass out through the ports 48, 49, chamber 50, and ports 52. The pressure on the piston 13 being thus reduced while the inlet pressure is still acting on the valve 11, the latter will be closed to greater or less extent until opposing pressures acting on the controlling valve will permit the ports 43 thereof to open to such an extent that the valve carrying piston 13 will hold the valve 11 in the proper position to reduce the outlet pressure to the desired point.

The moving parts of the valve have been so designed as to permit of the greatest possible freedom of movement without undue leakage resulting. Furthermore, the arrangement is such that the tendency to leakage is reduced to a minimum owing to the fact that the difference in pressure between points where leakage is likely to occur is

made as small as possible, thus the fluid in the inlet chamber 7 might tend to leak through the tubular portion 14 of the piston to the cylinder 12, while fluid in the cylinder might tend to leak past the piston 13 to discharge chamber 8 and as the difference in pressure between the chamber 7 and cylinder space 12′ and between the latter and chamber 8 is comparatively small, there will be practically little leakage. The seat of greatest friction would be in the stuffing box 31, but to reduce this friction, it is desirable to reduce the compression of the packing to the limit and provide a chamber into which fluid might be collected if it should escape through the stuffing box and for this purpose a bell or cap 53 is secured to the top of the casing of the valve and this bell or cap is provided with a stuffing box 54 through which the adjusting screw 35 extends. The chamber inclosed by the cap 53 is provided with an exhaust pipe 55, which, when the valve is used in a steam system may lead to a condenser or discharge in the atmosphere, but when the valve is used in a refrigerating plant for the ammonia system, the pipe 55 can connect with the evaporator of the plant.

From the foregoing description taken in connection with the accompanying drawing, the advantages of the construction and of the method of operation will be readily apparent to those skilled in the art to which the invention relates, and while I have described the principle of operation of the invention, together with the device which I now consider to be the best embodiment thereof, I desire to have it understood that the apparatus shown is merely illustrative and that such changes may be made when desired as are within the scope of the claims.

What I claim as new and desire to secure by Letters Patent is:—

1. A fluid pressure reducing and controlling device of the class described comprising a casing, a ported diaphragm therein dividing the casing into inlet and outlet chambers, a main piston mounted in the outlet chamber and having one end open, a valve adapted to seat on the diaphragm, a piston in the cylinder connected with the valve, a secondary cylinder in the inlet chamber, a piston therein, a controlling valve connected with the last mentioned piston, means for admitting fluid to the main cylinder through the controlling valve, and ports in the controlling valve arranged to be covered and uncovered by the movement of such valve for admitting fluid from the main cylinder to the secondary cylinder whereby the movement of the controlling valve controls the pressure of the fluid in the main cylinder and thereby determines the opening of the first mentioned valve.

2. A fluid pressure reducing and controlling device of the class described comprising a casing having inlet and outlet chambers, a pressure reducing valve controlling communication between the chambers, a main cylinder in the outlet chamber having one end closed and the other end opening into the chamber, a piston in the cylinder and connected with the valve and having one side exposed to the pressure in the outlet chamber, a controlling valve through which fluid passes from the inlet chamber to the cylinder at a pressure determined by the movement of the controlling valve, a secondary cylinder in the inlet chamber, a piston in the secondary cylinder connected with the controlling valve and having one side exposed to the inlet pressure, said controlling valve having means for connecting the main with the secondary cylinder whereby the opposing pressures on the piston in the secondary cylinder causes movement of the controlling valve, and means for weighting the controlling valve.

3. A fluid pressure reducing and controlling device of the class described comprising a casing, a diaphragm dividing the casing into inlet and outlet chambers, said diaphragm having a port, a main valve arranged to open and close the port, a main cylinder supported on the diaphragm and having an open end spaced from the latter, a piston in the cylinder connected with the valve to move the same, a secondary cylinder disposed in the inlet chamber and having an open end spaced from the diaphragm, a weighted controlling valve through which fluid passes from the inlet to the main cylinder and thence to the secondary cylinder, and a piston in the secondary cylinder acted on by fluid in the inlet chamber and fluid from the main cylinder to determine the position of the controlling valve and hence the pressure of the fluid acting in the main cylinder to open the main valve.

4. A fluid pressure reducing and controlling device of the class described comprising a casing, a diaphragm dividing the casing into inlet and outlet chambers and provided with a port, a main valve controlling the port, a main cylinder in the outlet chamber, a secondary cylinder in the inlet chamber, said cylinders having open ends nearest the diaphragm, means for supporting the cylinders on the diaphragm, a piston in the main cylinder connected with the main valve, a spring interposed between the main valve and secondary cylinder tending to seat the former, a piston in the secondary cylinder having one side exposed to the inlet pressure, a controlling valve connected with the last mentioned piston and having means for admitting fluid from the inlet chamber to the main cylinder and from the latter to the secondary cylinder whereby the pressure

of fluid in the main cylinder is controlled, and means for weighting the controlling valve.

5. A fluid pressure reducing and controlling device of the class described comprising a casing divided into inlet and outlet chambers, a main valve controlling communication between the chambers, a main cylinder in the outlet chamber, a piston in the cylinder connected with the valve, a secondary cylinder in the inlet chamber, a reciprocatory controlling valve having a chamber which is in permanent open communication with the inlet chamber and in controllable communication with the main cylinder and also having a passage permanently communicating with both cylinders, a piston in the secondary cylinder connected with the valve for actuating the same by the fluid from the second passage opposing the fluid in the inlet chamber, and means for weighting the controlling valve.

6. A fluid pressure reducing and controlling device of the class described comprising a casing divided into inlet and outlet chambers, a main valve controlling communication between the chambers, a main cylinder in the outlet chamber, a piston in the cylinder connected with the valve, a secondary cylinder in the inlet chamber, a reciprocatory controlling valve having a chamber which is in permanent open communication with the inlet chamber and in controllable communication with the main cylinder and also having a passage permanently communicating with both cylinders, a piston in the secondary cylinder connected with the valve for actuating the same by the fluid from the second passage opposing the fluid in the inlet chamber, means for weighting the controlling valve, and means for controlling the main cylinder when the controlling valve is in a given position for releasing the pressure in the main cylinder.

7. A fluid pressure reducing and controlling device of the class described comprising a casing divided into inlet and outlet chambers, a main valve controlling communication between the chambers, a main cylinder in the outlet chamber, a piston in the cylinder connected with the valve, a secondary cylinder disposed in the inlet chamber, a spring tending to hold the main valve closed, a controlling valve extending through the main valve and from one cylinder to the other and including a controllable passage connecting the inlet chamber with the main cylinder for admitting fluid to the latter and also including a passage connecting the main cylinder with the secondary cylinder for admitting fluid to the latter, said main and controlling valves being independently slidable, and means for weighing the controlling valve.

8. A fluid pressure reducing and controlling device of the class described comprising a casing divided into inlet and outlet chambers, a main valve controlling communication between the chambers, a main cylinder in the outlet chamber, a piston in the cylinder connected with the valve, a secondary cylinder disposed in the inlet chamber, a spring tending to hold the main valve closed, a controlling valve extending through the main valve and from one cylinder to the other and including a controllable passage connecting the inlet chamber with the main cylinder for admitting fluid to the latter and also including a passage connecting the main cylinder with the cylinder for admitting fluid to the latter, said main and controlling valves being independently slidable, means for weighting the controlling valve, and means for connecting the main cylinder with the outlet chamber through the controlling valve when the latter is in a predetermined position.

9. A fluid pressure reducing and controlling device of the class described comprising a casing divided into inlet and outlet chambers, a main valve controlling communication between the chambers, a main cylinder in the outlet chamber, a piston in the cylinder connected with the valve, a secondary cylinder disposed in the inlet chamber, a spring tending to hold the main valve closed, a controlling valve extending through the main valve and from one cylinder to the other and including a controllable passage connecting the inlet chamber with the main cylinder for admitting fluid to the latter and also including a passage connecting the main cylinder with the secondary cylinder for admitting fluid to the latter, said main and controlling valves being independently slidable, means for weighting the controlling valve, said controlling valve extending out of the casing, a stuffing box through which the controlling valve reciprocates where it projects under the casing, and a cap including the stuffing box for collecting fluid escaping therethrough.

10. The combination of a casing, a diaphragm dividing the casing into inlet and outlet chambers and provided with a port, a cylinder in the outlet chamber supported on the diaphragm and having an open end adjacent to those spaced from the latter, a main valve for opening and closing the port, a piston in the cylinder connected with the main valve, a secondary cylinder in the inlet chamber closed at one end and open at the other, means for supporting the secondary cylinder on the diaphragm, a piston in the secondary cylinder, means in the secondary cylinder for limiting the movement of the piston therein, a spring disposed between the secondary cylinder and main

valve for seating the latter, a reciprocatory controlling valve passing through the main valve and the main cylinder and extending from the secondary cylinder to a point outside the casing, said controlling valve being provided with a passage terminating in ports communicating with the inlet chamber and main cylinder, and also provided with a passage for connecting the main cylinder with the secondary cylinder, means in the main cylinder for controlling the opening and closing of the adjacent port of the first mentioned passage, means for connecting the main cylinder with the outlet chamber when the controlling valve is in a given position, a spring acting on the exterior end of the controlling valve for weighting the same, and means for adjusting the spring.

In testimony whereof I affix my signature in presence of two witnesses.

NICOLAS FILIBERTO.

Witnesses:

OTTO AHL,

GIUSEPPE CAMBONI.