

Dec. 23, 1930.

P. S. RUSSEL

1,786,402

REGULATOR

Filed Jan. 10, 1929

2 Sheets-Sheet 1

Fig. 1.

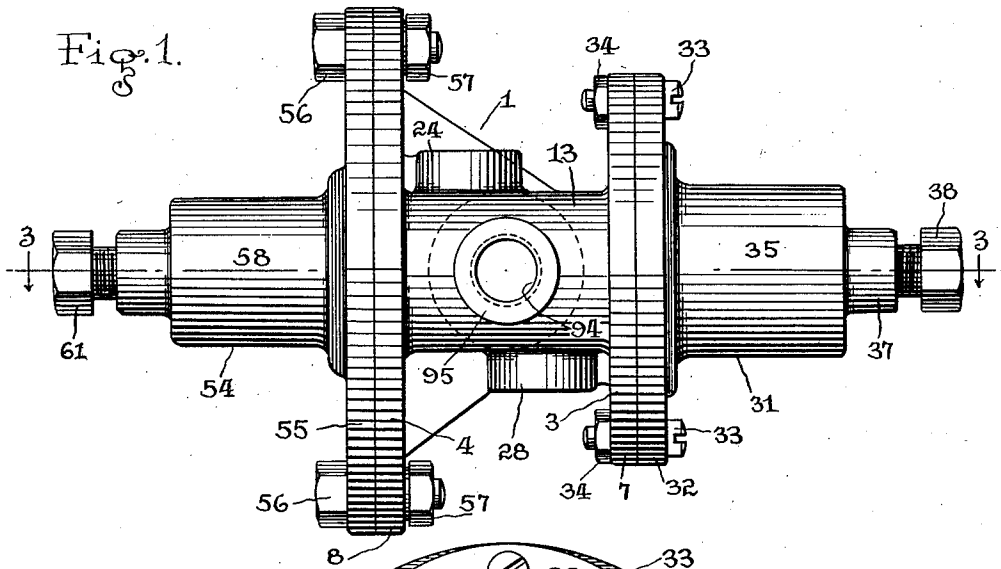
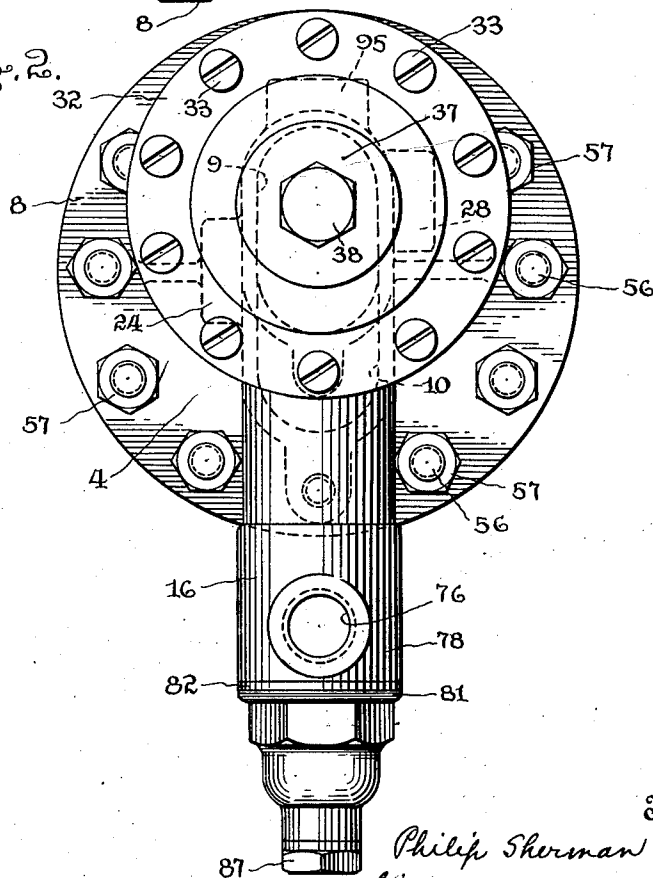


Fig. 2.



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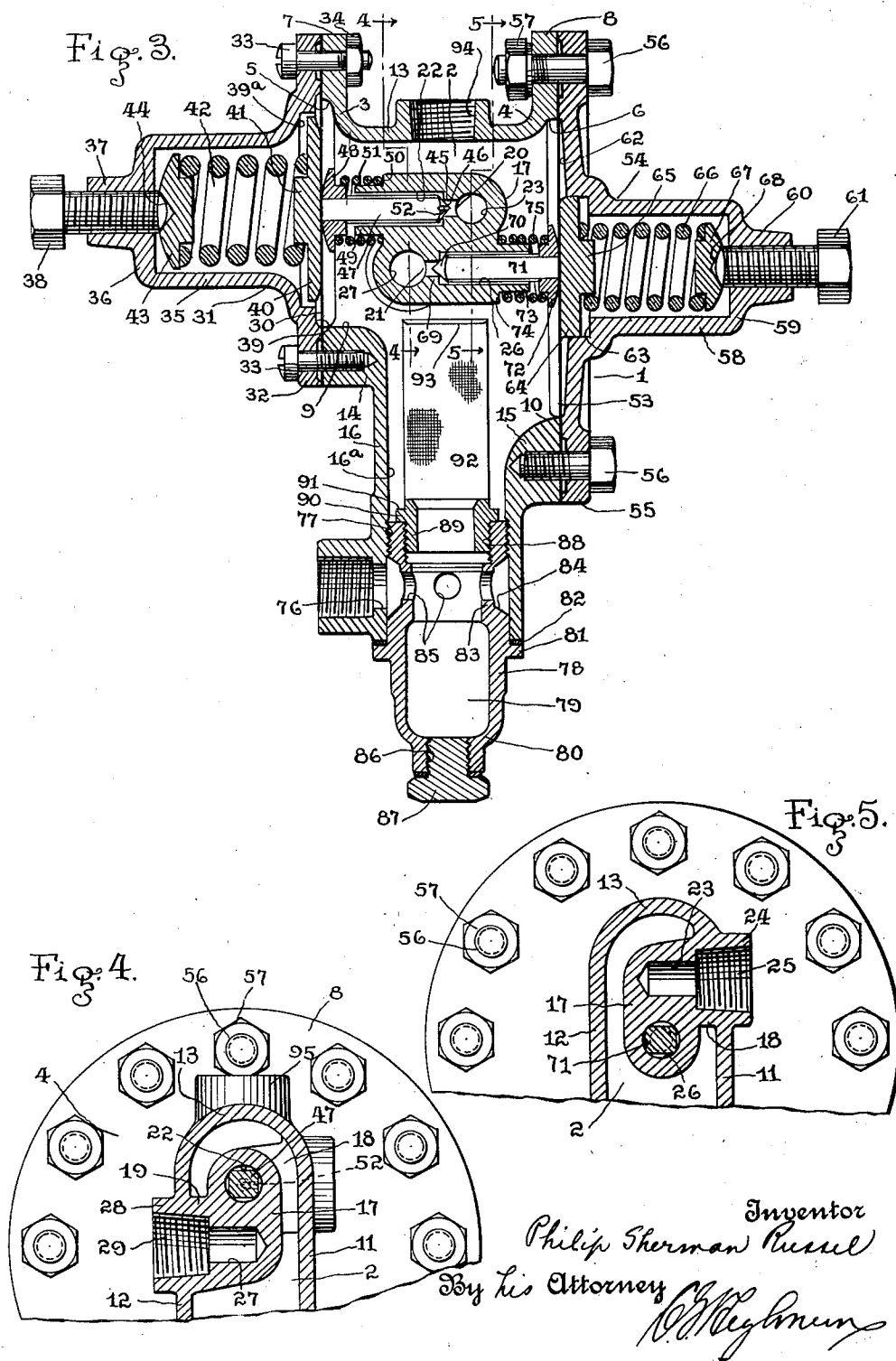
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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REGULATOR

Application filed January 10, 1929. Serial No. 331,655.

My invention relates to new and useful improvements in regulators, and more particularly to a regulator for maintaining the pressure of delivered liquid between certain minimum and maximum predetermined limits.

An object of my invention is to provide a device which is of simple construction and efficient and certain in operation.

Another object is to provide a device which will prevent delivery of liquid from a pressure means below a predetermined minimum pressure and will prevent delivery above a predetermined maximum pressure by automatically relieving the pressure on the liquid above the maximum.

Another object is to provide a pressure regulating device which will permit escapement of fluid at relatively low pressures and in quantities materially under that at which the device is designed to operate.

The invention consists in the improved construction and combination of parts, to be more fully described hereinafter, and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings, to be taken as a part of this specification, I have fully and clearly illustrated a preferred embodiment of my invention, in which drawings—

Figure 1 is a top plan view of the regulator embodying my invention;

Fig. 2 is a view in end elevation, looking from the right toward the left of Fig. 1;

Fig. 3 is a view in vertical central section on the line 3—3 of Fig. 1;

Fig. 4 is a detail view on the line 4—4 of Fig. 3, and

Fig. 5 is a detail view on the line 5—5 of Fig. 3.

Referring to the drawings by characters of reference, 1 designates, generally, the casing of my regulator having an internal chamber 2 and substantially circular, parallel and vertical end walls 3, 4 which are preferably of unequal diameters and tangent at their top edges to a horizontal plane. In the walls 3, 4 are outwardly facing, substantially cylindrical recesses 5, 6, which are concentric with their respective walls 3, 4, and therefore the centers of the recesses 5, 6 are offset

vertically. The recesses 5, 6 provide surrounding, parallel, annular flanges 7, 8, respectively. Through the end walls 3, 4 are opposite, substantially vertical, elongated apertures 9, 10, respectively, which are of substantially equal widths but of unequal heights or lengths, the lengths being substantially equal to the diameters of their respective recesses. Extending between the end walls 3, 4 from the marginal edges of the apertures 9, 10 are side walls 11, 12, a top wall 13, which joins the side walls 11, 12, and a bottom wall comprising horizontally and vertically spaced bottom wall portions 14, 15. Depending from the side walls 11, 12 and bottom wall portions 14, 15, is a hollow boss 16 having a vertical bore or passage 16^a therethrough which opens at its upper end into the chamber 2 between the side walls 11, 12. Within the chamber 2 is a block member 17 which is substantially square in cross-section in a plane parallel to walls 11, 12, and the center point of which is substantially in the plane of the lines of centers of the recesses 5, 6, and also substantially midway vertically therebetween. The member 17 is preferably spaced from the walls of the casing 1 and is joined thereto and supported therefrom by substantially cylindrical bosses 18, 19, which extend oppositely from diagonally opposite top and bottom corners of member 17 to the side walls 11, 12, respectively. The longitudinal center lines of the bosses or supporting members 18, 19 are preferably substantially in the horizontal planes through the centers of recesses 5, 6, respectively. Through the block member 17 and bosses 18, 19, are horizontal, vertically spaced passageways 20, 21, respectively. The passageway 20 comprises a passage 22 which opens into the chamber 2 concentric with and adjacent to recess 5, and which extends into the block 17 where it communicates with the inner end of a transverse passage 23 which extends through the boss 18 and the side wall 11, where it is preferably surrounded by a flange 24 which is internally threaded, as at 25, for connection to a conduit or piping, not shown. The passageway 21 comprises a passage 26 which opens into the chamber

2 concentric with and adjacent to recess 6, and which extends into the block member 17 where it communicates with the inner end of a transverse passage 27 which extends through boss 19 and the side wall 12 where it is preferably surrounded by a flange 28 which is internally threaded, as at 29, for connection to a conduit or piping, not shown.

The recess 5 is closed by a diaphragm member 30 which seats at its periphery on the flange 7, and is sealed thereto by a housing member 31 having an annular flange 32 which overlies the edge of diaphragm member 30 and the flange 7. The flanges 7 and 32 and the member 30 are tightly clamped together by bolts 33 and nuts 34, or the like, which are passed or threaded through aligned apertures in the flanges and member. The body 35, which is hollow, of the housing member 31, is preferably cylindrical and coaxial with the passage 22, the outer end of the body 35 being closed by an end wall 36 having an external boss 37. Threaded through the boss 37 and wall 36 is an adjustment member 38, preferably a cap screw, for a purpose to be described. The housing member 31 has a cylindrical recess 39 which faces the recess 7, and which is of substantially equal diameter therewith. In the body 35 is a recess 39^a concentric with and within recess 39 in which is an axially movable diaphragm actuating member 40, preferably a circular plate member, which seats against the diaphragm member 30 and has, on its rear face, a boss 41. Bearing against the rear face of member 40 is a resilient means 42, under compression, preferably a coil spring, which is supported by the boss 41. The outer or free end of this spring means 42 is provided with a follower member 43 having a recess 44 in its outer face, in which seats the inwardly projecting end of the cap screw 38.

The passage 22 is constricted, as at 45, adjacent its communication with passage 23 to form a valve seat which cooperates with a valve 46 having a stem 47 which is preferably polygonal in transverse cross-section, see Fig. 4, so that the passage 22 serves as a guide means for reciprocation of the valve to and from its seat. The stem 47 extends outward beyond the block member 17 and into engagement with the diaphragm member 30 where it is provided with a substantially circular surrounding abutment member 48 rigidly secured thereto. Extending from the block member 17 is a sleeve 49 which surrounds stem 47, providing an annular shoulder 50 and serving as a guide means. Positioned between the shoulder 50 and the member 48, is a resilient means 51, under compression, preferably a coil spring, which normally acts to move the valve 46 from its seat 45. The spring means 51 surrounds the guide sleeve 49 and is supported thereby for com-

pression and expansion. The valve 46 is constructed to permit leakage past the seat 45, and I preferably accomplish this by providing the valve with a shallow, longitudinal groove 52.

The recess 6 is closed by a diaphragm member 53 which seats at its periphery on the flange 8 and is sealed thereto by a housing member 54 having an annular flange 55 which overlies the edge of member 53 and the flange 8. The flanges 8 and 55 and the member 53 are clamped tightly together by bolts 56 and nuts 57, or the like, which are passed or threaded through aligned apertures in the flanges and member. The body 58, which is hollow, of the housing member 54, is preferably cylindrical and coaxial with the passage 26, the outer end of the body 58 being closed by an end wall 59 having an outward projecting boss 60. Threaded through the boss 60 and wall 59 is an adjustment member 61, preferably a cap screw, for a purpose to be described. The housing member 54 has a cylindrical recess 62 which is slightly concave and faces the recess 8, and which is of substantially equal diameter therewith. In the body 58 is a cylindrical recess 63 concentric with and within the recess 62, in which is an axially movable diaphragm actuating member 64, preferably a circular plate member, which seats against the diaphragm member 53 and has on its rear face a boss 65. Bearing on the rear face of the member 64 is a resilient means 66, under compression, preferably a coil spring, which is supported by the boss 65. The outer or free end of the spring means 66 is provided with a follower member 67 having a recess 68 in its outer face, in which seats the inwardly projecting end of the cap screw 61.

The passage 26 is constricted, as at 69, adjacent its communication with passage 27 to form a valve seat which is substantially in the plane of seat 45 and which cooperates with a valve 70 having a stem 71 which is preferably polygonal in transverse cross-section, see Fig. 5, so that the passage 26 serves as a guide means for reciprocation of the valve to and from its seat. The stem 71 extends outward beyond the block member 17 and into engagement with the diaphragm member 53, where it is provided with a substantially circular surrounding abutment member 72 rigidly secured thereto. Extending from the block member 17 is a sleeve 73 which surrounds stem 71, providing an annular shoulder 74 and serving as a guide means. Positioned between the shoulder 74 and the abutment member 72, is a resilient means 75, under compression, preferably a coil spring, which normally acts to move the valve 70 from its seat 69. The spring means 75 surrounds the guide sleeve 73 and is supported thereby for compression and expansion.

Through the side wall of the depending

boss 16 is an inlet aperture 76 which opens into passage 16^a and has an internally threaded nipple for attachment to a conduit or piping, not shown. Above the aperture 76, the passage 16^a is internally threaded, as at 5 77. Extending into the passage 16^a is a hollow plug member 78 having a longitudinal bore 79 opening at its upper end into passage 16^a and providing at its lower end a dirt collecting chamber having a bottom end wall 10 80. The inner end of member 78 is threaded for engagement with the threads 77. Surrounding the plug member 78 is a circumferential flange 81 which abuts the end of the boss 16 to seal the outer end of passage 16^a. 15 A gasket 82 may be interposed between boss 16 and flange 81 to further seal the joint. Substantially in the horizontal plane of the aperture 76 the member 78 is constricted, as at 83, to provide a circumferential groove 20 84. Through the constricted portion 83 of the wall of plug member 78 are one or more apertures 85 which provide communication between the inlet 76 and the chamber 79. The 25 bottom wall 80 is preferably provided with a clean-out opening 86 which is closed by a plug 87 threaded therinto. The upper end of the plug member 78 which is open, is internally threaded, as at 88, to receive an externally threaded sleeve 89 having a circumferential flange 90 which seats on the end of the plug member 78 and provides an upwardly facing shoulder 91. Seated on the shoulder 91 and surrounding the free end of the 30 sleeve 89 in tight circumferential contact therewith, is a substantially cylindrical filter or strainer member 92, preferably a screen of fine wire mesh, the upper end of which is closed, as at 93.

Through the top wall 13 is a port 94 having an internally threaded nipple 95, to which a pressure gauge, not shown, may be attached to indicate the pressures existing in the chamber 2. The port 94 may of course be 40 closed and sealed by a plug, if it is not desired to employ a gauge.

The operation of my regulator is as follows: The inlet 76 is connected by suitable 50 piping, not shown, to a pump, or the like, for supplying liquid fuel, preferably oil, under pressure to an oil burner. The outlet 27 is connected at the nipple 28 to piping, not shown, which leads to an oil burner, such for example as is employed in firing a house- 55 heating or other boiler. The outlet 23 is connected at the nipple 24 to piping, not shown, which leads back to the liquid fuel supply tank, and is therefore a by-pass. The minimum pressure per square inch at which delivery of fuel to the burner is desired, is controlled by the adjustment member 61 which is screwed in or out to regulate the 60 force exerted by the spring means 66. The force with which the spring means 66 holds

the valve 70 to its seat 69 will be equal to the minimum pressure per square inch times the area in square inches of the diaphragm 53, and due to the large area of the diaphragm 53, the force exerted by the spring 70 means 66 will be very large, serving to compress the spring means 75 and tightly seal the outlet passageway 21. The adjustment member 38 is secured in or out to regulate the force of spring means 42 on the valve 75 46, which force is equal to the maximum desired delivery pressure per square inch times the area of diaphragm 30, and is such as to hold the valve 46 on its seat 45 for all pressures in chamber 2 below the maximum desired delivery pressure to the burner. The 80 pump may now be started and will build up pressure in the chamber 2. Should it happen that the pump has lost its prime, the groove 52 will permit the discharge of fluid to the by-pass 20, thus enabling the pump to regain its prime. When the pressure of the liquid fuel in the chamber 2 has been built up by the pump to the minimum for which the regulator and the diaphragm 53 is set, 90 as above described, then the pressure acting on diaphragm 53 will compress spring means 66, permitting spring means 75 acting on stem 71 to open the valve 70 to allow liquid fuel to be delivered through passageway 21 95 to the spray nozzle of the burner. The pressure in the delivery line and the chamber 2 will continue to build up, due to the usual restriction in the delivery line which prevents a rate of flow of fluid from chamber 2 equal to the rate of flow into the chamber 100 2. When the pressure in the chamber 2 has reached that for which the diaphragm 30 is set, then the diaphragm 30 will be moved outward, permitting spring means 51 to act 105 through stem 47 to open valve 46 to by-pass a portion of the liquid fuel back to the supply tank, thus regulating or controlling the maximum pressure at which fluid is delivered through passageway 21 to the burner. It 110 is of course understood that the valve 46 only opens sufficiently to relieve the excess pressure above the maximum desired delivery pressure. Should it be desired to clean 115 the strainer member 92, this may be readily done by unscrewing and removing the plug member 78. Any dirt which may have collected in the chamber 79 may be removed by simply unscrewing the plug 87 without removing the plug member 78. 120

The foregoing description of operation of my regulator as embodied in an oil burner system, is solely for the purpose of illustration of operation, it, of course, being understood that my regulator is equally capable 125 of other uses and embodiment in other systems.

What I claim and desire to secure by Letters Patent of the United States is:—

1. A regulator comprising a hollow casing having an internal chamber, an inlet to said chamber, a block member in said chamber, means supporting said member in said casing, a plurality of outlet passages extending through said member and said supporting means, valve seats in said passages, valves in said passages cooperable with said seats and normally seated thereon, one of said valves sealing its passage, means to permit a minimum flow through another of said passages when its valve is seated, and means responsive to the pressure in said chamber to control the opening and closing of said valves.

2. A regulator comprising a hollow casing having an internal chamber, an inlet to said chamber, a block member in said chamber, means supporting said member in said casing, a plurality of outlet passages extending through said member and said supporting means, valve seats in said passages, valves in said passages cooperable with said seats and normally seated thereon, one of said valves sealing its passage, another of said valves permitting a minimum flow through another of said passages when its valve is seated, and means responsive to the pressure in said chamber to control the opening and closing of said valves.

3. A regulator comprising a hollow casing having an internal chamber, a block member in said chamber, oppositely extending supporting means between said member and said casing and supporting said member in said chamber, oppositely extending passages in said member opening into said chamber, oppositely extending passages in said member communicating with said first-named passages and extending through said supporting means and said casing, valve seats in said first-named passages, said seats being in a substantially common plane, valves cooperating with said seats and normally seated thereon, diaphragms in said chamber responsive to predetermined pressures therein, means acting on said valves to move them from their seats when said diaphragms respond to said predetermined pressures, and an inlet to said chamber for admission of fluid under pressure.

4. A regulator comprising a hollow casing having a block member therein, bosses extending between opposite side walls of said casing and said block member and supporting said member in said casing, said bosses being horizontally and vertically offset from each other, substantially parallel horizontal passages extending through said side walls and said bosses and into said member, horizontal passages in said block member transverse to and communicating with said first-named passages and opening into said casing on opposite sides of said block member, valve seats in said passages, valve means co-

operable with said seats and responsive to predetermined pressures in said casing to regulate flow through said passages, and an inlet to said casing for admission of fluid under pressure.

5. A regulator comprising a hollow casing having substantially parallel side walls, top and bottom walls joining said side walls, said side walls terminating in annular flanges providing substantially cylindrical recesses having their axes offset, a block member in said casing, said member having substantially parallel horizontal passages extending thereinto concentric with said recesses and opening respectively toward said recesses, bosses on said member extending oppositely therefrom substantially in the horizontal planes of and transverse to said passages and joining said member to and supporting said member from the opposite side walls of said casing, each of said bosses having a passage communicating respectively with one of said first-named passages and opening outward through the side walls of said casing, valve means for said passages, diaphragms sealing said recesses, means acting through said diaphragms on said valve means to normally close said passages, said valve means opening said passages in response to pressure in said casing on said diaphragms, and an inlet to said casing for admission of fluid under pressure.

6. A regulator comprising a hollow casing having an internal chamber, a block member in said chamber, bosses on said member integral with the side walls of said casing and supporting said member in said chamber, parallel passageways extending through said block member and said bosses and leading from said chamber to the outside of said casing, valve means responsive to pressure in said chamber to control said passageways, a hollow open-ended boss depending from said casing and opening at one end into said chamber, a plug member closing the other end of said hollow boss, said hollow boss having an inlet, a passageway through said plug member establishing communication between said inlet and said chamber, and strainer means supported by said plug member and interposed between said last-named passageway and the chamber.

7. A regulator comprising a hollow casing having an internal chamber, an outlet from said chamber, valve means controlling said outlet and responsive to pressure in said chamber, said valve means permitting flow from said chamber in response to a predetermined minimum pressure, a by-pass outlet from said chamber, valve means controlling said by-pass outlet and responsive to pressure in said chamber, said second-named valve means opening in response to a predetermined maximum pressure in said chamber whereby flow through said first-named out-

let is controlled, a boss depending from said casing, a passage through said boss opening into said chamber, a plug member secured in said passage and sealed at its periphery to said boss, a longitudinal bore in said plug member opening into said passage, means closing the bottom end of said bore to provide a dirt collecting chamber in said plug, an inlet in the wall of said boss, said plug having an aperture establishing communication between said inlet and said bore, and strainer means interposed between said bore and said passage.

In testimony whereof I have hereunto signed my name.

PHILIP S. RUSSEL.