Jan. 10, 1939. P. S. RUSSEL 2,143,229

CONTROL DEVICE

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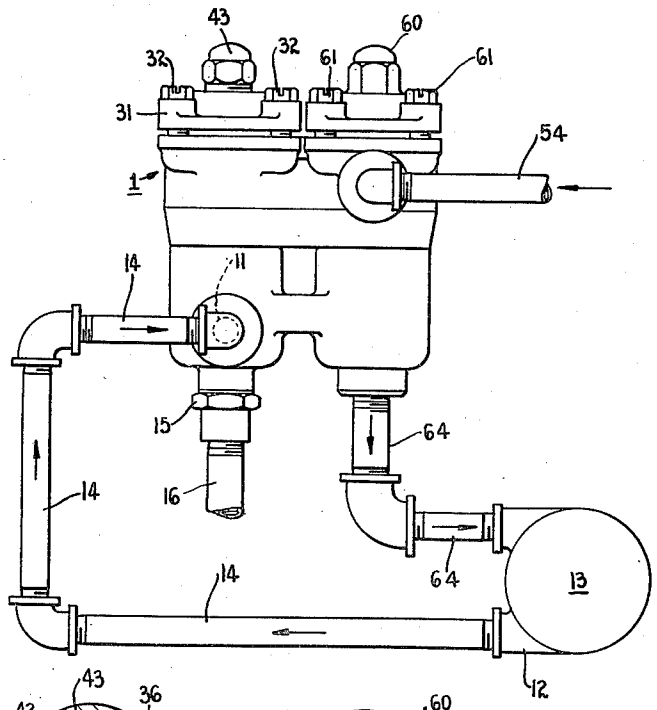


FIG.-1

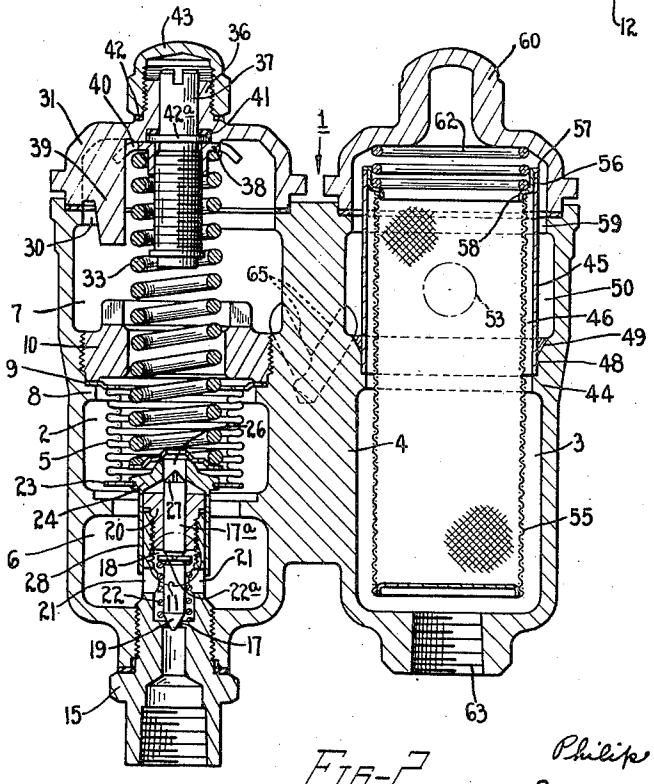


FIG.-2

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CONTROL DEVICE

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11 Claims. (Cl. 210—166)

My invention relates generally to control devices and more particularly to fluid pressure regulating devices.

One of the objects of my invention is to provide a new and improved pressure regulating device of the type for maintaining pump supplied fluid in a fluid flow line under a desired, substantially constant pressure.

Another object of my invention is to provide a pressure regulating device having a strainer unit of new and improved construction.

Another object of my invention is to provide a pressure regulating device having a new and improved arrangement of the parts thereof.

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 drawing, to be taken as a part of this specification, I have fully and clearly illustrated my invention, in which drawing—

Figure 1 is a view shown in elevation of a fluid flow system including my new and improved pressure regulating device, and

Fig. 2 is a view shown in vertical central cross section of my pressure regulating device.

Referring to the drawing by characters of reference, my pressure regulating device includes a casing, designated in general by the numeral 1, and this casing is preferably a casting having two compartments 2, 3 separated by an internal wall or partition 4 that may be integral of the casing 1. The compartments 2, 3 are preferably of general cylindrical shape and relatively laterally positioned with the axes thereof substantially parallel to each other. The compartment 2 houses fluid pressure regulating mechanism which preferably includes a metallic bellows 5 that is arranged to divide the compartment 2 into a pressure chamber 6 and a second chamber 7, the pressure chamber 6 preferably being located below chamber 7, as seen on the drawing. The bellows 5 is arranged with its longitudinal axis substantially in coaxial alignment with the longitudinal axis of the cylindrical compartment 2, or in other words is arranged so that it will expand and collapse longitudinally of compartment 2.

Preferably the casing wall defining the compartment 2 has an internal, upwardly facing annular abutment or shoulder 8 substantially midway of the ends of compartment 2 that supports the bellows 5, the bellows having one end sealed and secured to a flat, ring-like member 9 that seats on the shoulder 8. Above the shoulder 8 the casing side wall defining the upper chamber 7 is internally threaded for receiving an externally threaded tubular member 10 which at its lower end abuts an outer border portion of the bellows member 9 and tightly holds member 9 against its seat 8. The bellows 5 extends downward within the pressure chamber 6 and forms one wall of the pressure chamber to provide an expansible chamber.

The chamber 6 has an inlet 11 that may be located in the casing side wall and be connected to the outlet side 12 of a pump 13 by suitable conduits or pipes 14 and pipe fittings. The chamber 6 has an outlet that is preferably defined by a tubular fitting 15 that may be screw threaded into an aperture in the bottom wall of chamber 6. The outlet or lower end of the fitting 15 may be connected to a burner (not shown) or other means, by a conduit or pipe 16. The fitting 15 extends upwardly with its longitudinal axis coaxial of the longitudinal axis of compartment 2, or in alignment with the bellows 5, and intermediate its ends the fitting 15 has a flow restricting orifice 17. Flow through the orifice 17 is controlled by a reciprocal valve 17a that is operatively connected to the bellows 5 and is actuated thereby in accordance with slight variations in fluid pressure on the bellows to maintain a substantially constant pressure in chamber 6. The valve 17a is positioned above the orifice 17 within an enlarged bore 18 of the fitting 15, and the lower end of the valve may have a conical face 19 for cooperation with the flow restricting orifice 17 to control flow therethrough. The valve 17a projects upwardly above the upper end of fitting 15, and screw threaded into the upper end of the fitting there is preferably a tubular guide member 20 for slidably receiving and guiding the valve 17a. One or more apertures 21 may be provided in the side wall of fitting 15, above the orifice 17, for the passage of fluid from the pressure chamber 6 into the bore or valve chamber 18 for flow through the orifice 17. Disposed within the fitting 15 there is a helical coil spring 22 abutting an external annular flange 22a of the valve 17a and acting to move the valve upward away from the orifice 17.

The lower or movable end of the bellows 5 is hermetically sealed and secured to a movable end wall or plate 23, and rigidly secured to the bellows movable end wall there is a valve seat member 24 having an aperture 26 therethrough for by-passing fluid from chamber 6 into chamber 7 when the pressure in chamber 6 exceeds the desired pressure. Flow through the by-pass 26 is con-

trolled by the valve 17a which may have a conical face 27 at its upper end for cooperating with the by-pass aperture 26. The valve seat member 24 may have a tubular or sleeve-like portion 28 depending therefrom and slidably receiving the fitting 15 which thus serves as a guide for the bellows movable end wall and the member 24.

The casing top wall has an opening or aperture 30 leading into the upper chamber 7, and this opening is closed by a removable, cap-like closure member 31 that may be secured to the casing by screws 32 or by other suitable means. Disposed within the chamber 7 there is a helical coil spring 33 the lower end of which extends into the bellows 5 and abuts a movable abutment member 34, which in turn abuts the valve seat member 24 that is carried by the bellows movable end wall 23. The spring 33 is under compression and exerts a force opposing compression of the bellows 5, and the force exerted by the spring determines the pressure that will be maintained in the pressure chamber 6. The cap 31 preferably has a centrally disposed, upwardly extending, hollow boss 36 for receiving a manually operable adjustment member 37 for changing the force exerted by the spring 33. The adjustment member 37 may be of rod-like form, as shown, and may be surrounded by the coil spring 33. A lower end portion of the rod-like adjustment member 37 is preferably externally threaded, and screw-threaded thereon there is a movable abutment member 38 for the upper end of the spring 33. Preferably the cap 31 has an extended wall portion 39 that extends vertically within the cap and provides a key which is received in a slot 40 in the movable abutment member 38 to prevent rotation of the member 38 on rotating the adjustment member 37. Upon rotating the adjustment member 37 it will be seen that the abutment member 38 may be moved rectilinearly to change or regulate the force exerted by the spring 33.

Preferably the top inner wall of the cap 31 is recessed, as at 41, for receiving packing material 42 that surrounds the adjustment rod 37. The adjustment member 37 is provided with an external annular flange 42a that fits into the recess 41 and seats against the packing material 42, the packing material being compressed by the spring 33 which urges the adjustment member 37 upwardly. Preferably the adjustment member 37 projects slightly above the upper end of the boss 36 and in its upper end there may be provided a slot for receiving a tool, such as a screw driver, for rotating the adjustment member 37. Preferably the external hollow boss 36 of the cap 31 is externally threaded to receive a cap 43 for enclosing the upper end of the adjustment member 37.

The casing side wall defining the compartment 3 has an abutment or annular flange 44 that is preferably disposed substantially midway of the ends of compartment 3 and provides an internal, upwardly facing seating surface for an open ended tubular or sleeve member 45. The tubular member 45 extends longitudinally of the compartment 3 and the inner wall surface of the tubular member cooperates with the inner wall surface of the compartment 3, below the flange 44, to provide an elongated outlet or strainer chamber 46. The outer surface of a lower end portion of the tubular member 45 preferably fits snugly against an annular wall portion 48 of the side wall of compartment 3. Slightly above the seating shoulder 44 the wall portion 48 is beveled outwardly, or flares upwardly, to provide an annular space surrounding the tubular member 45 to receiver solder 49, or other suitable means for securing and sealing the tubular member around its periphery to the casing side wall. Above the sealing material 49 the side wall of compartment 3 is provided with an annular recess that surrounds the tubular member 45 and cooperates therewith, or with the outer wall surface of member 45, to provide an annular inlet chamber 50 for fluid. The inlet chamber 50 is in open communication with the upper end of the tubular member 45. An inlet 53 is provided and may open into the inlet chamber 50 through the casing side wall. The inlet 53 may be connected to a suitable source of liquid supply by a conduit 54, Fig. 1, the liquid preferably being supplied to the inlet chamber 50 by gravity.

Disposed within and extending longitudinally of the elongated outlet chamber 46 there is a tubular shaped strainer member 55 that strains liquid passing from the inlet chamber 50 to the outlet chamber 46, and the strainer 55 is removably carried by the tubular member 45. The upper end of the tubular shaped strainer 55 is open and has a tubular shaped collar 56 that has an outturned annular flange 57 at its upper end for seating on the upper end of the fixed tubular member 45. At its lower end the collar 56 preferably has an inwardly disposed, offset portion 58, or portion of reduced diameter, that fits into the upper end of the strainer 55 and is secured around its periphery thereto. The top wall of casing 1 has an opening or aperture 59 through which the upper end of the fixed tubular member preferably extends, and closing the aperture 59 there is a cap member 60 that may be rigidly secured to the casing 1 by screws 61, or by other suitable means. The offset portion 58 in the strainer collar 56 provides an upwardly facing annular shoulder or seating surface, and disposed within the cap 60 there is preferably a helical coil spring 62, having one end abutting the shoulder of collar 56 and its other end abutting the end or top wall of cap 60. The spring 62 is held under compression by the cap 60 and serves to hold the strainer collar flange 57 tightly against the upper end of the fixed tubular member 45 so that liquid will not enter the space between the strainer 55 and the inner wall surface of member 45. It will be seen that after removing the cap 60 the strainer 55 may be readily and easily removed from the casing 1. The strainer 55 extends downwardly and has its lower end disposed adjacent the bottom wall of the casing, in which wall there is provided an outlet 63 from the strainer chamber 46. As shown in Fig. 1, the outlet 63 may be connected by pipes or conduits 64 to the inlet or suction side of the pump 13. Through the casing wall 4 that separates the compartments 2, 3, there is provided a passage 65, preferably a bore that connects the upper chamber 7 and the inlet chamber 50. Through the passage 65 liquid by-passed to chamber 7 is returned to the inlet chamber 50 for flow to and recirculation by the pump 13.

The operation of the herein described device is as follows: Liquid flows from a source of supply via conduit 54 into the annular inlet chamber 50, from which it flows over the upper end of the tubular member 45 into the strainer 55. The liquid then passes through the strainer 55 and is drawn out of the outlet or strainer chamber through the outlet 63 by the pump 13, and enters the inlet or suction side of the pump. From the

pump 13 the liquid is supplied through the conduits 14 to the pressure chamber 6 at a greater rate than the liquid can flow out of the flow restricting orifice 17. Pressure will then build up in the pressure chamber 6 and when a predetermined pressure has been reached the spring 33 will be overcome, causing the bellows 5 to compress which will allow spring 22 to move the valve 17a toward open position. Movement of the valve 17a toward open position is limited by the valve flange 22a engaging with the lower end of guide member 20, and if the pressure in chamber 6 should increase after the valve engages its stop, the member 24 will be moved away from the upper valve face 27. This will open the by-pass passage 26 and liquid from chamber 6 will flow therethrough into chamber 7 so as to reduce the pressure in chamber 6. From the by-pass chamber 7 liquid will flow through passage 65 back to the inlet chamber 50 for restraining, and return by the pump 13 to the pressure chamber 6.

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

1. In a device of the character described, a casing having a continuous wall defining an internal chamber of enlarged cross-sectional area, an open ended tubular member positioned in said casing and cooperating with said wall and said casing to provide an annular inlet chamber surrounding an end portion of said tubular member and in open communication therewith, said casing having an outlet chamber with a continuous wall surface defined by the inner wall surface of said tubular member and a portion of the inner wall surface of said casing, said wall having an inlet to said inlet chamber, an outlet for said outlet chamber, and a tubular shaped strainer member carried by said first-named tubular member for straining fluid passing from said inlet chamber to said outlet chamber.

2. In a device of the character described, a casing having a continuous wall defining an internal chamber of enlarged cross-sectional area, an open ended sleeve member positioned in said casing and at one end thereof having its outer periphery sealed and secured to the casing inner wall surface, said sleeve member cooperating with said wall and said casing to provide an annular inlet chamber surrounding said sleeve member and in open communication with the other end of said sleeve member, said wall having an inlet to said annular chamber, said casing having an outlet chamber with a continuous wall surface defined by the inner wall surface of said tubular member and a portion of the inner wall surface of said casing, an outlet for said outlet chamber, and a tubular shaped strainer member carried by and extending longitudinally through said sleeve member and having one end communicatively connected to the said other end of said sleeve member.

3. In a device of the character described, a casing having a side wall provided with an internal annular recess, an open ended sleeve member positioned in said casing and at one end thereof sealed and secured along its outer periphery to the casing inner wall surface, said sleeve member cooperating with said casing to provide an elongated outlet chamber and cooperating with said recess to provide an annular chamber surrounding said sleeve member in open communication with the other end of said sleeve member, an inlet for said annular chamber, an outlet for said outlet chamber, a removable tubular shaped strainer member extending longitudinally through said sleeve member and having an outturned annular flange seating on said other end of said sleeve member, said casing having an opening in a wall thereof overlying the said other end of said sleeve member, a removable closure member closing said opening, and spring means abutting said strainer member and said closure member to hold said strainer member flange in engagement with the said other end of said sleeve member.

4. In a device of the character described, a casing having an elongated compartment and having an annular abutment in said compartment, a tubular strainer member extending longitudinally of and within said compartment, an open ended sleeve member surrounding said strainer member and seating at one end on said abutment, means for sealing and securing said sleeve member to the inner wall surface of said casing to provide an annular inlet chamber surrounding said sleeve member in communication with the other end thereof and to provide an outlet chamber, an inlet for said inlet chamber, an outlet for said outlet chamber, a removable tubular member having one end secured to one end of said strainer member in communication with the interior thereof, said removable tubular member being carried by said sleeve member and closing the annular space between said sleeve member and said strainer member, said casing having an opening in a wall thereof in registry with the said other end of said sleeve member and through which opening said removable tubular member and said strainer member are removable from said casing, a closure member closing said opening, and removable spring means abutting said closure member and said removable tubular member to hold said removable tubular member in place.

5. In a device of the character described, a casing having two elongated compartments, said compartments being relatively laterally positioned and extending longitudinally of each other, said casing having an internal annular abutment in each of said compartments, a tubular strainer member disposed in one of said compartments, an open ended sleeve member carrying said strainer member and at one end seating on the abutment in said one compartment, means for sealing and securing said sleeve member to said casing, said one compartment having a wall provided with an internal annular recess surrounding said sleeve member, said sleeve member surrounding said strainer member and cooperating with the casing inner wall surface to provide an outlet chamber and cooperating with said recess to provide an annular inlet chamber, said inlet chamber being in open communication with the other end of said sleeve member, an inlet for said inlet chamber, pressure regulating mechanism in the other of said compartments and including a pressure responsive means seating on the abutment in said other compartment and dividing said other compartment into a pressure chamber and a second chamber, means communicatively connecting said pressure chamber and said strainer outlet chamber, an outlet for said pressure chamber and controlled by said pressure regulating mechanism, a by-pass for the passage of fluid from said pressure chamber to said second chamber when the pressure in said pressure chamber exceeds a predetermined pressure, said by-pass being controlled by said pressure regulating mechanism, and a passage connecting said second chamber and said strainer inlet chamber.

6. In a pressure regulating apparatus, a casing having a compartment, a pressure responsive

member dividing said compartment into an inlet chamber and an outlet chamber and having a passage communicatively connecting said chambers and opened by movement of said responsive member, said inlet chamber having an inlet port and an outlet port, said casing having a second compartment having an inlet chamber and an outlet chamber, an inlet port for said second-named inlet chamber, an outlet port for said second-named outlet chamber, a strainer member in said second-named compartment and interposed between said second-named inlet and outlet ports, a conduit connecting said first-named inlet port and said second-named outlet port, a pump in said conduit operable to withdraw liquid from said second-named compartment and to discharge the liquid into said first-named compartment, and a passageway within the wall of said casing and connecting said first-named outlet chamber and said second-named inlet chamber so that liquid passing through said responsive member passage will be supplied to the inlet side of said strainer member and through said second-named compartment to said pump.

7. In a pressure regulating apparatus, a casing having a compartment, a pressure responsive member dividing said compartment into an inlet chamber and an outlet chamber and having an aperture connecting said chambers, a valve closing said aperture and being opened by movement of said responsive member, said inlet chamber having an inlet port and an outlet port, said casing having a second compartment, a partition dividing said second compartment into an inlet chamber and an outlet chamber, said casing having an inlet port to said second-named inlet chamber and having an outlet port from said second-named outlet chamber, a strainer member in said second-named compartment and interposed between said second-named inlet and outlet ports, a conduit connecting said first-named inlet port and said second-named outlet port, a pump in said conduit operable to withdraw liquid from said second-named compartment and to discharge the liquid into said first-named compartment, and a passageway in said casing, said passageway opening at one end into said first-named outlet chamber and opening at its other end into said second-named inlet chamber on the inlet side of said strainer member so that liquid passing through said responsive member aperture will be supplied through said strainer member and said second-named compartment to said pump.

8. In a device of the character described, a casing having a chamber with inlet and outlet means, an annular member within said chamber and protruding inwardly from the side wall of said casing, a tubular wall member having a passageway therethrough and positioned within said chamber, said wall member cooperating with said annular member to form an inlet chamber communicating with said inlet means and positioned within said first chamber, a strainer member interposed between said inlet and outlet means and positioned within said passageway, said casing having an open end portion for passage of said wall member therethrough, a cover member closing said open end portion, spring means interposed and held under compression between said cover member and said strainer member, and means on said strainer member receiving and locating a portion of said spring means.

9. In a device of the character described, a casing having a chamber with inlet and outlet means, an annular member within said chamber and protruding inwardly from the side wall of said casing, a tubular wall member having a passageway therethrough and positioned within said chamber, said wall member cooperating with said annular member to form an inlet chamber communicating with said inlet means and positioned within said first chamber, a strainer member interposed between said inlet and outlet means and positioned within said passageway, said casing having an open end portion for passage of said wall member therethrough, a hollow cover member closing said open end portion, said wall member extending upward into said cover member and terminating closely adjacent the top wall of said cover member, a helical coil spring completely housed within said cover member and interposed and held under compression between said cover member and said strainer member, and means on said strainer member receiving and locating a portion of said spring.

10. In a device of the character described, a casing having a chamber with inlet and outlet means, an annular member within said chamber and protruding inwardly from the side wall of said casing, a tubular wall member having a passageway therethrough and positioned within said chamber, said wall member cooperating with said annular member to form an inlet chamber communicating with said inlet means and positioned within said first chamber, a strainer member interposed between said inlet and outlet means and positioned within said passageway, said casing having an open end portion for passage of said wall member therethrough, a cover member closing said open end portion, a hollow supporting member conforming to and fitting within said wall member, said hollow member having oppositely directed opposite end flanges, one of said flanges seating on the inlet end of said wall member, the other of said flanges supporting said strainer member, and a helical coil spring seating at one end on said other flange and held under compression by said cover member.

11. A device of the character described, comprising a casing having a pressure chamber and a strainer chamber, pressure responsive means dividing said pressure chamber into an inlet chamber and a by-pass chamber, means for liquid flow from said inlet chamber to said by-pass chamber, a valve member cooperable with said responsive means and controlling flow through said last-named means, a strainer member in said strainer chamber and separating said strainer chamber into an inlet chamber and an outlet chamber, means for liquid flow from said strainer outlet chamber to said pressure inlet chamber, and a conduit communicatively connecting said by-pass chamber and said strainer inlet chamber so that foreign matter in the liquid from said by-pass chamber will be withheld from admission to said pressure inlet chamber.

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