

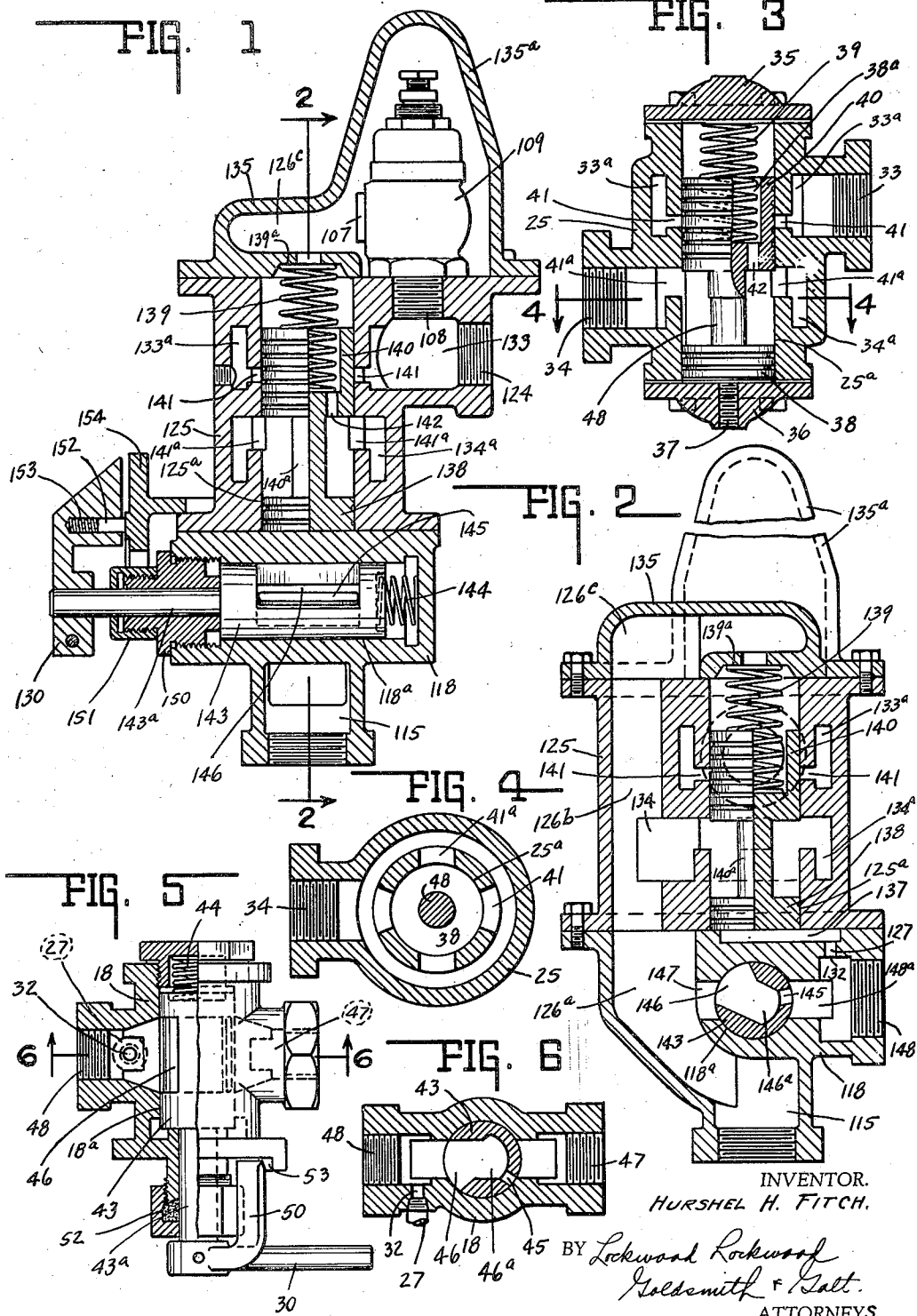
Sept. 8, 1936.

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2,053,330

CONTROL FOR FLUID POWER PLANTS

Filed April 17, 1933



UNITED STATES PATENT OFFICE

2,053,330

CONTROL FOR FLUID POWER PLANTS

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Application April 17, 1933, Serial No. 666,551

16 Claims. (Cl. 137—153)

This invention relates to a combination valve arrangement.

This application is a continuation in part of application Serial No. 382,442, filed July 31, 1929, entitled "Speed control units."

This invention is particularly directed to the specific valve arrangement which is embodied in a liquid pressure system including a source of pressure such as a pump, a device operable by said pressure and connected to the source thereof, a reservoir or the like from which the pump secures the liquid for device operation, and to which the device discharges.

All of the aforesaid is disclosed in the copending application previously referred to and is made a part of this disclosure.

The present invention, in common a part of the disclosure in the before mentioned application, is directed to certain mechanism that is interposed between the discharge from the device to the reservoir and which is associated with a by-pass construction automatically operable by the back pressure created by a throttle valve in the discharge from the device to the reservoir, and when desired, a relief valve controlled by-pass is incorporated for relieving excess pressure from the pump or source of pressure supply and to the reservoir and arranged to by-pass the device.

One feature of the present disclosure consists in the unitary arrangement of all of the parts into a compact unit.

The full nature of the invention will be understood from the accompanying drawing and the following description and claims.

In the drawing, Fig. 1 is a central sectional view through one form of the invention shown as a unitary arrangement, certain of the parts being shown in elevation.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1 and in the direction of the arrows.

Fig. 3 is a section through the pressure operated valve controlling the control by-pass of another modification.

Fig. 4 is a section taken on line 4—4 of Fig. 3.

Fig. 5 is a view partly in section of the throttling valve of the last mentioned modification.

Fig. 6 is a section taken on line 6—6 of Fig. 5.

In the present description Figs. 3 to 6 are identical with Figs. 4 to 7, inclusive, of the before mentioned application, and like numerals are applied to like parts herein.

Also, in Figs. 1 and 2, similar equivalent parts therein bear numerals similar to those found in

Figs. 3 to 6, inclusive, but increased by one hundred.

The form of the invention shown in Figs. 1 and 2 is of unitary type. In said figures the numeral 118 indicates the lowermost portion and mounted therein is a throttle valve 143 which controls the discharge to the outlet of conduit portion 115 that discharges to a supply tank or reservoir. The inlet 148 may be characterized as of the low pressure type. It is adapted for connection to the discharge from a fluid operable motor device supplied by a source of pressure, such as a pump, the intake of which naturally would be connected to the supply tank or reservoir for a circulatory system.

Superimposed upon the casing 118 is a casing 125 and the aforesaid constitutes the intermediate portion of the unit and includes the automatically operable valve for by-passing a portion of the fluid used for device operation control when the valve is automatically operated. This casing portion has the high pressure inlet 124 adapted for connection to the source of pressure. The head or upper portion of the casing 135 includes a dome or chamber 135a and mounted therein is a relief valve 109 which communicates with the inlet 124 as at 108 and which discharges to the chamber portion 126c in the head 135 as at 107. High pressure applied to the inlet 124 from a pump enters chamber 133 and upon excessive pressure is discharged through the relief valve 109 to the chamber portion 126c which communicates by the passage or intermediate chamber forming portion 126b in the casing 125 and which in turn communicates with the chamber forming portion 126a in the casing or lower portion 118 thereof. Chamber portion 126a, as shown clearly in Fig. 2, is in free communication with the discharge 115.

In the intermediate casing portion is a bore 125a and in it is mounted a piston plunger valve having the piston head 138, the stem 140a and the recessed valve portion 140, the exterior of which is suitably provided with sealing rings. A spring 139 has one end nested in the piston valve recess and the other end, in the present form of the invention, bears upon the face 139a of the head portion of the casing.

The casing 125 at one end and adjacent the high pressure intake, is provided with an arcuate chamber 133a. This chamber may be and preferably is cylindrical, if desired. The chamber 133a is in direct communication with the chamber 133—see Fig. 1. A plurality of arcuately spaced radial ports 141 extend from the chamber

133a to the bore 125a and are normally closed by the piston valve 140 when there is no back pressure in the system.

Also included within the casing 125 is the arcuate chamber or passage 134a which communicates with the bore 125a by means of a plurality of arcuately spaced radial ports 141a. The piston valve includes the port 142 that discharges to arcuate chamber 134a which may, if desired, be of cylindrical character. For relieving pressure behind the valve 140, the passage 142 may be provided. The arcuate or rather cylindrical chamber 134a discharges by the interior exhaust passage 134—see Fig. 2—to the chamber portion 126b. In this form of the invention, port 142 may be omitted. This is because the coaxial opening in cover 139a permits relief of pressure behind the plunger valve to discharge 115 through 126c etc.

Thus, when the piston 138 has pressure applied to the lower face through passage 137, the plunger valve is moved upwardly in opposition to spring 139 and the pressure fluid applied to intake 124 discharges through the ports 141, bore 125a and then discharges through the ports 141a to the chamber 134a and thence by means of the discharge or outlet portion 134 to the chamber portion 126b and discharge 115.

Within the casing portion 118 there is the bore 118a and rotatably, or rather pivotally, mounted therein is the manually operable valve 143 which carries a stem 143a that extends through a retaining seal construction, indicated by the numerals 150 and 151. A coil spring 144 normally opposes the valve so that it is in registration with the ports or passages 148a and 147, the latter constituting an internal outlet or discharge to the chamber portion 126a.

The rotary valve 143 has a relatively wide arcuate and elongated opening 146 which communicates with a central chamber 146a therein and also communicating with said central chamber is the narrower elongated port or passage 145. The valve is shown in the partially open position in Fig. 2. Portions 145, 146 and 146a constitute a passage through valve 143.

It will be recalled that the discharge from the fluid operable device discharges to the intake 148, termed the low pressure intake, and the valve 143 is adapted to restrict the flow of fluid there-through to the passage outlet or discharge 147. When the valve is rotated to partially restrict the passage of fluid through the valve, then there will be created back pressure in the intake 148.

A port 132 communicates with said intake and by means of the passage 127 discharges to a passage 137. The positioning of the rotary valve, so as to restrict the free flow of fluid from portions 148 to 147, creates a back pressure that is applied to the lower end of the piston 138 and serves to elevate the piston in opposition to the spring 139 which piston valve, when elevated, bypasses high pressure from the intake 124 to the discharge 134. Thus part of the pressure supplied to the system is by-passed to the discharge 115. The amount of pressure by-passed reduces the amount of pressure fluid supplied to the fluid operable device and in this manner the speed of the fluid operable device may be automatically controlled without the building up of the excessive pressures in the entire system, which system is of a character disclosed in the before mentioned application.

The valve stem supports an arm 130 and a portion 152 is a locking plunger backed by a

spring 153 and the same is associated with a stop bracket 154 that may be integral with the casing portion 118 or casing portion 125, as desired, but which is, as shown by the section lines, a separate piece. The plunger 152 serves to frictionally retain the rotary valve in its adjusted position.

It will be observed also from Figs. 1 and 2 that the casing portion 118 serves as the head of the cylindrical bore 125a in the intermediate casing portion 125 and that the head 135 has a portion 139a that serves as a head for said bore and as a spring retainer for the spring also included in said bore.

In Figs. 3 to 6, inclusive, there is illustrated a modified form of the invention which constituted the initial but which now is not the preferred form. This disclosure is substantially identical to that found in the co-pending application before referred to, and so far as possible identical numerals refer to identical or similar parts.

In Figs. 3 and 4, there is illustrated the automatic valve. In said figures, 33 indicates the high pressure intake, 33a the arcuate, and, as shown in Fig. 4, the cylindrical chamber which communicates by radial ports 41a with the bore 25a in the casing 25. The discharge 34 communicates with an arcuate, and herein cylindrical, chamber 34a and radial ports 41a also in arcuately spaced relation connect said chamber to the bore 25a. Mounted in the bore 25a is the plunger piston 38 which by the stem 48 supports a valve 40. Valve 40 is recessed as at 38a and is provided with the relief port or passage 42. A spring 39 is seated in the recessed portion 38a of the piston valve and bears against one end thereof, the opposite end bearing against the head or cover plate 35. The other end of the cylinder is closed by the end 36 having the passage 37 therein.

When pressure is applied through the passage 37 to the piston 38, the valve will be moved toward the spring 39 in opposition thereto and the high pressure supplied to the intake 33 is exhausted through the outlet or discharge 34. When no pressure is applied to the piston, the spring 39 maintains the valve closed and no fluid passes from the intake 33 to the exhaust 34.

In Figs. 5 and 6, there is illustrated the manual valve which is identical with the throttle valve shown in the before mentioned application. The casing 18 includes a bore 18a in which is rotatably mounted the valve 43 having a chamber 48a, a relatively large arcuate port 46 and a relatively restricted arcuate port 45. These ports are elongated longitudinally as shown in Fig. 5. The discharge from the fluid operable device, disclosed in the before mentioned application, enters the passage 48 and is throttled by means of the rotary valve or has free communication with the portion 47 or discharge, which, in turn, is adapted to discharge to a reservoir.

Throttling of the discharge through this valve 18 creates a back pressure in passage 48 and said back pressure is exerted through the port or passage 32 by means of a line 27 that, while not shown in these figures, is adapted to be connected at its other end, the opening 37. Thus, the reciprocatory piston plunger valve is adapted to be moved by the back pressure created in the discharge line of the power device.

The valve includes the stem 43a which carries the arm 30 and is sealed in the casing by means 52. Spring 44 is also provided. An arm 50 is adapted to engage a stop 53 which limits the position of the valve. The arm 30 may be held in any ad-

justed position by any suitable mechanism, such as shown in Figs. 1 and 2.

The invention claimed is:—

1. In a valve arrangement, the combination of
 5 a unitary casing structure with an external high pressure intake, a lower pressure external intake and an external discharge, said casing having a pair of bores therein, a reciprocating piston plunger valve in one bore, a manually operable
 10 rotary valve in other bore, said casing having a chamber in free communication with the discharge and an internal discharge to the rotary valve bore, and means in the other bore for piston movement in one direction, said casing having
 15 another internal discharge from the reciprocating valve bore to the chamber, said piston valve being arranged to connect the high pressure intake to the last mentioned internal discharge, said rotary valve when partially closed creating a back pressure upon the low pressure intake, said casing having a passage communicating with the latter intake and reciprocating valve bore to insure valve movement therein by the rotary valve created back pressure.

2. In a valve arrangement, the combination of
 25 a unitary casing structure with an external high pressure intake, a lower pressure external intake and an external discharge, said casing having a pair of bores therein, a reciprocating piston plunger valve in one bore, a normally operable rotary
 30 valve in other bore, said casing having a chamber in free communication with the discharge and an internal discharge to the rotary valve bore, means in the other bore for piston movement in one direction, said casing having another internal
 35 discharge from the reciprocating valve bore to the chamber, said piston valve being arranged to connect the high pressure intake to the last mentioned internal discharge, said rotary valve when partially closed creating a back pressure upon the low pressure intake, said casing having a passage communicating with the latter intake and reciprocating valve bore to insure valve movement therein by the rotary valve created back pressure, and yielding means associated with the rotary valve for the purpose set forth.

3. In a valve arrangement, the combination of
 40 a unitary casing structure with an external high pressure intake, a lower pressure external intake and an external discharge, said casing having a pair of bores therein, a reciprocating piston plunger valve in one bore, a manually operable rotary valve in other bore, said casing having a chamber in free communication with the discharge and an internal discharge to the rotary
 45 valve bore, means in the other bore for piston movement in one direction, said casing having another internal discharge from the reciprocating valve bore to the chamber, said piston valve being arranged to connect the high pressure intake to the last mentioned internal discharge, said rotary valve when partially closed creating a back pressure upon the low pressure intake, said casing having a passage communicating with the latter intake and reciprocating valve bore to insure valve movement therein by the rotary valve created back pressure, and a relief valve in free communication with the high pressure intake and enclosed with the chamber and discharging thereto for the purpose set forth.

4. In a valve arrangement, the combination of
 50 a unitary casing structure with an external high pressure intake, a lower pressure external intake and an external discharge, said casing having a pair of bores therein, a reciprocating

piston plunger valve in one bore, a manually operable rotary valve in other bore, said casing having a chamber in free communication with the discharge and an internal discharge to the rotary valve bore, means in the other bore for piston movement in one direction, said casing having another internal discharge from the reciprocating valve bore to the chamber, said piston valve being arranged to connect the high pressure intake to the last mentioned internal discharge, said rotary valve when partially closed creating a back pressure upon the low pressure intake, said casing having a passage communicating with the latter intake and reciprocating valve bore to insure valve movement therein by the rotary valve created back pressure, and a relief valve in free communication with the high pressure intake and discharging thereto for the purpose set forth.

5. In a valve arrangement, the combination
 55 of a unitary casing structure with an external high pressure intake, a lower pressure external intake and an external discharge, said casing having a pair of bores therein, a reciprocating piston plunger valve in one bore, a manually operable rotary valve in other bore, said casing having a chamber in free communication with the discharge and an internal discharge to the rotary valve bore, means in the other bore for piston movement in one direction, said casing having another internal discharge from the reciprocating valve bore to the chamber, said piston valve being arranged to connect the high pressure intake to the last mentioned internal discharge, said rotary valve when partially closed creating a back pressure upon the low pressure intake, said casing having a passage communicating with the latter intake and reciprocating valve bore to insure valve movement therein by the rotary valve created back pressure, a relief valve in free communication with the high pressure intake and enclosed with the chamber and discharging thereto for the purposes set forth, and yielding means associated with the rotary valve for the purpose set forth.

6. In a valve arrangement, the combination of
 60 a unitary casing structure with an external high pressure intake, a lower pressure external intake and an external discharge, said casing having a pair of bores therein, a reciprocating piston plunger valve in one bore, a manually operable rotary valve in the other bore, said casing having a chamber in free communication with the discharge and an internal discharge to the rotary valve bore, means in the other bore for piston movement in one direction, said casing having another internal discharge from the reciprocating valve bore to the chamber, said piston valve being arranged to connect the high pressure intake to the last mentioned internal discharge, said rotary valve when partially closed creating a back pressure upon the low pressure intake, said casing having a passage communicating with the latter intake and reciprocating valve bore to insure valve movement therein by the rotary valve created back pressure, a relief valve in free communication with the high pressure intake and discharging thereto for the purpose set forth, and yielding means associated with the rotary valve for the purpose set forth.

7. A device as defined by claim 1, characterized by the casing structure comprising three independent portions rigidly connected together, one portion including the discharge, the low pressure intake and the rotary valve bore, and

other portion including the high pressure intake, the reciprocating valve bore, and each of said portions including a portion of the discharge chamber.

8. A device as defined by claim 4, characterized by the casing structure comprising three independent portions rigidly connected together, one portion including the discharge, the low pressure intake and the rotary valve bore, another portion including the high pressure intake, the reciprocating valve bore, and each of said portions and the third portion including a portion of the discharge chamber, the third portion chamber enclosing the relief valve.

9. A device as defined by claim 4, characterized by the casing structure comprising three independent portions rigidly connected together, one portion including the discharge, the low pressure intake and the rotary valve bore, another portion including the high pressure intake, the reciprocating valve bore, and each of said portions and the third portion including a portion of the discharge chamber, the third portion chamber enclosing the relief valve supported by the second portion.

10. In a valve mechanism including an intake, an exhaust and a passage therebetween, the combination of a throttle valve in said passage and controlling the pressure of the fluid passing through the mechanism, a second passage in free communication with the intake and continuously subject to back pressure created by the throttle valve, another intake, another exhaust and a passage therebetween, a valve member in said last mentioned passage operatively and continuously controlling the communication therebetween, and pressure operable means controlling said valve member and connected to the first mentioned passage for continuous movement of the second mentioned valve in accordance with the variation of the back pressure.

11. A valve construction for continuously and automatically regulating continuous flow, including a passage subject to a source of high pressure, a valve arrangement therein, another passage subject to a lower pressure initially derived from the source of high pressure, a second and manually operable valve in the second mentioned passage and adapted to throttle the lower pressure applied to the second mentioned passage and create a back pressure ahead of the manually operable valve, and a passage around the throttle valve to the first mentioned valve arrangement, the valve arrangement including a plunger piston valve, means normally constraining said piston valve to cut off communication in the first mentioned passage, said piston of the plunger valve being continuously subject to the pressure in the third mentioned passage and in proportion to the back pressure in the second mentioned passage and in opposition to said constraining means for simultaneously and continuously regulating the flow through the first and second mentioned passages in response to back pressure variation.

12. A valve construction for continuously and automatically regulating continuous flow, including a passage subject to a source of high pressure, a valve arrangement therein, another passage subject to a lower pressure initially derived from the source of high pressure, a second and manually operable valve in the second mentioned passage and adapted to throttle the lower pressure applied to the second mentioned passage and create a back pressure ahead of the manu-

ally operable valve, and a passage around the throttle valve to the first mentioned valve arrangement, the valve arrangement including a plunger piston valve, means normally constraining said piston valve to cut off communication in the first mentioned passage, said piston of the plunger valve being continuously subject to the pressure in the third mentioned passage and in proportion to the back pressure in the second mentioned passage and in opposition to said constraining means for simultaneously and continuously regulating the flow through the first and second mentioned passages in response to back pressure variation, and a relief valve means for relieving excessive pressure in the first mentioned passage.

13. A valve construction for continuously and automatically regulating continuous flow, including a passage subject to a source of high pressure, a valve arrangement therein, another passage subject to a lower pressure initially derived from the source of high pressure, a second and manually operable valve in the second mentioned passage and adapted to throttle the lower pressure applied to the second mentioned passage and create a back pressure ahead of the manually operable valve, and a passage around the throttle valve to the first mentioned valve arrangement, the latter valve arrangement including a plunger piston valve, means normally constraining said piston valve to cut off communication in the first mentioned passage, said piston of the plunger valve being continuously subject to the pressure in the third mentioned passage and in proportion to the back pressure in the second mentioned passage and in opposition to said constraining means for simultaneously and continuously regulating the flow through the first and second mentioned passages in response to back pressure variation, and a relief valve means for relieving excessive pressure of the first mentioned passage and operatively discharging to the discharge side of the manually operable valve.

14. In a valve structure with a casing means having a cylindrical bore therein, an intake adjacent one end, an arcuate chamber concentric with the bore and in free communication with the intake, an outlet adjacent the other end of the casing means, an arcuate chamber concentric with the bore and in free communication with the outlet, each chamber having an arcuate port communicating with the bore, a hollow cylindrical valve in the bore, and a piston plunger in the bore, the combination of a stem therefor in the bore and of less area than the bore, said piston, stem and valve being of less length than the bore and reciprocable therein, one end of the bore having a port therein to subject the piston to pressure for valve movement, and spring means having one end operatively bearing at the opposite end of the bore for opposing pressure movement and having one end nested in the hollow valve, said valve having a closed end adjacent the stem and a passage therein for pressure relief to permit free valve movement.

15. In a valve structure with a casing means having a cylindrical bore therein, an intake adjacent one end, an arcuate chamber concentric with the bore and in free communication with the intake, an outlet adjacent the other end of the casing means, an arcuate chamber concentric with the bore and in free communication with the outlet, each chamber having an arcuate port communicating with the bore, a valve in the bore, and a piston plunger in the bore, the combina-

tion of a stem therefor in the bore and of less area than the bore, said piston, stem and valve being of less length than the bore and reciprocable therein, one end of the bore having a port therein to subject the piston to pressure for valve movement, and spring means at the opposite end of the bore for opposing pressure movement, said valve having a passage there-through for pressure relief to permit free valve movement.

16. In a valve structure with a casing means having a cylindrical bore therein, an intake adjacent one end, an arcuate chamber concentric with the bore and in free communication with the intake, an outlet adjacent the other end of

the casing means, an arcuate chamber concentric with the bore and in free communication with the outlet, each chamber having an arcuate port communicating with the bore, a valve in the bore, and a piston plunger in the bore, the combination of a stem therefor in the bore and of less area than the bore, said piston, stem and valve being of less length than the bore and reciprocable therein, one end of the bore having a port therein to subject the piston to pressure for valve movement, and spring means at the opposite end of the bore for opposing pressure movement.

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