No. 737,682. PATENTED SEPT. 1, 1903.

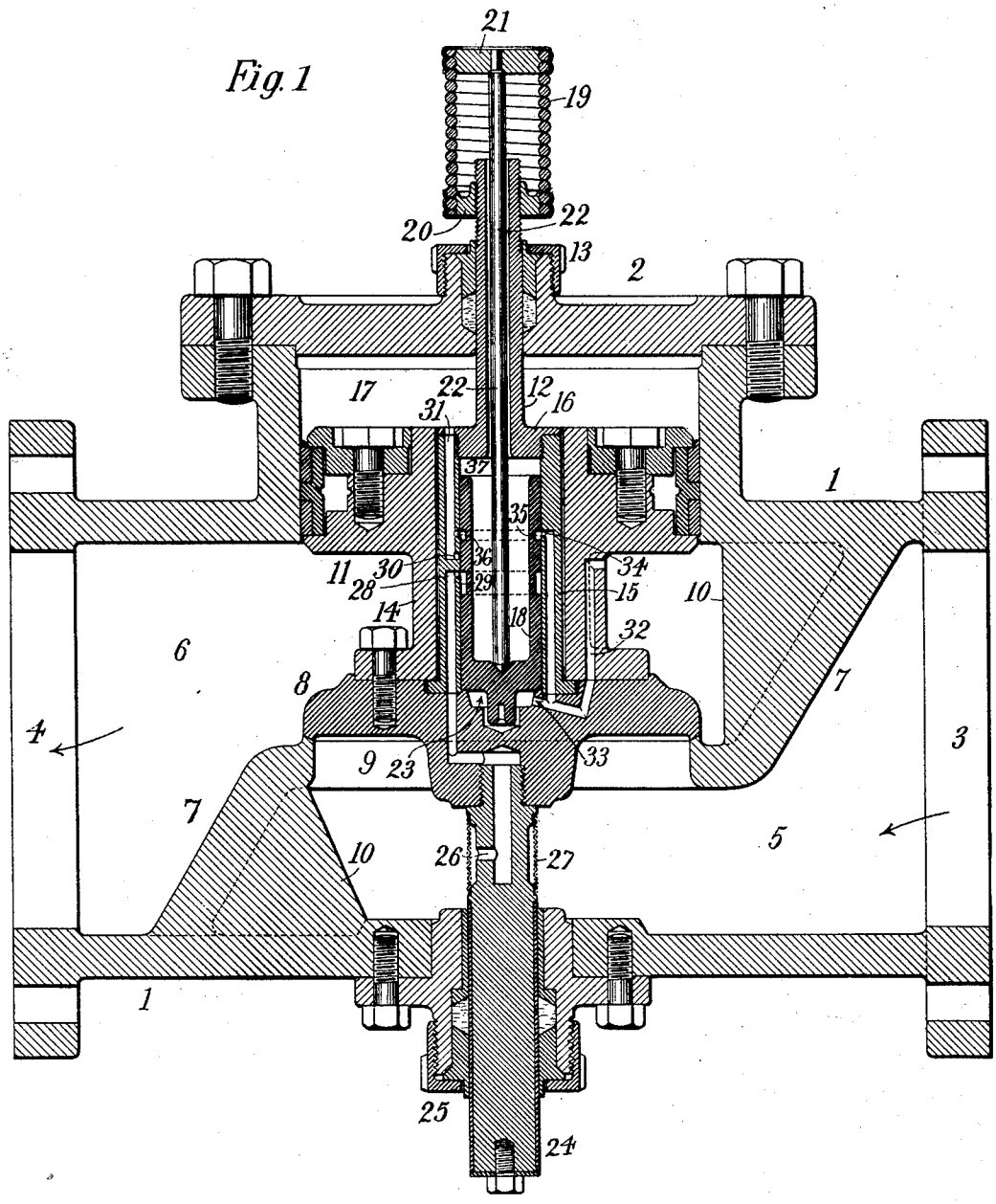
J. B. WARING.

REDUCING VALVE.

APPLICATION FILED NOV. 17, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1



Witnesses:
Raphael Netter
Henry Barnes

Inventor,
John B. Waring
by Henry B. Williams Atty

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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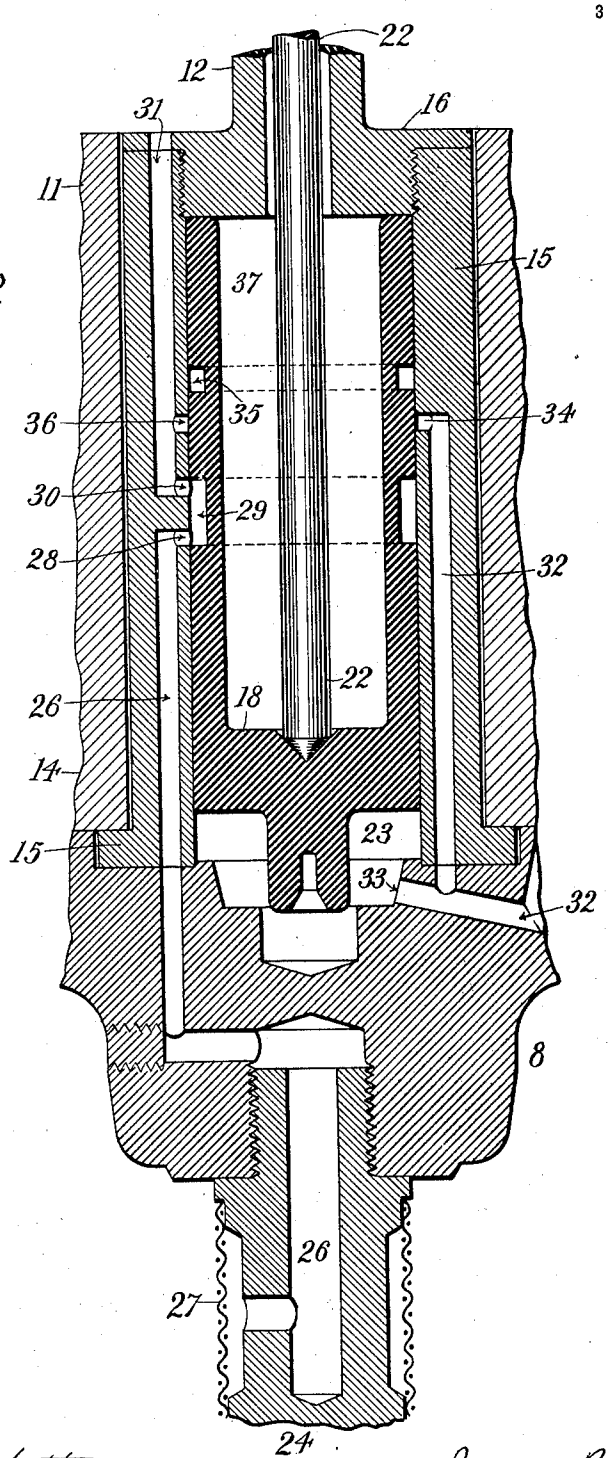
J. B. WARING.

REDUCING VALVE.

APPLICATION FILED NOV. 17, 1902.

NO MODEL. 3 SHEETS—SHEET 2.

Fig.2



Witnesses:
Raphael Netter
Henry Barnes

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No. 737,682. PATENTED SEPT. 1, 1903.

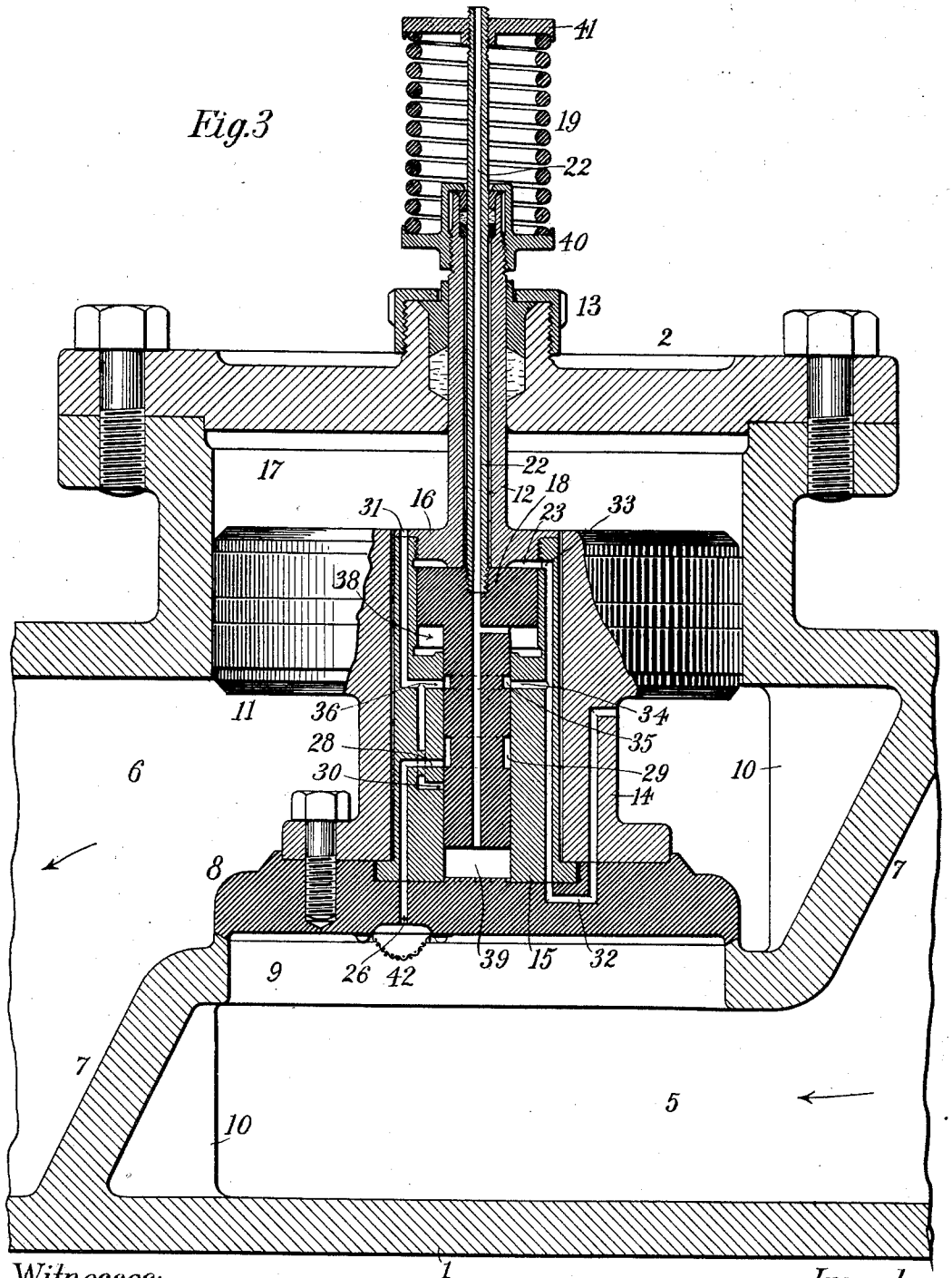
J. B. WARING.

REDUCING VALVE.

APPLICATION FILED NOV. 17, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

Fig.3



Witnesses:
Raphael Netter
Henry Barnes

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No. 737,682. Patented September 1, 1903.

UNITED STATES PATENT OFFICE.

JOHN B. WARING, OF EAST ORANGE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WARING PATENTS COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

REDUCING-VALVE.

SPECIFICATION forming part of Letters Patent No. 737,682, dated September 1, 1903.

Application filed November 17, 1902. Serial No. 131,601. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. WARING, a citizen of the United States, residing at East Orange, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Reducing-Valves, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to valves adapted for the regulation and reduction of pressures and for controlling the flow of a fluid from a high pressure to a low pressure, and has for its objects generally to simplify and improve the construction of such valves and to make the same more reliable and durable.

According to my invention a main piston is provided which is movable with the valve, and pressure and exhaust passages are provided for the chamber of this main piston and are controlled by a governing device carried by the valve, and thus the valve carries the several parts necessary to control its movement, and the construction is simple and compact. According to my invention this governing device comprises a movable part or piston and a resisting device, the governing part or piston being movable relatively to the valve and subjected to the low pressure and the resisting device controlling such movement of the governing part or piston. According to my invention this resisting device is located exteriorly to the casing and combined with a tubular guide for the main valve and a governing-piston rod.

My invention includes various improvements in the construction and combination of parts, as will appear from the following particular description of the valve embodying my invention, shown in the accompanying drawings, and from the claims.

Figure 1 is a longitudinal vertical section of such a reducing-valve, showing the valve closed and the governing-piston in lower position relatively to the valve. Fig. 2 is an enlarged section of the governing-piston and chamber and adjacent parts, showing the governing-piston in upper position relatively to the valve. Fig. 3 is a longitudinal vertical section of a modified construction.

The casing of the valve is shown as comprising two parts—a body and neck 1 and a cap or bonnet 2—these parts being bolted together. The body part of the casing is formed with an inlet 3 for the fluid at high pressure and an outlet 4 for the fluid at the reduced or low pressure, the high-pressure chamber 5 and the low-pressure chamber 6 being separated by a partition 7, which is stiffened by webs 10, and has a valve-opening 9 through it and a valve-seat formed about the valve-opening. The valve-disk 8 is adapted to close upon the valve-seat to control the passage of the fluid from the high-pressure chamber 5 to the low-pressure chamber 6.

A main piston 11 is fitted in a cylinder or chamber 17, such chamber being shown as inclosed at the top by the bonnet 2 and inclosed at the sides by the neck of the body 1, and this piston has a suitable packing and is movable with the valve and controls the movement thereof in opposition to the pressure against the valve, and, as shown, this piston has a flanged neck 14, extending to the valve-disk and bolted thereto. A chamber or cylinder is carried by the valve and, as shown, this chamber is laterally inclosed by a tube 15, which is inserted loosely in an opening in the valve-piston and neck and has a flange which is clamped between the piston-neck 14 and the valve-disk 8 in a centering-pocket formed in the valve-disk. This tube 15 may be of brass and has ports and passages therein and is inclosed at the top by a head or enlargement 16 of an upper tubular guide-rod 12, this guide-rod 12 extending out of the casing through the stuffing-box 13 in the bonnet. A governing-piston 18 is fitted in the tube 15 and has a limited movement therein and is subjected to pressure in the chamber 23, this pressure-chamber being located below the piston in the constructions shown in Figs. 1 and 2 and above the piston in the construction shown in Fig. 3.

The governing-piston 18 is shown as of uniform diameter throughout its length in Figs. 1 and 2; but in Fig. 3 the upper part or piston proper is of larger diameter than the lower or port-controlling part, and there is a chamber 38 below the enlarged upper portion and another chamber, 39, below the lower portion

both of which are in free communication with the atmosphere.

The action of the fluid-pressure in the pressure-chamber 23 is opposed by a resisting device carried by the valve, this resisting device being shown as consisting of a helical spring 19. In the constructions shown in Figs. 1 and 2 the spring 19 is an extension-spring and is held at its lower end by an adjustable nut 20, threaded on the upper end of the tubular guide-rod 12, and is held at its upper end by a collar 21, loosely mounted at the upper end of the governing-piston rod 22, the spring being set into helical grooves in this nut and collar and confined exteriorly by thin metal caps. The governing-piston rod 22 extends downward through the tubular guide-rod 12 and is seated at its lower end against the governing-piston 18. This governing-piston rod fits loosely in the tubular guide-rod, so that the chamber 37 above the governing-piston 18 is in free communication with the atmosphere. It will be noted that the resistance of the spring 19 is opposed to movement of the governing-piston 18 relatively to the main piston 11 and valve and that the valve and main piston are unrestrained by such resisting device.

In the modified construction shown in Fig. 3 the spring 19 is a compression-spring and presses at its lower end against the cap 40 and at its upper end against the disk 41, the cap 40 being threaded on the upper end of the tubular guide-rod 12 and inclosing and compressing the gland of a stuffing-box which closes the opening about the rod 22 where such rod emerges from the tubular guide-rod 12, and the disk 41 being threaded upon the upper end of the rod 21, so as to be adjustable thereon to vary the tension of the spring 19. In this modified construction the rod 22 is tubular to provide the desired free communication with the atmosphere of the chambers 38 and 39. Here also it will be noted that the resistance of the spring 19 is opposed only to relative movement of the governing-piston 18 and main piston 11.

In the construction shown in Figs. 1 and 2 a lower guide-rod 24 extends downward from the valve-disk 8, being shown as threaded into the valve-disk, and extends outward through a stuffing-box 25. The high-pressure passage 26 is formed through this guide-rod, extending from the high-pressure chamber 5, a screen 27 being shown as provided about the opening to exclude grit, and this high-pressure passage extends upward through the valve-disk 8 and tube 15 and terminates in a port 28, which coöperates with a high-pressure groove 29 in the governing-piston 18 and is connected thereby, when the governing-piston is in upper position, as shown in Fig. 2, with a high-pressure port 30, leading into a high-pressure and exhaust passage 31 in the tube 15, such passage opening into the chamber 17 above the main piston 11.

The low-pressure passage and exhaust 32 extends from the low-pressure chamber 6 through the piston-neck 14 and extends down into the valve-disk 8 and has a low-pressure port 33, opening into the chamber 23 below the governing-piston 18, and also extends up through the tube 15 and terminates in an exhaust-port 34, which coöperates with a groove 35 in the governing-piston 18 when the governing-piston is in lower position, as shown in Fig. 1, thereby connecting this port with the high-pressure exhaust-port 36 of the high-pressure and exhaust passage 31 when the governing-position 18 is in lower position.

The valve is shown in closed position in Fig. 1, and such position would be assumed in the absence of fluid under pressure from the device. The entrance of fluid under pressure will develop a pressure against the lower face of the valve-disk 8, which will be resisted only by the weight of the valve and parts carried thereby and by whatever pressure may exist at the low-pressure side of the valve, the chamber 17 in the casing above the valve-piston 11 being in communication with the low-pressure chamber 6 through the high-pressure and exhaust passage 31, exhaust-port 36, groove 35, and port 34, and the low-pressure and exhaust passage 32. The valve will therefore be opened and the fluid will flow through the valve to the low-pressure chamber 6, and the pressure in such chamber will increase and the fluid under pressure will enter the low-pressure and exhaust passage 32 and pass therefrom through the low-pressure port 33 into the chamber 23 below the governing-piston 18 and will exert an upward pressure on the governing-piston against the resistance of the spring 19, and as soon as this pressure exceeds the predetermined resistance exerted by the spring 19 the governing-piston will be moved upward relatively to the tube 15 and will first cut off the exhaust connection through the groove 35 and will thereafter, if its upward movement is continued, connect the high-pressure ports 28 and 30 by the high-pressure groove 29, thereby permitting the high-pressure fluid to enter the high-pressure passage 26 and pass by the port 28, groove 29, and port 30 to the high-pressure and exhaust passage 31 and from such passage 31 to the chamber 17 above the valve-piston 11. The area of the valve-piston 11 exposed in the chamber 17 to downward pressure will necessarily be greater than the area of the valve-piston or valve exposed to upward pressure by reason of the fact that the upper guide-rod 12 is of smaller diameter than the lower guide-rod 24, and, further, the weight of the valve and ports carried thereby will tend to close the valve, and therefore the presence of the high-pressure fluid in the chamber 17 will produce a downward movement of the valve-piston and valve, tending to close the valve, and thereby to reduce the pressure in the low-pressure chamber 6, and the reduction of the pressure in the low-pressure chamber 6 will bring about a corresponding reduction of pressure in the chamber 23 below the govern-

ing-piston 18, and when this pressure is lower than the predetermined resisting force of the spring 19 the governing-piston 18 will move downward relatively to the tube 15 and will first close the high-pressure port 30, thereby cutting off the high pressure from the chamber 17, and, if its downward relative movement is continued, will thereafter open the exhaust-port 36, thereby permitting the high-pressure fluid in the chamber 17 to escape to the low-pressure side of the valve. These movements tend to open the valve, and thereby to increase the low pressure, and thus to cause upward movement of the governing-piston 18 relatively to the valve, and the coaction of these controlling-pressures will effect such adjustment of the valve-opening as will produce a regulated and substantially uniform reduced or low pressure in the low-pressure chamber 6.

In the modified construction shown in Fig. 3 the valve is not provided with a lower guide and the weight of the valve and parts carried thereby is relied upon to overcome any excess of upward fluid-pressure. The passages, ports, and grooves are here designated as in the main views of the drawings, a reversal of position as to the ports being necessary by reason of the downward relative movement of the governing-piston 18 under the fluid-pressure in the chamber 23. The inlet-opening of the high-pressure passage 26 is here at the bottom of the valve-disk 8 and is guarded by a cup-shaped sieve 42. The operation is above described except that the relative movement of the governing-piston is in the reverse direction.

It is obvious that various modifications may be made in the construction shown and above particularly described within the spirit and scope of my invention.

What I claim, and desire to secure by Letters Patent, is—

1. A reducing-valve comprising a casing having a high-pressure chamber and a low-pressure chamber, a valve controlling the flow of fluid from the high-pressure chamber to the low-pressure chamber, a piston and a chamber therefor in the casing, the piston being movable with the valve and controlling the movement of the valve in opposition to the pressure against the valve, the valve being provided with pressure and exhaust passages leading to and from the piston-chamber, and a governing device carried by the valve and controlling both the pressure and the exhaust passages.

2. A reducing-valve comprising a casing having a high-pressure chamber and a low-pressure chamber, a valve controlling the flow of fluid from the high-pressure chamber to the low-pressure chamber, a piston and a chamber therefor in the casing, the piston being movable with the valve and controlling the movement of the valve in opposition to the pressure against the valve, a governing device carried by the valve, such governing device including a part movable relatively to the valve and exposed to the pressure of the low-pressure chamber and a resisting device opposing the movement of such part relatively to the valve, the valve being provided with pressure and exhaust passages leading to and from the piston-chamber, the governing device controlling such passages.

3. A reducing-valve comprising a casing having a high-pressure chamber and a low-pressure chamber, a valve controlling the flow of fluid from the high-pressure chamber to the low-pressure chamber, a piston and a chamber therefor in the casing, the piston being movable with the valve and controlling the movement of the valve in opposition to the pressure against the valve, a governing device carried by the valve, such governing device including a part movable relatively to the valve and exposed to the pressure of the low-pressure chamber and a resisting device opposing the movement of such part relatively to the valve, the valve being provided with pressure and exhaust passages leading from the high-pressure chamber to the piston-chamber and from the piston-chamber to the low-pressure chamber and the governing device controlling such passages.

4. A reducing-valve comprising a casing having a high-pressure chamber and a low-pressure chamber, a valve controlling the flow of fluid from the high-pressure chamber to the low-pressure chamber, a main piston and a chamber therefor in the casing, the main piston being movable with the valve and controlling the movement of the valve in opposition to the pressure against the valve, the valve being provided with pressure and exhaust passages leading to and from the main-piston chamber, a governing-piston and a chamber therefor carried by the valve and controlling such passages, and a resisting device controlling the movement of the governing-piston relatively to the valve.

5. A reducing-valve comprising a casing having a high-pressure chamber and a low-pressure chamber, a valve controlling the flow of fluid from the high-pressure chamber to the low-pressure chamber, a main piston and a chamber therefor in the casing, the main piston being movable with the valve and controlling the movement of the valve in opposition to the pressure against the valve, a governing-piston and a chamber therefor carried by the valve, and a resisting device controlling the movement of the governing-piston relatively to the valve, the valve being provided with pressure and exhaust passages leading from the high-pressure chamber to the main-piston chamber and leading out from the main-piston chamber and leading from the low-pressure chamber to the governing-piston chamber, the passages leading to and from the main-piston chamber being controlled by the governing-piston.

6. A reducing-valve comprising a casing having a high-pressure chamber and a low-pressure chamber, a valve controlling the flow

of fluid from the high-pressure chamber to the low-pressure chamber, a main piston moving with the valve, the main piston having a chamber in the casing and controlling the movement of the valve in opposition to the pressure against the valve, a chamber carried by the valve and a governing-piston therein, a tubular guide extending from the chamber of the governing-piston out through the casing, a rod extending from the governing-piston out through the tubular guide and a resisting device coacting with such rod to control the movement of the governing-piston relatively to the valve, the valve being provided with pressure and exhaust passages leading to and from the main-piston chamber and controlled by the governing-piston.

7. A reducing-valve comprising a casing having a high-pressure chamber and a low-pressure chamber, a valve controlling the flow of fluid from the high-pressure chamber to the low-pressure chamber, a main piston moving with the valve, the main piston having a chamber in the casing and controlling the movement of the valve in opposition to the pressure against the valve, a chamber carried by the valve and a governing-piston therein, a tubular guide extending from the chamber of the governing-piston out through the casing, a rod extending from the governing-piston out through the tubular guide and a resisting device arranged to act between the tubular guide and governing-piston rod, the valve being provided with pressure and exhaust passages leading to and from the main-piston chamber and controlled by the governing-piston.

8. A reducing-valve comprising a casing having a high-pressure chamber and a low-pressure chamber, a valve controlling the flow of fluid from the high-pressure chamber to the low-pressure chamber, a main piston moving with the valve, the main piston having a chamber in the casing and controlling the movement of the valve in opposition to the pressure against the valve, a chamber carried by the valve and a governing-piston therein, a tubular guide extending from the chamber of the governing-piston out through the casing, resisting means located outside of the casing and connected to the governing-piston through the tubular guide, and another guide extending from the valve out through the casing, the valve being provided with pressure and exhaust passages leading to and from the main-piston chamber and controlled by the governing-piston, substantially as set forth.

9. The combination with a casing having a high-pressure chamber and a low-pressure chamber, of a valve controlling the flow of fluid therethrough, a main piston having a chamber in the casing and moving with the valve, a chamber carried by the valve and a governing-piston therein, a tubular guide extending from the chamber of the governing-piston out through the casing, a rod extending from the governing-piston out through the tubular guide, and a resisting device arranged to act between the tubular guide and the governing-piston rod, another guide extending from the valve out through the casing, the valve being provided with pressure and exhaust passages leading from the high-pressure chamber to the main-piston chamber and from the main-piston chamber to the low-pressure chamber and from the low-pressure chamber to the chamber of the governing-piston, the governing-piston controlling the pressure and exhaust passages of the main-piston chamber, substantially as set forth.

10. A valve comprising a casing having an inlet and outlet, a valve controlling the flow of fluid from the inlet to the outlet, a governing device for the valve, a rod controlling the governing device and another rod controlled by the valve, one of such rods being a tubular guide-rod and the other rod being arranged within such tubular guide-rod and both of such rods extending out of the casing, and a resisting device connecting the two rods and controlling the relative movement of the valve and governing device.

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

JOHN B. WARING.

Witnesses:
HENRY D. WILLIAMS,
HENRY BARNES.