No. 715,745. Patented Dec. 16, 1902.

J. H. BICKFORD.

VALVE.

(Application filed Nov. 4, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

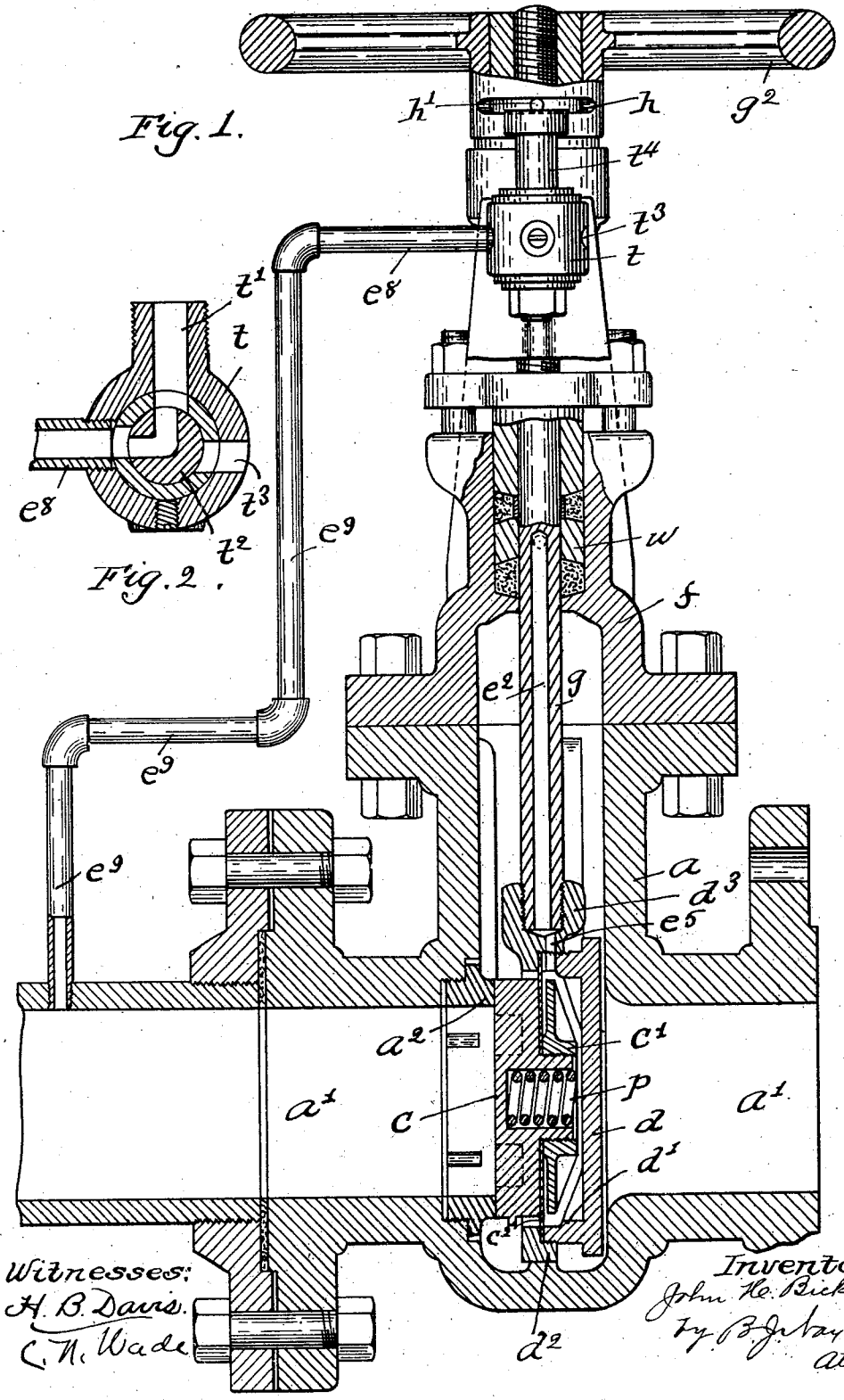


Fig. 2.

Witnesses:
H. B. Davis.
C. N. Wade

Inventor:
John H. Bickford
by B. J. Noyes
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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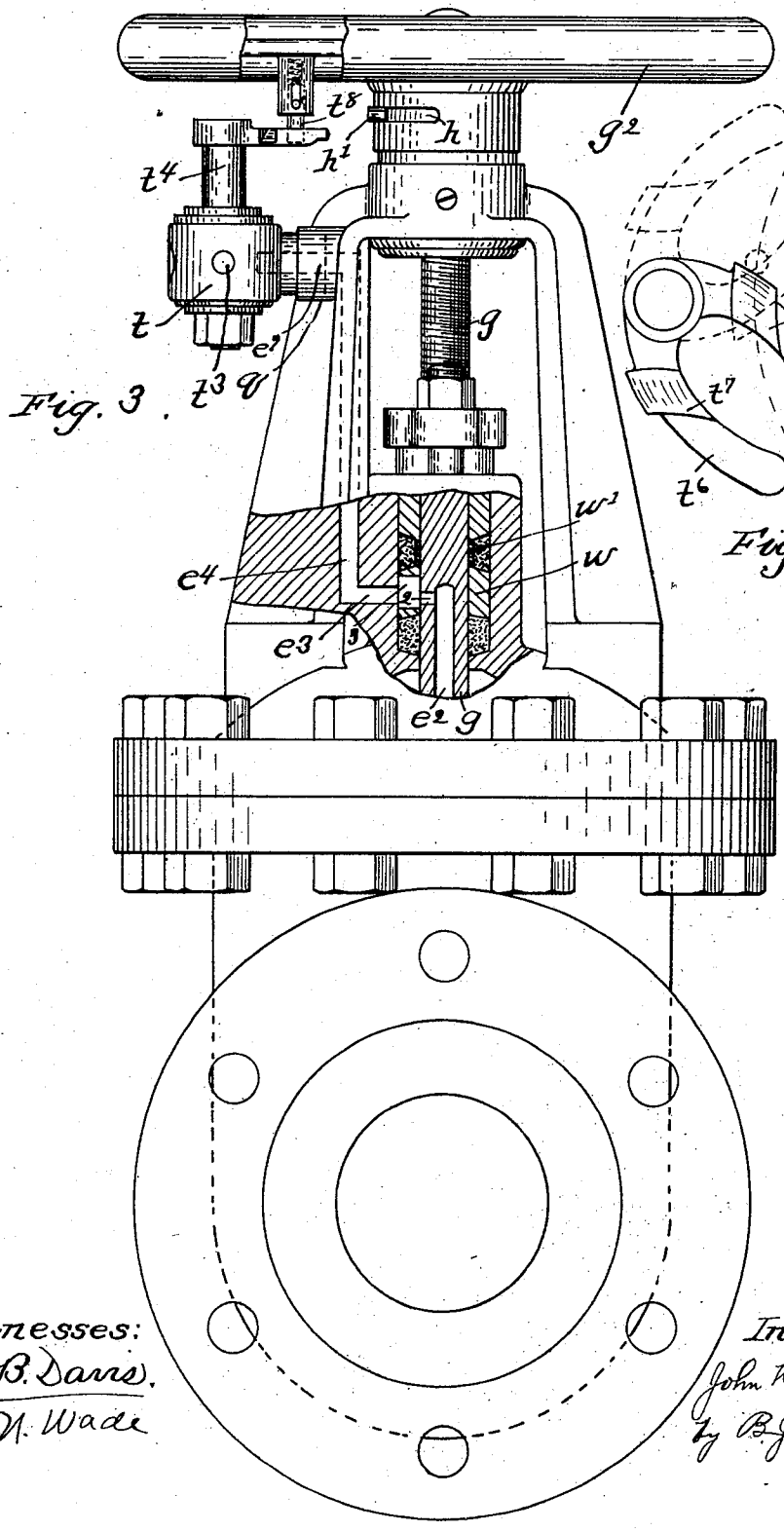


Fig. 3.

Fig. 4.

Witnesses:
H. B. Davis.
C. M. Wade

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UNITED STATES PATENT OFFICE.

JOHN H. BICKFORD, OF SALEM, MASSACHUSETTS.

VALVE.

SPECIFICATION forming part of Letters Patent No. 715,745, dated December 16, 1902.

Application filed November 4, 1901. Serial No. 81,126. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. BICKFORD, of Salem, county of Essex, State of Massachusetts, have invented an Improvement in Valves, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to valves and is intended as an improvement upon the valves shown and described in my applications for Letters Patent, Serial No. 64,831, filed June 17, 1901, and Serial No. 78,273, filed October 10, 1901.

In the first application above referred to the valve-plate is borne by a carrier, and a pressure-chamber is also borne by said carrier, which is connected with the pressure-supply, and said pressure-chamber controls the movements of said valve-plate laterally toward and from its seat, and means are provided whereby the pressure which holds the valve-plate upon its seat may be relieved or reduced to such an extent that said valve-plate is free to move laterally away from its seat and remains away from its seat during the entire up-and-down movement of the carrier, except for a short distance at the beginning of its upward movement and at the end of its downward movement. In my second application above referred to means are provided for relieving or reducing the pressure on the valve-plate before it is operated, so that the friction due to sliding upon its seat even for a short distance during its upward or downward movement is avoided. In both cases, however, a fluid-passage is provided leading from the pressure-supply to the pressure-chamber and a controlling-valve provided for said pressure-chamber, and in the first instance said controlling-valve is operated by the means employed for moving the carrier which carries the valve-plate, while in the second instance it is operated by means independent of the carrier. In the first instance where the controlling-valve for the pressure-chamber is operated by the means employed for moving the carrier the valve-plate has a sliding movement on its seat during the time said controlling-valve is being operated, while in the second instance the controlling-valve for the fluid-passage is operated absolutely independently.

It is very desirable to construct and arrange the parts, whereby the controlling-valve for the pressure-chamber can be operated by the means employed for moving the carrier, yet operate to relieve or reduce the pressure of the pressure-chamber before the valve-plate is raised, so that the valve-plate will not slide on its seat when raised; and it is also desirable in some valves to construct and arrange the parts whereby the controlling-valve for the pressure-chamber can be operated by the means for moving the carrier, yet operate to return the pressure to the pressure-chamber before the valve-plate arrives at its lowermost position, so that said valve-plate will slide on its seat a short distance as it closes—as, for instance, to assist in maintaining a clean surface between the disk and seat.

This invention therefore has for its object to provide a valve which may be similar in general construction to that shown in my aforesaid applications, whereby the controlling-valve for the pressure-chamber may be operated—as, for instance, by the means employed for moving the carrier which carries the valve-plate—yet said operation of the controlling-valve is performed previous to any upward movement of the valve-plate, so that the pressure of the pressure-chamber will be relieved or reduced before the valve-plate is lifted, and as a consequence said valve-plate will not slide upon its seat at the beginning of its upward movement.

The invention also has for its object to provide a valve which may be similar in general construction to that shown in my aforesaid applications, whereby the pressure of the pressure-chamber will be relieved or reduced previous to the valve-plate rising, so that said valve-plate will not slide on its seat at the beginning of its upward movement, as before stated, and whereby the pressure will be returned to said pressure-chamber before the valve-plate arrives at its lowermost position on its downward movement, so that said valve-plate shall slide on its seat for a short distance as it closes.

An embodiment of the first feature of my invention, as herein shown, comprises an op-

erating device for the carrier carrying the valve-plate having an initial movement independent thereof and a controlling-valve for the pressure-chamber operated by said operating device during its initial movement.

An embodiment of the second feature of my invention, as herein shown, comprises two controlling-valves for the pressure-chamber, both operated by the means employed for moving the carrier which carries the valve-plate, one operated in advance of the other on both the upward and downward movements of the valve-plate.

Figure 1 shows in longitudinal vertical section and partial elevation a valve embodying this invention. Fig. 2 is a sectional detail of one of the controlling-valves for the pressure-chamber. Fig. 3 is a side elevation and partial section of the valve, and Fig. 4 is a detail of one of the essential parts of the orerating device for the controlling-valve operated by the means employed for moving the carrier carrying the valve-plate.

a represents the valve-case, which is made of any suitable shape, having ports a' a', which are preferably made circular and having a bonnet f, containing a stuffing-box, through which the valve-spindle passes. The valve-case a is formed or provided interiorly with a valve-seat a^2, surrounding or inclosing the port a'. The valve-seat a^2 may be made circular or of any other suitable shape. The valve-plate, which coöperates with the valve-seat, as herein shown, consists of a disk c, having an externally-screw-threaded boss on its back side, on which is screwed a follower-plate c', and a spring p is contained in a recess provided in said boss, which is held in place by bearing against the inner wall of a shell d, which is the essential element of the carrier which supports and carries said valve-plate. The shell d of the carrier consists of a circular plate having an annular flange d', screw-threaded and screwed into a ring d^2, formed or provided with a boss d^3, which projects therefrom and which is socketed to receive the lower screw-threaded end of the valve-spindle g. The valve-plate is herein shown as flexibly connected to the shell d by a metallic or other diaphragm c^2, and any suitable means may be employed for securing said diaphragm to the valve-plate—as, for instance, it may be firmly clamped in position between the disk c and follower-plate c'—and also any suitable means may be employed for securing said diaphragm to said shell d—as, for instance, it may be firmly held in place between the shell d and ring d^2. Any other suitable flexible connection may be employed in lieu of a diaphragm for flexibly connecting the valve-plate to the shell, so far as this invention is concerned.

The diaphragm c^2 serves as and constitutes a flexible element, and the follower-plate c' back of it serves as a reinforcing-plate for said flexible element. By connecting the diaphragm c^2 to the shell d it will be seen that a chamber is produced, of which said flexible element forms a part, and said chamber is herein employed to receive the pressure from the pressure-supply, as will be hereinafter described, and consequently will be herein referred to as the "pressure-chamber," although so far as my invention is concerned this pressure-chamber may be constructed in other ways, yet having a flexible element as a part of it, which is adapted to serve as an actuator for or means for moving the valve-plate toward and from its seat when its movement is controlled, as will be hereinafter described, by the pressure in the pressure-chamber. The valve-plate is free to move laterally relative to the carrier in a direction toward and from its seat a^2, yet it is bodily borne by said carrier, and consequently moves up and down with it. Means are provided whereby the pressure is admitted to the pressure-chamber, which latter, as herein shown, is located at the back side of the valve-plate for the purpose of holding the valve-plate seated, and said means, as herein shown, consists of a fluid-passage or other connection which leads from the inlet of the valve, meaning the pressure-supply, to said pressure-chamber, which when open affords a free and unobstructed passage for the fluid which is being controlled and which acts to hold the valve-plate upon its seat. This fluid-passage from the inlet of the valve—*i. e.*, the pressure-supply—to the pressure-chamber may be made in many different ways more or less circuitous.

As herein shown, the spindle g, which is attached to the carrier, is made tubular for a portion of its length, thereby providing a passage e^2, which is in open communication with the pressure-chamber by means of a hole through the shell d, and at the upper end of said passage e^2 the spindle g has a side opening 2, normally communicating with a recess 3 in a gland w of the stuffing-box when the carrier is in its lowermost position and the valve-plate consequently closed on its seat, and the bonnet f, containing said stuffing-box, in which said spindle moves up and down, is cut away or formed to provide a passage e^3, which is in open communication with the recess 3 in said gland w and also with a passage e^4, extending up to a boss q, to which a three-way valve t is secured, said valve t having a passage t', communicating with the passage e^4 by means of a passage e^7. (See dotted lines, Fig. 3.) From the three-way valve t a pipe e^8 leads, which is connected by piping e^9 with the supply at the inlet of the valve—as, for instance, it may be connected to a pipe which is secured to said valve. A passage e^5 passes through the carrier and through the flange d' of the shell d, which connects the passage e^2 with the pressure-chamber. When said fluid-passage e^5 e^2 2 3 e^3 e^4 e^8 e^9 is open, (the plug t^2 of the three-way valve being properly positioned,) the pressure in said pressure-

chamber and acting back of the valve-plate will be the same per square inch as the pressure on the front side of the valve-plate; but as the area of the back side of the valve-plate in contact with the pressure is greater than the front side by the area of the seat it is obvious that the valve-plate will be moved laterally toward and held hard upon its seat by the pressure in the pressure-chamber acting back of it. The carrier bearing the pressure-chamber and valve-plate will be raised and lowered by turning the hand-wheel g^2 on the spindle g.

The three-way valve t is provided for the purpose of controlling the pressure in the pressure-chamber to thereby control the lateral movements of the valve-plate toward and from its seat and is adapted to open and close said fluid-passage and also open the closed portion of said fluid-passage, meaning the outlet-passage, to the atmosphere to thereby admit or withdraw the pressure. Whenever the three-way valve is turned into the position shown in Fig. 2, communication is established between the passages e^8 and e^7, and the pressure of the fluid acts back of the valve-plate, tending to thrust or hold it against or upon its seat. By turning the plug t^2 into another position the fluid-passage will be closed, and the pressure of the pressure-chamber acting at the back side of the valve-plate consequently relieved or reduced, and by turning said plug t^2 into still another position the fluid-passage will not only be closed, but its closed portion will be opened to the atmosphere by way of the exit t^3, or, in other words, the outlet-passage from the pressure-chamber will be opened. It is designed and intended that this controlling-valve shall be operated previous to raising the carrier, so as to relieve or reduce the pressure in the pressure-chamber before the valve-plate starts on its upward movement, yet shall be operated by the means employed for moving the carrier which carries the valve-plate, and to accomplish this result the stem t^4 of the plug t^2 is provided with means adapted to be engaged by suitable means borne by the hand-wheel g^2, and said hand-wheel g^2 is constructed and arranged to have an initial movement independent of the carrier, during which time it operates to turn said plug t^2.

The device on the stem t^4 of the plug t^2 consists of a pair of curved arms t^5 t^6, projecting therefrom in the form of a horseshoe, as illustrated in Fig. 4, each arm having on it a cam or inclined portion t^7, and the hand-wheel g^2 has depending from it a spring-pressed pin t^8, which normally occupies a position between said arms t^5 t^6 and when moved, by turning the hand-wheel, will engage either one or the other arm, and thereby turn the plug t^2 in one or the other direction. When moving the carrier up or down, the hand-wheel will be turned a number of revolutions, and on its first revolution it will act to turn the plug t^2 by the pin t^8 passing along and bearing against one of the arms, and in order that said pin may pass over the other arm as the hand-wheel begins its second revolution the spring-acting pin t^8 will ride up over the inclined portion or cam t', and also as the hand-wheel begins its successive revolutions said pin t^8 will also pass over said inclined portion or cam t'.

In Fig. 4 the full and dotted lines represent the two extreme positions of the device on the stem t^4 of the plug t^2 which it will occupy as the hand-wheel is turned in one or the other direction, and in said figure the path of movement of travel of the pin t^8 is also represented by a dotted line. To give the hand-wheel its initial movement independent of the carrier, the hub of said wheel is formed or provided with a slot h, extending a portion of the way around it, and the nut on the screw-threaded portion of the spindle g has a pin h' projecting laterally from it, which occupies a position in said slot, and the length of said slot determines the initial movement of the hand-wheel independent of the carrier. This slot h will be made long enough for the hand-wheel to turn the plug t^2 before it turns the nut on the spindle g. It will be seen that as the hand-wheel is turned in a direction to lift the carrier it will during its initial movement turn the plug t, and thereby close the fluid-passage and also open the closed portion thereof to the atmosphere, and thereafter as the carrier is raised the plug t will remain in this position. The pressure of the pressure-chamber acting at the back side of the valve-plate is therefore relieved or reduced before the valve-plate starts on its upward movement, and consequently said valve-plate does not slide on its seat. Yet the means employed for accomplishing the result is automatic—*i. e.*, operated by the means employed for raising the carrier. As the hand-wheel is turned in the opposite direction to move the valve-plate downward the pin t^8 will engage the other arm of the pair and will thereupon turn the plug t^2 and close the exit or way to the atmosphere and thereafter open the fluid-passage, and such operation of the plug t^2 takes place before the valve-plate is started on its downward movement; but this is immaterial. It is material, however, so far as this invention is concerned, that the pressure shall not act upon the valve-plate on its downward movement until just before it arrives at its lowermost position, so as to cause the valve-plate to slide on its seat a little as it ceases its downward movement, and to accomplish this result the fluid-passage is provided with another controlling-valve, operated by the means employed for moving the carrier, which, although incidentally operated as the valve-plate rises, performs no important function at such time and is inconsequential, but which is operated as the valve-plate descends and performs the desired function at the proper time. This controlling-valve consists of the gland w and ring w' above it, both in-

closing or embracing the spindle *g* and disposed relative thereto so that as the spindle rises the side opening 2 will be closed by said gland and ring, but will be opened as the spindle descends just before the valve-plate arrives at its lowermost position. It will be seen that notwithstanding the fluid-passage is opened by the three-way valve on the downward movement of the valve-plate said passage will at such time be closed by the other controlling-valve and is not opened until just before the valve-plate arrives at its lowermost position, and consequently the pressure will not be returned to the pressure-chamber, and therefore applied to the valve-plate, until such time, and the valve-plate will therefore be held away from its seat until just before it arrives at its lowermost position, when it may close thereupon and slide a short distance.

While I have herein shown a hand-wheel as the operating device for the carrier, yet I do not desire to limit my invention to the employment of such specific device, as it is obvious that other equivalent devices may be employed in lieu thereof.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having an initial movement independent thereof, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, and a valve for controlling the pressure in said chamber operated by said operating device during its initial movement, substantially as described.

2. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having an initial movement independent thereof, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled and a three-way valve for controlling the pressure in said chamber operated by said operating device during its initial movement, substantially as described.

3. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having as a coöperative part of it a hand-wheel having an independent initial movement, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled and a valve for controlling the pressure in said chamber operated by said hand-wheel during its initial movement, substantially as described.

4. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having an initial movement independent thereof, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate toward and from its seat as the pressure therein is controlled, a spring acting to assist in moving said valve-plate toward its seat and a valve for controlling the pressure in said chamber operated by said operating device for the carrier during its initial movement, substantially as described.

5. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having an initial movement independent thereof, means, as a passage, connecting said pressure-chamber with the pressure-supply, an outlet-passage leading from said pressure-chamber through which the pressure is released, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled and a valve for controlling said outlet-passage operated by said operating device during its initial movement, substantially as described.

6. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having an initial movement independent thereof, means, as a passage, connecting said pressure-chamber with the pressure-supply, an outlet-passage leading from said pressure-chamber through which the pressure is released, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled and a valve for controlling the pressure in said chamber operated by said operating device during its initial movement to close the passage leading from the pressure-supply to the pressure-chamber and to open the outlet-passage leading from the pressure-chamber, substantially as described.

7. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having an initial movement independent thereof, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, a valve for controlling the pressure in said chamber operated by said operating device during its initial movement and another valve for controlling the pressure in said chamber also operated by said operating device but before the valve-

plate arrives at its lowermost position, substantially as described.

8. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having an initial movement independent thereof, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, a three-way valve for controlling the pressure in said chamber operated by said operating device during its initial movement and another controlling-valve for controlling the pressure in said chamber also operated by said operating device but before the valve-plate arrives at its lowermost position, substantially as described.

9. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having an initial movement independent thereof, means, as a passage, connecting said pressure-chamber with the pressure-supply, an outlet-passage leading from said pressure-chamber through which the pressure is released, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled and a valve for controlling the pressure in said chamber operated by said operating device during its initial movement to close the passage leading from the pressure-supply to the pressure-chamber and to open the outlet-passage leading from the pressure-chamber, and another valve for controlling the pressure in said chamber also operated by said operating device but before the valve-plate arrives at its lowermost position, substantially as described.

10. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having as a coöperative part of it a hand-wheel having an independent initial movement, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled and a valve for controlling the pressure in said chamber operated by said hand-wheel during its initial movement, and another valve controlling the pressure in said chamber also operated by said hand-wheel but before the valve-plate arrives at its lowermost position, substantially as described.

11. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, two controlling-valves for controlling the pressure in said chamber and means for operating them to close said connecting-passage before the valve-plate starts on its upward movement and to open said passage before said valve-plate ceases its downward movement, substantially as described.

12. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, two controlling-valves for controlling the pressure in said chamber and means operated by the means employed for operating the carrier for operating them to close said connecting-passage before the valve-plate starts on its upward movement and to open said passage before said valve-plate ceases its downward movement, substantially as described.

13. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, an outlet-passage leading from the pressure-chamber through which the pressure is released, two controlling-valves for controlling the pressure in said chamber, means for operating them to close said connecting-passage and open the outlet-passage before the valve-plate starts on its upward movement and to close said outlet-passage and thereafter open the connecting-passage before said valve-plate ceases its downward movement, substantially as described.

14. In a valve, a carrier bearing a valve-plate, and also bearing a pressure-chamber having a flexible element as a part of it, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, an outlet-passage leading from the pressure-chamber through which the pressure is released, two controlling-valves for controlling the pressure in said chamber, and means operated by the means employed for operating the carrier, for operating them to close said connecting-passage and open the outlet-passage before the valve-plate starts on its upward movement and to close said outlet-passage and thereafter open the connecting-passage before said valve-plate ceases its downward movement, substantially as described.

15. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-

chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, two controlling-valves for controlling the pressure in said chamber and means for operating them successively, substantially as described.

16. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, two controlling-valves for controlling the pressure in said chamber and means operated by the means employed for operating the carrier for operating said controlling-valves successively, substantially as described.

17. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having an initial movement independent thereof, means, as a passage, connecting said pressure-chamber with the pressure-supply, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, a controlling-valve for said connecting-passage and means for operating it automatically to close the passage before the valve-plate starts on its upward movement and to open said passage on the downward movement of said valve-plate and another controlling-valve for said connecting-passage and means for operating it automatically to keep said passage closed on the first part of the downward movement of the valve-plate and to open said passage before said valve-plate arrives at its lowermost position on its downward movement, substantially as described.

18. In a valve, a carrier bearing a valve-plate and also bearing a pressure-chamber having a flexible element as a part of it, an operating device for said carrier having an initial movement independent thereof, means, as a passage, connecting said pressure-chamber with the pressure-supply, an outlet-passage leading from said pressure-chamber through which the pressure is released, said pressure-chamber controlling the movements of said valve-plate laterally toward and from its seat as the pressure therein is controlled, a controlling-valve and means for operating it automatically to close said connecting-passage and open the outlet-passage before the valve-plate starts on its upward movement and to thereafter close said outlet-passage and open the connecting-passage on the downward movement of the valve-plate and another controlling-valve and means for operating it automatically to open said connecting-passage before the valve-plate arrives at its lowermost position on its downward movement, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN H. BICKFORD.

Witnesses:
B. J. NOYES,
H. B. DAVIS.