No. 751,096. PATENTED FEB. 2, 1904.

J. W. NETHERY.

VALVE.

APPLICATION FILED DEC. 4, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

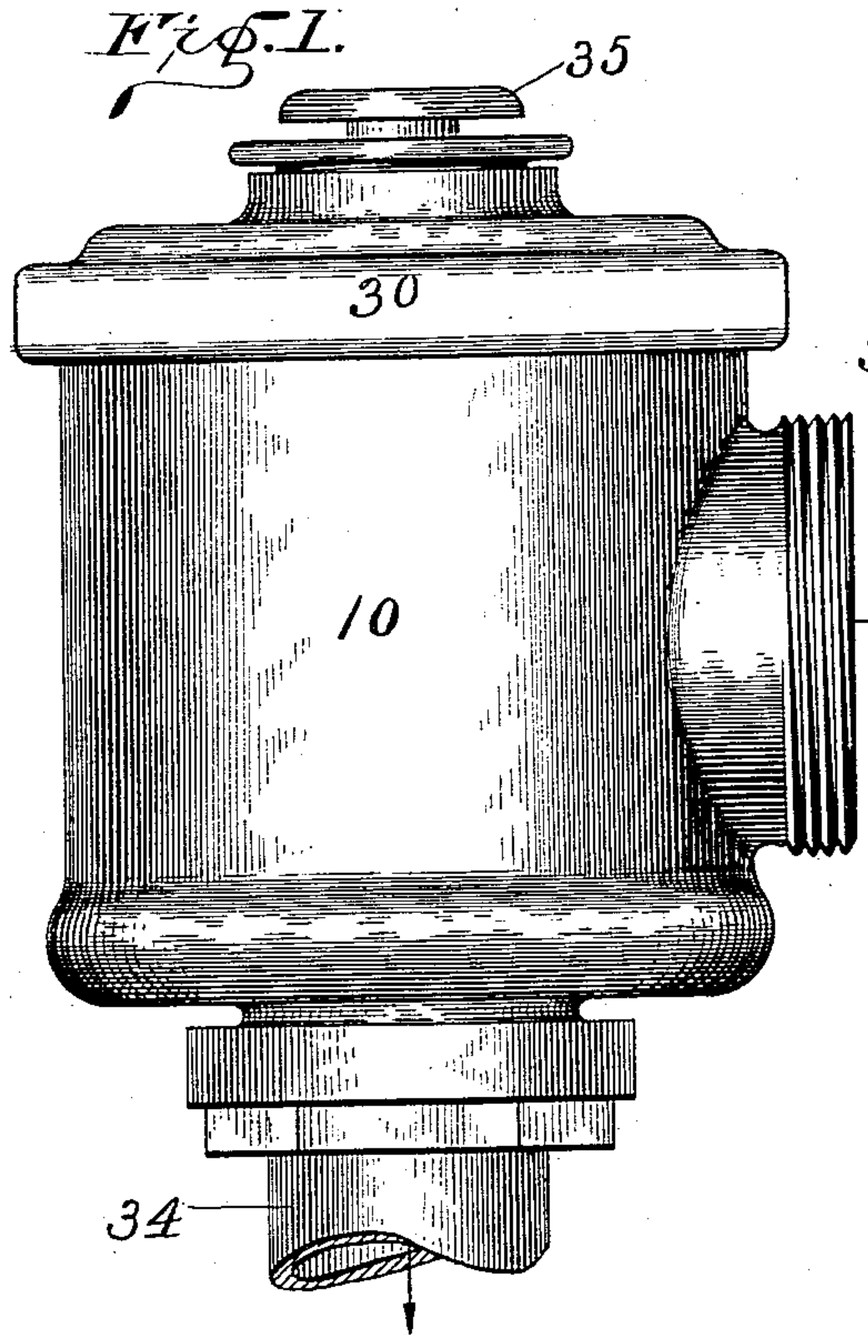


Fig. 2.

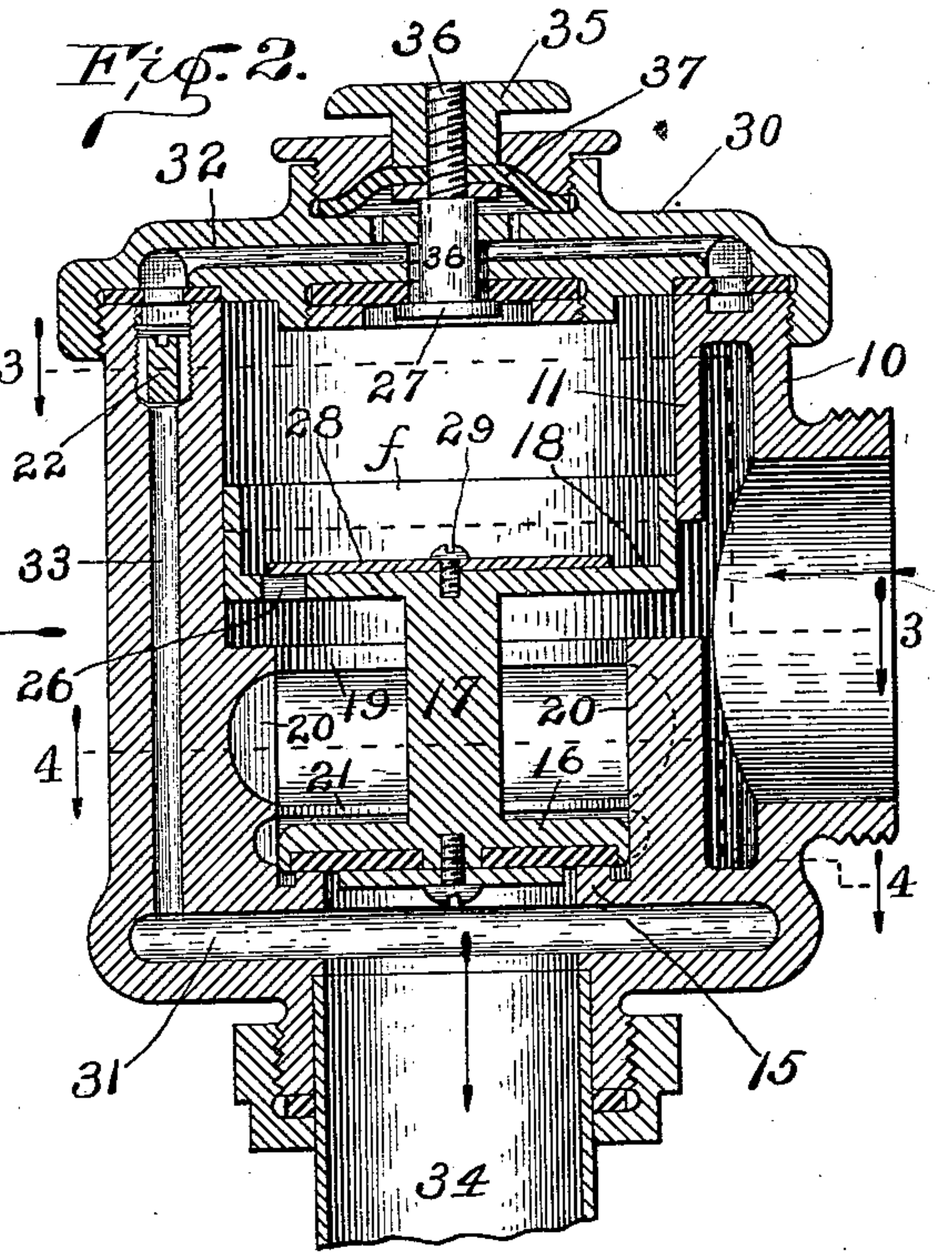


Fig. 3.

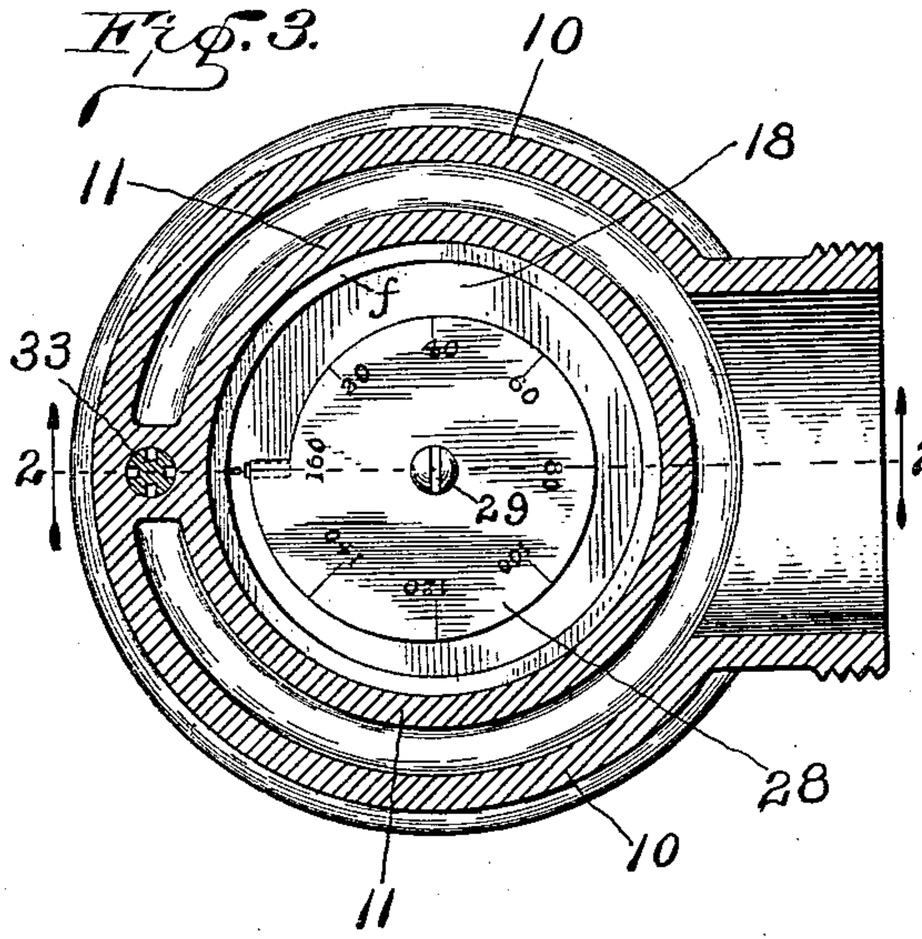
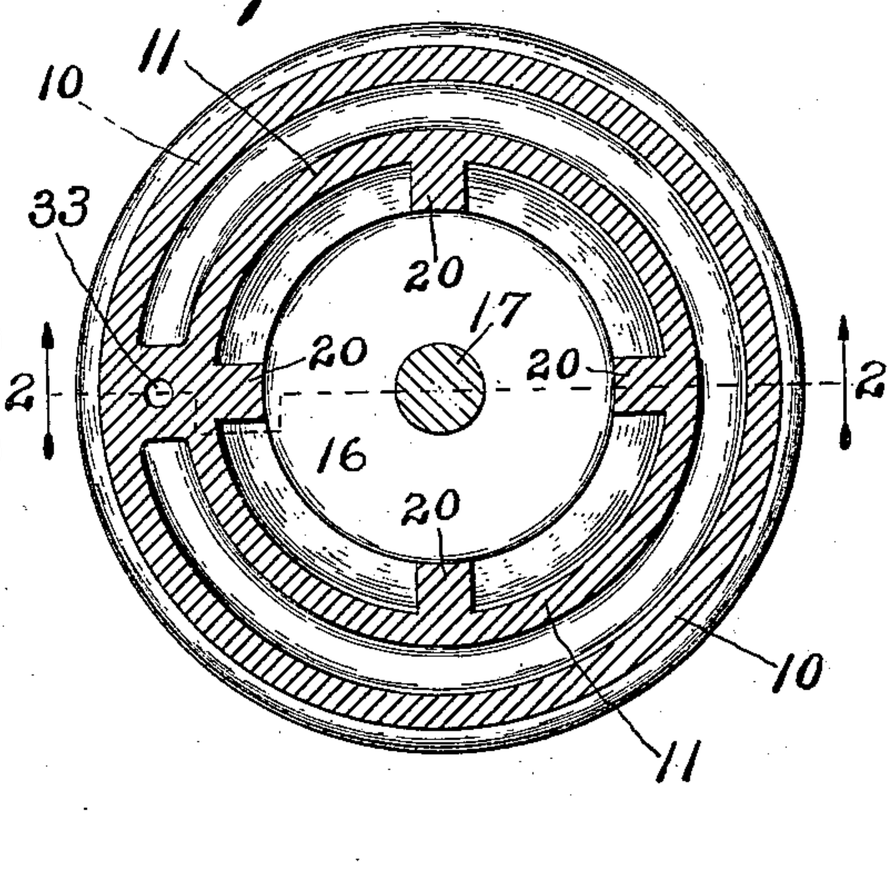


Fig. 4.



WITNESSES:

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 5.

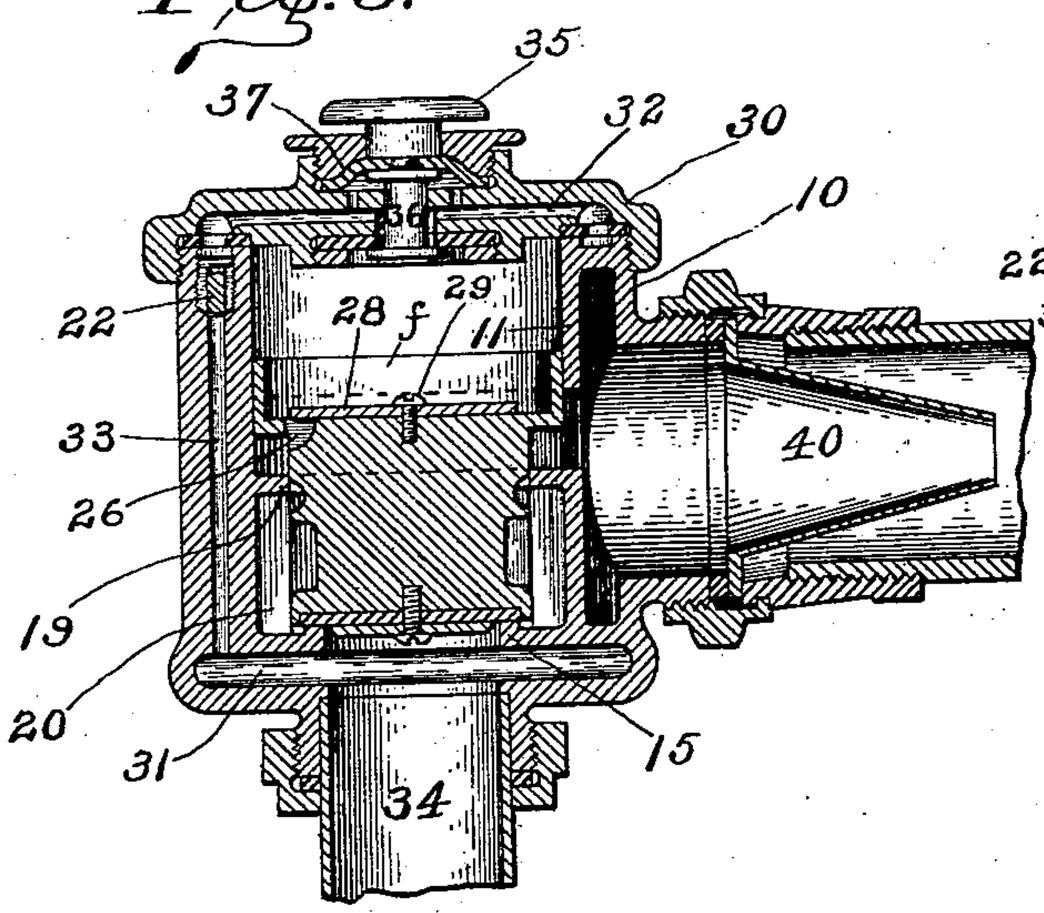


Fig. 7.

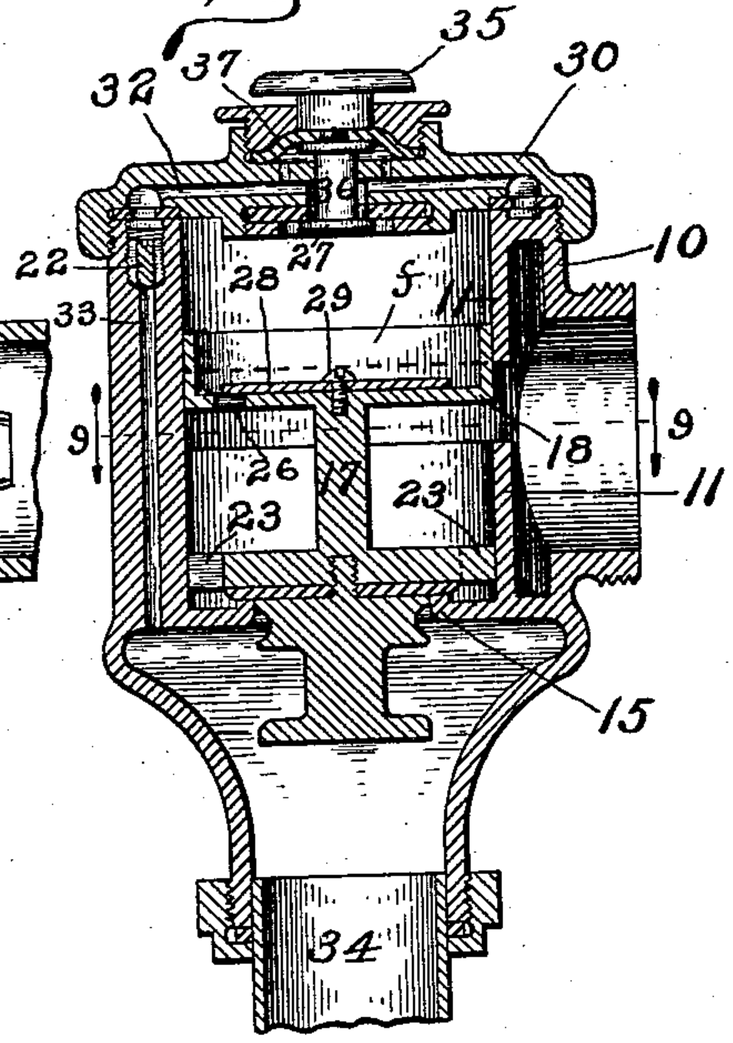


Fig. 6.

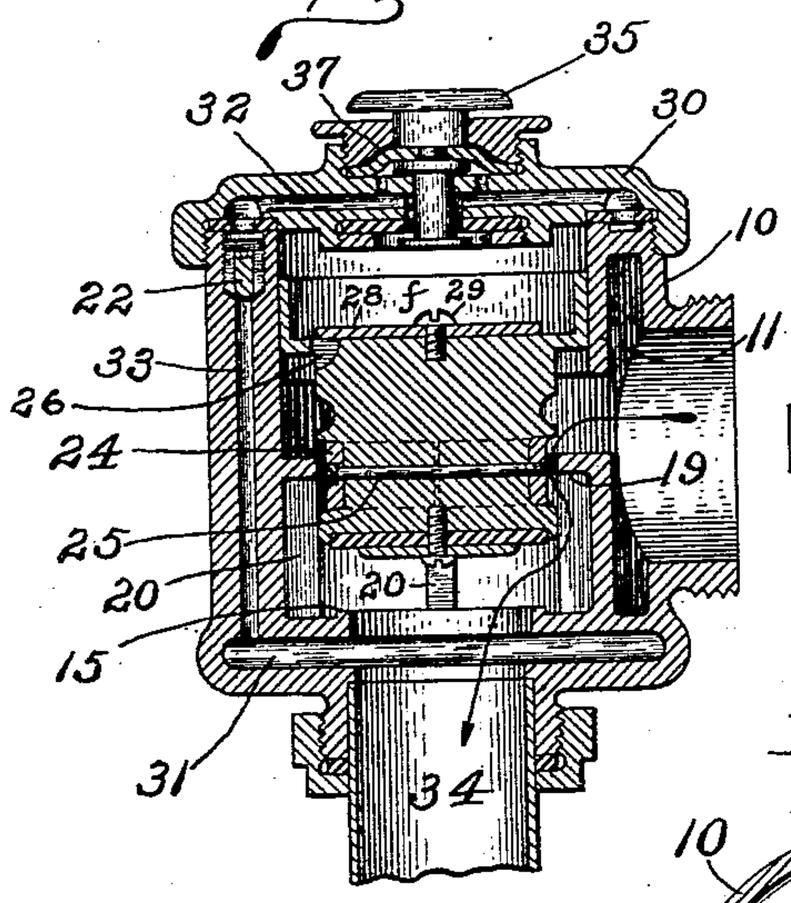


Fig. 8.

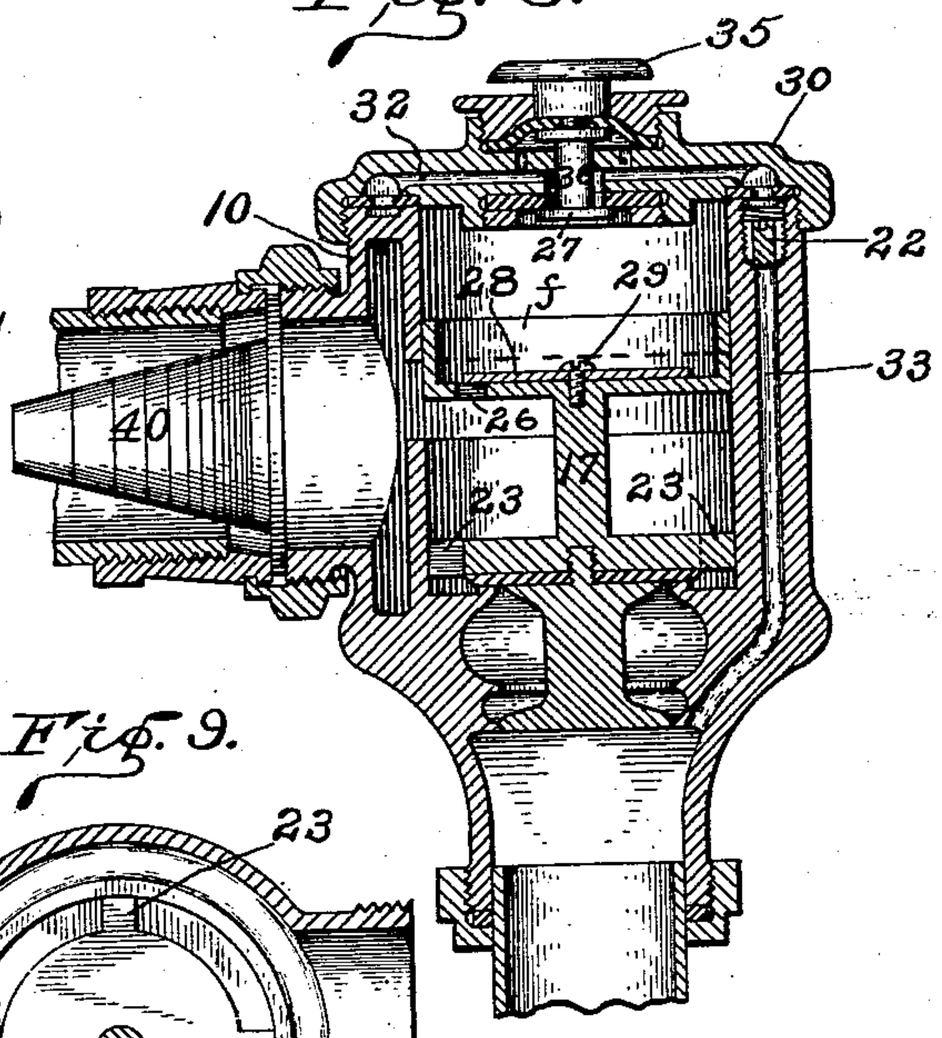
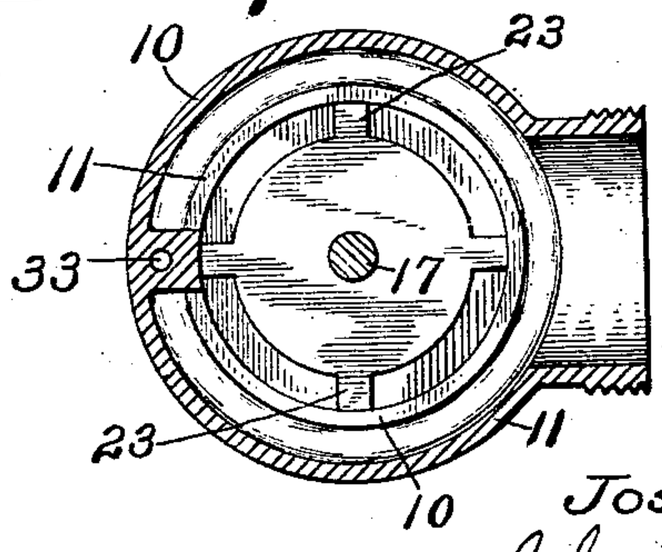


Fig. 9.



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No. 751,096. Patented February 2, 1904.

UNITED STATES PATENT OFFICE.

JOSEPH W. NETHERY, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO THE NETHERY HYDRAULIC VALVE COMPANY, OF INDIANAPOLIS, INDIANA, A CORPORATION OF NEW JERSEY.

VALVE.

SPECIFICATION forming part of Letters Patent No. 751,096, dated February 2, 1904.

Application filed December 4, 1901. Serial No. 84,667. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH W. NETHERY, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Valves, of which the following is a specification.

My present invention relates to that class of valves which are adapted when opened to close automatically; and it consists in means whereby the valve is prevented from being held open continuously, in means whereby the valve structure is shortened in length without reducing its capacity, in means for accurately and efficiently graduating its movement and thus controlling the time and quantity of the flow, and in various details of construction and arrangements of parts, all as will be hereinafter more particularly described and claimed.

Referring to the accompanying drawings, which are made a part hereof, and on which similar reference characters indicate similar parts, Figure 1 is a side elevation of a valve embodying my said invention; Fig. 2, a central vertical sectional view thereof; Figs. 3 and 4 horizontal sectional views as seen when looking downwardly in the direction indicated by the arrows from the points indicated by the dotted line 3 3 and 4 4, respectively, in Fig. 2; Figs. 5, 6, 7, and 8, central vertical sectional views similar in a general way to Fig. 2, but illustrating alternative constructions of my new valve; and Fig. 9, a horizontal sectional view as seen when looking downwardly from the point indicated by the dotted line 9 9 in Fig. 7.

The valve-casing, so far as external appearance is concerned, is or may be similar to that ordinarily employed, except that its length is less than usual in proportion to its diameter and capacity. It is composed of an outer shell 10 and an inner shell 11, the latter of which for the greater part of its circumference is divided at about the middle, leaving an ingress-opening to the valve-chamber proper much narrower than the diameter of the inlet-pipe; but on account of its length, taken circumferentially of said wall, of equal or greater area or capacity than that of said ingress-pipe. By this means I am able to greatly reduce the length of the valve structure. For example, I have shown in the drawings an ingress-opening one and one-half inches in diameter at the point where the supply-pipe is coupled onto the valve-casing, while the slit in the inner wall is only one-half an inch wide, so that the length of the casing is reduced a full inch. In entering, the fluid in passing from the supply-pipe spreads out into the annular chamber between the inner and the outer walls and thence passes into the interior of the valve through the slit in question from all sides except for a small distance at a point opposite the inlet, where I prefer to leave the metal solid for the purpose of making a by-pass.

Within the valve shell or casing is the main-valve seat 15, upon which the main valve 16 rests when the valve is closed. A stem 17 (or a continuation of the valve structure) extends up from the valve and carries a piston-head 18 upon its upper end, which head is of larger area than the valve. Said piston-head is preferably formed cup-shaped, as shown, the cup side or flange *f* extending up past the lower edge of the upper part of the inner wall 11 of the valve-casing, so that an inclosed chamber is formed above the piston-head.

Referring now especially to the construction illustrated in Figs. 1 to 4, inclusive, I form an annular ring 19 at a suitable point at or near the upper end of the lower part of the inner wall 11, with which the valve 16 will come in contact as said valve reaches its highest position during the opening movement. Extending between the valve-seat 15 and the ring 19 are guides 20, by means of which the main valve is guided in its movement as it recedes from or approaches the seating or cut-off points. The form of valve illustrated is especially designed as a flush-valve for water-closets and the like, and while it may be constructed to give a single discharge or flush I prefer to provide a means whereby it will deliver not only the main discharge or flushing

quantity of water, but also just before the final seating of the valve deliver a smaller discharge (not sufficient to cause a flush) to fill the bowl. I therefore provide for this purpose in addition to the rim 19, which forms the second or seating cut-off point, another rim 21, which forms a third cut-off point and divides the quantity of fluid passing through the valve (at one operation of it) into two discharges, the larger one of which serves to flush the closet, and the other and smaller one of which serves to fill the bowl after it has been flushed, as above stated. In doing this the movement of the valve itself is not interrupted; but the flow of fluid is momentarily interrupted, with the result stated, as the valve 16 passes the rim 21 on its way to its seat.

The space between the ribs 20 is tapered at the ends, so that the effective area of passage-way for the fluid around the valve during its opening and closing movements is greatest midway of the movement and least at the termination thereof. The flow is thus gradually decreased as the valve approaches its closing-point, and the valve is thereby caused to seat slowly and easily instead of suddenly and violently, as is apt to be the result where the passage-way is maintained full size throughout its complete length. This gradual variation in the size of the passage-way may be secured either by the construction which has just been described and which is illustrated in Fig. 2 of the drawings, or by the form of the valve itself, as illustrated in Figs. 5, 6, and 7, or by a construction in which both the valve and the adjacent walls are tapered between the seating or cut-off points, as illustrated in Fig. 8. In other words, the tapering formation may be either in the valve itself or in the walls surrounding it, or partly in both, without substantial variation in the result, one form being the equivalent of another and a change from one form to another being, in effect, a mere reversal of parts.

It should be explained at this point that when the by-pass is left entirely open, so that the fluid in passing out of the chamber above the piston-head when the valve is opened is not retarded by any back pressure, the operation of the main valve when started is to open suddenly and close gradually, so that the flushing or fluid-discharge occurs only during the closing movement. I may, however, provide for a double fluid-discharge or flushing by introducing into the by-pass a suitable valve, as 22, by means of which the effective area of the by-pass may be reduced, so that it shall be only slightly greater than the fluid-inlet perforation through the piston-head, in which case as the fluid from the chamber above the piston-head can be discharged only slightly faster than it enters the main valve is compelled to open slowly instead of substantially instantaneously, as when the by-pass is unobstructed, and consequently each manipulation of the valve will result in a double fluid-discharge or flush. It is obviously possible to make this by-pass-adjusting valve of any suitable form; but I have devised a special form which possesses some advantages. It consists of the plug 22, having channeled sides, the central portion being as large as the by-pass below it, while the perforation constituting said by-pass is counterbored or otherwise enlarged and threaded to receive the full size of the plug. By screwing the plug down tightly onto its seat the by-pass will be entirely shut off, while raising it slightly gives the opening desired, the channels in the sides being together of substantially as great cross-sectional area as the main perforation or by-pass portion below. Being within the structure of the valve under the cap it is not liable to be mischievously disturbed after being set to the desired point. This valve can obviously be set so that the upward movement of the valve shall just equal its downward movement, or it can be set so that the upward movement shall be longer or shorter than the downward or regularly flushing movement. In the case of unusually long sewer connections this will be of advantage, as it provides a means of securing a flow of water sufficiently long to give such connections an adequate flush.

By means of the valve-seat 15 and rim 19 or their equivalents I am enabled to form or provide duplicate cut-off points to the valve, so that as said valve reaches its limit of travel in either direction the flow of fluid will be shut off. In an automatically-acting valve (of the character in question) the movement of the main or piston valve, unless interrupted by some means not involved in its usual or regular operation, is continuous until the limit of movement is reached. I therefore (by means of these duplicate shut-off points) insure that when the valve is once opened it shall completely close before it can be operated again, and this irrespective of whether the auxiliary or starting valve is held open continuously or not. If said starting-valve is opened by a short pressure thereon in the ordinary way, the main or piston valve will travel up and down at its accustomed speed, (or the speed to which it has been regulated,) whereupon said main valve becoming regularly seated the flow of fluid will necessarily cease. If, however, the starting-valve is held open continuously or becomes stuck, so that it will not close, the main or piston valve will only rise to its highest position and will not return to its regular seat, but on account of the second or duplicate seat or cut-off which I have provided will by this ascending movement, as well as by the descending movement before described, shut off the flow of fluid through the main valve. A second movement of the starting-valve is a prerequisite to a further operation of the main valve in all cases.

As illustrated in Figs. 5, 6, 7, and 8, the ob-

jects and results of my invention are capable of accomplishment by several alternative forms of construction, all of which, however, are the equivalents of each other. In each of said figures a construction is shown in which there are seating or cut-off points at both ends of the movement of the valve. In Figs. 5 and 6 these cut-off points are located substantially as in Fig. 2. In Fig. 8 the valve is prolonged and the second flange or cut-off point is below instead of above the main-valve seat. In Fig. 7 the two seating or cut-off points are formed by the construction of the valve itself instead of in the valve-casing which surrounds it, this being merely a reversal of parts. In Figs. 5 and 6 the formation which causes the valve to seat slowly and easily instead of suddenly and violently is in the valve itself instead of in the casing surrounding it. The valve in these cases is made with the extension carrying the piston-head of a large size instead of being a mere stem, and the sides of this extension or body are formed with gradually-tapering depressions or grooves, so that the flow of fluid is reduced by the form of these parts instead of by that of the surrounding casing. In Fig. 8 the tapering or gradual flow-reducing construction is shown as formed partly in the casing and partly in the valve. In Figs. 7 and 8 the valve is guided in its movements by means of projecting wings 23 on the valve itself instead of the wings 20 in the valve-casing. In Fig. 6 I have shown means by which the fluid passage-way may be restricted, thus adapting the valve to operate under high pressures. This consists merely in filling up a part of said passage-way by half-rings or fillers 24 inserted in the space cut into the valve-body, these being shown as being held by the screw 25. Thus the same valve may be made to operate equally under different pressures by inserting or removing these fillers or half-rings of a proper thickness.

Other modifications will readily suggest themselves to those skilled in the art; but all such changes are mechanical merely and can be made at pleasure without departing from my invention.

The chamber above the piston-head 18 is supplied with fluid by means of a small opening 26, which extends through said piston-head, and consequently when the auxiliary or starting valve 27 is closed the main valve will also be kept closed by the pressure in said chamber on account of the area of the piston-head being larger than that of the valve 16. The opening 26 is regulated by means of a spiral-edged cut-off gate or plate 28, which is secured to the piston-head 18 by means of a pivot-screw 29. This gate 28 may be graduated and the graduation-marks may represent either the quantity of discharge (in gallons or otherwise) or the pressure in pounds per square inch under which the valve will best operate when set at the points indicated. I have shown it as graduated for pressure, the marks indicating the points at which the plate should be set at various pressures up to one hundred and sixty pounds to the square inch of surface. The marks indicate, respectively, "20," "40," "60," "80," "100," "120," "140," and "160;" but any other selection of figures may be made which may be desired. In adjusting this plate 28 the screw 29 is loosened slightly, the plate revolved thereon to the point desired, and the screw retightened, all as will be readily understood.

The lower end of the main-valve structure and also the top or cap 30 thereto are chambered out by coring, and the chambers 31 and 32 thus formed, together with the longitudinal perforation 33, down through the solid part of the main-valve casing wall 10 11, constitute the by-pass leading from the starting-valve 27 around to the egress opening or pipe 34. The by-pass valve 22 is preferably located in upper portion of the part 33 of the by-pass, as shown. The starting-valve 27 has a suitable valve-stem, which terminates in the button 35 at the upper end of the valve, where it can be conveniently reached for starting the valve into operation. When this button is pressed down, it opens the starting-valve 27, whereupon the fluid in the chamber above the piston-head 18 flows out through the by-pass, relieving the pressure and permitting the main-valve structure to rise, thus opening the main valve for the passage of fluid. The starting-valve stem 36 passes through a small chamber on its way to the outside, and a diaphragm 37 is secured to said stem in said chamber. Perforations lead to this chamber from the by-pass, so that the starting-valve is caused to close thereby as soon as the by-pass becomes filled unless prevented by superior pressure from the outside. The main-valve structure travels upwardly until it reaches its limit of movement and then the starting-valve 27, being by this time closed, it moves back again until the main valve is seated. Should the starting-valve 27 be held open or not permitted to close, the main valve will stop when it reaches its upward limit of movement, when the main valve 16, coming into close relation with the rim 19, the flow of fluid will thereby be stopped at that point. In normal operation the main valve 16 on its return first shuts off the flow when it reaches the rim or flange 21, and this marks the termination of the flow which causes the flush when the valve is used in connection with a water-closet. As the valve 16 passes on beyond the rim 21 the small additional flow permitted before it finally reaches its seat serves to fill the bowl of the closet, thereby making a perfect seal, but is not sufficient to cause a flush, as before stated.

I have already described a means consisting of the half-rings or fillers 24 for reducing the effective fluid passage-way, and thus adapting

the valve to be used under high pressures, such half-rings or fillers of varying thicknesses being adapted to be inserted and removed, according to requirements. I have also illustrated in connection with Figs. 5 and 8 another device for the purpose, consisting of a thin cone-like shell 40, adapted to be secured at the mouth of the inlet, with its smaller end projecting out into the inlet-pipe. These cone-like shells being small, light, and cheap may be furnished with the valve and used or not, according to the circumstances of the case. They may and preferably do have fine score-marks upon their outer surfaces, indicating the points at which they should be cut off to adapt the valve to the desired pressure. They are made originally with the ingress end small enough to adapt the valve to the highest pressure to which it will probably be subjected and can be adjusted for use with any less pressure by cutting off said shell at the appropriate score-mark. No further description of this feature will, however, be made at this time, as said feature is not claimed in this application, being made the subject-matter of another application, Serial No. 86,373, filed December 8, 1901.

Having thus fully described my said invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, in a valve, of a casing having a double wall, the inner wall and outer wall being united at or near the ends of said casing and also longitudinally along one side where a longitudinal perforation to serve as a by-pass is provided, said inner wall being nearly divided into two parts by a narrow circumferential slit through which the fluid enters the chamber therein, the cap and base of the valve-casing being also chambered to complete the above-mentioned by-pass, a starting-valve to said by-pass, and a main piston-valve suitably seated in the main-valve casing.

2. The combination, in a valve, of a suitable valve-casing, and a main piston-valve seated therein, two seats or cut-off points being provided whereby the fluid flow is shut off when the valve reaches its limit of travel in either direction, the space between the two cut-off points tapering gradually toward said cut-off points, whereby as the valve moves toward either end the available fluid-opening is decreased and the valve caused to seat slowly and easily instead of suddenly and violently, substantially as set forth.

3. The combination, in a valve, of a suitable valve-casing, a piston-valve operating therein, two seating or cut-off points situated at the limit of movement of said valve in either direction, guide-wings by which the valve in moving is kept to position, and spaces between said wings of greatest depth at a point intermediate the two seating or cut-off points and growing gradually shallower as said points are approached, substantially as and for the purposes set forth.

4. The combination, in a valve, of a suitable casing, a piston-valve therein, the piston-head whereof forms a partition dividing the interior of the valve into two chambers, a perforation through said piston-head whereby fluid is admitted slowly into the chamber above said head, and a centrally-pivoted spiral-edged cut-off gate to said orifice whereby the inflow of fluid therethrough may be accurately regulated and determined, substantially as set forth.

5. The combination, in a valve, of a suitable valve-casing, and a piston-valve mounted therein, said casing and valve being provided with three seating or cut-off points, one at each end of the travel of the valve, and the other near the termination of said travel as the valve approaches its seat, whereby a large or flushing discharge is first secured, and then a smaller or bowl-filling discharge, substantially as set forth.

In witness whereof I have hereunto set my hand and seal, at Indianapolis, Indiana, this 30th day of November, A. D. 1901.

JOSEPH W. NETHERY. [L. S.]

Witnesses:

CHESTER BRADFORD,

ALBERT F. ZEARING.