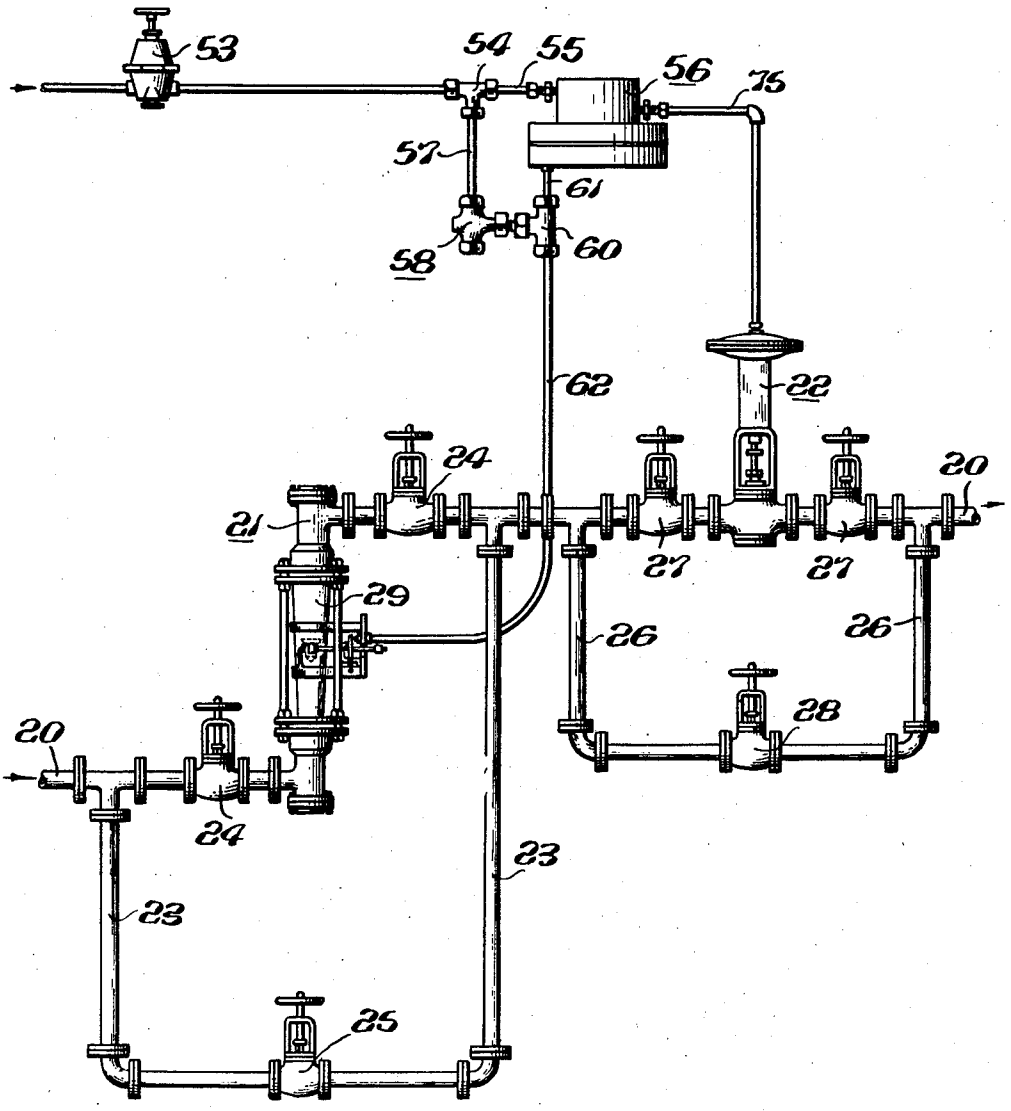
June 7, 1949. N. BREWER 2,472,090

FLOW-ACTUATED VALVE

Filed Nov. 23, 1943 3 Sheets-Sheet 1

Fig. 1.



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FLOW-ACTUATED VALVE

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Fig. 3.

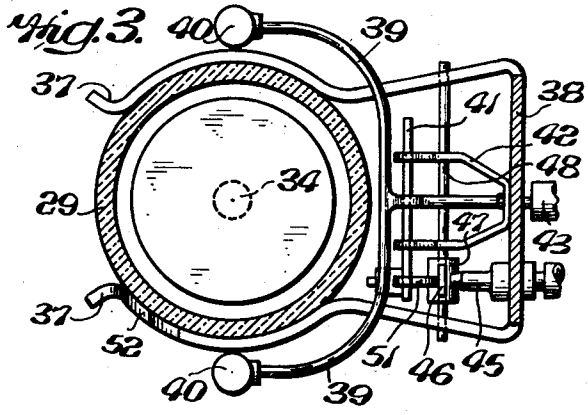


Fig. 5.

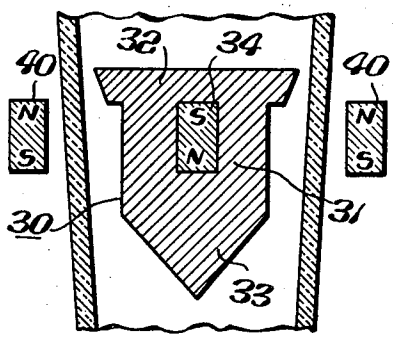


Fig. 2.

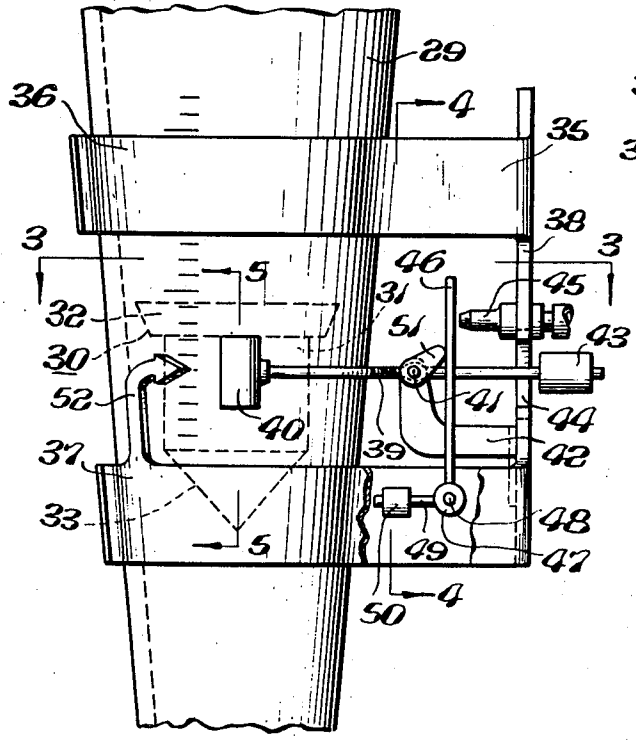
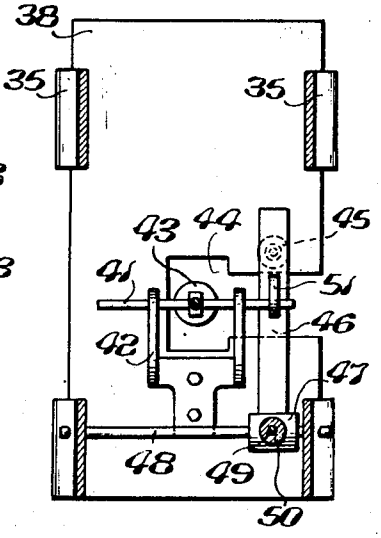


Fig. 4.



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FLOW-ACTUATED VALVE

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Fig. 6.

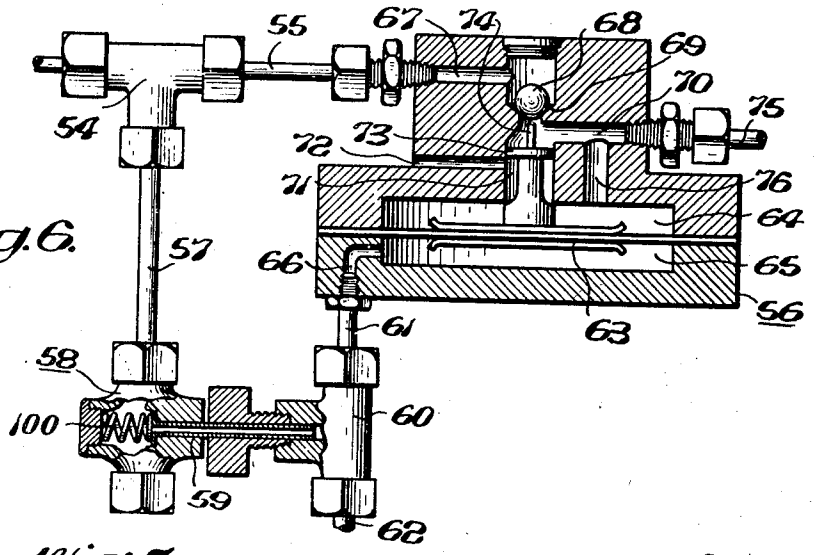


Fig. 7.

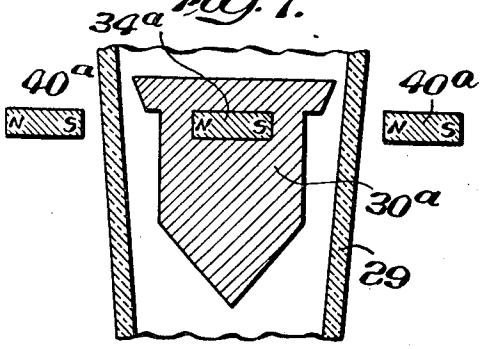


Fig. 8.

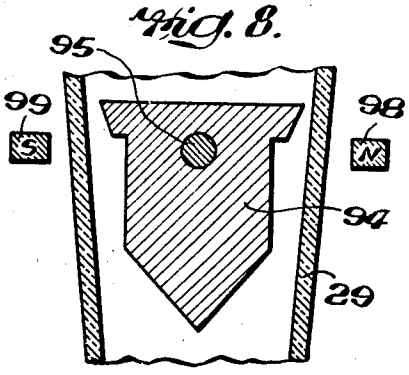
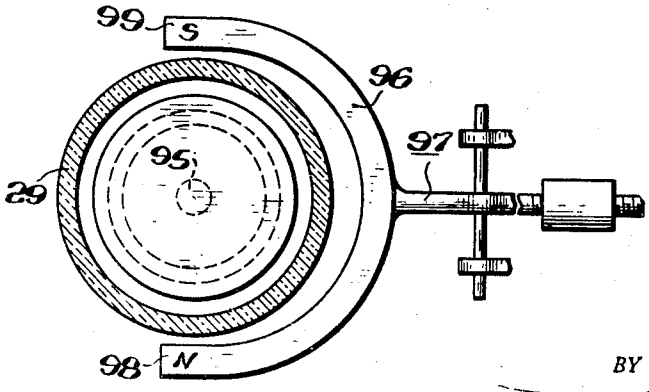


Fig. 9.



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Patented June 7, 1949 2,472,090

UNITED STATES PATENT OFFICE

2,472,090

FLOW-ACTUATED VALVE

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Application November 23, 1943, Serial No. 511,493

14 Claims. (Cl. 137—152)

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The present invention relates to a flow-actuated supply-and-waste type valve for use in systems for regulation and indication of the rate-of-flow of fluids.

An object of the present invention is to provide new and useful supply-and-waste type valve means for use in connection with the above-mentioned systems. Other objects and advantages of the present invention are apparent in the following detailed description, appended claims and accompanying drawings.

For the purpose of illustrating the invention, there are shown in the accompanying drawings forms thereof which are at present preferred, since the same have been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

Referring to the accompanying drawings in which like reference characters indicate like parts throughout:

Figure 1 represents a schematic view of one embodiment of the present invention applied to a system for maintaining constant rate-of-flow of fluid through a pipe-line.

Figure 2 represents a fragmentary side elevational view, on an enlarged scale, of the rotameter tube and associated parts of the embodiment of Figure 1—parts being broken away better to reveal the construction thereof.

Figure 3 represents a horizontal cross-sectional view generally along the line 3—3 of Figure 2.

Figure 4 represents a vertical cross-sectional view generally along the line 4—4 of Figure 2.

Figure 5 represents a vertical cross-sectional view generally along the line 5—5 of Figure 2.

Figure 6 represents a cross-sectional view, on an enlarged scale, of the relay valve mechanism of the embodiment of Figure 1.

Figure 7 represents a vertical cross-sectional view generally similar to that of Figure 5 but showing a modified form of the present invention.

Figure 8 represents a vertical cross-sectional view generally similar to that of Figure 5 but showing still another modification of the present invention.

Figure 9 represents a fragmentary plan view of the embodiment of Figure 8.

One phase of my present invention, shown generally in Figures 1 to 5, contemplates the use with a rotameter having an elongated vertical metering tube of axially-varying cross-sectional area and a metering float adapted for free up-and-down movement within the metering tube responsive to variations in rate-of-flow of fluid through the tube, of supply-and-waste type valve means, axially adjustable along the metering tube and actuated by movement of the metering float. Such supply-and-waste type valve may be used for automatically regulating a valve in the pipe-line responsive to variations in fluid rate-of-flow, whereby said variations are corrected and the rate-of-flow is maintained generally constant.

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In Figure 1, I have shown a pipe-line 20 having a rotameter 21 connected therein and having a diaphragm motor valve 22 connected therein for regulating the rate-of-flow of fluid therethrough. A by-pass line 23 is provided around the rotameter 21—valves 24 on either side of the rotameter 21 being closed, and valve 25 in the by-pass line 23 being opened when it is necessary to by-pass the rotameter. A similar by-pass line 26 is provided around the diaphragm motor valve 22—valve 27 on either side of the diaphragm motor valve 22 being closed and valve 28 in by-pass line 26 being opened when it is necessary to by-pass the diaphragm motor valve.

As shown more particularly in Figures 2 to 5, the rotameter includes a vertical elongated metering tube 29 which may be of glass or other suitable transparent material and which may be more or less uniformly downwardly tapered—the metering tube 29 being adapted for upward flow of fluid therethrough.

A metering float 30, having a generally cylindrical body portion 31, an uppermost transversely-extending flow-constricting head portion 32 and a lowermost conical tail portion 33, is adapted for free up-and-down movement within the metering tube 29—the metering float 30 having a density somewhat greater than the density of the fluid. As is well known in the art, the metering float 30 will rise within the metering tube 29 as the fluid rate-of-flow increases and vice versa—the position of the metering float, as read off against suitable graduations, being an indication of the rate-of-flow.

The metering float 30 is constructed of any suitable non-magnetic material and is provided with a permanent bar magnet 34 preferably disposed within the body portion 31 and extending generally axially therewithin.

A clamp 35 is adapted to be detachably connected around the outside of the metering tube 29—the clamp 35 being axially movable along said tube 29.

The clamp 35 includes upper and lower spring clips 36 and 37 respectively which surround the metering tube 29, and a base 38.

A forked lever 39 carries a pair of bar magnets 40 at the extremities of its forked end—the magnets 40 being in diametrically opposite positions outside the metering tube 29 and being spaced therefrom sufficiently to permit vertical movement thereof.

The lever 39 is mounted upon and keyed to a shaft 41 which is rotatably mounted upon the arms of a forked support 42 carried by the base 38 of the clamp 35. The other end of the lever 39 carries an adjustable counter-weight 43—a slot 44 formed in the base 38 of the clamp 35 permitting limited tilting of the lever 39.

A nozzle 45 is mounted upon the base 38 above the slot 44 therein.

A flapper assembly which is adapted to co-act with the nozzle 45 includes a flapper arm 46 having its lower end mounted upon a hub 47 carried by a shaft 48 having its ends journalled in suitable openings in the lower spring clip 37 of the clamp 35. An arm 49 extends generally horizontally from the hub 47 and carries an adjustable weight 50 which tends to rotate the flapper arm counter-clockwise (in Figure 2) about its pivot 48.

A cam 51 is carried by the shaft 41 of the lever 39—the car 51 bearing against the flapper arm 46 and tending to support it against the moment of the weight 50 as shown particularly in Figure 2. It is apparent that, if the forked lever 39 is moved counter-clockwise from the horizontal position shown in Figure 2, the cam 51 will also move so as to permit a counter-clockwise rotation of the flapper arm 46 from its generally vertical position in Figure 2 and away from the nozzle 45. On the other hand, if the lever 39 is moved clockwise from its position in Figure 2, the cam 51 will also move clockwise and will move the flapper arm 46 clockwise and toward the nozzle 45.

The cam 51 has been exaggerated in the drawings for the sake of clarity. Actually, however, the cam is given only very slight eccentricity since the total movement of the flapper arm 46 amounts to only a few thousandths of an inch between the limits of nearest approach to, and farthest recession from, the nozzle 45.

As shown particularly in Figure 5, the magnet 34 in the float 30 has its north and south poles disposed oppositely to the poles of the magnets 40 carried by the lever 39, so that the magnets 40 will be attracted by the magnet 34 and will tend to follow any movement thereof. If the metering float 30 is opposite the pointer 52 of the clamp 35, the center of the magnet 34 is in vertical alignment with the pivot 41 of the lever 39, whereupon the lever 39 will assume the horizontal position shown in Figure 2 with the magnets 40 in alignment with the magnet 34.

Should the metering float 30 tend to move downward within the metering tube 29 from the position shown in Figure 2, due to a drop in the fluid rate-of-flow, the magnets 40 will follow the magnet 34 and, as a result, the carefully-balanced lever 39 will move counter-clockwise to swing the flapper arm 46 away from the nozzle 45. If, on the other hand, the metering float 30 tends to move upward from the position shown in Figure 2 as a result of a rise in fluid rate-of-flow, the magnets 40 will again follow the magnet 34 to tilt the lever 39 clockwise and to move the flapper arm 46 toward the nozzle 45.

The diaphragm motor valve 22 is adapted to be operated upon movement of the flapper arm 46 (so as to reduce the flow when the metering float 30 rises above the pointer 52 and to increase the flow when the metering float 30 drops below the pointer 52) as will be described hereinbelow.

Air under pressure is passed through a pressure-reducing valve 53 from which it is sent, at a pressure of approximately fifteen pounds per square inch, to a T 54 wherein it divides into two streams, one passing through the line 55 leading to relay valve 56 and the other passing through a line 57 to a fitting 58 having a capillary tube 59 therein the tube 59 being held in place by a coil spring 100 as shown in Figure 6. The other end of the capillary tube 59 connects with a tee 60 wherein the air divides into two streams one passing through the line 61 to the relay valve 56 and the other passing through the line 62 to the nozzle 45.

The relay valve 56 contains a diphragm 63 separating upper and lower pressure chambers 64 and 65 respectively—the line 61 communicating with the lower pressure chamber 65 through a conduit 66.

The pressure line 55 connects with a conduit 67 in the relay valve 56—the other end of the conduit 67 leading to a check valve having a check ball 68 of stainless steel or the like seated upon an apertured valve seat 69, which in turn communicates with a generally horizontal outlet conduit 70 and with a generally vertical conduit 71 communicating with the upper pressure chamber 64. A conduit 76 connects the outlet conduit 70 to the upper pressure chamber 64.

An exhaust conduit 72 leads from the vertical conduit 71 to the exterior of the relay valve 56.

A piston valve 73 is mounted upon the diaphragm 63 and extends upwardly therefrom within the vertical conduit 71. A pin 74 extends upwardly from the piston valve 73—the upper end of the pin 74 terminating at the apertured valve seat 69.

A line 75 leads from the outlet conduit 70 to the diaphragm motor valve 22 and is adapted to transmit air under pressure to the valve 22 to actuate said valve in a manner to be hereinafter described.

In operation, assuming that fluid is passing through the pipe-line 20 at the predetermined rate-of-flow so that the metering float 30 is opposite the indicating pointer 52 and so that the flapper arm 46 is in the position shown in Figure 2, it is evident that air will escape through the nozzle 45 at a predetermined rate—the rate of escape of air through the nozzle 45 determining the pressure in the lower pressure chamber 65.

Should the rate-of-flow of fluid momentarily increase this causes the metering float 30 to rise to a position above that shown in Figure 2 whereupon the attraction of the magnet 34 for the magnets 40 will cause the lever 39 to tilt clockwise whereupon the cam 51 moves the flapper arm 46 closer to the nozzle 45. This restricts the nozzle 45 and reduces the rate of escape of air therefrom. Thus, the pressure in the lower pressure chamber 65 builds up and moves the diaphragm 63 and its associated piston valve 73 upward from the position shown in Figure 6. This causes the pin 74 to unseat the check ball 68 and to permit air under pressure to pass from the line 55 through the conduit 67, the apertured valve seat 69, the outlet conduit 70 and the line 75 to the diaphragm motor valve 22. The diaphragm motor valve 22 is arranged for direct action—that is an increase in air pressure transmitted to it

through the line 15 causes the valve to close and to reduce the rate-of-flow of fluid through the pipe-line 20.

So long as the metering float 30 is above the indicating pointer 52, the lever 39 will remain in its clockwise-rotated position and the flapper arm 46 will continue to restrict escape of air through the nozzle whereby increased air pressure will continue to be transmitted to the diaphragm motor valve 22 as described hereinabove to maintain the valve in its partially closed position. As the rate-of-flow of fluid drops due to the partial closure of the valve 22, the metering float 30 will gradually move downward until it again comes opposite the indicating pointer 52 whereupon the lever 39 will move back to its horizontal position causing the flapper arm 46 to move counter-clockwise and away from the nozzle 45. This permits greater escape of air through the nozzle 45 and results in a corresponding decrease in air pressure in the lower pressure chamber 65. In the meantime, the pressure in the upper pressure chamber 64 has gradually built up due to passage of compressed air from the conduit 67, past the open valve ball 68, through the connecting conduit 76 and into the chamber 64. As a result, the pressure in the lower pressure chamber 65 falls below that in the upper chamber 64 and the diaphragm 63 and its associated piston valve 73 and pin 74 move downward to their original position whereupon the check ball 68 reseats upon the valve seat 69 to cut off flow of air under pressure to the diaphragm motor valve 22.

The greater-than-normal air pressure acting on the motor valve 22 and, through the conduit 76, on the top of the diaphragm 63, moves said diaphragm 63 below the normal position shown in Figure 6. This moves the piston valve 73 down sufficiently to bring the exhaust conduit 72 in communication with the outlet conduit 70, whereupon the conduit 70 and the upper pressure chamber 64 are momentarily vented to relieve the excess pressure. This permits the diaphragm 63 to move back to the normal position shown in Figuge 6 in which the upper and lower pressure chambers 64 and 65 have equal pressure.

Thus, the pressure acting on the motor valve 22 has returned to normal and the valve has returned to its original setting in which the rate-of-flow is just sufficient to maintain the float 30 in its normal position opposite the pointer 52 as shown in Figure 2.

Should the rate-of-flow of fluid through the pipe-line 20 drop below its predetermined value, the metering float 30 will drop below the indicating pointer 52 and the lever will rotate counter-clockwise and will remain in this counter-clockwise-rotated position thereby causing the flapper arm 46 to be moved further away from the nozzle 45.

This permits greater escape of air through the nozzle 45 and produces a corresponding reduction in air pressure in the lower pressure chamber 65. This causes the diaphragm 63 and its associated piston valve 73 to move downward from the position shown in Figure 6 until the exhaust conduit 72 is brought into communication with the outlet conduit 70 whereupon the outlet conduit is vented to the atmosphere, thus reducing the pressure in the line 15 and the diaphragm motor valve 22. This reduction in air pressure causes the diaphragm motor valve to open further and to permit increased rate-of-flow of fluid through the pipe-line 20. This increase in flow gradually causes the metering float to move upward until

it again comes opposite the indicating pointer 52 whereupon the lever 39 is swung to horizontal position and the flapper arm is moved clockwise to the position shown in Figure 2 partically to constrict the nozzle 45 and to cause a corresponding increase in the lower pressure chamber 65. This increase in the pressure in the lower pressure chamber 65 causes the diaphragm 63 and its associated piston valve 73 to move upward and to close off the exhaust conduit 72. The valve ball 68 is momentarily opened to permit the air pressure acting on the motor valve 22 to return to normal whereupon the diaphragm motor valve assumes its original position to maintain the predetermined rate-of-flow of fluid through the pipe-line 20—the diaphragm 63 returning to the normal position shown in Figure 6 when the pressure in the upper and lower chambers 64 and 65 is equalized.

In Figure 7, I have shown a modified form of the present invention in which a metering float 30—*a* is provided with a horizontally extending magnet 34—*a* and in which the forked lever (39 or 77) is provided with horizontally extending bar magnets 40—*a* and 40—*b*; the magnets 40—*a* and 40—*b* being arranged with their opposite poles adjacent the metering tube 29. In this way, each pole of the magnet 34—*a* attracts the opposite pole of one of the magnets 40—*a* and 40—*b* to cause the forked lever to follow the vertical movement of the metering float as described hereinabove.

In Figures 8 and 9 I have shown a further embodiment of the present invention in which a float 94 is provided with an inner steel ball 95 and in which a U-shaped or horseshoe magnet 96 makes up the forked end of a counter-balanced lever 97. The U-shaped magnet 96 partially surrounds the metering tube 29 with the north and south poles 98 and 99 of the magnet in diametrically opposite positions. The opposed poles 98 and 99 of the horseshoe magnet 96 attract the steel ball 95 in the metering float 94 and cause the counter-balanced lever 97 to tilt in response to vertical movement of the metering float 94 in a manner similar to that described hereinabove.

It is apparent that the steel ball 95 could be used in place of the horizontally extending magnet 34—*a* in the embodiment of Figure 7 and that the magnet 34—*a* could be used in place of the steel ball 95 in the embodiment of Figure 8 and 9 and such modifications are within the scope of the present invention.

The present invention is particularly well adapted for use where a relatively light-weight metering float is required, as for example where a gas or the like having low specific gravity is being metered or where small rotameters measuring low rates-of-flow are being used. It has been impractical, in the past, to employ flow-regulation and/or remote indication with such light-weight floats since the elongated flow-extension arms required by conventional constructions unduly increased the weight of the float to a point at which it was no longer accurate or sensitive.

According to my present invention, on the other hand, I have found that extremely sensitive and accurate flow regulation and indication is obtainable even with extremely light floats. Thus, I have found that a magnet weighing as little as three grams or less, located within a float, exerts sufficient magnetic force to actuate the flapper-and-nozzle mechanism. As a result, flow control and/or remote indication is possible with even the smallest and lightest floats employed in plant or laboratory installations.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiments be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

Having thus described the invention, what I claim as new and desire to protect by Letters Patent, is:

1. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt.

2. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a magnet carried by said float and a magnet carried by one end of said lever, said lever magnet being disposed in close proximity to said tube.

3. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said utbe, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a magnet carried by said float and a pair of horizontally-spaced magnets carried by said lever, said lever magnets being disposed on opposite sides of said tube.

4. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a body of magnetic material carried by said float and a magnet carried by said lever, said lever magnet being disposed in close proximity to said tube.

5. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a body of magnetic material carried by said float and a pair of horizontally-aligned magnets carried by said lever, said lever magnets being disposed generally in diametrically-opposed relationship on opposite sides of said tube.

6. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a vertically-disposed bar magnet carried by said float

and a similar vertically-disposed bar magnet carried by said lever, said lever magnet being disposed in close proximity to said tube and having its north and south poles reversed relative to the poles of the float magnet.

7. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a vertically-disposed bar magnet carried by said float and a pair of similar bar magnets carried by said lever, said lever magnets being disposed on opposite sides of said tube and having their north and south poles reversed relative to the poles of the float magnet.

8. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a horizontally-disposed bar magnet carried by said float and a pair of similar bar magnets carried by said lever, said lever magnets being disposed in horizontal alignment on opposite sides of said tube, that lever magnet which is adjacent the south pole of the float magnet having its north pole innermost and that lever magnet which is adjacent the north pole of the float magnet having its south pole innermost.

9. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged

that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a body of magnetic material carried by said float and a generally U-shaped magnet carried by said lever, said lever magnet having its north and south poles disposed generally on opposite sides of said tube.

10. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a magnet carried by said float and a generally U-shaped magnet carried by said lever, said lever magnet having its north and south poles disposed in horizontally-spaced relationship on opposite sides of said tube.

11. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a body of magnetic material carried by said float, a magnet carried at one end of said lever in close proximity to said tube and a counter-weight disposed at the other end of said lever.

12. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one

end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said magnetic couple comprising a magnet carried by said float, a magnet mounted at one end of said lever in close proximity to said tube, and a counterweight adjustably mounted at the other end of said lever.

13. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said last-mentioned means comprising a weight adapted to move said flapper relative to said nozzle and a cam bearing against said flapper, said cam being operatively connected to said lever whereby tilting of said lever will cause movement of said cam and of said flapper.

14. A device of the character described comprising a vertical tube, a float within said tube, said tube and float being so constructed and

arranged that the float will assume definite positions, respectively, for each different rate-of-flow of fluid through said tube, a supply-and-waste type air valve including a nozzle and a flapper, a balanced lever mounted adjacent said tube and adjustable vertically therealong, means creating a magnetic couple intermediate said float and one end of said lever, the lever, lever mounting and magnetic couple being so arranged that said lever mounting may be adjusted to position said lever horizontally for any desired position of said float, vertical movement of said float from said desired position causing tilting of said lever, and means for causing relative movement of said flapper and said nozzle responsive to tilting of said lever, the air pressure within said nozzle varying generally according to the angle of tilt, said last-mentioned means including a weight connected to said flapper and adapted to urge it away from said nozzle, a rotatable cam bearing against said flapper, and means operatively connecting said cam to said lever whereby tilting of said lever will cause rotation of said cam and of said flapper.

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