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VALVE OPERATING MECHANISM

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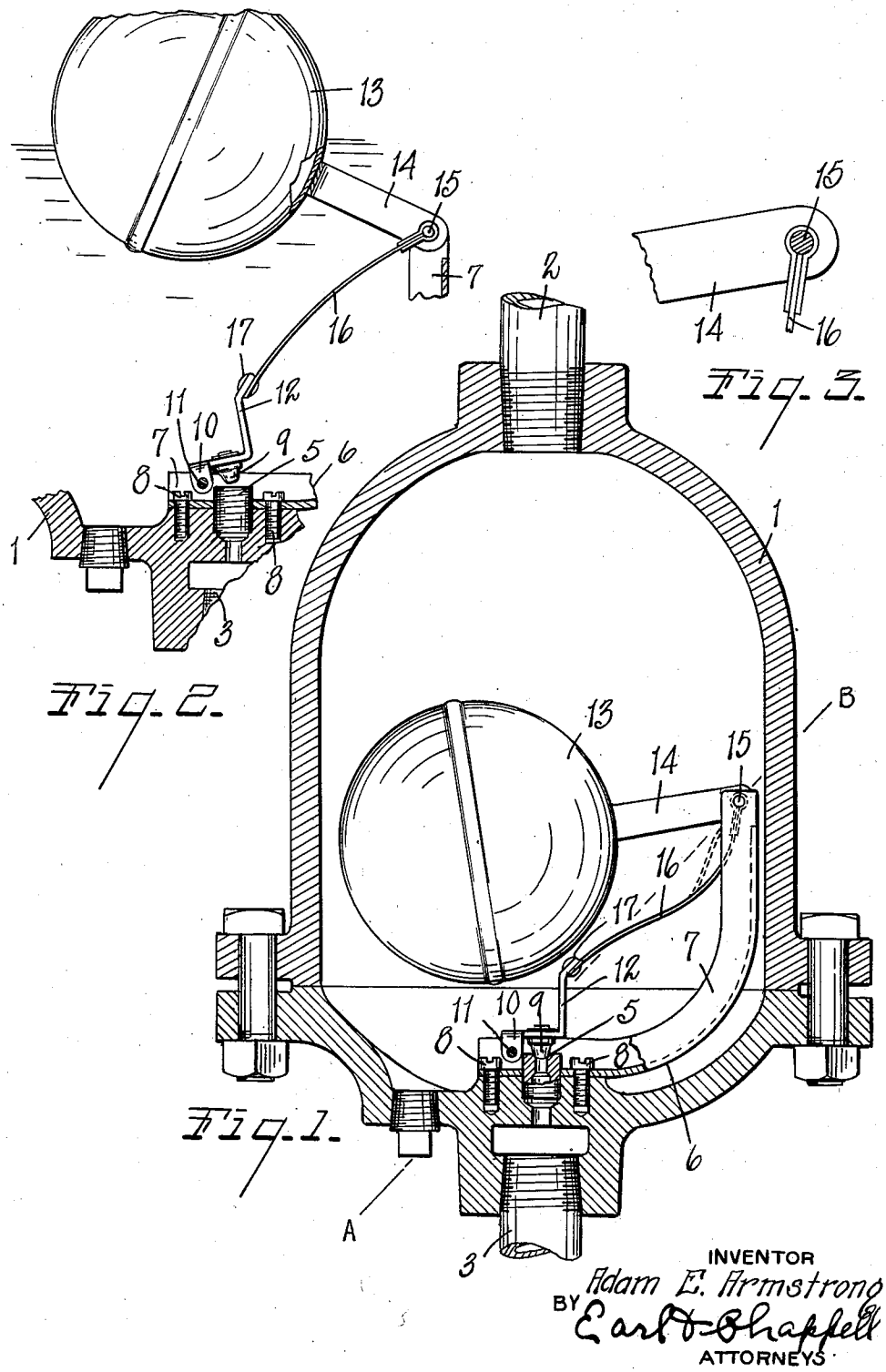


Fig. 1.

Fig. 2.

Fig. 3.

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VALVE OPERATING MECHANISM

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12 Claims. (Cl. 137—103)

This invention relates to improvements in valve operating mechanisms.

The main objects of this invention are:

First, to provide a novel valve operating mechanism for a float controlled valve.

Second, to provide a mechanism of the type described adapted to maintain a valve firmly seated against a valve opening or port until a predetermined fluid or liquid level is reached on one side thereof, then to open the valve quickly and fully.

Third, to provide a float controlled valve in which the valve is opened and closed with a snap action resulting in a full opening of the valve on each actuation and the forceful seating thereof.

Fourth, to provide a mechanism of the type described including an element adapted to transmit force in two different directions during a uni-directional movement of a control member for the element.

Fifth, to provide a mechanism of the type described which is simple and inexpensive in its parts but highly effective in operation.

Objects relating to details and economies of the invention will appear from the description to follow. The invention is defined in the claims.

A preferred embodiment of the invention is illustrated in the accompanying drawing, wherein:

Fig. 1 is a view in vertical section illustrating a float chamber or housing with the valve and valve control mechanism embodying the invention associated therewith, the valve being in closed position.

Fig. 2 is a fragmentary view similar to Fig. 1, illustrating the valve operating mechanism in valve opening position.

Fig. 3 is an enlarged fragmentary view illustrating a detail of construction.

The present invention relates to a quick or snap acting valve adapted to maintain a valve opening closed and thereby prevent the exit of liquid from a closed chamber until a predetermined liquid level is reached in the chamber, then to fully open position instantaneously or with a snap action. I have shown the valve and operating mechanism therefor in a preferred adaptation to an air trap for the separation of liquid from air or steam in a drainage system; however, it will appear from the description to follow that the principle of my invention has broad application in other types of devices wherein it is desired to control the flow of liquid past a valve opening. In such devices, hitherto known valve operating mechanisms have been found unsatisfactory in that they operate too slowly, with an attendant likelihood of a wire drawing effect on the valve seat or of the deposition of solid matter around the same, which subsequently prevent effective closing of the valve or sealing of the valve seat. These objections are sufficiently serious to render various well known types of valve operating mechanisms not entirely satisfactory; even though the inherent slowness of operation thereof does not itself constitute an objectionable feature.

The present invention overcomes the above noted defects by the use of a valve operating mechanism characterized essentially by an element adapted to transmit force in two directions, i. e., a longitudinal thrust in the direction of its length during part of the uni-directional movement of its control or actuating member and a lateral or arcuate spring action during a subsequent part of the aforesaid uni-directional movement of its control element, the result being that the valve is held firmly in place by a substantial and, in fact, increasing force during the initial movement of the control member and, after a certain point in the said movement is reached, is instantaneously shifted to a fully open position.

Referring to the drawing, the reference numeral 1 indicates a sealed trap chamber or housing adapted to have liquid and gas or vapor which may contain air admitted thereto through an inlet pipe 2 and to have the liquid discharged therefrom through a discharge pipe 3, the liquid in flowing to the latter pipe passing through an adjustable valve seat member provided with a valve seat 5.

Adjacent the valve seat 5 I provide a valve and valve operating assembly generally indicated by the numeral 6. This assembly includes a curved bracket 7 attached to the bottom of housing or chamber 1 by means of screws 8 and a valve 9 having an extension or pivot arm 10 pivoted at 11 to the bracket 7. The valve assembly further includes an upstanding or offset arm 12 secured to the valve 9 for a purpose to be described.

The reference numeral 13 indicates a sealed ball float carried by an arm 14 which is fastened to a pin 15 serving to pivot the arm and float to the upper end of bracket 7, the float, arm and pin being adapted to move angularly at the pivot point as the liquid level in the float chamber rises.

Pin 15 is likewise fixedly connected to one end of a thin, flexible, leaf spring 16, the other

end of which is attached to the uppermost end of the valve arm 12 at a point 17 above the imaginary line A, B through the pivot points of the valve float. The length of spring 16 is greater than the distance between its points of attachment to the pin 15 and arm 12, i. e., between the pin and point 17, respectively, so that in closing position the spring element is bowed as indicated in solid lines in Fig. 1, the spring crossing the line A—B and exerting a substantial resilient endwise thrust between pin 15 and arm 12 serving to maintain valve 9 against its seat 5.

As the liquid level in the float chamber rises, the float and pin 15 move angularly in clockwise direction causing the spring to assume the outline illustrated in dotted lines in Fig. 1, but still exerting endwise thrust on the valve arm 12 to seat valve 9 and, in fact, increasing this thrust over that exerted thereby in the solid line position. Instead of a once-reversed curved outline as illustrated in solid lines in Fig. 1, the element assumes the doubly reversed outline shown in dotted lines, and as the pivotal movement of the pin 15 is continued, the mid-part of the element 16 approaches the imaginary line A—B. A critical point is finally reached at which the spring element flexes exceedingly rapidly in a single direction throughout its entire length to the position illustrated in Fig. 2, thereby instantaneously exerting a substantial lateral or arcuate leaf spring action on the arm 12, with consequent instantaneous full opening of valve 9 from the seat 5. In this position the spring is also exerting end thrust acting to hold the valve in open position.

As the float 13 falls with the level of liquid in the housing flexing moment is applied to the spring until the critical point is reached when the spring flexes in the opposite direction to fully and instantaneously close valve 9, thus eliminating excessive wire drawing at the valve seat and dislodging or preventing the disposition of solid particles suspended in the liquid around the valve seat.

I have illustrated and described my improvements in an embodiment which is very practical. I have not attempted to illustrate or describe other embodiments or adaptations as it is believed this disclosure will enable those skilled in the art to embody or adapt my improvements as may be desired.

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

1. In combination, a float chamber provided with a valve seat, a valve pivotally mounted in said chamber adjacent said seat, and means for rapidly actuating said valve from fully closed to fully open position relative to said seat and vice versa, comprising an arm connected to the valve, a fixed supporting bracket, a float having an extension pivotally mounted on said bracket and adapted to rise and fall in said chamber in accordance with the level of liquid therein, and means for actuating said valve in accordance with the movement of the float, comprising an elongated flat leaf spring element fixedly connected at its ends to said arm and float extension, said element being longer than the distance between its points of connection to the arm and float extension, to thereby assume a bowed outline, and its point of connection to the arm being disposed whereby the element crosses a line between the pivot points of the float extension and valve in closed position of the latter, said element in lowered position of the float exerting longitudinal thrust on the arm serving to maintain the valve closed, and flexing rapidly when the float rises to a predetermined level to exert an arcuate leaf spring action on the arm and thereby fully open the valve.

2. In combination, a float chamber provided with a valve seat, a valve pivotally mounted in said chamber adjacent said seat, and means for rapidly actuating said valve, comprising a fixed support, a float having an extension pivotally mounted on said support and adapted to rise and fall in said chamber in accordance with the level of liquid therein, and means for actuating said valve in accordance with the movement of the float, comprising an elongated flat leaf spring element connected at one end to said valve and fixedly connected at the other end to said extension, said element being longer than the distance between its points of connection to the valve and float extension, to thereby assume a bowed outline, and its point of connection to the valve being disposed whereby the element crosses a line between the pivot points of the float extension and valve in a given position of the latter, said element in one position of the float exerting longitudinal thrust on the valve serving to maintain the valve in said given position and flexing rapidly when the float reaches a predetermined level to exert an arcuate leaf spring action on the valve and thereby fully actuate the valve to a position other than said given position.

3. In combination, a member having a valve seat, a valve pivotally mounted adjacent said seat, and means for rapidly actuating said valve, comprising a float having an extension pivotally mounted relative to said member and adapted to rise and fall in said member in accordance with the level of liquid therein, and means for actuating said valve in accordance with the movement of the float, comprising an elongated spring element fixedly connected at its ends to said valve and float extension, said element being longer than the distance between its points of connection to the valve and extension to thereby assume a bowed outline, and the point of connection to the valve being disposed whereby the element crosses a line between the pivot points of the extension and valve in one position of the latter, said element exerting longitudinal thrust on the valve in said one position serving to maintain the valve closed, and flexing rapidly when the liquid level reaches a predetermined point to exert arcuate leaf spring action on the valve and thereby actuate the valve to another position.

4. In combination, a liquid receiving member having a valve opening therein, a valve pivotally mounted adjacent the opening for coaction with the latter and having an extending arm thereon, a float pivotally mounted in said member, and means for rapidly and fully actuating said valve to open and closed position in accordance with the movement of said float, comprising an elongated flat spring member disposed under flexing tension between and having its ends fixedly connected to said arm and to the float at the pivot point of the latter, the end of the spring member connected to said last named pivot point moving angularly with the float upon movement thereof, said spring member crossing a line through the pivot points of the valve and float and flexing rapidly when the liquid level in said liquid receiving member reaches a predetermined point whereby to alter the direction of the pre-

dominant force exerted thereby on the arm and open or close said valve.

5. In combination, a liquid receiving member having a valve opening therein, a valve pivotally mounted adjacent the opening for coaction with the latter, a float pivotally mounted in said member, and means for rapidly and fully actuating said valve to open and closed position in accordance with the movement of said float, comprising an elongated flat spring member disposed under flexing tension between and having its ends fixedly connected to said valve and to the float to move angularly with the float upon movement thereof, said spring member crossing a line through the pivot points of the valve and float and flexing rapidly when the liquid level in said liquid receiving member reaches a predetermined point whereby to alter the direction of the predominant force exerted thereby on the valve and open or close the latter.

6. In combination, a liquid receiving member having a valve opening therein, a valve mounted adjacent the opening for coaction with the latter, a float pivotally mounted in said member, and means for rapidly and fully actuating said valve to open and closed position in accordance with the movement of said float, comprising an elongated flat spring member disposed under flexing tension between and having its ends fixedly connected to said valve and to the float to move angularly with the float upon movement thereof, said spring member flexing rapidly when the liquid level in said liquid receiving member reaches a predetermined point whereby to alter the direction of the predominant force exerted thereby on the valve and open or close the latter.

7. In combination, a member having a valve opening therein, a valve for the opening movably mounted adjacent the opening, a float pivotally mounted in said member, and means for rapidly and fully actuating said valve to open and closed position in accordance with the movement of said float, comprising an elongated spring element disposed under flexing tension between and having its ends connected to said valve and to the float, the end of the element connected to said float moving angularly therewith upon movement of the float, said element flexing rapidly when the liquid level in said member reaches a predetermined point whereby to alter the direction of the predominant force exerted thereby on the valve and open or close the latter.

8. In combination, a device having a valve seat, a valve pivotally mounted on the device for coaction with said seat to open or close the same, means for rapidly actuating said valve from open to closed position and vice versa, comprising a member adapted to be actuated pivotally mounted on the device, and an elongated leaf spring element fixedly connected to said valve and to said member at the pivot point of the latter whereby at least a portion thereof moves angularly with the member, said element being disposed between the valve and member and placed under spring tension thereby to assume a bowed outline with the element crossing a line through the pivot points of the valve and member, said element flexing rapidly when said member is actuated beyond a predetermined point to alter the direction of the predominant force exerted by the element on the valve and open or close the latter.

9. In combination, a device having a valve seat, a valve mounted on the device for movement relative to said seat to open or close the same, means for rapidly actuating said valve from open to closed position and vice versa, comprising a member adapted to be actuated pivotally mounted on the device, and an elongated leaf spring element fixedly connected to said valve and to said member at the pivot point of the latter whereby at least a portion thereof moves angularly with the member, said element being disposed between the valve and member and placed under spring tension thereby to assume a bowed outline, said element flexing rapidly when said member is actuated beyond a predetermined point to alter the direction of the predominant force exerted by the element on the valve and open or close the latter.

10. In combination, a device having a valve seat, a valve mounted on the device for movement relative to said seat to open or close the same, means for rapidly actuating said valve from open to closed position and vice versa, comprising a member adapted to be actuated pivotally mounted on the device, and a spring element operatively connected at one end to said valve and fixedly connected to said member actuated by movement of the latter, said element being under spring tension and flexing rapidly when said member is actuated beyond a predetermined point to alter the direction of the predominant force exerted by the element on the valve and open or close the latter.

11. In a device of the class described, the combination with a float chamber provided with a discharge port having a surrounding conical valve seat, of a conical valve coacting with said seat provided with an arm pivotally mounted at one side of said seat, said valve having an upwardly projecting actuating arm opposite said pivot arm, a float having a pivot fixed thereto, and a blade spring connected at one end to said actuating arm and at the other end fixedly connected to said pivot whereby when the float rises and falls flexing tension is applied to the spring, the length of the spring exceeding the distance between the end of said actuating arm and said float pivot when the valve is seated, the point of attachment of said spring to said actuating arm being at all times at one side of the plane through the float pivot and the valve pivot.

12. In a device of the class described, the combination with a float chamber provided with a discharge port having a surrounding valve seat, of a valve coacting with said seat provided with an arm pivotally mounted at one side of said seat, said valve having an upwardly projecting actuating arm opposite said pivot arm, a float having a pivot fixed thereto, and a blade spring connected at one end to said actuating arm and at the other end fixedly connected to said pivot whereby when the float rises and falls flexing tension is applied to the spring, the length of the spring exceeding the distance between the end of said actuating arm and said float pivot when the valve is seated.

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