

Dec. 13, 1932.

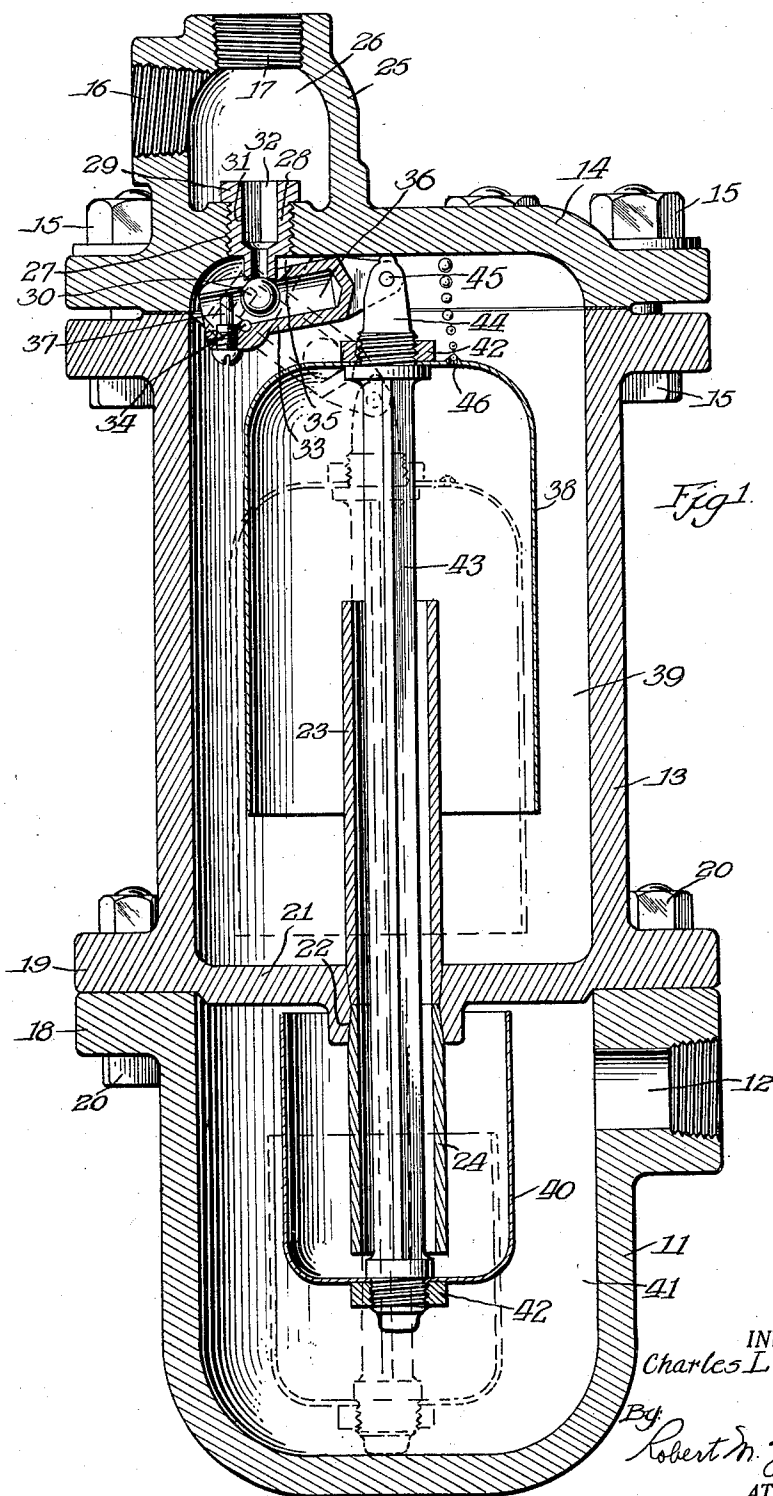
C. L. SHANK

1,890,591

STEAM TRAP

Filed Jan. 31, 1930

2 Sheets-Sheet 1



INVENTOR.

Charles L. Shank.

By Robert M. Zacharias

ATTORNEY.

Dec. 13, 1932.

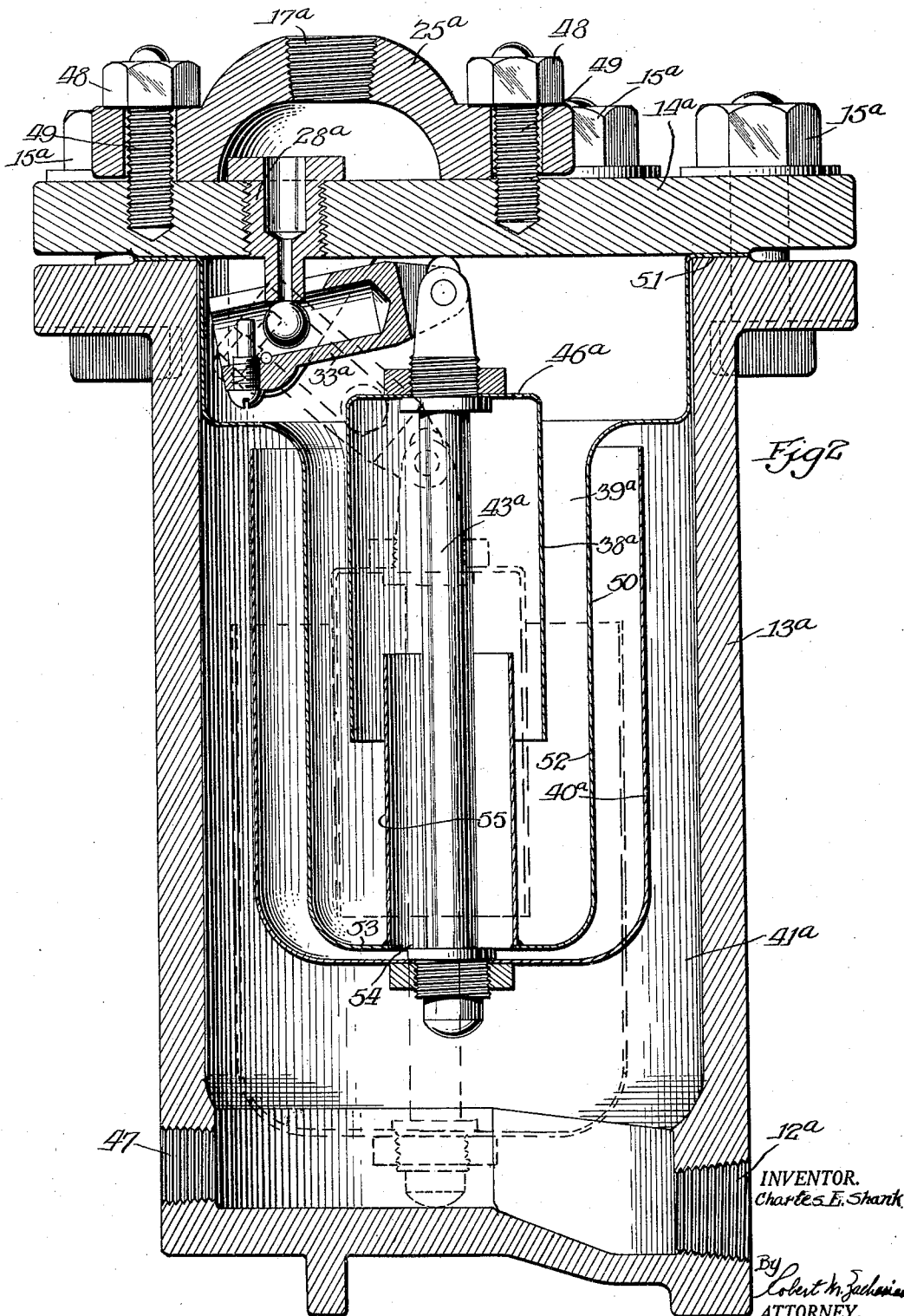
C. L. SHANK

1,890,591

STEAM TRAP

Filed Jan. 31, 1930

2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

CHARLES L. SHANK, OF NORTH CANTON, OHIO

STEAM TRAP

Application filed January 31, 1930. Serial No. 425,045.

This invention relates to valves, and more particularly to valves of the type known as "steam traps" and embodying controlling means for the valve to prevent the passage therethrough of gas but to permit the passage of liquid. One of the objects of the invention is to provide a structure for this purpose which can be economically manufactured, which will be reliable and efficient in operation, and which will be capable of withstanding the wear and strains incident to use. Further objects of the invention are to provide a structure of this type in which the danger of leakage is minimized, in which all possibility of accidental closure of the valve by the rush of current therethrough will be avoided, and in which operation of the valve can not be prevented by "air binding".

Further objects of the invention and the various novel features of construction of embodiments of the invention will be apparent from a consideration of the following specification in connection with the accompanying drawings, in which:—

Fig. 1 is a view in central vertical section of a structure embodying the invention; and

Fig. 2 is a view similar to Fig. 1, but showing a modified structure embodying the invention.

In the structure shown in Fig. 1, the body of the steam trap is formed of a cup shaped lower casing portion 11, having an inlet 12, a tubular upper casing portion 13, and a cap portion 14, removably secured to the top of the upper portion 13 by bolts 15, or other suitable means, and having outlets 16 and 17. The lower casing portion 11 and the upper casing portion 13 have their engaging surfaces machined, and are detachably secured together, preferably being provided with annular flanges 18 and 19 to receive attaching bolts 20. A diaphragm 21 is shown as formed integral with the upper body member 13, but it will be apparent that, if desired, it may be a separate piece clamped between the two members by the bolts 20. A central opening 22 is provided in the diaphragm 21, and is reamed out, both from top and bottom, to receive a tube 23, which may be forced into the opening and extends upwardly there-

from to a point above the center of the casing member 13, a similar tube 24 being likewise secured in the opening at the lower side of the diaphragm 21 and extending downwardly therefrom to a point adjacent the center of the lower casing member 11. It will be apparent that the tube 23 and the tube 24 may be threaded into the diaphragm 21, if desired; may be made in one piece, if desired; or may be cast integrally with the diaphragm.

The cap member 14 is preferably formed with a dome shaped extension 25, which may be integral therewith, or may be a separate piece secured to the cap member by bolts, or other suitable means, the extension 25 providing an outlet chamber 26 from which the outlets 16 and 17 lead. An opening 27 is formed in the body of the cap member 14, into which opening a valve seat member 28 is threaded, being insertable through the outlet 17, if necessary, and having a flange 29 to facilitate proper positioning within the cap member. The lower end of the member 28 is preferably reduced in diameter and is concave at its end to provide a seat for a ball valve member 30, an outlet opening 31 being provided in the member 28 and enlarged and squared at the top of the member as shown at 32, to receive a wrench, if desired.

A ball housing 33 is pivoted upon a pin 34 between a pair of lugs 35, which depend from the cap member 14 and only one of which is shown in the drawings. The housing 33 is formed with a bore 36 large enough to loosely receive the ball 30, being essentially an elongated cup deep enough to protect the ball from any rush of current of the liquid when in the dotted line position shown, and having a straight bottom down which the ball may roll by gravity when the housing is tilted to the full line position shown. Adjacent the open end of the housing 33, a finger 37 is provided to prevent escape of the ball from the housing and to force the ball from its seat on the member 28, as the housing is swung down toward the dotted line position.

An inverted cup member or float 38 is mounted in the upper chamber 39 formed by

the upper casing portion 13 and the cap portion 14 and a lower cup member 40 is mounted in the lower chamber 41 formed in the lower casing portion 11, such cup members being rigidly secured by nuts 42 to the ends of a rod 43 which extends vertically through the tubes 23 and 24 and has an extension 44 at its top which is pivotally connected at 45 to the end of the valve housing 33. As shown, the rod 43 is preferably cross-shaped in section to provide greater clearance within the tubes 23 and 24, and the upper cup member 38 is of much greater size than is the lower cup member 40. The upper cup member is of such length that its lower open end is at all times well below the upper end of the tube 23, and the lower cup member 40 is so shaped that its open upper end is always well above the lower end of tube 24. To permit the slow leakage of air from the upper cup member or float 38, and to thus prevent "air binding", a small vent 46 is provided in the top of the float.

The structure shown in Fig. 2 is essentially the same as that of Fig. 1, and many of the parts are identical with the corresponding parts in Fig. 1, certain of the parts being changed, however, to simplify and lighten the structure. The casing is a single cylindrical cup-shaped member 13^a, provided with a cap portion 14^a, such members being provided with flanges which receive bolts 15^a by which the members are secured together. At its bottom the casing is provided with an inlet 12^a and a blow-out opening 47, and a valve-seat member 28^a is threadedly mounted in the cap portion 14^a and covered by a dome-shaped outlet extension 25^a, having an outlet 17^a and secured to the cap portion by nuts 48 engaged upon studs 49 which are threaded into the cap portion.

The valve parts of the structure shown in Fig. 2 are of the same construction as those shown in Fig. 1, and the valve is operated by an upper float 38^a and a lower float 40^a, secured to the upper and lower ends, respectively, of a rod 43^a, which in turn is pivotally secured at its upper end to the valve housing 33^a.

The space within the casing is divided into an upper compartment 39^a and a lower compartment 41^a by a diaphragm member 50, preferably of sheet metal and having, at its upper end, an annular flange 51 which is clamped between the top of the casing and the cap portion 14^a. The upper part of the diaphragm member 50 substantially fills the top of the casing, and its lower portion is narrowed, as shown at 52, and provided with a bottom wall 53 having an opening 54 therein. A tube 55 extends upwardly from the bottom wall about the opening 54, and may be made integral with the diaphragm member or may be welded or otherwise secured thereto as desired. The cup-shaped float

member 38^a is of such dimension that it surrounds the tube 55 and its lower open end is always below the upper end of the tube 55. The lower cup-shaped float member 40^a surrounds the narrowed extension 52 of the diaphragm member, and its open upper end is always well above the level of the bottom wall 53 of such extension.

Considering the operation of the embodiments of the invention as shown, and assuming the parts to be in the position shown in dotted lines, the water of condensation, entering the inlet 12 or 12^a, will pass down into the lower float member 40 or 40^a, upwardly through the tubes 23 and 24 or 55, downwardly within the upper float member 38 or 38^a and then upwardly about such float member and out through the open valve and the outlet 17 or 17^a. The condensate will continue to be discharged as long as liquid enters the inlet opening, and it will be apparent that the ball valve member 30 will remain within its housing 36 and cannot be moved by the rush of current to close the valve. Any air trapped in the upper float member 38 or 38^a will slowly escape through the vent 46 and will be carried out with the water.

When any material quantity of vapor or gas enters the inlet 12 or 12^a it accumulates in the upper part of the lower chamber 41 or 41^a and will drive the liquid level in the lower float 40 or 40^a down, the liquid being forced up through the tubes 23 and 24 or the tube 55, and the float, being surrounded by liquid will be buoyant and tend to lift the rod 43 or 43^a. When the liquid level in the lower float is lowered sufficiently the vapor or gas will pass upwardly within the tubes 23 and 24 or tube 55 and accumulate in the top of the upper float 38 or 38^a, forcing the liquid out of the open lower end of the float and up about the float and through the valve to the outlet. As the liquid becomes displaced from the upper float member, such member will likewise become buoyant and eventually the buoyant effect of the floats will be sufficient to raise the rod 43 or 43^a and the valve housing 33 or 33^a connected thereto, to the full line position shown, permitting the ball valve member 30 to roll down against the pin 37 and be caught by the current and seated against the valve seat 28, thus stopping the discharge. The steam or vapor trapped in the top of the lower compartment 41 and 41^a, as well as in the top of the upper float 38 and 38^a will gradually condense, some of the gases escaping through the vent 46 and accumulating in the top of the upper compartment 39 or 39^a ready to be discharged when the valve is again open, but it will be apparent that no great quantity of gas can rush past the valve when the parts are in the full line position shown, as the valve will be seated by the rush of current and held seated by the greater pressure below it.

As the steam or vapor condenses the floats tend to lose their buoyancy, and if liquid again enters the inlet 12 or 12^a it will rise within the lower compartment 41 or 41^a and overflow the rim of the lower float 40 or 40^a, filling up the float, and will rise within the upper float to occupy the space formerly occupied by the steam which has condensed, and when the floats are no longer sufficiently buoyant to prevent it, they will move downwardly with the rod 43 or 43^a, tilting the valve housing member and engaging the finger or pin 37 with the ball 30 to unseat it, whereupon it will roll down into its housing. The uncondensed gas which has accumulated at the top of the upper chamber 39 or 39^a will be carried out with the flow of liquid, and the valve will remain open and the flow will continue so long as liquid is entering the inlet and until sufficient uncondensed gas or vapor enters to again increase the buoyancy of the floats sufficiently to again operate the valve.

While a vent 46 may be formed in the top of the upper float 38^a of the structure shown in Fig. 2 to prevent "air binding", such provision is not necessary. The lower float in this embodiment is much larger than the upper float and it consequently dominates the upper float in controlling the operation of the valve. As the lower float 40^a again fills with liquid it will effect operation of the valve and the air trapped in the upper part of the upper float 38^a will be carried down and out of such member by the rush of liquid.

It will be apparent that the use of two floats renders the device more positive of operation to either open or closed condition, and avoids the objectionable features of either a float open at the top, or a float open at the bottom, used alone. It will also be understood that, as the flow through the outlet is directed upwardly, the valve ball after being forcibly unseated, tends to move away from its seat by gravity, and the valve will be entirely open so that cutting of the valve surfaces by the current is minimized. When the valve closes it closes quickly, there being, no parts connected to and slowing the movement of the ball toward its seat.

While two preferred embodiments of the invention have been shown and described, it is realized that many changes may be made in details of structure without departing from the spirit of the invention which is defined in the following claims.

I claim:

1. In a steam trap, the combination of an inlet chamber having therein a float which is open at the top, an outlet chamber having therein a float open at the bottom, said outlet chamber having an outlet, a valve for controlling the flow through said outlet, and means connected to said floats for controlling operation of said valve.

2. In a steam trap, the combination of a

lower inlet chamber having an upwardly opening float therein, an upper chamber having a downwardly opening float therein and having an outlet, a valve for controlling the flow through said outlet, valve operating means, a conduit connecting said lower chamber at a point below the upper edge of its float to said upper chamber at a point above the lower edge of its float, and means connecting said floats together and to said valve operating means.

3. In a steam trap, the combination of a chamber having a float therein and having an outlet, a valve for controlling the flow through said outlet and comprising a ball valve arranged for movement upwardly against a seat, a pivoted member controlled by said float and having means for positively unseating said valve, said pivoted member having a recess therein so positioned that the ball valve will be moved into it by gravity when said float is in its lower position and will be moved out of it by gravity when said float is in its upper position.

4. In a steam trap a casing comprising a body portion and a cover plate, a cup-shaped sheet-metal diaphragm member having a flange at its top clamped between the body portion and cover plate of said casing, and forming an upper and a lower chamber within said casing, said diaphragm member having a tubular portion extending upwardly from its bottom, a float within said lower chamber, said float being open at its upper end and surrounding a portion of said diaphragm member, a float within said upper chamber and open at its lower end and extending downwardly about the upper end of said tubular portion, a valve for controlling the flow from said upper chamber and means for operating said valve connected to said floats.

5. A steam trap comprising a casing, a diaphragm separate from said casing and forming therein a lower inlet chamber and an upper chamber having an outlet, a valve controlling flow through said outlet, a tube communicating at its top with said upper chamber and extending downwardly into said lower chamber, an upwardly-opening float in said lower chamber surrounding said tube, and means operable by movement of said float for controlling operation of said valve.

6. A steam trap comprising a casing having a chamber therein and having a diaphragm dividing said chamber into an upper chamber and a lower chamber, a tube connecting with said lower chamber and extending upwardly from said diaphragm into said upper chamber, a float open at its top located in said lower chamber, a float open at its bottom and surrounding said tube in said upper chamber, said upper chamber having an outlet, a valve controlling flow

through said outlet, and means operable by said floats for controlling operation of said valve.

7. In a steam trap, the combination of a chamber having an upwardly opening outlet and having a float therein open at its bottom, a valve member adapted to seat upwardly against said outlet, a pivotally mounted member operatively connected to said float and having a projection thereon for positively unseating said valve member when said float falls, said pivotally mounted member having a recess therein to receive said valve member and protect it from operation toward its seated position by the current through said outlet.

8. In a steam trap, a casing having a chamber therein and having a diaphragm dividing said chamber into an upper chamber and a lower chamber, said diaphragm comprising an outer vertically extending tubular portion and an inner reversely directed vertically extending tubular portion connected at one end to an end of said outer portion, whereby said outer portion surrounds a part of said inner portion, a downwardly opening float in said upper chamber, said upper chamber having an outlet, and means operable by said float for controlling flow through said outlet.

9. A steam trap, comprising a casing having a chamber therein and having a diaphragm dividing said chamber into an upper outlet chamber and a lower inlet chamber, said diaphragm comprising reversely directed outer and inner tubular portions connected by a web and overlapped in their vertical extent, a valve member for controlling flow from said upper chamber, a float open at one end and telescopically engageable with one of said diaphragm portions, and means operable by said float for controlling operation of said valve.

10. A steam trap, comprising a casing, a diaphragm removably mounted in said casing and forming an upper chamber and a lower chamber therein, said upper chamber having an outlet and a valve for controlling flow through said outlet, said diaphragm comprising reversely directed outer and inner tubular portions connected by a web and overlapped in their vertical extent and a float having a part thereof surrounding a part of one of said portions and operatively associated with said valve.

11. A steam trap, comprising a casing open at its top, a cover member for closing said casing, an apertured diaphragm sealed against said cover member and forming an upper outlet chamber and a lower inlet chamber in said casing, a valve carried by said cover for controlling flow from said outlet chamber, and a float in one of said chambers operatively associated with said valve, said

diaphragm being removable from said casing when said cover member is removed.

12. A steam trap, comprising a casing formed of an upper part and a lower part and having a chamber therein, an apertured diaphragm having a circumferential flange clamped between said parts and dividing said chamber into an upper outlet chamber and a lower inlet chamber, a valve outlet through the wall of the upper part of said casing, a valve for controlling the flow through said outlet and a float operatively associated with said valve.

Signed at North Canton, in the county of Stark and State of Ohio, this 10th day of January, A. D., 1930.

CHARLES L. SHANK.