T. F. MULLIGAN.

AUTOMATIC AIR RELIEF VALVE FOR LIQUID SYSTEMS.

APPLICATION FILED MAR. 4, 1912.

**1,119,980.** Patented Dec. 8, 1914.

Fig. 1.

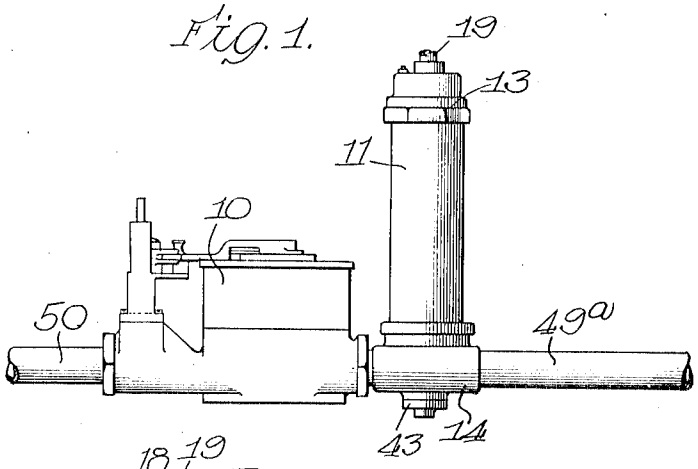



Fig. 2.

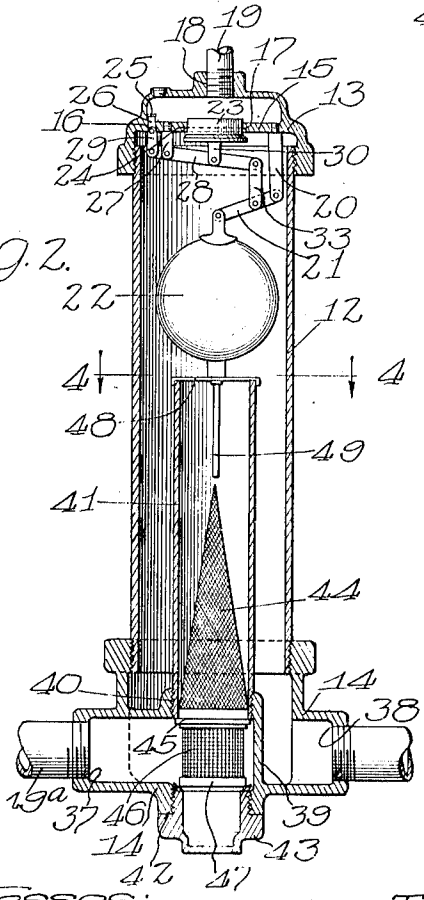



Fig. 3.

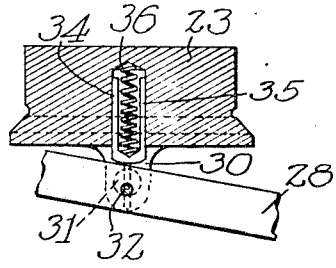
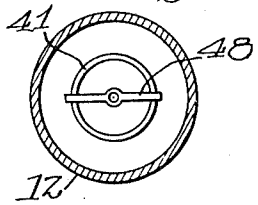



Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## AUTOMATIC AIR-RELIEF VALVE FOR LIQUID SYSTEMS.

1,119,980. Specification of Letters Patent. Patented Dec. 8, 1914.

Application filed March 4, 1912. Serial No. 681,525.

*To all whom it may concern:*

Be it known that I, THOMAS F. MULLIGAN, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Automatic Air-Relief Valves for Liquid Systems, of which the following is a specification.

This invention relates to an automatic air relief device, and the principal object of the invention is to provide an improved air trap and escape for air contained in liquid which operates automatically to open and permit the air to escape, and to close after the discharge of air to prevent the escape of liquid.

Another object of the invention is to provide a construction which differs in some respects from the applicant's co-pending application, Serial No. 534,010, filed Dec. 20, 1909, in which certain features illustrated by the present invention are also described and claimed, which are not claimed in the present case.

A further object of the invention is to provide an improved simple device of the class described which may be readily installed and which is effective and efficient in operation.

For the attainment of these ends, and the accomplishment of other new and useful objects, as will appear, the invention consists in the features of novelty in the construction, combination and arrangement of the several parts generally shown in the drawing and described in the specification, but more particularly pointed out in the appended claims.

In the drawing, Figure 1 is a view of a meter and an automatic air relief device of the class described, constructed in accordance with the principles of this invention; Fig. 2 is an enlarged sectional view of the air relief device or trap; Fig. 3 is an enlarged detail sectional view of one of the valves, showing the manner of connecting the valve to its operating arm or lever; Fig. 4 is a cross sectional view of the device on the line 4—4 of Fig. 2.

In the employment of liquid meters, when the source of liquid supply is located some distance from the meter, considerable difficulty is experienced from the fact that air may be forced through the meter, causing it to register. This occurs particularly when heavy or viscous oils are used, which carry with them globules of air; the air accumulates between the source of supply and the meter, so as to be forced through the meter, with the result that the meter will register incorrectly the amount of liquid passing therethrough, and a short supply of liquid will be furnished the customer.

The principal object of the present invention is to overcome these difficulties and objections and to provide improved means whereby the air will automatically escape or be discharged from the system before the liquid passes through the meter.

Referring now more particularly to the drawing, and in the present exemplification of the invention, the numeral 10 designates generally a fluid meter of any desired or suitable type, and the numeral 11 designates generally an automatic air relief device of the construction now to be described.

The automatic air relief preferably comprises a cylindrical shell 12 of any desired or suitable material, externally threaded at the ends, to which are attached a cap member 13 at one end and a base member 14 at the other. These members are preferably threaded on the shell 12, but of course may be secured thereto in any desired or suitable manner.

The cap member 13 is preferably formed with a partition 15 extending across the cap spaced from the top, preferably formed integral with the cap, and is provided with openings 16 and 17 in communication with the chamber formed by the cylindrical shell 12. The cap is also provided with an opening 18, which forms an outlet from the chamber in the cap, in which the extremity of a pipe 19 may be inserted.

A support 20 is preferably removably secured to the partition 15, so as to depend therefrom and to extend for any desired distance into the chamber by the shell 12. Pivotally connected to the support 20 by one extremity thereof is a link 21, and pivotally connected to the free end of the link is a ball or float 22 which is adapted to rise and fall in the chamber, the rising and falling movement being permitted by the link 21.

The opening 17 through the partition 15 in the cap is preferably of a large diameter,

and a valve 23 is provided which coöperates with a beveled portion 24 of the opening 17, forming a valve seat therefor, to close the opening. The valve 23 is preferably arranged within the liquid chamber below the partition 15, so as to close upwardly against its seat 24 when the float 22 rises, and to open when the float descends. The opening 16 in the partition is preferably of a diameter somewhat smaller than the diameter of the opening 17, and this opening is provided with a valve 25 arranged on the side of the partition opposite to the side on which the valve 23 is located, and having a stem 26 extending through the opening to guide the valve 25 toward and away from its seat in the opening. These valves 23 and 25 are arranged to work in opposition to each other, and any suitable means may be provided for accomplishing this result. For this purpose a support 27 is removably secured to the partition 15 and depends into the liquid chamber, and is preferably located between the apertures or openings 16 and 17.

An arm or lever 28 is pivotally connected intermediate of its ends to the support 27, and one of the extremities is pivotally connected by means of a link 29 to the stem 26 of the valve 25. The valve 23 is provided with spaced parallel ears 30 depending therefrom, and these ears are provided with registering apertures or openings 31 extending transversely therethrough. The portion of the arm or lever 28 extends between the spaced ears 30 and is connected to the valve 23 by means of a pin or connecting member 32, which extends through the registering apertures 31 in the ears 30. This pin 32 is of a diameter somewhat smaller than the diameter of the openings 31, so that the pin may be adapted for free bodily movement in the apertures. The other end of the arm or lever 28 is connected by means of a link 33 to the link 21 at a point intermediate of the ends, so that any movement of the ball or float 22 is communicated by means of the links 21 and 33 to the arm or lever 28.

The valve 23 is provided with a downwardly opening recess 34, preferably disposed between the ears 30. A tubular member 35 having an inclosed end is arranged in the recess, and is of a diameter substantially to fill the recess and to move freely therein. The inclosed end of the tubular member is disposed downwardly and projects below the lower face of the valve 23 and rests upon the adjacent portion of the arm or lever 28. An elastic member 36, such as a coil spring, or the like, is disposed within the tubular member 35, and the recess 34, one end of the member resting against the bottom of the recess, and the other against the bottom of the tubular member. The tension of this elastic member serves to hold the bottom of the tubular member in yielding engagement with the edge of the arm or lever 28 to force the pin 32 against the bottom of the apertures 31 of the ears. The purpose of this construction is to provide means whereby the valve 23 is seated in advance of the valve 25 when the float 22 rises in the liquid chamber.

The base member 14 is provided with an inlet opening 37 and outlet opening 38, preferably disposed diametrically opposite to each other. A partition 39 in the base member 14 separates the inlet opening from the outlet opening, and this partition is preferably provided with a threaded opening 40 substantially in the center of the base member 14, which has communication with the inlet opening 37.

Disposed in the opening 40 and extending upwardly in the liquid chamber, substantially concentric with the shell 12, is a cylindrical member 41, is open at the top and bottom and affords communication between the inlet opening 37 and the interior of the liquid chamber. The outlet opening 38 communicates with the bottom of the annular chamber surrounding the member 41 and is separated from the inlet opening 37 by the partition 39. It will be evident that liquid in passing from the inlet opening 37 to the outlet opening 38 will be forced upwardly through the member 41 until it overflows therefrom into the liquid chamber formed in the shell 12. At the bottom of the base member 14, and preferably in alinement with the opening 40, is a threaded aperture 42, which is provided with a suitably threaded cap 43.

Disposed within the tubular member 41 is a partition 44 of reticulated material. This partition is preferably conical in shape, and with the tip of the cone disposed upwardly. The base of the conical member 44 is provided with a shoulder 45, which is adapted to engage the lower end of the tubular member 41, and another reticulated member 46 of preferably coarser mesh than the reticulated member 44, and substantially cylindrical in form, is secured to or formed integral with the shoulder portion 45, and is provided with a bottom rim 47. This bottom rim 47 rests upon the edges of the cap member 43, so that the positioning of the cap in the opening 42 binds the reticulated members firmly in position. These reticulated members may be readily removed from the base of the member 14, through the opening 42, by simply removing the cap 43. It is evident that the liquid, in order to pass into the liquid chamber of the shell member 12, must pass first through the two partitions of reticulated material so that the impurities or foreign matters present in the

oil will be prevented from passing into the liquid chamber, and also the particles of air which may be carried by the liquid will be arrested and collected, so that they may more readily escape into the air chamber above the liquid chamber. This is one of the principal objects of these screens or partitions, of reticulated material, for it has been found that if the flow of liquid is retarded so that the particles of air may collect, they may be separated from the liquid and escape more readily to the free atmosphere. At the top of the member 41 there is disposed a perforated guide member 48, and to the lower end of the ball or float 22 a guiding rod 49 is secured which passes through the opening in the guide 48. These members serve to keep the float in position.

In operation the liquid flows through a pipe 49ª to the automatic air relief device through the inlet opening 37 and through the partitions 46 and 44. The liquid must be under sufficient pressure to force it through the tubular member 41 until it overflows into the liquid chamber, whereby the float 22 will be raised, during which movement the valves 23 and 25 will be seated against their respective seats to prevent the escape of the liquid through the discharge pipe 20. The liquid will also flow outwardly through the discharge opening 38, through the meter 10, and through a discharge pipe 50. When the discharge of the liquid through the pipe 50 is short of the pressure on the liquid to force it through, the pipe will be relieved, and any air which enters the pipe with the liquid will gradually work its way toward the air relief device 11, and will seek the highest point in the system, which will cause it to enter the chamber 10, and arise to the partition 15. As the pressure in the system is relieved the liquid will settle or will seek its own level and will permit the float 22 to drop a short distance. During this movement of the float the arm or lever 28 will raise the valve 25 off of its seat to permit the air accumulated in the chamber to escape through the opening 16 and out of the discharge pipe 19. As the float descends further, the arm or lever 28 will unseat the valve 23 to open the other passage for the air from the liquid chamber to the discharge pipe 19. When liquid is first supplied to the pipe 49ª the float 22 will be in the position shown in Fig. 2, and the valves 23 and 25 will both be open. In this position any quantity of air which enters the system in advance of the liquid will flow into the liquid chamber and out through the openings 16 and 17, the larger opening being provided for this special purpose. As the liquid rises in the chamber the float will be raised, and the valves will be seated. The yielding connection of the valve 23 and the arm or lever 28 is to prevent the valve from becoming jarred or displaced by a sudden rush of liquid into the chamber.

With this construction it will be evident that all of the liquid which passes to the meter must pass upwardly over the top of the partition formed by the member 41, and must also pass through the partitions of reticulated material which are disposed in the inlet passage. Any air which is contained in the liquid must pass up into the liquid chamber, and as the screens are provided for collecting the particles of air, the natural tendency for them will be to collect at the top of the automatic air relief device, from which they will be automatically discharged by the apparatus just described. If the air collects in the device 11 at any time becomes of sufficient volume, the device will be operated automatically to release the air from the device, thus assisting in maintaining the liquid at a uniform pressure and preventing the air from passing through the meter. It will also be apparent that the valves will be automatically seated to prevent the escape of any of the liquid when the air is discharged.

I claim:—

1. An air relief device for liquid supply systems, comprising a receptacle, an inner cylindrical member extending upwardly from the bottom of the receptacle open at the upper end and having an inlet opening at the lower end, the receptacle being provided with a fluid outlet at its lower end and with an opening at the upper end, means within the receptacle above the inner cylindrical member dependent for operation upon the height of liquid above the said member to open and close the said opening, and a screen retarding device to assist in separating air from liquid entering the receptacle through the said cylindrical member.

2. An air relief device for liquid supply systems, comprising a receptacle, an inner cylindrical member extending upwardly from the bottom of the receptacle open at the upper end and having an inlet opening at the lower end, the receptacle being provided with a fluid outlet at its lower end and with an opening at the upper end above the upper end of the inner cylindrical member, means within the receptacle dependent for operation upon the height of liquid above the said member to open and close the said opening, and a retarding device disposed within the cylindrical member to assist in separating air from liquid entering the receptacle through the said cylindrical member.

3. An air relief device for liquid supply systems comprising a cylindrical shell, a cap member threaded on the shell at one end, and having a closable aperture, a base mem-

ber secured to the shell at the other end, a cylindrical member open at the top and connected to the base member, the latter being formed with one passage communicating with the bottom of the cylindrical member and another passage communicating with the bottom of the shell, a screen disposed in the said cylindrical member, a valve in the cap member and means disposed in the shell above the cylindrical member and attached to the said cap member operative automatically to release air from the shell by operating said valve.

4. In a device of the class described, the combination with a cylindrical shell, a cap member at the top thereof having an opening therein, means supported by the cap automatically operative to open and close the opening, a base member at the bottom of the shell having passages opening diametrically opposite therefrom, a cylindrical member mounted within the shell open at the top and extending only part way therein, one of said passages communicating with the base of the inner cylindrical member and the other communicating with the annular chamber formed in the shell by the cylindrical member, and a reticulated air retarding member disposed in the cylindrical member.

5. In a device of the class described, the combination with a cylindrical shell, a cap member at the top thereof having an opening therein, means supported by the cap automatically operative to open and close the opening, a base member at the bottom of the shell having passages opening diametrically opposite therefrom, a cylindrical member mounted within the shell open at the top and extending only part way therein, one of said passages communicating with the base of the inner cylindrical member and the other communicating with the annular chamber formed in the shell by the cylindrical member, a conical reticulated member disposed in the cylindrical member, and means to engage the base to hold the reticulated member removably in position.

6. In a device of the class described, the combination with a cylindrical shell, a cap member at the top thereof having an opening therein, means supported by the cap automatically operative to open and close the opening, a base member at the bottom of the shell, a cylindrical member open at the top mounted in the base member, the base member being provided with separate passages leading to the base of the cylindrical shell and inner cylindrical member, and a conical reticulated member disposed within the inner cylindrical member.

7. In an automatic air relief device, the combination with a cylindrical shell, a valve at the top thereof, means to open the valve automatically, and an inlet comprising an upright tubular member, and a conical air separating screen upright within the tubular member.

8. In a device of the class described, the combination with a cylindrical shell, a cap member at the top thereof having an opening therein, means supported by the cap automatically operative to open and close the opening, a base member at the bottom of the shell, a cylindrical member open at the top mounted in the base member below said means, the base member being provided with separate passages leading to the base of the cylindrical shell and inner cylindrical member, a conical reticulated member disposed within the inner cylindrical member, an opening being provided in the bottom of the base member registering with the inner cylindrical member, through which the said reticulated member is inserted, and means to close the said opening to bind the reticulated member in position.

9. In a device of the class described, the combination with a cylindrical shell, a cap member at the top thereof having an opening therein, means supported by the cap automatically operative to open and close the opening, a base member at the bottom of the shell, a cylindrical member open at the top mounted in the base member, the base member being provided with separate passages, one leading to the base cylindrical shell, and the other leading to the base of the inner cylindrical member, and an opening being provided in the base member which registers with the inner cylindrical member, a reticulated air retarding partition having a portion thereof in the shape of a cone and the other part substantially cylindrical, the partition being inserted and removed through the bottom opening, and a plug for the bottom opening adapted also to engage the said partition to hold it releasably in place.

10. In a device of the class described, the combination with a cylindrical shell, a cap member at the top thereof having an opening therein, means supported by the cap automatically operative to open and close the opening, a base member at the bottom of the shell, a cylindrical member open at the top mounted in the base member, the base member being provided with separate passages, one leading to the base cylindrical shell, the other leading to the base of the inner cylindrical member, and an opening being provided in the base member which registers with the inner cylindrical member, a reticulated partition having a cone shaped portion with a collar at the base adapted to be positioned in the cylindrical member with the collar abutting at the lower end of the said member and with a substantially cylindrical reticulated portion depending from the cone shaped portion and having a

collar at the bottom, the cylindrical portion being disposed in the inlet passage, and a threaded plug for the bottom opening adapted to engage the bottom collar and to press the partition upwardly to hold the partition in place.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 13th day of February A. D. 1912.

THOMAS F. MULLIGAN.

Witnesses:
W. H. WALKER,
C. H. YOUNG.