Oct. 12, 1937. R. S. BASSETT 2,095,485

DEVICE FOR METERING LIQUIDS

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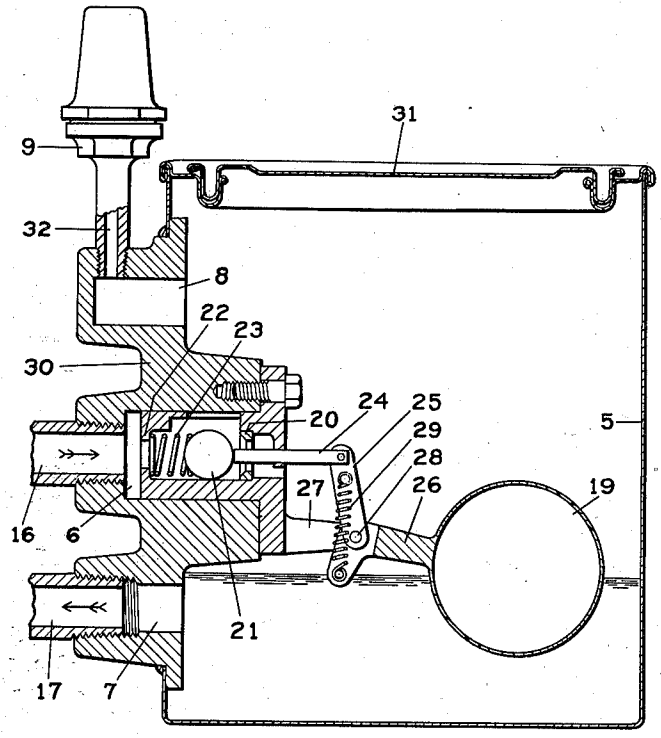



FIG. 2.

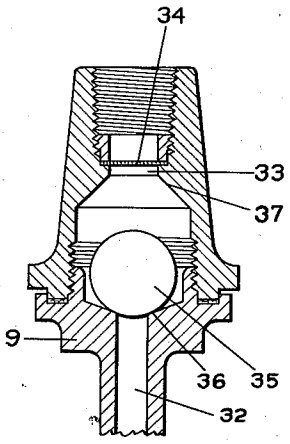



FIG. 3.

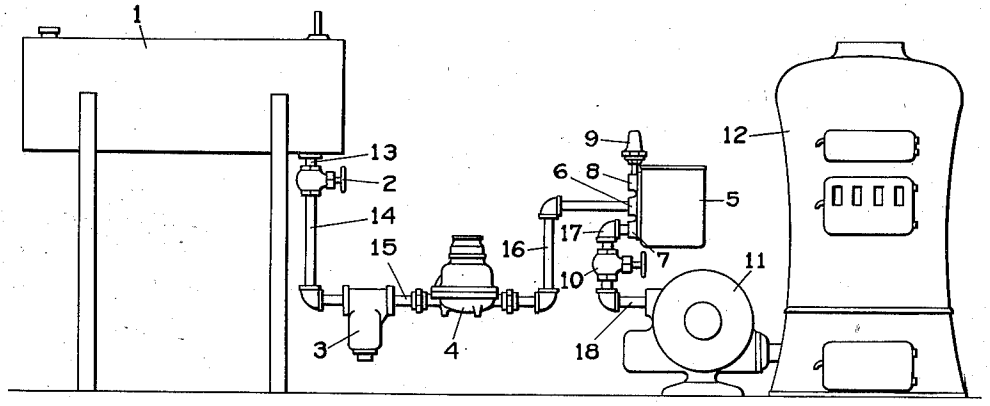



FIG. 1.

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## DEVICE FOR METERING LIQUIDS

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7 Claims. (Cl. 73—198)

My invention relates to a device for metering liquids which are flowing at such a low rate that they cannot be ordinarily metered by simple and inexpensive mechanical means such as the displacement type liquid meters which are now commercially available. Among the best of such meters is the familiar nutating disc type liquid meter which if carefully constructed will accurately measure flows of liquids such as fuel oil at flows having a rate as low as three gallons per hour or as high as twenty gallons per minute.

The object of my invention particularly is to measure flows of liquid which must be discharged from the measuring device slowly and uniformly at flow rates which will ordinarily be between one-half and two and one-half gallons per hour. Such flows do not develop enough power to continuously overcome the running friction of displacement type liquid meters. This friction loss, however, can be minimized if only operative during a part of the flow cycle. A particular application of my device is to the measurement of fuel oil consumed by small oil burners used especially for house heating purposes. The supply of oil to the oil burner when burning must be steady and constant and is usually at a flow of approximately two gallons per hour. My device is especially suited for the metering of such slow flowing liquid but its maximum capacity is substantially that of the liquid meter which is used as a part of the device as shown in the illustrations and the description.

Another object of my invention is to provide safety devices so that a fire hazard is eliminated. Metering devices of this type are usually used adjacent to a flame and my invention provides against oil overflowing into the surrounding space and also provides against igniting the oil through the vent opening, as might occur if a child was playing with matches and tried to put a lighted match into the vent opening of my device.

To illustrate more clearly the application of my invention I shall describe its particular use in connection with small oil burners.

Figure 1 is an exterior side view of my device as installed with a typical house heating furnace fitted with a fuel oil burner.

Figure 2 is a vertical sectional view through the accumulator or reservoir tank and shows the location of the openings and the interior mechanism.

Figure 3 is a vertical sectional view through the venting valve.

Referring to the drawing in detail, 1 is a tank serving as the oil supply container. 2 is the shut-off valve on the discharge line from supply container 1. 3 is a trap strainer of the usual type which is required on such installations to remove impurities from the oil before it enters the other apparatus. 4 is any suitable liquid meter and is shown as the familiar displacement type nutating disc liquid meter. 5 is the reservoir tank with inlet 6, outlet 7 and air outlet 8. 9 is a venting valve connected to air outlet 8 and allowing the passage of air but stopping the passage of liquid as explained later in this specification. 10 is a shut-off valve on the outlet line from reservoir tank 5. 11 is a fuel oil burner of the usual type installed to heat heating boiler furnace 12. Piping means 13, 14, 15, 16, 17, and 18 connect the previously mentioned units as indicated in the drawing. In the claims reservoir tank 5 is referred to as a "chamber".

Reservoir tank 5 as shown in Figure 2 has in combination with it a snap action valve controlling the flow through inlet 6 and which is shown operated by means of a float within the tank, which will open wide the valve when the level within the tank is at a low point and close the valve with a snap action when the level within the tank is at a much higher point. A snap action float controlled valve can be constructed in many ways and I am not limiting the construction to that shown in the drawing which is only one of a number of different types which can be used. The essential feature of the snap action valve is that it is suddenly opened wide when float 19 reaches its lowest point of travel and is similarly closed when float 19 reaches its uppermost point of travel. These relative positions of the valve and the float are features of my invention together with the location of the valve on the flow line ahead of the tank inlet.

In Figure 2 as illustrated, the valve comprises replaceable seat 20, valve ball 21, spring seat 22, and spring 23. Valve ball 21 is normally held against seat 20 by spring 23 which preferably is of the spiral compression type and confined between ball 21 and spring seat 22 to keep the valve in closed position. This valve as shown opens against the pressure which aids in holding it closed. Valve stem 24 is suitably guided for an ordinary pushing contact against the side of ball 21 so that the valve may be opened when stem 24 is pressed against ball 21 pushing it away from seat 20. The valve is closed when stem 24 moves away from ball 21 allowing it to be pushed by spring 23 to its normal closed position against seat 20. The connecting means between stem 24 and float 19 may be constructed as shown as a conventional spring operated snap action toggle type linkage comprising linking arm 25, float lever 26, fulcrum pin 28 and spring 29 which is shown as of the tension type, though a similarly acting linkage is often constructed, where the space is limited, with a compression type spring. It is not necessary to describe in detail the snap action of the valve as it is of the usual type, except to reiterate that ball 21 is suddenly pushed from seat 20, when float 19 approaches the bot-

tom of reservoir tank 5. Similarly, ball 21 is suddenly moved tight against seat 20 to close inlet passage 6, when float 19 approaches the upper portion of reservoir tank 5. While the term "snap action" is used to describe the valve, any quick opening and quick closing valve may be used, provided that the throttling of the flow, when the valve opens and closes, is for no appreciable length of time.

Reservoir tank 5 as shown in the drawing is constructed with its enclosing walls made from an ordinary snap top paint can of tinned steel. This construction is very low in cost as such cans are a standardized article produced in large quantities and readily purchased in the open market for adaptation as in my drawing. The member containing inlet passage 6, outlet passage 7 and air outlet 8 and assembled with the valve itself will be numbered as valve body 30 which can be made of brass and soldered into an opening in the wall of tinned steel reservoir tank 5. Tank cover 31 allows the servicing of float 19 and other parts inside of tank 5. In the drawing and in actual practice tank cover 31 is an ordinary snap type or beaded friction paint can top which is liquid-tight but at the same time very low in cost and perfectly serves its purpose of allowing occasional inspection of the parts inside of tank 5 and of, at other times, keeping the enclosure of tank 5 in a liquid-tight manner.

My drawing also illustrates in a reservoir tank of this type the use of a readily accessible snap action or quick acting valve which opens against the flow, as this construction not only prevents excess pressure from opening the valve, but it also makes seat 20 and valve ball 21 readily accessible for inspection and repair without disturbing other parts of tank 5 surrounding the float itself. The action of my device is relatively simple, as is necessary for continuous trouble-free operation of such an attachment, where the operation of the furnace must at no time be interfered with.

The oil in reservoir tank 5 runs out slowly to burner 11, as required for combustion in the burner. When there is only a small quantity of oil left within reservoir tank 5, float 19 opens the valve, allowing a sudden inrush of oil from container 1, through meter 4. This flow of oil to fill reservoir tank 5, is at a rate far in excess of that of the flow to the burner itself. Under ordinary installation conditions with the bottom of container 1 elevated a couple of feet above reservoir tank 5, this flow is around sixty gallons per hour which is more than ample to operate meter 4 at a speed at which it will measure very accurately.

In passing one gallon of oil through the system the meter is operated for approximately one minute only, while it will take approximately thirty minutes for one gallon of oil to be used by the oil burner. In this way the friction of the meter must be overcome during only one-thirtieth of the time that the burner is requiring oil, so that the power to operate the meter is thirty times that which it would be if the energy from the movement downward of one gallon of oil for a couple of feet was distributed over the entire period of thirty minutes. An inexpensive meter of the commercial type, such as would be used on this installation, requires a fractional number of foot pounds energy per minute to operate it, almost irrespective of the rate of flow through the meter, up to a couple of gallons per minute. To have such power available to operate the meter, it is necessary either to cut down the time per gallon of liquid passed, during which the meter operates or to introduce an additional source of power such as an electric motor, which would be connected to the meter to overcome its running friction. Such electrical power devices, however, have not proved satisfactory in actual service.

Reservoir tank 5, is fitted with air outlet 8, which releases air to allow the entrance of the oil to fill the tank, as it passes in through inlet 6. Such an air outlet is of conventional construction and is required if the walls of the tank are fixed in dimension.

The essential elements of my device are a storage reservoir on the outlet line from the meter and between the meter and the liquid consuming means, a quick acting valve controlling an intermittent flow to the reservoir and located between the reservoir and liquid supply means, together with means to open said valve when the supply of liquid within said reservoir approaches its minimum. My invention is much simpler and more practical than other devices used since my discovery thereof and which use a differential between two liquid pressures to operate the valve, the control chamber being always full of liquid. The means to open said valve in my invention also acts as means to close said valve when the supply of liquid within said reservoir approaches its maximum.

Figure 3 shows the details of venting valve 9 which include many novel features which make the above installation safe from fire hazard from nearby flames. These members of venting valve 9 are included in my claims as they act together with all other parts of the mechanism in such a way as to make the entire assembly a practicable and safe device. 32 is the inlet opening and 33 the outlet opening. Across outlet opening 33 is placed a screen 34 which is made of metal with fine openings to act in the well-known manner as a flame arrester to prevent flames from passing downward through it to the interior of venting valve 9 to ignite the fuel within tank or chamber 5. This device works on the well-known principle of the miner's safety lamp. The use of screen 34 is novel in that it eliminates the necessity of piping outlet opening 33 back to container 1 as has always been necessary in the past to prevent fire hazard. My invention greatly cuts down the installed cost of the metering device. 35 is shown as a cork ball which acts as a float as well as a closure means. The construction is not limited to the exact construction shown but may be any float device which controls the two openings of venting valve 9. Ball 35 rests loosely on seat 36 to prevent the unnecessary escape of oil fumes out of tank 5 through air outlet 8. This fire hazard protection is a novel feature and the retention of dangerous fumes within tank 5 is a feature not found on any other similar metering device. The weight of ball 35, relative to the area of the opening in seat 36, is designed with consideration for the values of the strength of spring 23, area of seat 20, and diameter of ball 21 so that the slight back pressure or pressure above atmospheric pressure caused to exist within tank 5 because of ball 35 will not interfere with the action of valve ball 21 as a closure means for inlet opening 6.

Venting valve 9 also serves another very important purpose. Valve ball 21 under abnormal conditions might fail to close completely when

the level of the liquid within tank 5 reaches its upper limit. This might be caused by dirt becoming lodged between valve ball 21 and seat 20 or by float 19 becoming full of liquid either through leakage or by collapse. Such contingencies must be provided for to make the metering device free from fire hazard. As the interior parts of tank 5 may fail to operate normally and become inoperative, I have provided a safety device entirely outside of tank 5 to prevent liquid within tank 5 that passes out through air outlet 8 from finding its way to the atmosphere outside. Venting valve 9, which controls air outlet 8, not only retards the escape of explosive fumes during the normal operation of the metering device, but it also acts as an automatic shut-off when tank 5 with its valve mechanism fails to operate satisfactorily. Liquid passing up into venting valve 9 causes cork ball 35 to rise upward to a position where it blocks outlet opening 33. Upper seat 37 is provided, against which cork ball 35 wedges, to act as a safety device to prevent overflow of the liquid. I have provided for a safety device entirely exterior to tank 5 so that the safety device which is shown as venting valve 9 is replaceable as a separate unit and can be readily inspected and removed for testing without in any way opening up tank 5, a novel and valuable feature. When tank 5 fills, venting valve 9 creates a slight air pressure within tank 5, which, however, is not sufficient to prevent tank 5 from filling up to the desired upper limit. When ball 21 moves back against seat 20 closing inlet 6, this air under slight pressure aids in forcing the liquid within tank 5 out through outlet opening 7. Cork ball 35, however, seats loosely on seat 36 so that a small amount of air can be drawn down through venting valve 9 into tank 5 as may be required to allow the liquid within tank 5 to flow out to its lower limit of level. While the pressure within tank 5 may be slightly below atmospheric during the latter half of this emptying process, the flow of the liquid from tank 5 is in no way stopped. Conversely, cork ball 35 acting as a back pressure valve maintains an even flow of liquid into tank 5 through inlet opening 6 during the filling operation and tends to create a very slight back pressure on the outlet of liquid meter 4 and thereby causes a more satisfactory operation and uniform measurement than if the flow out of liquid meter 4 was not held back in any way. All of these points have proven themselves to be of great value in actual tests conducted by the inventor. These features are incorporated in the claims with special reference to the fire hazard prevention value.

Having thus described my invention, what I claim for Letters Patent is:

1. The combination with liquid fuel metering apparatus comprising a supply tank, fuel directing means including a conduit for conveying the fuel from said tank to a point of use, and a flow meter interposed in the conduit for measuring and indicating the quantity of fuel conveyed therethrough; of a chamber interposed in said conduit between the meter and the point of use, and having a fuel inlet port, a valve controlling the entrance of fuel into said chamber through said inlet port, a float in said chamber, means for causing said valve to be moved to closed and open positions by said float only when said float is moved through a relatively wide range of movement, and an air vent from said chamber; and a venting valve attached to said air vent for maintaining a pressure in said chamber slightly above atmospheric pressure when said valve controlling the entrance of fuel into said chamber through said inlet port is open, and having a gravity-operated closure member, and a seat co-acting with said closure member to substantially close said valve to retard the escape of explosive fumes out through said venting valve but to open slightly as required to allow the escape of air when said chamber inlet port valve is open and said chamber is filling with liquid fuel, substantially as and for the purpose described.

2. The combination with liquid fuel metering apparatus comprising a supply tank, fuel directing means including a conduit for conveying the fuel from said tank to a point of use, and a flow meter interposed in the conduit for measuring and indicating the quantity of fuel conveyed therethrough; of a chamber interposed in said conduit between the meter and the point of use, and having a fuel outlet port from said chamber continuously open to said point of use whereby fuel may be withdrawn from said chamber at any time, a fuel inlet port, a valve controlling the entrance of fuel into said chamber through said inlet port, a float in said chamber, means for causing said valve to be moved to closed and open positions by said float only when said float is moved through a relatively wide range of movement, and an air vent from said chamber; and a venting valve attached to said air vent for maintaining a pressure in said chamber slightly above atmospheric pressure when said valve controlling the entrance of fuel into said chamber through said inlet port is open, and having a gravity-operated closure member, and a seat co-acting with said closure member to substantially close said valve to retard the escape of explosive fumes out through said venting valve but to open slightly as required to allow the escape of air when said chamber inlet port valve is open and said chamber is filling with liquid fuel, substantially as and for the purpose described.

3. The combination with liquid fuel metering apparatus comprising a supply tank, fuel directing means including a conduit for conveying the fuel from said tank to a point of use, and a flow meter interposed in the conduit for measuring and indicating the quantity of fuel conveyed therethrough; of a chamber interposed in said conduit between the meter and the point of use, and having a fuel outlet port from said chamber continuously open to said point of use whereby fuel may be withdrawn from said chamber at any time, a fuel inlet port, a valve in said inlet port and controlling the entrance of fuel into said chamber, a float in said chamber for controlling said valve, toggle mechanism connecting said float operatively with said valve to snap said valve to closed or open position only at two predetermined positions of said float within said chamber, and an air vent from said chamber; and a venting valve attached to said air vent for maintaining a pressure in said chamber slightly above atmospheric pressure when said valve controlling the entrance of fuel into said chamber through said inlet port is open, and having a gravity-operated closure member, and a seat co-acting with said closure member to substantially close said valve to retard the escape of explosive fumes out through said venting valve but to open slightly as required to allow the escape of air when said chamber inlet port valve is open and said chamber is filling with

liquid fuel, substantially as and for the purpose described.

4. The combination with liquid fuel metering apparatus comprising a supply tank, fuel directing means including a conduit for conveying the fuel from said tank to a point of use, and a flow meter interposed in the conduit for measuring and indicating the quantity of fuel conveyed therethrough; of a chamber interposed in said conduit between the meter and the point of use, and having a fuel outlet port from said chamber continuously open to said point of use whereby fuel may be withdrawn from said chamber at any time, a fuel inlet port, a valve controlling the entrance of fuel into said chamber through said inlet port, a float in said chamber, means for causing said valve to be moved to closed and open positions by said float only when said float is moved through a relatively wide range of movement, and an air vent from said chamber; and a venting valve with inlet and outlet openings and attached to said air vent for maintaining a pressure in said chamber slightly above atmospheric pressure when said valve controlling the entrance of fuel into said chamber through said inlet port is open, and having outside of said chamber float means for closing said venting valve outlet opening to prevent the escape of liquid fuel from said venting valve when said fuel escapes from said chamber into said venting valve, substantially as and for the purpose described.

5. The combination with liquid fuel metering apparatus comprising a supply tank, fuel directing means including a conduit for conveying the fuel from said tank to a point of use, and a flow meter interposed in the conduit for measuring and indicating the quantity of fuel conveyed therethrough; of a chamber interposed in said conduit between the meter and the point of use, and comprising a fuel outlet port from said chamber open to said point of use whereby fuel may be withdrawn from said chamber, a fuel inlet port, a valve controlling the entrance of fuel into said chamber through said inlet port, a float in said chamber, means for causing said valve to be moved to closed and open positions by said float only when said float is moved through a relatively wide range of movement, and an air vent from said chamber; and a venting valve with inlet and outlet openings and attached to said air vent for maintaining a pressure in said chamber slightly above atmospheric pressure when said valve controlling the entrance of fuel into said chamber through said inlet port is open, and comprising, outside of said chamber, float means for closing said venting valve outlet opening to prevent the escape of liquid fuel from said venting valve when said fuel escapes from said chamber into said venting valve, said float means also substantially closing said venting valve inlet opening to retard the escape of explosive fumes out through said venting valve but in such a manner as to open slightly as required under slight air pressure to allow the escape of air from said chamber through said chamber air vent when said chamber is filling with liquid fuel, substantially as and for the purpose described.

6. The combination with liquid fuel metering apparatus comprising a supply tank, fuel directing means including a conduit for conveying the fuel from said tank to a point of use, and a flow meter interposed in the conduit for measuring and indicating the quantity of fuel conveyed therethrough; of a chamber interposed in said conduit between the meter and the point of use, and comprising a fuel outlet port from said chamber open to said point of use whereby fuel may be withdrawn from said chamber, a fuel inlet port, a valve controlling the entrance of fuel into said chamber through said inlet port, a float in said chamber, means for causing said valve to be moved to closed and open positions by said float only when said float is moved through a relatively wide range of movement, and an air vent from said chamber; a venting valve with inlet and outlet openings and attached to said air vent for maintaining a pressure in said chamber slightly above atmospheric pressure when said valve controlling the entrance of fuel into said chamber through said inlet port is open, and comprising, outside of said chamber, float means for closing said venting valve outlet opening to prevent the escape of liquid fuel from said venting valve when said fuel escapes from said chamber into said venting valve, said float means also substantially closing said venting valve inlet opening to retard the escape of explosive fumes out through said venting valve but in such a manner as to open slightly as required under slight air pressure to allow the escape of air from said chamber through said chamber air vent when said chamber is filling with liquid fuel; and a flame arresting screen with fine openings at said venting valve outlet opening to prevent the entrance of flame into said venting valve when filling with explosive fumes, substantially as and for the purpose described.

7. The combination with liquid fuel metering apparatus comprising a supply tank, fuel directing means including a conduit for conveying the fuel from said tank to a point of use, and a flow meter interposed in the conduit for measuring and indicating the quantity of fuel conveyed therethrough; of a chamber interposed in said conduit between the meter and the point of use, and comprising a fuel outlet port from said chamber open to said point of use whereby fuel may be withdrawn from said chamber, a fuel inlet port, a ball spring-loaded check valve at said inlet port and controlling the entrance of fuel into said chamber, a float in said chamber for controlling said valve, toggle mechanism connecting said float operatively to said valve through said inlet port to open and close said valve only at two predetermined positions of said float within said chamber, and an air vent from said chamber; and a venting valve attached to said air vent for maintaining a pressure in said chamber slightly above atmospheric pressure when said valve controlling the entrance of fuel into said chamber through said inlet port is open, and comprising a light-weight gravity-operated closure member, and a seat co-acting with said closure member to substantially close said valve to retard the escape of explosive fumes out through said venting valve but to open slightly as required to allow the escape of air when said chamber inlet port valve is open and said chamber is filling with liquid fuel; said chamber also comprising an inspection opening above the normal level of the liquid within said chamber and a readily removable cover for said opening, substantially as and for the purpose described.

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