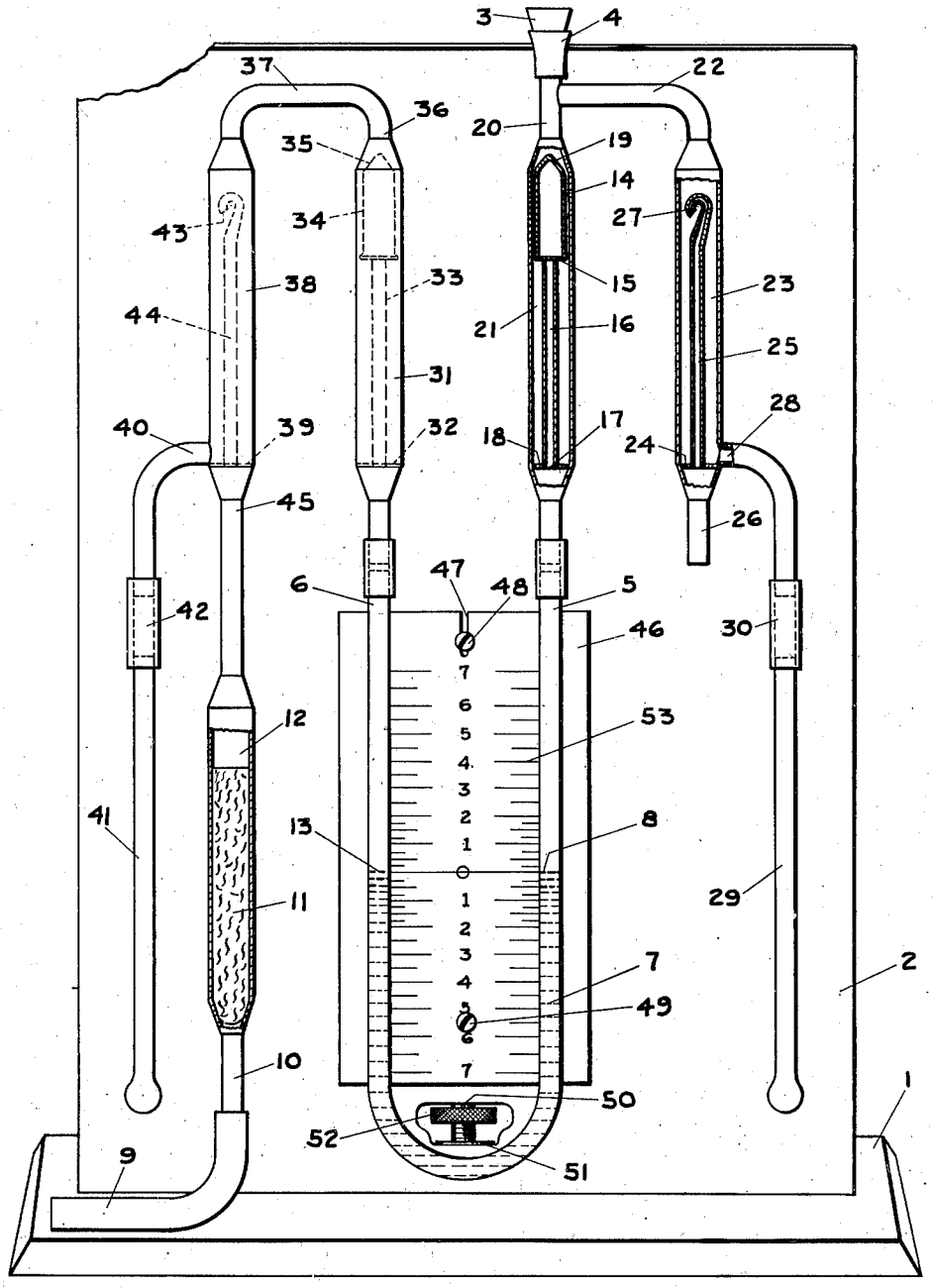
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MANOMETER

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MANOMETER

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This invention relates to manometers and more particularly to pressure or vacuum gauges in which the gauging medium is controlled and conserved.

Manometers are employed to gauge pressures in vessels such as gasoline tanks and the like. When excessively high or low pressures are encountered, such pressures cause the gauging medium, such as mercury, to be forced out of the gauging tube. Mercury is a relatively expensive item and where large quantities are used the noted losses run into substantial expense.

Heretofore, when manometer gauges have been tipped over or tilted, the mercury has also been lost and must be replaced with the cost and trouble of refilling manometer gauging tubes.

The principal objects of the present invention are, therefore, to provide for trapping mercury in the event it is forced out of the gauging tube by excessively high or low pressures applied to the tube; to provide for tilting or tipping of manometer tube without loss of mercury therein; to provide for valving manometer tubes in such a way as to allow escape of pressure medium and retaining mercury in the tube; to provide for filtering the pressure medium, thus eliminating the necessity for cleaning a mercury column in a manometer tube; to provide for widening the tolerances for amounts of gauging medium, such as mercury, in manometer tubes by adjusting the scales against which the mercury levels in the gauging tube are read; to accomplish the noted objects in a facile and economical efficient manner; and to provide improved elements and arrangements thereof in a monometer of the character and for the purposes set forth.

In accomplishing these and other objects of the present invention, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawing, wherein the figure is a front elevational view, partly in vertical cross-section, of a manometer embodying the features of the present invention.

Referring more in detail to the drawing:

1 designates a suitable base of a size, weight and material sufficient to adequately support an upright standard or backboard 2 on which the manometer embodying this invention is mounted and suitably supported.

3 designates a removable closure for the fill opening 4 of a manometer generally consisting of a U-tube having arms 5 and 6. Mercury 7 may be poured into the fill opening 4 to fill the U-tube arms 5 and 6 to a height such as that indicated at 8.

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9 designates a pressure inlet connection that may be suitably connected to a vessel the presure of which is to be gauged. The inlet 9 is connected with an arm 10 leading to the arm 6 of the U-tube, whereby pressure may act on the mercury 7 in the U-tube.

It is desirable to filter or clean the pressure medium admitted through the inlet 9 to the manometer and to this end I provide a filter 11 that is preferably of spun glass and arranged in an enlarged section 12 of the manometer arm 10.

Should excessive pressure be encountered in the vessel under test, such pressure acts, as at 13, on the mercury 7 in the U-tube and would normally blow the mercury out of the fill opening 4. To overcome such a disadvantage, I provide a valve 14 in the in the U-tube arm 5 that is preferably of glass. The valve 14 is preferably of approximately bullet shape and has a perforated base end 15 that seats on the upper end of a stem 16. The bottom end of the stem 16 is supported on a transverse partition 17 that is apertured, as at 18, to allow mercury or pressure medium to act on the bottom of the valve and force the nose 19 of the valve into the upper end 20 of the arm 5 to substantially prevent passage of the mercury there through. The valve 14 preferably has a sufficiently loose fit in the enlarged section 21 of the arm to allow passage of pressure medium. Such pressure medium is exhausted through a by-pass 22 leading from the upper end 20 of the arm 5 to a chamber 23 that is enlarged relative to the by-pass 22 and is provided with a transverse partition 24 at its lower end.

Mounted in the chamber 23 and supported on the partition 24 is a hollow stem 25 that opens to atmosphere through a nozzle 26 at the lower end of the chamber and is provided at its upper end with a constricted hook portion 27, the opening of which faces downwardly.

It is thus apparent that pressure medium bypassing the valve 14 is transmitted to the chamber 23 through the line 22 and escapes to atmosphere through the nozzle 26. Any mercury, however, by-passing the valve and passing to the chamber through the line 22 drops upon the partition 24 rather than going through the stem 25. The mercury is then led through an outlet 28 from the chamber 23 to a mercury receiver 29 that is removably mounted on the outlet 28 by the fitting 30. Thus, if and when, mercury collects in the receiver 29, the receiver may be removed from the chamber 23 and the mercury poured back into the U-tube through the fill

opening 4. Chamber 23, hollow stem 25, and receiver 29 comprise a mercury trap.

If, instead of excessively high pressures, excessively low pressures are encountered, atmospheric pressure acts on the mercury in the U-tube at the level 8 of mercury 7 in the arm 5 and normally would force such mercury through the tube arm 6 out through the pressure inlet with the same disadvantage heretofore outlined.

In order to prevent such an action, the U-tube arm 6 is provided with a chamber 31 similar to the enlarged portion 21 of the U-shaped arm 5, an apertured transverse partition 32 being provided at the lower end of the chamber and a stem 33 being mounted on the partition. A valve 34, similar to the valve 14, rests on the stem 33 and the bullet-like nose end 35 thereof substantially closes the constricted end 36 of the chamber 31 against passage of mercury therethrough.

Should mercury by-pass the valve 34, it passes through the neck 37 to a chamber 38 in the arm 10 that is similar to the chamber 23 previously described. Such mercury lodges on a transverse partition 39 and passes through an outlet 40 from the chamber 38 to a mercury receiver 41. Mercury collected in the receiver 41 may be poured back into the fill opening 4 by removing the receiver 41 from the outlet 40 by means of the fitting 42 provided therefor. Chamber 38, hollow stem 44, and receiver 41 comprise a mercury trap.

Pressure medium passing the valve 34 passes through the downwardly opening end 43 of the hook end of a hollow stem 44 that is supported by the partition 39 and opens at its lower end into the arm 10 above the filter 11, as indicated at 45. Such pressure medium may then pass through the filter and out of the pressure inlet opening into the vessel under test or to atmosphere as the case may be.

The arms 5 and 6 are preferably removable from the remainder of the structure by means of the fittings shown at the upper ends thereof, which may be merely rubber hose connections.

In order to provide greater tolerances of the amount of mercury that may be used in the gauge, a scale 46 is provided that is suitably mounted on the upright backboard 2 in slidable engagement therewith. A guide slot 47 is provided in this scale that cooperates with a guide pin 48 mounted in the backboard to allow vertical movement of the scale and to prevent lateral movements thereof. The scale 46 is fixed by a fastening device 49 to the shaft 50 of a scale adjusting device that is mounted in the backboard 2 in a suitable manner, as indicated at 51. A knurled collar 52 is threadedly mounted on a threaded portion of the shaft 50 and is movable up and down thereon.

The collar is suitably connected to the fastening device 49 on the gauge in such a manner as to cause movement of the gauge in response to movement of the collar. Thus, mercury may be added to the tube to the approximate amount desired and the scale indicia 53 on the scale may be brought to the plane of the mercury in the tube notwithstanding slight differences in the mercury level relative to a given position of the zero mark of the scale indicia.

Operation

The operation of a manometer constructed as described is as follows:

Closure 3 is removed and mercury 7 added to the U-tube. The pressure inlet connection 9 is applied to a vessel, the pressure of which is to be tested, and the pressure medium passes through the filter 11, chamber 38 and valve chamber 31 into the U-tube arm 6 to act on the mercury at 13 lowering the same relative to the zero mark and bottom portion of the scale and raising the mercury in the arm 5 relative to the zero mark and upper half of the scale in accordance with pressure in the vessel under test.

If excessive pressures are encountered, the mercury 7 is blown upwardly in the arm 5, the mercury and pressure medium passing through the stem 16 and apertures 18 to push the valve 14 upwardly. The valve 14 allows passage of the pressure medium and possibly small amounts of mercury through the by-pass 22 into the chamber 23. Mercury drops past the hook stem onto the partition 24 and passes through the outlet 28 into the receiver 29 where it is recovered and may be poured back into the U-tube through the fill opening 4.

When excessively low pressures are encountered in vessels under test, atmospheric pressure acting through the nozzle 26, stem 25, by-pass 22 and chamber 21 acts on the mercury at 8 in the arm 5 and forces it up the arm 6 where it is substantially trapped by the valve 34. Should mercury pass the valve 34, it lodges on the partition 39 and passes to the receiver 41 where it is recovered and may be poured back into the tube through the fill opening 4. The pressure medium passes through the hooked stem 44, through the filter and out the pressure inlet 9.

Should the manometer be tilted or tipped over, the mercury may run from the U-tube in either direction, but will be caught in the receiver 29 or 41 and is thus effectively conserved.

While I have shown but one embodiment of my invention, it is apparent that the device is susceptible to modification without departing from the spirit of the invention. I do not wish, therefore, to be limited by the disclosures set forth, but only by the scope of the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. A manometer unit comprising a U-shaped gauge tube adapted to receive mercury, a scale adjacent said gauge tube, valves to prevent loss of mercury from the gauge tube, each of said valves comprising a vertical tube of relatively large diameter relative to the U-tube connected at its lower end to an arm of said gauge tube, a horizontal partition in the lower portion of said tube of relatively large diameter having a plurality of apertures therein, a vertical tube of smaller diameter within the tube of relatively large diameter in spaced relation thereto fixed to the partition over one of said apertures and being open at each end, another of said apertures being located in the area of the partition between the tubes, and a float valve member resting loosely on the upper end of said tube of smaller diameter, and arranged to cooperate with the adjacent end of said tube of relatively large diameter to restrict flow of mercury, a tube leading from the upper end of each of said valves, said last named tubes each having a mercury trap comprising a vertical tube of relatively large diameter, a tube of smaller diameter within said last named tube of relatively large diameter in spaced relation thereto, said last named tube of smaller diameter terminating

at its upper end in a constricted bent over portion, the lower end of said last named tube of smaller diameter being open to receive or discharge gas, the last named tube of relatively large diameter being sealed at its lower end to said last named tube of smaller diameter except for a small outlet, said outlet leading to a removable tube sealed at its lower end.

2. For use with a manometer a trap for mercury comprising a tube of relatively large diameter, a tube of smaller diameter within said first named tube in spaced relation thereto terminating at one end in a constricted bent over portion, one end of said tube of large diameter being sealed to the tube of smaller diameter, an outlet leading from the sealed end of the tube of relatively large diameter, and a removable sealed tube attached to said outlet.

3. In a manometer, a U-tube having a mercury fill opening at the upper end of one arm and an outlet adjacent the fill opening, a tube leading from said outlet, a mercury receiver connected to and leading from said tube, a pressure outlet conduit arranged within said tube, the outer surface of said conduit adjacent the lower end thereof being sealed to said tube at a point below said mercury receiver connection, the upper end of said conduit extending above said mercury receiver connection and having a constricted hook portion to prevent mercury from dropping therethrough, an extension leading from the upper end of the second arm of the U-tube having an outlet, a mercury receiver connected to said extension at said outlet, a pressure inlet tube arranged within said extension, the outer surface of said inlet tube adjacent the lower end thereof being sealed to said extension at a point below the connection of said last named receiver, the upper end of said pressure inlet tube extending above said last named receiver connection and having a constricted hook portion at its upper end to prevent mercury from dropping through said pressure inlet tube, an apertured partition adjacent the fill opening of the first named arm of the U-tube, and a valve in said arm above said partition movable responsive to pressure in the U-tube to substantially close the outlet in the fill arm to passage of mercury therethrough, the receiver adjacent the fill opening being adapted to catch mercury normally lost through said opening because of pressure surges, the receiver adjacent the pressure inlet being adapted to catch mercury normally lost in measuring excessively low pressures.

4. In a manometer, a U-tube having a mercury fill opening at the upper end of one arm and an outlet adjacent the fill opening, a tube leading from said outlet, a mercury receiver connected to and leading from said tube, a pressure outlet conduit arranged within said tube, the outer surface of said conduit being sealed to said tube at a point below the connection of said mercury receiver, the upper end of said pressure outlet conduit extending above said mercury receiver connection and having a constricted hook portion to prevent mercury from dropping therethrough, an extension leading downwardly from the upper end of the second arm, a pressure inlet for said second arm, an apertured partition adjacent the fill opening of the first named arm, and a valve in said first named arm above said partition movable responsive to pressure in the U-tube to substantially close the outlet in the fill arm to passage of mercury therethrough, the receiver adjacent the fill opening being adapted to catch mercury normally lost through said opening because of pressure surges.

5. In a manometer, a U-tube having a mercury fill opening at the upper end of one arm, an extension leading downwardly from the upper end of the second arm having an outlet, a mercury receiver connected to said extension at said outlet, adapted to catch mercury normally lost in measuring excessively low pressures, a pressure inlet tube arranged within said extension, the outer surface of said inlet tube being sealed to said extension, said tube extending above said mercury receiver connection and having a constricted hook portion at its upper end to prevent mercury from dropping through said pressure inlet tube, an apertured partition in said second arm, and a valve in said second arm above said partition movable responsive to pressure in the U-tube to substantially close the inlet in the arm to passage of mercury therethrough.

6. For use in a U-tube manometer unit, a trap for the gauging medium comprising a chamber, fluid-conducting means communicating with said chamber and adapted to connect said chamber with one arm of said manometer unit, a tube within said chamber, the outer surface of one end of said tube being sealed to the periphery of an opening through a wall of said chamber and the other end of said tube being formed into a constricted hook portion, the opening of which faces downwardly, and a receiver for the gauging medium removably connected with the lower part of said chamber.

7. For use in a U-tube manometer unit, a trap for the gauging medium comprising a chamber adapted to be placed in communication with an arm of said manometer unit and containing a tube, the outer surface of said tube being sealed to the periphery of an opening through a wall of said chamber and one end of said chamber and one end of said tube being provided with a hook portion, the opening of which faces downwardly; and means communicating with the lower part of said chamber for draining gauging medium therefrom.

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