July 16, 1946. H. O. PARSONS 2,404,087

GAUGING AND SAMPLING DEVICE

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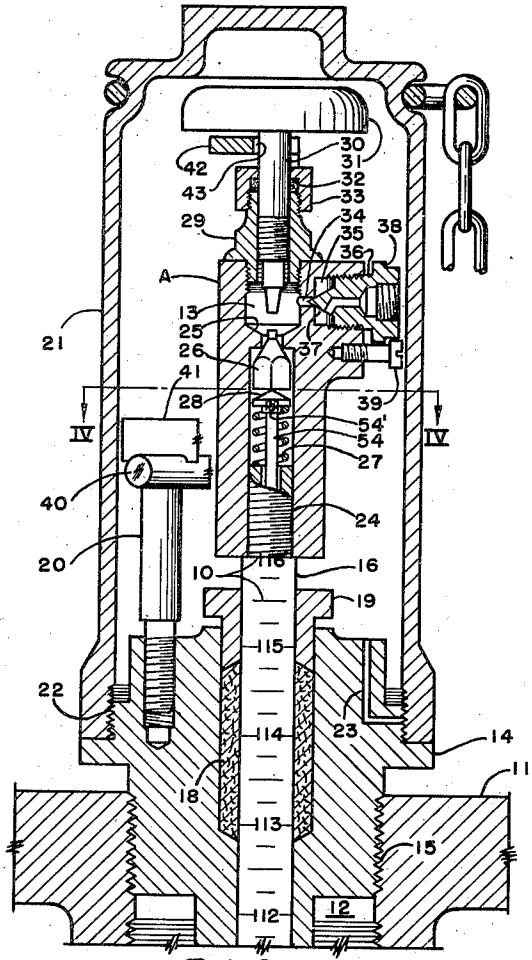


FIG. 1.

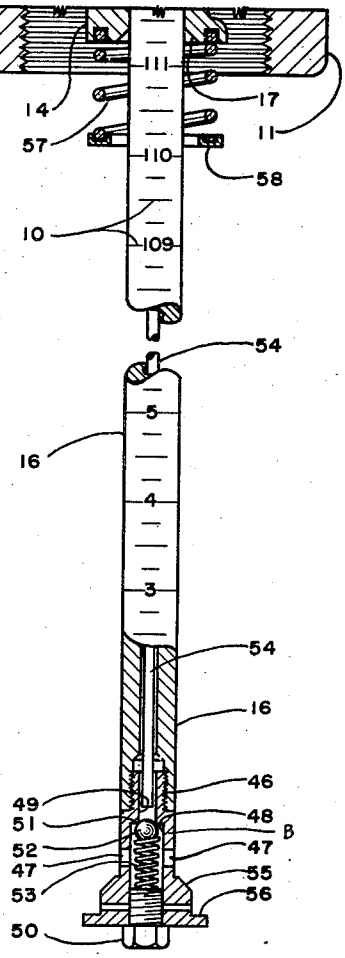


FIG. 2.

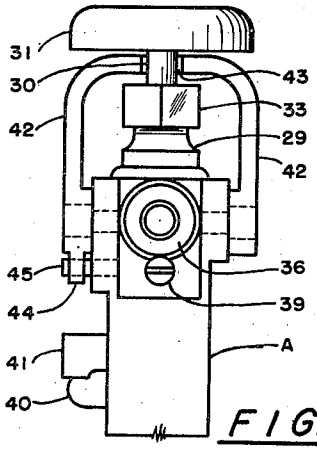


FIG. 3.

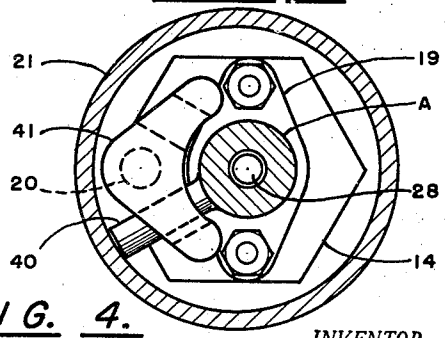


FIG. 4.

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GAUGING AND SAMPLING DEVICE

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4 Claims. (Cl. 73—298)

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This invention relates to a device for gauging and sampling liquids stored in a closed container under superatmospheric conditions. The device of the present invention is particularly adaptable to portable containers such as railroad tank cars which are used for transporting liquefied hydrocarbons under relatively high pressures and is provided with a plurality of valve means arranged to prevent loss of liquid from the container even though parts of the device are injured or destroyed by accident.

The invention and its scope may be fully understood from the following description read in conjunction with the accompanying drawing in which

Figs. 1 and 2 together constitute a side elevation, with parts broken away, of an embodiment of the present invention;

Fig. 1 showing the upper portion and Fig. 2 the lower portion of the device;

Fig. 3 is a fragmentary view of a portion of the mechanism of Fig. 1 with the view taken at 90° to Fig. 1; and

Fig. 4 is a view taken along line IV—IV of Fig. 1.

Referring now specifically to the drawing, a coupling member 11 is arranged to be secured to the top wall of a container. The walls of the container are not shown since the construction of storage tanks suitable for storing liquids under superatmospheric pressure is conventional to the art and it will be understood that coupling member 11 is secured to the wall of a container in a suitable fluid-tight manner. Coupling member 11 defines a vertically extending passage 12. Fitting upon coupling member 11 is a base member 14 which is secured to the coupling member in a fluid-tight manner. In the drawing mating screw threads 15 are shown as the means for securing the base member to the coupling member. It will be understood, however, that other suitable means for attaching the two members in a fluid-tight manner, such as by the use of cap screws, may be employed.

Base member 14 defines a vertically extending central passage in which gauging tube 16 is slidably arranged. Gauging tube 16 is provided with suitable calibrations 10. A tapering seat 17 is defined by base member 14 adjacent the lower end of the central passage. Base member 14 is additionally provided with packing 18 and packing gland 19 which is arranged to prevent loss of fluid between gauging tube 16 and the base member. Secured to the upper end of gauging tube 16 is a head member A which carries valves which will hereafter be described in greater detail and secured to the lower end of gauging tube 16 is tubular member B which also carries a valve which will be described in greater detail hereafter.

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A safety hook and sighting level screw member 20 is attached to the upper surface of base member 14. Cap 21, of suitable dimensions to cover head member A and the valve members incorporated therein, is secured to the base member by screw threads 22 arranged to engage corresponding threads formed on the base member. A passage 23 is formed in base member 14 and arranged to vent the space enclosed by cap 21 to the atmosphere as the cap is being disengaged from the head member.

Head member A is secured to the upper end of gauging tube 16 by mating screw threads 24. Head member A may be said to be of a generally tubular shape and defines a central passage 13 provided with a circular inwardly extending ledge 25 arranged some distance above the upper end of gauge rod 16. Ledge 25 forms a rest for valve member 26 which is mounted in the central passage below ledge 25 and is provided with a conically formed upper surface adapted to cooperate with ledge 25. Valve member 26 is biased upwardly against ledge 25 by spring 27. It will be noted that the upper end of spring 27 does not itself come into contact with valve member 26, but instead bears on a spring retainer member 28 which is shaped to allow the flow of fluid through passage 13. Spring retainer members 28 forces the valve member 26 against the circular ledge 25.

Mounted on the upper end of head member A is a bonnet 29 provided with a valve stem 30 which in turn is surmounted by hand wheel 31. The space between bonnet 29 and stem 30 is controlled by packing 32 held in place by stuffing box nut 33. The valve stem 30 may be moved downwardly by rotation of hand wheel 31 and upon engagement of the lower end of valve stem 30 with valve member 26 the valve member is pushed away from circular ledge 25 so that fluid may flow through central passage 13. Valve stem 30 is provided with left-handed threads. The reason for this is that conventional valves are opened by turning counterclockwise and closed by turning clockwise. If stem 30 were provided with right-handed threads, its operation would be the reverse of that of conventional valves. Consequently, it is convenient to employ left-handed threads in this case.

Above circular shoulder 25 central passage 13

is connected with a port 34 which extends at right angles to passage 13. Port 34 discharges into a passage 35 which is of substantially larger diameter than port 34. Within passage 35 is seated a valve 36 which is in the form of a screw thread plug having a conical projection 37 at its forward end which is adapted to seat at the outer end of port 34. The fluid passage through the valve 36 begins at the base of the conical projection and passes through the center of the plug. The outer end of the plug is provided with a circumferential shoulder 38 adapted to abut against a ledge 39, in this case the head of a screw, to limit outward motion of the plug. The plug 36 is of such dimensions that when it is in closed position its outer end is flush with the inside surface of cap 21, that is to say, that cap 21 cannot be screwed into place unless the valve 36 is in closed position.

Secured to head member A is laterally extending rod 40 arranged to cooperate with safety hook and sighting level member 20. It will be seen that the upper end of member 20 defines a hook designated by numeral 41. When the gauge rod is lowered into the container with member A adjacent stuffing box 19, rod 40 is below the lower surface of hook 41. It will be apparent that the head member A may be rotated with respect to base member 14. When head member A is in the position shown in Fig. 4, rod 40 is engaged with the hook portion 41 of the safety hook and sighting level member 20 and when thus engaged head A is locked against upward movement. If the head A is moved in a counterclockwise direction from the position shown in Fig. 4 the rod 40 becomes disengaged from hook member 41 and thereafter head A is free to move in a vertical direction. It will be observed that the central passage through which gauge member 16 is adapted to slide is slightly eccentric with respect to the screw threads 22 arranged for securing cap 21 to base member 14. This arrangement requires that rod 40 be immediately below hook 41 before cap 21 can be screwed into position and prevents gauge member 16 from being forced upwardly by pressure in the container as long as cap 21 is in position on base member 14. A bail 42 is pivotally mounted on head A. A recess 43 is provided in the bail and adapted to receive valve stem 30 when valve 26 is in a closed position. One end of bail 42 is provided with a lug 44 adapted to abut against stop 45 arranged in head A to limit the movement of the bail. Bail 42 is of such shape and dimension that it is capable of only slight movement from its vertical position when cap 21 is in place inasmuch as one side of the bail sets fairly snugly against the side wall of cap 21 when the bail is in vertical position. The dimensions of the bail are such that it cannot be placed in a vertical position unless valve 26 is in closed position. Consequently, the bail prevents the setting of cap 21 in place unless valve 26 is in closed position.

Member B is secured to the lower end of gauge tube 16 by suitable screw threads 46. Side ports 47 provide communication between the exterior of member B and a central passage 48 thereof. The upper end of passage 48 communicates with a corresponding central passage 49 in gauge member 16 while the lower end of passage 48 is closed by a suitable plug 50. Member B defines a valve seat 51 in passage 48 at a point above the side ports and arranged below the seat is ball 52 which is adapted to cooperate

therewith and close the central passage when the ball is in its uppermost position. A spring 53 is arranged in the central passage between plug 50 and ball 52 and biases the ball upwardly against seat 51.

A rod 54 is slidingly arranged in passage 49 of gauge member 16 with the dimensions of the rod and passage such that an annulus is provided through which fluid can flow. The upper end of rod member 54 is attached to spring retainer 28 by suitable means such as screw threads 54'. Rod 54 is of such length that when valve member 26 engages with the seat defined by ledge 25 the lower end of the rod is above ball 52 but when valve member 26 is forced downwardly away from ledge 25, the lower end of rod 54 comes in contact with ball 52 and forces it downwardly away from seat 51. In other words, the rotation of hand wheel 31 to move stem 30 downwardly first forces member 26 away from its seat and opens the upper valve and additional rotation forces ball 52 away from its seat and opens the lower valve.

The lower portion of member B at a point below side ports 47 is enlarged to form a shoulder which is provided with a surface 55 tapering outwardly and downwardly and of such a shape that when brought into contact with seat 17 it engages therewith to form a fluid-tight seal. Spaced slightly below seat 55 is an outwardly extending circular ledge 56. A spring 57 is secured to the lower surface of base member 14 with its upper end secured to the base member and its lower end secured to an annulus 58 of substantially the same diameter as ledge 56. The arrangement of spring 57, annulus 58 and ledge 56 is for absorbing the shock in the event a high pressure within the container drives gauging tube 16 upwardly.

The arrangement of seat 55 of member B and seat 17 of base member 14 allows packing 18 to be renewed without releasing the pressure from the container. If it is found desirable to add additional packing 18 or to renew packing 18 while under pressure, the gauging tube 16 may be drawn upwardly until tapering surface 55 engages seat 17 and forms a fluid-tight seal at the lower end of the central passage of base member 14. After surfaces 55 and 17 have been brought into engagement, stuffing box gland 19 may be removed, packing 18 replaced and the stuffing box nut 19 returned into position without releasing pressure from the container.

The device of the present invention may be employed to determine the liquid level in the container in the following manner. Cap 21 is removed from base member 14 and head member A rotated until rod 40 clears hook member 41. The valve means with which the device is provided may then be opened by rotating hand wheel 31 to move valve stem downwardly and force valve members 26 and 52 from their respective seats. Valve member 36 may then be opened. The superatmospheric pressure in the container will then cause fluid to pass upwardly through the passage defined by ports 47, passages 48 and 49, port 34 and passage 35. The gauge member 16 is moved vertically to determine the lever at which liquid discharges and above which vapors are discharged; at this point it is known that ports 47 have been lowered to the liquid level and a reading may be taken on scale 10.

It will be understood that the upper surface of the hook portion 41 of safety hook and sighting level member 20 may be used to define the line

of sight when reading the graduations of scale 10 when determining the liquid level in the container.

The device of the present invention is particularly advantageous for the handling of low molecular weight hydrocarbons such as butane or mixtures including substantial amounts of butane or light hydrocarbons. If water is present in the material being gauged, the refrigeration caused by the release of the vapors to the atmosphere may cause the upper portion of the gauging device to become frozen. In the arrangement of the present invention, the valve placed in member B remains submerged in the liquid of the container and at a sufficiently high temperature to prevent freezing thereof. The arrangement of the present invention has the dual advantages that if an accident occurs to the valve head A to render the valve in the upper end of the device useless, the lower valve in member B remains operable and in addition the freezing effects sometimes encountered with respect to the valve at the upper end of the device when releasing high pressure vapors to the atmosphere do not prevent the lower valve from being operable.

Having fully described the device of the present invention, what I desire to claim is:

1. A gauge suitable for determining the level of liquid in a container under superatmospheric pressure comprising, in combination, a base member defining an opening, an elongated body having a longitudinal passage extending therethrough slidably arranged in the opening in said base member, packing means arranged to seal the space between the base member and the elongated body, a valve seat defined in the lower end of said elongated body through which said passage extends, a valve seat defined in the upper end of the body through which the passage extends, a first valve member arranged in the passage adjacent the lower valve seat, means biasing said first valve member against said valve seat, a second valve member arranged in the body adjacent the upper valve seat, means biasing the second valve member against the upper valve seat, a valve stem mounted on the upper end of said elongated body and arranged for movement with respect thereto for forcing said second valve member away from the upper valve seat and a rod member mounted in the elongated passage between the first and second valve members and arranged to force the first valve member away from the lower valve seat upon movement of the second valve member away from the upper valve seat.

2. A gauge suitable for determining the level of liquid in a container under superatmospheric pressure comprising, in combination, a base member adapted to be secured to the container and defining a vertically extending passage with a seat on the lower surface of the base member adjacent the lower end of the passage, an elongated body having a longitudinal passage extending therethrough, said body being slidably arranged in the passage defined by the base member, a packing means arranged to seal the space between the base member and the elongated body, an outwardly extending shoulder carried by the lower end of said elongated body and defining an upper surface adapted to cooperate with the seat defined by the base member to seal the passage defined by the base member when said shoulder is brought into contact with the base member, a lower valve seat and an upper valve seat through which the longitudinal passage extends defined in the lower and upper ends of the elongated body respectively, a first valve member carried by the elongated body adjacent the lower valve seat, means biasing said first valve member against said valve seat, a second valve member arranged in the elongated body adjacent the upper valve seat, means biasing the second valve member against the upper valve seat, a valve stem mounted in the upper end of said elongated body and arranged for movement with respect thereto for forcing said second valve member away from the upper valve seat and a rod member mounted in the elongated passage between the first and second valve members and arranged to force the first valve member away from the lower valve seat upon movement of the second valve member away from the upper valve seat.

3. A device in accordance with claim 2 in which a gland is secured to the base member adjacent the upper end of the passage defined by the base member to hold said packing means in position.

4. A device in accordance with claim 2 in which a packing gland member is secured to the upper portion of the base member adjacent the central passage defined by the base member to secure the packing means in position and in which the passage defined by the elongated body above the upper valve seat discharges to the atmosphere and defines a third valve seat and a third valve member mounted on the elongated member to seal said third valve seat.

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