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Nov. 13, 1951

A. N. KERR

2,575,110

BALANCING TANK WITH CONTENT INDICATOR

Filed Aug. 12, 1948

2 SHEETS—SHEET 1

FIG. 1

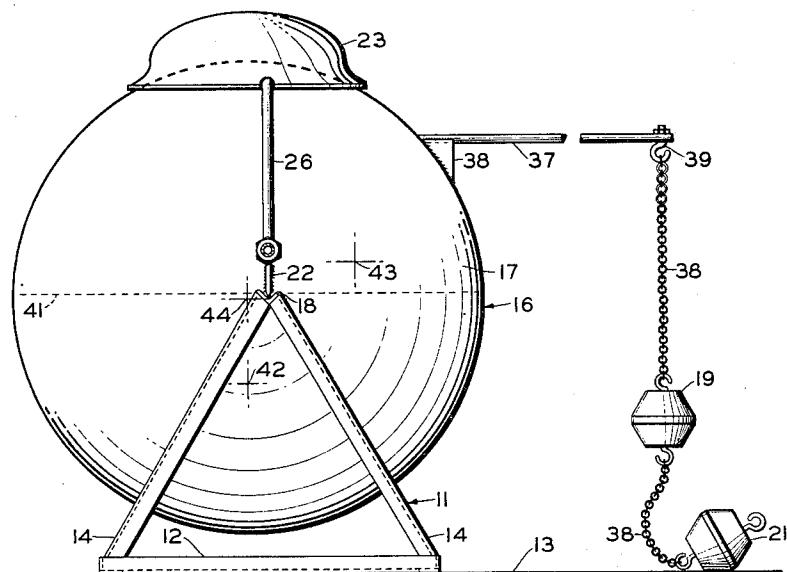
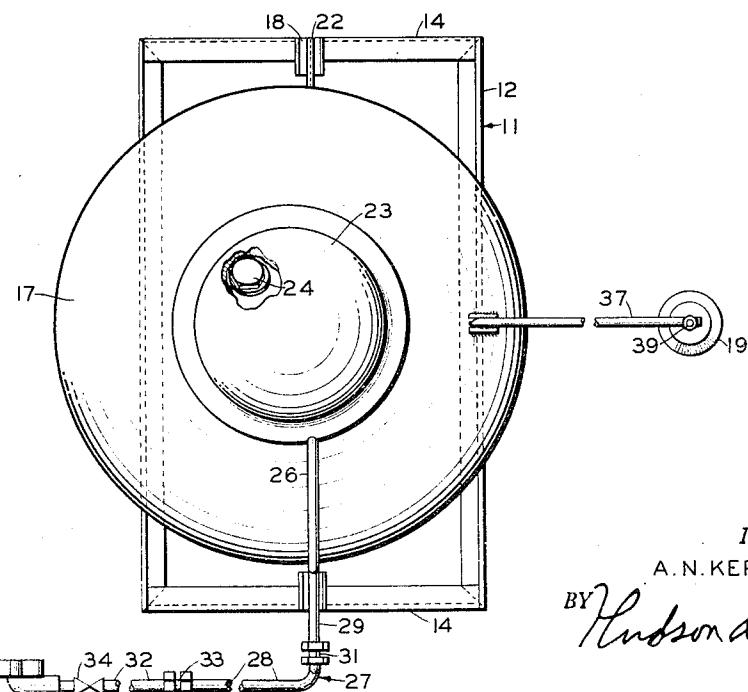


FIG. 2



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2 SHEETS—SHEET 2

FIG. 3

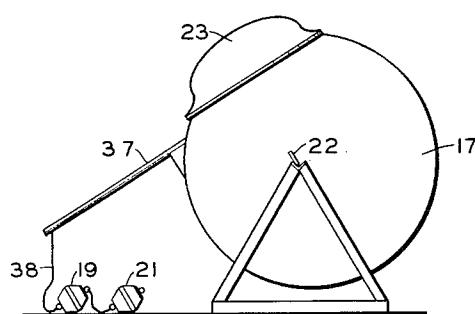


FIG. 4

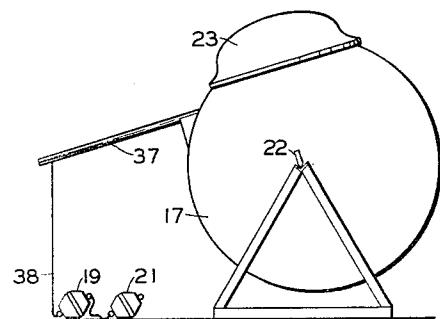


FIG. 5

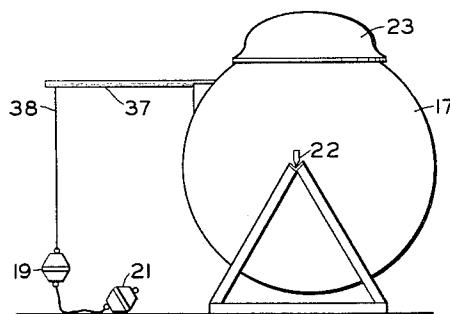


FIG. 6

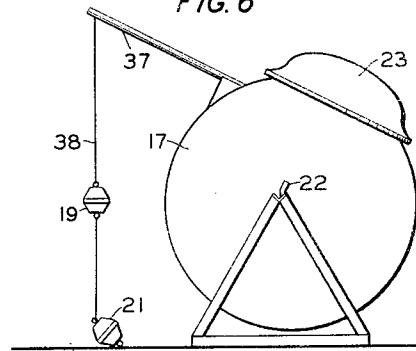
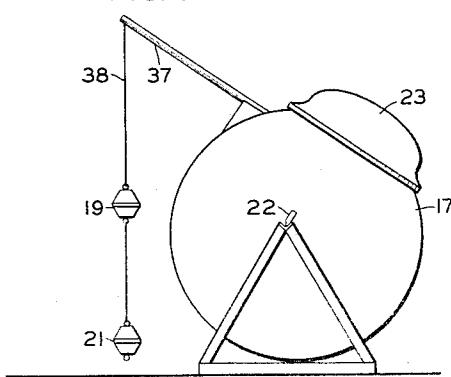


FIG. 7



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BALANCING TANK WITH CONTENT INDICATOR

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6 Claims. (Cl. 73—290)

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This invention relates to storage tanks for liquids. In one specific aspect it relates to storage tanks which balance or pivot and indicate by their position the approximate amount of liquid contained therein. In another specific aspect it relates to tanks for storing liquids having a high vapor pressure which may be dispensed for use in the form of a fluid, said fluid being either the original liquid, or a vapor or gas derived from the same.

In many rural or suburban areas there are no gas companies supplying gas by means of pipes running down the streets. In other instances consumers prefer the superior quality of certain liquified petroleum gases such as butane, propane and mixtures thereof, which may not be available in a public gas line running down the street. In such instances the gas supply of the consumer is taken from an individual tank containing, for example, liquified petroleum gas, which tank is generally located on the property of the consumer. Such individual tanks are generally very satisfactory to the consumer, and have only one disadvantage; namely, that the consumer has so many other things to think about that he forgets to check on how much liquified gas remains until he runs out of gas. Running out of gas is inconvenient, as it interrupts heating or illuminating the house, refrigerating or cooking food, or the like, often times at an hour most inconvenient to obtain more gas from the company supplying the liquified gas.

In the prior art numerous small indicators have been placed on such liquified gas containing tanks, but they often do not impress the consumer, or are too hard to read in a hurry, so that their warning goes unheeded. The supplier of liquified gas often keeps a card for each customer at his office and tries to anticipate when they will need more fuel, but because of variations in consumption some consumers still run out of fuel.

The present invention, however, indicates the approximate contents of the tank by the position of the tank, which position can hardly fail being seen by the consumer every time he traverses that portion of his property no matter how rapidly he passes by the tank. Also if the tank is positioned within the view of a street or alley, even though quite remote from the same, the supplier can send out a truck loaded with liquified gas and the driver of the truck can quickly check the supply each consumer has by the position of his tank without leaving the cab of the truck, and without even slowing the truck down. Therefore, the chance of the consumer running

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completely out of gas before he realizes it is substantially obviated.

One object of the present invention is to provide an improved tank for storing liquids.

5 Another object is to provide a storage tank the position of which indicates the approximate amount of liquid stored therein.

Another object is to provide a storage tank which by its position, observable at a considerable distance, will give a very obvious indication and warning of the fact that the liquid stored therein is almost all gone.

Other objects are to provide a storage tank of the type set forth above which is inexpensive, 15 strong in construction, able to withstand internal pressure, which is easily constructed out of standard available parts, in which liquid may be stored and from which vapor or liquid may be dispensed, which will have a long service life.

20 Numerous other objects and advantages will be apparent to those skilled in the art upon reading the accompanying specification, claims and drawings.

In the drawings:

25 Figure 1 is an elevational view of a storage tank embodying the invention with the portion of the dispensing line broken away to show details of construction.

Figure 2 is a plan view of the structure shown in Figure 1 with the dispensing line connected to a burner shown in elevation.

30 Figures 3 to 7 inclusive, are elevational views on a smaller scale of the tank shown in Figures 1 and 2 illustrating the positions of the tank when various amounts of liquid are in the tank.

35 Figure 3 shows the position of the tank when less than one-fourth full of liquid.

Figure 4 shows the position of the tank when one-fourth to one-half full of liquid.

40 Figure 5 shows the tank when about half full of liquid.

Figure 6 shows the tank when over half full to completely full of liquid.

Figure 7 shows the tank in a completely full 45 position at which time no more liquid should be added.

By "completely full" is meant that condition in which the tank holds all the liquid which it is considered desirable to place in the same.

50 Generally it is preferred to call a tank "completely full" and cease filling the same when there is still considerable vapor space in the tank over the surface of the liquid, which allows for thermal expansion of the liquid contents with 55 increases in atmospheric temperature without

added stress on the tank walls due thereto. However, for the purposes of the present invention, the tank may be completely liquid full so long as the walls can stand whatever pressure is generated by any differential expansion of liquid and walls as the temperature changes expected may cause.

In Figure 1 the base member 11 is shown made up of iron channels or angles 12 which are disposed on the surface of ground 13, and similar legs 14. The exact form of base member 11 is not an essential feature of the invention although the form illustrated is greatly preferred as being economical to construct, and as having a long life due to its strength. One advantage of the present invention is that base member 11 supports the liquid containing apparatus 16 out of contact with the ground, which prevents corrosion of tank 17 due to contact with the ground thereby increasing its life and reducing the chance of leakage occurring.

Base member 11 is provided with a pivot or fulcrum 18. I prefer to use the simple steel channel fulcrum shown and to weld the parts of the base member together, however, other forms economical to construct are available. For example, I may employ roller bearings of the type used for automobile wheels (not shown) in place of pivot 18, as often such bearings are available in suitable condition at a low price after the automobile has been disassembled for junk, and several modes of constructing and assembling base member 11 readily suggest themselves as embodiments of the present invention.

Tank 17 is preferably a spherical tank, but obviously the present invention could be embodied in a cylindrical tank having an eccentric pivot with the axis of the pivot extending parallel to the axis of the cylinder. In other words the cylinder would be circular in cross section when viewed as in Figure 1, but appear rectangular in cross section when viewed as in Figure 2. However, Figures 1 and 2 illustrate a spherical tank, which is greatly preferred, as a sphere is the strongest shape for containing liquified gas having substantial vapor pressure. While other shapes are possible they are not preferred because only a circular cross section as viewed in Figure 1 will provide the smallest and most gradual change of the center of mass of the tank and the center of mass of the liquid contents.

While the operation of the invention is not limited in any way by the size of tank 17, which may be quite large or quite small, I have found that one convenient size for tank 17 is such that it will contain about 135 gallons of propane when in a position shown in Figure 7. While the use of various sizes of weights 19 and 21 may be employed to give indications of different amounts of liquid in the tank, I prefer to have indications given at the time when the tank is one-fourth full, half full and completely full.

Tank 17 is pivoted on pivot 18 by a suitable tank pivot 22. While other forms of pivot 22 are suggested above, the form illustrated is preferred for its simplicity, ruggedness, satisfactory operation and long life. In its preferred form it consists of a metal plate 22 secured to the tank by welding and having its lower end beveled somewhat to increase its sensitivity in pivoting in pivot 18. However, 22 need not have a sharp edge and as 18 is generally provided with the

usual fillet it does not usually have a sharp right angle in its preferred form.

Tank 17 has a cover 23 which may be attached to a tank by any suitable means, such as screws, but which is preferably held onto tank 17 by means of spring clips the same way that the hub caps of automobiles (not shown) are readily snapped on and off the wheel (not shown). Any known means for detachably securing cover 23 may be used.

The removable cover 23 is shown in Figure 2 with a filler plug 24. This showing is for the purpose of simplicity, as obviously it is preferred to use the standard type of filling, pressure regulating and dispensing apparatus in place of this simple filler plug, as shown by the patent to R. W. Thomas 2,307,309 patented January 5, 1943. This Thomas patent shows suitable apparatus for filling the tank and for relieving pressure in case of undue increase of pressure such as might be caused by overheating due to a fire (not shown). Thomas also shows a suitable means for reducing the pressure for use of the gas in household appliances, and shows a suitable dispensing line which corresponds to dispensing line 26 of the present invention.

In other words any standard type of filling and/or dispensing apparatus used in the liquified petroleum gas prior art for either liquid or vapor production may be employed in place of plug 24 and dispensing line 26 of the present application. While liquid may be dispensed it is generally more useful and preferred to dispense the gas in the form of a vapor.

Line 26 runs out past the end of plate 22 to a pivoting portion 27 which may be in the form of a flexible pipe 28 connected with line 26 near 29 by any standard pipe connection 31 and with the other end of 28 connected to extension line 32 by a similar standard pipe connection 33. However, line 28 need not be flexible provided a suitable gas type swivel (not shown) is substituted for connection 31, and part 29 is brought down to the lower edge of 22 in order to make said swivel connection concentric with the pivotal axis of tank 17. It is regarded as preferable to use flexible pipe 28 as said swivel connection tends to give trouble as it becomes older.

While it is preferred to have the gas pressure regulator under hood 23 obviously one or more stages of gas regulation (not shown) may be inserted in line 32, it being customary in all events to have at least a shut off valve 34 at the end of line in order to control the gas going to such a consuming unit as burner 36. While a burner 36 is shown, obviously other useful means of gas consumption can be employed with the present invention.

Tank 17 is provided with a lever arm 37 secured rigidly to the same by any suitable means, such as gusset plates 38, and welding or riveting. Arm 37 extends out from the tank 17 a considerable distance and has a line 38 secured to its end by conventional connecting means such as eye 39. At suitable intervals in line 38, weights 19 and 21 are inserted and secured thereto by similar eyes. I prefer to use a light chain as line 38 because it gives better service, but any wire, rope, cable or other flexible longitudinal connecting member can be used and is believed included in the term "line."

Operation

As shown in Figure 1 the tank 17, tank pivot 22, and lever arm 37 are so proportioned and disposed that during normal pivoting of said tank from the

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position shown in Figure 3 to the position shown in Figure 7, the center of mass of liquid 41 in said tank (located at about point 42) and the center of mass of the combined lever arm 37, such portion of the line 38 as is supported by said lever arm, and said tank 17 independent of any liquid contained therein, (located at about point 43) are on opposite sides of pivot 18. This is possible because pivot 18, 22 is eccentric to the geometrical center of the tank which is located at point 44.

As shown in Figure 1, tank 17 is half full of liquid 41. The weight of this liquid may be considered as concentrated at its center of mass 42. At the same time the center of mass of tank 17, independent of liquid 41 but including arm 37, weight 19 and such parts of chain 38 as are supported, is located at point 43. The tank therefore balances in the position shown in Figure 1 because the weight of liquid 41 times the horizontal distance between 22 and 42 is equal to the weight of the tank and supported weight enumerated above times the horizontal distance between 22 and 43. It will be noted that weight 21 and a portion of chain 38 adjacent thereto are supported by the ground 13.

As flexible tube 28 offers substantially no resistance to movement of the tank compared to the larger forces tending to move the tank, it does not interfere with the tank indicating its contents by its position.

In Figure 3 the tank is less than one-fourth full, and therefore should be refilled. In Figure 4 the tank is more than one-fourth full and less than one-half full and still should be refilled in case it is seen in this position by a driver passing with the liquified petroleum gas delivery truck of the supplier. In Figure 5 the tank is about half full. In Figure 6 the tank is full or about full as can be seen from the fact that weight 21 is beginning to lift off the ground. In Figure 7 the tank is completely full and no more liquid should be placed in the same. The moment that weight 21 starts to leave the ground, the filling of tank 17 should cease.

While the position of the tank alone is a reliable indication, it is not necessary to rely entirely on the tank position in filling the tank, as many standard tank filling systems are provided with a filling gage, such as 86, 87, 88, 89 and 90 of Thomas 2,307,309 patented January 5, 1943.

By using different sized weights in place of 19 and 21 the tank can be held in different positions for different amounts of liquid content. Only one weight 19 may be employed in some instances while in other instances a very large number of smaller weights can be employed. The number of weights can be increased until they approach in number and size the links in line 38. In fact a line 38 having its own weight alone may be employed. I find however, it is preferable to have a limited number of concentrated weights because they give more positive positioning of the tank, and I find that because of psychological and business reasons it is best to have a clear indication of when the tank is empty, one-fourth full, one-half full, and completely full. Of these indications the most important are more than one-fourth full and less than one-fourth full, as when it is seen that there is less than one-fourth of a tank left it is time to order more liquified petroleum gas. On the other hand when it is more than one-fourth full, ordering is generally delayed for economic reasons, or due to procrastination common to

all of us. Therefore, when only one weight 19 is employed I prefer to indicate whether it is more or less than one-fourth of a tank of liquid, but I prefer to have two weights and indicate the various levels as explained above.

While I have illustrated in the drawings and discussed in the specification a preferred illustrative embodiment of my invention, obviously my invention is not limited strictly thereto, but instead is defined in the following claims.

Having described my invention, I claim:

1. Apparatus for storing liquids and indicating the approximate amount of liquid stored therein comprising a base member, a spherical tank pivoted on said base member, a lever arm rigidly secured to said tank and extending out from the same, a line secured to said lever arm, and a first and second weight secured to and spaced along said line, a portion of said line being adapted to rest on a supporting surface stationary relative to said base member, said tank, tank pivot, and lever arm being so proportioned and disposed that during normal pivoting of said tank the center of mass of the liquid in said tank and the center of the combined mass of the lever arm, plus such portion of the line supported by said lever arm, and plus said tank independent of any liquid contained therein, are on opposite sides of said pivot, whereby the mass of the liquid in said tank positions and balances said tank, lever arm, and such portion of said line and first and second weight as is supported by said lever arm to indicate the approximate amount of liquid in said tank, and a fluid dispensing conduit connected to the interior of said tank having a pipe connection portion rigidly attached to said tank and disposed and positioned with the axis of said pipe connection portion in the same plane as the pivotal axis of said tank whereby dispensing of fluid may occur at variable rates in all normal tank positions without greatly changing the position of said tank due to forces of reaction of said variable rate of dispensing.

2. Apparatus for storing liquids and indicating the approximate amount of liquid stored therein comprising a base member, a tank pivoted on said base member, said tank having an external surface of revolution about an axis adjacent to and parallel with the axis on which said tank is pivoted, a lever arm rigidly secured to said tank and extending out from the same, a line secured to said lever arm, and a weight secured to said line, a portion of said line being adapted to rest on a supporting surface stationary relative to said base member, said tank, tank pivot, and lever arm being so proportioned and disposed that during normal pivoting of said tank the center of mass of the liquid in said tank and the center of the combined mass of the lever arm, plus such portion of the line supported by said lever arm, and plus said tank independent of any liquid contained therein, are on opposite sides of said pivot, whereby the mass of the liquid in said tank positions and balances said tank, lever arm, and such portion of said line and weight as is supported by said lever arm to indicate the approximate amount of liquid in said tank, and a fluid dispensing conduit connected to the interior of said tank having a pipe connection portion rigidly attached to said tank and disposed and positioned with the axis of said pipe connection portion in the same plane as the pivotal axis of said tank whereby dispensing of fluid may occur at variable rates in all

normal tank positions without greatly changing the position of said tank due to forces of reaction of said variable rate of dispensing.

3. Apparatus for storing liquids and indicating the approximate amount of liquid stored therein comprising a base member, a tank pivoted on said base member, a lever arm rigidly secured to said tank and extending out from the same, and a line secured to said lever arm, a portion of said line being adapted to rest on a supporting surface stationary relative to said base member, said tank, tank pivot, and lever arm being so proportioned and disposed that during normal pivoting of said tank the center of mass of the liquid in said tank and the center of the combined mass of the lever arm, plus such portion of the line supported by said lever arm, and plus said tank independent of any liquid contained therein, are on opposite sides of said pivot, whereby the mass of the liquid in said tank positions and balances said tank, lever arm, and such portion of said line as is supported by said lever arm to indicate the approximate amount of liquid in said tank, and a fluid dispensing conduit connected to the interior of said tank having a pipe connection portion rigidly attached to said tank and disposed and positioned with the axis of said pipe connection portion in the same plane as the pivotal axis of said tank whereby dispensing of fluid may occur at variable rates in all normal tank positions without greatly changing the position of said tank due to forces of reaction of said variable rate of dispensing.

4. Apparatus for storing liquids and indicating the approximate amount of liquid stored therein comprising a base member, a tank pivoted on said base member, a lever arm rigidly secured to said tank and extending out from the same, a line secured to said lever arm, and a first and second weight secured to and spaced along said line, a portion of said line being adapted to rest on a supporting surface stationary relative to said base member, said tank, tank pivot, and lever arm being so proportioned and disposed that during normal pivoting of said tank the center of mass of the liquid in said tank and the center of the combined mass of the lever arm, plus such portion of the line supported by said lever arm, and plus said tank independent of any liquid contained therein, are on opposite sides of said pivot, whereby the mass of the liquid in said tank positions and balances said tank, lever arm, and such portion of said line and first and second weight as is supported by said lever arm to indicate the approximate amount of liquid in said tank.

5. Apparatus for storing liquids and indicating the approximate amount of liquid stored therein comprising a base member, a tank pivoted on said base member, a lever arm rigidly secured to said tank and extending out from the same,

a line secured to said lever arm, and a weight secured to said line, a portion of said line being adapted to rest on a supporting surface stationary relative to said base member, said tank, tank pivot, and lever arm being so proportioned and disposed that during normal pivoting of said tank the center of mass of the liquid in said tank and the center of the combined mass of the lever arm, plus such portion of the line supported by said lever arm, and plus said tank independent of any liquid contained therein, are on opposite sides of said pivot, whereby the mass of the liquid in said tank positions and balances said tank, lever arm, and such portion of said line and weight as is supported by said lever arm to indicate the approximate amount of liquid in said tank.

6. Apparatus for storing liquids and indicating the approximate amount of liquid stored therein comprising a base member, a tank pivoted on said base member, a lever arm rigidly secured to said tank and extending out from the same, and a line secured to said lever arm, a portion of said line being adapted to rest on a supporting surface stationary relative to said base member, said tank, tank pivot, and lever arm being so proportioned and disposed that during normal pivoting of said tank the center of mass of the liquid in said tank and the center of the combined mass of the lever arm, plus such portion of the line supported by said lever arm, and plus said tank independent of any liquid contained therein, are on opposite sides of said pivot, whereby the mass of the liquid in said tank positions and balances said tank, lever arm, and such portion of said line as is supported by said lever arm to indicate the approximate amount of liquid in said tank.

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