United States Patent [19]

Stiefel, Jr.

[11] **3,827,610**

[45] **Aug. 6, 1974**

[54] VOLUMETRIC FILLING DEVICE

[76] Inventor: **Harold A. Stiefel, Jr.**, Rt. No. 1, Box 202 Q, Cleveland, Tex. 77327

[22] Filed: **Aug. 9, 1972**

[21] Appl. No.: **278,988**

[52] **U.S. Cl.** **222/440,** 73/429
[51] **Int. Cl.** **G01f 11/44**
[58] **Field of Search** 222/424, 400.7, 445, 318, 222/438, 440, 400.8, 401; 73/219, 220, 223, 224, 429

[56] **References Cited**

UNITED STATES PATENTS

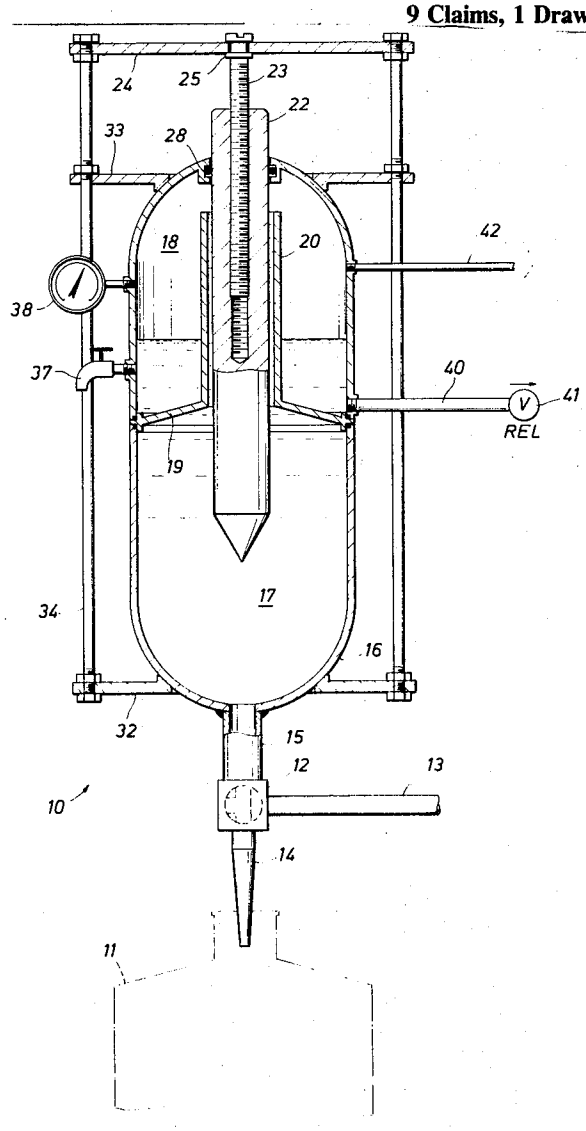
512,587	1/1894	McConnell	222/400.8
709,638	9/1902	Johnson	222/440 X
1,658,715	2/1928	Gueux	73/219
2,157,966	5/1939	Reisinger	222/400.7
2,557,386	6/1951	Lonier	222/440 X
3,145,881	8/1964	Moore	222/440 X
3,216,251	11/1965	Hansen	73/223

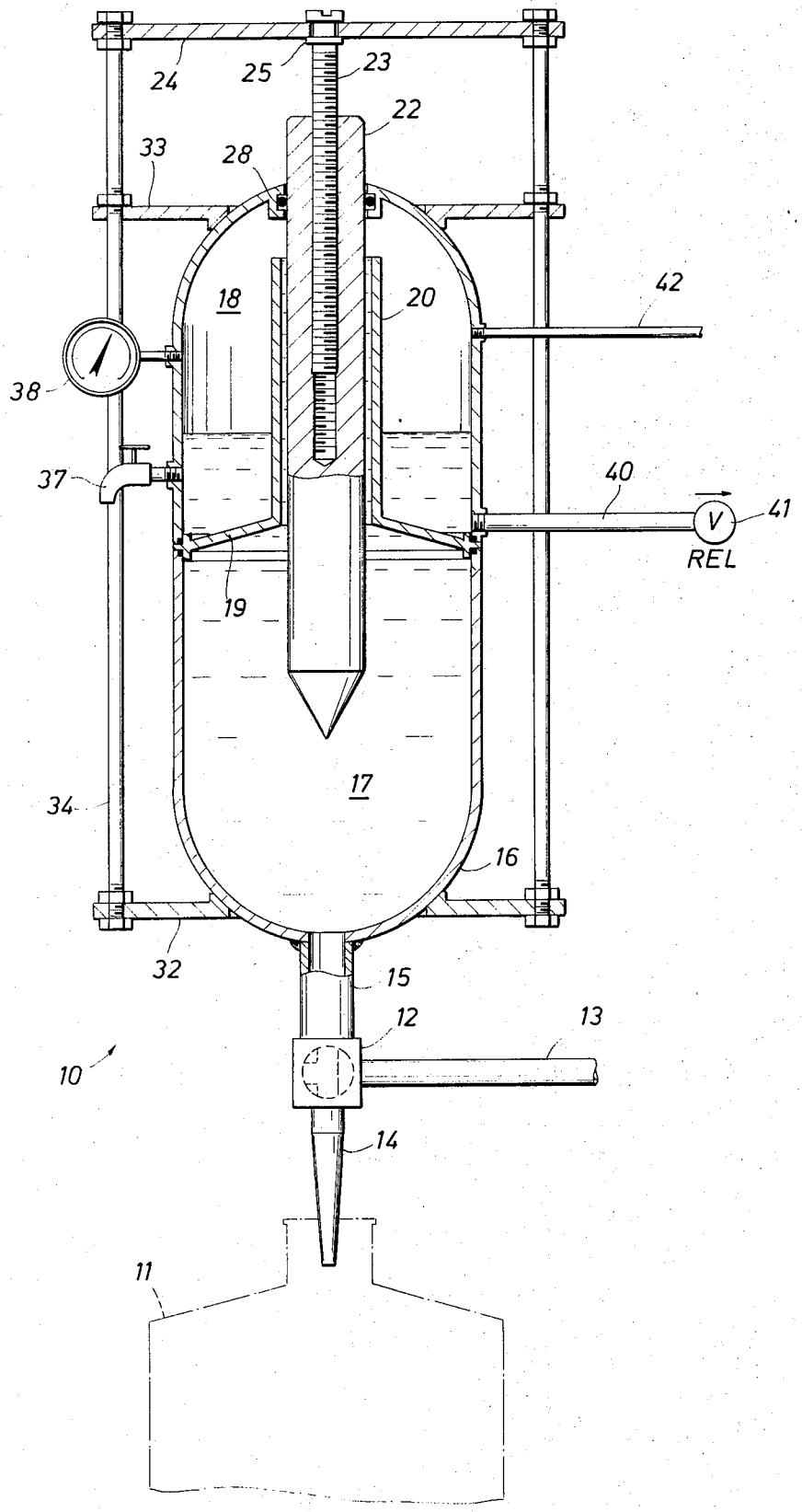
Primary Examiner—Robert B. Reeves
Assistant Examiner—Thomas E. Kocovsky
Attorney, Agent, or Firm—Donald Gunn

[57] **ABSTRACT**

A volumetric filling device which utilizes a pair of connected chambers is selectively filled through a threeway valve with a product. The volume of the lower chamber is adjusted by vertically manipulating a displacement plug in a standpipe extending into the upper chamber. The standpipe extends into the second or upper chamber so that an overflow from the standpipe falls into the bottom portion of the upper chamber. The chamber is pressurized upon the introduction of a product with pressure in the chamber being regulated. If excessive product is introduced, it flows from the bottom chamber through the standpipe into the upper chamber and is returned through a pressure release valve to be recycled. Once a particular pressure in the upper chamber is obtained, air is forced into the upper chamber to evacuate the standpipe and lower chamber through the three-way valve and an outlet to thereby meter a precise quantity of liquid.

9 Claims, 1 Drawing Figure




24
25
23
22
33
28
18
20
42
38
37
40
41
V
REL
19
17
34
16
32
15
12
13
10
14
11

VOLUMETRIC FILLING DEVICE

BACKGROUND OF THE INVENTION

In the bottling and packaging of liquid products, it is necessary to meter fairly precise quantities of product to comply with most state laws on labeling and packaging a product. Moreover, many problems exist with volumetric devices because of the nature of the product itself. For instance, some liquid products tend to expand when being handled either by dissolving air, by foaming or sudsing. Moreover, liquid products are quite often difficult to dispense from a volumetric device because of dripping or clinging to the side walls of the device. Further, many problems have been encountered in volumetric filling devices through the buildup of sediment or coatings on the surface so that the measured volume will vary through a work day. This typically will happen with paraffin containing liquids.

On occasion, it is necessary to adjust a volumetric filling device from a first desired metered quantity to a second quantity and if this occurs, such adjustment may have to take into account the effects mentioned above which are quite often nonlinear.

In the filling of containers from a volumetric metering device, production is quite often dependent on the speed with which the container is filled. The present invention provides assistance to filling speed by virtue of the use of pressurized evacuation of the device. This prevents holdover bubbles and side wall deposits which cling and run rather slowly to the bottom. They are forced out at a greater rate of speed through the introduction of a blast of air through the filling chamber. Moreover, the device can be filled rapidly with no problems from overflow. For instance, should the apparatus of the present invention be filled rapidly and cause foam on the top of the liquid, the foam is drained off quickly to permit the subsequent filling of the container through the metering apparatus of the present invention. More will be noted below in summarizing the present invention.

SUMMARY OF THE PRESENT INVENTION

The present invention is summarized as comprising a pressure vessel which is divided into a pair of chambers, upper and lower chambers. The lower chamber extends by means of a stand pipe into the upper chamber. A displacement plug is placed in the standpipe to adjust the volume of the lower chamber plus the standpipe diminished by the volume of a displacement plug. This permits fine adjustments on the volume of the lower chamber. A liquid product is introduced into the lower chamber by means of a three-way valve and fills to the top edge of the stand pipe. Foam on the top spills over the side into the second or upper chamber. Liquid product captured in the upper chamber is returned through a pressure release valve and line back to the product source for recycling. Air is introduced in the upper chamber to force the liquid product in the stand pipe and lower chamber through a threeway valve into the container to be filled. Many other details of construction and operation will be described below.

BRIEF DESCRIPTION OF THE DRAWING

The single drawing is a sectional view through the apparatus of the present invention showing the liquid metering apparatus of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the single view, the filling device of the present invention is generally indicated by the numeral **10.** It is adapted to fill a container of some suitable form and shape indicated by the numeral **11.** The liquid product to be placed in the container **11** is of no particular concern except to note that various and sundry liquid products have many different problems. For instance, the products may include food products such as milk or other drinks, cosmetic products such as facial soaps, household products such as kitchen waxes and many others. In any case, the present invention includes a three-way valve **12** which is connected by means of an inlet line **13.** The line **13** is adapted to be communicated with a large supply of the product to be placed in the container **11.** This may be a tank or vat which supplies the product under pressure. More will be noted concerning this hereinafter. The three-way valve **12** is connected to a downwardly directed spigot **14** which extends into the neck of the container **11** or at least is positioned immediately adjacent to the mouth of the container. Depending on the arrangement of the container **11** with respect to the spigot **14,** various and sundry conveyor belts and other transfer systems are utilized to position the container **11** in position below the spigot **14** so that several are filled in succession.

The numeral **15** identifies an upward extending conduit in line with the spigot **14.** The conduit **15** is connected to a large closed vessel **16.** The vessel **16** is divided into two chambers, the first chamber being that indicated at **17** which will be denoted hereinafter as the lower chamber or the product chamber. The upper chamber is denoted by the numeral **18.** A central diaphram **19** divides the vessel **16** into the two chambers. The lower chamber **17** is the chamber for receiving the product which is to be metered. The product is introduced through the conduit **13,** the valve **12** and then through the line **15.** The product is introduced into the lower chamber **17** and fills the lower chamber to a suitable level. The product is introduced until it fills the lower chamber **17** and also fills a stand pipe which is indicated by the numeral **20.** The stand pipe extends toward the top portions of the vessel **16,** well above the level of the liquid product overflowing into the upper chamber **18.** The stand pipe adds to the volume of the lower chamber in a manner to define a maximum volume which includes the lower chamber **17** and the volume of the stand pipe **20.** The stand pipe serves several purposes as will be noted hereinafter.

A displacement plug **22** is inserted into the stand pipe **20** to precisely control the total volume of liquid to be dispensed. Since the maximum is equal to the lower chamber **17** and the stand pipe **20** without the plug, the maximum is diminished to a desired level by lowering the displacement plug **22.** When it is lowered to the level of the upper lip of the stand pipe, it begins to reduce the total effective volume of the lower chamber. The displacement plug **22** is preferably mounted on a threaded shaft **23.** The threaded shaft connects with a transversely extending support bar **24.** Further, a bolt head **25** is carried on the upper end of the threaded shaft **23** to permit ease of manipulation by means of a tool such as a screwdriver or wrench to rotate the shaft **23** and thereby move the displacement plug upwardly or downwardly to finely tune the volume of the lower

chamber **17.** While other mechanical techniques can be implemented for moving the displacement plug, the apparatus described above is relatively simple and inexpensive in cost.

The displacement plug extends through an opening within the vessel **16.** The opening is sealed by means of an O-ring seal **28** which surrounds the displacement plug **22.** This prevents the escape of air or product along the displacement plug as it extends upwardly out of the vessel **16.**

The vessel **16** is held in a framework which supports the vessel with respect to the container **11** and the feed line **13.** While other arrangements can be utilized, the supportive framework includes a generally circular plate **32** at the bottom and a similar plate **33** at the top. A number of tie bars **34** extend between the two plates at spaced locations around the vessel **16.** The tie bars **34** are bolted and pulled snug to clamp the vessel firmly between the circular plates **32** and **33.** In addition, the tie bars **34** extend upwardly to the transverse member **24** and support it in position over the displacement plug **22.**

The vessel **16** is actually constructed of two members which are joined together at the central diaphram **19.** The diaphram **19** has an outwardly extending flange and O-rings are positioned on the upper and lower faces of the flange. Thus, the external framework holds the two members together and achieves a sealing relationship at the flange such that no leakage occurs along the edge of the diaphram **19.**

The upper chamber **18** is drained through a faucet **37.** Additionally, a pressure gage **38,** if desired, is attached to indicate pressure within the upper chamber.

The upper chamber is connected with a line **40** which communicates through a valve **41** for returning excess product to the supply source. This line is connected just above the divider **19** so that it drains substantially all of the fluid accumulated in the upper chamber **18.** A second line **42** is connected to the upper chamber. It is preferably connected with a source of air under pressure, a representative pressure being given hereafter. A valve (not shown) opens the line **42** to deliver air under pressure for evacuation of the lower chamber **17** when the container **11** is actually filled. This will be described in detail hereinafter.

The valve **41** is set to relieve pressure within the upper chamber in a particular manner. This will be described when representative values of various pressures are given hereinafter.

While the foregoing describes the apparatus, an example of operation will be given to further enhance the understanding of the present invention. Assume for sake of discussion that the chamber **17** including the stand pipe to its upper lip holds a volume of 32 fluid ounces. This then defines a structure, depending on the size of the displacement plug, which can dispense from **32** ounces down to approximately 20 ounces depending on the position of the displacement plug. Suppose again for sake of example that the displacement plug is positioned to reduce the lower chamber **17** by 8 ounces so that it holds 24 ounces. Suppose further that the ratio of the lower chamber to the upper chamber is such that the air which is in the lower chamber, when empty, is forced into the upper chamber to achieve an approximate four-fold increase in pressure. This might provide a pressure in the upper chamber when the fluid is introduced of approximately 60 psi. Following this example further, the three-way valve **12** is positioned so that the line **13** is connected with the lower chamber and the product is introduced. At least **24** ounces are introduced, preferably about 25 to 27 ounces so that some of the product overflows the stand pipe. After the product is introduced, the valve **12** is turned to close off the chamber **17** prepatory to delivery of the product to the container **11.** At this juncture, approximately 2 or 3 ounces has overflowed into the upper chamber **18** while the exact quantity desired, i.e., 24 ounces, is found in the lower chamber **17.** Additionally, the pressure in the upper chamber **18** has risen perhaps to about 60 psi.

With the pressure in the upper tank **18** at an elevated level, the three-way valve **12** is simply opened to communicate the lower chamber **17** with the spigot **14.** The air in the upper chamber forces the product from the stand pipe and the lower chamber **17** rapidly.

The rush of product is maximum when the valve **12** is first opened. The product quickly fills the container. After the initial surge the flow of product drops. This is quite useful in the filling of a container. The initial surge tends to fill the container quickly at a stage when foaming or sudsing does the least harm. By way of contrast, the last portion of product fills the container at a rate which declines, somewhat exponentially, with less splash and foaming. Since the filling rate drops, the foam in the container has time to disperse and spill over is avoided or eliminated.

The chamber in the device compresses the air by an amount equal to the amount of product introduced into the vessel, and the air is subsequently returned to atmospheric pressure on delivery of the product. The air serves a type of pneumatic spring which stores energy for dispensing the liquid product. The product is delivered with an initial surge and a later decay in flow rate.

Should it be helpful, a short air burst can be delivered and introduced through the line **42** to boost delivery. This is optionally of assistance for some circumstances but is not normally required for most products.

The release valve **41** is set at a desired level to periodically exhaust product overflow in the upper chamber **18.** The excess product is returned to the storage tank so that it can be supplied again.

After the device is placed in operation, the dispenser functions time after time without variation in quantity. The repetitive use of the device fills consistently notwithstanding wall cling which adds to each filling, the wall cling of the prior filling. Since this factor is constant, it is of no consequence during continued uses.

The amount of overflow of the lower chamber **17** need not be so great as to fill the upper chamber **18.** Preferably, the overflow is held as small as possible, consistent with the speed of operation in filling the lower chamber **17** to the desired level.

The foregoing describes the operation of the preferred embodiment of the present invention. It will be understood that through the sequencing of the product delivery valve and air valve (not shown) that the apparatus can be used to rapidly fill the container **11** and subsequent containers. Preferably, the valve **12** and the other valves are solenoid operated to enhance high speed automatic operation.

In the use of the device, it can be adjusted to dispense a different quantity by adjusting the displacement plug

22. However, it is believed that description of an example of operation is not needed because the foregoing disclosure is amply detailed to set forth the operation of the device after manipulation of the displacement plug to a different position. It is appreciated that the exterior of the displacement plug can be calibrated so that its linear position is related to the actual measure in liquid dispensed by the apparatus **10**. Thus, trial and error adjustments to position the displacement plug are not required.

The foregoing is directed to the preferred embodiment of the present invention while the scope of the present invention is determined by the claims which are appended hereto.

I claim:

1. Liquid metering apparatus comprising:

a closed vessel divided into upper and lower chambers by a transverse diaphram with said lower chamber having a generally upright stand pipe extending into said upper chamber above said diaphram;

a spigot connected to the lower chamber thereof and adapted to be positioned with respect to a container for filling such a container;

a valve in said spigot;

means for introducing a liquid product into said lower chamber in a predetermined measure;

means for adjusting the volume of said lower chamber and said stand pipe so that a metered quantity of product is accumulated in said lower chamber and said stand pipe jointly and compressing air therefrom in said upper chamber;

means for opening said valve to exhaust said lower chamber; and,

means for introducing compressed air from said upper chamber into said stand pipe and said lower chamber for evacuating the liquid product therefrom.

2. The apparatus of claim **1** including an exhaust line connected to a pressure responsive valve from the lower portions of said upper chamber.

3. The invention of claim **1** including an external flange on said diaphragm and seal rings positioned on the opposite faces of said flange to seal said flange with said pressure vessel.

4. The structure of claim **1** wherein said valve is a three-way valve and a supply line is connected thereto, and said spigot is selectively communicated by said valve to said lower chamber.

5. The invention of claim **1** including an adjustable displacement plug telescoped into said stand pipe and adjustable in position.

6. The structure of claim **5** including an opening in said vessel above said stand pipe, and means slidably and sealingly positioning said displacement plug in said stand pipe and extending from said opening.

7. The structure of claim **6** further including a threaded shaft mounting said plug, said shaft being relatively rotated to advance and remove said plug in said stand pipe.

8. The structure of claim **7** including an externally fixed member connected to said threaded shaft.

9. The structure of claim **8** including a supportive frame structure surrounding said vessel and incorporating said fixed member.

* * * * *