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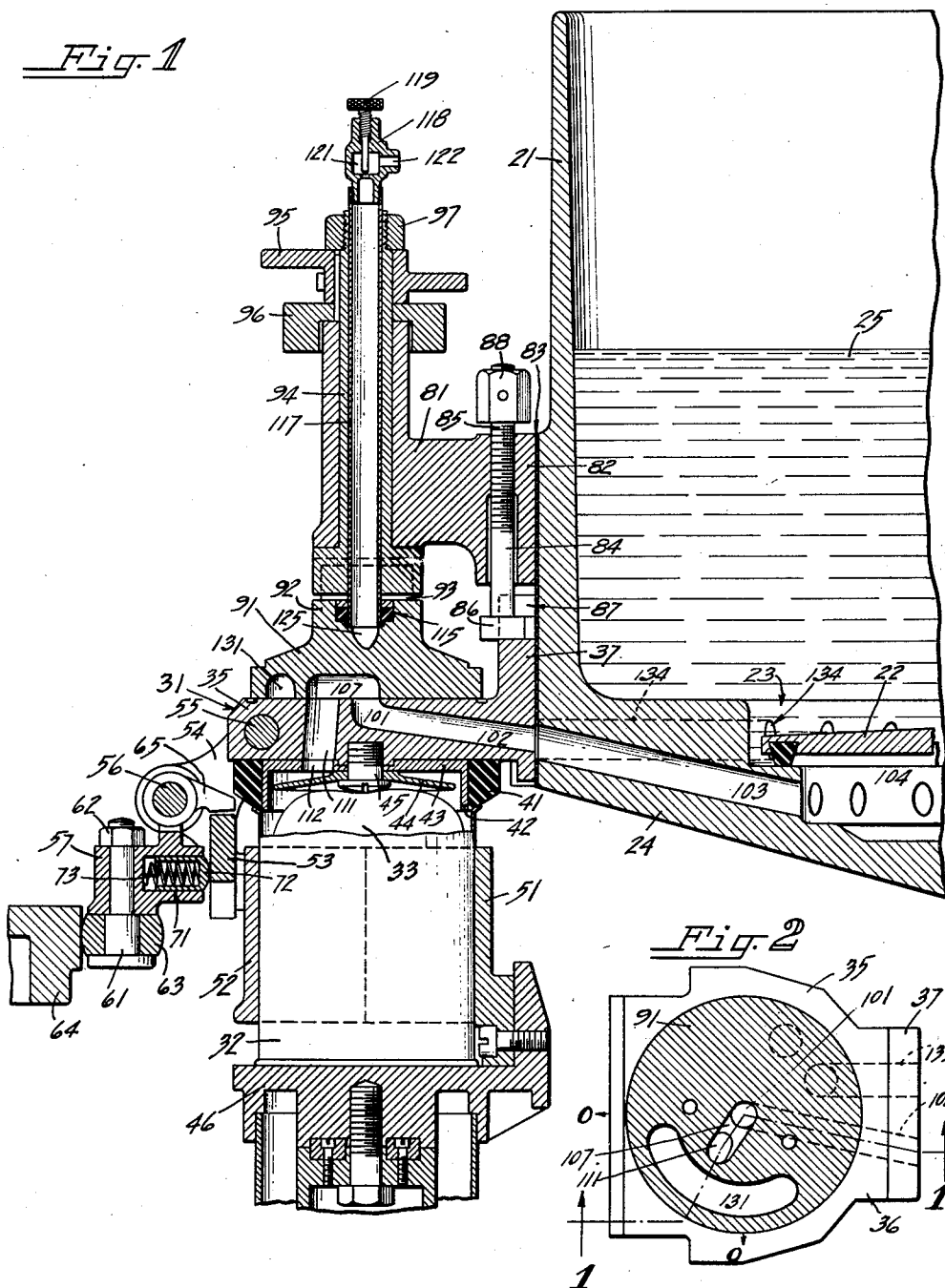
J. D. LE FRANK

1,998,462

ART OF LIQUID FILLING

Filed July 3, 1933

2 Sheets-Sheet 1



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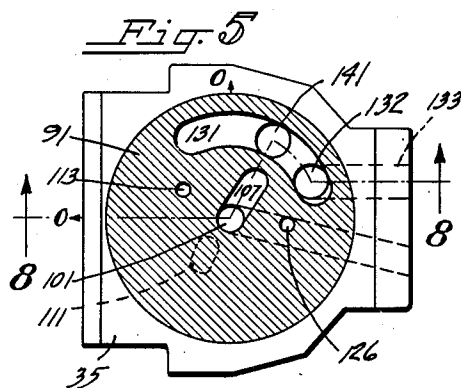
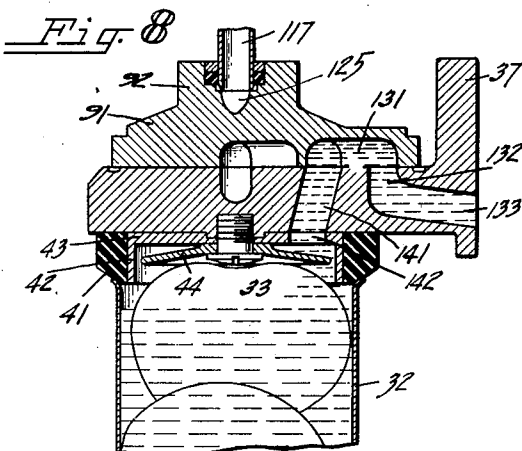
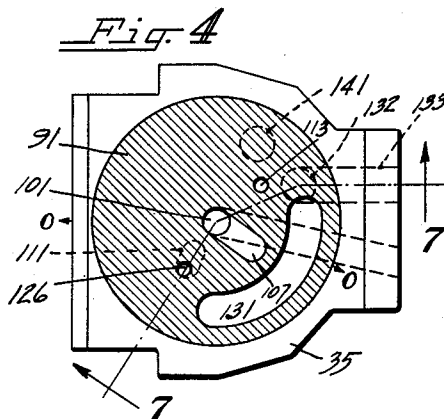
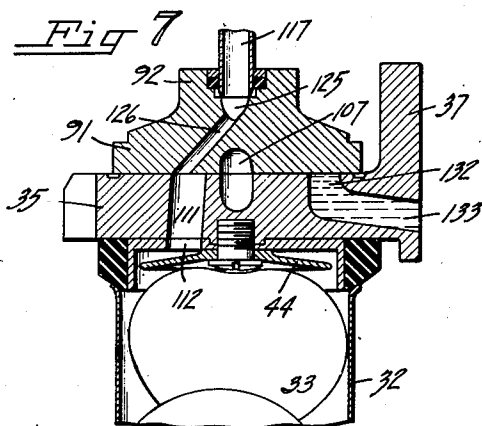
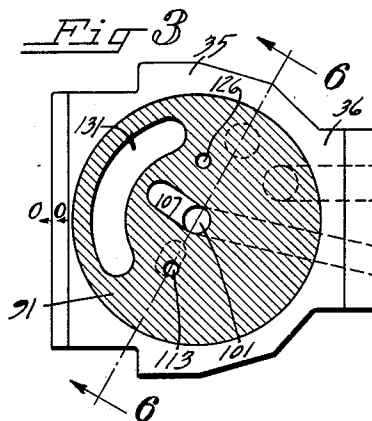
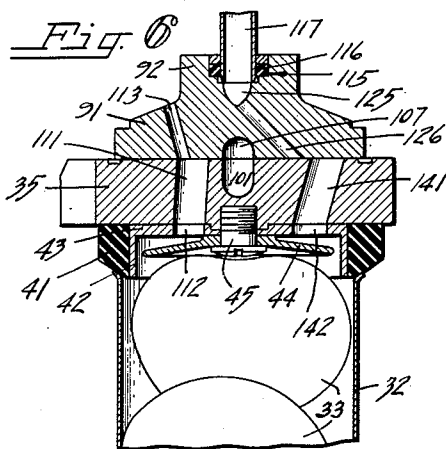
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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ART OF LIQUID FILLING

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Application July 3, 1933, Serial No. 678,960

11 Claims. (Cl. 226—116)

The present invention relates to the art of liquid filling and has particular reference to filling liquid into tin cans or the like by means of vacuum so that the height of fill within the can is accurately controlled by control of the degree of vacuum.

The invention contemplates the vacuumizing of the interior of a can at a substantially high degree of vacuum and thence introducing given quantities of atmospheric air into the vacuumized space so that the degree of vacuum is reduced to a point where the proper head space will result in the can after filling, to the end that the height of fill is easily controlled and easily varied without the necessity of changing vacuum pumps or other vacuum producing means for the original withdrawal of air from the can.

An important object of the invention is the provision of a method and such parts of an apparatus as will create in a simple manner, a definite vacuumized condition within a can which when subjected to the flow of a liquid will produce a liquid fill in the can to a predetermined height.

The invention also contemplates a ready and exact adjustment of the amount of air introduced into a vacuumized can so that an adjusted degree of fill within limits may be easily obtained.

One simple form of apparatus contemplated for effecting the desired results requires merely the operation of a valve to present a clamped or held open mouth can successively to several operations wherein the air is first substantially removed from the can interior, then the degree of vacuum in the can is reduced by admission of a predetermined amount of atmospheric air for the purpose of regulating the amount of liquid which will be drawn into the vacuumized interior at the next or filling step, the result of these operations effecting a fill while leaving a definite head space in the can, the amount of air introduced at the second step giving such control.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a sectional view of a part of an apparatus embodying a filling head, a valve unit and clamping devices for holding a can sealed against atmosphere while vacuumizing and filling, the filling head and valve positions shown being a sectional disclosure as viewed along the broken line 1—1 in Fig. 2;

Figs. 2, 3, 4 and 5 are plan sectional views taken through the valve unit and illustrating different valve settings; and

Figs. 6, 7 and 8 are schematic transverse sectional views of the valve showing a part of the can being taken respectively along the section lines 6—6, 7—7 and 8—8 in the respective plan views 3, 4 and 5.

It is the present purpose to illustrate only sufficient of an apparatus to give a clear understanding of the features of the present invention and to this end the drawings disclose a portion of a vacuum filling head which may be a part of a more elaborate machine.

Such a disclosure embodies a liquid tank 21 (Fig. 1) which is closed at its bottom by a plate 22 located in a depression 23 formed in the bottom 24 of the tank. This tank is adapted to contain a filling liquid 25 which is to be put into the can. A filling head unit 31 is secured to the outer wall of the tank 21 and is supported thereby, this unit being adapted to receive a can 32 which in most cases will partially contain a solid content 33 such as tomatoes or the like and which is to be filled with the liquid 25.

The filling head unit 31 comprises a body 35 (Figs. 1 and 2) which is formed with a reduced neck 36 merging into a vertically extending right angled foot 37 by means of which it is adjustably secured to and carried on the outside wall of the tank 21. Each foot part 37 may be clamped to the side wall of the tank in any suitable manner.

The unit body 35 carries a rubber ring 41 which is vulcanized or otherwise secured on the outside of a holding ring 42. The holding ring is formed with a top plate 43 which rests against the under surface of the body 35. A toppler 44 is located on the under side of this plate 43 and the ring 42 and toppler 44 are held in fixed position on the body 35 by a screw 45.

The rubber ring 41 may be formed with an inclined lower edge which is adapted to be engaged by the upper open end of the can 32 when the latter is raised into position on a can support unit 46. The resiliency of the ring cooperates with the support to effect a tight seal between the head and the open end of the can which when clamped against the rubber ring is in position for vacuumizing and filling. The can support unit 46 may be raised in any suitable manner to effect the clamping function.

It is contemplated that a high vacuum will usually be first drawn or, in other words, the air will be removed substantially from the in-

terior of the clamped can 32 prior to filling and in order to prevent collapse or distortion of the can wall by the excessive atmospheric pressure on the outside can, encircling and protecting instrumentalities are provided.

These clamp against the wall of the can and by preventing their movement during the vacuumizing operation prevent distortion or collapse. For this purpose a fixed jaw 51 (Fig. 1) is secured to the can support unit 46 and is carried up with the can and the unit. The inner wall of this jaw corresponds in size and curvature with the exterior wall of the can body 32 and is substantially a half cylinder so that a substantial section of the can body is engaged by the jaw.

A movable jaw 52 is provided for encircling the opposite half portion of the can wall. The jaw 52 is secured to a holding member 53 which is provided with spaced arms 54 which are pivotally mounted on a pin 55 carried in the body part 35. The movable jaw can be hinged on the pin 55 through practically 135° of movement and a cam, or more accurately, two cams control such movement.

In one position the movable jaw 52 is raised so that the can 32 may be properly inserted on the lifting device 46 and in the other position (Fig. 1) the movable jaw is held in can wall protecting position where it cooperates with the fixed jaw 51, the two jaws encircling the can body during its vacuumization and filling.

The arms 54 provide bearings for a horizontal pin 56 which carries a cam roller plate 57. The cam roller plate carries a shouldered and headed stud 61 which is held by a locknut 62. The stud 61 provides a rotatable support for a cam roller 63 which rides against a cam track 64 when the movable jaw 52 is in the position illustrated in Fig. 1. The roller 63 also cooperates with another cam when swinging and holding the jaw 52 away from the can.

The horizontal pin 56 rocking in its bearings allows for sliding movement between the frame part 53 and the cam roller mounting 57 and provides for a yielding clamping action of the movable jaw 52 on the wall of the can as it is held in the filling head. When in this clamping position stop lugs 65 do not touch the jaw frame 53 and have no mission but do so engage the frame to limit movement of the plate 57 on the frame when the jaw 52 is lifted. The stop lugs are formed as integral parts of the mounting 57.

The frame part 57 is provided with a bore 71 in which a spring barrel 72 is slidably mounted. A spring 73 located in the spring barrel normally tends to push the latter outwardly against the jaw 52 to hold the cam roller 63 against the can 32 and this provides the yielding connection previously referred to. With the can 32 securely clamped within the filling head 31 and its upper edge engaging the rubber 41 the can is ready for the first or vacuumizing step.

To control this vacuumizing step and also succeeding steps in the filling of the can, a valve unit is utilized which cooperates with the filling head. The valve unit is carried in a bracket 81 provided with a foot 82 located in a vertical groove 83 formed in the tank wall 21 directly above the filling head body foot 37.

Provision is made for a fine adjustment of the vertical position of the valve position and a vertical adjusting bolt 84 is located within the foot 82 of the bracket 81 for this purpose. This bolt is threadedly connected at 85 with the bracket 81 and is formed with a head 86 which rests in a

slot 87 formed in the filling head body foot. The upper end of the bolt 84 extends above the bracket 81 and carries a nut 88 which is pinned on the bolt. This nut provides means for turning the bolt to raise and lower the bracket into the desired position. After the bracket has been properly located it is secured to the tank wall 21 in any suitable manner.

Each bracket 81 supports the actuation or control for a rotary valve 91 which is located above the filling head body 35. The valve 91 is formed with a smooth bottom surface which engages a similar upper surface of the body member and these surfaces are closely fitted that they provide an air tight and liquid tight joint which is maintained during rotation of the valve to effect the various filling operations.

The valve 91 has a stem 92 which connects in a slot and tongue joint 93 to the lower end of a vertically extending sleeve 94. This sleeve is rotatably mounted in the bracket 81 and extends upwardly to a point above the bracket. The upper end of the sleeve carries an operating spider 95 by means of which it is actuated to rotate the valve 91 through substantially 90° at each operation. A spacer block 96 is also mounted on the sleeve 94 below the spider 95 and the locknut 97 threadedly engaging the upper threaded end of the sleeve, holds the parts together as a unit and in rotatable position within the bracket 81.

Each filling head body 31 (Figs. 1 and 2) is formed with a vertical passageway 101 which connects with an inclined passageway 102. This latter opening communicates with an inclined passageway 103 formed in the bottom 24 of the tank 21. The opposite end of the passageway 103 terminates in the side wall of a chamber 104 which is located in the bottom of the tank below the bottom plate 22. This chamber 104 is suitably connected at all times with a source of vacuum such as a vacuum pump or vacuum tank and any air introduced into the chamber 104 is immediately withdrawn.

Other passages are also formed in the filling head body 35 as well as in the valve 91 and it is the mission of the latter to connect certain of these body passageways. Different positions of the valve provide for the proper selection of such of these connections as are desired to produce a given result as will now be explained.

An oblong chamber 107 is formed in the lower part of the valve 91 and one end of this opening is at the center of the valve and is therefore at all times in communication with the upper end of the passageway 101. It is accordingly exhausted of air at all times. When the can 32 is first raised into the filling head the valve and body are in the relative position as shown in Figs. 3 and 6 the passageway 101 being the only connection at such time with the chamber 107. At the same time the interior of the can is open to atmosphere by means of passages in both valve and filling head body.

The filling head body 35 is cut through with a nearly vertical passageway 111, the lower end of which registers with an opening 112 cut through the top 43 of the ring 42 and this opens into the space within the ring and at the top part of the clamped can 32. The upper end of the passageway 111 registers at this time with an inclined port 113 formed in the valve 91 and it is by means of these openings 113, 111, 112 that the upper open end of the can is in communication with the atmosphere.

Both the head body 35 and the valve 91 in the plan views (Figs. 2 to 5, inclusive) are marked with arrows o which indicate a definite point on each and by referring to the different views and to the relative positions of the head and valve arrows, the angular valve position may be easily noted. The valve movement takes place in a counter-clockwise direction. The neutral valve position with the parts under atmosphere which has just been described and which is indicated in Fig. 3 is shown by the two arrows o being in alignment with and adjacent to each other.

At the first valve movement following the clamping of a can 32 between the lifting support 46 and the filling head, the valve turns through 90° of travel and the position of the parts after such movement is indicated in Fig. 2 where it will be observed that the two arrows o are 90° separate. This valve position gives the vacuumizing step of the apparatus and at such time the interior of the can is in communication with the vacuum chamber 104.

It will also be observed that the chamber 107 (Figs. 1 and 2) now joins the passageways 101, 111 and air is accordingly withdrawn from the interior of the can through the openings 112, 111, 107, 101, 102, 103 and the chamber 104. Since the chamber 104 is at all times on vacuum which is preferably a high degree of vacuum the interior of the can is correspondingly brought into the highly vacuumized state.

The second movement of the valve is through a further 90° of turn or from the position of Figs. 1 and 2 through or past the valve positions of Figs. 4 and 7. This is a fly position which means that the valve does not stop there but moves on to its stop position, the arrows o in Fig. 4 indicating that the valve has not quite reached its full 90° of turn.

The relation of the parts shown is utilized for the introduction of a given quantity of atmospheric air into the interior of the highly vacuumized can. The short time in which connection is made for this purpose between the atmosphere and the interior of the can is purposely provided to limit the amount of atmospheric air passing into the can. This passage of air into the can and the purpose of the operation will now be described.

The stem 92 of the valve 91 is provided with a counter bore 115 (Figs. 1 and 6) in which a packing gland 116 is disposed to provide an air tight seat for the lower end of a tube 117 which is located inside of the sleeve 94. This tube is inserted from above and its lower end where it passes into the valve stem is inserted in the packing gland 116, this construction permitting free rotation of the valve relative to the tube but preventing lateral movement.

A needle valve 118 is threadedly engaged in the upper end of the tube 117, this being at a point above the locknut 97 of the sleeve 94. This valve is provided with a thumb screw 119 which controls a valve opening 121 formed in the valve body and which leads into the interior of the tube 117. A lateral port 122 is formed in the body of the valve 118 and is open to atmosphere, the air passing from this port through the controlled valve port 121 and thence into the interior of the tube 117.

A chamber 125 is formed in the stem 92 of the valve 91 at the base of the tube and as the valve passes the position of Figs. 4 and 7 an inclined port 126 connects the chamber 125 with the passageway 111, the upper end of the port 126 be-

ing at all times in communication with the chamber 125. Atmosphere passes through the tube 117 but its amount is controlled by the needle valve 118. It expands and fills the interior of the vacuumized can.

The opening 121 in the needle valve 118 is closely adjusted to control to an extremely delicate point the amount of air which will pass into the tube 117 and into the interior of the vacuumized can during the time the lower end of the port 126 is in register with the passageway 111. In this way an exact predetermined amount of atmospheric air is introduced into the vacuumized interior of the can. Sufficient air is thus brought into the space within the can and this air supply is cut off at the right time by the continued movement of the valve.

The valve at its stop position cuts off registration between the port 126 and passageway 111 and locks any further inflow of air into the can. During the stop position or when the valve 91 is on its second period of rest this air which has been introduced into the can has ample time to equalize and completely fills the interior of the can as an expanded or rarefied atmosphere. The degree of rarefaction is accurately figured in accordance with the height of liquid fill desired in the can.

While the valve is at rest on its second stop position, one end of a chamber 131 formed in the valve 91 is in communication with a vertical section 132 of a passageway 133 formed in the filling head body 35. This chamber (Fig. 4) is formed with arcuate side walls and rounded ends and the forward end of the chamber is just coming into communication with the passageway 132 as the valve passes its fly position of Fig. 4.

The passageway 133 in the body 35 is at all times in communication with a passageway 134 formed in the bottom 24 of the tank 21 and the inner end of this passageway is open to the liquid 25 in the tank. The passageways 132, 133 and 134 are at all times filled with liquid as long as there is any liquid in the tank and as soon as the chamber 131 comes into communication with the upper end of the passageway 132 the liquid flows into and fills the chamber 131. It is not until the next or third valve movement, however, that this chamber 131 has any other connection than with the passageway 132.

The third quadrant of movement of the valve 91 positions the parts for filling, this being disclosed in Figs. 5 and 8. At such time the chamber 131 passes over and communicates with the upper end of a slightly inclined passageway 141 formed in the head body 35. As soon as this takes place the liquid within the chamber 131 flows through the passageway 141 and through a communicating opening 142 cut in the top wall 43 of the ring 42 and on into the interior of the can. This filling is very rapid since a substantial vacuum is in the can and atmosphere is at all times pressing down on the surface of the liquid in the tank.

It will be recalled that a given quantity of air at atmospheric pressure was introduced through the needle valve 118 and through the pipe 117 into the can at a previous period and this air is locked in the interior of the can during the filling operation. As the liquid passes into the can from the tank such air is compressed in the upper part of the can and in the filling head above the surface of the liquid flowing into the can.

This space above the liquid is constantly reduced as more liquid passes into the can interior and there comes a time when the resulting compression of air again equals atmospheric pressure or a little in excess of it to also overcome the hydrostatic head of the higher level in the tank. When such a point of compression is reached a balance takes place and the flow of liquid ceases.

10 The height to which the liquid rises in the can depends entirely upon the amount of air trapped in the can as determined by the amount of atmospheric air which is introduced into the interior of the can through the needle valve 118.

15 Each can therefore passing through the machine with a given setting of the needle valve is evenly filled.

By changing the setting 119 of the needle valve more or less air is introduced into the can and a greater or lesser degree of vacuum is provided. This directly affects the head space eventually resulting in the can as it is filled and by means of such adjustment any desired height of fill of the liquid within the can is obtained. Thus it

25 will be apparent that the vacuumizing energy need not be disturbed to adjust for the fill of liquid and the same vacuum pump installation is used for all fills. A high vacuum is naturally more desirable as this first vacuumization feature

30 must be sufficient to cover or include the highest vacuum (highest fill) desired.

On the fourth movement of the valve 91 the parts are shifted from the position indicated in Figs. 5 and 8 back to the positions of Figs. 3

35 and 6 and in the latter position air flows into the top of the filled can. It is then free to be removed, all of the steps of filling having been completed at such time.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the steps of the process described and their order of accomplishment without departing from the spirit

45 and scope of the invention or sacrificing all of its material advantages, the process hereinbefore described being merely a preferred embodiment thereof.

I claim:

50 1. The method of liquid filling cans to a predetermined height which comprises, vacuumizing the interior of the can, introducing a small quantity of atmospheric air into the vacuumized can to reduce the degree of vacuum to a desired

55 amount in accordance with the amount of fill desired, and thence flowing liquid into the can to the height permitted by the vacuumized condition of the can.

2. The method of liquid filling cans to a predetermined height which comprises, vacuumizing the interior of the can to a vacuum higher than required for the amount of liquid fill desired, introducing a predetermined quantity of atmospheric air into the highly vacuumized can

65 to reduce the degree of vacuum to the exact amount of vacuum required for the desired fill, and thence flowing liquid into the can to the desired height as determined by the degree of vacuum.

3. The method of liquid filling cans to a predetermined height which comprises, vacuumizing the interior of the can to a relatively high vacuum, introducing a predetermined quantity of atmospheric air into the highly vacuumized

75 can to reduce the degree of vacuum, the exact

amount of air so introduced being equal to that required for the desired head space for the filled can, and thence causing the liquid to flow into the can until stopped by the air in said head space.

4. The method of liquid filling cans to a predetermined height which comprises, vacuumizing the interior of the can to a relatively high vacuum, holding the can in this vacuumized condition to stabilize its interior, introducing a predetermined quantity of atmospheric air into the highly vacuumized can and permitting its diffusion into said interior to reduce the degree of vacuum and to provide a head space atmosphere, and thence introducing liquid under gravity flow into the can so that its rarefied atmosphere is constantly changed, the air being compressed as the can is filling, this air forming a head space above the liquid and when compressed to a sufficient degree to offset the force of gravity flow of the liquid preventing further filling of the can.

5. The method of liquid filling cans to a predetermined height which comprises, sealing the open end of a can with an air-tight joint, vacuumizing the interior of the can to a higher vacuum than required for the filling while maintaining said seal, introducing a predetermined quantity of atmospheric air into the vacuumized can and permitting its diffusion into said interior while still sealed to reduce the degree of vacuum and provide a definite head space atmosphere for the can, and thence introducing liquid under a gravity flow into the can without breaking said seal so that the can is filled with its head space atmosphere above the liquid.

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6. The method of liquid filling cans to a predetermined height which comprises, clamping the can by protecting walls to prevent its collapse during vacuumizing, vacuumizing the interior of the can with a relatively high vacuum while so protected and clamped, introducing a predetermined quantity of atmospheric air into the highly vacuumized can and permitting its diffusion into said interior to reduce the degree of vacuum and to provide a head space atmosphere, and thence introducing liquid under a gravity flow into the can so that the rarefied atmosphere therein is constantly compressed as the can is filled until such compression is sufficient to offset the force of flow of the liquid into the can.

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7. A vacuum filling machine for cans, comprising in combination, a filling head adapted to hold a can to be filled, means operating through said head for vacuumizing the interior of said held can, means for introducing a definite quantity of atmospheric air into said vacuumized can to alter its degree of vacuum, and means for filling said can with liquid to a predetermined level in accordance with its degree of vacuum.

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8. A vacuum filling machine for filling cans with a liquid, comprising in combination, a filling head adapted to hold a can to be filled, clamping jaws for protecting the can wall against collapse, means operating through said head for vacuumizing the interior of said held can to a relatively high degree of vacuum, means for introducing a definite quantity of atmospheric air into said vacuumized can to reduce its degree of vacuum in amount required for the desired amount of fill, and means for filling said can with liquid to the predetermined level as determined by its degree of vacuum.

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9. A vacuum filling machine for cans, comprising

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ing in combination, a liquid supply tank, a filling head mounted adjacent said tank and adapted to hold a can to be filled, and a combination valve unit associated with said head for establishing communication when in one position between the interior of the held can and a source of vacuum, in a second position between said can interior and a quantity of atmospheric air, and in a third position between the interior of said can and the interior of the said supply tank whereby the said can is filled with liquid to a predetermined height.

10. A vacuum filling machine for cans, comprising in combination, a liquid supply tank containing a liquid open to atmosphere, a filling head mounted adjacent said tank and adapted to hold a can to be filled, and a combination valve unit associated with said head for establishing communication when in one position between the interior of the held can and a source of vacuum to vacuumize the can interior to a relatively high degree of vacuum, in a second position between

said can and atmospheric air for a definite time to receive a predetermined quantity of air into the can, and in a third position between said can and the interior of the said supply tank whereby the former is filled with liquid to a predetermined height.

11. A vacuum filling machine for cans, comprising in combination, a filling head adapted to hold a can to be filled, means operating through said head for vacuumizing the interior of said held can, means for holding said vacuumized can in its vacuumized condition, means for introducing atmospheric air into said vacuumized can to alter its degree of vacuum, means for filling said can with liquid, and means for altering the amount of atmospheric air introduced to adjust for a definite head space in the can being filled so that the liquid flowing therein will fill the can to a predetermined height of level.

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