March 6, 1951 M. W. LOVELAND 2,543,788

FILLING HEAD HAVING AIR LOCKED CHAMBER FOR FILLING LIQUIDS INTO CONTAINERS

Filed Nov. 30, 1948

2 Sheets-Sheet 1

Fig. 1

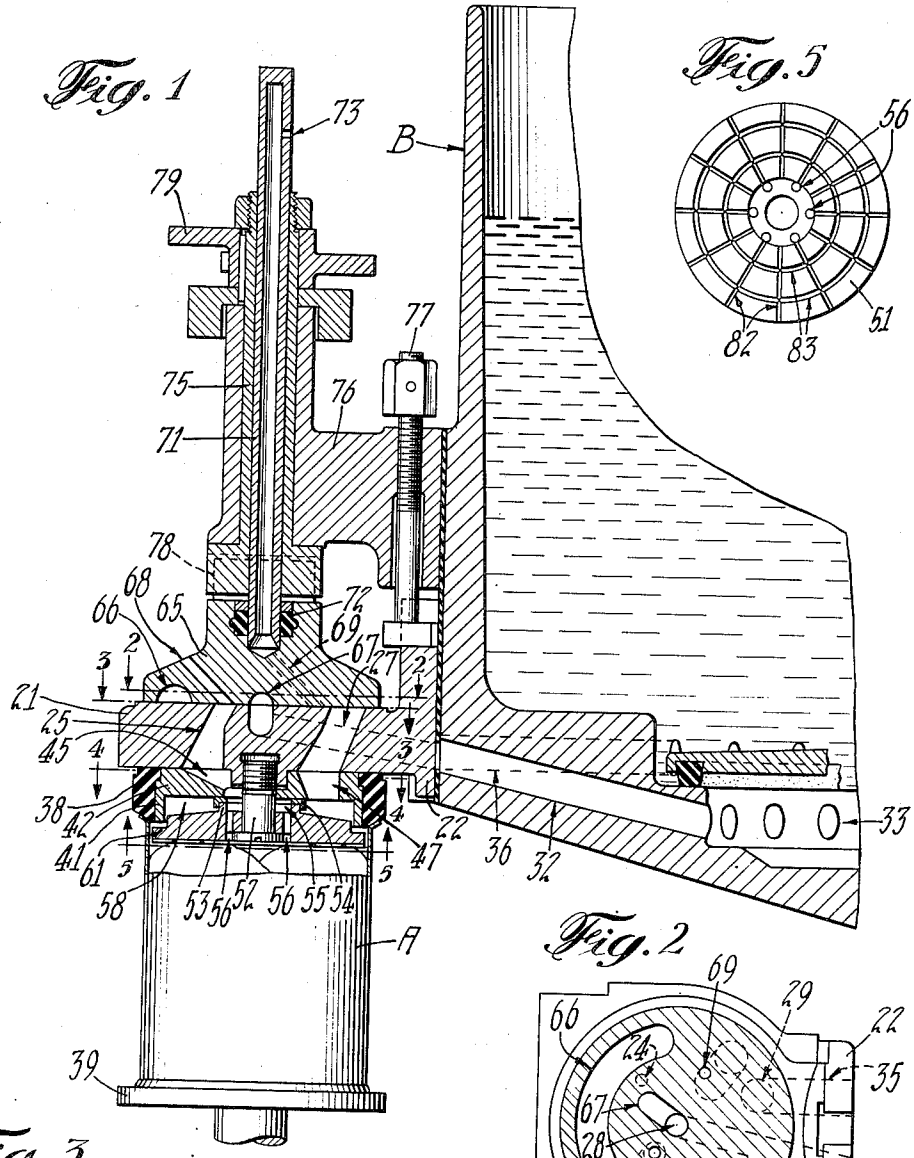


Fig. 5

Fig. 2

Fig. 3

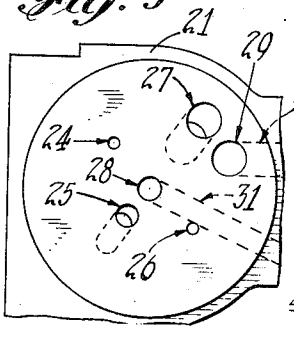
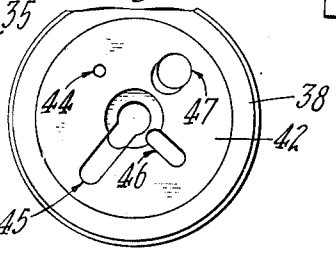


Fig. 4



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FILLING HEAD HAVING AIR LOCKED CHAMBER FOR FILLING LIQUIDS INTO CONTAINERS

Filed Nov. 30, 1948 2 Sheets-Sheet 2

Fig. 10

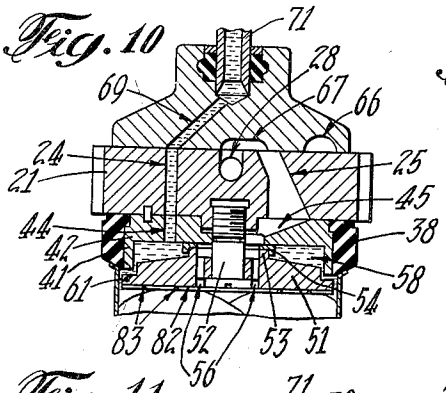


Fig. 11

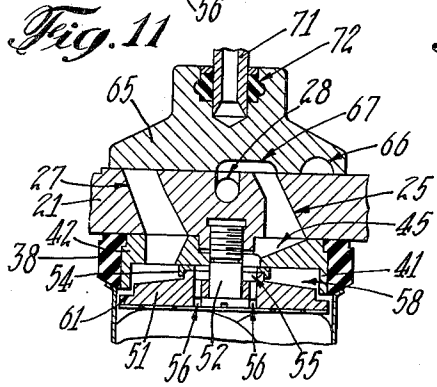


Fig. 12

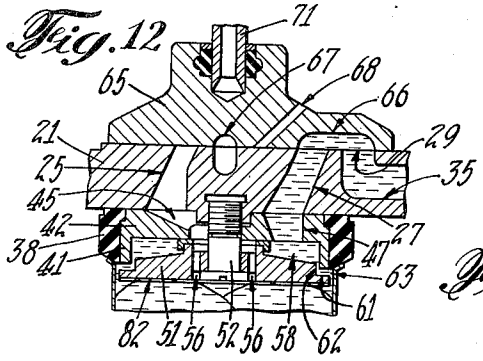


Fig. 13

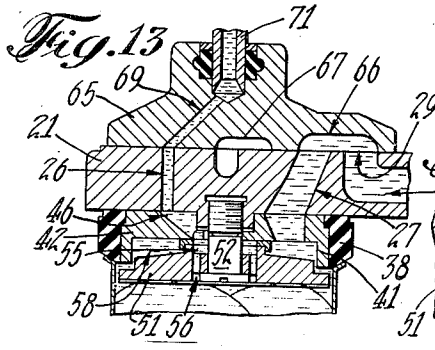


Fig. 6

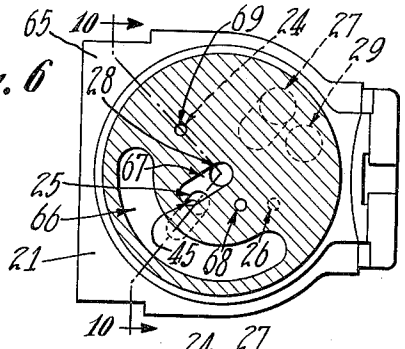


Fig. 7

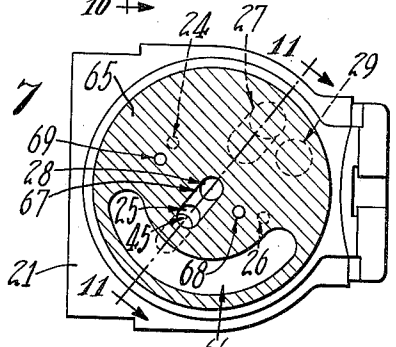


Fig. 8

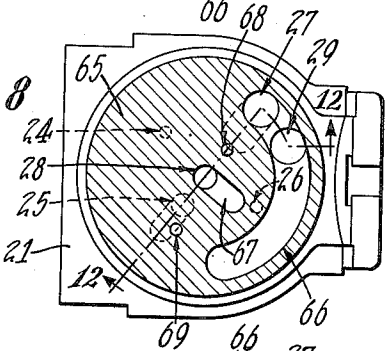


Fig. 9

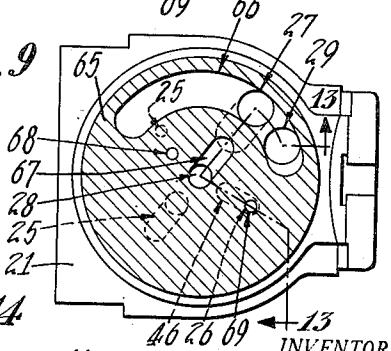
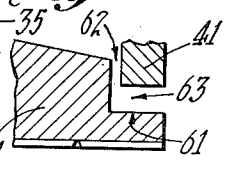


Fig. 14



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UNITED STATES PATENT OFFICE

2,543,788

FILLING HEAD HAVING AIR LOCKED CHAMBER FOR FILLING LIQUIDS INTO CONTAINERS

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Application November 30, 1948, Serial No. 62,654

5 Claims. (Cl. 226—116)

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The present invention relates to an apparatus for filling liquids into cans or containers and has particular reference to a filling head for accurately controlling the height of fill within the cans regardless of variations in the voids between and in any solids which may be in the cans prior to filling with the liquid.

It has been found that in packing some kinds of products, such as food products which require syruping or the like, by present methods of packing, there sometimes is a wide variation in the final vacuum retained in the cans after sealing. In these methods of packing, the air within the can and within the product if possible is displaced before the syrup or other liquid is filled into the can.

With this air displacement system, head spaces produced within the cans are constant only when the volume of the voids between the particles of the product is constant. Head spaces in the filled cans vary directly as the variation in the volume of the voids in the can, thus causing the head spaces to vary outside the desired minimum and maximum range. It is this head space variation that causes the wide variation in final can vacuums as mentioned above.

The instant invention contemplates overcoming this difficulty by the provision of a displacement type filling head having restricted passageways forming capillary tubes which permit of filling a can and a portion of the head with liquid to insure accuracy of fill and which retains that volume of liquid which remans in the head to prevent its return to the can when the latter is removed from the head.

An object of the invention is the provision in an apparatus for filling liquids into cans or containers, of a displacement type filling head wherein the head spaces produced in the cans may be maintained at a predetermined constant, regardless of variations in the voids between the particles of any solid product which may be in the cans prior to filling with liquid.

Another object is the provision of such a filling head wherein any liquid that remains in the head as an incident to accurately filling a can is air locked and is thus prevented from flowing back into the can or from dripping when the filled can is removed from the head for subsequent operations.

Another object is the provision of such a filling head which is easily cleaned while retaining the features of the overflow liquid air lock, so that the head may be maintained free of any contamination that would affect the liquid filled into the cans.

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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 portion of an apparatus including a filling head embodying the instant invention, the view showing a can in place for filling, with parts of the apparatus and the can broken away;

Figs. 2, 3, 4 and 5 are sectional views taken substantially along the respective lines 2—2, 3—3, 4—4, 5—5 in Fig. 1;

Figs. 6, 7, 8 and 9 are sectional views similar to Fig. 2 and showing different positions of a rotatable valve member of the filling head;

Figs. 10, 11, 12 and 13 are schematic transverse sectional views of the lower portion of the filling head and the upper portion of the can being filled, the views being taken substantially along the lines 10—10, 11—11, 12—12, 13—13 in Figs. 6, 7, 8, 9 respectively, with parts broken away; and

Fig. 14 is an enlarged sectional detail of a portion of the filling head.

As a preferred and exemplary embodiment of the invention the drawings illustrate a solid displacement type filling head used for vacuumizing a can A (Fig. 1) and then filling it with a liquid received from a reservoir or tank B. The filling head may form a part of a more elaborate machine such as the machine disclosed in United States Patent 2,124,581 issued July 26, 1938 to R. Luthi on Can Filling Machine. As shown in Fig. 1 of the drawings the cans A to be operated upon preferably contain solid matter such as fruits or vegetables and are to receive a liquid such as syrup or brine which is to fill the spaces in the cans to a predetermined level so as to provide for a definite head space, although the invention is equally well adapted to filling liquids into cans without solid matter in them.

The filling head comprises a flat horizontally disposed body member 21 (Figs. 1, 2 and 3) which at one end is formed with a vertical support pad 22 adjustably secured to and carried on the outside wall of the tank B near its bottom. The support pad 22 may be clamped to the tank in any suitable manner. The body member 21 is formed with a plurality of ports arranged as shown in Fig. 3. These ports include a blow out port 24, a vent-vacuum port 25, a displacement port 26, and a filling port 27 which extend entirely through the body member.

The body member 21 is also formed with a

vacuum port 28 and a liquid port 29 which are formed in the upper face of the member. The vacuum port 28 communicates with a vacuum bore 31 formed in the body member and connecting with an auxiliary vacuum bore 32 formed in the bottom of the liquid tank B. The inner end of the auxiliary vacuum bore 32 communicates with a vacuum chamber 33 formed in the bottom of the liquid tank B. This chamber is maintained in a vacuumized condition in any suitable manner, such for example, as that shown in the above mentioned Luthi patent.

In a similar manner, the liquid port 29 communicates with a liquid bore 35 (see Figs. 2, 12 and 13) formed in the body member 21 and connecting with an auxiliary liquid bore 36 (Fig. 1) formed in the bottom of the liquid tank B. The inner end of this auxiliary liquid bore 36 communicates with the interior of the liquid tank.

The lower face of the body member 21 carries a depending resilient annular sealing ring 38 preferably made of rubber. This sealing ring preferably is formed with a beveled lower edge which is engaged by the flange surrounding the upper open end of a can A when the latter is raised into filling position against the head, on a can support unit 39. The support unit may be operated in any suitable manner, such as that disclosed in the Luthi patent above mentioned. The resiliency of the ring co-operates with the support unit in effecting a tight seal between the head and the open end of the can for efficient vacuumizing and filling of the can.

The sealing ring 38 preferably is secured to the outer peripheral face of a depending annular flange 41 of a stationary holding plate 42 which is secured to the lower face of the body member 21. This holding plate 42 is formed with a plurality of ports arranged as shown in Fig. 4 and which include a blow out port 44, a vent-vacuum port 45, a vent tube port 46, and a filling port 47. These ports extend entirely through the plate, some at an angle (see Fig. 1), and register or align respectively with the blow out port 24, the vent-vacuum port 25, the vent tube port 26, and the filling port 27 formed in the body member 21.

Below the holding plate 42, the body member 21 carries a displacement disc 51 (Figs. 1 and 5) which extends down into the top open end of a can A clamped against the sealing ring 38 and displaces a predetermined volume of liquid during the filling operation to control the head space desired in the can after filling. This displacement disc also serves as a topper and in this capacity pushes any solid matter down below the upper edge of the can as the latter is lifted into filling position. A screw 52 extends up through the middle of the disc 51 and the holding plate 42 and is threadedly engaged in the body member 21 and thus secures these parts to the body member and holds them stationary.

The displacement disc 51 is an important element in the instant invention. It is formed with an annular vertically projecting ring or bead 53 which surrounds the holding screw 52 in spaced relation thereto and which seats against a head space adjusting washer 54 interposed between the bead 53 and the holding plate 42. The bead 53 and the washer 54 set off or define a recess 55 (Fig. 1) in the top of the displacement disc and surrounding the holding screw 52. This recess 55 communicates with the vent-vacuum port 45 and the vent tube port 46 in the holding plate 42 and by way of a plurality of apertures 56 formed in the displacement disc and arranged in a circle around the screw 52, communicates with the interior of the can A clamped against the head. All other ports in the holding plate 42 are maintained out of communication with the recess 55. This is for the purpose of vacuumizing the can as will be hereinafter explained.

The bead 53 of the displacement disc 51 and its washer 54 also separate the displacement disc vertically from the holding plate and thereby form between the disc and the plate an annular liquid chamber 58 (Fig. 1) which surrounds the recess 55. This chamber communicates only with the atmosphere or blow out port 44 and the filling port 47 in the holding plate 42 and is entirely out of communication with all the other ports in the plate. This is for the purpose of filling the liquid into the can through the liquid chamber.

For this same purpose, the diameter of the displacement disc is slightly smaller than the inside diameter of the can to be filled so that a filling space exists between the periphery of the disc and the wall of the can as best shown in Fig. 1. This outer periphery of the disc is formed with an annular step or shoulder 61 (see Fig. 14) which provides adjacent the lower end of the plate flange 41, a restricted annular and vertical outlet passageway 62 having a capillary action on the liquid passing between the disc and the inner face of the flange 41. The step 61 also provides a continuing larger free flowing passageway 63 between the disc and the lower face or edge of the flange 41. These passageways are for the purpose of admitting liquid into the can and to prevent dripping when the liquid is cut off as will be hereinafter explained.

Control of the vacuumizing and filling of the can through the ports and passageways above mentioned is effected by a rotatable valve 65 (Figs. 1 and 2) which rests on the upper face of the body member 21. The body member contacting face of the valve 65 is formed with an elongated curved filling channel 66, a short straight vacuumizing channel 67, an atmosphere port 68, and a vent tube port 69 arranged as shown in Fig. 2. The vacuumizing channel 67 is in continuous communication with the vacuum port 28 in the body member 21. The atmosphere port 68 extends through the valve as shown in Fig. 1 and its outer end is constantly open to the outside atmosphere. The vent tube port 69 extends through the valve and leads to and is in communication with the lower end of a vertically disposed vent tube 71 which is secured to the valve in a stuffing box 72 formed therein. This vent tube forms an axis for the valve. At its upper end the tube is open to the outside atmosphere by way of a vent port 73.

Rotation of the valve 65 is effected through a sleeve 75 (Fig. 1) which surrounds the vent tube 71 and which is carried in a bearing bracket 76 bolted to the outside of the liquid tank B in a position above the body member support pad 22. An adjusting screw 77 threadedly carried in the bearing bracket 76 and connecting with the pad 22 is utilized in vertically adjusting the body member 21 as hereinbefore mentioned.

The lower end of the sleeve 75 is connected to the valve 65 preferably with a conventional tongue and groove connection 78 (Fig. 1) to facilitate removal of the valve for cleaning. The upper end of the sleeve carries a star wheel 79 which is keyed to the sleeve and which is rotated intermittently through partial or step-by-step rotations as disclosed in the above mentioned Luthi

patent, to rotate the valve 65 through a cycle of predetermined positions for aligning the ports and channels of the valve with those of the body member to effect the vacuumizing and the filling of the can as will now be explained.

The zero or initial position of the valve 65 in respect to the body member 21 is that shown in Fig. 1 where all of the ports in the body member 21 are closed by the valve except the atmosphere port 25 which is in register with the atmosphere port 68 in the valve. Alignment of the two ports permits of free passage of air through the apertures 56 and recess 55 in the displacement disc 51, atmosphere port 45 in the holding plate 42, atmosphere port 25 in the body member 21 and the atmosphere port 68 in the valve, when the can is initially clamped against the filling head. This free passageway for the air prevents compression of the air in the can during the clamping operation.

With the can in fully clamped position against the head, it is ready for vacuumizing. For this vacuumizing step, the valve 65 is partially rotated into the position shown in Figs. 7 and 11. In this position of the valve the atmosphere port 68 in the valve is out of register with the vent-vacuum port 25 and the interior of the can A is thus closed or sealed off from the outside atmosphere. In this same position of the valve, its vacuum channel 67 is in communication with the vent-vacuum port 25 and the vacuum port 28 in the body member 21. Thus communication is established between the interior of the can A and the vacuum chamber 33 in the bottom of the tank B, by way of the apertures 56 and recess 55 in the displacement disc 51, the vent-vacuum port 45 in the holding plate 42, the vent-vacuum port 25 in the body member 21, the vacuum channel 67 in the valve 65, the vacuum port 28 and vacuum bore 31 in the body member 21, and the auxiliary vacuum bore 32 which leads to the vacuum chamber 33. Through these ports, channels, and bores, the interior of the can A is vacuumized to a predetermined degree.

As soon as the can A has been vacuumized the valve 65 is again partially rotated through its second or liquid filling step of rotation into the position shown in Figs. 8 and 12. In this position of the valve its vacuum channel 67 is out of register with the vent-vacuum port 25 and hence the vacuum from the vacuum chamber 33 is cut off from the interior of the can. However, in this position of the valve its filling channel 66 is in register with the filling port 27 and the liquid port 29 in the body member 21. Hence liquid from the tank B flows into the can A through the auxiliary liquid bore 36 in the tank, the liquid bore 35 and the liquid port 29 in the body member 21, the filling channel 66 in the valve 65, the filling port 27 in the body member 21, the filling port 47 in the holding plate 42, and the liquid chamber 58 adjacent the displacement disc 51. The pressure differential between the liquid in the tank B and the vacuum in the container forces the liquid through the restricted passageway 62 and out through the passageway 63 against the adjacent inside surface of the side wall of the can along which it flow gently to the bottom of the can. As this liquid fills the can, the vacuum becomes dissipated and any air that remains in the can due to the imperfect vacuum initially created therein, collects at the top of the liquid below the displacement disc 51.

In order to remove this remaining air, the valve 65 is again indexed or partially rotated through its third step of rotation to a "level-off" position shown in Figs. 9 and 13. In this position of the valve its filling channel 66 remains in communication with the filling port 27 and the liquid port 29 in the body member 21, the filling channel 66 being of sufficient length to maintain this communication during the third step of rotation of the valve so as to continue the liquid filling operation without interruption. The turning of the valve into this third position does bring its vent tube port 69 into register with the vent tube port 26 in the body member 21.

Hence the rising liquid being filled into the can forces the air remaining in the can upwardly through the apertures 56 and recess 55 in the displacement disc 51, through the vent tube port 46 in the holding plate 42, the vent tube port 26 in the body member 21, and the vent tube port 69 in the valve 65 into the vent tube 71. The liquid rises with the air into all of these ports and into the vent tube 71 until it reaches the level of the liquid in the tank B. The air escapes from the port 73 in the upper end of the tube. In this manner all of the air that was originally in the can is completely expelled and its place is taken by the liquid, the liquid filling the connected ports up into the vent tube 71.

With the can A and the filling head filled with the liquid, the valve 65 is again indexed or partially rotated through a fourth step which returns it to its zero or starting position (Fig. 1) thus having been rotated through one complete cycle of rotation. This fourth step of rotation of the valve shifts its filling channel 66 out of register with the filling port 27 and liquid port 29 in the body member 21 and thereby cuts off the supply of liquid from the tank B. It also shifts the vent tube port 69 in the valve 65 out of register with the displacement port 26 in the body member 21. This locks the liquid in the can and in the head below the valve 65.

This same rotation of the valve 65 brings its atmosphere port 68 into register with the vent-vacuum port 25 in the body member 21 as shown in Fig. 1. Thus atmospheric pressure is exerted on the liquid in the can through the vent-vacuum ports 25, 45 in the respective body member 21 and the holding plate 42, and in the recess 55 and the apertures 56 in the displacement disc 51 so that the can may be lowered from the head without suction.

As the can is lowered from the head, by the lowering of the support pad 39 as disclosed in the above mentioned Luthi patent, air under atmospheric pressure entering by way of the atmosphere port 68 in the valve 65 enters the can below the displacement disc 51 and exerts its force against the passageways 62, 63 between the edge of the displacement pad and the adjacent flange 41 of the holding plate 42. Radial grooves 82 formed in the bottom of the displacement disc 51 and connecting with the apertures 56 and annular grooves 83 connecting with the radial grooves 82 as shown in Fig. 5 facilitate this movement of the air.

Thus the liquid within the liquid chamber 58 is air locked within the chamber and this permits the can to leave the filling head with a clean sweep without any liquid dripping from the head into the can, the capillary action of the restricted passageway 62 holding the liquid in the chamber.

The displacement disc having displaced a predetermined volume of liquid during the filling operation, insures a predetermined accurate head

space in the can when the latter is fully removed from the head.

The residual liquid in the liquid chamber 58 after such a can filling operation is partially removed during the vacuumizing of the next can to be filled so as to clear the vent tube for use during this subsequent filling operation. This is effected during the first step of rotation of the valve 65, as the valve rotates from the zero or starting position as shown in Fig. 1, into the can vacuumizing position shown in Figs. 7 and 11. During this first step of rotation and just as the vacuumizing channel 67 in the valve starts to come into register with the vent-vacuum port 25 in the body member 21 as shown in Figs. 6 and 10, the vent tube port 69 in the valve momentarily comes into register with the blow out port 24 in the body member. This passing registry of these ports is of sufficient duration to effect a partial vacuumization of the can to the extent that the atmospheric pressure on the liquid in the vent tube 71 forces the liquid in the tube down through the vent tube port 69 in the valve, and through the blow out port 24 in the body member 21, into the liquid chamber 58 and further forces this liquid and part of the liquid in the chamber out through the chamber passageways 61, 62 into the can. The vent tube 71, the vent tube port 69, the blow out port 24, and a portion of the liquid chamber 58 are thus cleared of all liquid in readiness for a repeat filling operation on the can now being vacuumized. When the valve 65 comes to rest at the end of its first step of rotation as shown in Figs. 7 and 11, full vacuumization of the can takes place as hereinbefore described, the vent tube port 69 being out of register with the blow out port 24 at this time.

With such a filling head construction, all of the ports, channels, recesses, apertures, chambers, and passageways of the head are readily accessible for cleaning in the usual manner of operating the head idly while passing steam and water or other cleaning fluid through it. Thus this improved head is easily maintained. Since during the filling operation of a can, any liquid that rises in the head above the displacement disc 51 is air trapped or locked in the liquid chamber 58 by reason of the capillary action of the restricted passageway 62, there is no liquid to be returned to the can during its removal from the head. Hence the displacement disc 51 is the sole regulator of the head space in the can and insures accuracy in the establishment of this head space irrespective of variations in the voids between and in any solids which may be in the cans prior to filling the cans with the liquid.

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 form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In a filling head for filling liquids into containers, the combination of sealing means for sealing off an open end of a container to be filled, means operating through said head for partially vacuumizing the interior of said sealed off container, a liquid chamber in said head having a restricted passageway leading into said vacuumized container, means for passing a volume of liquid greater than the capacity of said container into said liquid chamber to fill the container through said restricted passageway, means in said head for venting residual air displaced from said partially vacuumized container by said entering liquid and for receiving the surplus liquid beyond the capacity of said container from said liquid chamber, and means in said head for admitting air to the top of the container after it is filled with liquid to facilitate removal of the container from said sealing means and to lock the surplus liquid in said liquid chamber against return to said filled container to maintain a predetermined level of the liquid in the container.

2. In a filling head for filling liquids into containers, the combination of sealing means for sealing off an open end of a container to be filled, means operating through said head for partially vacuumizing the interior of said sealed off container, a liquid chamber in said head having a restricted passageway to said vacuumized container, means for passing a volume of liquid greater than the capacity of said container into said liquid chamber to fill the container through said restricted passageway, means in said head for venting residual air displaced from said partially vacuumized container by said entering liquid and for receiving the surplus liquid beyond the capacity of said container from said liquid chamber, means in said head for admitting air to the top of the container and adjacent the outlet passageway of said liquid chamber after the filling of the container to facilitate removal of the container from said sealing means and to lock the surplus liquid in said liquid chamber against return to said filled container to maintain a predetermined level of the liquid in the container, and means in said head communicable with said liquid chamber during vacuumization of a subsequent container for blowing out the surplus liquid in said liquid chamber to recondition said chamber for a repeat operation.

3. In a filling head for filling liquids into containers, the combination of sealing means for sealing off an open end of a container to be filled, means operating through said head for partially vacuumizing the interior of said sealed off container, a displacement element depending from said head and extending into a container sealed against said sealing means, a liquid chamber in said head adjacent said displacement element said chamber having a restricted passageway, to said vacuumized container formed by the close proximity of a wall of said displacement element with a wall of said head, said displacement element also having a recess connecting with an aperture forming communication with the interior of a sealed off container, means for passing a volume of liquid greater than the capacity of said container into said liquid chamber to fill the container through the restricted passageway recess and aperture of the chamber, means in said head for venting residual air displaced from said partially vacuumized container by said entering liquid and for receiving the surplus liquid beyond the capacity of said container from said liquid chamber, and means in said head for admitting air to the top of the container below said displacement recess and its connecting aperture and adjacent the outlet passageway of said liquid chamber after the filling of the container to facilitate removal of the container from said sealing means and to lock the surplus liquid in said liquid chamber against return to said filled container, removal of said displacement ele-

ment maintaining a predetermined level of the liquid in the container.

4. In a filling head for filling liquids into containers, the combination of a body member having a plurality of ports therein, a holding plate secured to said body member and having a plurality of ports therein connecting with the ports in said body member, said holding plate having a depending flange thereon, a resilient sealing member adjacent said flange for sealing off a container to be filled with liquid, a displacement disc disposed adjacent said holding plate and setting off between said disc and said plate a liquid chamber having a restricted outlet passageway, said displacement disc also setting off adjacent said plate a recess separated from said chamber and communicating with a plurality of displacement apertures extending through said disc, and a rotatable valve unit seated on said body member and having channels and ports communicable with the ports in said body member, said valve in one position establishing communication through said displacement apertures between the interior of the sealed off container and a source of vacuum for partially vacuumizing said container, in a second position establishing communication between said liquid chamber and a source of liquid for passing a volume of liquid greater than the capacity of said container into the chamber to fill the container through said outlet passageway, in a third position establishing a vent opening to the atmosphere through said displacement apertures for receiving residual air displaced from said container by the entering liquid and for receiving surplus liquid, and in a fourth position establishing communication between the container and the outside atmosphere for admitting air into the container and adjacent the outlet passageway of said liquid chamber to facilitate removal of the container from the sealing member and to lock the surplus liquid in said liquid chamber against return to said filled container to maintain a predetermined head space produced in said container by said displacement disc.

5. In a filling head for filling liquids into containers, the combination of a reservoir for holding a filling liquid, a filling head secured to said reservoir, a vent tube in said filling head and extending up to a level above the liquid in said reservoir, sealing means in said head for sealing off an open end of a container to be filled, means operating through said head for partially vacuumizing the interior of said sealed off container, a liquid chamber in said head having communication with said vacuumized container, means for passing a volume of liquid into said liquid chamber sufficient to fill said container and said liquid chamber and to extend up into said vent tube to the level of liquid in said reservoir, means in said head for venting residual air displaced from said container from said liquid chamber and from said vent tube by said entering liquid, means in said head for admitting air to the top of the container after it is filled with liquid to facilitate removal of the container from said sealing means, and means for sealing off said liquid chamber to air lock the surplus liquid in the chamber and in the vent tube to prevent its return to said filled container and to maintain a predetermined level of the liquid in the container.

MALCOLM W. LOVELAND.

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