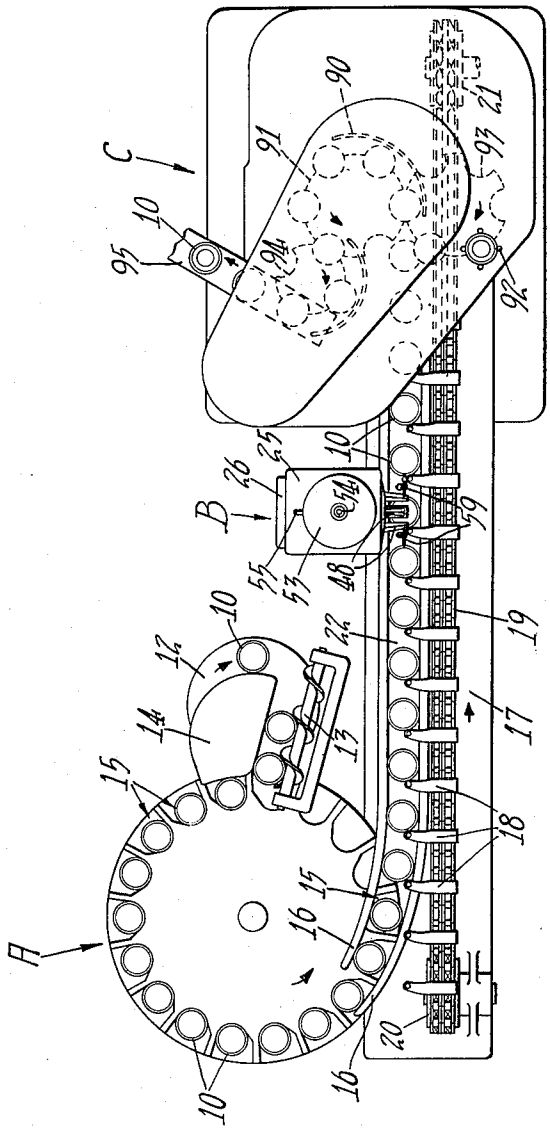
Jan. 25, 1955 S. S. JACOBS 2,700,495

METHOD OF AND APPARATUS FOR FILLING CANS TO A UNIFORM LIQUID LEVEL

Filed Feb. 9, 1950 3 Sheets-Sheet 1

Fig. 1



INVENTOR.
SAMUEL S. JACOBS
BY Charles H. Erne
Ivan D. Thornburgh
ATTORNEYS

Jan. 25, 1955 S. S. JACOBS 2,700,495

METHOD OF AND APPARATUS FOR FILLING CANS TO A UNIFORM LIQUID LEVEL

Filed Feb. 9, 1950 3 Sheets-Sheet 2

Fig. 2

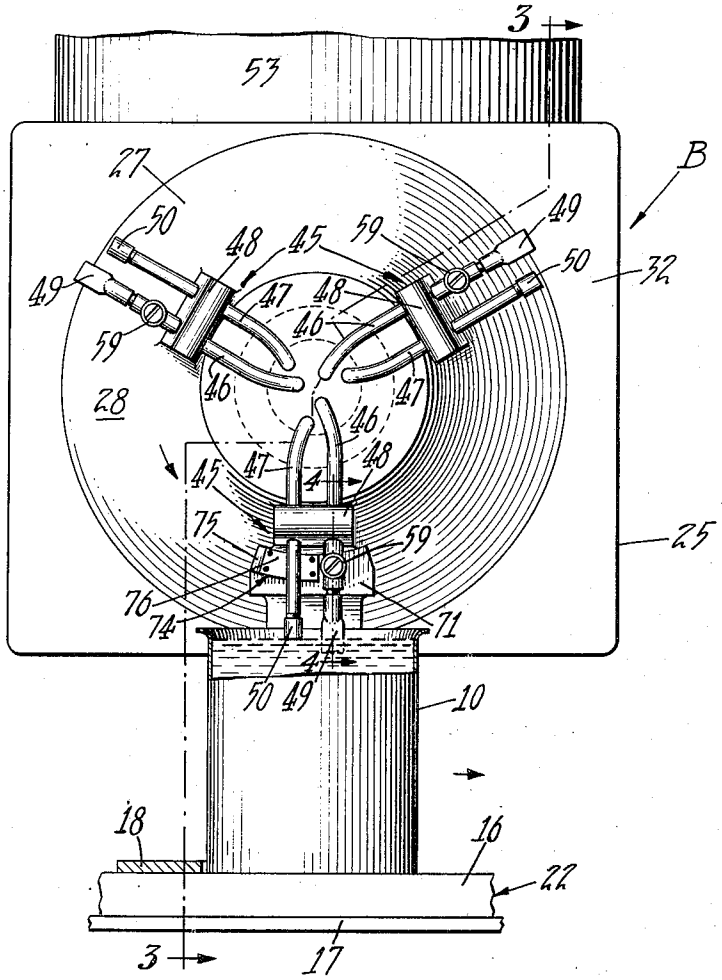


Fig. 4

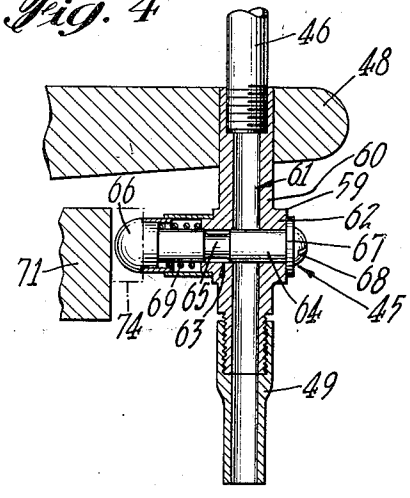
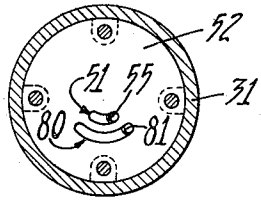


Fig. 5



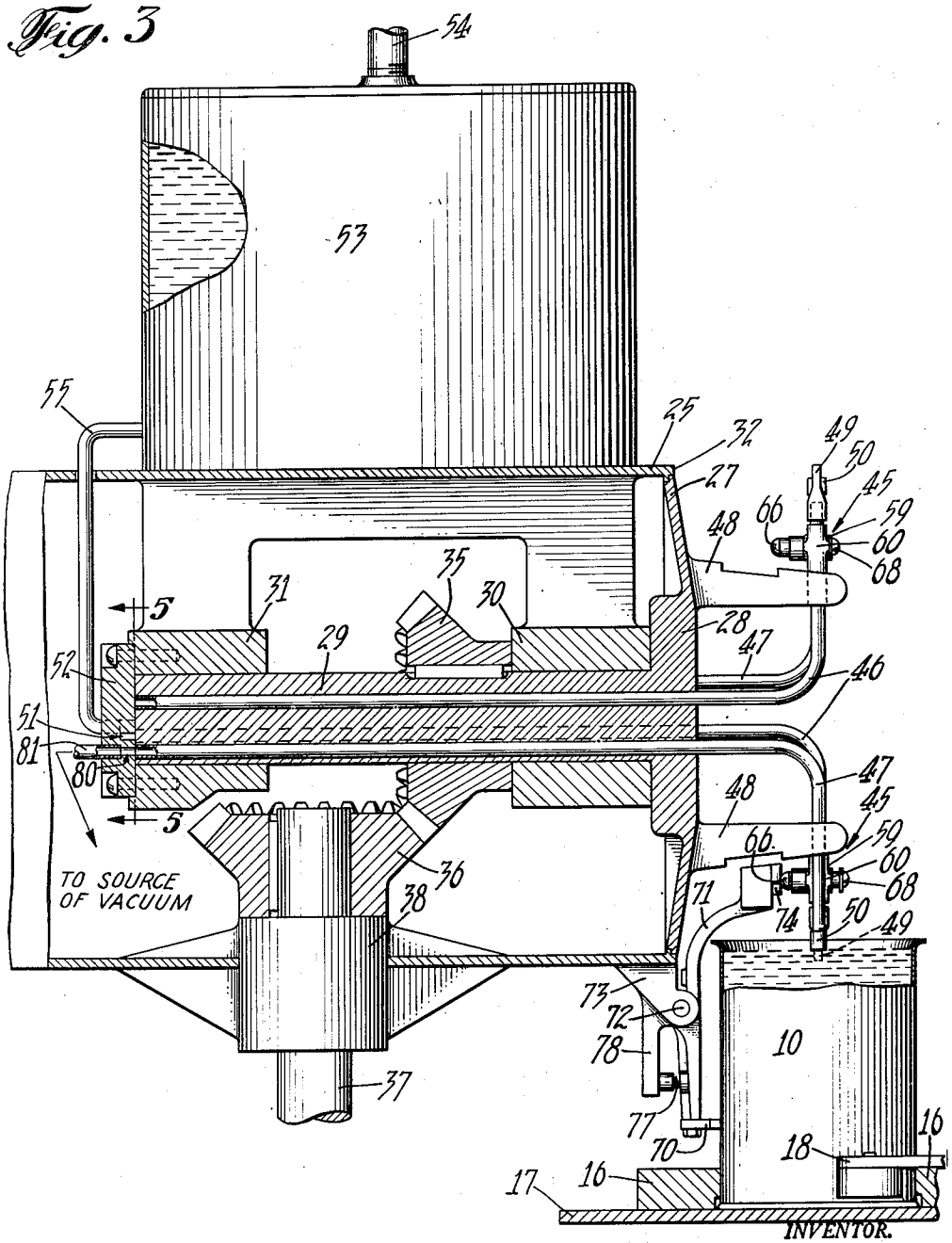
INVENTOR.
SAMUEL S. JACOBS
BY Charles H. Erne
Ivan D. Thornburgh
ATTORNEYS

Jan. 25, 1955 S. S. JACOBS 2,700,495

METHOD OF AND APPARATUS FOR FILLING CANS TO A UNIFORM LIQUID LEVEL

Filed Feb. 9, 1950 3 Sheets-Sheet 3

Fig. 3



INVENTOR.
SAMUEL S. JACOBS
BY Charles H. Erne
Ivan D. Thornburgh
ATTORNEYS

United States Patent Office

2,700,495

Patented Jan. 25, 1955

2,700,495

METHOD OF AND APPARATUS FOR FILLING CANS TO A UNIFORM LIQUID LEVEL

Samuel S. Jacobs, Forest Hills, N. Y., assignor to American Can Company, New York, N. Y., a corporation of New Jersey

Application February 9, 1950, Serial No. 143,253

8 Claims. (Cl. 226—22)

The present invention relates to a method of and apparatus for accurately filling open top cans with liquid at high-speed with a minimum of spillage, and is particularly directed to a system of filling wherein cans having initial liquid levels differing from an ultimately desired level, have their levels automatically adjusted to produce the desired level.

At the present time in commercial canning plants, automatic liquid filling machines are being run at ever-increasing speeds in order to keep up with the newest high-speed closing machines. This means that the time allocated to fill each can has been reduced and, in many cases has resulted in a nonuniformity of fill from can to can, some cans being either overfilled or underfilled due to the inherent limitations of the filling machine at the higher speeds. This variation in the fill is small and usually fluctuates within known limits above and below the norm, but it has its serious aspect in that it does produce underfilled cans, which are objectionable to the ultimate consumer and may also violate labeling regulations.

In order to eliminate underfilled cans, it is customary in many canneries to adjust the filling machines to deliver to each can an excess or over-normal amount of liquid in order to compensate for any deficiency due to inaccurate filling. This practice, in addition to being uneconomical, has a serious disadvantage in that the surplus liquid brings the liquid level too close to the top edge of the can so that some liquid frequently spills during the transfer of the can from the filling machine to the seaming head of the closing machine. This spillage of liquid onto the machines and conveyors results in corrosion of the affected parts, particularly if the spilled liquid is acidic in nature, and consequently increases the cost of maintenance.

The present invention overcomes these difficulties by providing a filling system wherein the cans may be deliberately underfilled by a primary filling machine. The cans are then transferred to a liquid level correcting or adjusting unit, preferably located adjacent the closing machine, which almost instantaneously adjusts the liquid level to the ultimately desired point. To accomplish this, the unit jets into the can a supplementary volume of liquid sufficient not only to make up the deficit but to fill the can to excess. Simultaneously with this jetting operation, the excess liquid thereby deposited within the can is removed by the unit and the desired level is produced. By treating the cans in this manner it is possible to positively eliminate underfilled cans and yet avoid the necessity of having the cans deliberately over-filled for any substantial period of time, thus avoiding spillage.

The uniformly filled cans thus obtained are ideally adapted for the steam-flow method of closing wherein steam is injected into the can headspace just prior to the application of the covers and subsequently condenses to produce a vacuum within the can. In this method of closing, uniform headspaces within the cans are essential to the production of consistently uniform vacuums.

An object of the invention is to provide a method of and apparatus for uniformly filling cans with liquid at high speeds while eliminating the spillage which is usually attendant such an operation by making it unnecessary to deliberately overfill the cans in the liquid filling machine.

Another object is to provide a liquid filling system wherein the liquid levels in inaccurately filled containers are corrected while the containers are moving at high-speed.

A further object is to provide a liquid level adjusting method and apparatus wherein nonuniformly filled cans are provided with a supplemental volume of liquid sufficient to fill them to excess to insure against underfilled cans, the excess being simultaneously removed by means of suction to produce the finally desired level.

A still further object is to provide an automatic liquid level equalizing or adjusting device which operates to raise the level of the liquid in an underfilled can and to lower the liquid level in an overfilled can.

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 illustrates a schematic plan view of a filling system embodying the principles of the present invention;

Fig. 2 is an enlarged front elevation of the liquid level adjusting device of the present invention, parts being broken away;

Fig. 3 is an enlarged section taken substantially along the line 3—3 in Fig. 2, parts being broken away;

Fig. 4 is an enlarged section taken substantially along the broken line 4—4 in Fig. 2, and

Fig. 5 is a section taken substantially along the broken line 5—5 in Fig. 3.

As a preferred or exemplary embodiment of the present invention, Fig. 1 illustrates a container filling system which includes a main primary filling machine A and a liquid level correcting, equalizing, or adjusting machine or unit B. A closing machine C receives the containers after they have been filled to the desired level by the machines A and B and seals them in the usual manner, as by double seaming.

The containers **10**, which for the purpose of illustrating the present invention are shown as metal cans of uniform dimensions, are fed into the primary filler A by a rotary feed disc **12** and a spacing worm **13**. A stationary guide plate **14** co-operates with the worm and the disc to fully seat the cans in the filler pockets **15**. The exact construction of the primary filler A is not a part of this invention, and thus is not shown in the drawings. It will suffice to say that it is preferably one of the standard commercial rotary fillers, and may be of the design illustrated in United States Patent No. 1,036,778, issued to L. A. Baker on August 27, 1912 and entitled Machine for Filling Receptacles with Liquid or United States Patent No. 1,340,185 entitled Can Filling Machine, issued to J. Schmidt, Jr. on May 18, 1920.

The cans **10**, after entering the pockets **15** are filled by the measuring units of the filler A as it rotates in the direction of the arrow (Fig. 1). These measuring units are not shown for the sake of simplicity, but it should be stated that one measuring unit is provided for and rotates with each pocket **15**.

The measuring units of the primary filler A are adjusted to slightly underfill the cans **10** to a level which although not critical, preferably ranges from 1/16 to 1/8 of an inch below the ultimately desired level. Since commercial liquid filling machines are constructed with numerous individually adjustable measuring units (the one illustrated in Fig. 1 has eighteen) and since such units have only a limited time in which to fill each can, it is difficult to have a perfectly uniform fill in each can **10**. Hence the liquid levels in the cans fluctuate upwardly from a minimum level which can be easily determined experimentally.

The rotation of the filler A carries the underfilled cans **10** into position between the curved ends of guide rails **16**, which remove them from the pockets **15** and deposit them onto a feed table **17** of the closing machine C. Here the cans **10** are engaged by spaced feed fingers **18** carried by a continuously moving endless chain **19** which travels around an idle sprocket **20** mounted on the feed table **17**, and a drive sprocket **21** which is mounted on the base of the closing machine C (Fig. 1), where it is driven by the closing machine drive.

As the cans **10** are propelled along a runway **22** defined by the guide rails **16**, they are presented to the liquid level

equalizing unit B which operates to bring the liquid levels within the cans to a uniform finally desired level.

The correcting unit B (Figs. 1, 2, 3) comprises a stationary main frame 25 secured to a bracket 26 (Fig. 1) which may be supported either by the feed table 17 or by a floor pedestal. A rotary turret member or support 27 having a front disc 28 and a horizontal shaft 29 is carried in bearings 30, 31 which form a part of the frame 25. The front disc 28 of the turret 27 fits within a circular opening formed in a front wall 32 (Fig. 2) of the main frame 25, and is rotated in time with the moving cans 10 on the runway 22 through a bevel gear 35 secured to the shaft 29 in any suitable manner. Bevel gear 35 meshes with a second bevel gear 36, which is secured to a vertical shaft 37 carried in a bearing 38 in the frame 25. The shaft 37 may be rotated in any suitable manner, but it preferably is geared to the closing machine drive so that it is always synchronized with the endless chain 19 which is similarly driven.

Mounted on the front disc 28 of the turret are three liquid level correcting or adjusting heads 45, which are successively and individually projected into the open mouths of successive cans 10 as the cans are conveyed along the runway 22 beneath them. Each head 45 comprises a jetting tube or conduit 46 which delivers to a previously underfilled can a supplemental amount of liquid sufficient to fill it above the norm hereinbefore mentioned, and a suction tube or conduit 47 which simultaneously removes the excess liquid from the can.

The jetting tubes 46 and the suction tubes 47 are held in position on the turret disc 27 in brackets 48 and are provided with suitably shaped radially adjustable threaded nozzles or tips respectively designated as 49 and 50. These tubes are formed in the shape of an L and have their shorter forward legs disposed in a vertical plane which extends along the center line of the can runway 22, while their rearward legs are located in horizontal bores which extend the full length of the turret shaft 29.

The rotation of the turret 27 moves the heads 45 at a rotary speed which is equal to the linear speed of the cans, so there is little or no splashing as the nozzles of the tubes dip into the liquid in the cans.

As each adjusting head 45 is projected into the open mouth of a can, the rear end of the jetting tube 46 comes into registration with a port 51 formed in a stationary valve disc or plate 52 (Figs. 3 and 5) which is screwed to the rear bearing 31 of the frame 25. The jetting tube 46 is thereby brought into communication with a reservoir 53, which is mounted on the frame 25 and is kept supplied with liquid by a feed-in pipe 54. A pipe 55 connects the reservoir 53 near its bottom to the valve port 51.

Hence, the liquid in the reservoir is free to flow into the can 10 via the connecting pipe 55 and the tube 46 whenever a valve member 59 (Fig. 4) located in the tube 46, is opened. The liquid may if desired be maintained under pressure to accelerate its movement. The valve 59, which preferably is screwed onto the jetting tube and forms a forward extension thereof, also forms a part of a no-can, no-fill device, and comprises a tubular body member 60 which is provided with a longitudinal bore 61 and an enlarged portion 62 containing a cross bore 63. A valve plunger stem 64 having a reduced portion 65 operates within the bore 63. The stem 64 is provided at one end with an enlarged head 66 and at the other end with a stop washer 67 held in place by a screw 68. A coil spring 69 surrounds the stem 64 between the head 66 and the enlargement 62 and normally holds the valve in closed position (Fig. 4). A cylindrical sleeve attached to the head 66 telescopes within a similar sleeve attached to the enlargement 62 to shield the valve stem from extraneous matter.

As each can 10 is fed along the table 17 it strikes a shoe 70 (Fig. 3) and forces the shoe inwardly (to the left as viewed in Fig. 3) from its path of travel. The shoe 70 is bolted to the lower end of a lever 71 (see also Fig. 2) which is pivotally attached at 72 to a bracket 73 formed on the frame 25.

An arcuate cam 74, replaceably secured to the upper end of the lever 71, is thereby moved into position where it intercepts the head 66 of the valve stem 64. The stem 64 first engages a beveled face 75 (Fig. 2) of the cam 74 and is moved outwardly against the pressure of the spring 69 into open position with its reduced stem portion 65 in alignment with the bore 61, thus permitting the flow or injection of liquid into the can.

The duration of this flow of liquid into the can is controlled by the length of a flat face 76 on the cam 74, and can be easily varied by replacing the cam 74 with a cam of a different length. The amount of liquid thus injected is sufficient to raise the liquid level in the can to a level above the ultimately desired level.

The shoe 70 is urged into the path of travel of the cans 10 by a spring 77 which operates between a depending extension 78 of the bracket 73 and the lower end of the lever 71 to exert a counterclockwise pressure against the lever 71. The cam 74 is thus held out of the path of travel of the plunger stem 64 and the valve 59 remains closed should no can be present when a head 45 moves into jetting position.

As has just been explained, each can 10 has injected into it by the adjusting unit B a volume of liquid greater than the volume of the deficit resulting from its initial underfilling. This provides a safety factor to insure that no cans, even those with the lowest liquid level, will remain underfilled. However, overfilled cans are also objectionable, and since the ideal situation is to have each can uniformly filled to a predetermined level, the suction tube 47 operates to produce this condition by removing the excess liquid introduced by the jetting tube 46.

The rear end of each suction tube 47 is radially offset from the rear end of its corresponding tube 46, being located farther from the center of the shaft 29, and is also angularly offset in a clockwise direction (see Figs. 2 and 3). Just prior to or simultaneously with the time the flow of liquid into the can 10 begins, the suction tube 47 registers with an arcuate port 80 (Figs. 3 and 5) in the valve plate 52. Thus, as the suction tube 47 is projected into the open can mouth by the rotation of the turret 27 it is brought into communication with a tube 81 (Fig. 3) connected to a suitable source of vacuum.

The supplemental amount of liquid delivered to the can by the jetting tube 46, which amount as hereinbefore stated is sufficient to fill the can to excess i. e. above the norm, tends to raise the liquid level in the can above the lowermost level reached by the nozzle 50 of the suction tube during its circular path of travel. This lowermost level is substantially the ultimately desired level, however, and as the suction nozzle 50 dips into the liquid, the pressure differential created by the vacuum in the tube 47 causes all the excess liquid above this level to be sucked up and wthdrawn from the can. The withdrawal of the excess liquid is thereby effected simultaneously with its delivery since the tubes 46 and 47 are closely spaced from each other, so that at no time in the adjusting cycle does the liquid level in the can build up to the level it would reach if the excess were not thus removed.

The valve stem head 66 slides off the cam face 76 just prior to the time the suction nozzle 50 reaches this lowermost level (see Fig. 2), thereby closing the valve 59 and stopping the flow of liquid and preventing the liquid level in the can from rising as the suction tube 47 is withdrawn from the can mouth. The tube 47 is open to vacuum during its withdrawal from the can for a period of time sufficient to insure that all of the withdrawn liquid is drawn past the port 80. The liquid, after passing through the port 80 is recovered by a suitable trap (not shown) in the tube 81 and may be refed into the reservoir 53.

If more time is necessary to inject the liquid into the can, the cam 74 may be replaced with a longer cam so that the liquid may be jetted even after the suction tube passes the vertical position of Fig. 2. If this is done, the final level will be somewhat above the lowermost point of the travel of the suction nozzle 50 and in order to compensate for this, the nozzle should be adjusted radially outwardly so that it projects more deeply into the mouth of the can.

It will be noted that the suction tube 47 normally removes from the can only a portion of the supplemental amount delivered to the can by the jetting tube 46. However, it may happen, either through accident or design, that a normally or even overfilled can is delivered to the correcting unit B. In order that such cans be delivered to the closing machine C with the same ultimate liquid level as the initially underfilled cans, it is necessary that the suction tube 47 remove from the can the whole supplemental volume of liquid delivered by the jetting tube 46, plus the original excess if there be any. The suc-

tion tube 47 therefore is constructed so that its liquid removing capacity considerably exceeds the liquid delivering capacity of the jetting tube 46.

Hence, it is also possible to use the correcting unit B in conjunction with a main filling machine A which is adjusted to fill cans to a normal level. Some of the cans thus filled will be normally filled, some will be underfilled and some will be overfilled, due to the limitations of the filler A. However, the liquid level in all abnormally filled cans will be corrected by the correcting unit B regardless of whether they are under or overfilled. In the case of underfilled cans, the unit B will add more liquid than it removes, and in the case of overfilled cans, the unit will remove more than it adds. With normally filled cans, of course, the equal amounts will be added and removed.

After the cans pass the correcting unit B, they are conveyed to the closing machine C which may be a standard, steam-flow or vacuum type of machine of commercial design, the exact details of which are not pertinent to the instant invention. The closing machine schematicly illustrated in Fig. 1 incorporates the principles disclosed in R. E. J. Nordquist Patents 2,447,525 and/or 2,469,401. Here the cans 10 are stripped from the conveyor by a rail 90 (Fig. 1) and delivered to a seaming turret 91 where can covers, fed from a cover magazine 92 by a feed disc 93, are double seamed to the open ends of the cans. After they have been closed, the cans are transferred to a discharge disc 94 and discharged from the machine C along a runway 95.

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 parts of the apparatus mentioned herein and in the steps and their order of accomplishment of the process described herein, without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the apparatus and process hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. The method of uniformly filling containers to a desired level, which comprises initially underfilling said containers, then delivering to each of said containers a supplemental amount of liquid more than sufficient to fill each container to the desired level while simultaneously withdrawing the excess liquid from the container at substantially said desired level and at a rate not less than said predetermined rate of delivery of the supplemental liquid, whereby the liquid at no time rises substantially above the desired level and spillage is avoided.

2. The method of uniformly filling containers, which comprises advancing containers in processional order, underfilling said containers successively to below a normal desired level, and then adding to each underfilled container at a predetermined rate a uniform supplemental amount of liquid more than sufficient to fill it to the desired level and simultaneously removing from the container all excess liquid at substantially said desired level and at a rate exceeding said predetermined rate of adding the supplemental liquid, whereby the liquid at no time rises substantially above the desired level and spillage is avoided.

3. A machine for filling containers with liquid to a desired level, comprising in combination, means for conveying a container along a predetermined path of travel, primary filling means adjacent said conveying means for underfilling said container to a level below said desired level, supplemental filling means adjacent said conveying means for delivering at a predetermined rate into said underfilled container an additional amount of liquid more than sufficient to raise the level of said underfilled container to said desired level, suction means adjacent said supplemental filling means for simultaneously removing excess liquid at substantially said desired level at a rate exceeding said predetermined rate of delivery of the additional liquid, and valve means operating in time with said conveying means for controlling the operation of said supplemental filling means and said suction means and thereby effecting the aforesaid simultaneous supplemental filling and withdrawal of liquid from the container to prevent said liquid from rising at any time substantially above said desired level during delivery of the additional liquid and thus prevent spillage from the container.

4. A machine for filling containers to a desired uniform liquid level, comprising in combination, initial filling means for underfilling containers with liquid to below a desired uniform level, jetting means for delivering at a predetermined rate to each of said underfilled containers a uniform supplemental amount of liquid more than sufficient to raise the liquid from said minimum level to said desired level, suction means adjacent said jetting means for simultaneously withdrawing from each of said containers all excess liquid at said desired level and at a rate not less than said predetermined rate of delivery of the supplemental liquid, and timing means for actuating said jetting and suction means simultaneously to prevent said liquid level from rising at any time substantially above said desired level during delivery of the supplemental liquid and thus prevent spillage from the containers.

5. A machine for filling containers to a desired uniform liquid level, comprising means for advancing containers in processional order, means for filling the advancing containers with liquid to nonuniform levels below a desired level, a rotary turret adjacent said advancing means and having a plurality of liquid level equalizing heads mounted thereon and successively insertable into the nonuniformly filled containers, each of said heads comprising a jetting conduit and a suction conduit the latter terminating in a tip insertable to substantially said desired level in an advancing container, means for supplying liquid to said jetting conduits, a valve associated with each of said jetting conduits and actuated by said containers for controlling delivery to each of said nonuniformly filled containers of a predetermined supplemental amount of liquid more than sufficient to raise the liquid to said desired level, vacuum means connected to said suction conduits for removing excess liquid from said containers through said suction conduit tips at substantially said desired level and at a rate not less than that at which the supplemental liquid is delivered to the containers, and means connecting with each of said equalizing heads and operating in time with said container advancing means for effecting simultaneous action of said liquid supplying and vacuum means through said heads on an advancing container to prevent said liquid level from rising at any time substantially above said desired level and thus prevent spillage during advancement of the containers.

6. A machine for filling containers to a desired uniform liquid level, comprising means for advancing containers along a predetermined path, means adjacent said advancing means for underfilling the containers with liquid to below the desired level, a jetting conduit adjacent said advancing means and having a nozzle directed toward the advancing underfilled containers, a liquid reservoir connected to and supplying said jetting conduit, a jetting valve in said conduit, a cam actuated by said containers when each container is aligned with said jetting nozzle for opening said valve for a predetermined period of time to deliver to the container a predetermined supplemental amount of liquid more than sufficient to raise the liquid in the container to above said desired level, a suction conduit adjacent said jetting conduit and having a suction nozzle close to said jetting nozzle, means for inserting said suction nozzle to said desired liquid level in the advancing containers, and vacuum means communicating with said suction conduit for removing liquid at said desired level from each of said containers at a rate not less than that at which the supplemental liquid is delivered to the containers to prevent the liquid level from rising at any time substantially above said desired level during delivery of said supplemental liquid and thus prevent spillage during advancement of the containers.

7. A machine for filling containers to a desired uniform liquid level, comprising means for advancing open mouthed containers in orderly procession, means for underfilling said containers with liquid to a level below the desired level, a level equalizing head rotating around a substantially horizontal axis above said containers and for a portion of its rotary path substantially following the path of said advancing container and entering the mouth of the container, said head comprising a jetting tube and a suction tube, liquid supply means communicating with said jetting tube for delivering to said containers a substantially uniform supplemental amount of liquid in excess of that required to raise the liquid level in the con-

tainers to said desired level, said suction tube having a nozzle moving in a path substantially along said desired liquid level in each container advancing thereunder, vacuum producing means communicating with said suction tube nozzle and having a capacity for withdrawing said excess liquid through said suction nozzle from said containers at least as fast as the liquid reaches said desired liquid level, and valve means connected with said equalizing head and operating in time with said container advancing means for controlling delivery of said supplemental liquid to and simultaneous withdrawal of excess liquid from an advancing container, thereby preventing said liquid from rising at any time substantially above said desired level and thus preventing spillage during advancement of the containers.

8. A machine for filling containers to a desired uniform liquid level, comprising means for advancing open mouthed containers along a predetermined path, means adjacent said advancing means for underfilling containers with liquid to below the desired level, a turret rotatable on a substantially horizontal axis above said advancing containers, a plurality of liquid level equalizing heads mounted on and movable with said turret, each of said heads comprising a jetting nozzle and a suction nozzle insertable in the open mouth of an advancing container, a stationary distributing valve disposed adjacent said turret and having an elongated liquid port and an elongated suction port formed therein, jetting and suction conduits in said turret and communicating with said jetting and suction nozzles respectively and terminating at their opposite ends adjacent said valve and alignable with the

respective liquid and suction ports therein, means for supplying liquid to said liquid port and through said liquid conduits and nozzles to the underfilled containers in quantity more than sufficient liquid for filling the containers to the desired level, vacuum means communicating with said suction port and having a capacity for withdrawing liquid through said suction nozzles and conduits at a rate greater than said predetermined rate of supplying liquid to said liquid port, and means for rotating said turret in time with said container advancing means for successively inserting said heads into the advancing containers with the suction nozzles substantially at said desired level and for aligning said conduits and ports to establish communication between the nozzles of each head and their respective ports in the distributing valve while the nozzles are inserted in an advancing container, whereby the excess liquid supplied by said jetting nozzle is withdrawn as it reaches said desired liquid level to prevent overfilling and spillage during advancement of the containers.

References Cited in the file of this patent

UNITED STATES PATENTS

962,026	Keast	June 21, 1910
989,546	Jensen	Apr. 11, 1911
1,218,315	Redd	Mar. 6, 1917
1,483,861	Heulings	Feb. 12, 1924
1,722,420	Horton	July 30, 1929
2,509,756	Berthelsen	May 30, 1950
2,546,418	Ardron et al.	Mar. 27, 1951