April 1, 1952 L. G. HUGGINS ET AL 2,591,071

APPARATUS FOR FILLING LIQUID CONTAINERS HAVING VERTICALLY ADJUSTABLE TANK AND CONSTANT LEVEL VALUES

Filed Nov. 10, 1950 3 Sheets-Sheet 1

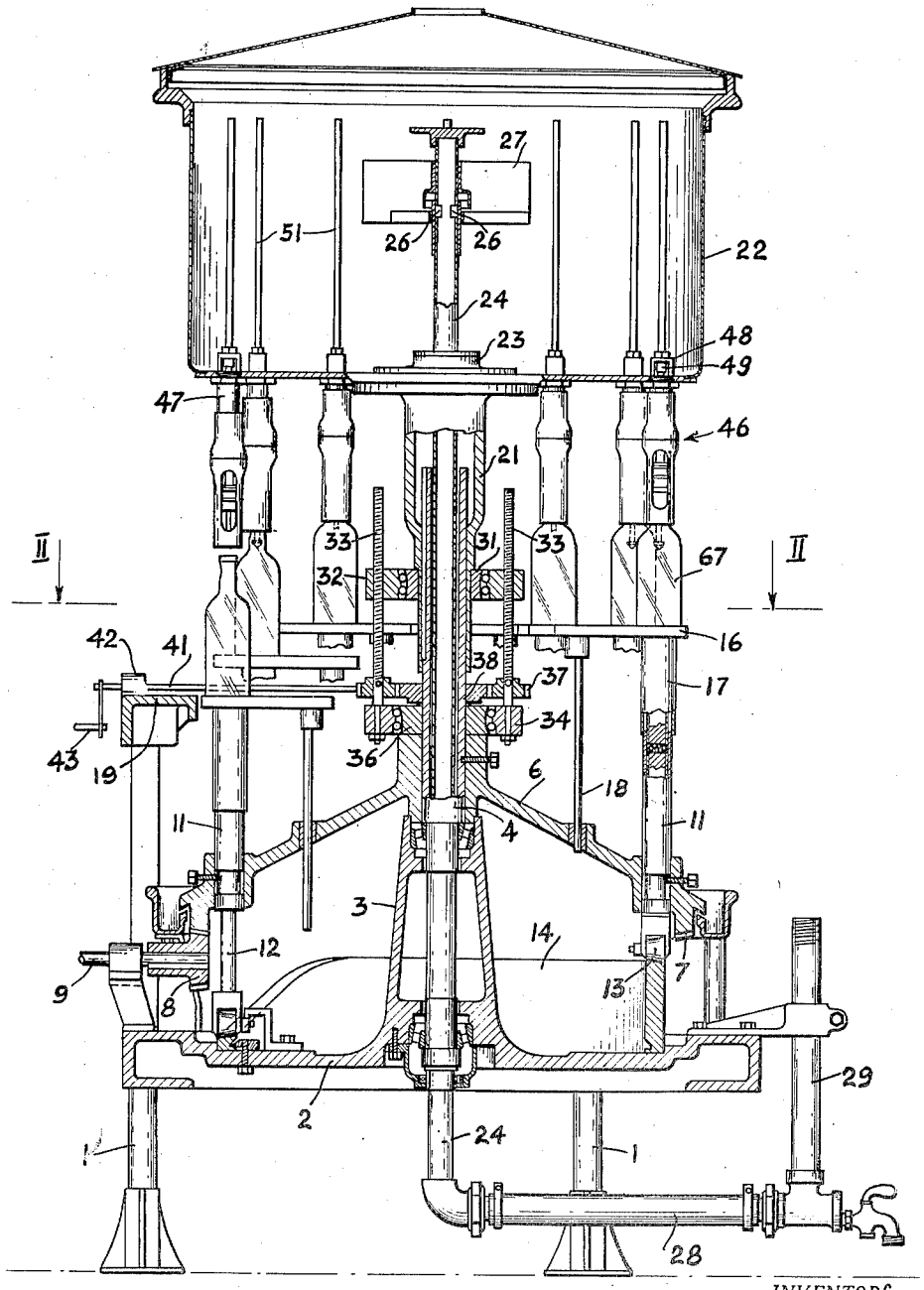

Fig. 1.

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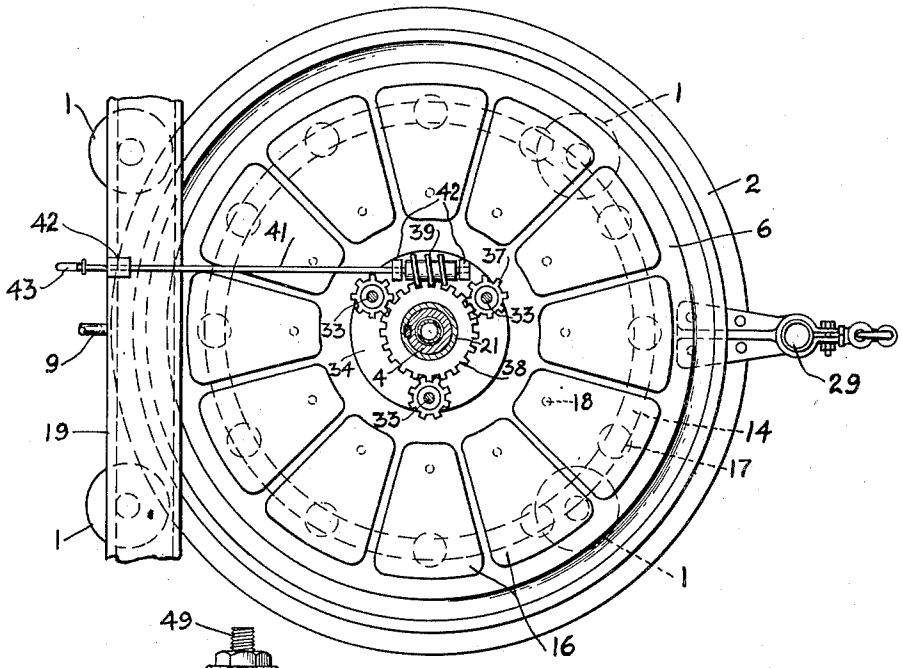

Fig. 2.

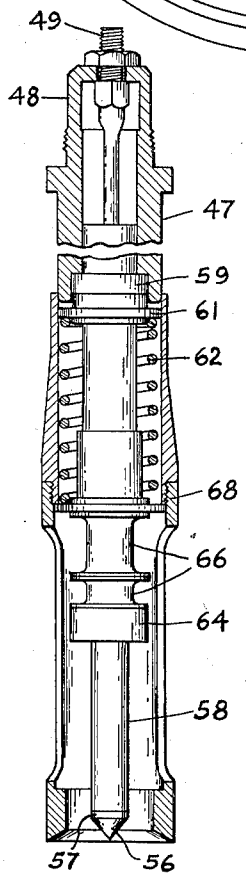

Fig. 9.

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APPARATUS FOR FILLING LIQUID CONTAINERS HAVING VERTICALLY ADJUSTABLE TANK AND CONSTANT LEVEL VALVES

Filed Nov. 10, 1950 3 Sheets-Sheet 3

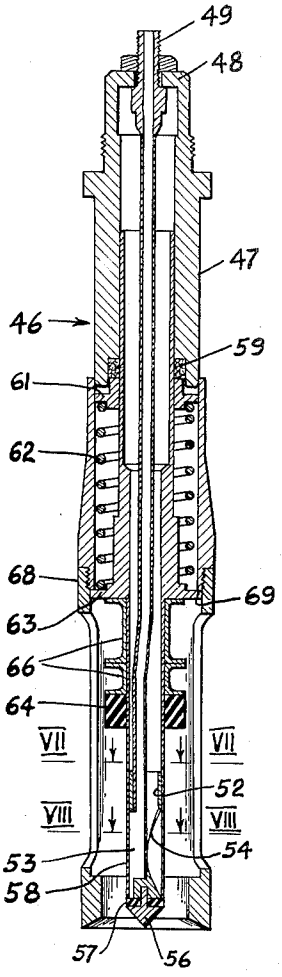

Fig. 3.

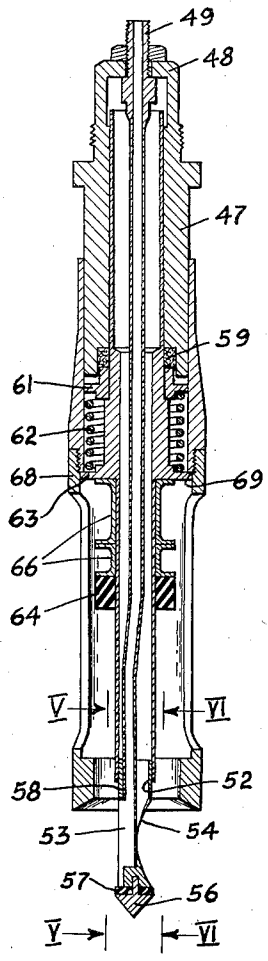

Fig. 4.

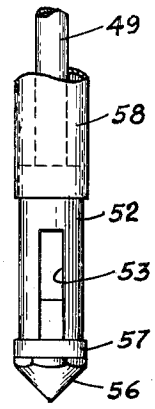

Fig. 5.

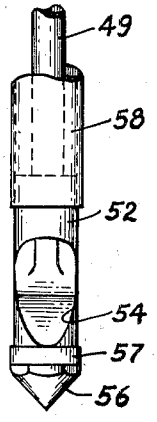

Fig. 6.

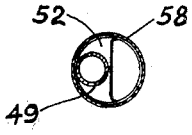

Fig. 7.

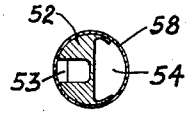

Fig. 8.

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APPARATUS FOR FILLING LIQUID CONTAINERS HAVING VERTICALLY ADJUSTABLE TANK AND CONSTANT LEVEL VALVES

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Application November 10, 1950, Serial No. 194,952

4 Claims. (Cl. 226—96)

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This invention relates to a method and apparatus for filling containers with a liquid, and more particularly to machines in which containers are periodically raised to receive and open filling valves connected to tanks above them.

In a well known type of container filling machine a continuously rotating tank is provided with downwardly extending valves which normally are closed. Empty containers are continuously carried through the machine, during which they are lifted so as to receive the valves and open them. Each valve is provided near its lower end with an outlet for liquid from the tank and with a vent port for air from the container being filled. These openings normally are closed by a sleeve which is pushed upward by the container to open them when the container pushes against a sealing washer that is mounted on the sleeve in a vertically adjustable position. In the past, containers have always been filled until the liquid reached the lower end of the valve sleeve and thereby cut off escape of air from the containers. Therefore, the liquid level in a container was determined by the distance from the top of the container down to the lower end of the sleeve of the open valve; that is, the distance between the bottom of the sealing washer and the lower end of the sleeve. As this dimension was constant for any given run of containers, any variation in their height would raise or lower the lower end of the sleeve relative to the bottoms of the containers and thereby change the height of fill. Although height variations encountered in containers is not great, in some industries, such as whiskey distilleries, a slight increase in the volume of liquid in many containers per day can add up to a big loss.

Also, when it has been desirable heretofore to vary the height of fill in a run of containers, it has been necessary to stop the machine and change the distance that each valve sleeve on the machine will project into a container. That was done by adding or subtracting spacers above the sealing washer. On a thirty-two valve machine, for example, it required a considerable amount of time to make such adjustments. When a machine was stopped for such a purpose, production not only ceased, but all workers along the production line following the machine had to remain idle while the valves were being adjusted. While the machine was stopped, the tank could be adjusted vertically relative to the container carriers, but only for the purpose of setting up the machine to receive containers of

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a different height. The distance from the tops of the containers down to the liquid level therein would remain the same as before, because the valve sleeves would extend down into the containers the same distance as previously unless changed by changing the spacers on each individual valve sleeve. There has been no way to change the filling level for all valves simultaneously and quickly, and especially without stopping the machine.

It is among the objects of this invention to provide a method and apparatus for filling containers, in which the height of fill is measured from the bottom instead of from the top of the containers, in which normal variations in container heights will not affect the liquid level therein, in which the filling level can be changed quickly and simultaneously for all valves, in which this change can be made while the machine is in motion, and in which containers of materially different heights can be accommodated without making any adjustments in the apparatus.

The preferred embodiment of the apparatus of this invention is illustrated in the accompanying drawings, in which Fig. 1 is a vertical section through my machine; Fig. 2 is a horizontal section taken on the line II—II of Fig. 1; Fig. 3 is an enlarged vertical section through one of the closed valves; Fig. 4 is a similar section through an open valve; Figs. 5 and 6 are further enlarged fragmentary side views of the lower end of the valve, showing the air vent and the liquid outlet, respectively; and Figs. 7 and 8 are horizontal sections of the valve, taken on the lines VII—VII and VIII—VIII, respectively, of Fig. 3.

Referring to Figs. 1 and 2 of the drawings, four legs 1 support a base 2 that is provided centrally with an up-standing hub 3, in which a hollow vertical shaft 4 is supported and rotatably mounted.

Directly above the hub the shaft supports a conical bonnet or carrier 6, the outer edge of which is provided with an integral ring gear 7 meshing with a pinion 8 on a horizontal drive shaft 9. The driven carrier is rotated continuously and drives the center shaft 4. This carrier is provided just inside the ring gear with a plurality of circumferentially spaced vertical openings, in each of which a sleeve 11 is rigidly mounted. Slidably mounted in each sleeve is a push rod 12 that is supported by a tapered roller 13 which travels on a circular cam track 14 mounted on the base around the hub. The low-

est part of the track is between the two front legs of the machine, the rest of the track being high. Each push rod supports a rest 16 for a container, such as a can or bottle, that is to be filled with a liquid. Fastened to the bottom of the rest is another sleeve 17 that telescopes over lower sleeve 11. The container rest is prevented from turning relative to carrier 6 by means of a slide rod 18 extending from the inner end of the rest down through an opening in the carrier. The two front legs of the machine project above the base and support a narrow table 19 at the same level as the container rests being moved by it by the carrier. As the carrier carries the rests around the center shaft 4, containers are slid from the table onto the rests at the front of the machine by well known mechanism (not shown), and then the cam track 14 raises the rests to a higher level.

Splined on the upper portion of center shaft 4 above carrier 6 is a tubular flange 21, which supports a tank 22 for the liquid with which the containers are to be filled. The bottom of the tank is horizontal and is provided with a central opening and a packing gland 23, through which a liquid supply pipe 24 extends. The upper part of the pipe in the tank is provided with outlet openings 26 which are adapted to be closed by a float valve 27, when the liquid in the tank rises to a predetermined level, slidably mounted on the pipe. The supply pipe extends out of the lower end of hollow shaft 4 and is connected by pipes 28 and 29 to a suitable source of liquid (not shown) with which the tank is kept filled.

The tank flange 21 is supported at the desired point on the center shaft by means of the inner race 31 of a bearing encircling the flange. The outer race 32 of this bearing is supported by three vertical screws 33, the lower ends of which are rotatably supported by the outer race 34 of a lower bearing. The inner race 36 of this lower bearing is supported by the top of carrier 6. A pinion 37 is rigidly mounted on each screw directly above the lower bearing, and all three pinions mesh with a worm gear 38 journaled on the center shaft. This gear can be turned by a worm 39 (Fig. 2) mounted on a horizontal shaft 41 that is rotatable in bearings 42 and projects from the front of the machine. The outer end of the shaft is provided with a crank 43 for turning it. When this crank is turned, the three screws 33 are turned and the upper bearing 31—32 is moved up or down accordingly, so that the tank will be adjusted vertically relative to the carrier 6 below it. It will be seen that, since the adjusting screws are mounted in the stationary outer bearing races, this adjustment can be made while the tank and carrier are rotating, which is a great advantage because it eliminates loss of production time.

The bottom of the tank is provided with a plurality of circumferentially spaced outlet openings, each of which is in axial alignment with one of the carrier push rods 12 below it. Extending down from each of these tank openings is a filling valve 46, one above each container rest. These valves fill the containers supported beneath them when the containers are raised by cam track 14 to open the valves. Each valve includes a nozzle 47 that is screwed into a tank outlet. The upper end of the nozzle is provided with a crosspiece 48, through which the upper end of a vent tube 49 extends. The tube is rigidly supported by the crosspiece and, in turn, supports a stand pipe 51 that extends above the liquid level in the tank. As shown in Fig. 3, vent tube 49 is of considerably smaller diameter than the inside of the nozzle, from the lower end of which it projects several inches. The lower end of the tube is surrounded by a tubular barrel 52 which is of considerably greater diameter than the tube and has an open upper end and a closed lower end. The lower portion of the tube is offset and extends down into the barrel along one side of the latter, to which it is welded. One side of the lower part of the tube is open and communicates with a vent port 53 in the adjoining side of the barrel. The vent port is substantially rectangular in shape and has a horizontal upper end, as shown in Fig. 5. The vent tube does not communicate with the inside of the barrel, which has a liquid outlet 54 (Fig. 6) in the side opposite to the vent port. The lower end of the barrel is provided with an axial opening in which a tip 56 is screwed. The tip holds against the lower end of the barrel a valve washer 57 that projects radially from the barrel a slight distance to form a valve seat.

To conduct liquid from the tank down through the nozzle and into the upper end of barrel 52, there is a sleeve 58 that has its upper end slidably mounted in the nozzle and its lower end slidably mounted on the barrel. A packing washer 59 is mounted on this sleeve inside a recess in the lower end of the nozzle, and is compressed therein by a ring 61 which is pressed against the washer by a coil spring 62 compressed between the ring and a rigid collar 63 on the sleeve. The pressure of this spring against the collar also causes the lower end of the sleeve to be pressed down against the valve seat 57 normally, whereby liquid outlet 54 and vent port 53 in the barrel are closed by the sleeve. Encircling the sleeve 58 below its collar is a sealing washer 64, which is adapted to be engaged by the top of the container that is to be filled by the valve. This washer can be spaced from the collar any desired distance by means of removable spacers 66 slidably mounted on the sleeve. It will be seen that if the sealing washer is pushed upward by means of a container engaging it from below, it will push the sleeve upward against the resistance of the coil spring and thereby uncover or open the liquid outlet and the air vent port in the barrel of the valve, as shown in Figs. 4, 5 and 6. When this machine is used for filling bottles 67, a tubular guide 68 for bottle necks is slidably mounted on each valve nozzle. The guide extends down around sealing washer 64 and barrel 52, and is provided with an internal shoulder 69 which rests on sleeve collar 63. When the neck of the bottle enters the guide and pushes the sealing washer and sleeve 58 upward, the sleeve collar carriers the bottle guide upward with it.

A feature of this invention is that for any given run of bottles through the machine the sealing washers 64 are spaced far enough from sleeve collars 63 to insure that valve sleeves 58 will be raised high enough on barrels 52 during filling to locate the lower ends of the sleeves above the upper ends of air vent ports 53, so that the ports always will be fully open. Consequently, filling of the bottles always continues until the rising liquid therein reaches the upper ends of the vent ports and cuts off escape of air from the bottles. This stops the flow of liquid into the bottles from valve outlets 54. The valve sleeve has nothing to do with determining the filling height. The upper ends of the vent ports

of all of the valves on the machine are located the same distance from the bottom of the tank; that is, they are all in the same horizontal plane, so all of the bottles are filled to the same height above their bottoms or the raised rests 16 that support them. In other words, the filling height is determined by the distance between the upper end of each vent port and the top of the elevated bottle rest below it.

By adjusting the sealing washers on the valve sleeves so that normally the lower ends of the sleeves will be about one-quarter inch above the vent ports when the valves are opened, the filling level of the bottles can be raised up to one-quarter inch by merely turning the crank 43 to raise the tank. The valves are so constructed that the filling level can be lowered at least one-quarter inch by lowering the tank in the same way. The filling level is changed in this way quickly and simultaneously for all valves without stopping the machine. A quickly adjustable filling level through a range of plus or minus one-quarter inch will take care of normal variations required in filling height as long as the same bottles are being filled with the same product. This range also will take care of normal variations in bottle height, since the bottles will merely raise or lower the sleeves slightly without affecting the filling level. A change in the distance that the valve sleeves project into the bottles generally will be necessary only when the machine is being set up for a different size bottle. It is accomplished by changing spacers 66. Such a change need be made only when, without it, the valve sleeves would not entirely uncover the vent ports, or would reach the upper limit of their travel before the bottles are fully raised.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. In a container filling machine, the combination with a continuously rotatable tank provided in its bottom with a plurality of circumferentially spaced liquid outlets, a carrier below the tank rotatable in unison with it, vertically movable container rests carried by the carrier in line with said tank outlets, and means for periodically raising each container rest a predetermined distance while said carrier is rotating, of container filling valves connected with said tank outlets and extending downward from the tank in line with the underlying container rests, each valve comprising a vertical nozzle rigidly connected to the tank, a vent tube of considerably smaller diameter than the inside of the nozzle rigidly connected to the upper end of the nozzle and extending down through it, a tubular barrel surrounding the lower end of the tube and rigidly supported by it, the barrel having a closed lower end and an inside diameter considerably greater than the tube, a valve seat secured to the lower end of the barrel and projecting radially therefrom, one side of the barrel being provided with a liquid outlet and the other side of the barrel being provided with a vent port communicating only with the lower end of the vent tube, the top of said port being located a predetermined distance from the bottom of the tank, a sleeve surrounding the vent tube and slidably mounted in the nozzle and on the barrel to conduct liquid from the tank to the upper end of the nozzle, a coil spring encircling the sleeve and normally pressing the lower end of it down onto said valve seat to close said barrel outlet and vent port, and a sealing washer mounted in a predetermined position on the sleeve and adapted to be engaged by the top of a container when the container is pushed up around the sleeve, whereby the sleeve is pushed upward to uncover said barrel outlet and vent port, said washer being so positioned on the sleeve as always to raise the lower end of the sleeve above the top of the vent port so that the filling level for containers will be determined by the location of the top of the vent port relative to the underlying raised container rest, and manually operable means for adjusting the tank vertically relative to the carrier to raise or lower the level of the tops of all of the vent ports simultaneously, whereby to change said filling level.

2. In a container filling machine, the combination with a continuously rotatable tank provided in its bottom with a plurality of circumferentially spaced liquid outlets, a carrier below the tank rotatable in unison with it, vertically movable container rests carried by the carrier in line with said tank outlets, and means for periodically raising each container rest a predetermined distance while said carrier is rotating, of container filling valves connected with said tank outlets and extending downward from the tank in line with the underlying container rests, each valve comprising a vertical nozzle rigidly connected to the tank, a vent tube of smaller diameter than the inside of the nozzle rigidly connected to the upper end of the nozzle and extending down through it, a tubular barrel surrounding the lower end of the tube and rigidly supported by it, the barrel having a closed lower end and an inside diameter greater than the tube, a valve seat secured to the lower end of the barrel and projecting radially therefrom, one side of the barrel being provided with a liquid outlet and the other side of the barrel being provided with a vent port communicating only with the lower end of the vent tube, the top of said port being located a predetermined distance from the bottom of the tank, a sleeve surrounding the vent tube and slidably mounted in the nozzle and on the barrel to conduct liquid from the tank to the upper end of the nozzle, a coil spring encircling the sleeve and normally pressing the lower end of it down onto said valve seat to close said barrel outlet and vent port, and a sealing washer mounted in a predetermined position on the sleeve and adapted to be engaged by the top of a container when the container is pushed up around the sleeve, whereby the sleeve is pushed upward to uncover said barrel outlet and vent port, said washer being so positioned on the sleeve as always to raise the lower end of the sleeve above the top of the vent port so that the filling level for containers will be determined by the location of the top of the vent port relative to the underlying raised container rest, and manually operable means for adjusting the tank vertically relative to the carrier to raise or lower the level of the tops of all of the vent ports simultaneously, whereby to change said filling level.

3. In a container filling machine, the combination with a continuously rotatable tank provided in its bottom with a plurality of circumferentially spaced liquid outlets, a carrier below the tank rotatable in unison with it, vertically

movable container rests carried by the carrier in line with said tank outlets, and means for periodically raising each container rest a predetermined distance while said carrier is rotating, of a stationary ring at the top of the carrier coaxial therewith, a plurality of vertical screws rotatably mounted at their lower ends in the ring at circumferentially spaced points, a vertically adjustable ring above the stationary ring and coaxial therewith, the upper ring being provided with threaded vertical openings receiving said screws, pinions rigidly mounted on the screws, a gear meshing with the pinions, manually operable means for turning the gear to rotate said screws so as to adjust the upper ring vertically, a bearing rotatably supported by the upper ring and supporting said tank, whereby the tank can be adjusted vertically while it is rotating, container filling valves connected with said tank outlets and extending downward from the tank in line with the underlying container rests, each valve comprising a vertical hollow member adapted to extend down into a container and provided near its lower end with an outlet for liquid from the tank and with a vent port for air from the container, the top of said port being located a predetermined distance from the bottom of the tank, a sleeve surrounding said hollow member for closing said outlet and vent port but slidable upward on said member to open them, and stop means mounted in a predetermined position on the sleeve and adapted to be engaged by the top of a container when the container is pushed up around the sleeve, whereby the sleeve is pushed upward to uncover said liquid outlet and vent port, said stop means being so positioned on the sleeve as always to raise the lower end of the sleeve above the top of the vent port so that the filling level for containers will be determined by the location of the top of the vent port relative to the underlying raised container rest.

4. In a container filling machine, the combination with a continuously rotatable carrier, vertically movable container rests carried by the carrier at circumferentially spaced points, means for periodically raising each rest a predetermined distance while the carrier is rotating, a shaft extending upward from the center of the carrier and rotatable therewith, and a tank splined on the shaft and provided in its bottom with liquid outlets in line with said rests, of a bearing encircling the lower part of said shaft and rotatable therewith, a stationary ring supported by the bearing, a plurality of vertical screws rotatably mounted at their lower ends in the ring at circumferentially spaced points, a vertically adjustable ring concentric with the shaft above the stationary ring and provided with threaded vertical openings receiving said screws, pinions rigidly mounted on the screws between said rings, a gear rotatable around said shaft and meshing with the pinions, manually operable means for turning the gear to rotate said screws so as to adjust the upper ring vertically, a bearing encircling said shaft and rotatably supported by the upper ring, said last-mentioned bearing supporting said tank, whereby the tank can be adjusted vertically while it is rotating, of container filling valves connected with said tank outlets and extending downward from the tank in line with the underlying container rests, each valve comprising a vertical hollow member adapted to extend down into a container and provided near its lower end with an outlet for liquid from the tank and with a vent port for air from the container, the top of said port being located a predetermined distance from the bottom of the tank, a sleeve surrounding said hollow member for closing said outlet and vent port but slidable upward on said member to open them, and stop means mounted in a predetermined position on the sleeve and adapted to be engaged by the top of a container when the container is pushed up around the sleeve, whereby the sleeve is pushed upward to uncover said liquid outlet and vent port, said stop means being so positioned on the sleeve as always to raise the lower end of the sleeve above the top of the vent port so that the filling level for containers will be determined by the location of the top of the vent port relative to the underlying raised container rest.

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