July 20, 1943. E. S. MINARD 2,324,795

LIQUID FILLING MACHINE

Filed Jan. 31, 1941 5 Sheets-Sheet 1

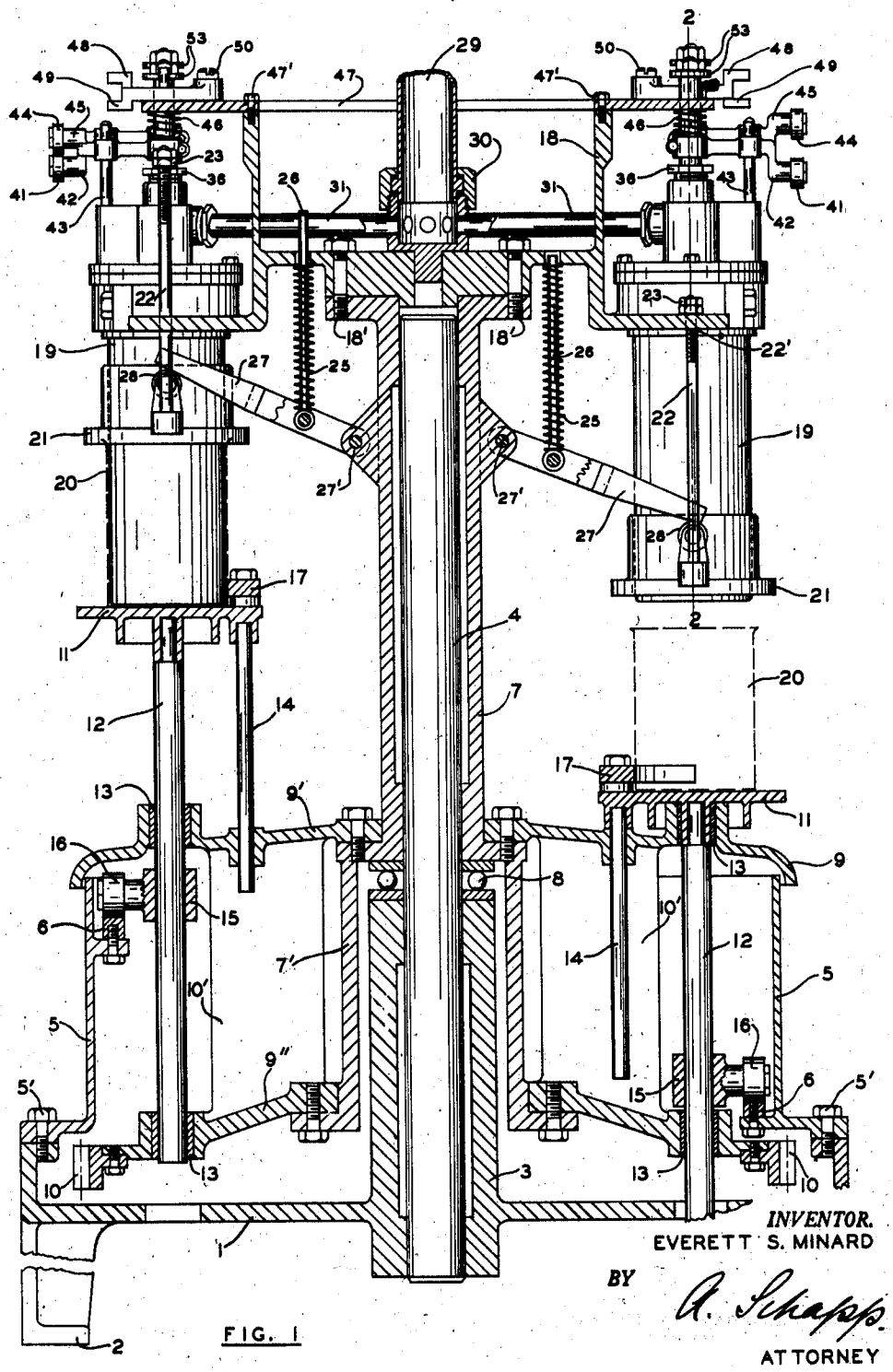


FIG. 1

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LIQUID FILLING MACHINE

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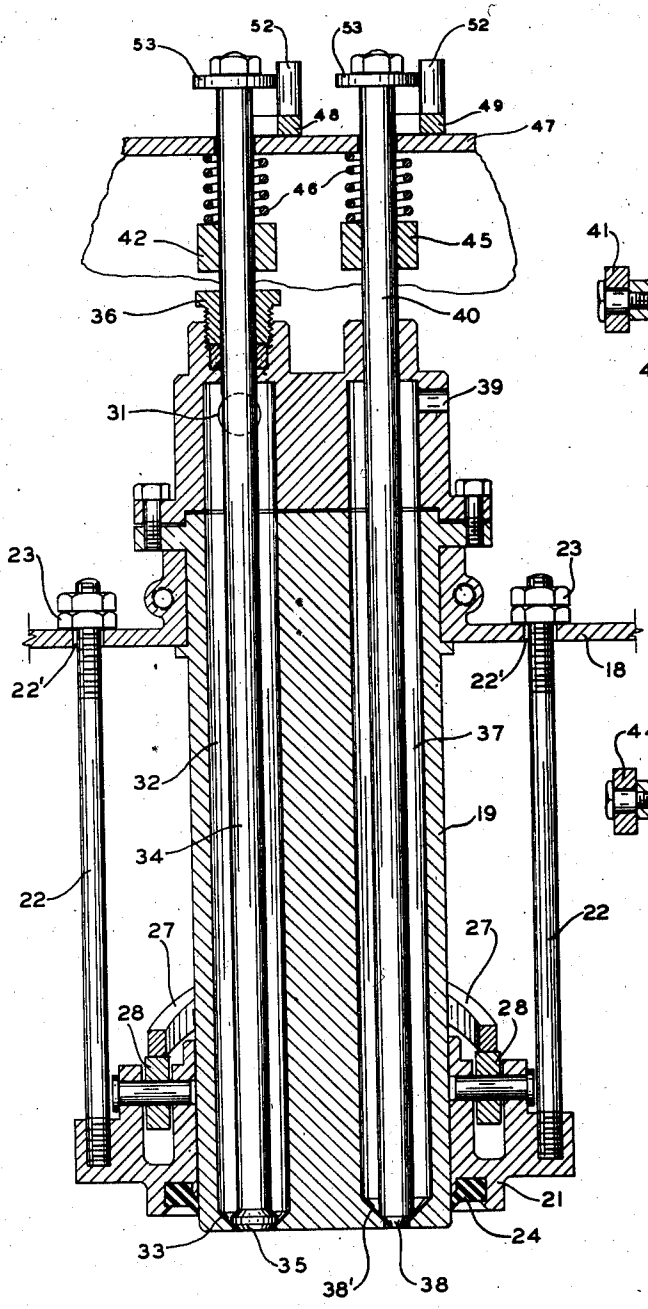


FIG. 2

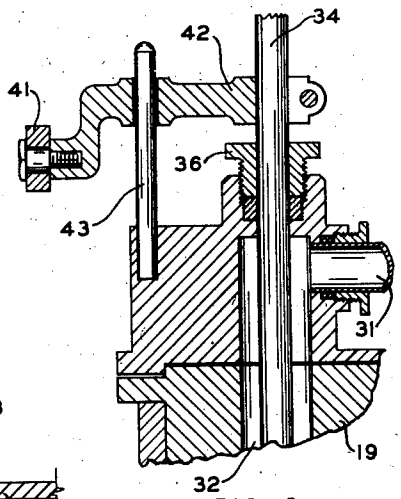


FIG. 3

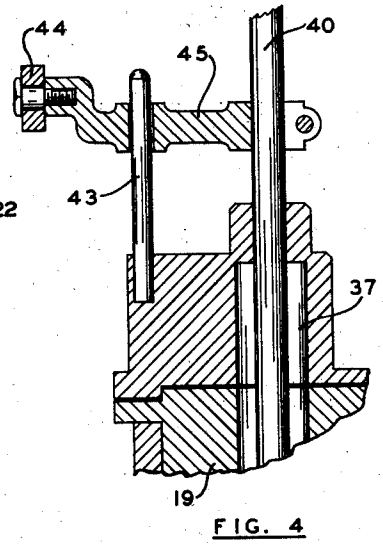


FIG. 4

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LIQUID FILLING MACHINE

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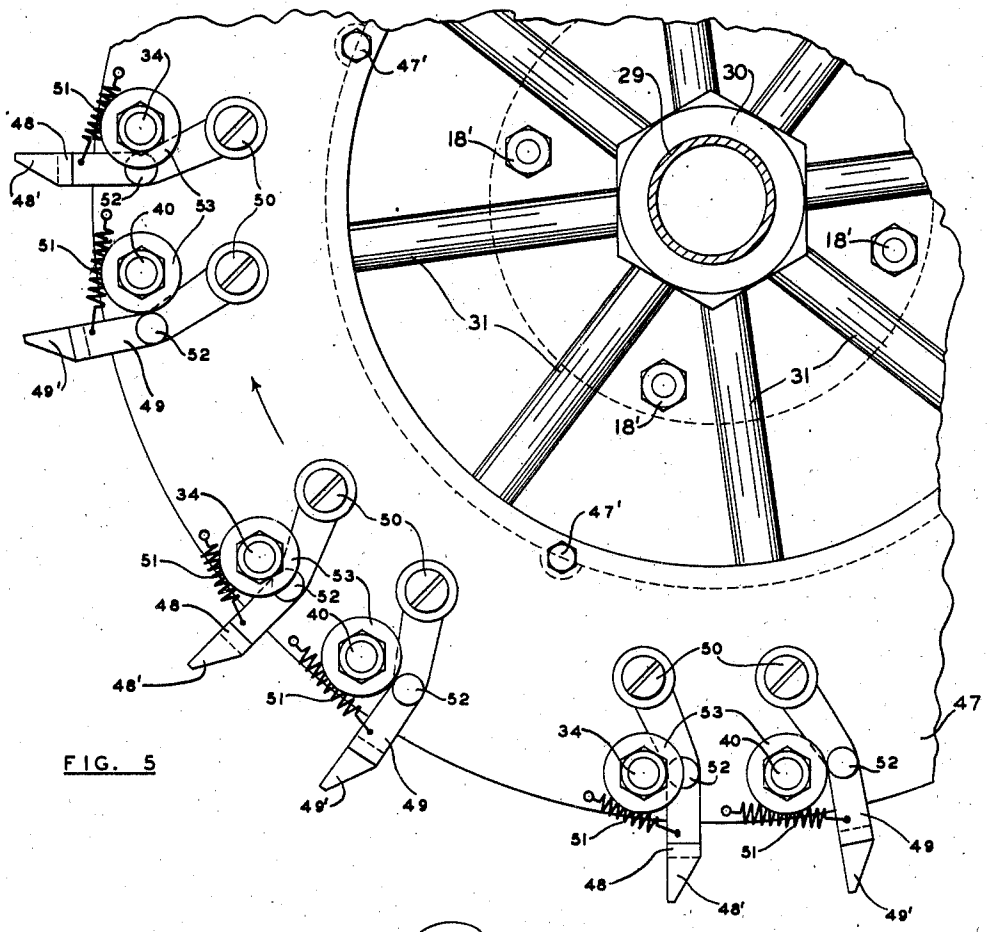


FIG. 5

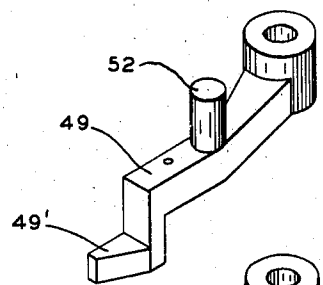


FIG. 6

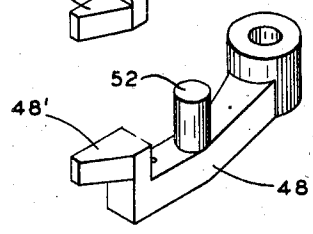


FIG. 7

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LIQUID FILLING MACHINE

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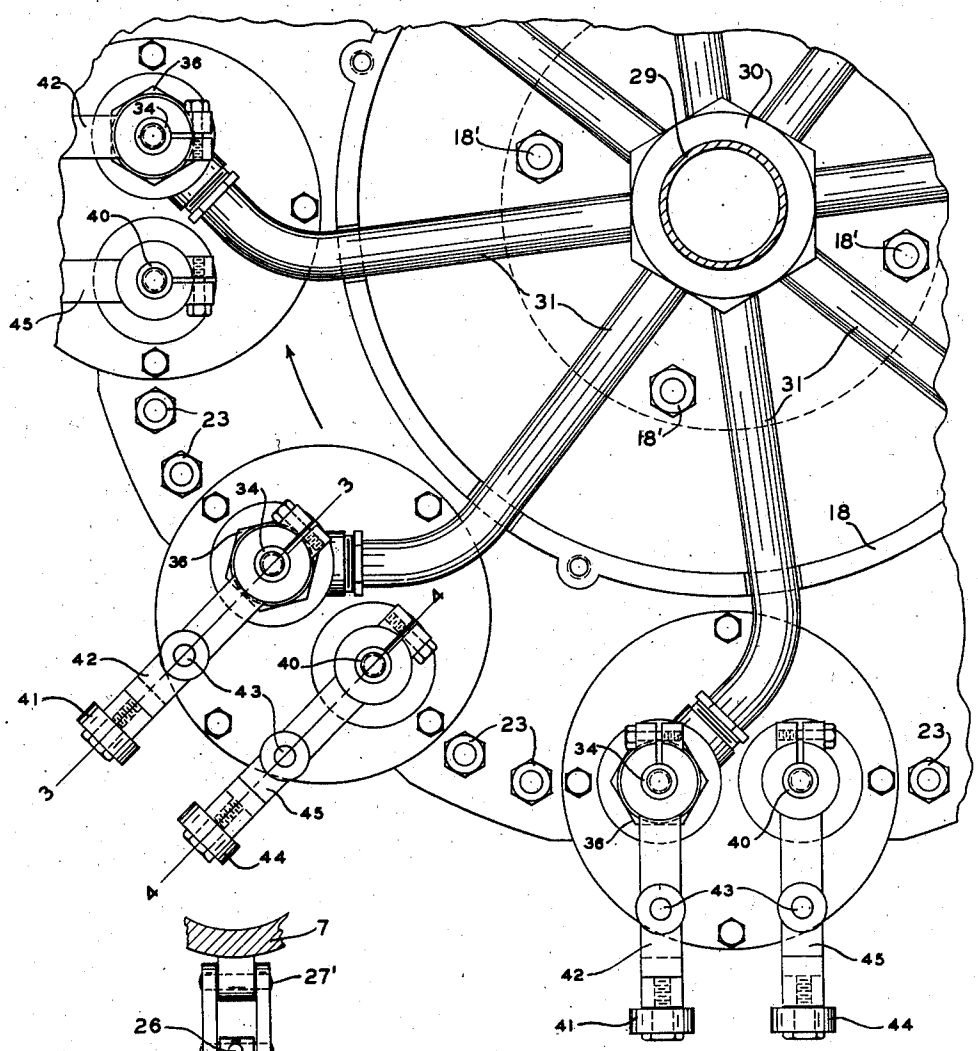


FIG. 8

FIG. 9

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LIQUID FILLING MACHINE

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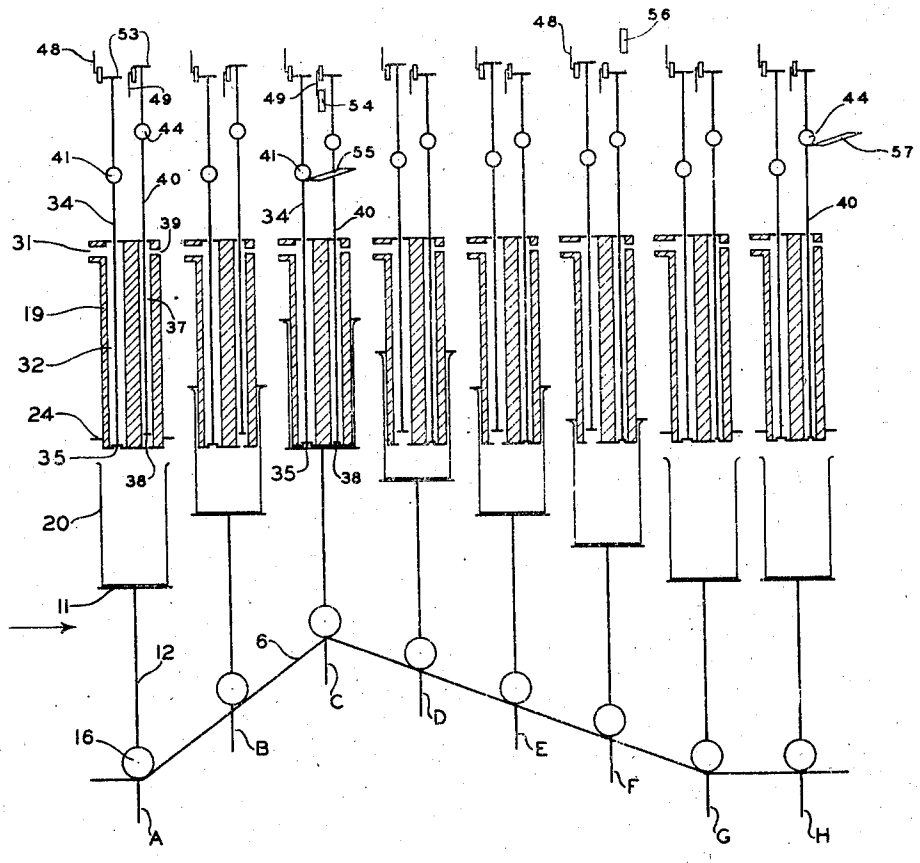


FIG. 11

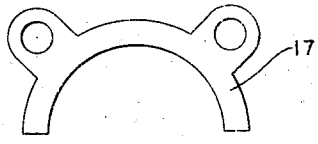


FIG. 10

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Patented July 20, 1943 2,324,795

UNITED STATES PATENT OFFICE

2,324,795

LIQUID FILLING MACHINE

Everett S. Minard, San Francisco, Calif., assignor, by mesne assignments, to The Pfaudler Co., Rochester, N. Y., a corporation of New York

Application January 31, 1941, Serial No. 376,762

13 Claims. (Cl. 226—98)

The present invention relates to improvements in liquid filling machines, and its principal object is to provide a machine for filling cans or similar containers with milk, or fruit juices, or other liquids, in such a manner that the air is first removed from the container, and the liquid is made to be fed into the vacuum thus created without being agitated and without coming in contact with any air during the entire feeding operation.

More particularly, it is proposed to provide a plug which is engaged with the container so as to entirely fill the same and to expel the air therefrom and to provide means in connection with the plug for feeding the liquid into the container as the plug is slowly withdrawn therefrom.

It is further proposed to provide special liquid-feeding and air-venting devices in connection with the plug and operating means for the same whereby the air-expelling and liquid-filling operations may be carried out in properly timed relation.

Another object of my invention is to provide sealing means engageable by the container during the air-exhausting and liquid-filling operations.

It is a further object of the invention to provide a machine in which a plurality of liquid-filling units are arranged to operate in continuous succession, so that a plurality of containers may be accommodated in one machine and pass therethrough to successively go through the different operations involved.

Further objects and advantages of my invention will appear as the specification proceeds, and the novel features thereof will be fully set forth in the claims hereto appended.

The preferred form of my invention is illustrated in the accompanying drawings, in which:

Figure 1 shows a vertical central section through my machine;

Figure 2, a vertical section through a plug unit substantially as seen from line 2—2 of Figure 1;

Figure 3, a fragmentary vertical section illustrating a liquid-valve opening means, and taken along line 3—3 of Figure 8;

Figure 4, a similar section illustrating the construction of a vent-valve operating means, and taken along line 4—4 of Figure 8;

Figure 5, a fragmentary top plan view of my machine;

Figures 6 and 7, isometric views of two lock members shown in plan in Figure 5;

Figure 8, a fragmentary top plan view with the valve locks removed, and showing the valve-lifting assemblies of my machine;

Figure 9, a top plan view of a pressure arm used in the sealing operation;

Figure 10, a detail view in plan of a container centering shoe; and

Figure 11, a diagrammatic view illustrating the operation of the machine.

While I have shown only the preferred form of my invention, I wish to have it understood that various changes or modifications may be made within the scope of the claims hereto attached, without departing from the spirit of the invention.

Referring to the drawings in detail, and particularly to Figure 1, my machine comprises in its general organization, a base 1, a column 7 rotatable thereon, a lower, lifter-supporting frame 9 carried by the lower end of the column and an upper frame 18 carried by the upper part of the column and supporting plugs 19 in alined relation with the lifters 11 of the lower frame.

The base 1 is provided to support the machine and has suitably spaced feet 2 to give the machine the desired elevation. The base is formed with a central hub 3 which rigidly supports a vertical shaft 4.

A cylindrical section 5 is secured on the outer margin of the base by means of bolts 5' and serves as a closure for the lower working parts of the machine, as well as a supporting means for the endless cam track 6, the outline of which is indicated in the diagrammatic showing of Figure 11.

The column 7 fits revolvably over the upper end of shaft 4, and it is supported by the ball bearing 8 resting on the hub 3. The lower end of the column is widened into an apron 7' which surrounds the hub 3 and carries the lifter-supporting frame 9 consisting of upper and lower plates 9' and 9'' interconnected by bracing members 10'. The lower plate 9'' has a ring gear 10 bolted to the margin thereof and any suitable source of power may be used to impart rotary motion to the column 7 and the frame structure supported thereby through the ring gear 10.

An annularly arranged series of lifters 11 are mounted on the frame 9 at the upper end of shafts 12 which have guide bearings 13 in the upper and lower plates of the frame 9. A pin 14 is rigidly attached to each lifter 11 and freely slides through a hole in the upper frame plate 9' to keep its respective lifter shaft 12 from rotating. Each shaft 12 carries a bracket 15 rigidly secured to the shaft, and the brackets are pro-

vided with rollers 16 riding on the cam track 6 for raising and lowering the lifters as the frame 9 rotates. A semi-circular centering-shoe 17 is bolted to each lifter plate to allow a can or container 20 to be properly positioned thereon.

The upper frame 18 is removably mounted on top of the column 7 by means of bolts 18'. In the marginal portion of this frame are mounted an annular series of container-filling members or plugs 19 which correspond in position and number to the lifters 18, and are disposed, one above each lifter and centered with respect to the lifter and the container 20, carried thereby.

While in the drawings, the machine is illustrated as having eight filling units, each comprising a lifter and a cooperating plug, it should be understood that the number of units may be readily changed without affecting the spirit of the invention.

The container-filling members or plugs 19 are cylindrical in form, and are of a diameter corresponding to the inside diameter of the container 20, so as to have a sliding fit therewith. It should be understood of course, that the form of the plug 19 should correspond to that of the container 20, no matter what the shape of the latter may be.

On the exterior of the plug, and slidably mounted thereon, is a ring or sleeve 21, held in adjustable position by means of studs 22 which fit loosely in holes 22' in the frame 18, and have adjusting nuts 23 on their upper ends. A rubber or resilient ring 24 is placed in the ring 21 at a point where it will seal the top opening of the container 20 when the latter is raised against it.

The inner edge of the rubber ring 24 fits closely against the surface of the plug 19 to form an air-tight joint with the plug, but to permit vertical sliding motion of the ring 21. Downward pressure is brought to bear on the ring 21 through a pressure arm 27 pivoted in the column, as at 27', and urged downward by a spring 25 encircling a guide bar 26.

The pressure arms, one of which is shown in detail in Figure 9, have forked free ends straddling the rings 21 and bearing on rollers 28 to urge the rings downwardly, the downward movement being limited by the effective length of the studs 22 as adjusted by the nuts 23.

A liquid-supply line 29 extends toward the frame 18 from above and in line with the shaft 4, and terminates into a turning union 30 supported centrally on the frame 18. The turning union has a number of branch lines or feeders 31 extending toward the different plugs and connecting with vertical passages 32 within the plugs. These passages extend downwardly to the bottom ends of the plugs and terminate in valve seats 33 (see Figure 2).

A valve stem 34 extends vertically through each passage 32, and has a head 35 adapted to seat on the valve seat 33 for closing the passage. Where the valve stem 34 leaves the plug at the upper end, a stuffing box 36 is provided to prevent liquid from leaking out along the stem.

Adjacent the liquid passage 32, each plug is provided with an air vent passage 37 running parallel to the former passage and formed with a valve seat 38' at its lower extremity, and a vent hole 39 at the upper end. A valve stem 40 passes through the passage 37, and has a valve head 38 adapted to cooperate with the seat 38' in opening and closing the lower end of the passage 37.

The two valve stems 34 and 40 are operated as follows:

The valve stem 34, as illustrated in Figure 3, has a bracket 42 clamped thereto so as to project laterally in a substantially radial direction and terminates in a downwardly offset roller 41, the bracket being guided vertically by means of a pin 43. Each of the valve stems is provided with the roller 41, and, as indicated in the diagrammatic view of Figure 11, as each roller 41 proceeds in its circular path, it strikes, at a given point, corresponding to the highest point of the cam track 6, a cam face 55 which lifts the roller and thereby raises the valve stem 34 and the valve 35 for opening the passage 32.

Each valve stem 40 is provided with a similar bracket 45 and an upwardly off-set roller 44, which cooperates with a fixed cam 57 in lifting the valve stem 40 when its respective plug reaches a pre-determined point in its circular path. (See Figures 4 and 11.)

For holding the two valve stems and their respective valves in raised position, I provide the following mechanism:

A top plate 47 is rigidly secured over the frame 18 by means of bolts 47' to provide a ring overlying the annular series of plugs 19. The valve stems 34 and 40 project through this top plate and have washers 53 secured to the top ends thereof in spaced relation to the plate 47. Valve stem locking members 48 and 49 (see Figures 5, 6 and 7), are pivoted to the plate 47 by means of screws 50 for swinging movement in a horizontal plane toward and away from the valve stems 34 and 40.

Springs 51 tend to pull the valve locks toward the stems 34 and 40. The valve locks are provided with vertical studs 52 which are drawn underneath the washers 53 by the springs 51 when the stems are raised and thereby hold the same in raised position.

The two valve stem locks 48 and 49 have off-sets 48' and 49' projecting radially beyond the periphery of the plate 47 and adapted to strike suitable stops 54 and 56 (indicated in Figure 11), whereby the locks are retracted and are made to release their respective valve stems 34 and 40, which immediately return to valve closing position under the influence of springs 46 interposed between the top plate 47 and the brackets 42 and 45.

The respective off-sets in the brackets 42 and 45 are provided to bring all rollers 41 into one plane adapted for cooperation with cam 55, and all rollers 44 into another plane adapted for cooperation with cam 57. Similarly the off-sets in the valve locks 48 and 49 serve to bring all the off-sets 48' into the plane of stops 56 and all the off-sets 49' into the plane of the stop 54. (See Figure 11.)

The operation of my machine may be described as follows:

Referring particularly to the diagrammatic view of Figure 11 which shows the progress of an individual can in eight different positions, indicated by letters A to H. The roller 16 is shown as travelling on the cam 6 to rise rather quickly to its highest point in a quarter of a revolution; to descend more slowly to its lowest level in one-half of a revolution, and to proceed on the same level for a quarter of a revolution. The lifter 11, of course, follows the same movement.

In the position shown at A, the can 20 resting on the lifter 11, is below the plug 19 and spaced therefrom. The valve 35 in the liquid passage

32, is closed, and the valve 38 in the air vent passage 37 is open, the valve stem 40 being held in raised position by the valve lock 49.

As the unit proceeds to point B, the lifter raises the can and the upper edge thereof engages with the resilient ring 24 of the sleeve 21 for sealing the can, the sealing ring being raised with the can. The position of the valves remains unchanged. As the roller 16 reaches the point C, the can is fully telescoped over the plug, and at that time, the valve lock 49 strikes the stop 54, releasing the valve stem 40 which closes the air vent valve at 38.

After this the downward travel of the roller 16 begins. At the beginning of the downward travel, the roller 41 strikes the cam 55, and opens the valve 35. Since all the air has been expelled during the upward travel of the can, and the valve 38 is closed at the end of the upward travel and the upper end of the can is firmly sealed against the plug, the downward travel of the can will create an almost perfect vacuum underneath the plug and the liquid runs into the evacuated space beneath the plug as fast as space is made available by the progressive descent of the can. It will be noted that the descent is made comparatively slowly, occupying substantially a full one-half of the circle.

Just before the roller 16 reaches the point G on the track and substantially coinciding with the moment when the seal is broken between the can and the resilient ring 24, the end of the valve lock 48 strikes the stop 56, releasing the lock and causing valve 35 to close.

When the can reaches the position of point G, it is filled to a desired level and both valves in the plug are closed. It may now be removed and a new can substituted. As the roller 16 reaches point H, the roller 44 reaches the cam 57 and operates the valve stem 40 to open the air vent valve preparatory to engagement with a new can.

The extent to which the container is to be filled can be very accurately adjusted by a proper setting of the nuts 23 on the studs 22. The container fills as fast as it is withdrawn from the plug 19, and the valve 35 is made to close when the container loses contact with the rubber ring 24. The higher the sleeve 21 carrying the ring 24 is raised by adjustment of the nuts 23, the shorter will be the feeding stroke, and the lower the level to which the container is filled. The operator may thus secure a uniform level in all the cans, allowing whatever space above the liquid is required for finishing operations.

As has been stated, the upper frame 18 is removable. Since the plugs are made to have an exact fit with the containers to be filled, it is apparent that they have to be changed for different sizes of containers. This change may be easily effected by taking off the entire frame 18 as a unit, and by substituting another one.

The centering shoes 17, of course, would have to be changed accordingly for the proper positioning of different sizes of containers.

While my machine has been shown and described as designed for the filling of the conventional cylindrical can, it is apparent that the principles of my invention could as easily be applied to cans or containers of different shapes.

Where containers are to be filled which have a narrow opening, such as the conventional bottle, or the like, the plugs 19 should be made of yielding material, and expansible, so that they could enter and leave the bottle through their restricted necks and still entirely fill the same at the point of deepest engagement.

I claim:

1. In a machine of the character described, a plug member comprising a cylindrical body having two longitudinal passages therein, one a vent passage and one a liquid passage, valves at the lower ends of the passages having valve stems extending through the passages, spring means urging the valves closed, cam means periodically opening the valves, means automatically locking the valves when opened and means for periodically releasing the locking means for closing the valves.

2. In a machine of the character described, a base comprising a base plate, a cylindrical housing and a central hub structure, a vertical shaft supported in the hub structure, a column revolvable on the shaft and supported by the hub, an apron suspended from the column and encircling the hub structure, a pair of plates supported in vertically spaced relation by the upper and lower ends of the apron and having annular series of alined bearings therein, vertical shafts supported in the latter bearings and having container supporting plates at the upper ends thereof and above the upper plate, a cam track supported inside the cylindrical housing, and rollers riding in the cam track and connected to the vertical shafts for endwise moving the same when the pair of plates are rotated.

3. In a machine of the character described, a base comprising a base plate, a cylindrical housing and a central hub structure, a vertical shaft supported in the hub structure, a column revolvable on the shaft and supported by the hub, an apron suspended from the column and encircling the hub structure, a pair of plates supported in vertically spaced relation by the upper and lower ends of the apron and having annular series of alined bearings therein, vertical shafts supported in the latter bearings and having container supporting plates at the upper ends thereof and above the upper plate, a cam track supported inside the cylindrical housing, and rollers riding on the cam track and connected to the vertical shafts for endwise moving the same when the pair of plates are rotated, the lower one of the pair of plates having a ring gear thereon by means of which it may be rotated.

4. In a machine of the character described, a base comprising a base plate, a cylindrical housing and a central hub structure, a vertical shaft supported in the hub structure, a column revolvable on the shaft and supported by the hub, an apron suspended from the column and encircling the hub structure, a pair of plates supported in vertically spaced relation by the upper and lower ends of the apron and having annular series of alined bearings therein, vertical shafts supported in the latter bearing and having container supporting plates at the upper end thereof and above the upper plate, a cam track supported inside the cylindrical housing, and rollers riding on the cam track and connected to the vertical shafts for endwise moving the same when the pair of plates are rotated, the container supporting plates having means for holding the same against rotary movement on their own axes.

5. In a machine of the character described, a base comprising a base plate, a cylindrical housing and a central hub structure, a vertical shaft supported in the hub structure, a column revolv-

able on the shaft and supported by the hub, an apron suspended from the column and encircling the hub structure, a pair of plates supported in vertically spaced relation by the upper and lower ends of the apron and having annular series of alined bearings therein, vertical shafts supported in the latter bearings and having container supporting plates at the upper ends thereof and above the upper plate, a cam track supported inside the cylindrical housing, and rollers riding on the cam track and connected to the vertical shafts for endwise moving the same when the pair of plates are rotated, the container supporting plates having means for centering containers thereon.

6. In a machine of the character described, a column, means for revolvably supporting the same, a plate supported by the column horizontally, an annular series of plug members supported vertically in the margin of the plate, a passage in each plug, a valve for each passage having a stem projecting above the plug, a central liquid feed conduit over the column, a distributing head supported by the column and connecting with the feed conduit and having radial arms connecting with the passages, and means for actuating the projecting ends of the valve stems for valve opening and closing movements as the column is rotated.

7. In a machine of the character described, a column, means for revolvably supporting the same, a plate supported by the column horizontally, an annular series of plug members supported vertically in the margin of the plate, a passage in each plug, a valve for each passage having a stem projecting above the plug, a central liquid feed conduit over the column, a distributing head supported by the column and connecting with the feed conduit and having radial arms connecting with the passages, and means for actuating the projecting ends of the valve stems for valve opening and closing movements as the column is rotated, the latter means comprising spring means urging the valves closed, a cam for periodically opening the valves, means automatically locking the valves in open position and means for periodically releasing the locking means.

8. In a container filling machine of the character described, a plug adapted for telescoping engagement with the container, the plug having a lengthwise vent passage and a lengthwise feed passage, with the passages forming valve seats at the end of the plug, and valve rods movable in the passage and having valve heads fitting on the said seats to come flush with the end of the plug.

9. In a container filling machine of the character described, a plug adapted for telescoping engagement with the container, the plug having a lengthwise passage and a valve in said passage, a valve rod projecting through the passage beyond the plug and having an arm extending from the projecting end, a cam for raising the arm for opening the valve when the plug is moved with respect to the cam, means for locking the arm in raised position, means for releasing the arm after a predetermined interval, and means for urging the valve closed.

10. In a container filling machine of the character described, a plug adapted for telescoping engagement with the container, the plug having a lengthwise passage forming a valve seat at the end thereof, and a valve rod movable in the passage and having a valve head fitting on the said seat to come flush with the end of the plug.

11. In a machine of the character described, a plug member comprising a cylindrical body having two longitudinal passages therein, one a vent passage and one a liquid passage, valves at the lower ends of the passages having valve stems extending through the passages, and means cooperating with the stems for periodically opening and closing the valves in cyclic relation.

12. In a machine of the character described, a column, means for revolvably supporting the same, a plate supported by the column horizontally, an annular series of plug members supported vertically in the margin of the plate, a cam sealing sleeve movable upon the outside of each plug, means carried by the plate for limiting the downward movement of the sleeve, and lever means anchored to the column and bearing on the sleeve and having yielding means opposing upward movement of the sleeve.

13. In a machine of the character described, a member adapted to support a container thereon, a solid plug member of substantially the length of the container and having a sliding fit with the latter and having a vent passage extending through the body thereof, means for supporting the two members with freedom of telescoping movement between the container and the plug member, a sleeve retractable on the plug member and engageable by the container at the beginning of the telescoping movement for forming a seal between the plug member and the container, a valve at the bottom end of the vent passage and having a stem projecting through the passage and above the plug and means acting on the stem above the plug for opening the valve at the beginning of the telescoping movement and for closing the same at the end of the telescoping movement.

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