

[54] **ASEPTIC CONTAINER FILLING APPARATUS**

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**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 823,010, May 8, 1969, abandoned.

[52] U.S. Cl. .... **141/85, 141/181, 141/198**

[51] Int. Cl. .... **B65b 3/12**

[58] **Field of Search**..... 141/85, 86, 138, 140-143, 141/153, 156, 157, 167, 180, 183, 185, 188, 192, 198, 200, 202, 210, 219, 242, 243, 361, 160, 181

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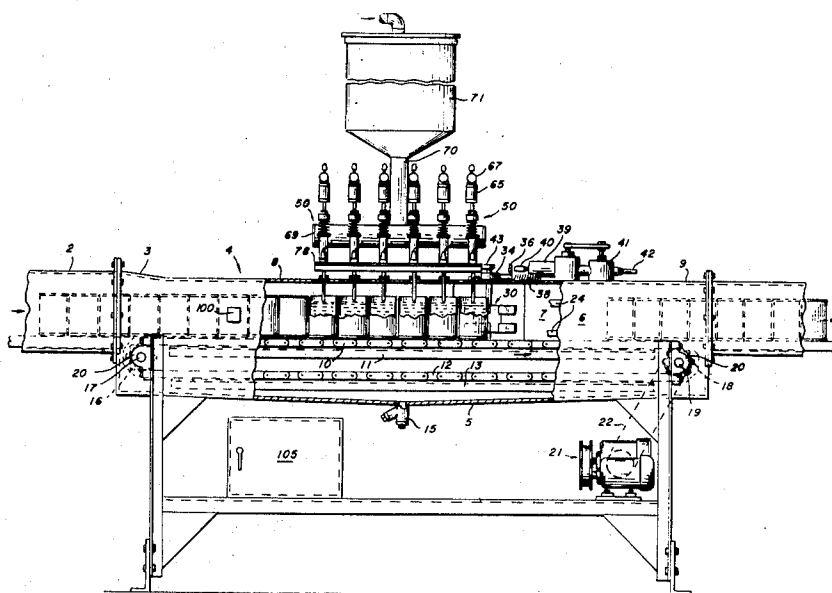
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[57] **ABSTRACT**

There is disclosed an apparatus for filling containers in a steam-filled sterile atmosphere. The containers move in a single line from a sterilizing chamber onto a continuously-moving conveyor in the elongated filling apparatus. Means interposed across the path of travel of the containers arrests the motion of the containers in such location that each of several containers is under a filling tube. When the containers are so arrested, an electric probe is lowered into each container, whereupon a filling valve for each tube opens and the product flows into the containers. When the product reaches the probe in each container, the valve for that container is closed. When all containers are filled, the probes lift, and the means that arrested the travel of the containers is released to let the filled containers pass until all filled containers are discharged and the following empty containers are arrested in position for a repetition of the filling cycle. Means are provided to prevent operation of the filling cycle if there is not a container under each filling tube.

**19 Claims, 10 Drawing Figures**



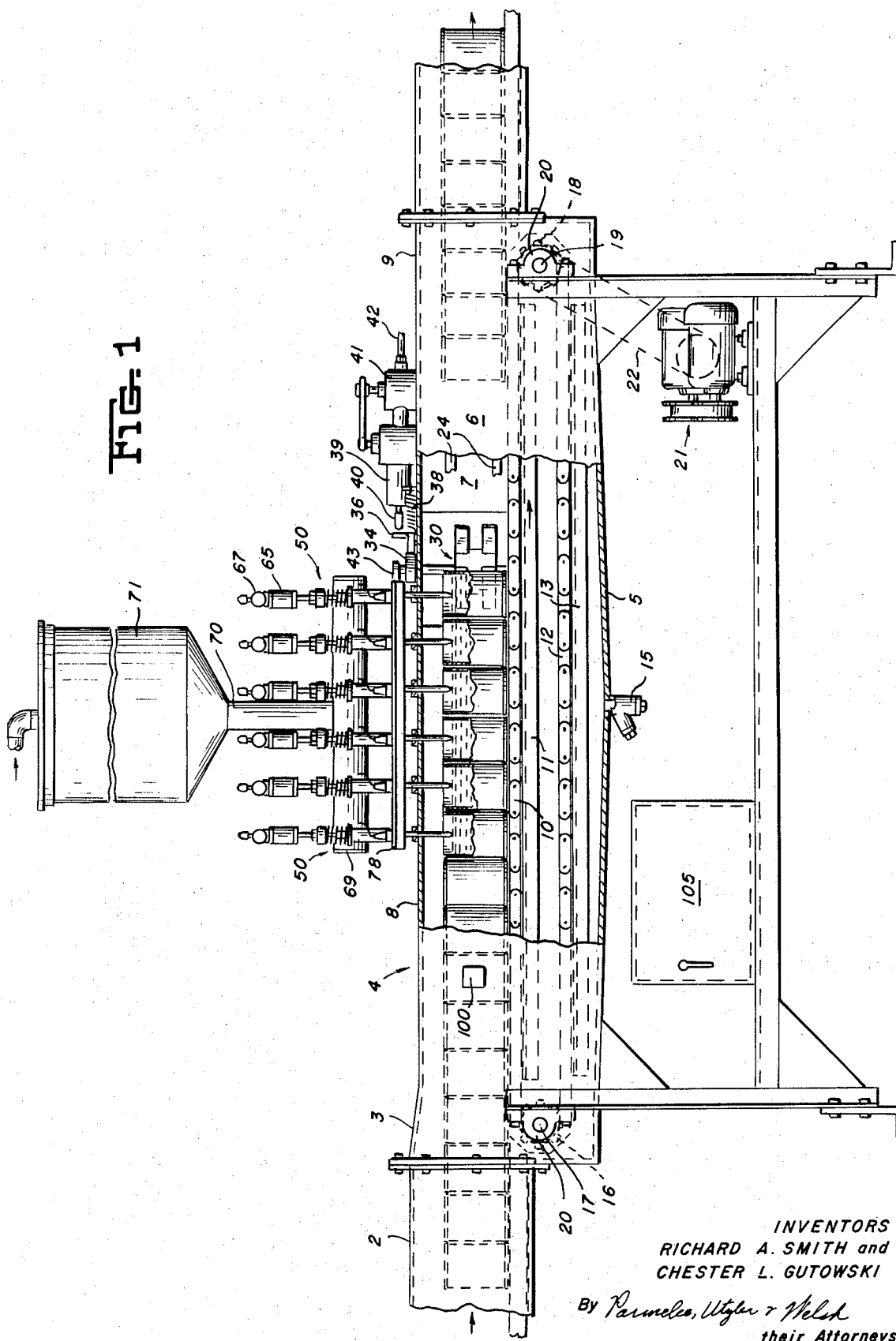
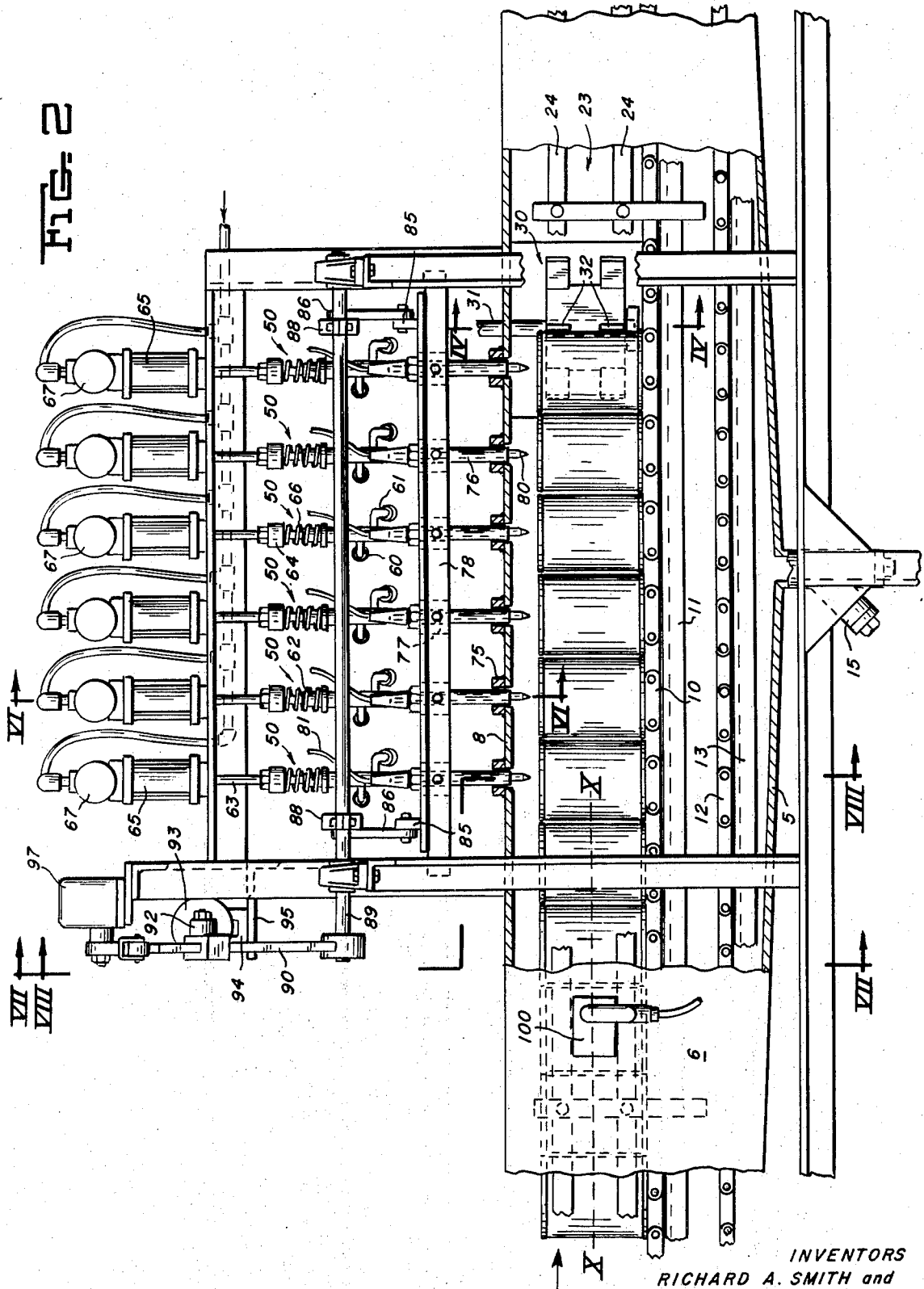


FIG. 2



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FIG. 5

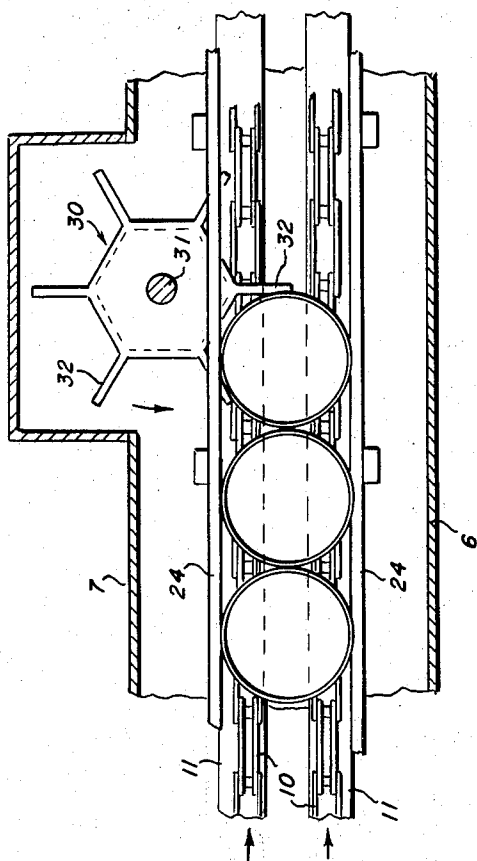


FIG. 3

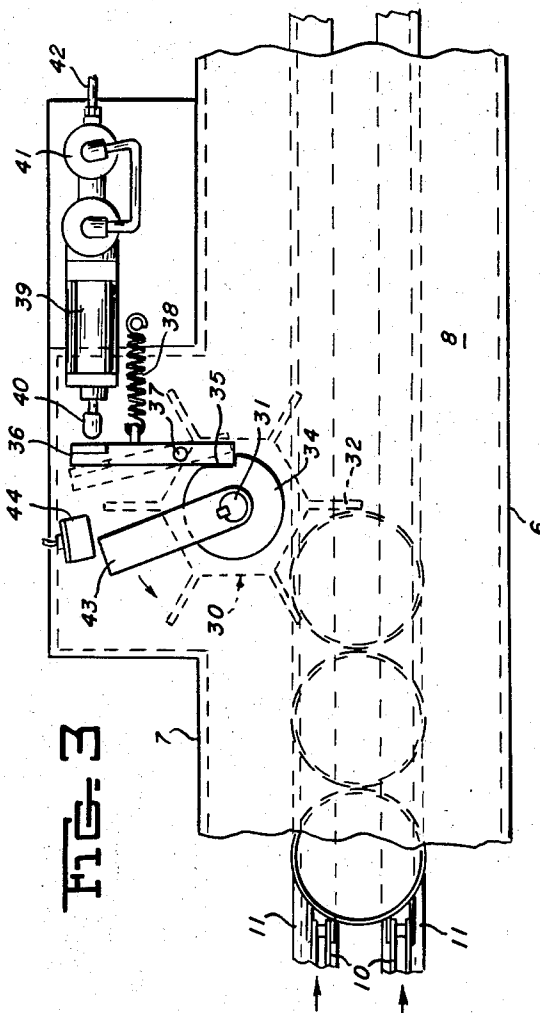
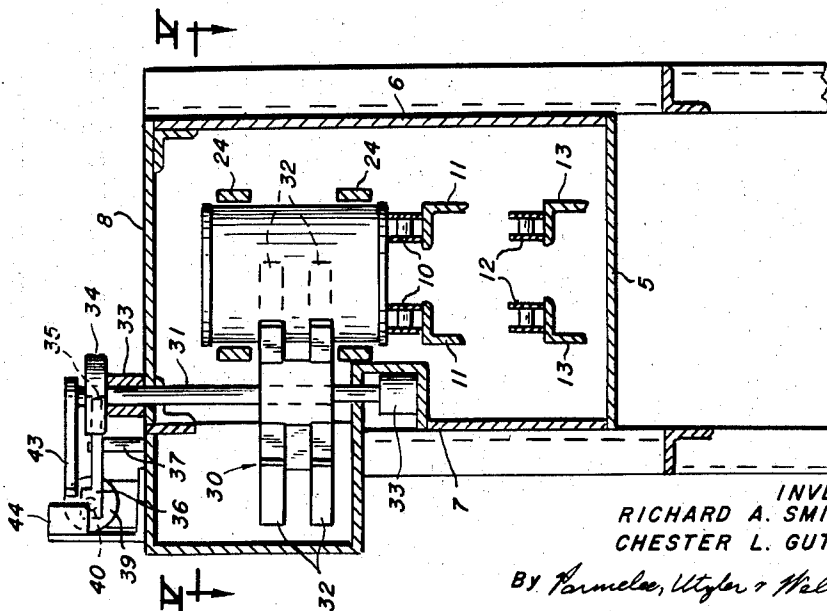


FIG. 4



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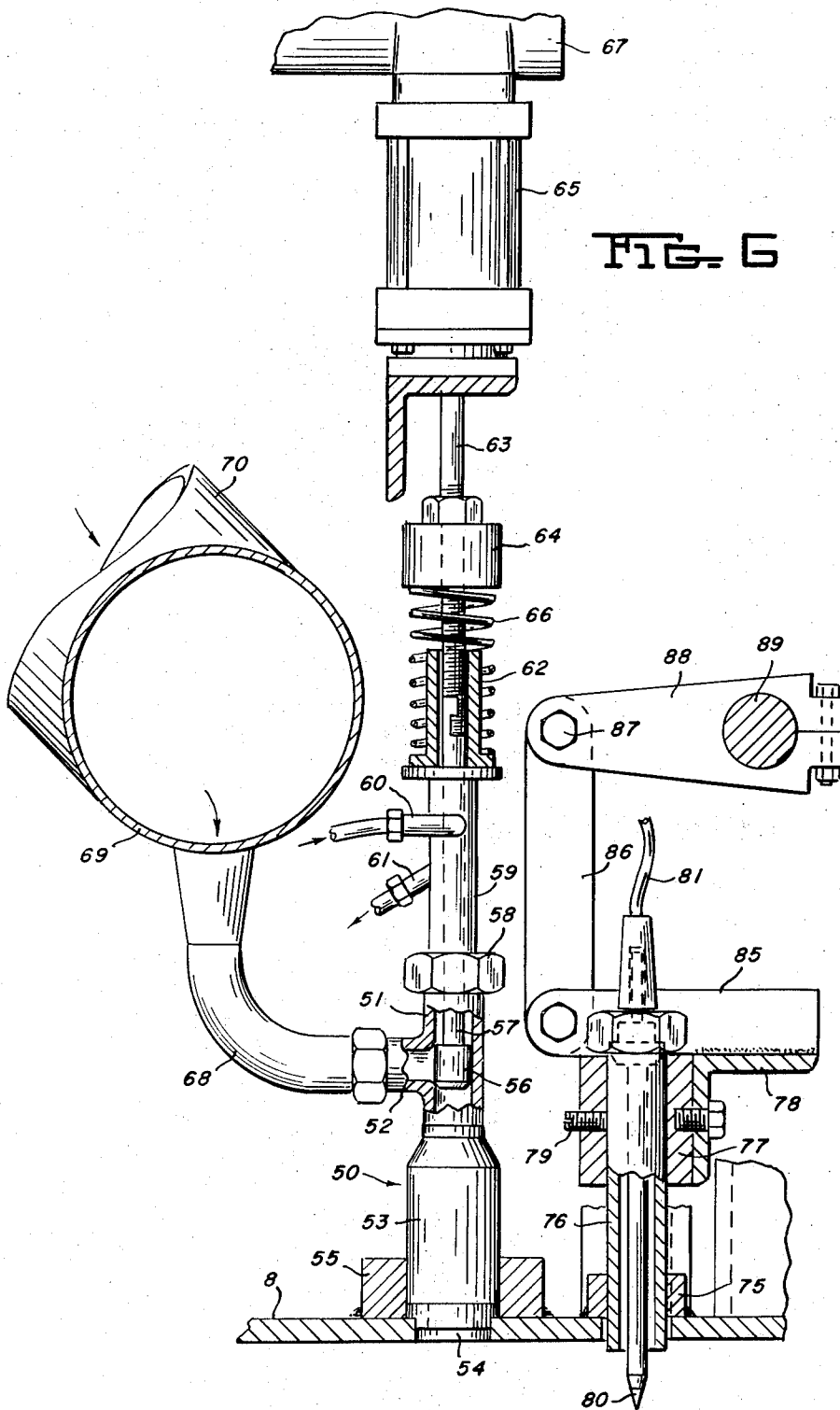


FIG. 6

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FIG. 7

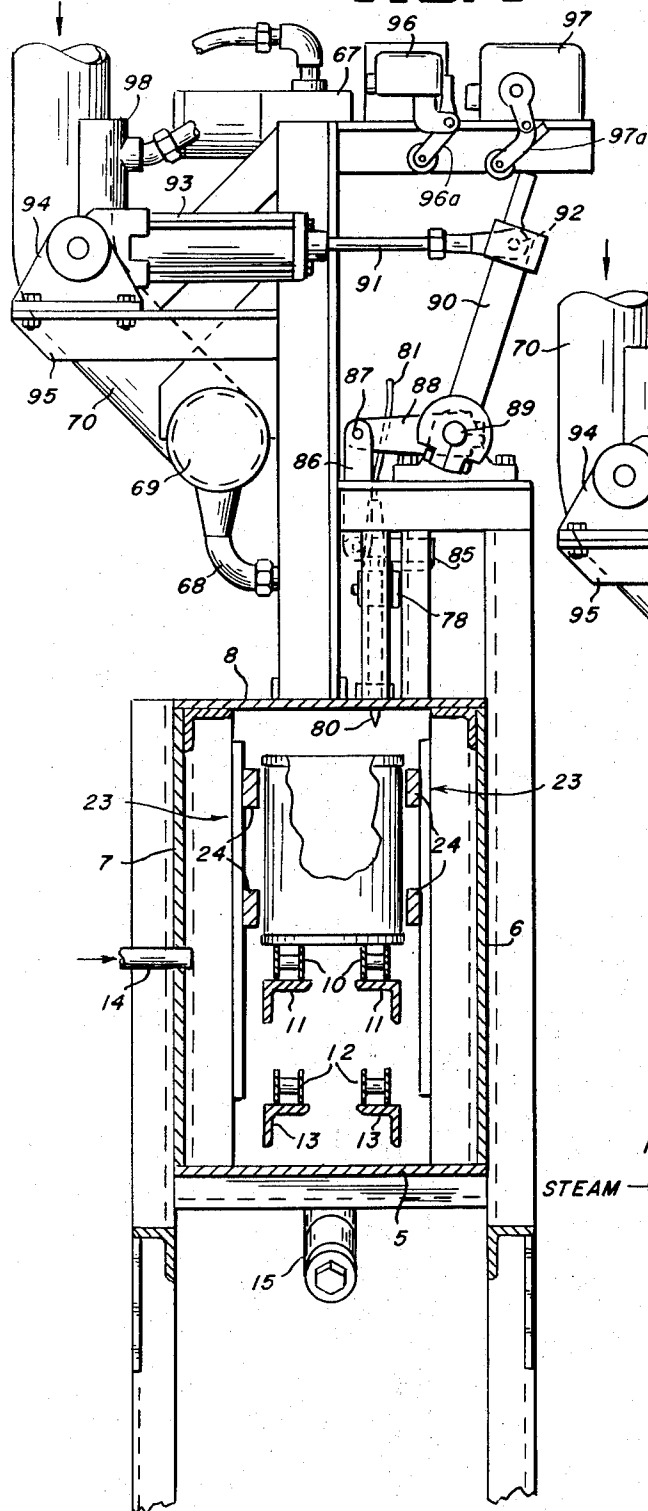
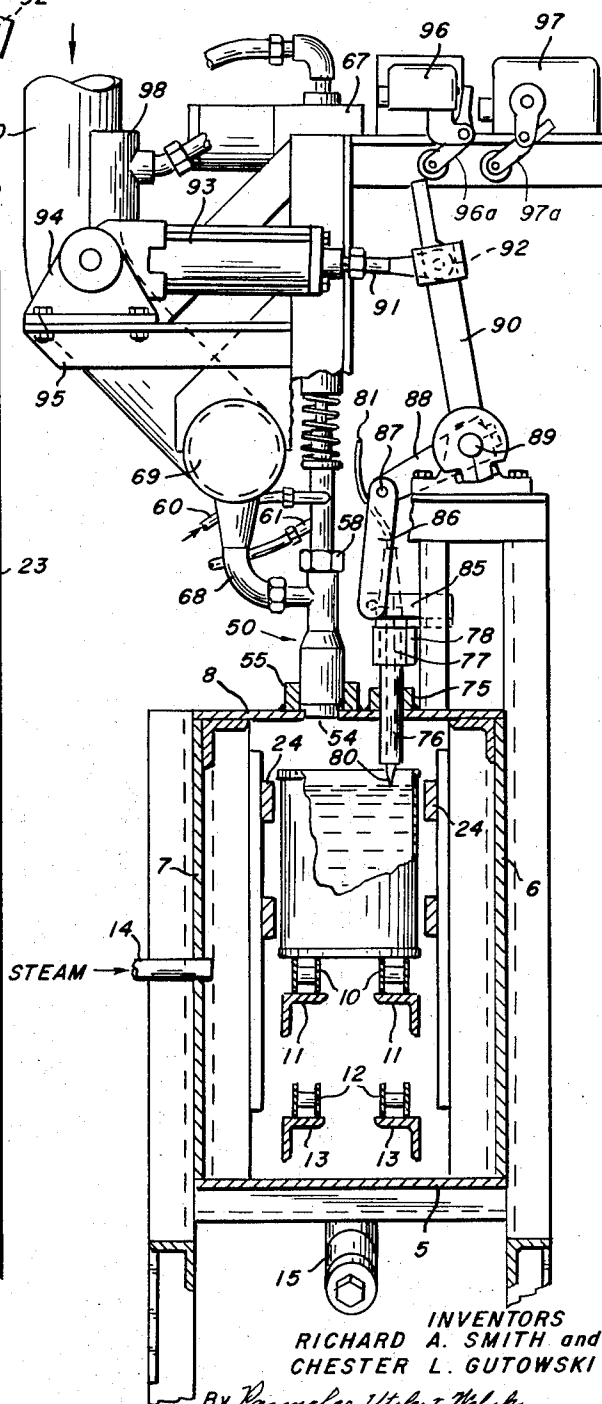
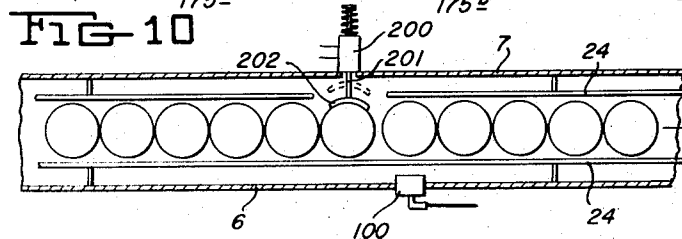
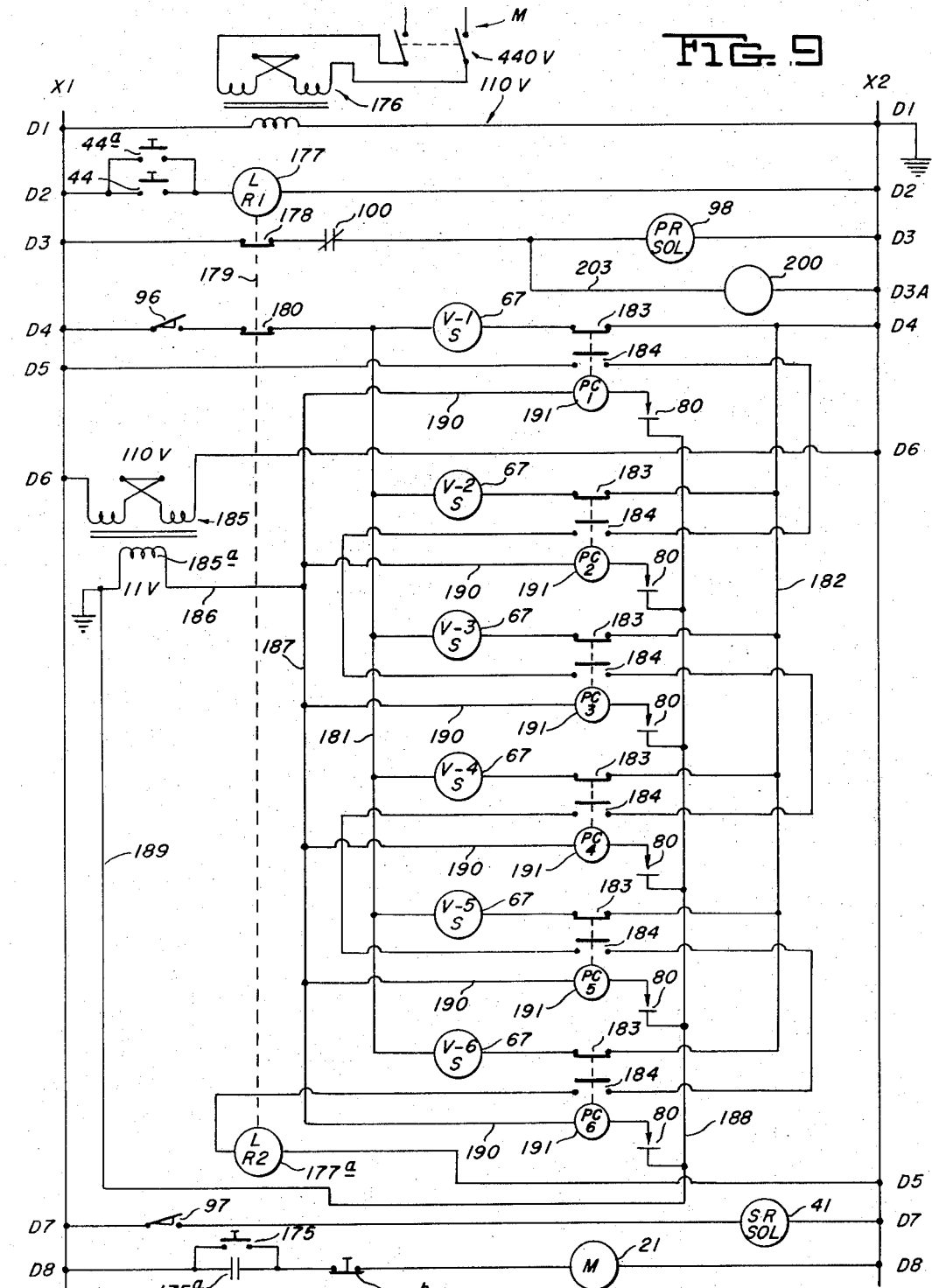


FIG. 8



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# ASEPTIC CONTAINER FILLING APPARATUS

## SPECIFICATION

This application is a continuation-in-part of application Ser. No. 823,010, filed May 8, 1969, now abandoned, and the invention relates to the filling of previously sterilized containers with a previously sterilized perishable liquid or semi-liquid product in an aseptic environment, and is for an apparatus wherein a succession of containers are intermittently moved in groups under filling nozzles, filled to a uniform depth in a sterile atmosphere and then advanced to an apparatus where they are sealed.

Many liquid and semi-liquid food products, either with or without finely-divided or chunky solids, are marketed in cans or glass containers. In some cases the sterile product may be cooled to a temperature where air-borne organisms may survive when it is introduced into the container. Unless the product is subsequently retorted to further sterilize it after the container is sealed, or unless the product is filled into previously-sterilized containers in a completely sterile atmosphere, spoilage may result. This invention is especially applicable to the filling of such a so-called "cold" product not intended to be further sterilized in containers.

Attempts have heretofore been made for filling cans in a sterile atmosphere, usually an atmosphere of steam. Modifications of existing types of rotary filling machines have been generally modified for such use, but difficulty is encountered largely due to the fact that it is difficult to maintain an aseptic steam atmosphere in a combination of revolving and stationary equipment and because bearings of one kind or another failed, or parts failed to operate smoothly because the atmosphere of hot steam and the character of the operation either removed the lubricant, or lubricant could not be supplied to critical parts.

According to the present invention, the containers travel in a straight line rather than in a rotary machine from a sterilizing enclosure into the enclosed container-filling apparatus where there is maintained an atmosphere of steam. A selected number of cans or jars move to a position under the equal number of filling spouts or nozzles, one container under each spout. When the containers are so positioned, an electric probe is projected down into each of these containers, whereupon the product is discharged from the filling spouts into the containers until contact is made with the respective probes, each filling spout being closed independently of the others as each probe makes contact with the product. When all containers have been filled to the same depth, the probes are raised to clear the tops of the containers, and the filled cans or jars are moved into an enclosure through which they are transferred in an aseptic environment to a seaming or closure-applying machine.

The cans are carried through the apparatus on endless chains passing around a sprocket, the shafts for which are on bearings outside the housing. All other movable parts are outside the housing, or in the case of a star wheel, which blocks the movement of the cans under the discharge spouts and monitors their movement from the filling machines, its shaft is in bearings outside the housing. Only the conveyor chain links are

the moving parts for which lubrication outside the atmosphere of steam is not provided.

## IN THE DRAWINGS

FIG. 1 is a side elevation of the container-filling apparatus with a portion of the sterilizing chamber at one end and the filled can discharge chamber at the other;

FIG. 2 is a side elevation of the filler on a larger scale with parts of the enclosure broken away;

FIG. 3 is a top plan view of the star wheel control arrangement;

FIG. 4 is a transverse vertical section in the plane of line IV—IV of FIG. 2;

FIG. 5 is a horizontal fragmentary section in the plane of line V—V of FIG. 4;

FIG. 6 is a detail view on a larger scale showing a single filler valve and its associated parts, and showing partly in section and partly in elevation one of the probes together with the vertically-movable probe support and the rock shaft arrangement for moving the support vertically;

FIG. 7 is a transverse section in the plane of line VII—VII of FIG. 2 showing the position of the parts with the probes elevated;

FIG. 8 is a transverse section in the plane of line VIII—VIII of FIG. 2 showing the probes lowered;

FIG. 9 is a schematic circuit diagram through which the sequence of operation of the apparatus is effected; and

FIG. 10 is a horizontal section in about the plane of line X—X of FIG. 2 showing one arrangement for preventing the seam on the bottom of one can in the filling section from riding up on the edge of the can ahead.

Referring to the drawings, there is illustrated an apparatus designed for filling large No. 10 cans, and while such cans will be referred to, the apparatus may be designed to fill other sizes of cans and also glass containers.

The cans which have been sterilized in an atmosphere of steam, move through an enclosure 2 to the entrance at 3 of the can-filling machine designated generally as 4 which comprises an elongated tunnel-like enclosure having a bottom 5, side walls 6 and 7, and a top 8. The discharge end of the tunnel is indicated at 9. Within the tunnel is a chain conveyor comprising parallel sprocket chains having an upper flight 10 moving over the top of parallel rails 11 from the entrance toward the discharge end, and a lower flight 12 moving in the opposite direction on support rails 13. There is a steam inlet pipe 14 indicated in FIGS. 7 and 8 on the side wall 7, and the bottom 5 is sloped downwardly from the ends toward the central drain 15 for the removal of condensate.

The conveyor chain passes around sprocket wheels 16 on a shaft 17 at the entrance end of the enclosure and around sprocket wheels 18 on a shaft 19 at the exit end. While these shafts pass through the enclosure, their bearings are indicated at 20 on the supporting frame structure outside the housing. The conveyor is continuously driven by a motor and variable speed drive unit 21 and sprocket chain 22 that passes around a sprocket wheel on shaft 19. There are guide fences 23 having horizontal rails 24 in the tunnel along each side of the conveyor to keep the cans lined up on the conveyor.

To prevent the cans from being carried continuously through the tunnel, and to position the cans under the filling nozzles to be hereinafter described, there is an offset on the side wall 7 (see FIGS. 3, 4, and 5) to provide an enclosure around a restraining device comprising a turnstile-like star wheel 30 on a vertical shaft 31. The vanes 32 of the star wheel travel in a circle that extends partway across the path of travel of the cans on the conveyor. This star wheel is located near the discharge end of the enclosure. Its shaft passes upwardly and downwardly through bearings 33 on the outside of the top and bottom of the offset portion of the enclosure. Above the bearing the shaft has a cam disk 34 with a step 35 on its periphery.

As viewed in FIG. 5, the cans, by reason of their being urged forward by the conveyor, tend to rotate the star wheel in a counterclockwise direction, and continuous rotation is prevented by a latching lever or dog 36 engaging the step in a cam. The latching lever 36 is pivoted on a vertical pivot at 37, and the end of the lever beyond the pivot has a tension spring 38 that urges the lever into latching position. Beyond the spring there is an air cylinder 39 with a piston and piston rod 40 which is normally retracted, as shown in FIG. 3. When cylinder 39 is receiving an air impulse, it is extended to the left as here shown to engage the lever 36 and swing it against the tension of the spring 38 to release the latch from the step in the cam. A solenoid valve 41 controls the flow of air from pipe 42 to the cylinder.

When the star wheel is latched against rotation, one of the vanes of the star wheel projects directly across the path of travel of the cans, so that even though the conveyor chain is continuously operating, the can cannot pass. When the latch is tripped, then each can in turn will engage successive vanes of the star wheel, rotating the wheel one full revolution when the latching dog will snap into engagement with the step of the cam and prevent further rotation until the latch is again released. In the apparatus shown, the star wheel has six vanes so that the can-restraining device will pass six cans each time the latch is released.

The star wheel shaft has a metal arm 43 thereon above the cam that rotates with the star wheel, and which is a sensor for momentarily energizing a proximity switch 44 on a fixed support, and so located that the sensor will move past it just as the last can has cleared the star wheel and the star wheel has latched. Its purpose, as hereinafter more fully described, is to generate an impulse that will signal when six cans have passed the star wheel.

There is a fixed support above the top of the enclosure that supports a spaced series of product-filling valves and tubes, all of like construction, and each of which is designated generally as 50. With a star wheel set to pass six containers, there are an equal number, that is six of these units 50, and the first of the series, starting at the right in FIGS. 1 and 2, is located directly above that can which is then immediately against the restraining vane of the star wheel. Each other valve unit is then located over the succeeding five cans, so that each of six cans is under one of the six filling valve units in position to receive product therefrom.

One of the filling valve units is shown in FIG. 6. Each one comprises a valve body 51 with a laterally-extending inlet connection 52 and a vertical discharge tube 53 positioned above a discharge port 54 in the top

8 of the elongated tunnel-like enclosure. There is a collar 55 on the top 8 into which the tube is fitted. The valve element 56 is normally in the closed position where it blocks the flow of product from the inlet to the discharge. This element is carried on a valve stem 57 that extends up through a gland 58 and through a biological seal 59 forming an extension of the gland. This comprises a tube concentric about the valve stem with a stem inlet connection 60 and a stem outlet connection 61. By circulating steam through this tube at above atmospheric pressure, air cannot leak into the valve through the gland. There is a quick disconnect coupling sleeve 62 at the top of the tube, through which the valve stem also passes, which is restrained by a quick disconnect coupling retaining spring 66.

The upper end of the valve stem 57 is coupled to the lower end of a piston rod 63 on which is a collar 64. This rod extends down from an air cylinder 65 in which there is a piston (not shown). Pressure in the cylinder 65 moves the valve 56 down into closed position. There is a solenoid valve 67 which controls the flow of air to cylinder 65 and which is spring biased to move to one position when its solenoid is de-energized and to another position when its solenoid is energized. The admission of air to the lower end of cylinder 65 lifts valve 56 to open it, and this occurs when the solenoid of the air flow valve 67 is energized, and when the solenoid of air control valve 67 is de-energized, air pressure is admitted to cylinder 65 to close the product supply valve 56. The solenoid valves 67 are, of course, standard equipment.

Each valve inlet 52 has a pipe 68 that leads to a manifold 69 into which product under pressure is supplied by a pipe 70 from a reservoir 71 in which a sterile gas, such as air or nitrogen, is maintained under pressure above the body of liquid in the reservoir.

The filling valves are all opened simultaneously when there is a can under each one, as hereinbefore described, and each is closed independently when its can is filled to a predetermined level. This is controlled by an electrode, herein termed a "probe", that effects the closing of the valve when the product touches the probe. This probe arrangement will be next described.

Alongside each discharge tube there is a bushing 75 on the top 8 of the tunnel. There is a sleeve 76 slidably passing through this bushing, and there is a collar 77 around the top of this sleeve that is bolted to the downturned leg of an angle bar 78 that is the common support for all of the probes. Each sleeve can be adjusted vertically in the collar 77 and held in the adjusted position by a set screw 79. At the top of each sleeve there is an insulator that closes the top of the sleeve, and through which passes the metal electrode or probe element 80, which extends down through the sleeve but is out of contact therewith. The lower end of the electrode which is pointed extends below the sleeve and the point is bare metal while the electrode above the point is coated with an insulation such as "Teflon." An electric lead wire 81 is connected to the top of the probe.

When the cans are moving into and out of position, these probes must be clear of the tops of the cans, but when the cans are being filled, the probes must project into the open tops of the cans so that their points will be at the level to which the cans are to be filled. They must therefore all be raised and lowered in unison. This

is accomplished by raising and lowering the bar 78 on which all of the probe units are carried, and in this raising and lowering of the probes, the sleeves 76 slide in their respective bushings 75.

The bar 78 has an extension 85 at each end. There is a link 86 (FIG. 6) pivotally attached to each extension, and the upper end of this link is pivotally attached at 87 to a crank arm 88. The crank arms 88 are on a rock shaft 89 that extends longitudinally above the top of the tunnel-like enclosure. By rotating the rock shaft in a limited arc, the bar 78 with its probe units is moved up and down.

As best seen in FIGS. 2, 7, and 8, the rock shaft 89 has an upwardly-extending lever 90 at the left end. There is a piston rod 91 pivotally connected at 92 with lever 90. This rod has a piston that operates in a cylinder 93 that has its end pivotally secured to a bracket 94 on a fixed support 95.

Starting from the position shown in FIG. 7 at the extreme right hand limit of its throw, the lever 90 first moves under the operating extension 97a of a switch 97 to a position at the extreme left hand limit of its throw under the operating extension 96a of a switch 96. Operating extension 97a has a pivoted "knee" or ratchet action so that as the lever 90 moves from right to left, it lifts the operating extension 97a without operating switch 97. When the lever moves under operating extension 96a, it raises said extension to close switch 96 and hold it closed. When the lever then moves from under extension 96a toward the right, it releases extension 96a to open switch 96 and contacting extension 97a it operates said extension momentarily to close switch 97 and then clears said extension as it reaches its limit of travel toward the right. The operation of the cylinder-piston unit 93-91 is controlled by a solenoid valve unit 98 to admit air under pressure to one end of cylinder 93 to drive the piston to the left when the solenoid is energized to effect lowering of the probes and to the opposite end of cylinder 93 to raise the probes when its solenoid is deenergized, such operations, of course, being effected through the rocking of the lever 90 as previously explained.

Finally, there is a proximity switch 100 located on the side wall 6 of the enclosure between the entrance end 3 and the nearest of the filling valves, preferably at a location where there will be at least eight or nine cans between it and the star wheel 30, the drawing showing it positioned so that there are nine cans between it and the star wheel, with six of them positioned under the six filling valve tubes or nozzles. This is to assure that no operation can take place until there are the required six cans under the filling valves.

Assume that there are not cans in the machine at start-up and the conveyor is operating. The cans will enter the apparatus from the sterilizing chamber and move through an atmosphere of steam until the leading can is blocked by the star wheel. The succeeding cans will line up behind the leading one, and as the ninth comes to rest, it will energize the proximity switch 100. This will energize a relay and solenoid valve 98 to admit air to cylinder 93 to move lever 90 from the position shown in FIG. 7 toward the left to the position shown in FIG. 8, rocking the shaft 89, thereby lowering the probes 80 into the cans positioned beneath them. The lever 90 will also contact switch 96. This will energize a relay to open all of the filling valves. The cans may not fill at the same rate, and as the liquid reaches the

level of the probe in each can, a circuit will be closed through the product and ground to close the particular filling valve for that can. There is a second circuit in which the probes are all in series, and when all the cans have been filled to contact their respective probes, this circuit will be completed, and it will send an impulse to effect the admission of air to cylinder 93 to move piston rod 91 and lever 90 in the opposite direction to rock shaft 89 in a direction to raise bar 78 to lift the probes clear of the tops of the cans.

As the lever 90 returns to the position shown in FIG. 7, switch 97 will be operated by it. This will send a current through star wheel release solenoid 41 to momentarily admit air under pressure to cylinder 39 to effect the release of latch lever 36 from cam 34, whereupon the cans on the continuously-moving chains will rotate the star wheel 30. When the six filled cans have rotated the star wheel one revolution, the latch will again lock the star wheel for the next series of cans. Proximity switch 44 will be energized by arm 43 as the star wheel reaches this position. This will send a signal to the central control, indicating that all filled cans are clear, and prevents reactivation of the apparatus should a can become stuck and not pass through the star wheel as rapidly as it should. It will be seen that if all filled cans do not move out from under the filling tubes, the proximity switch will prevent the opening of the filling valves, and that if there are not nine cans between the proximity switch 100 and the star wheel, the apparatus cannot operate, so that if, for example, there were only five cans under the filling tubes, the valves to the filling tubes could not open.

The circuitry for accomplishing the sequence above described employs all standard well-known apparatus, and the wiring is conventional. There is a control box shown at 105 in FIG. 1 under the machine. In FIG. 9 there is a simplified schematic ladder type diagram that we preferably use and which is illustrative of one circuit which we have found to be preferable.

Referring to FIG. 9, closing main switch M in the 440 volt factory line energizes transformer 176 to induce a 110 volt current in the top line D1 of the ladder diagram. Vertical side X<sub>1</sub> of the diagram may be considered for the purpose of explanation, the "hot" side of the circuit and X<sub>2</sub> the "ground" side.

In line D2 there is a switch 44 which is the proximity switch associated with the star wheel and in parallel with it there is a self-opening, manually closed switch 44a that must be pushed to initiate operation of the machine after shut down. The closing of either of these switches energizes the coil of a latch-in relay 177.

In line D3 are relay contacts indicated as switch 178 which is closed by energizing relay 177 in line D2, the broken vertical line 179 indicating this relation. In line D3 there is also proximity switch 100 which is indicated to be closed so that current may flow through solenoid 98 to energize it and effect operation of cylinder-piston unit 93-91 to lower the probes and keep them down as long as said solenoid is energized.

In line D4 there are relay contacts represented as switch 96 that is closed when the probes lower with lever 90 moving to the left hand limit of its travel. There are also like contacts or switch 180 that is closed by energizing latch-in relay 177. The several solenoid valves 67 for the filling valves are designated by the circles V-1-S, V-2-S, V-3-S, V-4-S, V-5-S and V-6-S and they are all connected in parallel to the lines X<sub>1</sub> and X<sub>2</sub>.

in line D4 through vertical lines 181 and 182. However, there is a normally closed relay operated switch 183 in series with each of these valve solenoids 67 so that each valve will remain energized only so long as its individual switch 183 is closed.

Line D5 of the diagram has a series of six normally open switches 184 (one for each filling valve) connected in series so that all must be closed before current can flow from the hot line through the latch release coil 177a of the latch-in relay to open switches 178 and 180.

Line D6 includes the primary winding of a step-down transformer 185 for inducing a low voltage current, typically about 11 volts in the probe circuit comprising the transformer secondary 185a, line 186 and vertical lines 187 and 188. Line 188 is connected through line 189 to the other side of the transformer secondary 185a and to ground. For each filling valve there is a circuit leading from vertical line 187 to vertical line 188, these circuits all being in parallel, and each comprises a line 190, probe relay coil 191, and a probe 80 with its container, all in series. The arrangement is such that when a circuit from vertical line 187 can flow through line 190, probe relay coil 191 and probe 80 and the contents of the can to vertical line 188 the relay coil 191 will be energized to open the normally closed contacts 183 for that filling station, thereby allowing its valve 67 to close and at the same time closing the normally open contacts 184 for that same filling station. Thus, as each can or container is filled to a level where the product contacts the probe 80 that is then projected into it, the filling spout or valve for that container will close with the de-energizing of solenoid valve 67 to effect closing of the product supply valve for that station, as previously explained. Since one can may fill more quickly than another, the closing of the product supply valve at one station does not affect the closing of the product supply valves at other stations, since the solenoid valves 67 are connected in parallel. However, until all cans have been filled the probes must not be raised, so the relay contacts 184 for each of the filling stations are all in series, and a circuit is not completed to latch-in relay release coil 177a until all of the probe relay coils 191 have been energized by the filling of all of the cans to the required level and thereby close the relay contacts 184 in the entire series.

Line D7 of the diagram includes lever actuated switch 97 and the star-wheel release relay 41. As soon as latch-in relay release 177a is actuated with the filling of all of the containers under the several spouts, as above explained switch 178 is opened. This de-energizes solenoid valve 98, thereby reversing air flow to the cylinder 93 to move lever 90 (FIGS. 7 and 8) to the right. As lever 90 moves to the right, it momentarily closes switch 97 in line D7 of the diagram to energize the solenoid of the starwheel latch release relay 41, allowing the filled containers to move out of the container filling station. When all filled containers have cleared the star-wheel it will have made one revolution, and since switch 97 was only momentarily closed, the star-wheel latch 35 will engage the step on cam disk 34 (FIG. 3) and restrain further rotation of the star-wheel. Just before this occurs, arm 43 will move past proximity switch 44 again closing latch-in relay 177 to repeat the operation, provided however that proximity switch 100 is also closed. Arm 43 is positioned to move just

past proximity switch 44 operating position so that the system cannot recycle until the star-wheel has made a revolution to clear all of the filled cans from under the filling spout, at which time the filled cans will have been replaced by the six empty cans immediately following them.

Line D8 of the diagram includes the circuit for the conveyor driving motor 21. In this line there is a manually operated starting switch 175 which closes a main switch 175a and an emergency "stop" or overload switch 175b. The first step in operating the machine after shut down is to start the conveyor by closing switch 175a, switch 175b then being closed. This will bring containers from an external source into the machine so that the machine will be ready to function when switch 44a in line D2 is closed. Switch 175-175a will remain closed until stop switch 175b is operated, after which the switches 175-175a must be reset to again start the conveyor.

While the invention is primarily used for the filling of metal cans, it may also be used for filling glass containers, in which case there may be spaced parallel probes 80 for each can or when the single probe for each container here shown contacts the liquid product in the can, the current will be grounded through the down-coming stream of product instead of through the metal can and in either case the operation will be the same as with metal cans.

The cans, which at the time of filling have no top, have a roll seam around the bottom. If the empty cans are crowded too forcefully together the seam of a following can may tend to climb or ride up on the seam of the can ahead, thereby tilting the second can. This does no harm except under the filling spouts the cans will not be uniformly filled with product if one can is level and another tilted. FIG. 10 shows an arrangement for relieving the pressure of the following cans against the eight or nine cans between the star-wheel and the proximity switch 100. For this purpose, one of the side walls, 7, of the enclosure has a solenoid 200 mounted thereon just ahead of the proximity switch 100. This solenoid has an armature 201 that projects through the side wall 7 at a level above the lower side rails 24 and below the upper side rails. It has a terminal 202 curved to generally follow the contour of the cans. When the solenoid 200 is energized, the terminal 202 of the armature will push the can which is then in position opposite said terminal and move the can laterally just slightly, thereby breaking its contact with the container ahead just enough so that when the leading container is stopped by the star-wheel the few cans in the series between the armature and the star-wheel will be relieved of the pressure of the long line of oncoming cans back of the armature. When the solenoid 200 is de-energized, a spring retracts the armature and frees the containers so that they may again travel forward. For simplicity this brake arrangement is described as being a solenoid. Actually we prefer to use an air cylinder controlled by a solenoid valve.

In the diagram, line D3 includes a circuit 203 in parallel with the probe raising solenoid valve 98 which includes the solenoid 200 so that when the valve 98 operates to effect lowering of the probes, solenoid 200 will be energized to operate armature 201 and its terminal 202 to relieve the pressure of the line of cans against those in the filling section and when solenoid valve 98 is de-energized to raise the probes, the armature 201

will retract to allow empty cans to follow into position under the filling nozzles as the filled cans are moving out past the star-wheels.

While the circuit above described in FIG. 9 is fully automatic, the machine could of course be operated manually by the use of circuitry where a succession of signal lights would enable an operator to push buttons in a proper sequence. Also, the fundamental elements of the circuits may be augmented by the use of various other relays and amplifier circuits. All relays and solenoid operated valves and switches are of conventional construction and available as "off-the-shelf" items forming no part, per se, of our invention.

The apparatus as here described functions smoothly repeating several cycles a minute. The cold product, such for example as ketchup or tomato paste for restaurant and institutional use, flows into the cans under pressure and the cans pass directly from the sterilizer into the atmosphere of steam in the filling chamber. At the discharge end of the filling apparatus the cans pass through exit 9 into a closed steam-sterilized tunnel or enclosure to the can or container-closing or seaming machine where they are closed or sealed in the conventional manner.

Since the cans move intermittently in a straight line, all significant bearings and operating parts are outside the machine, and complications inherent in turntable-type filling machines are avoided.

We claim:

1. Container-filling apparatus comprising:

- a. an elongate tunnel-like enclosure having an entrance end and a discharge end,
- b. means for maintaining an atmosphere of steam in the enclosure,
- c. a continuously operating conveyor on which containers are carried in a single line from one end of the enclosure to the other,
- d. an in-line series of filling valves above the enclosure, each having a fixed product discharge tube depending therefrom, the enclosure having a series of openings therein corresponding in number to the number of discharge tubes with a separate one of said discharge tubes projecting through one of said openings and terminating above the conveyor clear of the containers on the conveyor and so positioned that each discharge tube will be positioned to discharge product into one of a group of containers in line on the conveyor beneath said tubes, each of the several valves being connected with a source of product supply so arranged that product flows by gravity into the respective containers from the respective tubes at rates that may vary,
- e. means for blocking the travel of the line of containers arranged to stop the travel of the containers with one container under each product discharge tube,
- f. means operable to effect opening of all of said filling valves simultaneously when the containers are in position under the tubes,
- g. means for separately effecting the closing of each filling valve as the product in the container to which said valve admits product reaches a predetermined level, and
- h. means arranged to release said blocking means only when all of the filling valves have been closed and to thereafter hold the blocking means released until all of the containers in the group which have

been so filled have all been moved by the conveyor away from beneath the product discharge tubes and while succeeding containers are moved by the conveyor into position under the said tubes, and then restore said blocking means to container-blocking position for repeating the filling cycle.

2. Container-filling apparatus as defined in claim 1 wherein there is a means to prevent the opening of the filling valves unless there are at least sufficient empty containers on the conveyor to provide a container under each filling tube.

3. Container-filling apparatus as defined in claim 2 in which said last-named means comprises a proximity switch on the enclosure positioned between the entrance end of the enclosure positioned between the entrance end of the enclosure and the first product discharge tube.

4. Container-filling apparatus as defined in claim 1 in which said means for blocking the travel of the containers comprises a star wheel having vanes that move in succession over the conveyor in the path of travel of the containers thereon with the number of vanes corresponding to the number of filling valves, said star wheel being positioned at a location following the endmost discharge tube past which the filled containers move and in advance of the discharge end of the enclosure, said means arranged to release the blocking means comprising a latch normally holding the star wheel against rotation with means to release the latch just long enough for the star wheel to make a single revolution.

5. Container-filling apparatus as defined in claim 1 in which said means for blocking the travel of the containers comprises a star wheel having vanes that move in succession over the conveyor in the path of travel of the containers thereon with the number of vanes corresponding to the number of filling valves, said star wheel being positioned at a location following the endmost discharge tube past which the filled containers move and in advance of the discharge end of the enclosure, the said means arranged to release the blocking means comprising:

- a. a shaft for the star wheel, a cam on the shaft having a step thereon, a latch with means for yieldingly holding the latch in engagement with the latch normally abutting said step to restrain the star wheel against rotation in the direction in which it is urged by the containers on the conveyor, electrically-controlled means arranged to momentarily release the latch, said means for yieldingly holding the latch engaged with the cam serving to move the latch back into engagement with said step when the star wheel has rotated the cam to a position to be latched.

6. Container-filling apparatus as defined in claim 1 in which there are a series of probes arranged to be lowered from a level above the tops of the containers down into the interior of the containers so positioned that one probe enters each container that is under a product discharge tube with means for raising and lowering the probes in unison, said means for raising and lowering the probes including also means to effect simultaneously the opening only of the filling valves when it operates to lower the probes, the probes controlling the closing of the individual filling valves when the product in each container contacts its respective probe.

7. Container-filling apparatus as defined in claim 1 in which there are a series of probes arranged to be lowered from a level above the tops of the containers down into the interior of the containers so positioned that one probe enters each container that is under a product discharge tube, a common supporting bar on which all of said probes are mounted, means for raising and lowering said supporting bar, electric switch means operated by said raising and lowering means arranged to effect simultaneous opening of the filling valves when said bar is lowered, the probes controlling the closing of the respective filling valves independently of one another when the product in each container contacts that individual probe which enters the container, and circuit means so arranged that said bar-raising and lowering means can effect raising of the bar only when all filling valves have been closed, said bar raising and lowering means being arranged to effect release of said blocking means when the bar is raised.

8. Container-filling apparatus as defined in claim 7 wherein there is a proximity switch on the enclosure between the entrance end of the enclosure and the first product discharge tube positioned to be operated by containers on the conveyor with a circuit controlled thereby arranged to effect operation of supporting bar raising and lowering means to effect lowering movement only of the bar, and wherein there is another electric circuit which includes all of the probes arranged to operate said bar-raising and lowering means to effect only the raising of the bar when every container under a product discharge tube has been filled to a level where the product in the container touches the probe which projects into it.

9. Container-filling apparatus as defined in claim 8 wherein each probe is also included in an electric circuit arranged to effect the closing of the filling valve that delivers product to the container into which that probe then projects at such time that the level of the product touches the probe.

10. Container-filling apparatus as defined in claim 9 where the bar raising and lowering means with the said probes, the filling valves and operating means therefore and said cam and latch and operating means for the latch are all outside the steam-filled enclosure.

11. Container-filling apparatus comprising:

- a. an elongate enclosure having an entrance end and a discharge end and means for maintaining an atmosphere of steam therein,
- b. means for intermittently advancing a line of containers in groups through the enclosure from the entrance end to the discharge end,
- c. means for filling each group of containers in said line uniformly with a product when the containers are stationary; and
- d. means controlled by the position of a group of the containers in the enclosure when they are stopped to effect the filling of product into the containers of the group, and means controlled by the level of product in the respective individual containers in the group arranged to terminate the filling of product into the containers as each becomes filled and means arranged to effect the simultaneous movement of the filled containers in the group only after the filling of product in all of the containers has been finished.

12. The apparatus defined in claim 11 wherein there is a star wheel for holding a group of containers in posi-

tion under the filling means, the star wheel having a number of vanes corresponding to the number of containers in each group whereby the star wheel makes one complete revolution as each group of filling containers moves from beneath the filling means, and means controlled by rotation of the star wheel for preventing the advance of another group of containers through the enclosure until all of the filled containers in a group have first moved clear of said filling means.

13. In a container-filling apparatus wherein there is a line of single containers in single file on a continuously-moving conveyor, the travel of which line of containers only is interrupted each time a predetermined number of empty containers in the group at the lead end of said line is each in product-receiving position under a separate individual filling tube and filled with product, and wherein the travel of the line of containers is then resumed to move the filled containers from beneath the filling tubes and they are replaced with an equal number of the empty containers next in the line, the improvement comprising wherein there is a means for electrically sensing when each separate container under the several filling tubes has been filled to a predetermined level comprising a vertically-movable bar having a series of spaced probes therealong electrically insulated one from another with the probes thereon so positioned that when the bar is lowered, one probe will enter each of the containers so positioned under the filling tubes to the level to which the container is to be filled, and when the level of product in each container all make contact with their respective probe the bar is raised to be clear of the tops of the containers, the means for raising and lowering the bar comprising a rock shaft with crank arms thereon with links connecting said crank arms to the bar for lowering or raising the bar as the shaft is rocked one way or the other, a fluid pressure cylinder and piston unit operatively connected with the crank arm for moving it through a predetermined arc to raise or lower the bar and wherein each filling tube is connected with a product supply manifold through its individual electro-magnetically-operated filling valve and each filling tube also has a discharge terminal spaced from the valve, there being a star wheel arranged with vanes that project into the path of travel of the containers on the conveyor at a location to be rotated by the filled cans moving from under the filling tubes, the star wheel having a latch that holds the star wheel against rotation after said predetermined number of filled containers has passed from under the filling tubes and has been replaced by empty ones, electro-magnetic means for releasing said latch, said probes each being in an individual valve-closing circuit including a relay which is energized when the product in a container touches the probe in said container, the relay having contacts arranged to effect closing of the valve in its circuit when the relay is energized, said relays also each having contacts in a series circuit separate from the valve closing circuit which includes all of the relays arranged to effect operation of the said cylinder and piston means for raising the probes only after all of said relays in the series circuit have been closed.

14. The apparatus defined in claim 13 wherein there is a lever on said rock shaft that is moved through an arc when the cylinder and piston unit operate to move the rock shaft and wherein there is a switch positioned

to be operated by said lever to energize said electromagnetic latch-releasing means when the lever moves to a position where the probes are clear of the containers which have just been filled.

15. The apparatus defined in claim 14 wherein there is a switch means operated by rotation of the star wheel arranged to effect the operation of the cylinder and piston means to lower the probes only after a predetermined rotation of the star wheel by the movement of filled containers past the star wheel has taken place, and switch means positioned to be operated by said lever as it operates to move the probes into the containers arranged to effect the simultaneous opening of all of said product supply valves.

16. Apparatus as defined in claim 15 in which there is an enclosure for the conveyor providing a sterilizing section in advance of the filling spouts and extending continuously to a location beyond the star wheel and wherein there is means for continuously maintaining an atmosphere of steam in the enclosure, the top of the enclosure having openings therethrough into each of which one of the discharge terminals of a filling tube is fitted, the filling valves, manifold, vertically movable bar, rock shaft, lever and cylinder and piston unit for moving the lever and the star wheel latch and operating means therefore, all being outside said enclosure.

17. In an apparatus for simultaneously filling a group of containers with a sterile product in an aseptic atmosphere, the invention comprising:

- a. an elongate enclosure and a continuously moving conveyor for supporting and moving a line of containers to be filled in single file through the enclosure,
- b. a plurality of filling tubes arranged in line over the conveyor, each filling tube extending through the top of the enclosure,
- c. each filling tube being connected with a common product-supplying manifold outside the enclosure through a separate valve also positioned outside the enclosure for controlling the flow of product from the manifold through the tube,
- d. each valve having a solenoid for opening it when the solenoid is energized and spring means arranged to effect closing of the valve when the solenoid is de-energized,
- e. a star wheel in the enclosure arranged in turnstile fashion over the conveyor having a number of radial vanes equal to the number of filling tubes, and a cam driven by the star wheel,
- f. latch means outside the enclosure biased to engage said star wheel driven cam and normally hold the star wheel against rotation, and means for temporarily withdrawing the latch from the cam to permit only a single rotation of the star wheel when it is released, whereby the star wheel will normally block the movement of containers while the conveyor continues to move and with the containers so located that one container will be positioned under each filling tube and when the latch is released the star wheel may then rotate only sufficiently to pass a number of containers corresponding to the number of filling tubes.

18. Container-filling apparatus comprising:

- a. an elongate tunnel-like enclosure having an entrance end and a discharge end,
- b. means for maintaining an atmosphere of steam in the enclosure,

c. a continuously-operating conveyor on which empty containers to be filled are carried in a continuous single line in contacting relation from one end of the enclosure, filled while in the enclosure and discharged at the other end,

d. a plurality of filling valves above the enclosure with fixed product discharge tubes opening through the top of the enclosure, each arranged to discharge product into a separate container on the conveyor,

e. means for blocking the travel of the line of containers arranged to stop the travel of the containers with one container under each product discharge tube,

f. means operable to effect opening of all of said filling valves simultaneously when the containers are in position under the tubes,

g. means for closing each filling valve individually when the container which receives product from it has been filled to a predetermined level,

h. means arranged to release said blocking means only when all filling vanes have been closed and keep said blocking means released until the containers so filled have all been moved by the conveyor away from beneath the product discharge tubes and while succeeding containers are moved by the conveyor into position under the said tubes, and then restoring it to container-blocking position for repeating the entire cycle, and

i. means arranged to relieve those containers on the conveyor positioned under the filling valves waiting to be filled from the pressure of the line of containers on the continuously-operating conveyor rearwardly of those waiting to be filled to thereby assure that such containers so positioned will remain level until such time as the containers have been filled and the blocking means released.

19. In an apparatus wherein a continuously-operating conveyor moves a continuous line of abutting empty containers into an elongated tunnel-like enclosure in which a group of containers at the lead end of the line are filled while positioned in the enclosure, which group is then discharged, the invention comprising:

- a. an elongate enclosure and a continuously-moving conveyor for supporting and moving a line of containers to be filled in single file through the enclosure with the containers in contacting relation to one another,
- b. a plurality of filling tubes arranged in line over the conveyor, each filling tube extending through the top of the enclosure,
- c. each filling tube being connected with a common manifold outside the enclosure through a separate passage in which is a valve positioned outside the enclosure,
- d. each valve having a solenoid for opening it when the solenoid is energized and spring means arranged to effect closing of the valve when the solenoid is de-energized,
- e. a star wheel in the enclosure arranged in turnstile fashion over the conveyor having a number of radial vanes equal to the number of filling tubes and a cam driven by the star wheel,
- f. latch means outside the enclosure biased to engage said star wheel driven cam and normally hold the star wheel against rotation, and means for temporarily withdrawing the latch from the cam to permit

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only a single rotation of the star wheel when it is released, whereby the star wheel will normally block the movement of containers while the conveyor continues to move and with the containers so located that one container will be positioned under each filling tube and when the latch is released the star wheel may then rotate only sufficiently to pass a number of containers corresponding to the number of filling spouts,

- g. said latch means cooperating with the star wheel and arranged to limit the star wheel to a single revolution after each time latch is released and thereby temporarily hold a container under each filling spout,
- h. a series of vertically-movable probes passing through the top of the enclosure, one probe being positioned to enter each one of the containers so

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- temporarily positioned under a filling tube,
- i. means outside the enclosure for raising and lowering all of said probes in unison from a position above the container so positioned to a position where each probe enters the upper portions of one of the containers in the group which is so positioned under the filling tubes,
- j. means for continuously maintaining an atmosphere of steam in the enclosure, and
- k. means for restraining the containers on the continuously-moving conveyor from pushing against the group positioned under the filling tubes to prevent any such containers so positioned from being tilted and thereby prevent non-uniform filling which would occur if one or more of the containers so positioned became tilted.

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