ABSTRACT: A versatile container rinser and inverter has an endless succession of container-receiving and handling pockets into which the containers are fed sidewardly in an upright position, transported about a rinsing wheel which subjects the containers to external and internal rinsing, whereafter the containers are transported in an upside down condition for drainage and then returned to upright position and ejected from the pockets. A single line of containers or a plurality of lines of containers can be handled. A single line of containers can be subjected to a double rinse or a double drain, or to alternate rinses, as desired.
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CONTAINER RINSER AND INVERTER

This invention relates to a container rinser and inverter in which a continuous succession of open top containers can be fed into the apparatus, transported through one or more rinsing and drain cycles, and then delivered from the machine for transportation to filling equipment or the like.

Before containers such as bottles whether of glass, metal or plastic, and cans of various types may be filled with consumable contents, it is customary, and often required by law that the containers be cleansed and sterilized. Various types of apparatus have been provided to meet production line requirements to effect such rinsing. In general, however, prior arrangements have been unduly complicated and costly to operate, and special complicated and elaborate mechanisms have been employed to effect rinsing, inversion and drainage of the containers, as well as complicated loading devices.

According to the present invention, a simple and efficient container-receiving and -handling pocket construction and arrangement enables high-speed, simple and efficient continuous production line rinsing of the containers.

An important object of the present invention is to provide a new and improved container rinser and inverter in which the containers are adapted to be continuously fed into and out of an endless series of continuously running pockets.

Another object of the invention is to provide a container rinser and inverter provided with new and improved container-handling pocket structure.

A further object of the invention is to provide new and improved container-handling pocket structure for a container rinsing and inverting apparatus. Still another object of the invention is to provide a new and improved container rinsing and inverting machine in which the containers are processed under generally aseptic conditions.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic isometric illustration of apparatus embodying features of the invention;

FIG. 2 is a schematic isometric illustration of a modification of the apparatus;

FIG. 3 is a fragmentary schematic top plan view of the apparatus in FIG. 2;

FIG. 4 is a fragmentary side elevational view of the container-handling pocket structure of the apparatus;

FIG. 5 is a sectional elevational view taken substantially along the line V-V of FIG. 4;

FIG. 6 is a fragmentary sectional detail view taken substantially along the line VI-VI of FIG. 3;

FIG. 7 is a fragmentary top plan view of the container-handling pocket structure of FIG. 5; and

FIG. 8 is an exploded isometric view of a modified container-handling pocket structure.

On reference to FIG. 1, a container rinser and inverter 10 is shown to which containers such as bottles 11 in upright open top condition are adapted to be delivered as by means of an endless conveyor 12. From this conveyor, the containers are diverted by a guide structure 13 to and maintained in successive loading notches of a vertical axis star wheel 14 which has a lower coronatal transfer plate 14a on which the containers are received and by which the containers are successively loaded into respective pockets 15 which run in endless circuit on endless carriers 17 such as suitable sprocket chains running over and between sprocket wheels 18 rotatably supported on respective shafts 19 journaled on a supporting frame comprising spaced upright frame bars 20. Support and rotary power for the feed-in wheel 14 is provided through a vertical shaft 21 suitably supported to depend from and driven by mechanism within a housing 22 mounted on a housing structure 23 carried by the frame bars 20. Driving power for the feed-in wheel 14 and the sprocket wheels 18 may be provided by an electrical motor 24 which may be suitably mounted on one of transverse base bars 25 supporting the upright frame bars 20. After being fully engaged by the respective pockets 15, the containers 11 are moved in and with their pockets onto a turnover container-engaging guide 27 following an arcuate path the radius of curvature of which is complementary to the path of movement of the pockets about the sprocket wheels 18 adjacent to and associated with on the same shaft and coronatal with a rinsing jet nozzle wheel 28. This wheel has a peripheral series of radially outwardly directed nozzles 29 which are supplied with a rinsing liquid from any suitable source as by delivering the liquid under pressure through a supply duct 30 to an outer end of the associated shaft 19 which is hollow for this purpose and has communication through suitable passages in the wheel 28 with the respective nozzles 29 which are spaced complementary to the pockets 15 as they move about the wheel synchronized with rotation of the wheel. Thereby as the pockets 15 approach the spray range of the nozzles of the rinsing wheel 28 rinsing fluid may enter through respective openings 31 in at that time inverted base portions 32 of the pockets to flush and rinse external surfaces of the containers. As the pockets and the containers transported thereby travel the inverting track or guide 27, the openings 31 of the pockets and the opening or mouth ends of the containers 11 which are in alignment therewith assume generally axial alignment with the nozzles 29 and thus the jet or spray streams from the nozzles enter the interiors of the containers. Whereas, as shown, the containers 11 are necked bottles, a substantial volume of the rinsing fluid may accumulate within the bowls as they travel toward the fully inverted position. Thereupon the bottles drop downwardly in the respective pockets 15 with the bottle shoulders resting on the base 32 and the necks projecting downwardly through the openings 31, and rinsing liquid L trapped within the bowls gradually drains out, efficient drainage being assured by a substantial inverted run of the pockets to a reverting or return track guide 33 which is the substantial counterpart of the guide 27 and follows a radius of curvature complementary to the return path described by the pockets 15 and the associated containers 11 about the sprocket wheels 18 at the opposite end of the machine from the rinsing wheel assembly.

After the rinsed containers 11 reach the lower end of the return guide 33 and resume an upright position, they may be delivered out of the respective pockets where the apparatus is conditioned for single line, single rinse operation. For this purpose the machine may have but a single rinsing wheel 28. In the illustrated arrangement in FIG. 1, however, provision has been made for plural rinsing. Hence, as the containers 11 assume upright position at the completion of return, they are deflected, as by means of a deflecting guide bar 34 to shift gradually from the entry side of the respective pockets toward the opposite side as the pockets travel in a return run toward the loading wheel 14. For this purpose, the pockets 15 are constructed to accommodate a pair of the containers simultaneously. Then, as the returned containers again reach the inverting guide 27, they come within the range of a second rinsing wheel 35 which may be substantially counterpart of the rinsing wheel 28 and has rinsing nozzles 37 which discharge jets or streams of rinsing fluid onto and into the containers 11 as they are recycled through the rinsing circuit offset from the first rinsing circuit or pass such multiple rinsing desirable where, for example, a plurality of rinsing solutions of different character such as first a chemicalized solution and then a washing solution, or a plurality of chemical solutions, the second of which will neutralize the first, or any other desirable sequence of rinsings may be employed. If preferred, the first or the second rinses may be merely a gaseous fluid such as air.

After the containers 11 have been drained in the second cycle inverted run thereof, assuming a liquid rinse has been employed, they are returned along the return guide 33 to upright position and are then deflected out of the respective pockets 15 as by means of guide bars 38 onto a discharge transfer wheel 39 which is much the same as the star wheel 14 but without the loading notches and preferably rotating at a slightly greater speed by which the containers may be propelled onto a takeoff conveyor 40.
Instead of a double rinse, the containers may be run through the machine in a plurality of cycles in the first of which rinsing occurs and the second cycle may be merely a second drain so that a single-rinse double-drain arrangement is provided. As a practical matter the arrangement disclosed in respect to FIG. 1 may be operated to handle up to as many as 800 containers per minute.

Instead of running the containers through a multiplicity of cycles, a plurality of lines of containers may be run through the machine in a single-cycle, thereby multiplying the capacity of the machine. For example, where the machine may handle up to 800 containers per minute in a double-cycle arrangement, twice that many or up to 1600 containers per minute may be handled in a double-line, single-rinse arrangement as shown by way of example in FIGS. 2 and 3 wherein details of the machine are identical with those described in respect to FIG. 1, but the manner of loading containers into the machine and the manner of discharging the rinsed containers is modified. For this purpose, the machine 10 may be located alongside an endless conveyor 41 which not only supplies the containers to the machine but also transports the rinsed containers away from the machine. For this purpose the containers 11 are fed by the conveyor 41 to a separating guide 42 which divide the containers into a plurality, herein two, lines and divert the respective lines to respective loading star wheels 14° and 14° substantially the same as the loading star wheel 14 but with the loading notches thereof oriented, in this instance for clockwise rotation rather than the counter-clockwise rotation shown in FIG. 1. Thereby the containers are transferred from the conveyor 41 into the pockets 15 which in this instance are arranged to travel in their return run toward the right as viewed in FIG. 2 rather than toward the left as viewed in FIG. 1 to the rinsing wheels 28 and 35. The containers 11 are directed by the guide bar structure 42 from the loading wheel 14° into the far sides of the pockets 15 as viewed in FIGS. 2 and 3 and from the loading wheel 14° to the near sides of the pockets for respectively rinsing by rinsing fluid streams projected by the nozzles 29 and 37.

After rinsing and drainage of the liquid L therefrom, the containers drain and are returned to upright position and are diverted from the pockets 15 as by means of guide bars 43 onto respective discharge transfer wheels 39° and 39° which are substantially the same and operate the same as the transfer wheel 39. Thence, the containers are propelled onto the conveyor 41 and taken away, as for example to filling equipment. It may be noted that the discharge wheels are provided with corotational container bottom supporting respective plates 44.

In order to facilitate sideward entry and discharge of containers, the pockets 15 are provided with curvately tapered lead-in surfaces 45 (FIGS. 4 and 7) along the inner margins of and extending from vertical edges of a pair of spaced parallel container propelling wall flanges 47 extending from and preferably integral with the base panel 32 of each of the pockets. Each of the pockets 15 thus comprises a desirable unitary structure which is adapted to be economically made as a casting from suitable material and preferably from a plastic material such as nylon which has a low coefficient of friction, is easily cast and easily machined.

Means are provided for attaching the respective pocket units or members 15 to the driving chains 17, in one desirable arrangement comprising respective brackets 48 which may comprise angular link plates on the chains secured as by means of screws 49 to the adjacent end portions of the outer face of the base panel 32 of the pocket (FIGS. 4, 5 and 7).

In an alternative structure for attaching the pocket to the driving chains 17, the machine basis 51, and the respective brackets 48 may have attached thereto generally T-shaped respective connectors 50 (FIG. 8) engageable by relative sliding assembly movement within a generally T-shaped groove provided on the outer face of the base plate 32 of a pocket unit 15 as by means of complementary undercut parallel spaced bars 51 attached to the unit as by means of screws 52 and adapted after assembly with the connecting T-members 53.
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operable handwheel 78 by which all of the adjustment foot mechanisms 69 can be simultaneously operated. To this end the respective opposite ends of the shaft 77 may carry similar driving worm wheels to drive simultaneously the adjustment devices 69 at one side of the machine. Simultaneously, the adjustment devices 69 at the opposite side of the machine are adjusted by means such as respective coupling shafts 79 having worm gears 80 meshing with the worms 75 of the adjustment shaft 77, and having suitable gear coupling with the respective rotary adjustment nuts 72 of the adjustment devices 69 at said opposite side of the machine. Alternatively, drive chains may be traversed over respective sprockets on the respective adjustment rods at the opposite sides of the machine base bars 25 to effect unison driving of the rods 71. Through this arrangement, height adjustment for various sizes of containers can be effected quickly as needed simply by turning the hand wheel 78 to raise or lower the main frame of the machine.

Driving of all of the moving parts of the machine is effected by power derived from the motor 24 through a gearbox 81 (FIG. 1) which is connected through a shaft 82 and a suitable sprocket thereon (not shown) which drives a chain 83 (FIG. 6) which in turn drives a sprocket wheel 84 keyed to one of the shafts 19, and preferably the shaft which carries the driving sprocket wheel 84. By driving such shaft 19 and thereby the pocket driving sprocket 18, the pocket carrying chains 17 also drive the sprocket wheels at the opposite end of the machine.

Driving of the one or more loading wheels (14, 14'14'') and the discharge wheels (39, 39' and 39'') is preferably effected by drivingly connecting the same with the driven shaft 19, as by means of a suitable sprocket wheel 85 keyed to said shaft FIG. 3 and 6, and driving a chain 87 drivingly connected to a transverse sprocket 88 mounted on the machine frame and having a bevel gear connection with the respective driving and supporting shafts of the loading and discharge wheels, substantially as shown.

Desirably rinsing is effected in as nearly as practicable an aseptic atmosphere within the housing for the machine provided by the housing body 23, the cover 61 and the pan 64. For this purpose, one or more sterile gas injecting ducts or nozzles 89 (FIG. 6) supplied from any suitable source communicate with the interior of the housing to purge the atmosphere within the housing and maintain a pressure differential which will cause at least slight outflow from the housing and thus substantially prevent influx of contaminated air. To maintain the sterile atmosphere in various vertical adjustments of the machine, and to permit access to the pan 64 at any place therealong or thereabout for cleanout at any time, either while the machine is in operation or when it is shut down such as to remove pieces of a broken bottle in the unlikely event of such breakage, and to permit ready entry and exit of containers, the relationship of the housing body 23 and the pan 64 is such that there is a substantial gap therebetween, which gap is bridged by an enclosing sheet curtain 90 secured at its upper margin to the housing body 23 and its lower margin fitting loosely within the pan against the inside surfaces of the upstanding walls of the pan, substantially as shown in FIG. 6. Desirably this curtain comprises a flexible clear vinyl sheet. Internal pressure of the sterilized air within the housing presses the curtain against the inside surfaces of the pan walls, spent rinsing liquid in the pan and wetting the lower margins of the curtain 90 assisting in the sealing engagement of the curtain with the pan walls. At those intervals along the curtain 90 where access must be had to the interior for entry or discharge of containers, suitable doorway openings or windows may be provided. As relative vertical adjustments are made between the main frame of the machine and the pan 64, the curtain 90 automatically adjust along the pan walls. By having the curtain transparent, continuous visual inspection of the lower portion of the machine within the housing and above the pan 64 is readily enabled.

In order further to implement vertical adjustments of the machine to accommodate containers of various heights, means are provided for thrust bearing support of the vertical shafts for the star wheels 14, 14', 14'' and the vertical shafts of the discharge wheels 39, 39', and 39' at a stationary elevation relative to the upper frame of the machine. For this purpose, respective thrust bearing support brackets or bars 91 (FIGS. 1 and 3) extend rigidly laterally a suitable distance from the pan 64 and preferably from the bottom thereof. On the brackets thus provided, suitable thrust bearings support the respective vertical shafts rotatably. On their upper end portions these shafts extend with a sliding key connection through bevel gears 92 which are rotatably driven by the horizontal shafts 88 to rotate the wheel shafts. Through this arrangement, as the upper frame is adjusted vertically by partation of the hand wheel 78, the respective load-in star wheels and discharge wheels remain at the same elevation so that the bottom supporting or dead plates 14, 14' and 44 will remain on a level with the respective conveyors 12, 40 or 41, as the case may be.

Further, in order to avoid any need for replacing the arcuate guides 27 and 33 when vertical adjustments of the machine are made to accommodate containers of various heights, these guides are desirably constructed from resiliently flexible strip material and means are provided to enable the guide strips to adjust their radius of curvature to accommodate the different height containers. For example, the guide strips may be made from resiliently flexible sheet metal or a suitable low-friction plastic of which nylon is exemplary. Efficiently, the guides 27 and 33 may be extensions of at least part or provide part of the runner 62, and thereby have their lower end portions secured as by means of flathead screws 93 (FIGS. 2 and 6) to the platform 63. From the platform, the respective guide members extend upwardly freely on the desired radius of curvature to respective adjustment clamps 94, only one of which is shown in detail in FIG. 6 and in both of which are indicated schematically in FIG. 2. Each of these clamps comprises a fixedly mounted inverted U-shaped bar 95 which extends across and overlies an upper portion of the respective guide strip and has a clamping bar 96 in underlying relation to the guide strip and arranged to be drawn up tight into clamping relation to the strip as by means of bolts 97. Both the respective clamps 94 are located sufficiently spaced from the adjacent end of the strip in the low adjustment aspect of the machine so that by loosening the clamp bar 96 while upward adjustment of the upper frame of the machine is effected, the guide strips will automatically slide outwardly under guidance of the clamp bars and assume a larger radius of curvature proportionate to the relative vertical adjustment effected in the machine frames, to accommodate the larger height containers to be processed.

It will be understood that variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the novel invention.

I claim as my invention:

1. Container-handling apparatus comprising:
   an endless series of side-loading and side-discharging container-receiving pockets;
   endless means for guiding and moving said pockets along a path;
   means for loading containers into said pockets from a side of said path;
   means for discharging the containers sidewardly from said pockets;
   said pockets being of generally U-shape, each having a base portion and spaced-apart wall flanges which extend in planes transversely relative to said paths;
   said path including upper and lower runs wherein said pockets open downwardly and sidewardly in the lower run and open upwardly in the upper run;
   said pockets having openings in the base portions thereof;
   said loading means being constructed and arranged to load open top containers in upright position into the pockets in said lower run so that the open tops of the containers are aligned with said openings;
   means for maintaining the containers in said pockets with the open tops aligned with said openings while the
pockets are moved in said path from downwardly opening relation in said lower run to upwardly opening relation in the upper run so that the containers assume inverted position in the pockets with open top end portions of the containers in said openings.

2. Apparatus according to claim 1, including means for subjecting the containers to rinsing fluid while they are inverted in said pockets, said rinsing means comprising means for directing streams of the rinsing fluid through said openings.

3. Apparatus according to claim 2, comprising a rotary shaft, means on said shaft for controlling movement of said pockets about the shaft axis from said lower run to said upper run, said rinsing fluid means comprising a rotary device mounted corotatively on said shaft and having rinsing fluid nozzles directed toward said pockets and at least in a portion of the rotary movements of said rinsing fluid means aligned with said openings.

4. Apparatus according to claim 1, said pockets having walls extending transversely relative to said path, said walls having slots therein, and stationary dividers extending into said slots and along which the pockets run in said path, said dividers separating the containers in the respective pockets.

5. Apparatus according to claim 1, comprising a supporting frame, a pair of spaced parallel shafts journaled on horizontal axes on said frame, respective sprocket wheel means corotative on said shafts, endless sprocket chains trained over said sprocket wheel means and carrying said pockets to travel in said lower run and about said sprocket wheel means and in said upper run, said pockets being inverted to open upwardly in said upper run in travelling about the sprocket wheel means on one of said shafts and being reverted from upwardly opening to downwardly opening in travelling about the sprocket wheel means on the other of said shafts, means for driving one of said shafts to drive the sprocket wheel means thereof and thereby drive the sprocket chains, the shaft having thereon the sprocket wheel means effecting inversion of the pockets having thereon means for applying rinsing fluid through said openings to the containers in the pockets as they are being inverted.

6. Container-handling apparatus comprising: an endless series of side-loading and side-discharging container-receiving pockets; endless means for guiding and moving said pockets along a path; means for loading containers into said pockets from a side of said path; and means for discharging the containers sidewardsly from said pockets; said means for loading containers comprises a star wheel rotatably mounted on a vertical axis and having a corotational container supporting plate onto which containers are delivered to rest on their bottoms and to be engaged successively in peripheral advancement notches in the wheel; said advancement notches being synchronized with the pockets to load the containers successively into the pockets.

7. Container-handling apparatus comprising: an endless series of side-loading and side-discharging container-receiving pockets; endless means for guiding and moving said pockets along a path; means for loading containers into said pockets from a side of said path; and means for discharging the containers sidewardsly from said pockets; said means for discharging the containers comprising a wheel device rotating on a vertical axis and having a plate receptive of the containers on their bottoms from the pockets.

8. Container-handling apparatus comprising: a supporting frame; a pair of spaced parallel shafts journaled on horizontal axes on said frame; endless flexible means trained over said rotary means; an endless series of side-loading and side-discharging container-receiving endless flexible means to travel in a lower run and about said rotary means and in an upper run; said pockets opening downwardly as well as sidewardly in said lower run and being inverted to open upwardly in said upper run in travelling about the rotary means on one of said shafts and being reverted from upwardly opening to downwardly opening in travelling about the rotary means on the other of said shafts; means for loading containers into said pockets from a side of said path and means for discharging the containers sidewardly from said pockets in the lower run; means for driving one of said shafts to drive the rotary means thereof and thereby drive said flexible means; said means for loading containers into the pockets being located along said lower run and the containers entering the pockets open end up; means including a runner for engagement by the bottom of containers as they move within the pockets in said lower run; and means for adjusting the relative vertical spacing between said pockets in said lower run and said runner to enable handling of containers of various heights in said pockets.

9. Apparatus according to claim 8, comprising means for supporting said runner at a stationary elevation, and means for adjusting said frame vertically to effect said spacing adjustment between the runner and the pockets.

10. Apparatus according to claim 9, housing means enclosing a substantial space about the path of said pockets and in which the containers are adapted to be rinsed, said runner being supported in a tray for spent rinsing fluid, and a curtain extending between said housing means and said tray enabling a substantial range of relative vertical adjustment.

11. Apparatus according to claim 10, said curtain being substantially transparent to enable looking into said space.

12. Apparatus according to claim 10, including means for introducing sterilized gas into said space to maintain a substantially aseptic atmosphere.

13. Apparatus according to claim 10, said curtain being flexible to enable access into said space by flexing said curtain.

14. In apparatus of the character described: a container-handling pocket comprising a generally U-shaped molded plastic member having a base portion and thick spaced wall flanges adapted to receive containers thereinto while the pocket is moved along a path with the space between the walls opening sidewardly relative to the path; said wall flanges having tapered lead-in inside surfaces along margins thereof at a sideward opening therefrom; and means for attaching said base portion to means for moving said pocket member being of a size to receive a pair of containers therein, aligned slots in said wall flanges between container compartment spaces within said pocket and adapted to receive spacer bar means to maintain the containers separated within the pocket.

15. In apparatus of the character described: a container-handling pocket comprising a generally U-shaped member having a base portion and spaced wall flanges adapted to receive containers thereinto while the pocket is moved along a path with the space between the walls opening sidewardly relative to the path and means for attaching the pocket to means for moving the pocket; said base portion having an opening therethrough with which an open top of a container is adapted to register for receiving rinsing fluid through the opening into the open top.

16. In apparatus of the character described: a container-handling pocket comprising a generally U-shaped member having a base portion and spaced wall flanges adapted to receive containers thereinto while the
pocket is moved along a path with the space between the walls opening sidewardly relative to the path; and means for attaching said base portion to means for moving said pocket comprising brackets attached to opposite sides of said base portion and having flanges extending normal to said base portion to serve as connecting links by which the pocket is adapted to be attached to supporting chain means by which the pocket is moved in an operative path.

17. In apparatus of the character described:
a container-handling pocket comprising a generally U-shape member having a base portion and spaced wall flanges adapted to receive containers thereinto while the pocket is moved along a path with the space between the walls opening sidewardly relative to the path; means for attaching said base portion to means for moving said pocket comprising means on said base portion providing a T-slot, and T-shaped connector means receivable in said slot for connecting the pocket to means for transporting the pocket operatively.

18. Container-handling apparatus of the character described, comprising:
a lower container-supporting structure adapted to receive containers in an upright condition;
an upper container-receiving and handling structure including means for transporting the containers from said lower structure and inverting the containers along an arcuate route;
means for relatively adjusting a spaced relation between said structures to accommodate containers of various heights;
a bottom guide for the containers while being inverted comprising a resiliently flexible strip arcuately shaped substantially complementary to said route and fixed at a lower end to said lower structure to receive the container bottoms for travel toward inverted position along said route; and means on said upper structure operable adjacent to the upper end of said strip to retain the same in position and also operable in the relative vertical adjustment of said structures to compel the strip to assume a radius of curvature related to said relative vertical adjustment to accommodate the height of containers for which the adjustment has been effected.

19. Apparatus according to claim 18, said last-mentioned means comprising a releasable clamp which firmly holds the upper end portion of said strip when clamped and which clamp is releasable for enabling the radius of curvature compelling function of the last-mentioned means.

20. Apparatus according to claim 18, the lower end portion of said strip comprising a low-friction runner for supporting the containers on their bottoms while propelled by said handling means toward said inverting route.

21. Apparatus according to claim 18, comprising a second arcuate guide strip of resiliently flexible material operative to guide the containers from the inverted position to upright position as propelled by said handling means, said second arcuate strip being secured at a lower end portion to said lower structure and having an upper end portion, and means on said upper structure cooperative with the upper end portion of said second strip to retain the same in position and also operative to effect variations in radius of curvature of said second strip incident to relative vertical adjustments of said structures to accommodate containers of various heights.