

March 28, 1967

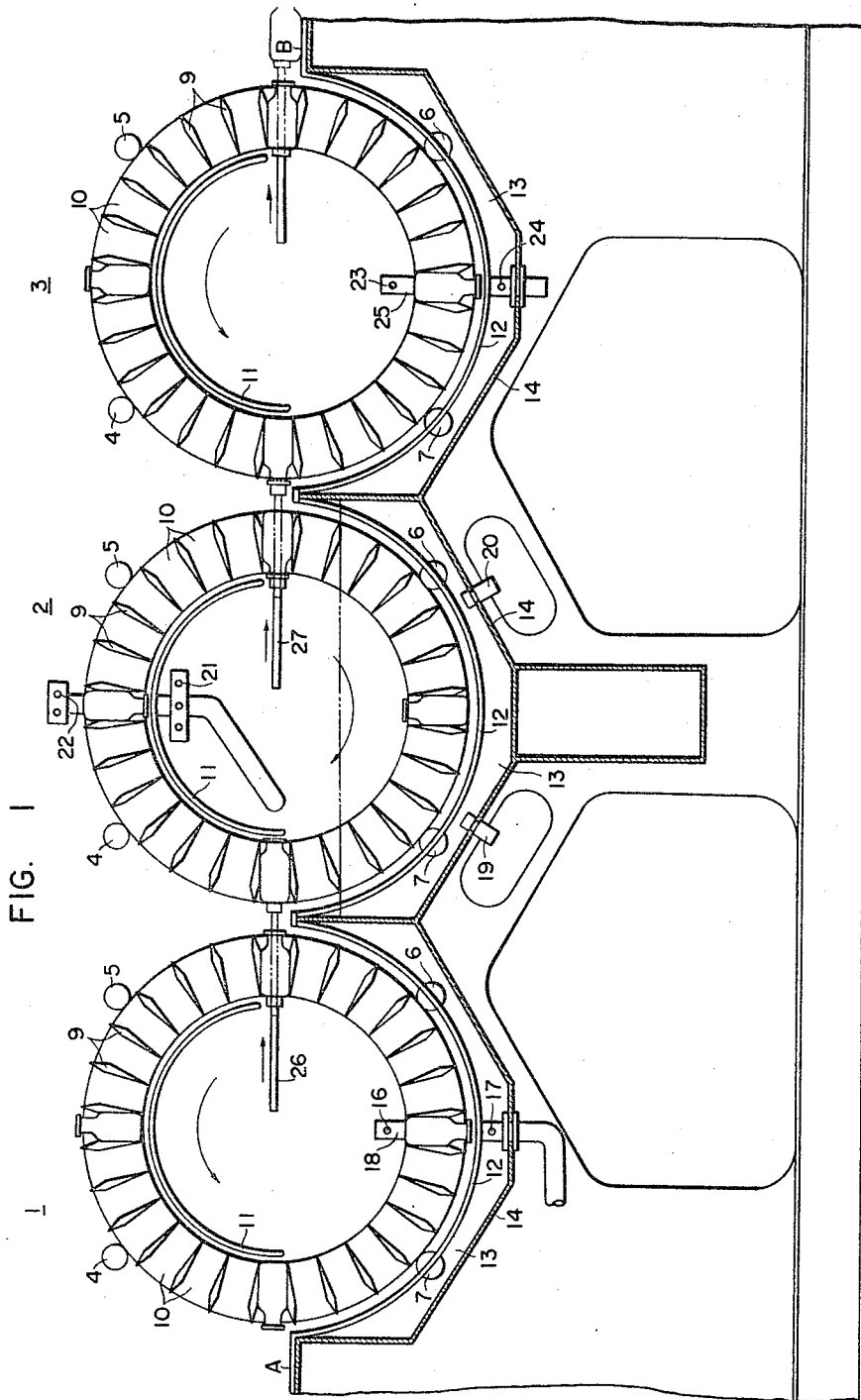
TOSHIMICHI SETO

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CONTINUOUS FEED BOTTLE SYSTEM FOR BOTTLE WASHING MACHINE

Filed April 6, 1965

3 Sheets-Sheet 1



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FIG. 2a

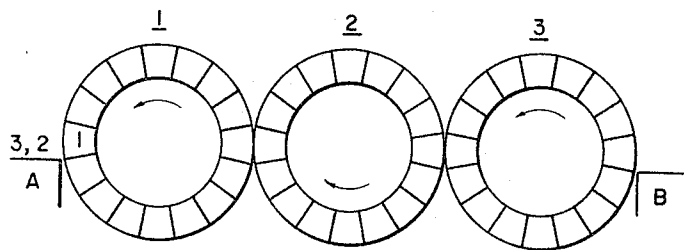


FIG. 2b

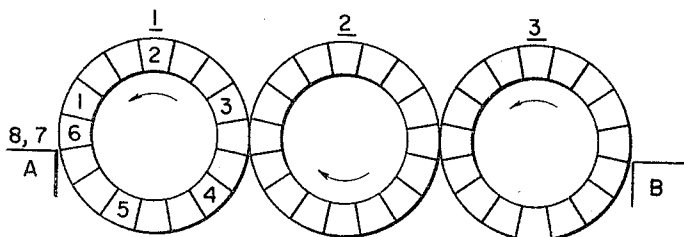
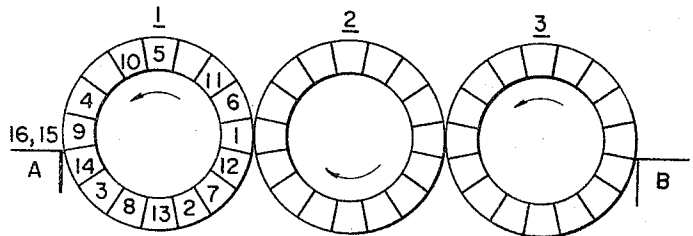


FIG. 2c



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FIG. 2d

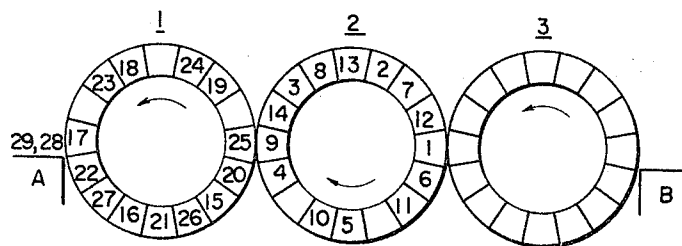


FIG. 2e

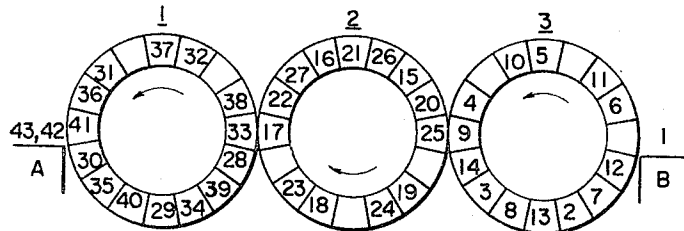
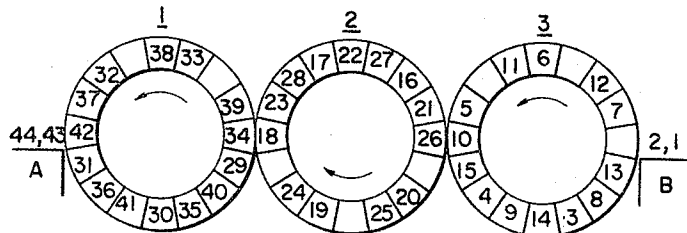


FIG. 2f



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CONTINUOUS FEED BOTTLE SYSTEM FOR BOTTLE WASHING MACHINE

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5 Claims. (Cl. 134-23)

This invention relates to a continuous feed bottle system for use with a bottle washing machine.

In the conventional type of bottle washing machines, it has been common practice to continuously feed bottles to be washed into a cleaning mechanism in which is carried out the steps of immersing the bottles into a washing solution, shower spraying a washing solution upon the bottles, brushing the bottles, ultrasonic cleaning and so on, through a feed bottle system comprising conveyor means, and a multiplicity of supporting members for supporting the bottles. Alternatively, a predetermined number of bottles to be washed are loaded in a bottle holding device of a rotary member or drum type and then subject to a selected one of various cleaning treatments for a predetermined period of time followed by a subsequent cleaning treatment for a predetermined period of time and so on whereby the cleaning operation sequentially proceeds.

However, the continuous feed system utilizing the conveyor means is disadvantageous in that the washing machine as a whole is large-sized and hence requires a large area occupied by the machine for the reason that, due to a difference between either the number of bottles cleaned or detaining times required for the respective cleaning steps including, in combination, the immersing, spraying, brushing, ultrasonic cleaning procedures etc., it is required to use a plurality of identical cleaning steps in parallel relationship or to lengthen the cleaning tank involved so that the capacity of the machine is commensurable with a predetermined speed of the conveyor means.

On the other hand, the washing system utilizing the rotary member or the rotary drum is also disadvantageous in that means for varying the number of revolutions of the rotary member or drum must be provided in order to effect continuous feed and discharge of bottles because of a difference between the number of bottles cleaned or detaining times required for the respective cleaning steps. With the rotary members or drums equal in both diameter and speed of revolution to each other, it is required to load all of a predetermined number of bottles to be washed into the same to be cleaned and then to transfer all the cleaned bottles to the subsequent step after which the predetermined number of other bottles to be washed are again loaded into the drum. This results in a waiting time occurring between any pair of the successive steps and hence in a certain step or steps temporarily ceasing.

Accordingly, it is the primary object of the invention to eliminate the abovementioned disadvantages of the prior art practice.

It is another object of the invention to provide a novel and improved feed system for continuously feeding bottles to be washed into a washing machine with a high degree of efficiency.

With the above cited objects in view, the invention resides in a continuous feed bottle system for use with a washing machine comprising a plurality of rotatory members horizontally disposed at predetermined intervals with the longitudinal axes parallel to each other in a common plane, the rotatory members effecting rotational movement in alternate directions at a predetermined common speed, each of the rotatory members being provided on

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the peripheral portion with $(Kn+1)$ bottle holding cages circumferentially aligned thereon where K is a predetermined number of revolutions of the rotatory member through which the bottles are revolved prior to discharge and n is any integer, each of said rotatory members being operatively associated with a different one of the various cleaning devices of the known construction. Bottles to be washed are successively loaded on a first one of the rotatory members into each K th cage and subject to the cleaning operation of the associated cleaning device for a period of time during which the rotatory member effects a predetermined number of rotations. Thereafter the bottles thus treated are transferred from the first rotatory member to the second rotatory member into each K th cage to be subject to the cleaning operation of the associated cleaning device for the same period of time as on the first rotatory member. Then the bottles are passed successively through the remaining rotatory members in the same manner as above described and finally the bottles are discharged from the last rotatory member from each K th cage whereupon the bottles are completely cleaned.

The invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a diagrammatic view in longitudinal section of a bottle washing machine embodying the principle of the invention; and

FIGS. 2a through f are schematic plan views of rotatory members for holding bottles useful for explaining the principle of the invention.

Referring now to FIG. 1, there is illustrated a bottle washing machine embodying the principle of the invention. An arrangement illustrated comprises three rotatory members generally designated by the reference numerals 1, 2 and 3. Each of the rotatory members 1, 2 and 3 is rotatably supported on its outer periphery by four guide rolls 4, 5, 6 and 7 rotatably disposed on a machine frame (not shown) such that the rotatory members are horizontally disposed at predetermined intervals with the longitudinal axes parallel to each other in a common plane. The rotatory members 1, 2 and 3 are adapted to be driven in alternate directions at a predetermined common speed and in synchronization by any suitable drive (not shown). For example, the first rotatory member 1 is adapted to be driven in a counterclockwise direction as viewed in FIG. 1 or in the direction of the arrow indicated in the interior of the rotatory member, the second rotatory member 2 is adapted to be driven in the clockwise direction or in the direction of the arrow indicated in the interior thereof and the third rotatory member 3 is adapted to be driven in the same direction as first rotatory member 1 as shown in FIG. 1. While three rotatory members are shown in FIG. 1 it is to be understood that any desired number of the rotatory members may be used if desired. In any event it is to be noted that alternate rotatory members should be driven in the same direction.

As shown in FIG. 1, each of the rotatory members 1, 2, or 3 is provided on the peripheral portion with $(Kn+1)$ radial partitions 9 disposed at angularly equal intervals to define $(Kn+1)$ cages 10 for holding bottles to be washed one in each cage. Here K represents the number of revolutions of the rotatory member corresponding to a period of time for which the bottles loaded on the rotatory member in a manner as will be described hereinafter are to be rotated prior to discharge and n is any integer. That number of revolutions will be referred to hereinafter as the number of detaining revolutions. The rotatory members 1, 2 and 3 each preferably have disposed on the peripheral portion a plurality of cage annuli each including the same number of cages 10 with the

cages in each annulus aligned with the corresponding cages in the other annuli longitudinally of the rotatory member.

Assuming in the embodiment illustrated that K has a value of 3 and n has a value of 9, the number of the cages is equal to $Kn+1=28$. Assuming that each of the rotatory members has 8 cage annuli disposed longitudinally thereof, the rotatory member has a total of 224 cages. However, the above specified figures are mentioned only for the purpose of illustration and it is to be understood that any desired numbers different from those above specified may be used if desired.

As shown in FIG. 1 each of the rotatory members 1, 2 or 3 is operatively associated with a stationary guide rail 11 of semi-circular shape disposed adjacent the inner peripheral surface of the cages 10 located on the upper half of the rotating member while the rotatory member is also operatively associated with a second stationary guide rail 12 disposed adjacent the outer peripheral surface of the cages 10 located on the lower half of the rotating member. These stationary guide rails 11 and 12 are provided to prevent the bottles loaded in each cage 10 from falling during rotational movement of the rotatory member.

The arrangement further includes a cleaning tank 13 formed by wall plates 14 enclosing substantially the lower half of each rotatory member 1, 2 or 3 along the associated guide rail 12.

As shown in FIG. 1, a pair of spraying nozzles 16 and 17 are positioned adjacent the inner and outer sides of the particular cage 10 which is at substantially the lowermost position in operation and the nozzles communicate with a conduit 18 extending through the cleaning tank 13. The conduit 18 is operatively coupled to any suitable pump (not shown) serving to spray a washing liquid such as water from a reservoir (not shown) through the conduit 18 and the spouting nozzles 16 and 17. Thus when a bottle accommodated in each cage reaches the position at which it faces the nozzles, the external and internal surfaces of the bottle are subject to a shower cleaning treatment which will be referred to hereinafter as a preliminary cleaning treatment. After having washed the bottles, the soiled water is exhausted from the tank 13 through the bottom.

A cleaning tank 13 identical in construction to the abovementioned tank and operatively associated with the second rotatory member 2 may preferably have contained therein a cleaning solution such as an aqueous solution of caustic soda up to a level designated by dot-and-dash line in FIG. 1. The tank 13 is further provided with a plurality of ultrasonic transducers 19 and 20 disposed at any suitable positions on the wall plate or plates 14. When energized, the transducers 19 and 20 serve to subject the bottles within the cages to an ultrasonic washing treatment. The rotatory member 2 further is operatively associated with a pair of spraying nozzles 21 and 22 disposed adjacent the inner and outer sides of the particular cage 10 which is at substantially its uppermost position. These nozzles 21 and 22 are then connected to a conduit 23 which, in turn, opens into the second cleaning tank 13. Means (not shown) is provided to suck one portion of the aqueous solution within the tank 13 into the conduit 23 for the purpose of spraying the sucked portion of the aqueous solution from the nozzles 21 and 20 upon the bottles in the cages 10 at their substantially uppermost position thereby to further clean the external and internal surfaces of the bottle.

The third rotatory member 3 is operatively associated with a pair of spraying nozzles 23 and 24 substantially identical to the nozzles 16 and 17, in the same manner as the first rotatory member 1 and performs the finish cleaning treatment. A conduit 25 is substantially of the same construction as the conduit 18 as above described in conjunction with the first rotatory member 1 and opens into a third cleaning tank 13 identical in construction to the tank 13 operatively associated with the first rotatory member 1.

The arrangement thus far described is operated as follows: Bottles to be washed are fed onto a feed bottle table A by a suitable conveyor or the like (not shown) and are successively loaded into the bottle holding cages 10 formed on the peripheral portion of the rotatory member 1 rotating at a predetermined speed, by any loading means of conventional design (not shown). It is recalled that in the embodiment illustrated the rotatory members 1, 2 and 3 each has disposed on the peripheral portion eight cage annuli each including 28 cages 10 circumferentially disposed on the peripheral portion. The corresponding cages in each annulus are longitudinally aligned to form individual longitudinal rows. It is assumed that the number of detaining revolutions K of the rotatory member is three. Under these circumstances, eight bottles to be washed are arranged to be loaded at a time into a first longitudinal row of cages 10 facing the bottles at that time and successive sets of eight bottles are subsequently loaded on, set at a time into the 3rd, 6th . . . , rows. In other words the bottles to be washed are successively loaded eight at a time into each third longitudinal row of cages. However the description hereinafter will be directed only to a single cage annulus in order to facilitate the description. Therefore a single bottle is loaded on the rotatory member 1 into each third cage.

Since the rotatory member 1 is rotated at a predetermined constant speed in the counterclockwise direction as viewed in FIG. 1, the bottles thus loaded on the rotating member 1 are moved downwardly and subject to a shower cleaning treatment due to the spraying nozzles 16 and 17. Then the bottles on the rotating member 1 are moved upwardly. During three complete revolutions of the rotatory member 1 the bottles accommodated in the associated cages 10 will have thrice passed the spraying nozzles 16 and 17. After having effect $2\frac{1}{2}$ complete revolutions the bottles in the cages 10 are transferred from the rotatory member 1 to the particular cage on the rotatory member 2 facing that cage 10 on the first rotatory member in which the bottle to be transferred is loaded. This transfer movement of the bottles may be effected by any suitable conventional means for loading each third cage. In FIG. 1, these means are shown as a push rod 26 movable in the direction of the arrow adjacent the same.

It is to be understood that the rotatory member 2 is rotated in the clockwise direction as viewed in FIG. 1 at the same speed as and in synchronization with the rotatory member 1. Therefore, for every cage 10 on the rotating member 1 which reaches the discharging position there will be one cage 10 on the rotating member 2 facing that cage on the member 1. It is also to be understood that a bottle which has been subject to shower cleaning treatment is transferred from every third cage 10 on the rotating member 1 to every third cage on the rotating member 2.

The bottles loaded on the rotating member 2 pass twice through the tank 13 containing the solution of caustic soda and they also pass the ultrasonic transducers 19 and 20 at their lower position twice and pass the spraying nozzles 21 and 22 at the upper position three times while the bottles effect $2\frac{1}{2}$ complete revolutions whereupon the bottles are subjected to the ultrasonic cleaning treatment with each bottle passing four times past an ultrasonic transducer. After these $2\frac{1}{2}$ complete revolutions or 5 complete revolutions measured from the time when the bottles were loaded on the rotatory member 1, the bottles are discharged from the rotating member 2 by any known discharging means which may be, as shown in FIG. 1, a push rod 27 similar to the push rod 26.

As on the rotating member 1, the bottles which have been subject to the ultrasonic cleaning treatment on the rotating member 2 are discharged from every third cage 10. The bottles thus discharged from the rotating

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member 2 are arranged to be accommodated in every third cage 10 on the third rotatory member 3 rotating in the counterclockwise direction as viewed in FIG. 1 at the same speed as and in synchronization with the rotatory member 2.

While the bottles loaded on the rotating member 3 effect further $2\frac{1}{2}$ complete revolutions or $7\frac{1}{2}$ complete revolutions measured from the time when they were loaded on the first rotatory member 1 the bottles are subject thrice to the finish cleaning treatment by the spraying nozzles 23 and 24. Thereafter the completely cleaned bottles are discharged upon a bottle receiving table B by a push rod 28 similar in construction and operation to the push rods 26 and 27. At this point the overall washing treatment is completed.

The invention has been illustrated and described in conjunction with a washing machine comprising three rotatory members each including 28 cages in a single annulus and having three detaining revolutions with the rotatory members operatively coupled to the preliminary cleaning, the ultrasonic cleaning and finish cleaning devices respectively. However, it is to be understood that the invention is equally applicable to washing machines having the rotatory members, with cages and annuli disposed on each rotatory member, the detaining revolutions of which are different in number from those above specified and with the rotatory members operatively coupled to various cleaning devices respectively.

Referring now to FIGS. 2a through f, there is illustrated a modification of the invention wherein $K=3$ and $n=5$ or $Kn+1=16$. In other words, a cage annulus disposed on each rotatory member includes 16 cages. The remainder of the apparatus is substantially the same as in the arrangement shown in FIG. 1. For the purpose of illustration, it is assumed that each rotatory member has disposed on the peripheral portion a single cage annulus rather than a longitudinal row of cage annuli.

In FIG. 2a three rotatory members 1, 2 and 3 have started to rotate at a predetermined common speed in such a manner that each of the rotatory members is rotated in a direction opposite to that of the adjacent rotating member. At the same time, a bottle #1 to be washed has been loaded in a first cage on the first rotating member. The reference numerals 2 and 3 above a feed bottle table A represent bottles #2 and #3 to be successively loaded on the first rotating member 1.

As the first rotatory member 1 continues to be rotated successive bottles such as the bottles #2 and #3 are loaded one at a time in every third cage on the rotating member 1. After the first member 1 has effected one complete revolution six bottles up to a bottle #6 are loaded in the first, fourth, seventh, tenth, thirteenth, and sixteenth cages or in each third cage as shown in FIG. 2b. FIG. 2b also shows bottles #7 and #8 left on the table A.

After the rotatory member 1 has effected $2\frac{1}{2}$ complete revolutions the bottle #1 first loaded in the first cage has terminated its preliminary cleaning treatment and reaches a position in which it is ready to be transferred from the first rotating member 1 to the second rotatory member 2 as shown in FIG. 2c. During these complete revolutions of the first rotatory member 1, a plurality of bottles up to bottle #14 have been loaded on the rotating member 1 in each the third cage. FIG. 2c shows the first rotatory member in its position where it advances in the direction of the arrow an angular distance corresponding to the width of one cage after the bottle #14 has been loaded in the associated cage with bottles #15 and #16 left on the table A.

After all the rotatory members have effected further $2\frac{1}{2}$ complete revolutions from their positions illustrated in FIG. 2c or 5 complete revolutions from their starting positions, the bottle #1 will have been subjected to the ultrasonic cleaning treatment and will be ready to be

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transferred from the second rotating member 2 to the third rotating member 3. During this further rotational movement of the rotatory members, a plurality of bottles up to a bottle #27 are loaded on the first rotating member 1 while a plurality of bottles up to the bottle #14 are transferred from the first rotating member 1 to the second rotating member one in each third cage for the ultrasonic cleaning treatment. FIG. 2d shows the first rotatory member 1 in its position where the same has advanced in the direction of the arrow an angular distance corresponding to the double width of one cage and having the bottles #17 to #27 loaded in the associated cages and the second rotatory member 2 having the bottles #1 to #14 loaded in the associated cages thereof with bottles #28 and #29 left on the table A. However, the third rotatory member has no bottles loaded into it.

After further $2\frac{1}{2}$ complete revolutions of the rotatory members from their positions illustrated in FIG. 2c or $7\frac{1}{2}$ complete revolutions from their starting positions, the three rotatory members 1, 2 and 3 reach the positions illustrated in FIG. 2e. During the rotational movements of the rotatory member from the positions illustrated in FIG. 2d to those illustrated in FIG. 2e, a plurality of bottles fed to the table A are successively loaded one at a time on the first rotating member 1. The bottles having been subjected to the preliminarily cleaning treatment on the rotating member 1 are transferred one at a time from the first member to the second rotatory member 2 for the ultrasonic cleaning treatment. The bottles having been subjected to the ultrasonic cleaning treatment on the second rotating member 2 are successively transferred one at a time from the second member to the third rotating member 3 for the finish cleaning treatment. It is noted that the loading and transferring operations are performed for each third cage on each rotating member. In FIG. 2e, it will be seen that the bottle #1 which has been subjected to the finish cleaning treatment has just been discharged upon a bottle receiving table B while bottles #42 and #43 are left on the feed bottle table A for subsequent loading.

After the rotatory members have advanced a distance corresponding to three times the width of one cage from their positions illustrated in FIG. 2e, the bottle #2 completely cleaned is discharged upon the table B. At the same time, a bottle #42 is loaded in the associated cage on the first rotating member 1 with bottles #43 and #44 left on the feed bottle table A.

From the foregoing it will be appreciated that the feed bottle system of the invention can cause the bottles to be washed to continuously pass through various cleaning devices associated with the same. Therefore, no waiting time will occur between successive cleaning steps. The bottles to be washed are subjected to each of the various cleaning treatments repeatedly as determined by the number of detaining revolutions of the associated rotatory member. This eliminates the necessity of providing a plurality of the same cleaning devices in parallel relationship and thus permits use of a small-sized cleaning tank. Therefore, a washing machine incorporating the invention is, as a whole, small-sized and hence occupies a relatively small area. In addition, as the ultrasonic cleaning device may be dispensed with the washing machines can be produced at very low costs.

While the invention has been illustrated and described in conjunction with a few preferred embodiments thereof it is to be understood that various changes in the details and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention.

What is claimed is:

1. In a continuous bottle feeding system for use with a washing machine comprising a plurality of rotary members horizontally disposed at predetermined intervals with the longitudinal axes parallel to each other in a common

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plane, said plurality of rotatory members effecting rotational movement in opposite rotational direction of adjacent rotatory members at a predetermined common speed, each of said rotatory members being provided on the peripheral portion with $(Kn+1)$ of bottle holding cages disposed circumferentially thereon, where K is a predetermined number of revolutions of the rotatory member through which the bottles are revolved prior to discharge and n is any integer, each of said rotatory members being operatively associated with a cleaning tank, the method of operating the said system comprising first loading bottles to be washed into a first cage located on the periphery of the first of said rotatory members and successively loading each K th cage on said first rotatory member and revolving said first rotatory members through K revolutions in the said cleaning tank and after completion of K revolutions continuously transferring bottles from said first cage and successively from each K th cage to a first cage and successively to each K th cage in said second rotary member that is revolving in a second tank and revolving said second rotatory member through K revolutions and successively discharging said bottles.

2. The continuous bottle feeding system of claim 1 further characterized in that 3 rotary members are operated.

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3. The method of the bottle feeding system of claim 1 further characterized in that the integer n is equal to the number of cages in a row disposed along the longitudinal axes of the rotary member.

4. A continuous feed bottle system as claimed in claim 1 wherein each of said rotatory members has a longitudinal row including a plurality of cage annuli longitudinally disposed on the peripheral portion, each of said annuli including $(Kn+1)$ of bottle holding cages, said cages in each annulus being aligned with the corresponding cages in the other annuli longitudinally of the rotatory member.

5. A continuous feed bottle system as claimed in claim 1 wherein said cages on each of said rotatory members are operatively associated with a pair of stationary guide members disposed on the upper and lower halves of the rotatory member respectively to prevent the bottles accommodated in the cages from falling from the latter.

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