April 29, 1958 V. R. ABRAMS 2,832,106

METHOD AND APPARATUS FOR STERILIZING ARTICLES

Filed April 14, 1955 3 Sheets-Sheet 1

Fig. 1.

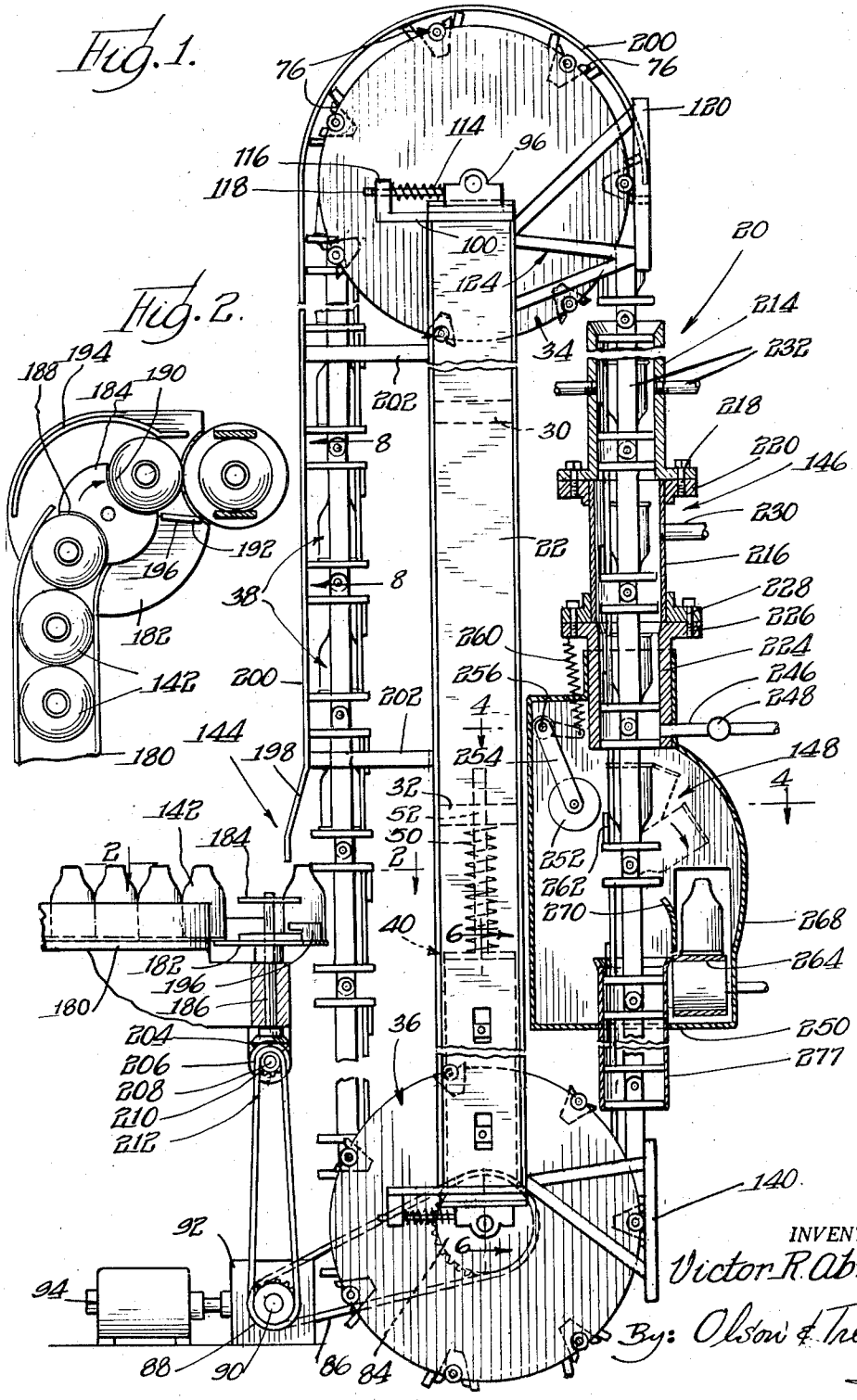



Fig. 2.




INVENTOR.
Victor R. Abrams
By: Olson & Trexler
Attys

April 29, 1958 V. R. ABRAMS 2,832,106

METHOD AND APPARATUS FOR STERILIZING ARTICLES

Filed April 14, 1955 3 Sheets-Sheet 2

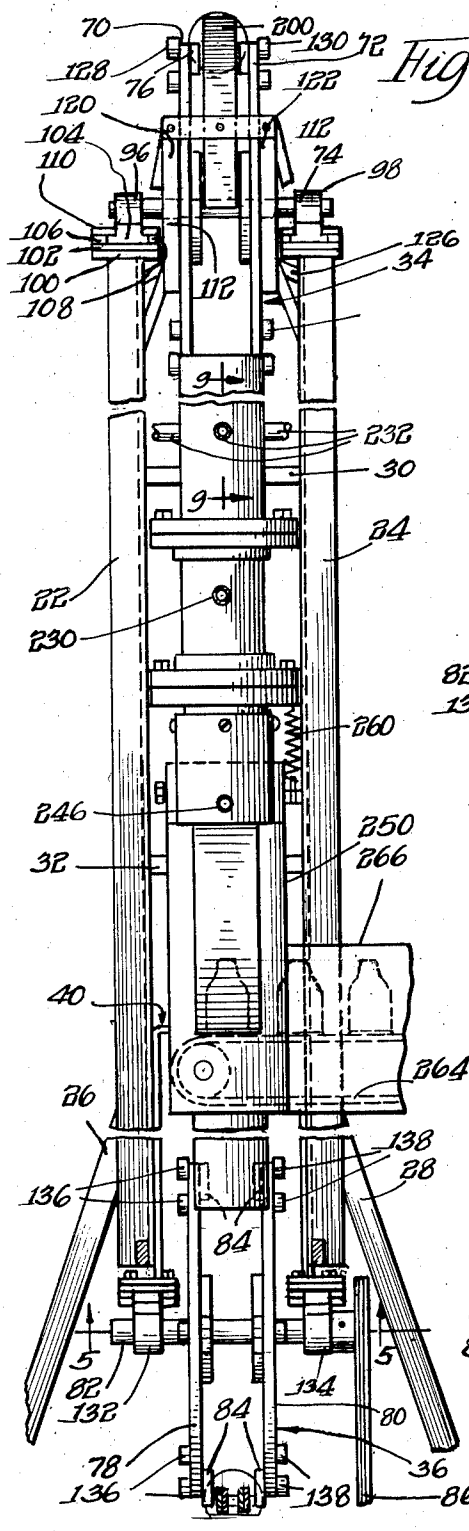



Fig. 3.

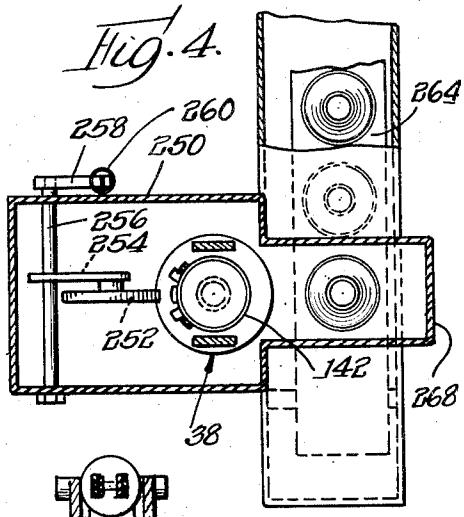



Fig. 4.

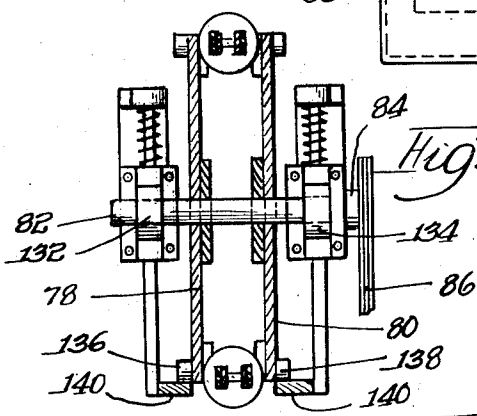



Fig. 5.

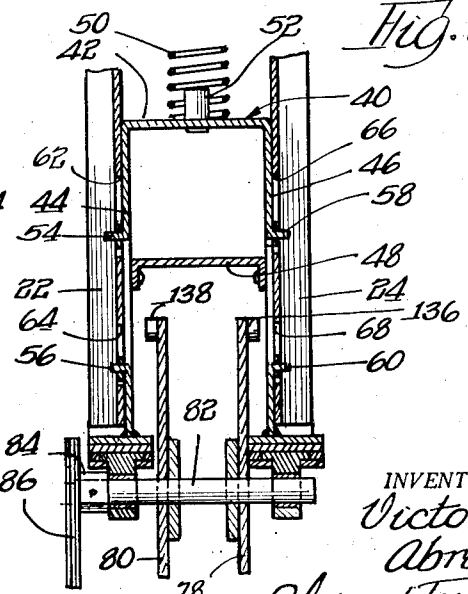



Fig. 6.

INVENTOR.
Victor R. Abrams
By: Olson & Therlen
attys.

April 29, 1958 V. R. ABRAMS 2,832,106

METHOD AND APPARATUS FOR STERILIZING ARTICLES

Filed April 14, 1955 3 Sheets-Sheet 3

Fig. 7.

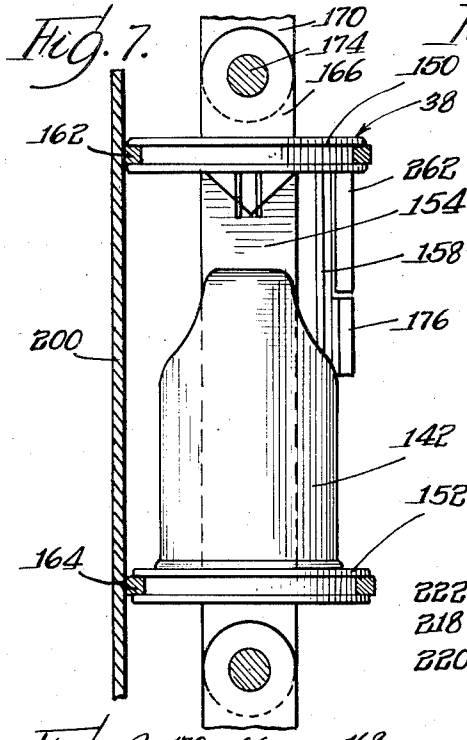



Fig. 9.

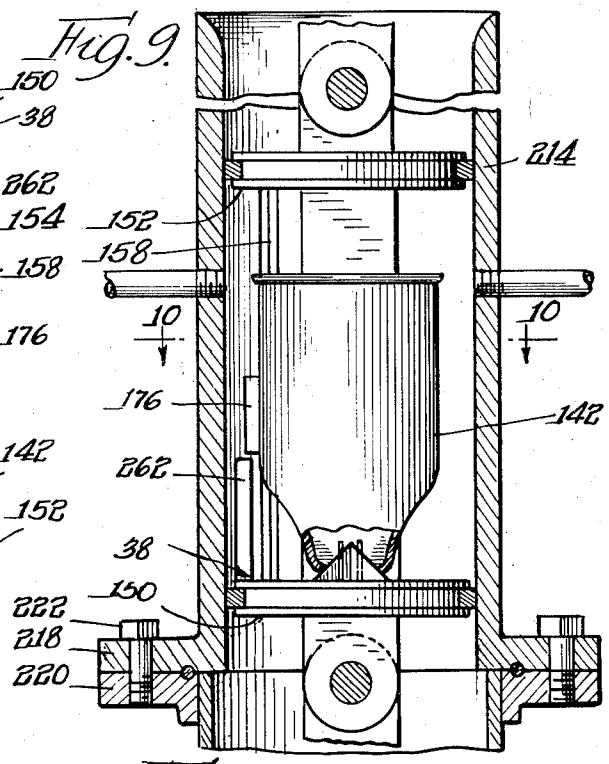



Fig. 8.

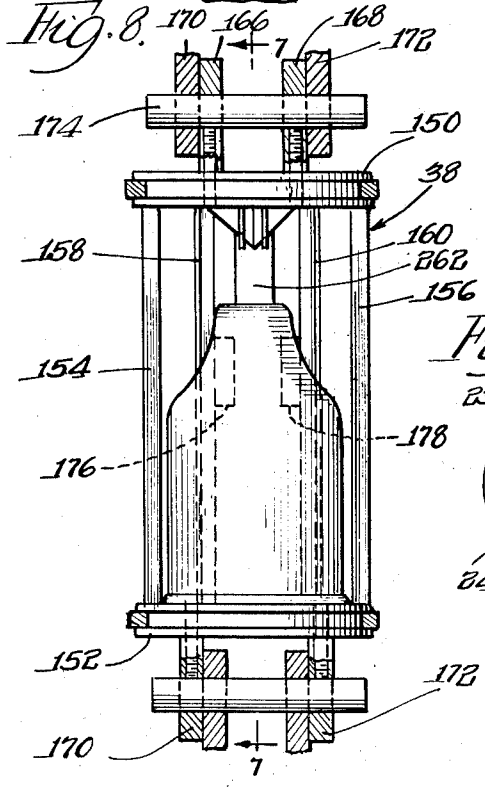



Fig. 10.

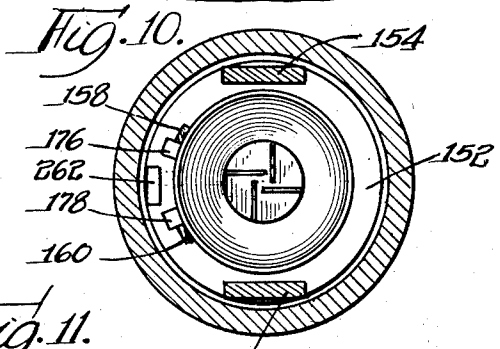



Fig. 11.

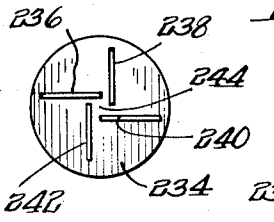
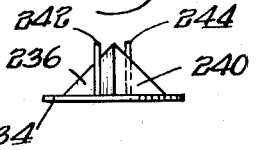



Fig. 12.




INVENTOR.
Victor R. Abrams
BY: Olson & Trevor
attys.

United States Patent Office 2,832,106 Patented Apr. 29, 1958



2,832,106

# METHOD AND APPARATUS FOR STERILIZING ARTICLES

Victor R. Abrams, Rockford, Ill.

Application April 14, 1955, Serial No. 501,266

15 Claims. (Cl. 21—78)

The present invention relates to a novel method and apparatus for processing articles and more particularly to a novel method and apparatus for sterilizing articles such as containers and the like.

It is often necessary or desirable to sterilize cans or other containers before they are filled as, for example, the cans to be used in an aseptic canning process must be sterilized and maintained in a sterile condition before previously sterilized food stuff is dispensed therein. Therefore, it is an important object of the present invention to provide a novel method and apparatus for sterilizing articles such as containers and the like in a rapid, economical, and thorough manner.

Another object of the present invention is to provide a novel method and apparatus whereby articles such as containers and the like may be sterilized with saturated steam under a pressure greater than atmospheric pressure so as to reduce the time required for effecting thorough sterilization.

A more specific object of the present invention is to provide a novel method and apparatus whereby articles such as containers and the like may be moved through a chamber filled with saturated steam under pressure while continuously maintaining the steam pressure greater than atmospheric pressure.

Another object of the present invention is to provide a novel apparatus for conveying a series of articles such as containers into and out of a chamber filled with saturated steam under pressure while continuously sealing conveyor inlet and outlet openings in the chamber.

A further object of the present invention is to provide a novel method and apparatus of the above described type wherein the containers are at least partially evacuated before entry into the steam chamber to facilitate flow of steam into the containers.

Other objects and advantages of the present invention will become apparent from the following description and the following drawings, wherein:

Fig. 1 is an elevational view of an apparatus embodying the principles of this invention with portions thereof broken away or shown in cross section to illustrate the structure in greater detail;

Fig. 2 is a fragmentary cross sectional view taken along line 2—2 in Fig. 1;

Fig. 3 is another side elevational view of the apparatus in this invention;

Fig. 4 is a fragmentary cross sectional view taken along line 4—4 in Fig. 1;

Fig. 5 is a fragmentary cross sectional view taken along line 5—5 in Fig. 3;

Fig. 6 is an enlarged fragmentary cross sectional view taken along line 6—6 in Fig. 1;

Fig. 7 is a sectional view taken along line 7—7 in Fig. 8;

Fig. 8 is a fragmentary enlarged sectional view taken along line 8—8 in Fig. 1;

Fig. 9 is an enlarged fragmentary sectional view taken along line 9—9 in Fig. 3;

Fig. 10 is a cross sectional view taken along line 10—10 in Fig. 9;



Fig. 11 is a plan view of an element of the apparatus which serves to support a container and direct steam into the container; and

Fig. 12 is an elevational view of the element shown in Fig. 11.

Referring now more specifically to the drawings, wherein like parts are designated by the same numerals throughout the various figures, an apparatus 20 is shown for the purpose of illustrating the present invention and this apparatus includes a frame comprising a pair of upstanding channel members 22 and 24 which are respectively supported by braces 26 and 28. The braces are in turn connected to any suitable base structure, not shown. Spacing members 30 and 32 extend between and are secured to the upstanding channel members for fixing the channel members with respect to each other.

The frame carries a conveyor for containers or other articles to be processed, which conveyor includes a pair of sprocket wheel means 34 and 36 and an endless conveyor chain made up from a plurality of pivotally connected links 38. The upper sprocket wheel means 34 is supported on the upper ends of the frame members 22 and 24, and in order to insure the maintenance of the proper tension in the conveyor chain, the lower sprocket wheel means 36 is carried by a slide member 40. As shown in Figs. 1 and 6, the slide member 40 includes a substantially U-shaped strap having a closed end 42 and legs 44 and 46 respectively slidably disposed against the frame members 22 and 24. A spacer member 48 is disposed between and connected to the legs 44 and 46. The slide member is resiliently urged outwardly to maintain the conveyor chain under tension by means of a compression spring 50 which is disposed between the frame spacing member 32 and the end 42 of the slide member and which is retained in position by a rod 52 fixed to the end portion 42 of the slide member and slidably extended through a suitable aperture in the spacing member 32. Movement of the slide member with respect to the frame members 22 and 24 is limited by connecting a plurality of lugs or studs 54, 56, 58, and 60 to the legs 44 and 46, which lugs respectively extend through elongated slots 62, 64, 66, and 68 in the channel members 22 and 24.

The sprocket wheel means includes a pair of disks 70 and 72, which are fixed on a rotatably supported shaft 74. Chain engaging lugs or tooth elements 76 are spaced evenly about the peripheries of the disks 70 and 72. As shown best in Fig. 1, these lugs are provided with notches adapted to receive link connecting pins of the conveyor chain. The sprocket wheel means 36 also includes a pair of disks 78 and 80 which are fixed on a rotatably supported shaft 82. A plurality of chain engaging lugs 84 is also mounted on the disks 78 and 80. In order to drive the conveyor, a sprocket 84 is fixed on the shaft 82 and a chain 86 is wrapped around this sprocket and also around a sprocket 88 fixed on an output 90 of a speed reducing unit 92, and the speed reducing unit may be driven by any suitable means such as a motor 94.

As will be understood, the courses of the conveyor chain will vibrate or shake back and forth with respect to a line drawn through the centers of rotation of both of the sprocket wheel means since the points of engagement between the chain and the sprocket wheel means move in an arc around the centers of rotation. In accordance with the present invention, and for the purpose described fully hereinbelow, the conveyor is constructed so that the paths of travel of the upwardly and downwardly moving courses of the chain are fixed in space and vibrating or back and forth shaking motion of the courses is substantially eliminated. In order to accomplish this result, it should be noted that the sprocket wheel

means are each provided with an odd number of chain engaging lugs or teeth. Thus, when the elements of the conveyor are in the positions shown in Fig. 1, it is seen that the right hand or downwardly moving course is laterally offset from a plane extending through the centers of rotation of the sprocket means a maximum distance which is determined by the radius of the sprocket means. On the other hand, the left or upwardly moving course is laterally offset from this plane the minimum possible distance. Upon rotation of the sprocket means, it will be appreciated that the downwardly moving course will shift relatively inwardly with respect to the centers of rotation, while the upwardly moving course will shift relatively outwardly with respect to the centers of rotation. Still further rotation causes repeated back and forth relative shifting between the courses and the centers of rotation of the sprocket means, but it should be noted that both courses always shift in the same direction, or in other words, when the downwardly moving course shifts toward the right, the upwardly moving course also shifts toward the right, and when the downwardly moving course shifts toward the left, the upwardly moving course also shifts toward the left. This movement of the upwardly and downwardly courses in unison would not be obtained if the sprocket wheel means were provided with an even number of chain engaging lugs, and to the contrary, the courses would shift to the opposite direction. Since the courses shift in unison with respect to the centers of rotation of the sprocket wheel means, it is possible to fix the paths of travel of the conveyor chain courses in space by shifting the centers of rotation of the sprocket wheel means.

In order to shift the center of rotation of the sprocket means 34 for the purpose described above, the sprocket means shaft 74 is journaled in a pair of slidably mounted bearing blocks 96 and 98 and means is provided for shifting the bearing blocks back and forth in time with the rotation of the sprocket wheel. More specifically, a plate member 100 is welded or otherwise secured to the top of the channel frame member 22, a bearing plate 102 is fixed to the top of the plate 100, and a slipper 104 is fixed to the bottom of the bearing block 96 for slidably supporting the bearing block on the plate 102. The side edges of the slipper are confined by guide members 106 and 108 and hold-down members 110 and 112 are fixed on top of the guide members and extend over the edges of the slipper. As shown in Fig. 1, the bearing block 96 is resiliently biased toward the right by a spring 114, which abuts against a block 116 fixed on the plate 100. The spring is disposed on a rod 118 which is fixed to the bearing block and slidably extends through a suitable aperture provided in the block 116. The bearing 98 is slidably mounted and resiliently biased in substantially the same manner and by substantially the same means as the bearing 96, and therefore this means need not be described in detail.

Movement of the sprocket wheel 34, and therefore the bearings 96 and 98, toward the right as viewed in Fig. 1, is limited by a pair of fixed elongated and substantially vertically disposed cam members 120 and 122, which are respectively mounted on the upstanding frame members 22 and 24 by strut means 124 and 126. In addition, each of the sprocket wheel disks 70 and 72 carries a plurality of spaced rollers 128 and 130, which rollers are disposed in axial alignment with the slots or grooves in the chain engaging lugs 76. The cams 120 and 122 are disposed for engagement by the rollers 128 and 130. When the sprocket wheel means 34 is in the position shown in Fig. 1, a plane extending through the centers of the rollers in engagement with the cams 120 and 122 and also through the axis of the sprocket wheel shaft is substantially perpendicular to the cams. Thus, the center of rotation of the sprocket wheel is located at the maximum distance it can be shifted away from the cams. As the sprocket wheel rotates from the position shown in Fig. 1, the rollers 128 and 130 are maintained in engagement with the cams, since the sprocket wheel bearings are shifted toward the right by the springs. The movement of the bearings toward the right continues until the next pair of rollers 128 and 130 also engage the cams, whereupon these rollers in co-operation of the cams serve to shift the bearings toward the left until the rollers pass the horizontal centerline.

The sprocket wheel means 36 is shiftably mounted and actuated on the ends of the frame legs 44 and 46 in substantially the same manner as the sprocket wheel means 34 is mounted and actuated. Thus, it suffices to state that the shaft 82 of the sprocket wheel means 36 is journaled in a pair of slidably and yieldably biased bearings 132 and 134, and that the disks 78 and 80 carry rollers 136 and 138 which correspond to the above described rollers 128 and 130 and which co-operate with cam means 140 which is substantially identical to the above described cams 120 and 122. However, in order to show other features of the structure in greater detail, certain elements of the cam means and the means for slidably mounting and yieldably biasing the bearings for the lower sprocket wheel have been omitted from the drawings.

Each link 38 of the conveyor chain is adapted to carry an article such as a container or can 142 upwardly from a loading station 144 around the upper sprocket wheel, then downwardly through processing or sterilizing means 146 and then to an unloading station 148. As shown best in Fig. 7–12, each link 38 includes a pair of piston-like end plates 150 and 152 which are connected in axially spaced relationship by a pair of straps 154 and 156. The straps provide opposite sides of a cage-like enclosure in which the container is held and a third side of the enclosure is provided by a pair of bars 158 and 160 extending between and secured to the piston-like end plates. The fourth side of the enclosure is left open so as to permit containers to be placed in and removed therefrom. A split piston ring 162 is mounted in a suitable groove formed in the periphery of the piston 150, and a similar ring 164 is mounted in a groove in the periphery of the piston 152. These rings which may be made from a suitable plastic material are provided for the purpose to be set forth fully hereinbelow. A pair of lugs 166 and 168 having aligned apertures is secured to the piston 152. As shown best in Fig. 8, the lugs 166 and 168 are adapted to extend between the lugs 170 and 172 of a preceding link, and a pin 174 is inserted through the aligned apertures in the lugs for connecting the adjacent links. The pins 174 are also adapted to co-operate with the lugs or tooth members on the sprocket wheels to provide a driving connection between the chain and the sprocket wheels. Each link 38 may also be provided with permanent magnets 176 and 178 mounted on the bars 158 and 160 in order to hold a can within the cage-like link in a predetermined manner.

The containers or cans 142 are delivered to the loading station 144 by any suitable means such as a chute or track 180. A disk 182 is mounted on the frame of the apparatus by bracket means, not shown, for receiving the cans from the chute. A pair of star wheels 184 are fixed on a rotatably mounted shaft 186 for transferring the containers or cans from the chute to the conveyor chain. As shown best in Fig. 2, the star wheels are provided with notches 188 and 190 adapted to receive containers from the chute so that upon rotation of the star wheels in the direction indicated by the arrow the containers are moved around the disk. The disk or platform 182 is provided with a notch 192 through which the links of the conveyor chain pass and a guide member 194 is fixed on the disk or platform to direct the cans to a position in alignment with the notch 192 and the conveyor chain links. A guide member 196 is also mounted on the disk or platform 182 for stripping the cans from the star wheels and directing the cans at least

partially over the notch 192 and partially in axial alignment with the conveyor chain links. Means is provided for driving the star wheels in timed relationship with the conveyor chain so that a can forced over the notch 192 by the star wheels will be positioned between the piston end plates of one of the conveyor chain links. Thus, as the conveyor chain link rises, its piston end plate 152 engages beneath the can and then lifts the can with the link. Since, however, the star wheel only partially inserts the cans between the piston-like end plates of the links, a guide bar 198 is provided for forcing the cans completely into the links as the cans are raised with the links. This guide bar 198 is integrally connected with an elongated guide bar 200 which is mounted to the apparatus frame by a plurality of brackets 202, and which serves to close the open sides of the cage-like conveyor links to prevent the cans from accidentally falling from the links.

The means for driving the transfer star wheels in timed relationship with the conveyor chain may be of any known construction. For the purpose of illustration only, this means has been shown as including a bevel gear 204 fixed on the shaft 26 and meshing with a bevel gear 206 mounted on a rotatable shaft 208. A sprocket wheel 210 is also mounted on the shaft 208 and is driven by a chain 212 which encircles a sprocket wheel mounted on the shaft 90 of the speed reducing unit.

The means 146 for processing the containers includes a first elongated tube or cylinder 214 which has a length substantially greater than the length of each of the conveyor links 38 and which has an internal diameter substantially equal to the diameter of the conveyor chain piston rings. A second elongated tube 216, which has a larger internal diameter, is disposed in axial alignment with the tube 214. Annular flanges 218 and 220 are secured to the tubes 214 and 216 respectively, which flanges are clamped together by a plurality of bolt means 222. A third tube 224 also having an internal diameter substantially equal to the diameter of the piston rings, is disposed in axial alignment with the tube 216 and is provided with an annular flange 226 which is bolted or otherwise secured to an annular flange 228 fixed to the tube 260. Steam is introduced to the chamber provided by the tube 216 through a conduit 230, which is connected to a source of supply, not shown, which preferably is capable of providing saturated steam under a pressure greater than atmospheric pressure. The elongated tubes 214 and 224 at the opposite ends of the tube 216 cooperate with the pistons of the conveyor chain links continuously to seal the chamber provided by the tube 216 from the surrounding atmosphere, so that saturated steam under pressure may be maintained within the chamber. By using saturated steam under pressure the temperature of the steam may be closely controlled by controlling the pressure and rapid and thorough sterilization of the containers or other articles being processed may be obtained.

In order to insure intimate contact of the steam with all portions of the interior surfaces of the containers, the containers are at least partially evacuated before they pass into the steam chamber. In order to accomplish this, a plurality of conduits 232 communicate with the interior of the tube 214 in the manner shown in Figs. 1 and 3, which conduits are connected with a source of vacuum or reduced pressure, not shown. Upon entry of each conveyor link into the tube 214, a sealed chamber is provided between the piston end plates of the links, which chamber communicates with the vacuum conduits 232. Thus, the chamber is evacuated and the interior of the container carried by the link is also evacuated. The sealed evacuated chambers remain sealed until the piston end plates 150 pass into the steam chamber beyond the end of the tube 214. Since the internal diameter of the tube 216 is greater than the diameter of the pistons, steam immediately rushes into the formerly evacuated chamber between the piston links, and also into the interior of the container. Furthermore, means is provided for supporting the containers on each of the pistons 150 and for deflecting the steam rushing into the interior of the containers so that the steam flows with a swirling motion against the interior surfaces of the container. This means, which is shown best in Figs. 9, 10, 11 and 12, includes a disk 234 which is adapted to be fixed to the piston 150 and a plurality of upstanding triangular vanes 236, 238, 240, and 242 fixed to the disk 234. The vanes are arranged in generally radially extending and offset relationship, so as to provide, in effect, a central steam passageway or orifice 244, through which steam may pass into the interior of the container, which is supported on the inclined edges of the vanes as shown in Fig. 9. The portion of the steam which rushes past the vanes and to the central orifice combines within the orifice to set up a swirling motion.

As the conveyor chain links pass out of the steam chamber through the sealing tube 224, they carry with them between the piston plates a portion of the steam which is then discharged through a conduit 246, having a check valve 248 therein. The conveyor links emerging from the sealing tube 224 enter a housing 250 which encloses the unloading station 148 and which is filled with a sterile gas to prevent the cans from becoming contaminated. The unloading mechanism includes a roller 252 which is mounted on the end of a lever 254 fixed on a rotatably supported shaft 256. As shown in Figs. 1 and 4, the shaft 256 has an end portion projecting through a wall of the housing 250, and a lever 258 is fixed to this end portion. A tension spring 260 is connected to the free end of the lever 258 and to the flange 226 of the tube 224. With this structure, the roller 252 is normally resiliently biased toward a position wherein it projects into the path of the containers carried by the conveyor links. As the conveyor links emerge from the sealing tube 224, their leading piston ends 150 engage the roller 252 and force it against the action of the spring out of the path of the cans. In addition, each piston end plate 150 has fixed thereon an upstanding cam finger 262, which is located between the bars 158 and 160 and serves to maintain the roller 252 out of engagement with the can until the conveyor links have been lowered to a predetermined position. This position, which may be changed by varying the length of the cam finger 216, is such that when the roller passes over the top of the cam finger, it is snapped against the can by the spring 260, so that the can pivots about its lower end and the supporting vanes 236–240 in the manner shown by the broken line positions of the can in Fig. 1. The cans fall from the conveyor links onto an endless belt conveyor 264, which is disposed in part in the housing 250 which extends through an elongated tunnel 266 in which a sterile atmosphere is maintained. The sterilized containers are carried by the conveyor 264 to any desired point of discharge. However, the apparatus of this invention is especially adapted for use in sterilizing cans which are to be filled with sterilized goods or food under aseptic conditions, therefore, the conveyor 264 may be arranged to deliver the cans beneath a dispensing device, not shown. It is seen, that the cans moving downwardly in the conveyor chain are upside down, and that the spring actuated roller 252 knocks the cans from the conveyor links and starts them turning end over end. In order to insure that the cans will land right side up on the endless conveyor 264, a portion of the housing 250 is formed as at 268 to provide a guide wall for the cans and an opposing guide member 270 is mounted within the housing. As will be understood, the upper end of the guide member 270 will engage a falling can so that the can will complete its end over end motion and the guide wall 268 prevents the can from continuing to tumble after it has landed on the conveyor 264. In order to prevent an undue amount of the sterile atmosphere from escaping through an outlet opening in the housing 250 provided for the conveyor chain, the outlet opening is

formed by an elongated tube or cylinder 272, which co-operates with the pistons to seal the outlet opening continuously.

A brief resume of the operation of the above described apparatus is as follows. The motor 94 is energized so that the conveyor chain and the transfer or star wheels are driven in predetermined timed relationship. In addition, suitable means, not shown, is energized for continuously driving the discharge conveyor 264 and steam is introduced into the tube 216. Also, the means, not shown, for evacuating the tube 214 is energized. Then a series of containers 142 is supplied to the transfer wheels and these containers are successively transferred to the cage-like links of the conveyor. As the containers move upwardly from the loading station, they rest on the piston ends 152 of the links, and as the links pass over the sprocket wheel means 34 and start downwardly, the containers are inverted and they fall down onto the supporting and steam-directing vanes 236—240 on the piston ends 150. As the containers fall downwardly in the manner just described, they are retained by the permanent magnets 176 and 178 in a predetermined manner against the bars 158 and 160, so as to insure alignment of the open ends of the containers with the supporting vanes. Then the chain links and cans carried thereby pass downwardly into the sealing tube 214. It is important to note that the position of the sealing tube 214 in space is fixed and that the downwardly moving course of the conveyor chain should always be substantially in axial alignment with the tube as well as the other sealing tubes 224 and 277, in order to obtain proper seals and in order to reduce unnecessary wear on the pistons and the tubes. This result is accomplished since the path of the course of conveyor links is also fixed in spaced as a result of the manner in which the sprocket wheels are mounted and actuated. As the conveyor links pass through the tube 214, the containers carried thereby are evacuated so as to permit ready entry of steam into the interior of the containers when the links pass into the tube 216. Then the conveyor links pass through the sealing tube 224 and into the housing 250 wherein the spring actuated roller 252 functions to tumble the containers onto the discharge conveyor 264. Since the containers are inverted, any condensate which may form within the interior thereof may drain therefrom while the containers pass through the sealing tube and downwardly into the housing 250.

From the above description is seen that the present invention has provided a novel method and apparatus whereby a series of cans or other articles may be continuously processed or sterilized in a rapid or economical manner. More specifically, it is seen that the present invention has provided a novel method and apparatus wherein a series of cans may be successively and continuously introduced into and removed from a chamber containing saturated steam under a pressure greater than atmospheric pressure, while at the same time the chamber is continuously sealed from the surrounding atmosphere. It is also seen that the present invention has provided a novel apparatus for conveying a series of containers to such a steam filled chamber, for evacuating the containers before entry into the steam chamber and for removing the containers from the conveyor after they have been sterilized.

While the preferred embodiment has been shown and described herein, it is obvious that many structural details may be changed without departing from the spirit and scope of the appended claims.

The invention is claimed as follows:

1. An apparatus for processing articles such as containers and the like comprising a movably mounted endless conveyor chain of link means each for carrying an article to be processed, chamber means surrounding a portion of said chain and having inlet and outlet opening means for said chain, said chamber means being adapted to contain a processing fluid under pressure, said link means and said chamber means including co-operable means for substantially continuously sealing said inlet and said outlet opening means, means communicating with a portion of said chamber means adjacent said inlet opening means and connectable with a source of reduced pressure for evacuating said chamber means portion, and means for directing processing fluid under pressure into a second chamber means portion.

2. An apparatus for processing articles such as containers and the like comprising a movably mounted endless conveyor chain of link means each for carrying an article to be processed, chamber means surrounding a portion of a course of said chain, means for actuating said conveyor chain for moving said course portion along a path of travel which is substantially fixed relative to said chamber means, said chamber means having inlet and outlet openings for said course, said link means and said chamber means including co-operable means for continuously substantially sealing said inlet and outlet openings, means communicating with a portion of said chamber means adjacent said inlet opening and connectable with a source of reduced pressure for evacuating said chamber means portion, and means for directing processing fluid under pressure into a second chamber means portion.

3. An apparatus for processing articles such as containers and the like comprising a movably mounted endless conveyor chain of link means, each for carrying an article to be processed, means for actuating said chain with a course thereof moving along a substantially fixed path of travel, fixed chamber means surrounding a portion of said course, said chamber means including an inlet tube and an outlet tube for said course, each of said link means including spaced piston-like ends cooperable with said tubes for continuously substantially sealing said chamber means, means communicating with a portion of said inlet tube and connectable with a source of reduced pressure for evacuating the inlet tube, and means for directing processing fluid under pressure into said chamber means.

4. An apparatus, as defined in claim 3, wherein said piston means are spaced so as continuously to seal said means connectable with a source of reduced pressure from said means for directing processing fluid under pressure into the chamber means.

5. An apparatus for processing articles such as containers and the like comprising conveyor means including a pair of spaced rotatable sprocket means and an endless chain of link means on and having courses extending between said sprocket means, each of said link means being for carrying an article to be processsed, means supporting said sprocket means for shifting movement transversely of said courses, means including resilient biasing means and cam means for shifting said sprocket means back and forth for continuously positioning said courses for movement along substantially fixed paths of travel, chamber means surrounding a portion of one of said courses and adapted to contain a processing fluid, said chamber means having inlet and outlet openings for said endless chain, and said link means and said chamber means including co-operable means for continuously substantially sealing said inlet and outlet openings.

6. An apparatus for processing articles such as containers and the like comprising conveyor means including a pair of spaced rotatable sprocket means and an endless chain of link means on and having courses extending between said sprocket means, each of said link means being for carrying an article to be processed, means supporting said sprocket means for shifting movement, means resiliently biasing said sprocket means transversely of said one of said courses, fixed cam means disposed for engagement with elements of said sprocket

means for limiting shifting movement of the sprocket means under the influence of the resilient biasing means and thereby continuously positioning said one course for movement along a fixed path of travel, chamber means surrounding a portion of said one course and having inlet and outlet openings for said one course, said chamber means being adapted to contain a processing fluid, and means defining said inlet and outlet openings and co-operable with means on said links for continuously substantially sealing said inlet and outlet openings.

7. An apparatus for processing articles such as containers and the like comprising a movable mounted conveyor chain of cage-like link means each for holding an article to be processed, each of said link means including a pair of spaced piston ends and having an open side through which articles may be inserted at a loading station and removed at an unloading station, magnet means disposed at one side of each of said cage-like links for retaining articles within the links, chamber means for confining processing fluid under pressure enclosing a portion of the links between said loading and unloading stations and having inlet and outlet openings for said links, and means defining said inlet and outlet openings and co-operable with said piston ends for continuously substantially sealing said inlet and outlet openings.

8. An apparatus for processing articles such as containers and the like comprising a movably mounted endless conveyor chain of link means each for holding an article to be processed, said conveyor chain being disposed so that it has an upwardly moving course and a downwardly moving course, means for successively loading containers having an open upper end into the links of the upwardly moving course so that said containers will become inverted when they are advanced to said downwardly moving course, and chamber means for containing processing fluid surrounding a portion of said downwardly moving course, each of said link means including means registerable with the open end of the inverted containers for directing processing fluid into the containers with a swirling motion.

9. An apparatus for processing articles such as containers and the like comprising a movably mounted endless conveyor chain having upwardly and downwardly moving courses of link means each for holding an article to be processed, means for successively loading containers having open upper ends into the links of said upwardly moving course so that said containers will become inverted when they are advanced to said downwardly moving course, chamber means for containing processing fluid surrounding a portion of said downwardly moving course and having inlet and outlet openings for said downwardly moving course, means supporting and actuating said conveyor chain with said downwardly moving course constantly disposed in a fixed path of travel, means defining said inlet and outlet openings and co-operable with means on each of said link means for continuously substantially sealing said inlet and outlet openings, and means on each of said link means registerable with the open ends of the inverted containers in the downwardly moving course for directing the processing fluid into the containers with a swirling motion.

10. An apparatus for processing articles such as containers and the like comprising movably mounted endless conveyor chain means having an upwardly moving course and a downwardly moving course of link means each for holding an article to be processed, the link means of said upwardly moving course being adapted to receive containers having open upper ends so that said containers will become inverted when they are advanced to said downwardly moving course, cylinder means surrounding a portion of said downwardly moving course, each of said link means including means co-operable with the first portion of said cylinder means for providing a substantially sealed chamber enclosing the container carried by such link means, means communicating with said chamber and connectable with a source of reduced pressure for evacuating said chamber and the container therein, means for directing processing fluid under pressure into a second portion of said cylinder means, and means on each of said link means registerable with the open ends of the inverted containers on the downwardly moving course for directing processing fluid into the containers.

11. An apparatus for processing articles such as containers and the like comprising a movably mounted endless conveyor having upwardly and downwardly moving courses of link means each for holding a container to be processed, the link means in said upwardly moving course being adapted to receive containers having open upper ends so that said containers will become inverted when they are advanced to said downwardly moving course, chamber means for containing processing fluid surrounding a portion of said downwardly moving course, means on each of said link means registerable with the open ends of the inverted containers in said downwardly moving course for directing the processing fluid into the containers with a swirling motion, and magnet means on each of said link means for retaining said containers in position for registration with said fluid directing means.

12. An apparatus for processing containers and the like comprising movably mounted endless conveyor chain means having upwardly and downwardly moving courses of link means each for holding a container to be processed, means adjacent said chain means for successively loading containers having open upper ends into the link means of said upwardly moving course so that said containers will become inverted when they are advanced to said downwardly moving course, chamber means for containing a processing fluid surrounding a portion of said downwardly moving course, and means adjacent said conveyor chain for successively unloading processed containers from the link means of said downwardly moving course and turning the containers to position their open ends up.

13. An apparatus for processing containers, as defined in claim 12, wherein said means for unloading and turning the containers includes means for striking the containers substantially above the lowermost end thereof for knocking the containers from the links and reorientating the containers with their open ends up.

14. A method of sterilizing articles such as containers and the like comprising continuously moving a series of containers forwardly along a predetermined endless path of travel having a substantially straight portion, successively at least partially evacuating the containers while the containers are moving along said path of travel portion, and subsequently continuously advancing the evacuated containers through a body of saturated steam around said path of travel portion and under a pressure greater than atmospheric pressure, which steam expands rapidly into the evacuated containers for thoroughly sterilizing the interior of the containers.

15. A method of sterilizing containers, as defined in claim 14, which includes the step of imparting a swirling motion to the steam entering the containers to promote intimate contact of the steam with the interior surfaces of the containers.

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