United States Patent

[11] 3,536,225

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[21] Appl. No. **736,239**
[22] Filed **April 22, 1968**
Division of Ser. No. 473,107, July 19, 1965, now Patent No. 3,473,934.
[45] Patented **Oct. 27, 1970**

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[54] **ARTICLE CONFINING CAPSULE**
5 Claims, 27 Drawing Figs.

[52] **U.S. Cl.** **220/8,** 220/17; 206/46
[51] **Int. Cl.** **B65d 7/04**
[50] **Field of Search** ..... 220/8, 42(A), 17, 9; 206/46(m); 215/12; 99/359

[56] **References Cited**

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425,646	4/1890	Wykoff	220/42(A)UX
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Primary Examiner—George E. Lowrance
Attorney—Francis W. Anderson

ABSTRACT: A capsule for confining a frangible or deformable container during heat treatment includes an inner tubular body having one end substantially closed and its other end open for telescopically receiving the container, and an outer tubular body having one end substantially closed and the other end open for loosely and telescopically receiving the cartridge and container therein. The substantially closed ends of the outer and inner bodies are magnetically attractable, and a nonmagnetic means is provided for preventing the open end of the inner body from magnetically clinging to the closed end of the outer body.

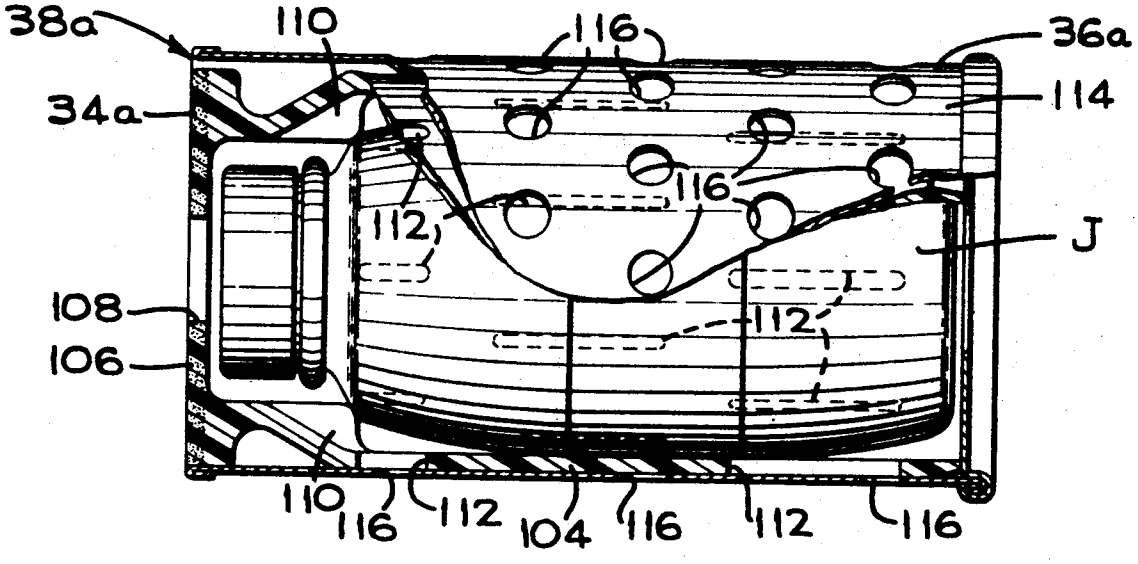


FIG_1

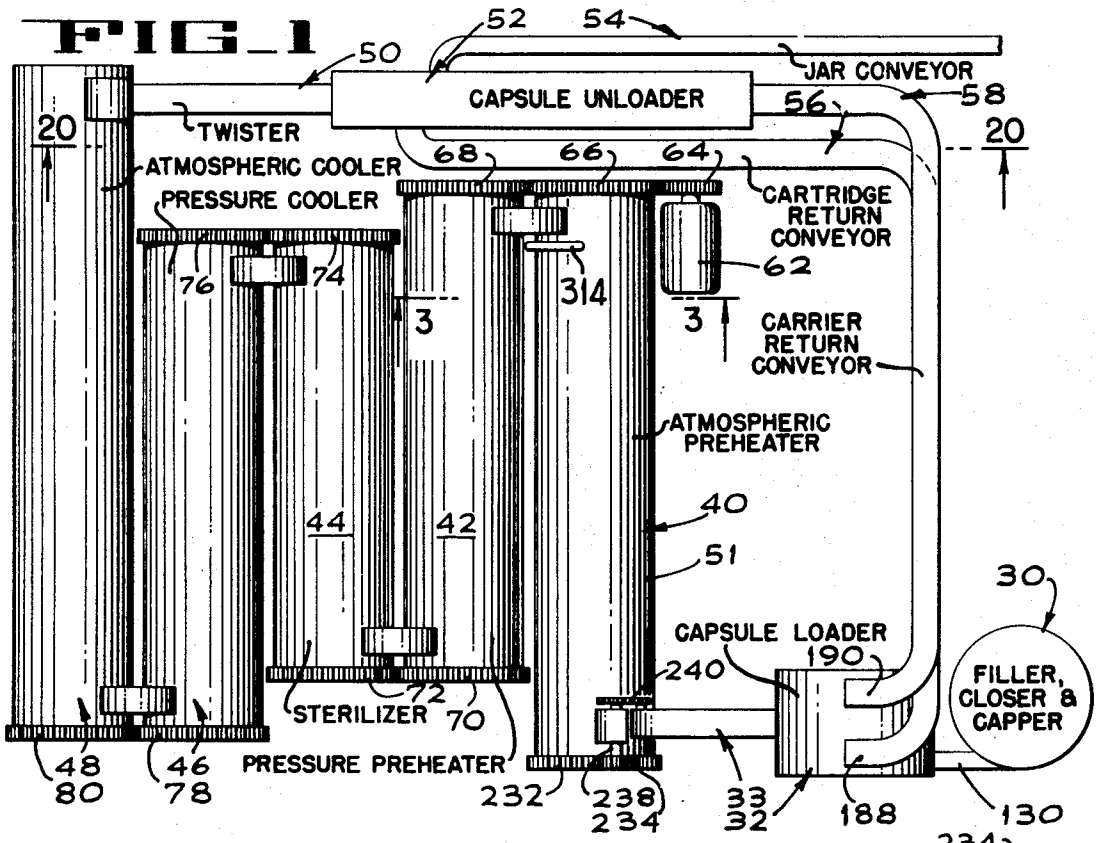
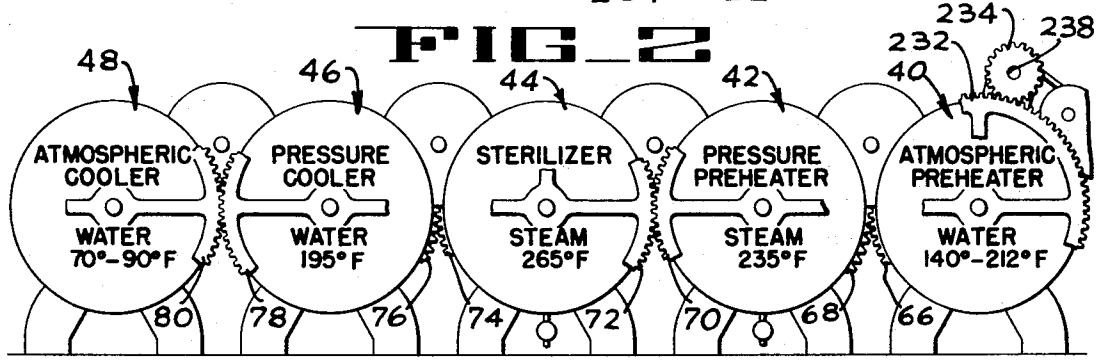


FIG_2



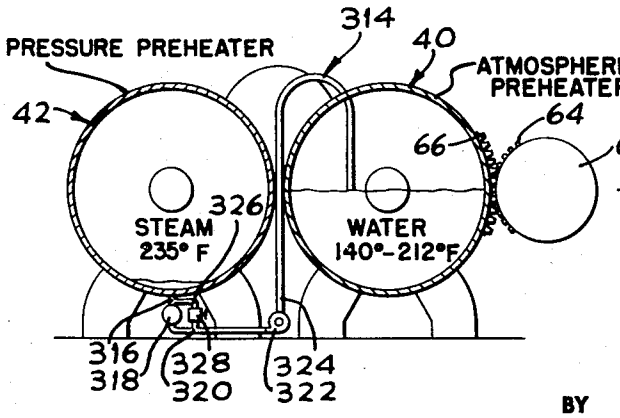


FIG_3

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FIG_4

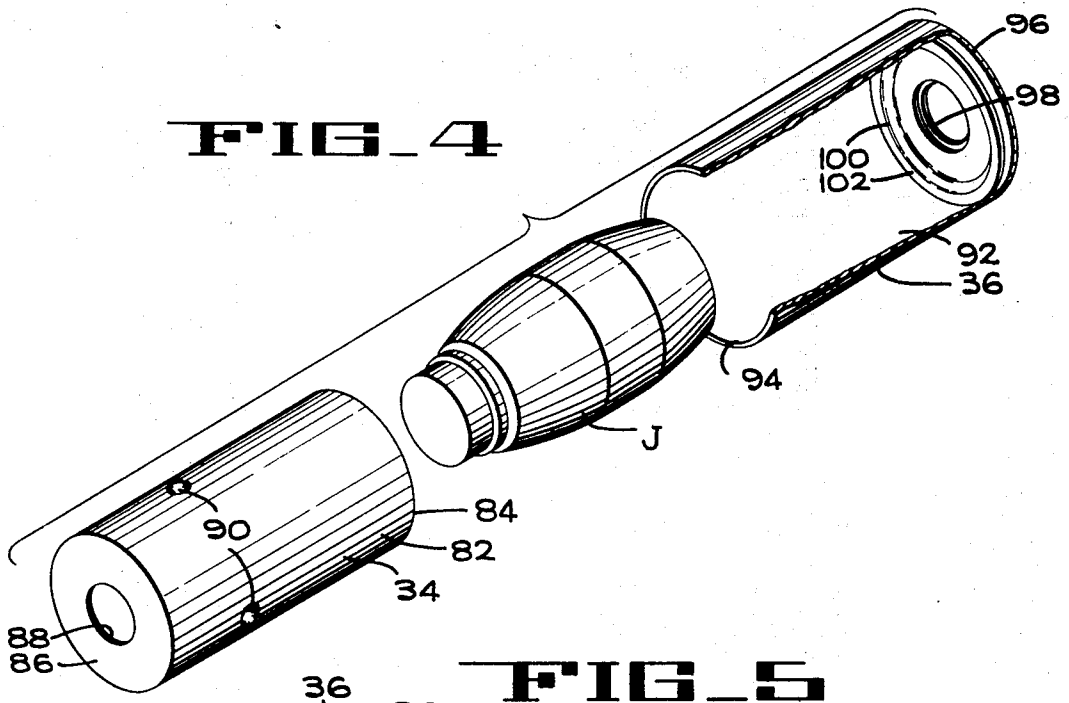
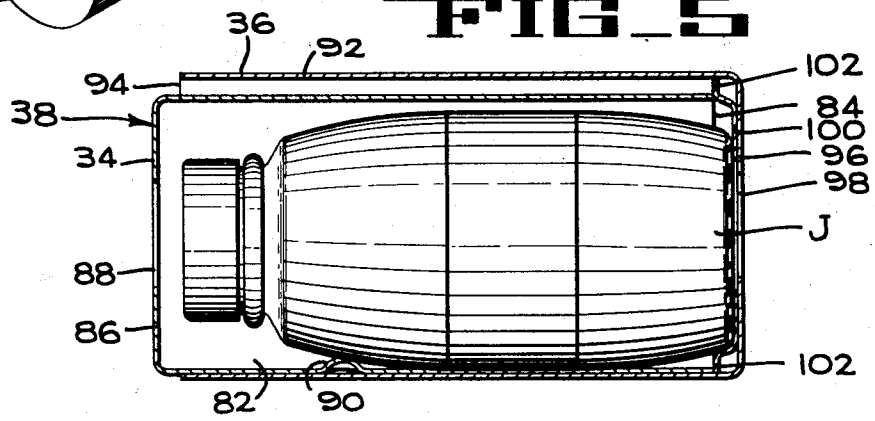


FIG_5



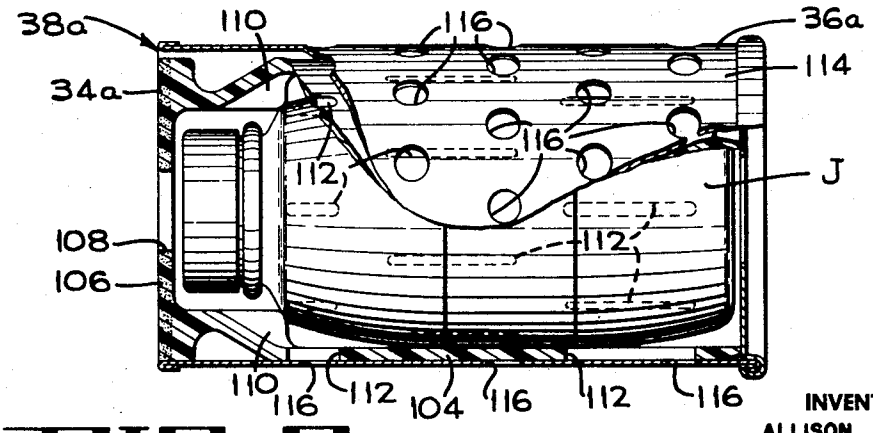


FIG_6

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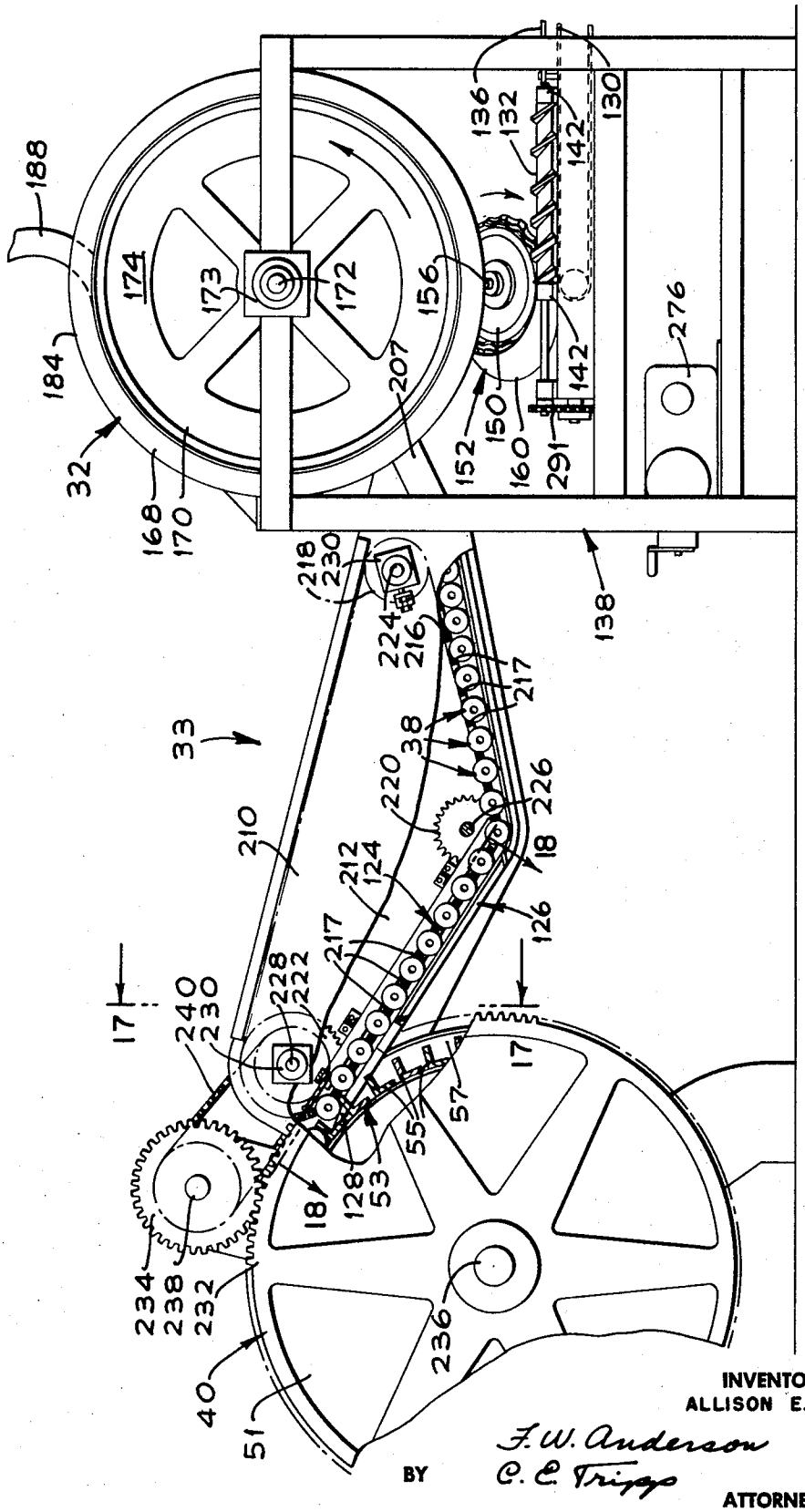


FIG_7

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FIG_8

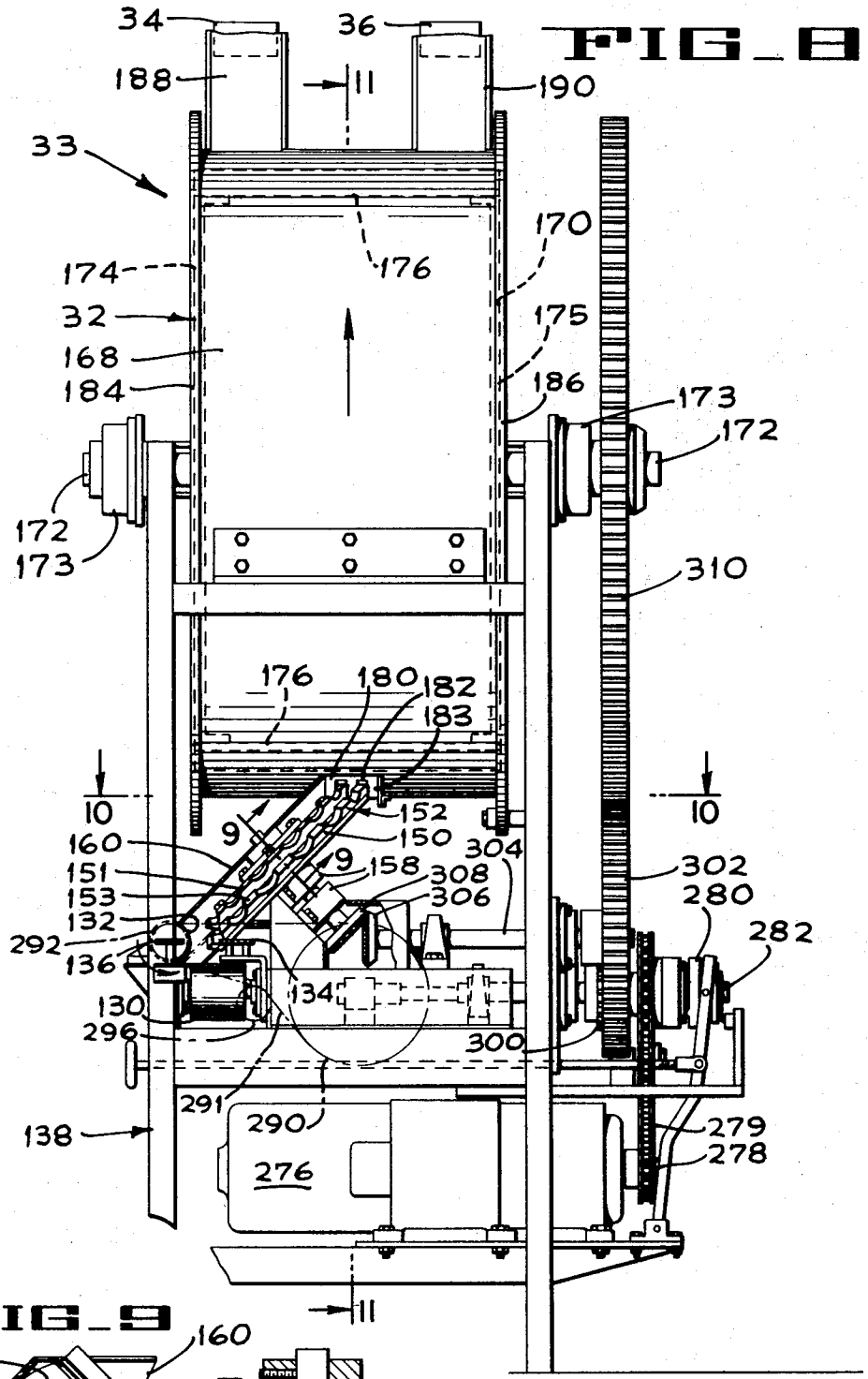
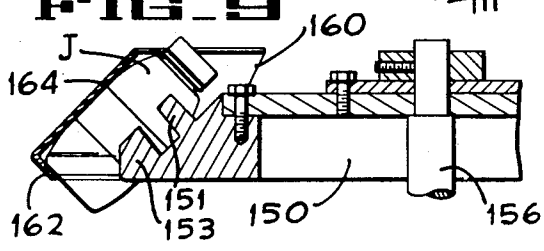


FIG_9

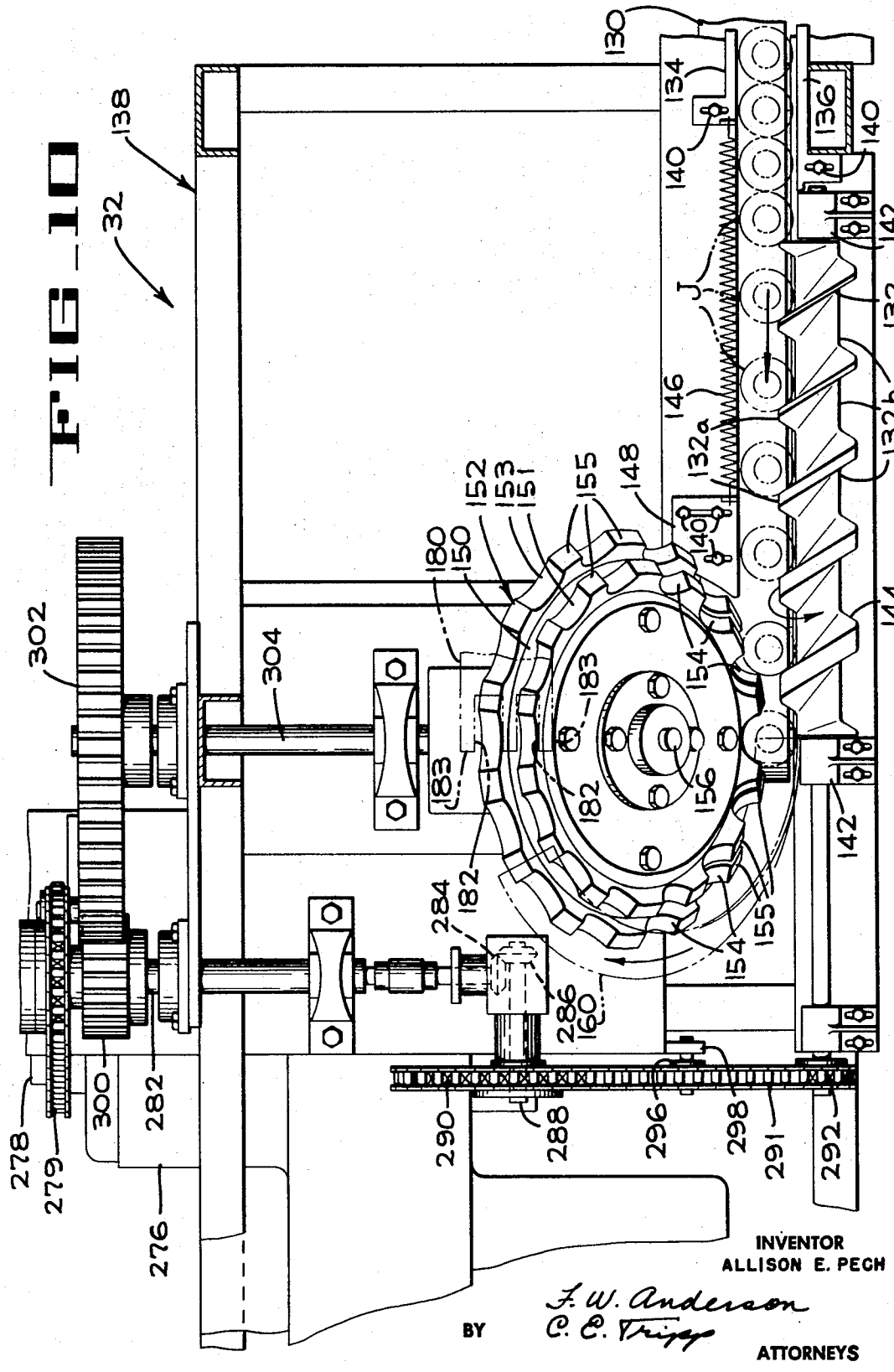


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FIG_10

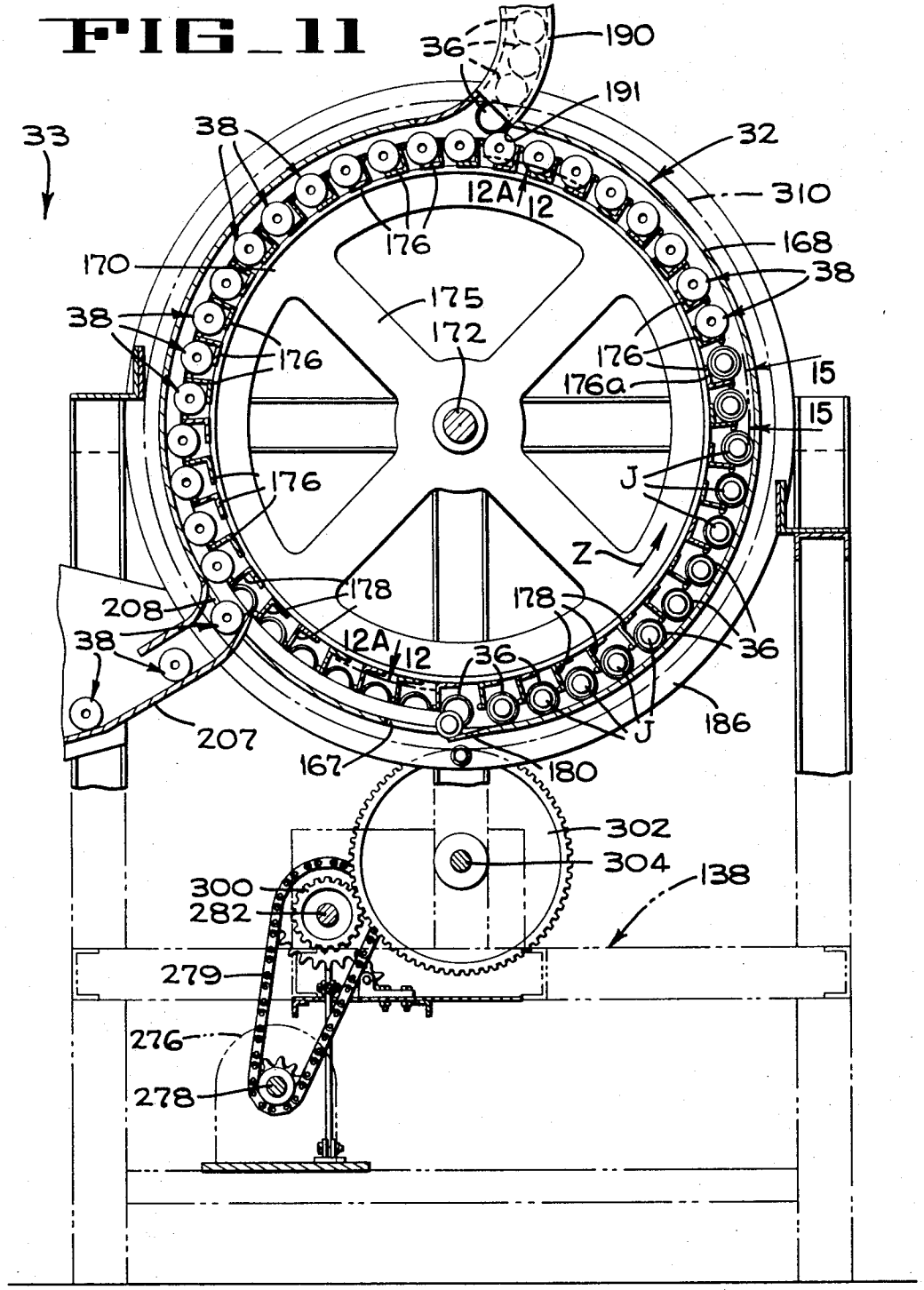


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FIG_11



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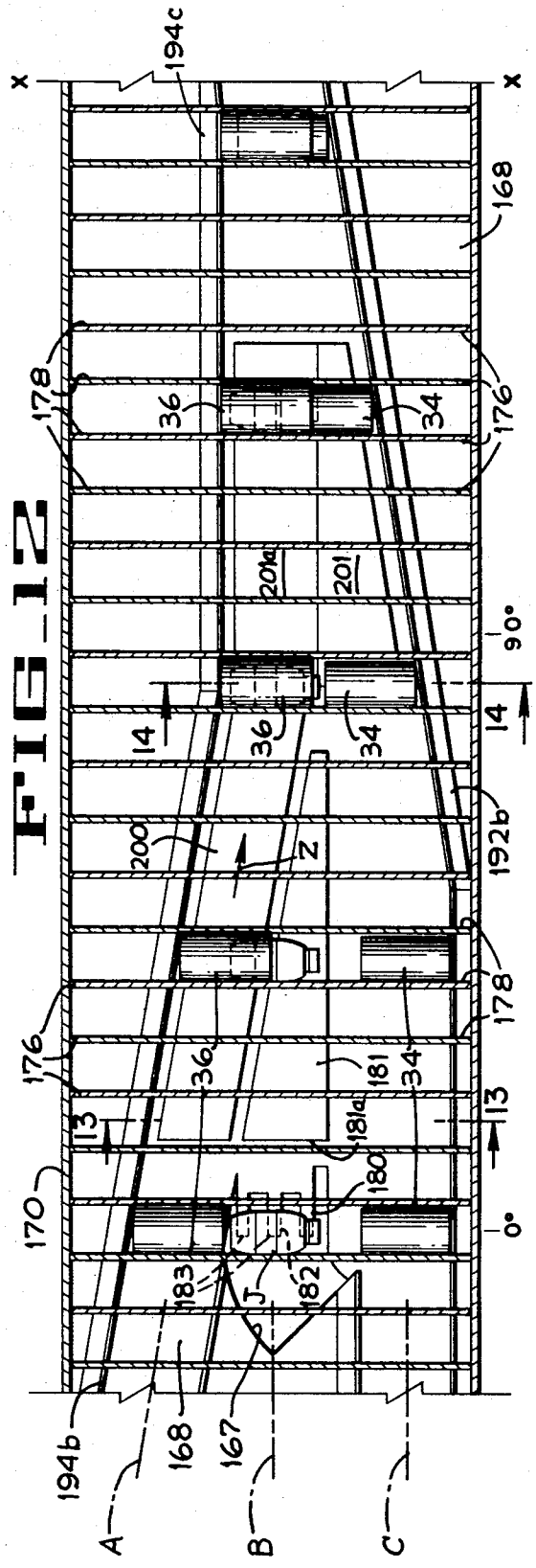


FIG_12

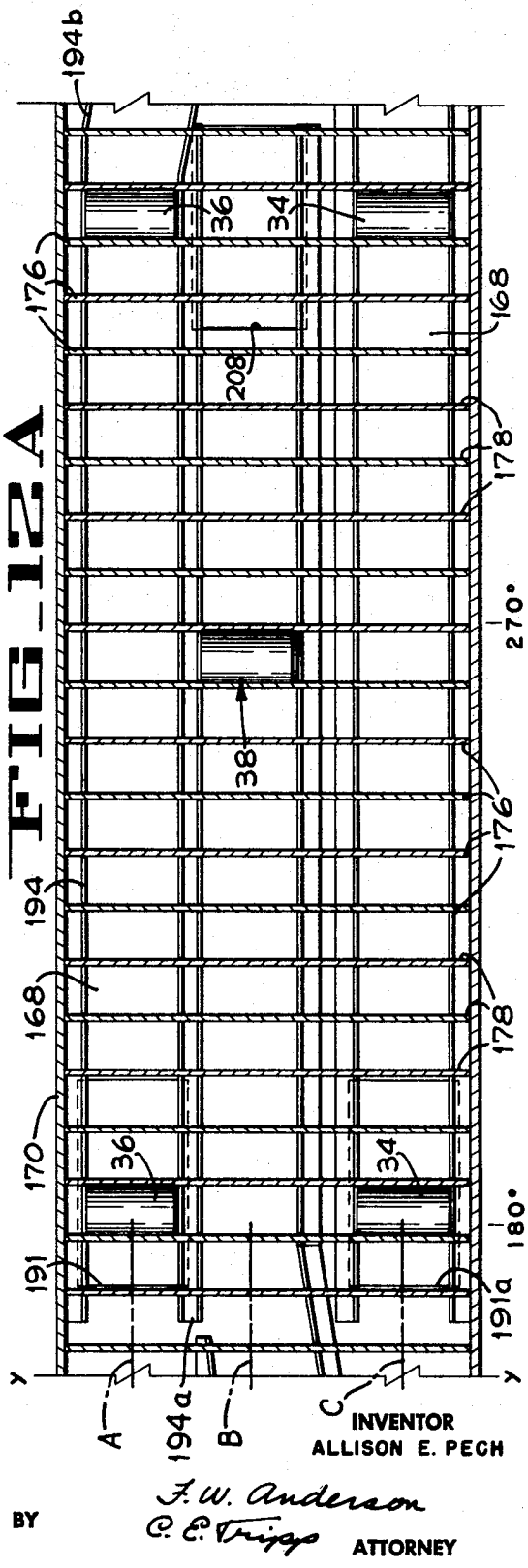


FIG_12A

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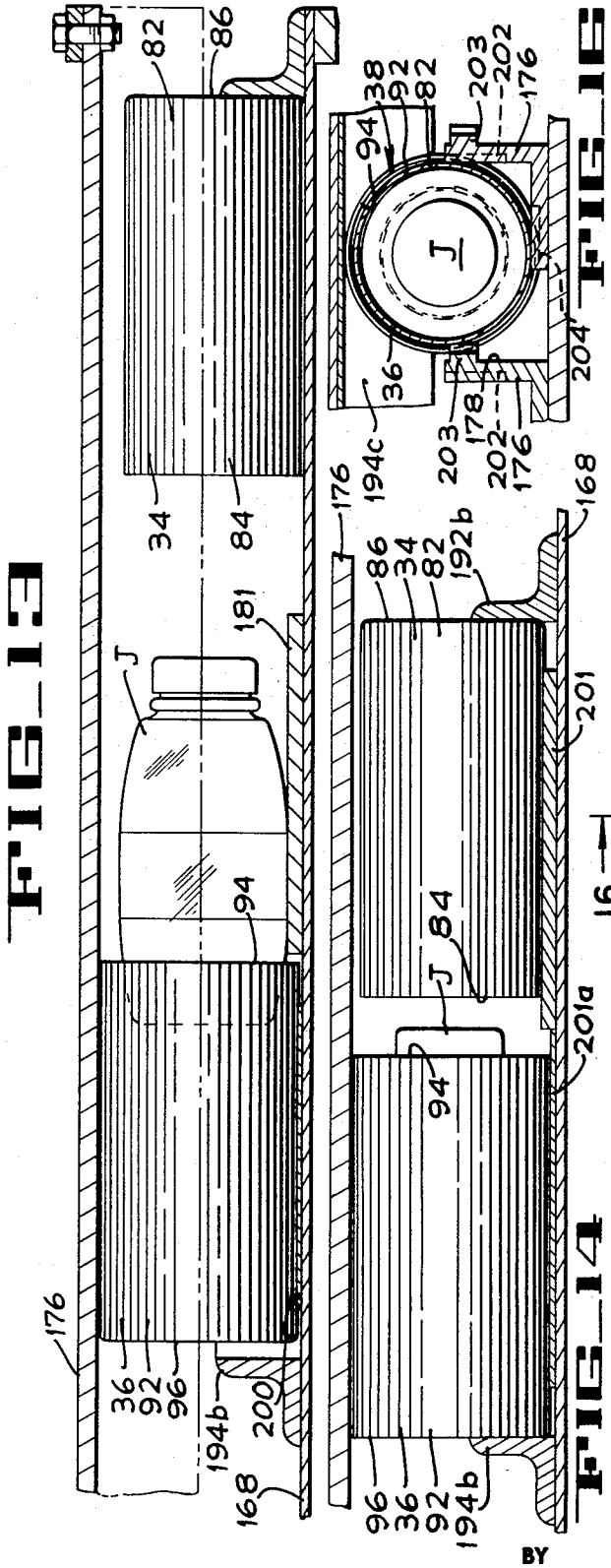


FIG. 13

FIG. 14

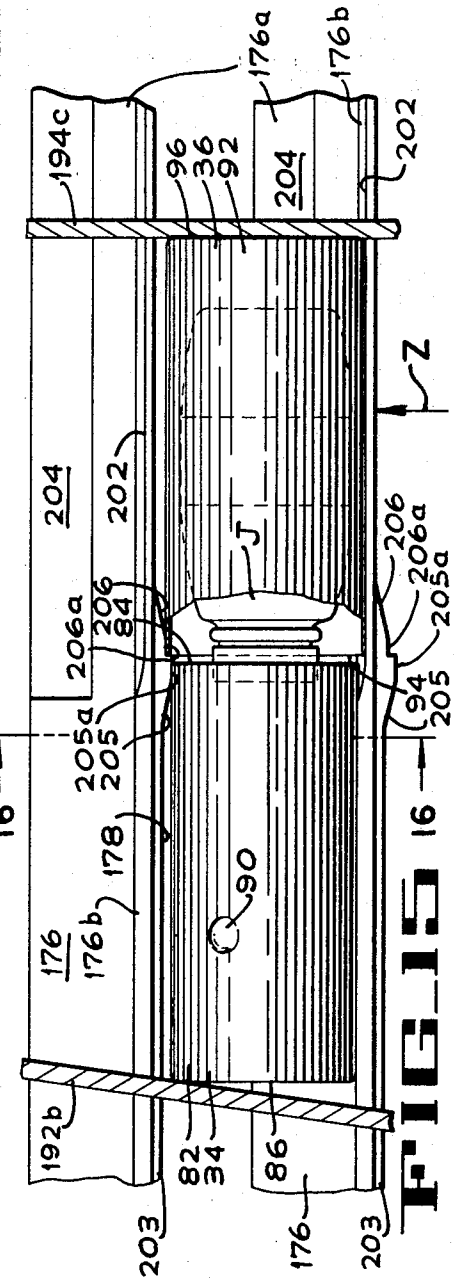


FIG. 15

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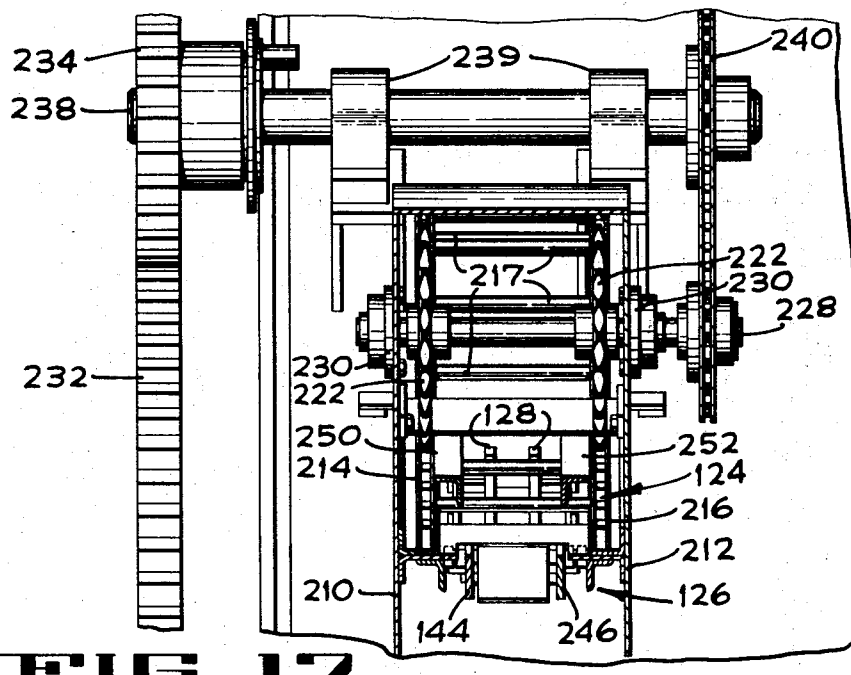
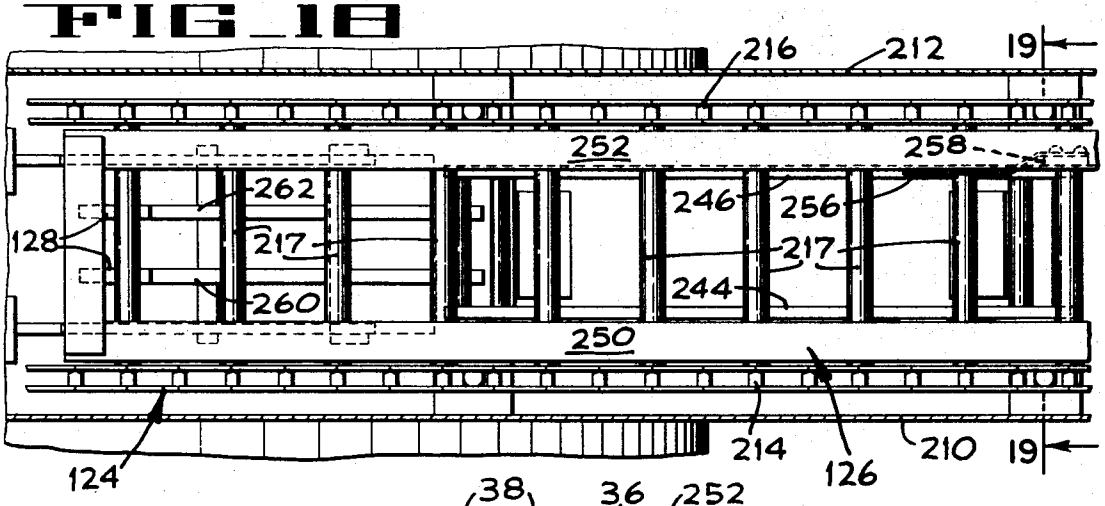


FIG_17

FIG_18



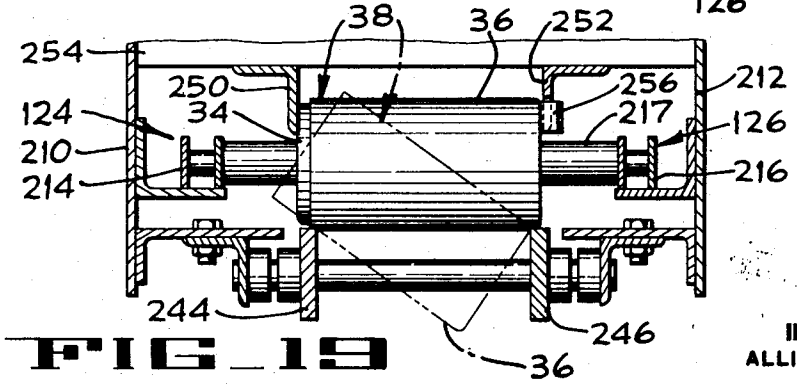
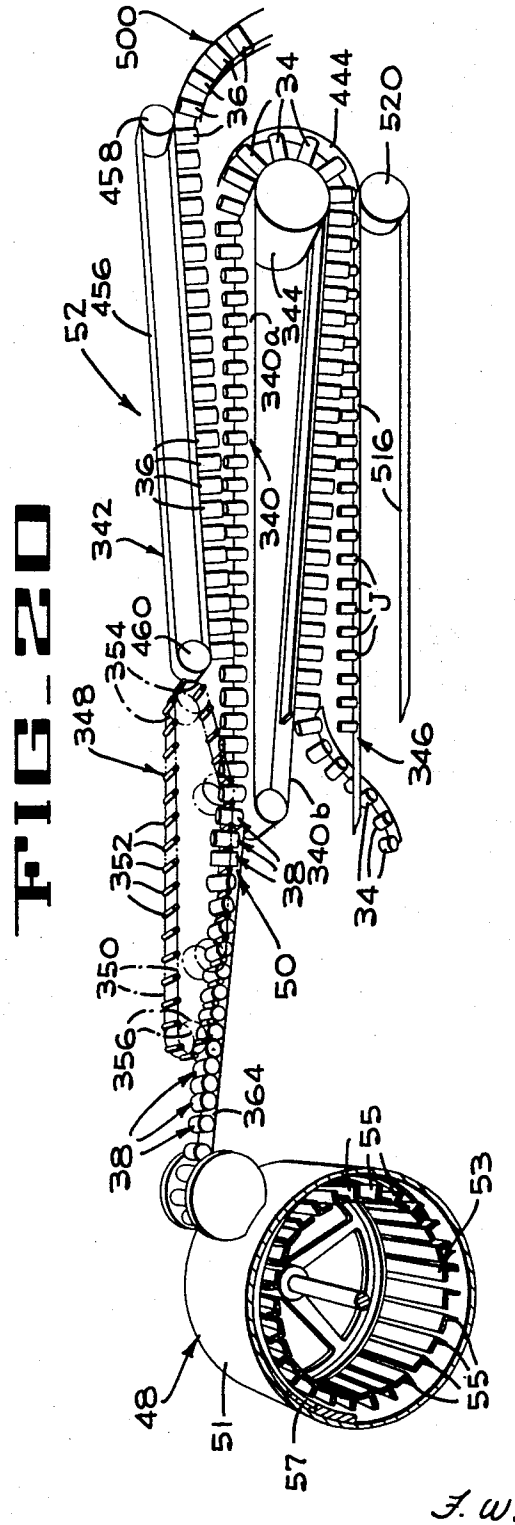


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FIG_20



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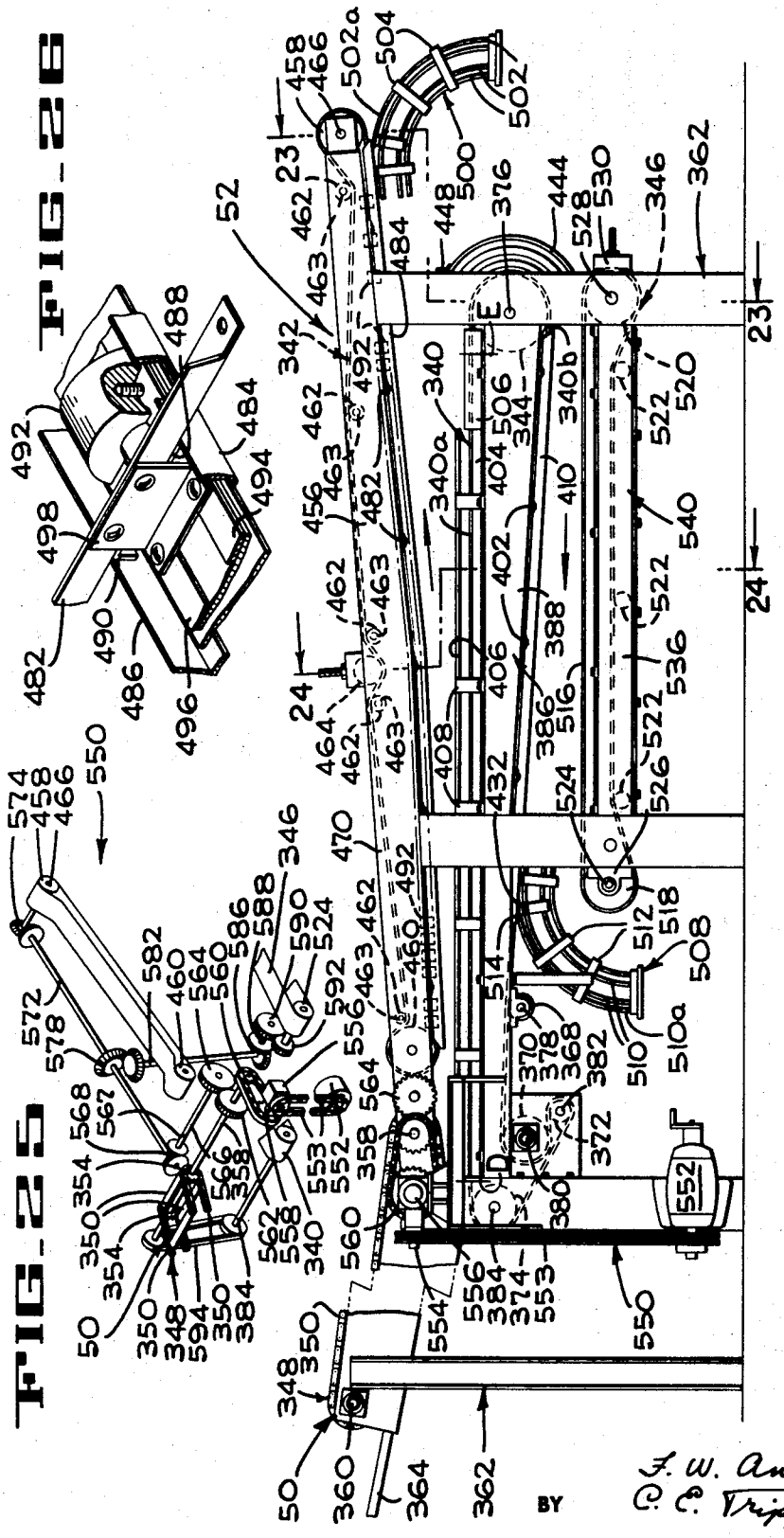


FIG. 21

FIG. 25

FIG. 26

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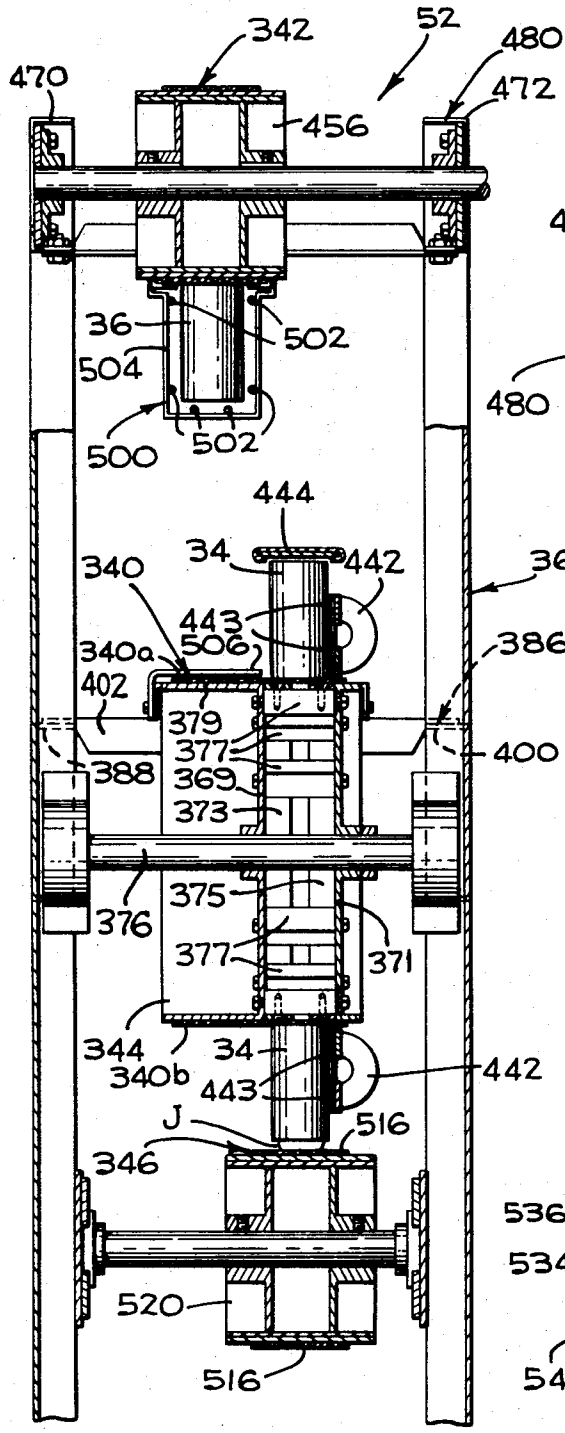


FIG_23

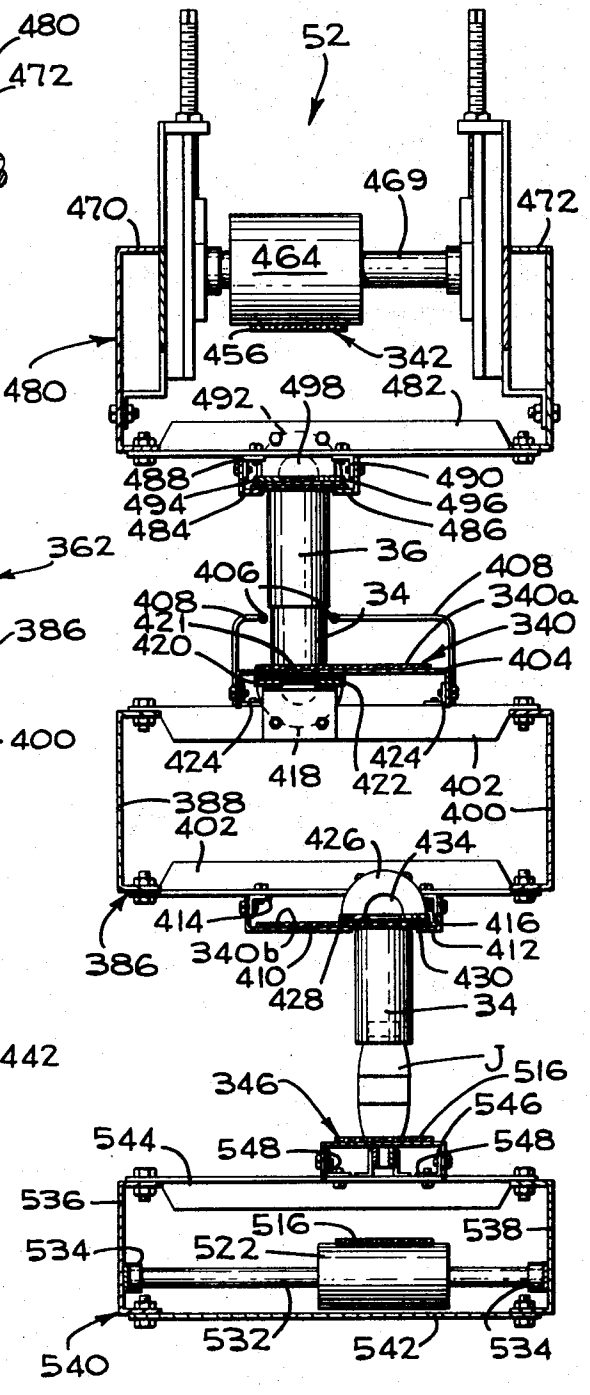


FIG_24

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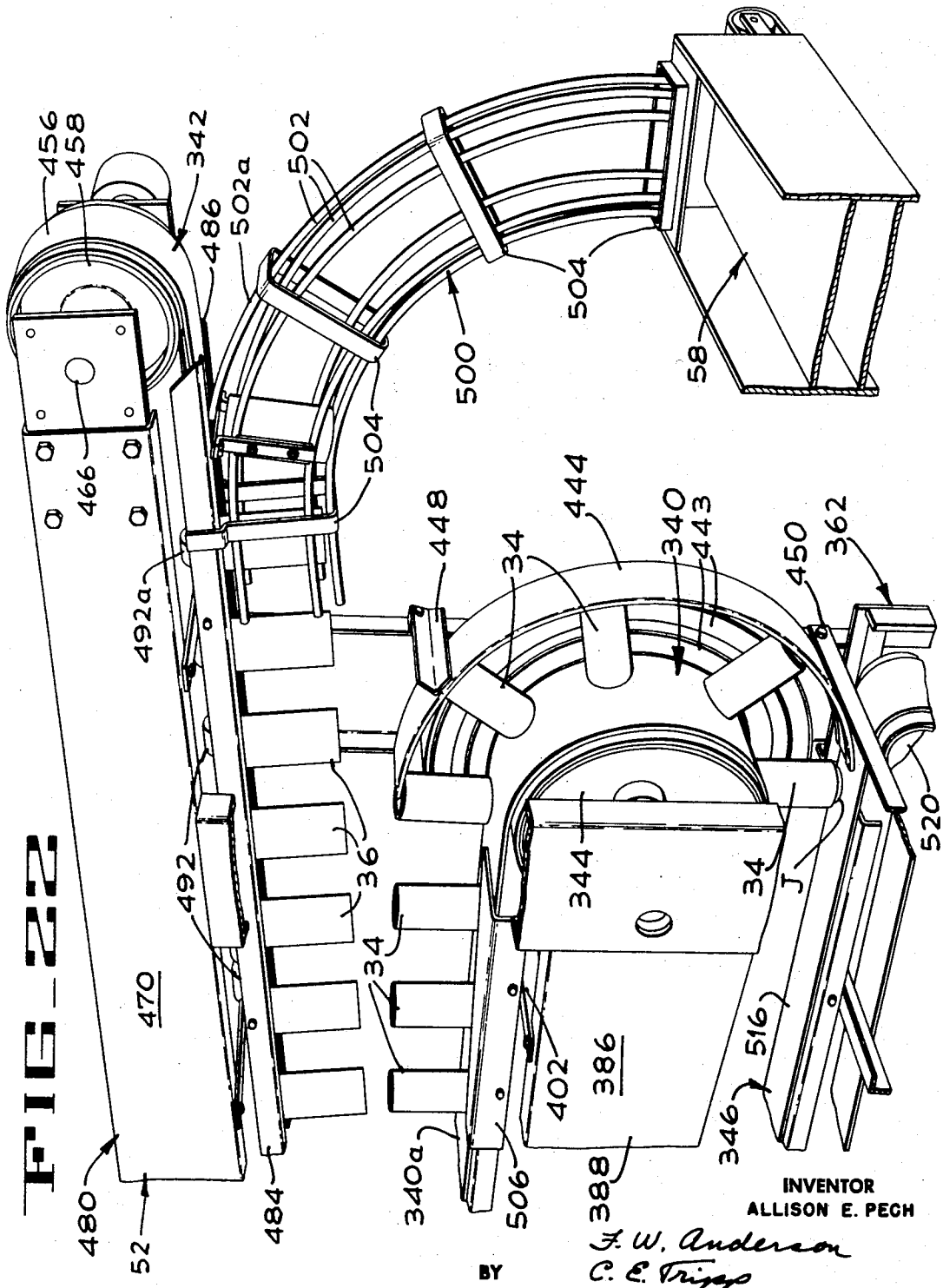


FIG_22

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ARTICLE CONFINING CAPSULE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a division of my application Ser. No. 473,107 filed on July 19, 1965, which application issued as U.S. Pat. No. 3,473,934 on Oct. 21, 1969.

The present invention pertains to a continuous sterilizing system and more particularly relates to a method of and apparatus for processing products in containers such as glass jars and bottles.

When food products such as milk are sterilized in glass jars, a certain amount of breakage always occurs due to defective jars being subjected to mechanical or thermal shocks. Although this breakage may be minor, when jars are handled in reel and spiral rotary cookers, the broken jars will build up on the floor of the cookers and will interfere with the unbroken jars thereby incurring still greater breakage.

Accordingly, it is one object of the present invention to provide a method of and apparatus for processing products in glass jars without risking the danger of process interference because of jar breakage.

Another object is to provide a method of and apparatus for processing glass jars in reel and spiral cookers and coolers without danger of process interference because of glass jar breakage.

Another object is to provide a method of and apparatus for individually confining containers, such as glass jars, for subjecting the confined containers to a heat treatment process while confined, and for releasing the containers from individual confinement only after completion of the heat treatment process.

Another object is to provide apparatus for individually confining containers in capsules and for advancing the confined containers completely through a heat treatment apparatus before opening the capsules and discharging the containers, either broken or intact, externally of the heat treatment apparatus.

Another object is to provide an apparatus for individually confining jars in capsules.

Another object is to provide an apparatus for removing encapsulated jars from confinement.

Another object is to provide a capsule for individually confining jars therein.

Another object is to provide an apparatus for draining water from a pressure processing chamber and for introducing said water into an atmospheric processing chamber.

These and other objects and advantages of the present invention will become apparent from the following description and the accompanying drawings, in which:

FIG. 1 is a plan diagrammatically illustrating a preferred disposition of the components of the sterilizing system of the present invention on a work floor.

FIG. 2 is an enlarged diagrammatic end elevation of part of the apparatus of FIG. 1, illustrating the placement of five reel-and-spiral type processing units through which the glass jars are passed.

FIG. 3 is a vertical section taken along lines 3–3 of FIG. 1 diagrammatically illustrating a hot water recirculation system interconnecting the pressure preheater with an atmospheric preheater.

FIG. 4 is an enlarged, exploded perspective, partly broken away, illustrating the position of a jar relative to a cartridge and carrier of the present invention prior to being encapsulated within the cartridge and carrier.

FIG. 5 is a vertical central section through a telescoping capsule formed by the cartridge and carrier, illustrating the manner in which a jar is confined therein.

FIG. 6 is a side elevation with parts broken away illustrating a second embodiment of the telescoping capsule, which embodiment includes a plastic cartridge.

FIG. 7 is an enlarged end elevation, with parts broken away, illustrating the capsule loader and the mechanism for feeding the loaded capsules into the atmospheric preheater of the system of FIG. 1.

FIG. 8 is an enlarged front elevation of the capsule loader of FIG. 7.

FIG. 9 is an enlarged fragmentary section taken on lines 9–9 on FIG. 8.

FIG. 10 is an enlarged fragmentary horizontal section taken along lines 10–10 of FIG. 8.

FIG. 11 is a vertical section taken along lines 11–11 of FIG. 8.

FIGS. 12 and 12A are arcuate sections forming a diagrammatic developed view of the inner surface of the shell of the capsule loader, FIG. 12 being taken along lines 12–12 of FIG. 11 and FIG. 12A being taken along lines 12A–12A, and the sections being arranged so that when the sections are placed end-to-end with lines x–x of FIG. 12 overlying lines y–y of FIG. 12A the complete view of the inner surface is formed.

FIGS. 13, 14 and 15 are enlarged diagrammatic vertical sections taken along lines 13–13, 14–14 and 15–15 of FIG. 11, respectively.

FIG. 16 is an enlarged vertical section taken along lines 16–16 of FIG. 15 illustrating a cartridge and carrier aligning device.

FIG. 17 is an enlarged vertical section taken along lines 17–17 of FIG. 7.

FIG. 18 is an enlarged horizontal section taken along lines 18–18 of FIG. 7 illustrating a reject mechanism and a capsule letdown device.

FIG. 19 is an enlarged section taken along lines 19–19 of FIG. 18 illustrating the manner of rejecting an improperly formed capsule.

FIG. 20 is a diagrammatic perspective of a capsule twister and a capsule unloader shown associated with an atmospheric cooler, the view being taken looking substantially in the direction indicated by lines 20–20 of FIG. 1.

FIG. 21 is a diagrammatic side elevation of the capsule unloader of FIG. 20, certain parts being broken away.

FIG. 22 is an enlarged perspective, with parts broken away, of the carrier discharge end of the capsule unloader.

FIG. 23 is an enlarged vertical section taken along lines 23–23 of FIG. 21.

FIG. 24 is an enlarged vertical section taken along lines 24–24 of FIG. 21.

FIG. 25 is a diagrammatic perspective illustrating the drive for the capsule twister and capsule unloader of the system.

FIG. 26 is a perspective showing the structure for mounting certain magnets used in the capsule unloader.

The continuous sterilizing system of the present invention is provided for the purpose of processing containers such as glass jars J (FIG. 4) in reel and spiral cookers and coolers in such a manner that, even if a container breaks, it will not interfere with the sterilizing process.

Although the containers J will hereinafter be referred to as glass jars, it will be appreciated that other articles such as containers made of plastic, aluminum, or other material, said articles being either symmetrical or irregular in configuration, may also be handled in the apparatus of the present invention. For example, nonrolling containers such as those that are square or hexagonal in transverse cross section may be processed.

In general, the sterilizing process is performed in an apparatus which is adapted to handle jars J that are first filled with a product such as milk, and are then closed and capped by a conventional filling and closing apparatus that is indicated generally by the numeral 30 (FIG. 1). Each jar is then advanced into a capsule loader 32 of an encapsulating and loading apparatus 33 and is positioned between a cartridge 34 and a carrier 36 as indicated in FIG. 4. As the jar J, cartridge 34, and carrier 36 are advanced through the capsule loader 32, the cartridge 34 and the carrier 36 are urged into telescoped relation to provide a capsule 38, with the jar positively confined or encapsulated therein as indicated in FIG. 5. The capsule 38 with the container confined therein is then successively fed into water at approximately 140°—212°F. in an atmospheric preheater 40 (FIG. 1); into steam at approximately 235°F. in a pressure preheater 42; into steam at ap-

proximately 265°F. in a sterilizer **44**; into water at approximately 195°F. in a pressure cooler **46**; and finally into water at approximately 70°—90°F. in an atmospheric cooler **48**.

Each capsule **38** with the sterilized and cooled jar therein is then advanced through a twister **50** (FIGS. **1** and **20**) which moves the capsule **38** from a horizontal to an upright position. The capsule **38** is then moved to a capsule unloader **52** wherein the carrier **36** and cartridge **34** are magnetically withdrawn from around the jar, and the jar is discharged from the system by a conveyor **54**. The empty cartridge **34** and carrier **36** are then returned to the capsule loader **32** by return conveyors **56** and **58**, respectively.

Five heat treatment vessels **40**, **42**, **44**, **46** and **48** have been shown in the preferred embodiment of FIGS. **1** and **2**, however, it will be understood that other numbers and arrangements of vessels may be employed. The vessels are of the reel-and-spiral type and may be constructed and arranged as indicated in detail in U.S. Pat. No. 2,536,115 to P.C. Wilbur. Although the Wilbur patent discloses angle carrier bars, it is to be understood that curved carrier bars may be substituted for the angle bars which curved bars may be of the type disclosed in the patent to Mencacci No. 3,181,692.

As seen in FIG. **7**, each vessel comprises a generally cylindrical shell **51** in which an elongate reel **53** is journaled for rotation about a horizontal axis. A plurality of longitudinally extending angle bars **55** are secured to the periphery of the reel to form a series of longitudinally extending can channels. A T-iron guide track **57** is secured to and extends in a helical path around the inside of the shell from an inlet opening at one end of the vessel to a discharge opening at the other. As the reel rotates, the helical guide track **57** causes the cans to move longitudinally in the shell toward the discharge opening while being subjected to a heating or cooling medium in the vessel. The processing temperatures of the treating medium and the time of treatment may vary according to the product being handled, and may have the values disclosed in the above-mentioned Wilbur patent, if milk is the product being handled. The reels of all processing vessels are continuously driven by a motor **62** (FIG. **1**) and a gear train comprising mating gears **64**, **66**, **68**, **70**, **72**, **74**, **76**, **78** and **80**, the gear **64** being keyed to the motor drive shaft and the other gears being keyed to the drive shafts of associated reels.

Although the present application completely discloses and broadly claims the encapsulating and loading apparatus **33**, the capsule twister **50**, and the capsule unloader **52** and their interaction, the details of each of these structures are claimed in the following separate applications filed on even date herewith. The encapsulating and loading apparatus has been described and claimed in an application of Milton L. Croall et al. for U.S. Letters Pat. having Ser. No. 472,969, which issued on June 18, 1968 as U.S. Pat. No. 3,388,528; the capsule twister **50** has been described and claimed in an application of Milton L. Croall for U.S. Letters Pat. having Ser. No. 472,975, which issued on Apr. 18, 1967 as U.S. Pat. No. 3,314,522; and the capsule unloader has been described and claimed in an application of Raymond J. Bell for U.S. Letters Pat. having Ser. No. 472,976, which issued on Apr. 18, 1967 as U.S. Pat. No. 3,314,560.

An important feature of the invention resides in the fact that the jars J are individually confined within a capsule **38** of a size and shape which may be reliably handled by the several heat treatment vessels. By confining an individual jar in a separate capsule, any defective jar which is broken by thermal or mechanical shock is retained in its capsule until after the capsule has been moved through all of the vessels and is subsequently opened.

The capsule **38** illustrated in FIGS. **4** and **5** comprises the cartridge **34** and the carrier **36** both of which are formed of a ferrous metal which may be magnetically attracted. The cartridge **34** includes a cylindrical body **82** which is slightly larger in diameter than the jars J being processed, and has one open end **84** through which the jar is inserted. The other end of the cartridge **34** is partially closed by an end plate **86** which is formed integrally with the body **82** and has an opening **88** therein to permit the heat treating medium to enter the capsule **38**. Dimples **90** are formed in the cylindrical body **82** near the end plate **86** to project inwardly and engage the jar and act as a stop which prevents the cap of the jar from contacting the end plate **86**. If such contact were permitted, lithography on the jar caps could be damaged by engagement with the end plate **86**.

The carrier **36** of each capsule **38** is similar in appearance to the cartridge **34** and includes a cylindrical body **92** of slightly greater diameter than the body **82**. The body **92** has an open end **94** which receives the cartridge **34**, and a partially closed end defined by a plate **96** integral with the body and having an opening **98** therein. In order to minimize magnetic attraction between the open end **84** of the cartridge and the end plate **96** of the carrier when the end plate **96** is subjected to a magnetic force, an apertured dish **100** of nonmagnetic material is rigidly secured to the inside surface of the end plate **96**, and includes an annular flange **102** which is spaced from the plate **96** and substantially breaks any magnetic force tending to pull the carrier and cartridge toward each other.

The capsule **38***a*, shown in FIG. **6**, is a second embodiment which is provided to handle jars having embossed words or legends projecting outwardly from the outer periphery of the jars. It has been discovered that such legends become marked if the jars are permitted to roll within metal cartridges such as that shown in FIG. **5**.

The capsule **38***a* (FIG. **6**) comprises a plastic cartridge **34***a* which supports the jar but does not mar it and includes a cylindrical body **104** having one end open and the other end substantially closed by an end plate **106** having a hole **108** therein. The end plate **106** of the cartridge is impregnated with a ferrous material so that the cartridge **34***a* can be magnetically attracted. Jar engaging shoulders **110** are provided in the cartridge **34***a* to prevent the jar cap from engaging the end plate **106**, and slots **112** are provided in the cylindrical body **104** to permit more effective entry of the heat treating medium into the capsule. It will be appreciated that the interior of the cartridge **34***a* may be formed so as to handle odd shaped articles if desired.

The capsule **38***a* also includes a carrier **36***a* which is similar to the carrier **36** except that it includes a cylindrical body **114** having a plurality of perforations **116** therein for permitting water and steam to flow into or out of the capsule. Since the cartridge **34***a* is of plastic material, the carrier **38***a* need not include a dish of the type required by capsule **38** since there will be no tendency for the cartridge **34***a* and carrier **36***a* to magnetically cling to each other.

CAPSULE LOADER

The capsule loader **32** (FIGS. **7**—**19**) receives filled and capped jars J from a feed conveyor **130** and positions a carrier **36** over each jar. Then the loader telescopes a cartridge **34** into the carrier **36** between the carrier and the jar, whereby the jar is then enclosed in a capsule. The loaded capsules are then moved by a timing conveyor **124** (FIG. **7**) over a reject mechanism **126** which causes incomplete capsules to drop out of the timing conveyor allowing only properly assembled capsules to move over letdown fingers **128** into the atmospheric preheater **40**. accommodate

As best shown in the plan view of FIG. **10**, filled jars are received in upright position and in random order on the feed conveyor **130**, which may be of the endless belt type and is continuously driven by drive means, such as a motor, not shown. As the jars move along the feed conveyor **130**, they are guided into a screw type spacing conveyor **132** by guide rails **134** and **136** (FIG. **10**), which rails are secured to the frame **138** of the capsule loader **32** by bolts **140** that extend through slots in the rails and permit transverse adjustment of the rails to accommodate jars of different sizes. The spacing conveyor **132** is journaled in bearings **142** which are secured to the frame for transverse adjustment. The pitch of the screw thread

144 of the spacing conveyor gradually increases in the direction of movement of the jars thereby spacing the randomly spaced jars a predetermined distance from each other as they reach the discharge end of the screw conveyor 132.

A resilient guide rail in the form of a spring 146 is stretched between the rail 134 and a rail segment 148 that is adjustably secured to the frame near the discharge end of the screw conveyor 132. The spring 146 provides a resilient guiding surface which is disposed opposite the inlet end of the screw conveyor and will deflect in the event a jar should engage a ridge 132*a* of a portion of a screw conveyor 132, as it enters the conveyor, rather than being disposed in the valleys 132*b* between adjacent ridge portions of the screw thread 144. The resistance to forward movement of the jar by the spring 146 will cause such a mispositioned jar to be forced into the next adjacent valley 132*b* as the jar moves to the left in FIG. 10.

The screw conveyor 132 is driven slower than the feed conveyor 130 and in timed relation with a transfer turret 152 which consists of an annular member 150 that is secured to a shaft 156 and has two rings 151 and 153 integrally formed around its periphery. Pockets 154 are provided in the rings 151 and 153 by fingers 155, the pockets being spaced apart a distance equal to the distance between jars at the discharge end of the screw conveyor 132. The shaft 156 is inclined and is journaled in bearings 158 bolted to the frame of the capsule loader 32.

The provision of the two rings 151 and 153 make it possible to handle both tall and short jars in the turret 152 without requiring any alterations to the turret. When tall jars are to be handled, the jars are supported by both rings and when short jars are being handled, the lower ring 153 operates alone and provides sufficient jar-supporting surface to prevent twisting or turning of the jar in the pocket while the jar is moved from a vertical to a horizontal position by the turret. A stationary, curved track 160 (FIGS. 8 and 9) is secured to the frame 138 and includes a bottom-engaging section 162 and a side-engaging section 164 which cooperate to retain the jars in their pockets 154 as the jars are moved from the vertical to the horizontal position.

While moving the jars to a horizontal position, the transfer turret 152 moves the jars upwardly through an opening 167 (FIGS. 11 and 12) on the lower side of a stationary drum 168 (FIGS. 8 and 11) which forms the outer shell of the capsule loader 32. While in the drum 168, the carriers 36 and cartridges 34 are moved into telescoping engagement over the jars to confine each jar in one of the capsules 38.

The jars are transferred one at a time from the turret 152 (FIG. 8) onto an arcuate stripper plate 180 which is formed integrally with the shell 168 adjacent the opening 167. The outer or free end of the stripper plate 180 is provided with slots 182 (FIG. 10) defining fingers 183 which extend into the spaces alongside and between the rings 151 and 153 to intercept and strip each jar from the transfer turret. Immediately inside the opening 167, a jar support and spacer plate 181 is secured to the inside wall of shell 168. This plate 181 may have a tapered leading edge 181*a* for guiding each jar up onto the plate which is of a thickness adapted to maintain the jar in slightly spaced relation to the inner wall of the shell so that the carriers can easily be telescoped at a subsequent station around the jar without danger of the bottom of the jar engaging the open end of the carrier as will be explained in more detail hereinafter.

As best shown in FIG. 11, a continuously driven combiner reel 170 is disposed within and is concentric with the shell 168. The reel is mounted on a shaft 172 which is journaled in bearings 173 (FIG. 8) secured to the frame 138 of the capsule loader. The reel 170 includes a pair of spaced wheels 174 and 175 which are keyed to the shaft and have a plurality of equally spaced angle carrier bars 176 secured to the outer periphery of each wheel. The angle bars are spaced sufficiently from each other and from the under surface of the drum 168 (FIGS. 12 and 13) so that jars J, cartridges 34 and carriers 36, which are fed into pockets 178 defined between adjacent angle bars, will be advanced along the inner surface of the drum 168 upon rotation of the reel 170. As best shown in FIG. 8, the ends of the shell 168 are secured to side plates 184 and 186 which are apertured to receive the reel shaft 172.

The empty carriers 36 are received from the carrier conveyor 58 (FIG. 1) and are directed into a chute 190 (FIG. 11) which communicates with an opening 191 in the shell and guides the carriers 36 through the opening into the reel pockets 178. The empty cartridges 34 are received from the conveyor 56 and are similarly directed through a chute 188 (FIG. 8) which is identical to chute 190 and is arranged to guide the cartridges 34 through an opening 191*a* (FIG. 12A) in the shell and into the reel pockets 178.

Referring to FIGS. 12 and 12A, it will be noted that, when these views are placed end-to-end with transverse lines x–x of FIG. 12 overlying lines y–y of FIG. 12A, a developed diagrammatic view of the entire inner surface of the shell 168 is provided, the plane of this view being indicated by the circular section lines 12–12 and 12A–12A, respectively, of FIG. 11. Various operations take place as the jars, carriers, and cartridges are moved around the inside of the shell and, in order to locate the positions at which these operations take place, angular positions around the stationary shell have been indicated on FIGS. 12 and 12A. The zero degree position has been chosen to be the lowermost section of the shell at the area of the opening 167. Accordingly, by referring to FIG. 11 and FIG. 12A it will be recognized that the chutes 188 and 190 through which the carriers and cartridges enter the shell are at approximately the 180°, or uppermost area of the shell.

In general, three paths A, B and C (FIGS. 12 and 12A) are defined on the inner periphery of the shell, these paths being indicated by centerlines. The entrance opening 167 is located along the central path B and, accordingly, each jar is placed in the central portion of one of the reel pockets and remains in this central position while it is being encapsulated and finally discharged. The opening 191 (FIG. 12A) through which the carriers 36 enter the shell is disposed along path A and, accordingly, the carriers 36 enter the shell at a point 180° from the point of entry of the jars and at a point spaced laterally from the central path B. As will be explained presently, the carriers 36 do not remain in path A but are eventually cammed over to path B. Similarly, since the opening 191*a* (FIG. 12A) through which the cartridges 34 enter the shell is disposed along path C, the cartridges enter the machine at a point spaced laterally from the central path B and are cammed over to path B to encircle a jar and telescope inside the carrier 36 that has been already positioned around the jar.

Referring to FIG. 12A, it will be seen that each carrier 36 enters the shell through opening 191 and is moved to the right along path A by an angle bar 176. During the initial portion of its movement downwardly along the inner surface of the shell, the carrier is confined to movement along path A by two longitudinally extending guide rails 194 and 194*a*. At approximately the 340° section of the shell, one edge of the carrier engages an inwardly slanted rail 194*b* which guides the carrier inwardly toward path B. After the carrier passes the 0°—360° section (FIG. 12), it is moved to approximately the 12° section where it rides up onto a relatively thin plate 200 that is secured to the inner face of the shell and extends to approximately the 130° section. The inwardly slanted guide 194*b* ends before the 90° section is reached and a straight, longitudinally extending guide bar 194*c* forms a continuation of rail 194*b* to guide the carrier in a straight line as it is moved along path B.

It will be noted in FIG. 12 that, as each carrier bar 176 approaches the 90° section of the shell, the cartridge 34 contacts a plate 201 secured to the inner wall of the shell and the carrier continues on a portion 201*a* of plate 200, which is thin relative to plate 201, as seen in FIG. 14. These plates urge the cartridge and carrier radially inwardly of the drum so that, as they pass the 90° section, they roll inwardly (FIG. 11) into contact with the upstanding leg 176*a* of the carrier bar 176. At this time, the inclined guide rail 192*b* (FIG. 12) has not as yet telescoped the cartridge into the adjacent carrier. In order to

position the open end of the cartridge for telescoping movement into the carrier, each carrier bar **176** (FIG. **15**) is provided with an aligning mechanism comprising a guide strip **203** welded to the rear face of the leg **176***b*, a recess **204** in the leg **176***a*, and a recess **202** in the capsule supporting leg **176***b*. The guide strip **203** has a slanted surface **205** leading to a flat surface **205***a*, and a slanted surface **206** leading to a recess **206***a*. As seen in FIG. **15**, when the carrier **36** with the jar therein is being moved upwardly in the general direction of arrow Z toward the 90° section of the shell, it rests in the recess **202** of the carrier bar and has been urged by the adjacent guide bar **194***c* into the recess **206***a* of the guide strip **203** on the rear wall of the carrier bar next ahead. Similarly, the cartridge **34** rests on the leg **176***b* of the carrier bar and has been urged inwardly by guide bar **192***b* until it is in abutting engagement with the surface **205***a*. As the carrier engages the thin plate **201**, it is urged inwardly into the recess **204** of leg **176***a*. Thus, as seen in FIG. **16**, after the cartridge and carrier pass the 90° section, they are in alignment such that the cartridge **34** can telescope into the carrier under the further urging of the guide bar **192***b* (FIG. **12**). The telescoping operation continues until the cartridge and carrier reach approximately the 170° section of the shell. As the telescoped unit continues around the shell along the path B, it moves downwardly (FIG. **11**) and is finally discharged through an opening **208** in the shell.

The telescoped units, which will hereinafter be referred to as capsules, gravitate from the opening along an inclined support plate **207** (FIG. **7**) which forms the floor of a portion of the roller conveyor **124** which includes a pair of spaced vertical mounting plates **210** and **212** (FIGS. **7**, **17**, **18** and **19**). One end of each mounting plate is secured to the frame **138** while the other end is secured to the atmospheric preheater **40** adjacent the feed opening thereof. The feed conveyor **124** comprises a pair of spaced endless chains **214** and **216** (FIGS. **17**—**19**) having a plurality of rotatable rollers **217** carried between the chains at even intervals. The chains are trained around pairs of sprockets **218**, **220** and **222**, which are keyed to shafts **224**, **226** and **228**, respectively. The shafts are journaled in bearings **230** secured to the plates **210** and **212**.

The feed conveyor **124** is driven in timed relation with the reel **53** of the atmospheric preheater **40** by a gear **232** which is secured to the shaft **236** of the reel **53** and meshes with a gear **234**. The gear **234** is keyed to a shaft **238** that is journaled in bearings **239** supported by the atmospheric preheater **40**. A chain drive **240** interconnects the shaft **238** with the shaft **228** and drives the feed conveyor at a speed which will deposit the capsules **38** one at a time into the elongated carrier bars **55** (FIG. **7**) formed on the periphery of the reel **53** in the atmospheric preheater **40** as disclosed in the above-mentioned patent to Wilbur No. 2,536,115.

As indicated in FIG. **7**, when the capsules **38** are discharged from the opening **208** they will roll down the inclined support plate **207** into abutting contact with each other. As they roll down the plate, each capsule will be engaged and conveyed, one at a time, away from the following capsules in a predetermined spaced and timed arrangement. The feed conveyor **124** moves the capsules upwardly past the reject mechanism **126** and the letdown fingers **128** prior to discharging the capsules into the carrier bars **55** of the preheater **40**.

The reject mechanism **126** (FIGS. **7**, **15** and **16**) is provided to discharge incomplete capsules, that is, a carrier **36** without a mating cartridge **34** or a cartridge without a mating carrier, from the feed conveyor **124** prior to entering the atmospheric preheater **40**. The reject mechanism **126** comprises a pair of upwardly inclined support rails **244** and **246** (FIG. **17**) which are spaced apart a distance slightly less than the length of the carrier. The support rails **244** and **246** are supported by the mounting plates **210** and **212**, respectively. In order to maintain properly assembled capsules **38** centered and supported by the rails **244** and **246**, guide rails **250** and **252** (FIG. **18**) are mounted above the upwardly inclined run of the chain conveyor **124** in position to engage the upper portions of the end faces of the cartridges **34** and carriers **36**, respectively. The guide rails **250** and **252** are likewise connected to the vertical mounting plates **210** and **212**, respectively, by suitable brackets **254**. A leaf spring **256** has one end bolted to a bracket **258** that is supported by the rail **252**, and has its other end projecting through a slot in the rail **252** into the path of movement of the capsules **38** as they move over the rails **244** and **246** of the reject mechanism **126**.

As clearly shown in FIG. **19**, the spring **256** forces the capsule **38** to the left so that the cartridge of each assembled capsule engages the guide rail **250** and remains supported by the support rails **244** and **246**, while the open end of a carrier **36** without a mating cartridge **34**, or the end plate of a cartridge without the mating carrier will engage the rail **250**, causing the foreshortened unit to fall downwardly between the supporting rails **244** and **246** and be rejected from the feed conveyor **208**.

The properly formed capsules **38**, after moving past the reject mechanism **126**, are moved upwardly along support rails **260** and **262** (FIG. **18**). The rails **260** and **262** define extensions of the rails **244** and **246** but are spaced closer together. Upon reaching the upper discharge end of the feed conveyor **208**, the capsules roll over the letdown fingers **128** which are integral with and form extensions of the rails **260** and **262**. The letdown fingers **128** (FIG. **7**) project within the atmospheric preheater **40** and into slots (not shown) formed in the carrier bars **55** of the reel **53**. Thus, the letdown fingers **128** serve to gently lower the filled capsules **38** into the carrier bars **240** thereby greatly minimizing mechanical shock to the jars within the capsules **38**.

The drive for the screw conveyor **132**, the transfer turret **152**, and the combiner reel **170** is best shown in FIGS. **7**, **8**, **10** and **11**. The drive comprises a variable speed gear motor **276** (FIG. **11**) having an output shaft **278** that is connected by a chain drive **279** to a slip clutch **280** of the type marketed by the Mercury Clutch Division of Automatic Steel Products, Inc., Canton, Ohio under model No. AC-4868. The slip clutch **280** is mounted on and drives a shaft **282** which is journaled in the frame **138** and has a bevel gear **284** (FIG. **10**) keyed thereon. The bevel gear **284** meshes with a mating gear **286** that is keyed to one end of a shaft **288** that is suitably journaled in the frame **138** of the machine and is perpendicular to the shaft **282**. A sprocket **290** is keyed to the other end of the shaft **288**. The screw conveyor **132** is driven by a chain **291** which is trained around the sprocket **290**, around a sprocket **292** keyed to the drive shaft **294** of the screw conveyor **132**, and around a takeup sprocket **296** that is journaled on a bracket **298** adjustably mounted on the frame **138** of the capsule loader **32**.

The transfer turret **152** is driven from a gear **300** which is keyed to the shaft **282** and meshes with a larger gear **302** that is keyed to one end of an intermediate shaft **304**. A bevel gear **306** (FIG. **9**) keyed to the other end of the intermediate shaft **304** meshes with a bevel gear **308** keyed to the lower end of the turret shaft **156**.

The combiner reel **170** is driven from the gear **302** which meshes with a larger diameter gear **310** which is keyed to the reel shaft **172**. The direction of rotation of the screw conveyor **132**, the transfer turret **152** and the combiner reel **170** is indicated by arrows in FIGS. **7**, **8** and **10**.

As mentioned previously, the filled capsules **38** are progressively passed through the atmospheric preheater **40**, the pressure preheater **42**, the sterilizer **44**, the pressure cooler **46** and the atmospheric cooler **48**.

The heating medium in the atmospheric preheater **40** is water which is maintained at shaft level by suitable controls (not shown) while the heating medium in the pressure preheater **42** is steam that is maintained at the desired temperature and pressure. Because of the relatively close fit between the cartridges **34** and the carriers **36** when telescoped together as best shown in FIG. **5**, water is trapped within the capsules and is carried from the atmospheric preheater **40** to the pressure preheater **42** when the capsules **38** are transferred from the atmospheric preheater to the pressure preheater. After

prolonged operation, the carry-over water deposited in the pressure preheater would build up to such an extent that it would detrimentally affect the operation of the pressure preheater **42** if not removed therefrom.

It is a feature of the invention to provide a water return system **314** (FIG. **3**) which not only removes the water from the pressure preheater **42** but also serves to supply makeup water as well as heat to the atmospheric preheater **40**. The water return system comprises a conduit **316** that is connected to the bottom portion of the pressure preheater **42** near the feed end thereof and communicates with a steam trap **318** of the usual well known type which blocks the passage of steam but permits the passage of water. A conduit **320** is connected between the discharge end of the steam trap **318** and the suction opening of a pump **322**. A conduit **324** is connected to the discharge opening of the pump **322** and has its free end communicating with the discharge end of the atmospheric preheater **40**. The free end of the conduit **324** is preferably disposed slightly below the water level in the atmospheric preheater **40**.

Since the flow of water induced by the transfer of capsules **38** from the atmospheric preheater **40** to the pressure preheater **42** is relatively large and could not be entirely accommodated by the steam trap **318**, a bypass conduit **326** is connected between the conduits **316** and **320**. A valve **328**, such as a control valve that is responsive to the level of water in the preheater **42**, is connected in conduit **326** and is effective to prevent the flow of steam therethrough if the water level in the pressure preheater **42** falls below a predetermined level. A manually operated valve may be used in conduit **326** so that conduit **326** may be closed when steam begins to escape from preheater **42**. By discharging the carry-over water into the atmospheric preheater **40** near the hot or discharge end thereof as indicated in FIG. **1**, it will be appreciated that the carry-over water will add a substantial amount of heat to the water in the atmospheric preheater **40**. Since this addition of heat is at a point where the jars have already been raised to a temperature near the boiling point of water, the danger of applying an excessive thermal shock to the jars is minimized while the jars are in the atmospheric preheater **40**. It will be appreciated that thermal and mechanical shock will also be minimized when the capsules **38** are transferred from the 212°F. water in the atmospheric preheater **40** to the 235°F. steam in the pressure preheater **42** since the carry-over water within the capsules absorbs considerable amount of the heat and acts as a cushion against mechanical shock.

Although the pump **322** has been shown in the water return system **314**, it will be appreciated that the pump is not needed and can be eliminated if the pressure within the pressure preheater **342** is sufficient to force the water through the system **314** as it is when the temperature therein is 235°F.

After the filled capsules have moved through the atmospheric preheater **40** and pressure preheater **42**, the capsules **38** are progressively advanced through the sterilizer **44**, the pressure cooler **46**, and the atmospheric cooler **48** in the usual manner before being transferred to the capsule unloader **52**.

CAPSULE UNLOADER

The capsule unloader **52** (FIGS. **1** and **20**) includes the twister **50** which receives capsules from the atmospheric cooler **48** with their longitudinal axes disposed horizontally. The twister **50** turns the capsules through 90° so as to move the capsules **38** to an upright position on the upper run **340***a* (FIG. **20**) of a cartridge conveyor **340** with the carriers **36** of the capsules uppermost. The carriers **36** are then magnetically attracted to an upwardly inclined overhead carrier conveyor **342** and are withdrawn from the associated cartridges before being discharged onto the carrier return conveyor **58** for return to the capsule loader **32**. The cartridges **34**, with the processed jars J therein, are then conveyed around a magnetic drum **344** (FIGS. **21** and **22**) permitting the jars to gravitate onto the upper run of a jar conveyor **346**. The cartridges **34** are magnetically held against the lower run **340***b* of the cartridge conveyor **340** and are gradually lifted upwardly away from the jars. After the cartridges **34** have been lifted clear of the jars, the cartridges are discharged from the unloader **52** onto the cartridge return conveyor **56** (FIG. **1**) which returns the cartridges to the capsule loader **32**. The processed jars are discharged from the jar conveyor **346** onto any suitable discharge means such as a takeaway conveyor or the like (not shown).

The twister **50** includes a twister conveyor **348** (FIGS. **20** and **21**) which is similar to the timing conveyor **124** (FIG. **7**) and comprises a pair of endless conveyor chains **350** having a plurality of evenly spaced transverse rollers **352** journaled thereon. The chains **350** are trained around two drive sprockets **354** (FIG. **20**) and around driven sprockets **356** keyed to shafts **358** and **360**, respectively, (FIG. **21**) journaled in the frame **362** of the unloader. The conveyor **348** is continuously driven, causing capsules **38** supported on an inclined gravity ramp **364** to enter between adjacent rollers **352** and to positively advance along the ramp **364** which is twisted thereby causing the capsules **38** to assume an upright position on the cartridge conveyor **340** with the carrier **36** uppermost.

The twister **50** is described and claimed in the aforementioned Milton L. Croall U.S. Pat. No. 3,314,522. If a more detailed description of the twister **50** is required, reference may be had to the Croall patent.

The continuously driven cartridge conveyor **340** comprises an endless nonmagnetic belt that is trained over the magnetic drum **344** and over guide rollers **368**, **370**, **372** and **374** keyed to shafts **378**, **380**, **382** and **384**, respectively, which shafts are journaled in the frame **362** of the capsule unloader **52**. The drum **344** may be of the type disclosed in the patent to Cmiel No. 3,120,891, and in general comprises a pair of nonmagnetic discs **369** and **371** which have hubs keyed to a shaft **376**. A pair of pole strips **373** and **375** of magnetic material are disposed near the outer periphery of the discs **369** and **371**, respectively, and are bolted to bar magnets **377** which are in turn bolted to the discs **369** and **371**. A cylindrical flange **379** is formed integrally on the outer periphery of the disc **369** and is of the same outside diameter as the pole strips **373** and **375**. The magnets are oriented so that the north poles are all connected to the strip **373** and the south poles are all connected to the strip **375**. Magnetic drums of this type are marketed by the Eriez Manufacturing Company of Erie, Pennsylvania. The upper run **340***a* and the lower run **340***b* of the cartridge conveyor **340** are supported by an elongated subframe **386** (FIGS. **23** and **24**) which includes a pair of spaced channel members **388** and **400** that have a plurality of spaced transverse upper and lower angle straps **402** bolted thereto. A longitudinally extending, inverted channel shaped belt guide **404** (FIG. **24**) is secured to the upper straps **402** to support the upper run **340***a* and, elongated capsule guide rails **406** are secured to brackets **408** bolted to the belt guide **404**. Spaced belt supporting bars **410** and **412** slidably support the lower run **340***b* of the conveyor **340** as best illustrated in FIG. **24**. The belt supporting bars **410** and **412** are bolted to angle clips **414** and **416** which are, in turn, bolted to the lower transverse angle straps **402**.

A plurality of stabilizing permanent magnets **418** (only one being shown in FIG. **24**) are disposed below a portion of the downstream end of the upper run **340***a* of the conveyor **340** and serve to magnetically attract the cartridges **34** and pull them down to the upper run **340***a* of the belt to stabilize the cartridges after the carriers **36** have been withdrawn therefrom. The common poles of the magnets **418** are bolted to flat magnetic rails **420** and **422**, which extend from point D (FIG. **21**) to point E, and the belt guide **404** which supports the belt is secured to brackets **424** that are bolted to the upper angle straps **402**. As seen in FIG. **24**, each magnet **418** is a horseshoe magnet, and they are so oriented that the rails **420** and **422** constitute north and south poles, respectively. If desired a nonmagnetic wear strip **421** may be connected across the rails. Similarly, a plurality of cartridge lifting horseshoe mag-

nets 426 are secured to flat, downwardly-facing magnetic rails 428 and 430 which extend along lower run 340*b* from the magnetic drum 344 (FIG. 21) to a cartridge discharge point 432 at the discharge end of the lower run 340*b* of the cartridge conveyor 340. The magnetic rails 428 and 430 are secured to brackets 434 which are bolted to the lower angle straps 402.

In order to maintain control of the cartridges 34 and jars J as they move around the drum 344 in clockwise direction (FIG. 21), a plurality of equally spaced horseshoe magnets 442 are secured to arcuate magnetic rails 443 (FIGS. 22 and 23) which are suitably secured to the frame 362 of the capsule unloader 52 and engage the side surfaces of the cartridges 34 to further stabilize the cartridges as they move around the drum. A semicylindrical guide rail 444 (FIG. 22) is disposed around the drum in position to hold the jars within their cartridges 34 and to guide them onto the jar conveyor 346. The guide rail 444 has angle brackets 448 and 450 welded thereto, which brackets are bolted to the frame 362 of the capsule unloader 52.

The continuously driven carrier conveyor 342 comprises an endless nonmagnetic belt 456 (FIG. 21) that is trained around a drive roller 458, an idler roller 460, around five idler rollers 462, and around a takeup roller 464. The rollers 458 and 460 are keyed to shafts 466 and 468, respectively. The idler rollers 462 are keyed to shafts 463 and the takeup roller 464 is keyed to a shaft 469. The shafts of conveyor 342 are journaled in bearings that are bolted to elongated upwardly inclined channel members 470 and 472 (FIG. 24) of a carrier conveyor subframe 480. The channel members are welded to the main frame 362, and the lower surfaces of the channel members are interconnected at spaced intervals by angle brackets 482. A pair of elongated angle belt guides 484 and 486 are bolted to angle clips 488 and 490 which are in turn bolted to the angle brackets 482. A plurality of carrier magnets 492 have their common poles secured to magnetic rails 494 and 496 (FIG. 26), and the rails are secured to the angle brackets 482 by brackets 498. FIG. 26 discloses a typical mounting for all of the horseshoe magnets used in the machine.

As the capsules 38 move along the cartridge conveyor 340 under the carrier conveyor 342, the carrier magnets 492, some of which are shown in phantom in FIG. 21, magnetically attract the carriers 36 and gradually lift the carriers free from the cartridges 34. As the carriers approach the discharge end of the carrier conveyor 342, the spacing of the magnets 492 is increased thereby reducing the magnetic force attracting the carriers.

The discharge chute 500 comprises six curved rods 502 which are welded to several generally rectangular frame members 504 and slidably engage the ends and sides of the carriers 36. The upper end of the chute 500 is bolted to the belt guides 484 and 486 and is positioned to receive the carriers 36. The uppermost curved rod 502*a* is shorter than the other rods 502, and the last magnet 492*a*, (FIG. 22) as well as the associated magnetic rails, are positioned so that the carriers 36 will be completely released from the conveyor 342 at a point between the forward end of the rods 502 and the forward end of the upper rod 502*a*. The chute 500 then guides the freed carriers 36 onto the carrier return conveyor 58 (FIG. 1) which returns the carriers to the capsule loader 32.

As best illustrated in FIGS. 22 and 23, as the cartridges and jars traveling along conveyor run 340*a* approach the magnetic drum 344, they are deflected by a cam plate 506 to the right (FIG. 22) of the vertical plane of movement of the carriers 36 which are supported by the conveyor 342. Thus the normal path of the cartridges 34 is not directly under the path of the carriers 36 but is to one side thereof and, therefore if a cartridge 34 becomes wedged in the associated carrier and projects downwardly therefrom, the defective carrier and cartridge will not be carried over the guide rail 444 around drum 344 but will be advanced past the side of the guide rail 444 before it is dropped from the carrier conveyor 342. Therefore, when the wedged cartridge is released from the carrier, it will not drop on the rail 444 or into the path of movement of cartridges 34 and jars moving along the cartridge conveyor 340.

After the cartridges 34 and jars J move around the magnetic drum 344, the jars are received on the jar conveyor 346, and the cartridges 34 are magnetically attracted to the lower run 340*b* of the cartridge conveyor 340 as previously described. The cartridges 34 are advanced by the cartridge conveyor 340 to the cartridge discharge point 432 (FIG. 21) at which point the magnetic attraction terminates and the cartridges are released into a cartridge chute 508 which comprises a plurality of curved rods 510 that are welded to and held in spaced relation by rectangular frame members 512. The chute 508 is bolted to the subframe 386 with its upper end disposed in position to receive the empty cartridges 34 from the cartridge conveyor 340. The forward end 514 of the uppermost rod 510*a* terminates downstream of the ends of the other rods 510 so that the upper side of the chute is open and the cartridges may freely drop into the chute 508 upon loss of magnetic attraction and be guided by the chute onto the cartridge return conveyor 56 (FIG. 1).

The processed jars J are received on the jar conveyor 346 (FIG. 21) which comprises an endless belt 516 that is trained around a drive roller 518, a driven roller 520, and around idler rollers 522. The drive roller 518 is keyed to a shaft 524 journaled in bearings 526 secured to the frame 362 of the capsule unloader 52. The driven roller 520 is keyed to a shaft 528 journaled in bearings of a take-up device 530 that is secured to the frame 362 in the usual manner. The idler rollers are keyed to shafts 532 (FIG. 24) journaled in bearings 534 secured to channel members 536 and 538 of a subframe 540.

A plurality of straps 542 are secured to the lower edges of the channel members 536 and 538, and a plurality of angle brackets 544 are secured to the upper edges of the channel members. As best shown in FIG. 24, an inverted channel belt guide 546 is secured to the angle brackets 544 by angle clips 548 and cooperating cap screws. The processed jars are conveyed off the discharge end of the jar conveyor 346 onto any suitable collecting means such as a takeaway conveyor (not shown).

The drive train 550 (FIGS. 21 and 25) for the capsule unloader 52 receives power from a variable speed motor 552 which is connected by a chain drive 553 to the drive shaft 554 of a right-angle gear box 556. The output shaft 558 of the gearbox 556 is connected by a chain drive 560 to the twister conveyor drive shaft 358 which is suitably journaled on the frame 362 of the capsule unloader 52. A drive gear 562, keyed on the twister conveyor drive shaft 358, meshes with a driven gear 564 keyed on a shaft 566 journaled on the frame of the unloader. The shaft 566 is coupled to the drive shaft 567 of the right angle gear unit 568 which has its output shaft coupled to a multisectioned drive shaft 572 which extends longitudinally of the unloader 52. The drive shaft 572 is coupled to the input end of a right angle gear unit 574 which has its output shaft coupled to the drive shaft 466 of the carrier conveyor 342 thereby driving the conveyor 342 in the direction of the arrows in FIG. 21.

An intermediate right angle gear unit 578 is coupled to the shaft 572 and has its output shaft coupled to a vertical shaft 582 which is coupled to a right angle gear unit 586. The output shaft of unit 586 is coupled to a gear shaft 588 that is journaled on the frame 362 of the unloader 52. A drive gear 590 keyed on the shaft 588 meshes with a driven gear 592 keyed on the drive shaft 524 of the jar conveyor 346 and drives the same in the direction indicated by arrows in FIG. 21.

The cartridge conveyor 340 is driven in the direction of the arrows in FIG. 21 by a belt drive 594 (FIG. 25) connected between the twister drive shaft 358 and the drive shaft 384 of the conveyor 340.

OPERATION

Although the operation of the apparatus of the present invention has been included with the description of the several components, a brief resume of the operation will follow.

Filled and sealed jars J to be processed are advanced by the conveyor 130 (FIG. 7) into engagement with the screw con-

veyor 132 which singulates and spaces the jars J a predetermined distance from each other before feeding the jars one at a time into the pockets 154 of the inclined transfer turret 152. The transfer turret 152 shifts the jars from a position wherein their longitudinal axes are vertical to a position wherein the axes are horizontal, at which time the jars are moved upwardly through the opening 167 (FIG. 11) in the shell of the capsule loader to a position above the stripper plate 180 and between carrier bars 176 of the reel 170. Empty cartridges 34 and carriers 36 which have previously been introduced into the drum between the bars 176 of the capsule loader 32 are disposed on opposite sides of the jars and are cammed toward each other to enclose the jars thereby defining capsules 38 as the reel 170 advances the jars J, cartridges 34 and carriers 36 upwardly within the drum 168.

The capsules 38, each carrying an individual jar J, are then discharged from the drum 168 and are moved into the free roller timing conveyor 124 (FIG. 7), which conveyor advances the capsules over the reject mechanism 126 which discharges all incomplete capsules from the system. The capsules 38 are then advanced into the carrier bars 55 of the reel 53 of the atmospheric preheater 40 after moving over the letdown fingers 128 which gently place the capsules onto the bars 55, thereby minimizing mechanical shock during transfer. The capsules 38 are then passed through the hot water in the reel and spiral atmospheric preheater 40 and are transferred to the pressure preheater 42 through a conventional pressure valve.

Since the cartridges 34 and the carriers 36 of the capsules 38 have their lower portions fitted tightly together as indicated in FIG. 5, water from the atmospheric preheater 40 is carried into the pressure preheater 42. This water is raised in temperature while in the pressure preheater 42 and is returned to the atmospheric preheater 40 through the water return system 314 (FIG. 3) to aid in supplying heat to the water in the atmospheric preheater.

The capsules are then passed through the pressure preheater 42, the sterilizer 44, the pressure cooler 46, and the atmospheric cooler 48 thereby sterilizing the product within the jars. Although the transfer of the capsules 38 from processing vessel to processing vessel is relatively gentle due to the use of letdown fingers which are similar to the fingers 128 at each transfer point, and also due to the presence of cushioning water within the capsules at certain of these transfer points, the jars are subjected to thermal shock during such transfer and may break. If such breakage occurs, the broken pieces of the jar will be confined within the associated capsule until the capsules have been discharged from the atmospheric cooler 48 and are opened by the capsule unloader 52.

Upon being discharged from the atmospheric cooler 48 (FIG. 20), the capsules are advanced through the twister 50 by the twister conveyor 348, thereby shifting the longitudinal axes of the capsule 38 from a horizontal to a vertical position. The capsules 38 are then advanced a short distance by the upper run 340*a* of the cartridge conveyor 340 and become positioned below the carrier conveyor 342. The carriers 36 are then magnetically attracted to the carrier conveyor, and are withdrawn from the cartridges 34 for subsequent discharge through the chute 500 onto the carrier return conveyor 58 which returns the empty carriers to the capsule loader 32. The cartridges 34 with jars J therein are advanced around the magnetic drum 344 to invert the cartridges and deposit the jars on the jar conveyor 346. The cartridges 34 are magnetically attracted to the upwardly inclined lower run 340*b* of the cartridge conveyor 340 and are withdrawn from the conveyor 340 through the cartridge chute 508 onto the cartridge return conveyor 56 for return to the capsule loader 32. The processed jars J are discharged from the jar conveyor 346 onto any suitable collecting means such as a takeaway conveyor (not shown).

From the foregoing description it is apparent that the present invention provides an efficient method of confining individual containers, such as glass jars, in telescoping capsules so that the jars can be moved through a reel and spiral type processing vessel without danger of the accumulation of broken glass within the vessel since such broken glass is confined in the capsules until after the capsules have been removed from the vessel. The invention also provides novel apparatus for performing the above method. Additionally, the present invention includes two embodiments of a telescoping capsule which supports jars in such a way as to prevent damage to lithography of the jar caps as well as preventing damage to raised indicia on the surface of the jars.

Another feature of the invention is that the water return system is effective to return carry-over water, which water has been carried by the capsules from the atmospheric preheater to the pressure preheater. The water return system returns the carry-over water to the atmospheric preheater after first raising the temperature of the water due to its contact with steam in the pressure preheater.

It is also evident that if the container is made of a plastic or other material that might deform due to rough handling, excessive heat, or excessive pressure differential, the capsule of the present invention will prevent any deformed part of the container or any part, such as the container cap, that might be released due to the deformation of the container, from becoming wedged or jammed in the processing apparatus.

It will also be understood that it is within the concept of the present invention to use capsules that are completely closed only at the wall portions, such as the bottom wall, where glass particles can normally fall out. Thus an open top carrier might be used if it is maintained in upright position at all times and if the side walls are high enough to restrict the outward movement of glass particles, deformed containers and the like.

It is to be understood that the term capsule as used herein is to be considered broad enough to cover any type of carrier which is capable of confining a container therein even though the container may be broken into small pieces.

While one embodiment of the present invention has been shown and described, it will be understood that other changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A capsule for confining articles comprising a tubular cartridge having one end open and one end substantially closed, said cartridge being of sufficient size to telescopically receive the article, a tubular carrier having one end open and one end substantially closed, said carrier being of sufficient size to telescopically and loosely receive the cartridge and article therein, said substantially closed ends of said cartridge and said carrier being magnetically attractable, and nonmagnetic means for precluding the open end of said cartridge from being magnetically attracted to the substantially closed end of said carrier.

2. A capsule for confining articles comprising a first tubular body of cylindrical cross section having one end open for telescopically receiving the article and extending substantially the full length of the article, a first end plate of magnetically attractable material for partially closing the other end of said body and having an aperture therein, a second tubular body of cylindrical cross section having one end open for telescopically and loosely receiving said first body with the article therein and extending substantially the full length of the article when telescoped over said first body, a second end plate of magnetically attractable material having an opening therein for partially closing the other end of said second body, and means for precluding magnetic attraction between the open end of said first tubular body and said second end plate.

3. A capsule for confining articles comprising a first tubular body of cylindrical cross section having one end open for telescopically receiving the article, a first end plate of ferrous material partially closing the other end of said body and having a centrally disposed aperture therein, a second tubular body of cylindrical cross section having one end open for telescopically receiving said first body with the article therein, a

second end plate of ferrous material having a centrally disposed opening therein for partially closing the other end of said second body, and a nonmagnetic dish secured to said second plate within said second cylindrical body whereby said first and said second bodies may be magnetically separated.

4. A capsule for confining a glass jar with a cap thereon comprising a first tubular body of plastic material and having one end open and a cross section slightly larger than and corresponding to the shape of the jar, a first end plate impregnated with a ferrous material and partially closing the other end of said body, said one end of said body being open to slidably and telescopically receive the jar with its cap adjacent said end plate wherein sliding movement over said plastic material will not mar the outer surface of the jar, said body having a plurality of openings formed in the periphery thereof and extending substantially the full length of the jar, a second tubular body of cylindrical cross section extending substantially the full length of said first tubular body and having one end open for loosely and telescopically receiving said first body with the jar therein and having a plurality of apertures therein, and a second magnetically attractable end plate having an opening therein for partially closing the other end of said second body, said plastic material at said open end of said first tubular body precluding magnetic attraction between said open end of said first body and said second end plate.

5. A capsule for confining articles comprising a first tubular body of cylindrical cross section having one end open for telescopically receiving the article, a first end plate of ferrous material partially closing the other end of said body and having an aperture therein, a second tubular body of cylindrical cross section having one end open for telescopically receiving said first body with the article therein, a second end plate of ferrous material having an opening therein for partially closing the other end of said body, and a nonmagnetic dish secured to said second plate within said second cylindrical body whereby said first and said second bodies may be magnetically separated.