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Pierce

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[54] **ASEPTIC PACKAGING METHOD AND MACHINE**

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[52] **U.S. Cl.** **53/37,** 53/167, 53/282

[51] **Int. Cl.** **B65b 31/02**

[58] **Field of Search** ..... 53/37, 40, 41, 51, 53/112 R, 141, 167, 184, 281, 282, 329

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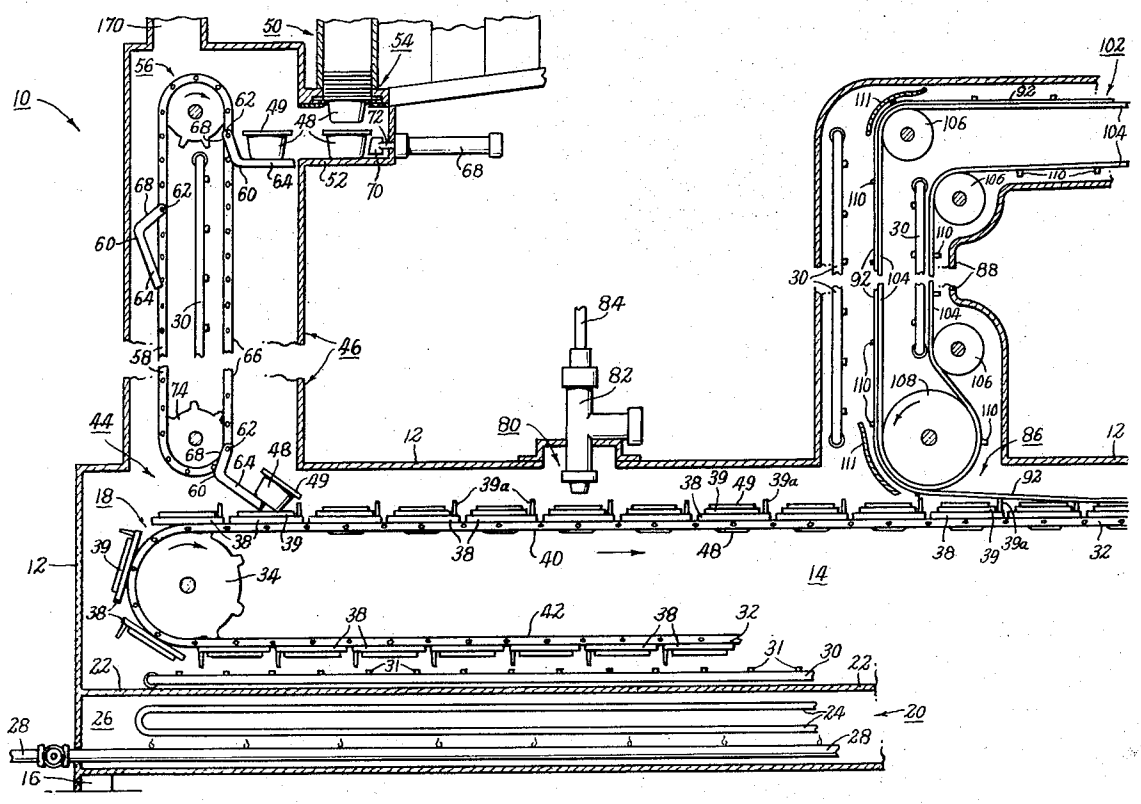
[57] **ABSTRACT**

An apparatus for aseptically packaging food and other products includes a housing which defines an enclosed sterile chamber and contains an endless conveyor having an upper flight adapted to transport individual containers through a plurality of operating stations. The housing is formed with a container sterilization section located adjacent one end of the conveyor and has a container dispenser mechanism mounted therein which holds individual containers in this section for a predetermined period of time and thereafter dispenses the containers on the upper flight of the conveyor; the latter transports the containers to a filling station where a sterile product is placed in the container. Downstream of the filling station, a continuous strip of interconnected covers is sequentially advanced, through a cover sterilization section formed in the housing, into position in registry with the containers on the conveyor. Thereafter, the covers are heat sealed to the containers and discharged from the housing. The entire sterile chamber is supplied with a sterile atmosphere at a pressure above atmospheric pressure to maintain the containers and covers in a sterile condition during the filling and cover sealing operation.

27 Claims, 6 Drawing Figures



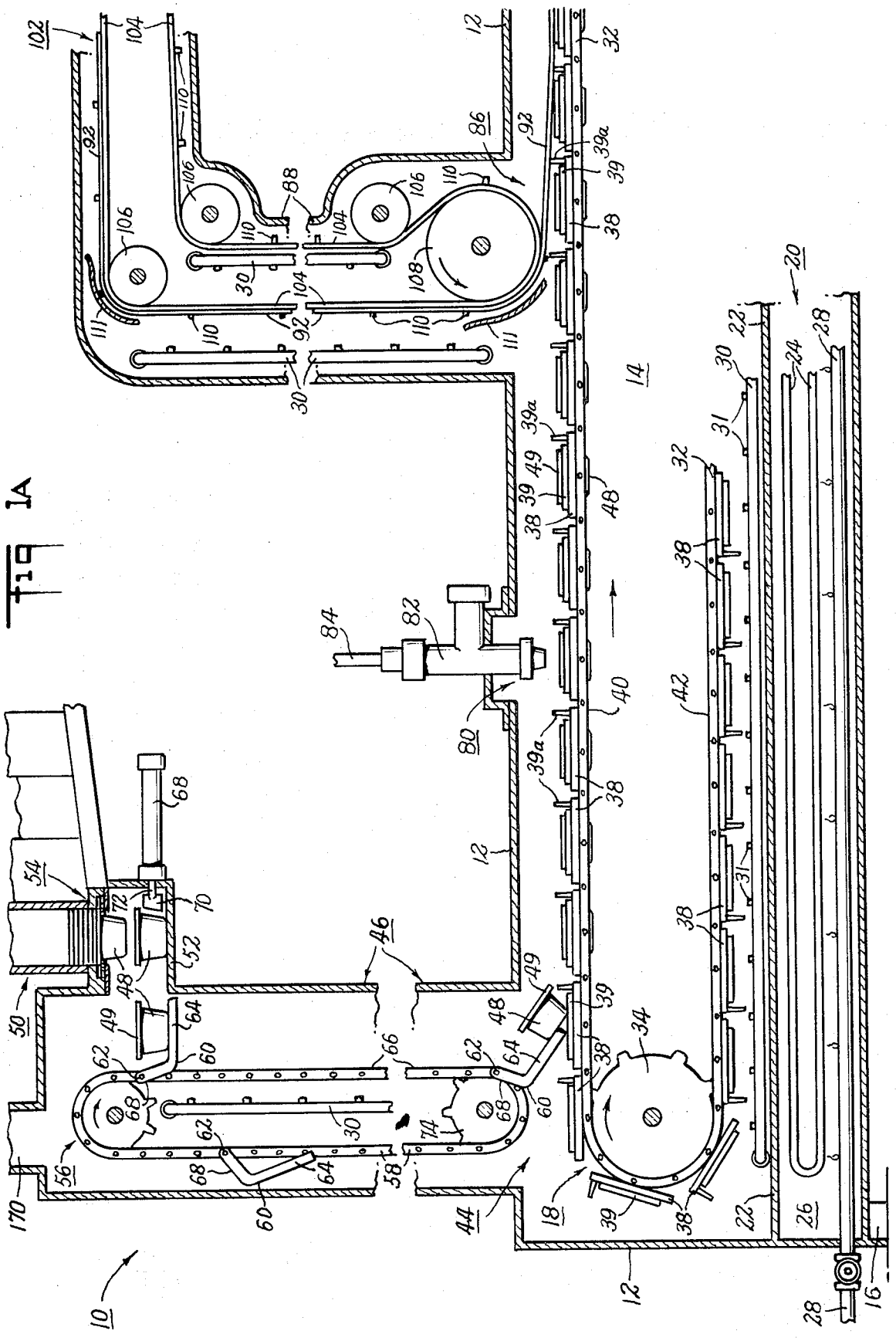


Fig 1A

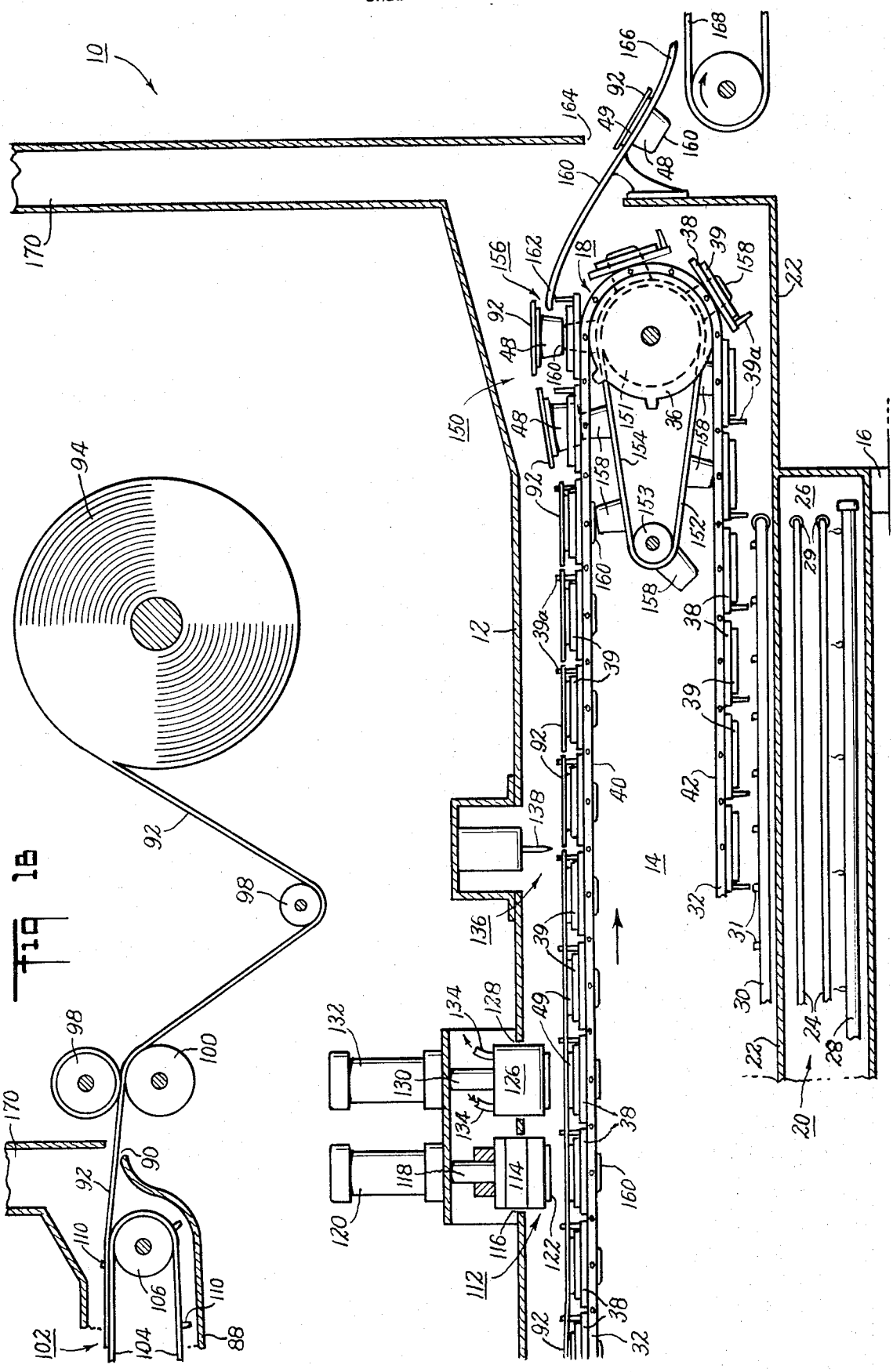

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Fig 1B

Fig 2

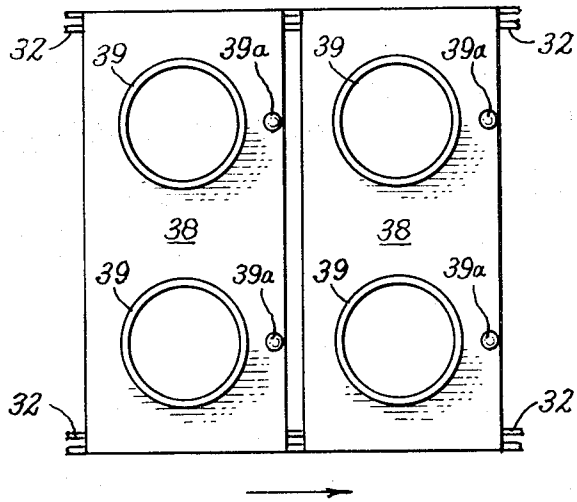


Fig 3

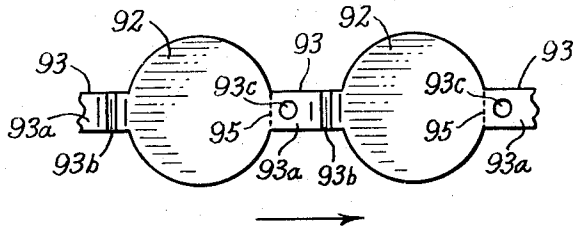


Fig 4

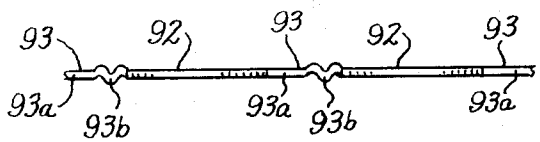
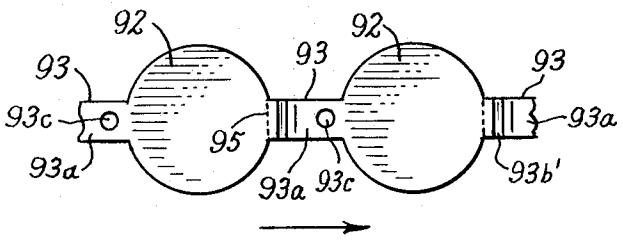


Fig 5



ASEPTIC PACKAGING METHOD AND MACHINE

The present invention relates to aseptic packaging of food, drugs and other products, and in particular, to an apparatus for sterilizing containers and covers, filling the containers with a sterile product, and securing the covers to the containers, all within a single sterile enclosure.

A number of previous attempts have been made to provide aseptic packaging apparatus in which a sterile food product or the like is placed in containers and enclosed to preserve the product for later use. However, none of these prior attempts has been completely successful because heretofore it has not been possible to completely eliminate the risk of recontamination of the food product or the container during the filling and closing operations. As a result, it has been found necessary to carry out a re-sterilization of the filled container in order to insure the complete elimination of contaminating bacteria in the container or the food product prior to storage and shipment. This re-sterilization represents an additional expense in the packaging process and, because of the generally high temperatures required for the re-sterilization, the quality and taste of food products are often detrimentally affected thereby.

Accordingly, it is an object of the present invention to sterilize, fill and seal a container for a food product and the like in a single sterile enclosure so as to eliminate the requirement for re-sterilization after completion of the packaging operation.

Yet another object of the present invention is to provide an apparatus which will package sterile food products and the like under sterile conditions in a single enclosure and which is relatively inexpensive in construction and durable in use.

Yet another object of the present invention is to package food products and the like under sterile conditions in which the possibility of contamination of the products during the packaging operation is substantially eliminated.

In accordance with an aspect of the present invention an apparatus for aseptically packaging food, drugs and other products, under sterile conditions, is provided in which an enclosed sterilization chamber, formed from a substantially air-impervious housing, has an endless conveyor mounted entirely therein for sequentially moving containers to be filled through a plurality of operating stations located along one of the flights of the conveyor. The housing includes a container sterilization section located at a first station therein to which individual containers are supplied. A container dispenser is mounted in the container sterilization section and receives the individual containers and deposits them on the conveyor. The container dispenser holds the containers in the sterilization chamber for a predetermined period of time, as the container is moved towards the conveyor from the point at which it is supplied to the sterilization chamber, so that the container is sterilized immediately prior to being placed on the conveyor.

Once the containers are on the conveyor, they are moved to a second station in the housing at which a filling device is mounted to fill the containers with a sterile food product or the like, as they are sequentially presented at this station. Downstream of the filling station, the housing is formed with a cover sterilization section having a predetermined length and containing means for sequentially advancing a continuous strip of interconnected die cut covers from a point of entry into the housing to a position over the containers and in registry therewith. The length of the cover sterilization section is so selected that the time taken for movement of an individual cover from the point of entry into the housing to the point of application to the filled container is sufficient for the covers to be completely sterilized and all bacteria thereon destroyed.

From the point of application of the covers to the containers, the containers are sequentially moved by the conveyor to a cover sealing station located within the enclosure at which means are provided for heat sealing the cover to the container. Thereafter, the conveyor moves the sealed container to a station at which the interconnection between the container lids is severed and thence to a discharge apparatus which removes the separated containers from the conveyor and discharges them from the enclosure.

The entire sterile chamber is supplied with a sterile atmosphere such as, for example, dry, high-temperature steam or superheated air, so that each of the packaging operations is performed under sterile conditions and the container and cover are sterilized and maintained sterile as part of the packaging operation itself. The sterile atmosphere is supplied at a pressure above atmospheric, so that sterile air will leak out of the chamber through any openings in the housing, thereby preventing any non-sterile air surrounding the packaging apparatus from entering the sterile chamber.

The above, and other objects, features and advantages of this invention, will be apparent in the following detailed description of an illustrative embodiment thereof which is to be read in connection with the accompanying drawings, wherein:

FIGS. 1A and 1B together comprise a sectional elevation view of an aseptic packaging apparatus constructed in accordance with an embodiment of the present invention;

FIG. 2 is a plan view of a portion of the container transport conveyor shown in FIG. 1;

FIG. 3 is a plan view of a portion of a strip of covers adapted to be utilized in conjunction with the present invention;

FIG. 4 is an elevational view of the cover strip in FIG. 3; and

FIG. 5 is a plan view, similar to FIG. 3, of another embodiment of covers which are suitable for use with the present invention.

Referring to the drawing in detail, it is seen that an aseptic packaging apparatus **10**, embodying the present invention, includes a substantially air-impervious outer housing **12** which defines an enclosed sterile chamber **14** in which the packaging operations are performed. Housing **12** is supported in any desired manner, as for example by legs **16** located at the corners of the housing, and has an endless chain type conveyor **18** rotatably mounted therein for transporting individual containers through a plurality of operating stations located within chamber **14**.

A sterile atmosphere is supplied to chamber **14** from a supply system **20** mounted on the lower portion of housing **12** and separated from chamber **14** by an air-impervious horizontal panel **22**. The sterile atmosphere may be either dry high temperature steam or superheated air, with the water or air being supplied from a source thereof (not shown) to a heat exchanger coil **24**

mounted within the chamber **26** defined by supply system **20.** A conventional gas manifold **28** is mounted below heat exchanger coil **24** and the combustion products of the burning gases transfer the heat of the combustion to the water or air contained within heat exchanger coil **24** by conduction to heat the water or air in the coil to temperatures sufficiently high enough to kill bacteria in chamber **14.** The steam or air thus heated flows from coil **24,** at outlet **29,** and is distributed within chamber **14** by a plurality of discharge manifolds **30.** As more fully described hereinafter, the sterile atmosphere is supplied to chamber **14** at a pressure slightly above atmospheric.

Conveyor **18** is similar in construction to the conveyor disclosed in my copending patent application Ser. No. 53,947, filed July 10, 1970 now U.S. Pat. No. 3,694,997, the disclosure of which is incorporated herein by reference, and is formed from a pair of endless edge chains **32** (FIGS. **1** and **2**), which extend around pairs of spaced drive and driven sprockets **34, 36** respectively. Chains **32** are spaced apart a predetermined distance and are interconnected by a plurality of flights or panels **38** having openings **39** therein for the reception of containers to be filled. The drive to conveyor **18** may be through a chain and sprocket system from a drive motor (not shown) mounted at the base of the apparatus, or by any convenient drive system such as would be clear to those skilled in the art.

Conveyor **18** provides upper and lower flights **40, 42** respectively, with upper flight **40** moving towards the right in FIGS. **1A** and **1B**, passing a loading station **44** adjacent sprocket **34.** Directly above loading station **44,** housing **12** is formed to define a container sterilization section **46** in which individual containers **48** are held for a predetermined period of time sufficient for the temperature of the containers to be raised above a predetermined level, such as for example 350° F, at which all possible contaminating bacteria or the like on the containers are destroyed.

Individual containers **48** are supplied to sterilization section **46** from a container storage hopper **50** mounted on housing **12** and are sequentially dispensed from the hopper to a platform **52** by a dispensing unit **54.** The dispensing unit may be of conventional construction for supplying individual containers to the platform **52** in housing **12** and, in one embodiment of the invention, is constructed in a manner similar to the dspensing unit described in my above-mentioned patent application.

From platform **52** the individually dispensed containers **48** are supplied to a conveyor **56** mounted within sterilization chamber **46.** Conveyor **56** is formed from a pair of spaced endless chains **58,** only one of which is seen in the drawing, having a plurality of L-shaped platform members **60** pivotally connected thereto at the free ends **62** of their short legs. By this arrangement, it is seen that the long leg **64** of platform **60** will be located in a generally horizontal position along the downwardly moving flight **66** of conveyor **56.** As a plaftorm **60** is presented in position adjacent platform **52,** the individual containers **48** on the platform are moved onto platform **60** by a pneumatic or hydraulic ram **68.** The latter has a pusher head **70** secured to its actuator rod **72** and is operated in synchronization with conveyor **56** so that containers **48** are moved towards conveyor **56** only when a platform **60** is adjacent platform **52.** After a container **48** has been placed on platform **60,** conveyor **56** is operated to move the next platform **60** into position adjacent platform **52.** Simultaneously, and in synchronization therewith, dispenser unit **54** releases another individual container from the hopper **50** onto platform **52** and the sequence of operation is repeated.

It is noted that while only a single row of containers **48** is shown in FIG. **1,** it is to be understood that one or more parallel rows of containers can be treated at the same time. That is, a series of container hoppers may be mounted adjacent each other, so that two or more cups are placed on platform **52,** next to each other, and moved onto platforms **60** for simultaneous, side by side passage through apparatus **10,** with each of the components in the apparatus being duplicated for each row of cups. In this manner, a plurality of cups may be treated at the same time within the single housing **12.** Thus, for example, conveyor **18** has been illustrated in FIG. **2** as having two adjacent openings **39** in each flight **38** for simultaneously transporting two rows of containers through the apparatus. Further, while the specific mechanical drive systems for operating the various components of the present apparatus in synchronization have not been illustrated, the specific mechanisms form no part of the present invention and a variety of synchronization systems such as would occur to those skilled in the art may be utilized to drive the present apparatus.

Referring again to the drawing, as a platform **60** approaches the lower sprockets **74** (only one of which is seen in FIG. **1A**) of conveyor **56,** the platform begins to tilt about its pivotal connection **62** because of the movement of its center of gravity about the end sprocket. As the platform was moving down the vertical flight **66** of the conveyor, its rear edge portion **68** rested against the conveyor chains to support containers **48** in a horizontal position; however, as conveyor chains **58** move away from the rear edge of platform **60,** i.e. as they move about sprockets **74,** the center of gravity of platform **60** causes it to tilt. As a result, a container **48** on the platform slides therefrom under the influence of gravity. At the same time a flight **38** of conveyor **18** is presented at station **44** with its opening in location to receive the discharged container. Conveyor **18** is driven in synchronism with conveyor **56** in any convenient manner so that the synchronous arrival of platform **60** and a flight **38** of the conveyor is assured.

In this manner a sterilized container is supplied to conveyor **18** at station **44.** The container is supported in the opening **39** in a flight **38** by its rim **49** and is sequentially moved from station **44** to a second operating station **80** by the conveyor. At this operating station a sterile feed system **82** is provided for automatically filling containers **48** presented at the station with a sterile food product, drug or the like. The filling system may be of a known construction such as for example, the "Apparatus for Dispensing Viscous Materials" disclosed in my copending application Ser. No. 846,742, filed Aug. 1, 1969 and now abandoned, and is operated in synchronism with conveyor **18** so that as a container **48** is presented at filling station **80,** a predetermined supply of food or the like is automatically dispensed into the container. It is noted that the food product supplied to the sterile feed system **82** is supplied in a sterile condition from its point of manufacture through a closed supply system or conduit **84** so that it is sterile

when released into container 48 by the feed system. Since the containers 48 and the atmosphere in chamber 14 are both sterile, there is no chance for the food to become contaminated in any way as it is dispensed into the containers.

Continuing from filling station 80, conveyor 18 sequentially moves the now filled containers 48 to a cover dispensing station 86 located downstream of the filling station with respect to the direction of travel of the conveyor. At station 86 housing 12 is formed with a cover sterilization chamber 88 of predetermined length, for reasons more fully described hereinafter.

Cover sterilization section 88 has an opening 90 (FIG. 1B) formed at its uppermost end through which a continuous strip of interconnected covers 92 pass from a rotatably mounted supply reel 94. Covers 92 are preferably formed as die cut covers having a peripheral configuration conforming to the peripheral configuration of the lip 49 of containers 48 with each of the covers interconnected in a strip by integral connecting portions 93, as seen in FIG. 3. Alternatively, the covers may be formed as a strip of aluminum foil or the like. In either case, the underside of the covers, that is, the side thereof which is to be in contact with the containers is treated with a heat sealable material or adhesive, for securing the cover to the container as described hereinafter.

From reel 94, the continuous strip of covers 92 is guided over a pair of rollers 98 and across a print roller 100 which is adapted to place an indentification code and/or date on the external surface of each lid in succession. From print roller 100, the strip fed covers pass through aperture 90 into housing 12 to a transport conveyor system 102. This system includes an endless feed belt 104 positioned about a plurality of rollers 106 and an unwinding roller 108 contained within sterilization section 88. Belt 104 has a plurality of teeth or pins 110 thereon which engage the edges of the covers in strip 92 and hold them to belt 104 for movement therewith to cover dispensing station 86.

Dry steam and/or superheated air is supplied to sterilization section 88 from system 20 through a pair of manifold members 30 in order to sterilize the covers in the supplied strip 92. The height or length of section 88 is predetermined so that the length of time taken for an individual cover to move from opening 90 to the point at which it is dispensed, i.e. adjacent unwinding roller 108, is sufficient for the temperature of the lids to be raised to a level, preferably 350° F, at which all contaminating bacteria on the covers are destroyed, so that the covers are thus sterilized.

Unwinding roller 108 is driven in synchronization with conveyor 18 from the main power source of the apparatus so that individual covers on the strip 92 are presented at station 86 in synchronism with containers 48 and individual covers are moved into position over the containers 48 in registry therewith.

The use of the pinned conveyor belt 104 for guiding cover strips 92 through the sterilization section 88 is advantageous since the belt provides a self threading feature such that when a new supply reel 94 is utilized in the apparatus the free end of the strip 92 thereon is merely placed through opening 90 and the first cover is automatically engaged by the teeth or pins 110 on the belt to hold the cover strip against belt 104 and guide it into position at station 86. To assist in the self threading operation a plurality of guide plates 111 are mounted in sterilization section 88 to guide the free edge of the cover strip about the curves in the conveyor during the initial threading operation. In this manner any necessity of opening housing 12 to the atmosphere in order to thread the cover strip over unwinding roller 108 is eliminated. As a result, the apparatus need not be resterilized when a new supply of covers is initially supplied to the apparatus. On the other hand, it is contemplated that belt 104 may be eliminated and roller 108 provided with pins 110 in lieu thereof to hold strip 92 and guide it into position adjacent containers 48.

In a presently preferred embodiment of the invention a relatively simple system is provided to assure that each cover 92 is accurately positioned in registry with its associated container 48. To this end the interconnecting portions 93 between covers 92 in the strip of covers are formed with two integral section 93*a* and 93*b* respectively, as seen in FIG. 3. Section 93*a* is coplanar with its adjacent cover 92 (i.e. the cover behind it in the direction of travel of the strip) and has an aperture 93*c* formed therein, while section 93*b* is crimped or corrugated so that it has the capacity to readily expand or contract. Apertures 93*c* are accurately located in the connecting portions 93 with respect to their associated cover 92 and are adapted to be engaged with the upright pins 39*a* mounted on conveyor flights 38 adjacent apertures 39. Thus, as the covers 92 are moved into position over the containers 48 on conveyor 18 the apertures 93*c* become engaged with and receive pins 39*a* to insure that their associated cover 92 (i.e. the cover to the left of the apertures 93*c* in FIG. 3) is properly positioned on its associated container. To facilitate the engagement of pins 39*a* in apertures 93*c*, the pins may be formed as frustroconical members so as to compensate for errors in the tolerance permitted between the aperture and the pins.

In the event that the length of the connecting portion 93 is either too short or too long to allow exact registry of cover 92 with its associated container it will be appreciated that the deficiency or excess in such length will be accommodated by the expansion or contraction of its corrugated section 93*b*, which is now located between the pin 39*a* and the previously positioned cover 92 since engagement of pin 39*a* in aperture 39*c* will cause the cover 92, and thus straight section 93*a*, to shift to the right or left in the drawing when registry therebetween is improper. Accordingly, any tolerance errors in the exact permissible spacing between covers 92 is automatically compensated for as each cover is placed on the container. Of course, it will be recognized that this is an important feature of the present apparatus since without it, an error in tolerance between the spacing of even one pair of covers on the strip will cause the latter cover of the pair to be positioned out of exact registry with its associated container. This lack of registry or misalignment then becomes additive for each successive container being covered and therefore, even with only a slight variation of tolerance, the covers ultimately would be placed on the containers with complete lack of registry. By the provision of tolerance compensations between each successive cover, as described above, this problem is avoided.

In another embodiment of the invention, shown in FIG. 5, the positions of the corrugated sections 93*b* and straight sections 93*a* of the cover strip are reversed. In this case when a pin 39*a* becomes engaged in aperture 93*c*, it will force the cover in front of it (in the direction

of travel) to move into registry with its container, thereby expanding or contracting the corrugated section **93***b*′ on the opposite side of the cover.

From station **86,** containers **48,** with the cover strip **92** placed on top of and in registry therewith, are moved to a sealing station **112** at which the covers are secured to the containers. Station **112** includes a conventional electrically heated heat sealing head **114** slidably mounted through an opening **116** in housing **12.** Head **114** is connected to the actuator rod **118** of a hydraulic or pneumatic ram **12o** which is operated in synchronism with conveyor **18** so that head **114** is lowered into contact with cover strip **92** when a container **48** is moved into position by conveyor **18.** A rim **122** is preferably formed on head **114,** which rim conforms in peripheral configuration to the periphery of the cover and the periphery of the container, so that heat and pressure are applied to the edges of the cover and lip **49** of the container. As a result, the heat sealable adhesive applied on the surface of the cover, as described above, is heated and pressed into engagement with the container to form a heat seal therebetween.

The cover which is thus heat sealed to container **48** provides a flawless seal for the contents of the cup which can withstand considerable abuse in handling, but which may readily be broken upon removal of the cover from the container. This type of a cover for containers is a substantial improvement over those previously proposed and utilized with sterile packaged food products. Such previously proposed arrangements are the conventional metallic pull tab type which have a weak resistance to shock and are susceptible to rupture of the score line along the top. In addition, such tops are dangerous since children apparently tend to lick these tops and are often cut by the sharp edges thereof. With the covers utilized in the aseptic packaging apparatus of the present invention, the heat seal has a greater resistance to the shock and the cover is approximately 1 percent container less in cost than the conventional tab top arrangements. Moreover, there are no sharp edges to cut children licking such covers.

Immediately downstream of heat sealing head **114,** a cooled platen **126** is mounted for sliding movement in an opening **128** in housing **12.** Platen **126** is mounted on the free end of the actuator rod **130** of a hydraulic or pneumatic ram **132** which serves to reciprocate the platen with respect to the containers and caps. A continuous supply of water or the like is passed through heat exchanger conduits **134** in the platen to cool it during use.

As a container **48** with a heat sealed cover secured thereto is presented beneath platen **126,** the platen is moved downwardly by ram **132** into contact therewith. The cooled platen serves to maintain the cover in contact with the container and to cool the bond therebetween to the solidification temperature of the sealant material on the lid coating so that a flawless airtight seal is formed. The cooled platen is required because of the relatively high temperatures maintained within chamber **14** in order to maintain sterile conditions therein. That is, without platen **126** there would be the possibility that the seal would not fully solidify before the container **48** is discharged from the sterile enclosure. Thus, the cooled platen assures this solidification and completion of the seal prior to discharge from the sterile chamber. As a result, no resterilization of the container is required on completion of the packaging operation. Moreover, since the covers on strip **92** are still interconnected at this point in the operation, it is seen that the motion of conveyor **18** is transmitted through containers **48** to the cover strip **92,** thereby to draw the strip with the conveyor.

A cutting station **136** is provided within housing **12** downstream from cooling platen **126.** Station **136** includes a reciprocating knife member **138** which serves to sever the interconnection **93** between the covers on strip **92** along the line **95** shown in FIGS. **3** and **5.** As a result each interconnection **93** after the severing operation remains integral with one of the covers **92** and forms an extension tab which is utilized to remove or strip the cover from the container when the food or product within the container is to be used. Knife **138** is reciprocated in timed relation with the movement of conveyor **18** so that the interconnection **93** between each of the containers is severed in sequential relation. The mechanism for driving knife **138** in this relation is a relatively simple conventional mechanical movement which would be readily understood by those skilled in the art. It forms no part of the present invention, and therefore, is not described herein in detail.

At this point the filling operation is completed and the containers are ready for discharge from sterile chamber **14.** To this end, a discharge conveyor system **150** is provided at the right end of conveyor **18.** Conveyor system **150** includes an auxiliary belt conveyor **152** mounted between the flights of conveyor **18** and having one end thereof mounted on a roller **151** coaxially with the driven gear **36.** The other end of conveyor **152** is positioned about a roller **153** of smaller diameter than roller **151** to form an inclined conveyor portion **154** which approaches conveyor **18** at a point adjacent the discharge end **156** thereof.

Belt **152** includes a plurality of lifting projections **158** on its exterior surface, which projections are spaced along the belt at distances equal to the distance between successive containers **48** in conveyor **18.** As seen in the drawing, as projections **158** move to the right with belt **152,** they engage the bottoms **160** of containers **48** and lift the containers from the openings **39** in flights **38** until the containers are substantially completely lifted from the flights. Conveyor **152** is driven in synchronism with conveyor **18** to insure that projections **158** will always contact the bases **160** of the containers.

To finally remove containers **48** from conveyor **18,** a pair of fixed support rods **160** are mounted on housing **12** in spaced relation to each other. Although only one of the rods is seen in the drawings, it is to be understood that the rods are spaced adjacent each other a distance equal to the diameter of the containers **48,** with their rear ends **162** projecting into chamber **14** through an opening **164** in housing **12.** As conveyor **18** moves containers **48** about sprocket **36,** the containers, having been lifted by projections **158,** pass between the ends **162** of rods **160** and the undersides of their lips **49** are engaged by the rods. As a result, the containers rest on rod ends **162** and are fully removed from their associated conveyor flight **38** as it moves about sprockets **36.** Rods **160** are inclined so that containers **48** will, under the influence of gravity, slide between the rods and be guided thereby to the exterior of the housing where they are discharged at the front ends **166** of rods **160** onto a discharge conveyor **168** for further packaging and shipment.

The sterile atmosphere supplied to enclosure **14** from supply system **20** maintains the equipment, containers and food within the container in a sterile condition and prevents contamination thereof during the packaging operation. Substantially all of the sterile atmosphere supplied to chamber **14** passes from the nozzles **31** in the manifolds **30** located adjacent base **22** of the chamber. This sterile steam or superheated air is supplied at a temperature which is sufficiently high enough to maintain sterile conditions within the chamber at all times.

A greater volume of the sterile steam or superheated air atmosphere is supplied to the sterilization chambers **46** and **88** through the additional manifolds **30** respectively located therein. The supply of this additional heated sterile atmosphere to these points maintains the temperature in these sections at a somewhat higher level than in the remainder of the chamber **14.** This additional heat is required in order to sterilize the containers and covers transported through these sections of the chambers. The additional heat brings the temperature of the containers and covers, which are supplied thereto in a normally clean condition, to a level sufficiently high to kill contaminating bacteria on the containers and covers prior to their being placed on conveyor **18.** Of course, it is also contemplated that the containers and covers may be supplied to the apparatus in a sterile condition thereby eliminating the need for sterilization sections **46** and **88.**

The sterile food which is supplied through the filling system **82** is placed in the containers in a sterile atmosphere and any air entrapped between the food and the covers on strip **92** during the sealing operation will be sterile, and therefore will not contaminate the food within the container. The heat seal formed at the sealing station between the cover and the container is firmly bonded and made flawless by the cooled platen utilized at the sealing station so that contamination of the food product within the container after removal from enclosure **14** is avoided and the need for re-sterilization of the packed product as required in previously proposed sterile packaging systems is eliminated.

The sterile atmosphere is supplied from system **20** at a pressure which is above the atmospheric pressure surrounding the exterior of enclosure **14.** This can be done by suppling the water or air to system **20** under pressure or by increasing the pressure of the sterile atmosphere as it leaves coil **24** by the use of pumps as would occur to those skilled in the art. In either case, this creates a positive pressure within chamber **14** so that any leakage of air which may occur in the walls of housing **12** will be outwardly from chamber **14** so that entrance of contaminating bacteria and the like into the chamber through any openings therein is avoided. This is particularly important at the openings in housing **12** at which the individual containers **48** are supplied to platform **52,** at the opening **90** through which the strip fed covers are supplied at section **88** and at the discharge opening **164.** Thus, because of the positive pressure within sterile chamber **14,** the sterile atmosphere therein escapes through these openings and prevents surrounding air from entering the chamber, thereby maintaining sterile conditions therein. Of course, it is to be understood that these openings are made as small as possible. In addition, it is noted that vent openings **170** may be provided at various points in the system in order to relieve pressure in the sterile chamber **14,** so that a constant flow of newly sterilized air or steam will be continuously supplied to the chamber.

Accordingly, it is seen that a relatively simple apparatus is provided for aseptic or sterile packaging of food products or the like in a single enclosure. The apparatus sterilizes the containers and covers immediately prior to the filling operation and, in the preferred embodiment, uses heat sealed covers having no sharp edges thereon.

Although an illustrative embodiment of the present invention has been described herein with reference to the accompanying drawing, it is to be understood that the invention is not limited to that precise embodiment, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of this invention.

What is claimed is:

1. Apparatus for aseptically packaging food, drugs and other products comprising, a housing defining an enclosed sterilization chamber, an endless conveyor mounted completely within said housing and having upper and lower flights and means thereon for receiving containers to be filled; a plurality of operating stations located along one of said flights and drive means for sequentially moving said conveyor along said flights between sid operating stations, said housing including a container sterilization section located at a first station therein and container dispenser means mounted in said container sterilization section at said first station for holding containers in said container sterilization section comprising a vertically extending endless conveyor having a downwardly moving flight located above the first mentioned endless conveyor at said first station and a plurality of container support platforms secured thereto and extending horizontally therefrom along said downwardly moving flight, including container supply means mounted on said housing adjacent the upper end of said downwardly moving flight for supplying individual containers to said platforms, and said vertically extending conveyor holding said individual containers in said container sterilization section for said predetermined time as said containers are moved from said container supply means to said first station whereby said containers are sterilized prior to being deposited on said first mentioned conveyor; filling means mounted on said housing at a second station, downstream of said first station in the direction of travel of said conveyor, for filling each container on said conveyor with a sterilized product; said housing also including a cover sterilization section of predetermined length located at a third station therein downstream of said second station; means for sequentially advancing a continuous strip of interconnected die cut covers through said cover sterilization chamber to said third station in timed relation with the arrival of containers at said third station to sequentially position said covers over said containers in registry therewith, means at a fourth station, downwstream of said third station, for securing said covers to said containers as the containers are sequentially moved to said fourth station by said conveyor, means at a fifth station, downstream of said fourth station for moving the covered containers from said conveyor and discharging them from said housing, and means for supplying a sterile atmosphere to said housing at a pressure above atmospheric pressure to maintain said containers and covers in a sterile condition during movement through said operating stations.

2. Apparatus as defined in claim 1 wherein said means for supplying a sterile atmosphere comprises means for supplying dry high-temperature steam to said sterile chamber.

3. Apparatus as defined in claim 2 wherein said means for supplying a sterile atmosphere includes means for maintaining higher temperatures in said container and cover sterilization sections than in the remainder of said housing whereby said containers and covers are sterilized in said sterilization sections prior to placement on said conveyor.

4. Apparatus as defined in claim 1 including means cooperating with the covers in said strip of covers for individually registering each of said covers with its associated container.

5. Apparatus as defined in claim 4 including means mounted in said housing between said fourth and fifth stations for severing the interconnection between individual covers in said strip of covers, after said covers are secured to the containers.

6. Apparatus as defined in claim 5 including means for sequentially supplying individual containers to said container holding and depositing means.

7. Apparatus as defined in claim 5 wherein said means for sequentially advancing said strip of die cut covers includes a reel supporting a roll of said strip of covers, means for guiding said strip along a predetermined path in said cover sterilization chamber from said reel to said third station whereby said covers are maintained in said sterilization chamber for a period of time sufficient to sterilize the covers, and means at said third station for unwinding said strip from the reel, drawing the strip along said predetermined path and sequentially directing each cover as it is advanced to said third station over a container which is sequentially advanced to said third station by said conveyor.

8. Apparatus as defined in claim 5 wherein said covers have a heat sealing coating on the side thereof positioned in contact with said containers and said means for securing said covers to said containers comprises heat sealing means for heating and pressing the heat sealing coating on said cover against the adjacent portions of said container.

9. Apparatus as defined in claim 8 including means at said fourth station, immediately downstream of said heat sealing means, for cooling the heat sealed cover and pressing the cover against the container, thereby to maintain the bond formed by said heat sealing means and cool it to its solidification temperature.

10. Apparatus as defined in claim 5 wherein said container receiving means on said conveyor has a plurality of apertures therein for receiving and supporting said containers, said conveyor having a discharge end located at said fifth station and said means for removing the covered containers from said conveyor comprising an auxiliary endless conveyor located between the flights of the first mentioned conveyor and having one end located on a common axis of rotation with the discharge end thereof, said auxiliary conveyor having an inclined upper flight portion approaching said first mentioned conveyor at the discharge end thereof and having a plurality of projections thereon for engaging the bottoms of said containers supported in said openings and lifting them therefrom at said discharge end.

11. Apparatus as defined in claim 10 including a pair of fixed support rods mounted in closely spaced relation to each other and having one end thereof located adjacent said discharge end of said first mentioned conveyor for receiving said lifted containers therebetween and guiding them from said discharge end.

12. Apparatus as defined in claim 11 wherein said housing has an opening therein through which said rods extend to permit removal of said containers from said housing.

13. Apparatus as defined in claim 4 wherein said strip of covers includes an interconnecting portion between each pair of adjacent covers and formed integrally therewith, said interconnecting portion including a flat section and a corrugated section selectively adapted to expand or contract, said flat section having an aperture therein and said means for individually registering said covers with their associated container comprising individual upstanding pins on said endless conveyor respectively adjacent said container receiving means for engagement in said apertures.

14. Apparatus for aseptically packaging food, drugs and other products, comprising, a housing defining an enclosed sterile chamber, an endless conveyor mounted completely within said housing and having an upper flight for transporting containers through said housing; said housing having a container sterilizing section located adjacent one end of said conveyor and a container dispenser means mounted in said section including a vertically extending endless conveyor having a plurality of container support platforms secured thereto for holding containers therein for a predetermined period of time and thereafter depositing the containers on said upper conveyor flight, means in said housing, downstream of said container sterilization section in the direction of travel of said conveyor, for sequentially filling containers on the conveyor with a sterilized product; said housing also including a cover sterilization section having a predetermined length and means mounted in said cover sterilization section for sequentially advancing a continuous strip of interconnected covers through said cover sterilization chamber and for sequentially positioning said covers over said containers in registry therewith downstream of said filling means; means for thereafter securing said covers to said containers, and means for supplying a sterile atmosphere to said enclosed sterile chamber at a pressure above atmospheric pressure to maintain said containers and covers in a sterile condition during the filling and cover securing operations.

15. Apparatus as defined in claim 14 including means downstream of said sealing means for severing the interconnection between individual covers in said strip after said covers are secured to the containers.

16. Apparatus as defined in claim 15 including means downstream of said severing means for removing covered containers from said conveyor and discharging them from said housing.

17. Apparatus as defined in claim 14 wherein said means for supplying a sterile atmosphere includes means for maintaining a higher temperature in said container and cover sterilization sections than in the remainder of said sterile chamber whereby said containers and covers are sterilized in said sterilization sections prior to placement on the conveyor.

18. Apparatus as defined in claim 17 wherein said covers have a heat sealing coating on the side thereof positioned in contact with said containers and said means for securing said covers to said containers comprises heat sealing means for heating and pressing the

heat sealing coating on said cover against the adjacent portions of said container.

19. Apparatus as defined in claim **18** including means immediately downstream of said heat sealing means for cooling the heat sealed cover and pressing the cover against the container thereby to maintain the bond formed by said heat sealing means and cool the bond to its solidification temperature.

20. Apparatus as defined in claim **18** wherein said means for supplying a sterile atmosphere comprises means for supplying dry high temperature steam to said sterile chamber.

21. Apparatus for aseptically packaging food, drugs and other products, comprising, a housing defining an enclosed sterile chamber, an endless conveyor mounted completely within said housing and having an upper flight for transporting containers through said housing; means in said housing for depositing individual sterilized containers on said upper conveyor flight, means, downstream of said depositing means in the direction of travel of said conveyor, for sequentially filling containers on the conveyor with a sterile product; transport conveyor means including an endless feed belt for sequentially advancing a continuous strip of interconnected sterile covers into position over the filled containers in registry therewith downstream of said filling means, pin means on said endless conveyor cooperating with the covers in said strip for individually registering each of said covers with its associated container; means for thereafter securing said covers to said containers, and means for supplying a sterile atmosphere to said enclosed sterile chamber at a pressure above atmospheric pressure to maintain said containers and covers in a sterile condition during the filling and cover securing operations.

22. Apparatus as defined in claim **21** wherein said strip of covers includes an interconnecting portion formed between each pair of adjacent covers and formed integrally therewith, said interconnecting portion including a flat section and a corrugated section selectively adapted to expand or contract, said flat section having an aperture therein for engagement with said pin means.

23. A method for aseptically packaging food, drugs and other products comprising: supplying individual containers to an enclosed container sterilization section; holding said containers within said section for a time sufficient to effect sterilization thereof; and thereafter transporting said containers through a plurality of operating stations within a sterilization housing including; filling said containers at a first station in said housing with a sterile product, supplying a continuous strip of interconnected covers to an enclosed cover sterilization section, sterilizing said covers in said sterilization section and, at a second station, positioning said covers over said containers and in registry therewith, securing said covers to said containers at a fourth station and supplying a sterile atmosphere to said housing at a pressure above atmospheric pressure to maintain said containers and covers in a sterile condition during the filling and cover securing operations.

24. The method as defimed in claim **23** including the step of severing the interconnection between individual covers in said strip after said covers are secured to said containers.

25. The method as defined in claim **24** including the step of removing the covered containers from said housing after said severing step.

26. The method as defined in claim **25** wherein said covers have a heat sealing coating on the side thereof positioned in contact with said containers and said securing step comprises the step of heat sealing said covers to said containers.

27. The method as defined in claim **23** wherein said container and cover sterilization sections are maintained at a higher temperature than said housing.

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