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5 Sheets--Sheet 1



**ATTORNEY**

Nov. 27, 1956

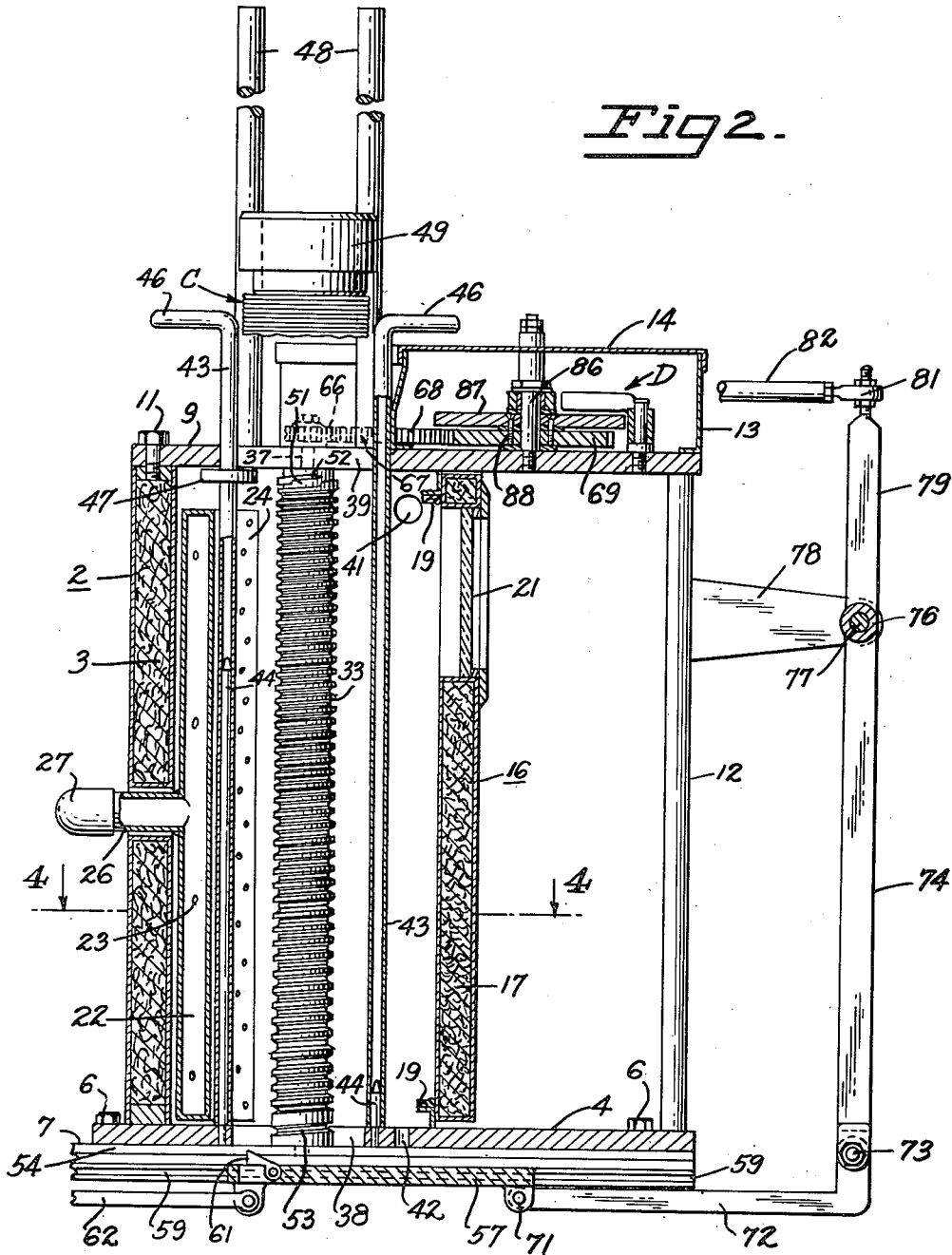
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APPARATUS FOR STERILIZING CONTAINER COVERS

Filed Aug. 7, 1950

5 Sheets-Sheet 2



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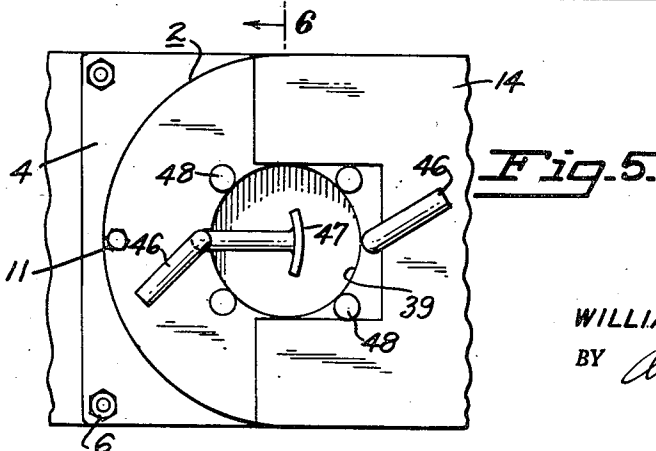
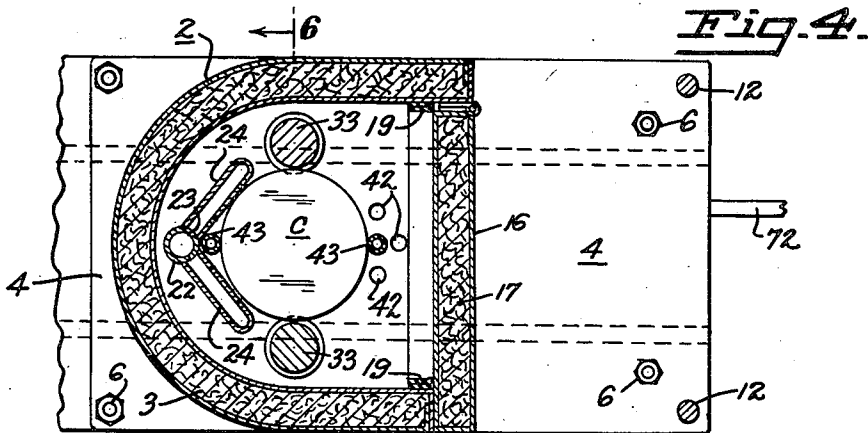
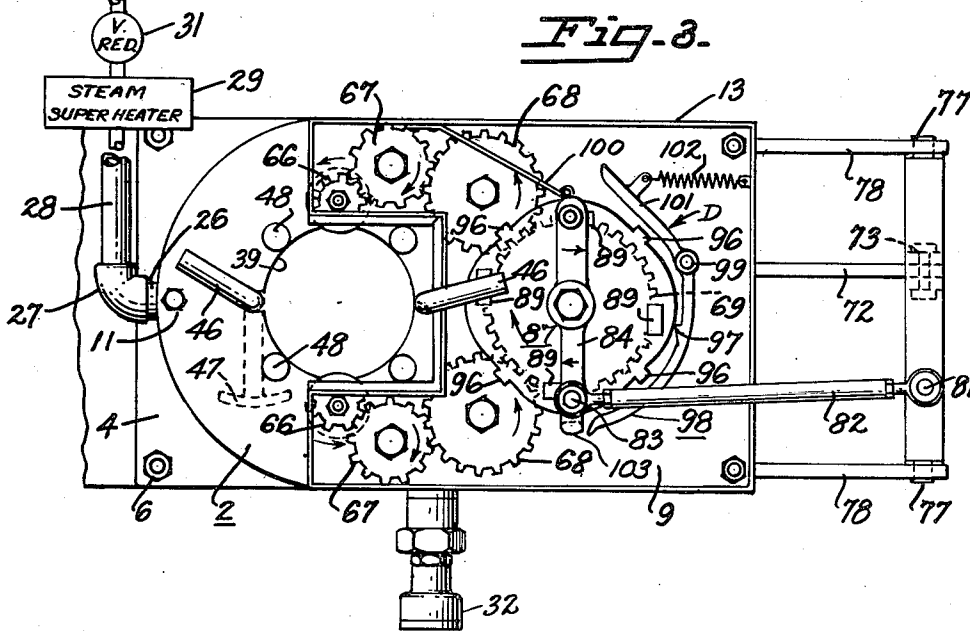
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5 Sheets-Sheet 3



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Fig. 6.

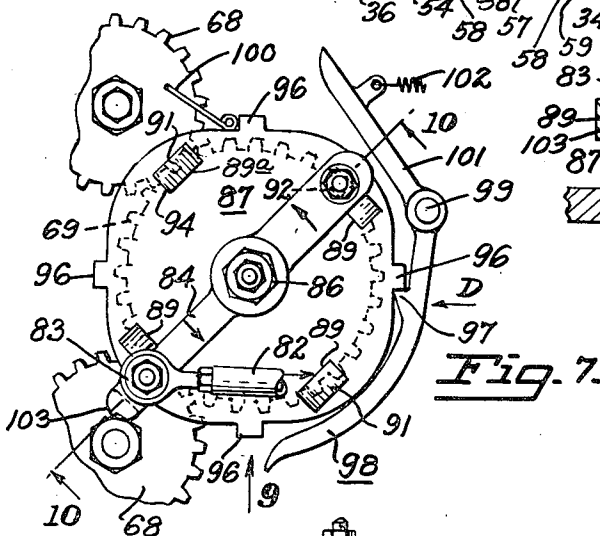
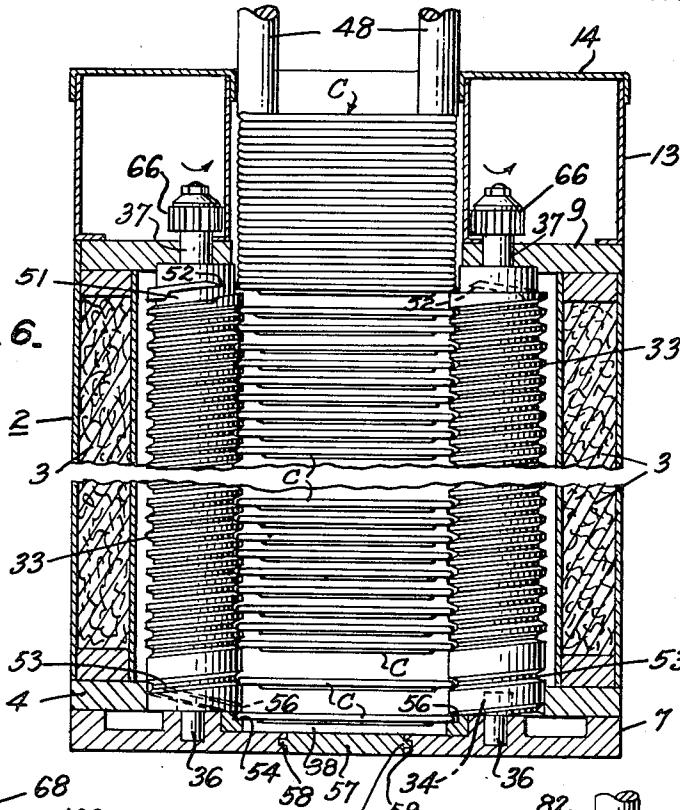


Fig. 7.

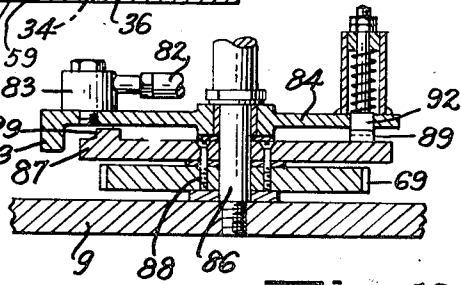


Fig. 10.

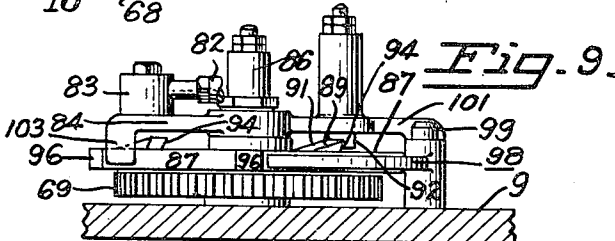


Fig. 9.

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Fig. 8.

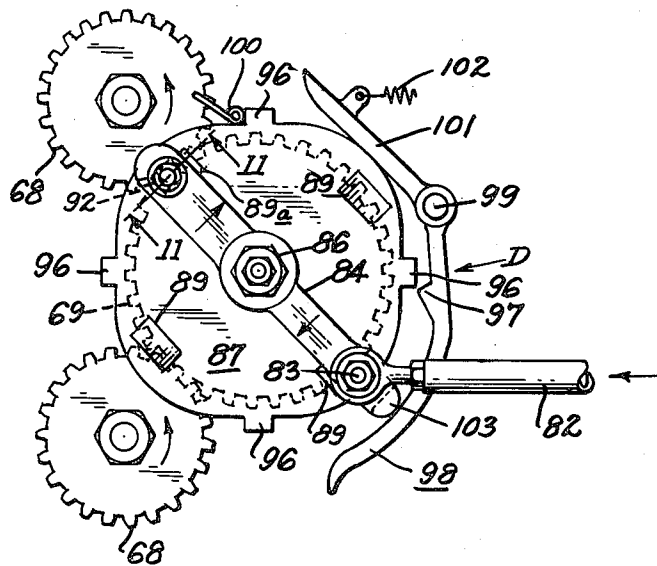
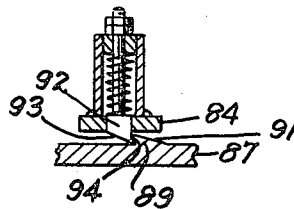


Fig. 11.



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## APPARATUS FOR STERILIZING CONTAINER COVERS

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Application August 7, 1950, Serial No. 178,116

4 Claims. (Cl. 21—78)

This invention relates to the sterilization of container covers, and more particularly to an improved apparatus and method for effecting sterilization of such covers in the type of non-pressurized aseptic processing system disclosed in applicant's co-pending applications, Serial No. 767,726, filed August 9, 1947, and issued as Patent No. 2,549,216, dated April 17, 1951, Serial No. 104,074, filed July 11, 1949, wherein all operations of sterilization of the containers and their covers, filling the containers with a sterile product and covering the product filled containers, are conducted under sterile or aseptic conditions in a unitary self contained apparatus at substantially atmospheric pressure. Steam or other gas heated by heating means to a sterilizing temperature above 212° F. is introduced into the apparatus to maintain sterile conditions therein and prevent inflow of outside air into the apparatus. In the case of steam, the heating means provides a super-heater which imparts heat energy to the steam in addition to the energy imparted thereto by heat of vaporization as a result of mere generation of steam.

Summarizing this invention, it relates to the cover sterilizing section or zone of the described type of apparatus, which comprises an enclosure having an entrance for the covers open to the atmosphere and an exit therefor from which sterile covers are adapted to be conducted to another enclosure wherein the sterile covers are applied to sterile containers containing the sterile food product; the latter enclosure being in the form of a conventional closing machine which automatically applies the covers to the containers. Means is provided in the cover sterilizing enclosure to convey the covers therethrough from said entrance to the exit, so that a sterilizing medium in the enclosure can effect thorough sterilization of the covers.

The particular form of mechanism for conducting the covers comprises cooperable rotatable screws which feed the covers toward the exit; and by virtue of their rotation, exposure of all portions of the edges of the covers to the sterilizing medium is assured. The cover sterilizing enclosure is positioned in association with the cover feeding part of the closing machine; so that the sterilized covers leaving the exit of the enclosure are fed directly to the closing machine by the usual type of mechanism employed in such closing machine for the feeding of covers thereto.

To maintain sterile conditions in the cover sterilizing enclosure, flow of gas is continually effected into the enclosure for preventing inflow of outside air through the cover entrance and all other openings in the enclosure, and the gas is heated to a suitable sterilizing temperature above 212° F. at substantially atmospheric pressure for the purpose of effecting the sterilization. In the case of steam, the heating means is in the form of a super-heater in which any suitable heating means may be employed, such as gas or electrical means. Because of the super-heating, the steam is not saturated steam but is dry steam that has outside heat energy imparted thereto in addition to the energy imparted to the steam by heat of vaporization as a result of mere generation of the steam.

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Superheating of the steam is necessary because at substantially atmospheric pressure, the steam could otherwise not be at a sufficiently high temperature above 212° F. to sterilize the covers within a time period practical for commercial operations. As other gases beside steam, sterile nitrogen, carbon dioxide gas, flue gas or even sterile air may be employed. These gases may also be heated to the desired temperature, by any suitable heating means, such as gas or electrical means. Steam is preferred for introduction into the cover sterilizing enclosure because of its availability and economy. Furthermore, steam has a better heat transfer and consequently more penetrating effect.

As is well known, sterilization is a function of time and temperature. Therefore, for any given residence time of the covers in the cover sterilizing enclosure, the gas may be heated to the temperature necessary to effect thorough sterilization of the covers. The residence time in the cover sterilizer will depend upon the rate of feeding of the covers therethrough which is determined by the speed of operation of the closing machine. Hence, the means for conducting the covers through the cover sterilizer is operated in timed relationship with the closing machine.

Effective sterilization of the covers when the residence time in the cover sterilizer is about 30 seconds, can be effected at a temperature of about 500° F. If the temperature is 550° F., the residence time need only be about 20 seconds. For commercial practicability, it is desirable that the residence time be relatively short; and it has been found that under most conditions a temperature of about 350° F. to 500° F. provides a practical operating temperature with a residence time of about 1 minute to 30 seconds, respectively.

Reference is now made to the drawings for a detailed description of a preferred form of apparatus which is particularly adapted for sterilization of conventional metal can covers to so-called tin cans handled by a conventional tin can closing machine; it being understood, however, that the principle of the apparatus and method of this invention is applicable to the sterilization of any type of container covers adapted to be applied to other types of containers adapted for use with such covers. In the drawings:

Fig. 1 is an isometric view of the cover sterilizer shown in association with a conventional can closing machine, a portion of which is shown schematically in the view;

Fig. 2 is a vertical longitudinal section of the cover sterilizer, certain of the mechanism being omitted and other parts being shown broken away to illustrate more clearly the construction. In this view, the sterilizer is shown mounted on the more or less conventional cover feeding guide part of the closing machine; and a portion of the conventional type of drive from the closing machine is schematically illustrated;

Fig. 3 is a top elevation of the sterilizer with the drive mechanism housing cover removed to illustrate the mechanism within such housing for driving the cover conveying means in the sterilizer. This view also illustrates schematically means for heating the sterilizing gas;

Fig. 4 is a horizontal section taken in a plane indicated by line 4—4 in Fig. 2;

Fig. 5 is a fragmentary top elevation of the sterilizer illustrating the stacking position of a cover stacker therein;

Fig. 6 is a fragmentary vertical sectional elevation taken in a plane indicated by line 6—6 in Fig. 4, for the purpose of illustrating more clearly the cover feed screws in the sterilizer; other structure being omitted from the view to illustrate more clearly the construction and the view being broken away to shorten the same;

Fig. 7 is a fragmentary plan view of a portion of the screw driving mechanism illustrating the position thereof at the commencement of its idle stroke;

Fig. 8 is a view similar to Fig. 7 illustrating the posi-

tion of the screw driving mechanism at the commencement of its actuating stroke;

Fig. 9 is a fragmentary elevational view looking in the direction of arrow 9 in Fig. 7;

Fig. 10 is a fragmentary sectional view taken in a plane indicated by line 10—10 in Fig. 7;

Fig. 11 is a fragmentary section taken in a plane indicated by line 11—11 in Fig. 8.

The cover sterilizer comprises an enclosure in the form of housing 2 having insulated walls 3, a base plate 4 adapted to be detachably secured by cap screws 6 to the cover feed guide part 7 of closing machine 8, and a top plate 9 detachably secured by cap screws 11 to the walls of housing 2. Plates 4 and 9 project beyond the housing and the projecting portions of such plates are connected by posts 12 which provide mounting means for a portion of the driving mechanism to be subsequently explained.

Mounted on the top of top plate 9 is a drive mechanism housing 13 having a removable cover 14 which when removed permits access to drive mechanism D within housing 13. Such drive mechanism D will also be explained hereinafter.

Housing 2 is provided at one side (conveniently designated the front side) with a hingedly mounted door 16 having insulated wall 17 and which may be held closed by conventional clasps 18; a sealing gasket 19 being provided about the periphery of the door inside of housing 2 to form a seal when the door is closed. This gasket may be of any suitable packing material adapted to withstand high temperature. Adjacent the top, a glass window 21 is provided in the door to permit one to see inside the sterilizer without opening the door, which may be desirable at times when the sterilizer is operating.

Adjacent the rear, sterilizer 2 is provided with an upright gas inlet pipe 22 having apertures 23 to permit passage of heated gas into a V-shaped jacket in the form of two hollow plates 24 secured to such inlet pipe 22; the front wall of the jacket being provided with a plurality of apertures to direct the gas forwardly into the sterilizer. With reference to Fig. 4, it will be noted that the V or generally arcuate shape of the described gas distributor permits the same to come into close proximity to the edges of an upright column of overlying and spaced apart covers C which are conveyed downwardly through the sterilizer, and simultaneously rotated always in the same direction in a manner to be subsequently described. As a result of such conveying, rotation and positioning of the covers adjacent the gas distributor, thorough sterilization of all portions of the edges of the covers is assured.

Distributor pipe 22 is connected to a feed pipe 26 projecting through the rear wall of housing 2 and which is in turn connected by elbow 27 to piping 28 which conducts the gas from a source of supply. In the preferred embodiment of the invention, this gas, as was previously explained, is steam which is superheated to the desired sterilizing temperature by means of any suitable heating mechanism in the form of a conventional steam superheater 29 illustrated schematically in Fig. 3. A pressure reducing valve 31 is generally utilized ahead of the superheater to reduce the pressure of the steam from that of boiler pressure to a pressure not excessively above atmospheric pressure. For ascertaining the temperature in the sterilizer, a conventional high temperature thermometer 32 is mounted on a wall of the sterilizer with its heat sensitive mechanism extending into the sterilizer.

Means is provided for conveying the container covers C through the sterilizer in an upright column thereof and with the covers in overlying spaced relationship, so that the steam can thoroughly contact both the upper and the lower surfaces of all the covers. Such means includes a pair of cooperable upright feed screws 33 which are positioned diametrically at opposite points as determined by the circumference of covers C. The bottom ends of screws 33 are hollow to permit journaling there-

of on suitable bearings 34 (Fig. 6) mounted on pins 36 seated in the feed guide part 7 of the closing machine. At the upper end, each of screws 33 has a pin 37 journalled in top plate 9 of the sterilizer.

Base plate 4 of the sterilizer is provided with an aperture 38 to provide an exit for discharge of the covers from the bottom of the sterilizer; and at the top, top plate 9 of the sterilizer is provided with an aperture 39 providing an entrance for the covers into the top of the sterilizer. Entrance 39 is open to the atmosphere; and the interior of the sterilizer housing will, hence, be at substantially atmospheric pressure. In this connection, other apertures are provided in the housing open to the atmosphere including vent hole 41 adjacent the top of the housing. Holes 42 are also provided in base plate 4 to provide drainage from the housing of any steam condensate.

Screws 33 are spaced apart a distance substantially equal to the diameter of covers C to support the same by their screw flights. Cooperable with screws 33 are a pair of guide rods 43 which are located on a diameter at a right angle to the diameter on which the screws are located; so that the covers will be guided in an upright column as they are fed continuously by the rotating screws. Each of these guide rods is removably mounted; and for this purpose, the guide rods are preferably hollow, thus enabling them to be inserted over supporting pins 44, as can be seen more clearly from Fig. 2. At their upper ends, guide rods 43 are provided with transversely extending handle portions 46 to permit them to be readily grasped.

With reference to Fig. 2, the right hand guide rods 43 appearing therein is piloted in top plate 9. Consequently, its supporting pin 44 is relatively short. The left hand guide rod 43 is not piloted in top plate 9 because it is provided with a cover stack holding member 47 below plate 9, adapted to be moved under and away from entrance 39, and which would prevent removal of such guide rod when desired if the guide rod were piloted in plate 9. Consequently, the left hand supporting pin 44 is relatively long to provide an adequate support for such left hand guide rod 43.

When the sterilizer is to be supplied with covers to be sterilized, the left hand guide rod 43 appearing in Figs. 2, 3 and 5 is turned to the position shown in Fig. 5 so that cover stack holding member 47 is under entrance 39. Consequently, an upright supply stack of the covers when placed over entrance 39 will be supported by member 47. Such supply stack is held in position by four guide posts 48 mounted on and extending upwardly from top plate 9 of the sterilizer; the posts 48 being of any desired length in accordance with the maximum number of covers it is desired to support on the sterilizer at one time. To hold the covers in the supply stack in relatively tight contacting relationship so that their feeding will be even, a weight member 49 is provided to engage the uppermost cover in the supply stack. When the covers are to be fed from the supply stack into the sterilizer, the left hand guide rod 43 is turned to position stack holding member 47 away from entrance 39 in the dotted line position illustrated in Fig. 3, whereupon each lowermost cover in the supply stack is ready to be conveyed successively through the sterilizer by the conveying screws 33.

Each of screws 33 is of the same pitch; and as can be seen more clearly from Fig. 6, the pitch of the screws is substantially constant for their entire length except for a short distance adjacent the bottom thereof where the pitch increases for a reason to be later described. Adjacent the top, each screw is formed with a cover splitter part 51; the pitch at this point being substantially equal to the overall thickness of each cover being handled by the sterilizer. The screws are positioned with their respective pointed lead ends 52 of splitter part 51, at diametrically opposite points. Thus, as the screws are rotated

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in the same direction, as indicated by the direction arrows in the drawings, they can each pick up each underlying cover in the supply stack at diametrically opposite points and at the same time, and convey the covers downwardly.

Inasmuch as the screws are rotated in the same direction, the covers are conveyed smoothly in a column determined by the screws, and in overlying spaced relationship fixed by the pitch of the screws. Because of the spacing between the covers and their rotation, the sterilizing medium can flow through such spaces and impinge against the entire surface areas of the covers, and sterilize thoroughly the upper and the lower surfaces of the covers, irrespective of irregularities or indentations in the covers. Upon reaching the bottom of the respective screws, each of which has an increased pitch portion 53 adjacent cover exit 38 to increase the spacing between the covers, the covers are deposited onto the usual spaced guide grooves 54 formed adjacent the top of the closing machine feed guide part 7. In this connection, the discharge ends 56 of the increased pitch portions 53 of the screws are respectively located at diametrically opposite points and extend to the bottom ends of the screws to cause each screw to release the lowermost cover at the same time onto guide grooves 54 which are open at the top and at their inner sides to receive the covers.

Below guides 54 for the covers, feed guide part 7 of the closing machine is provided with the usual slidably mounted reciprocable, cover pusher bar 57 which has side flanges 58 slidably mounted in grooves 59 which thus form trackways for bar 57. The inner end portion of pusher bar 57 is provided with the usual spring pressed cam surfaced pusher pin 61 which in one direction of movement (to the right in Fig. 2) is adapted to slide under the lowermost cover being conveyed by the screws 33. When the bar is moved in the opposite direction, pusher pin 61 engages the edge of such cover to push the same along the guides 54 supporting the same, and into the closing machine wherein the cover is applied to the containers by the usual mechanism provided in the closing machine. The increased spacing between the covers caused by the increased pitch portions 53 of the screws, insures that the pusher pin 61 will engage the edge of only one cover at a time.

The drive of pusher bar 57 which is reciprocated back and forth is conventionally taken off of the closing machine by the usual mechanism including pitmanrod 62 connected to means including an eccentric (not shown) driven from the closing machine.

The particular form of drive for the sterilizer illustrated is adapted for a conventional closing machine which operates intermittently, because the covers are applied to the containers periodically while the containers are at rest. Means is, therefore, provided to drive the feed screws 33 intermittently in timed relationship with the feeding of the covers in the closing machine. Such drive means may be of any suitable construction to accomplish this result. A preferred form of drive is illustrated and will now be described.

Each of feed screws 33 is provided with a driven gear 66 secured to the upper journal pin 37 of such screws. Each of gears 66 is in turn driven by speed change gearing including a larger idler gear 67 meshing with a still larger driving gear 68. Both of driving gears 68 mesh with a still larger main driving gear 69; the gearing being housed within gear housing 13. The ratio of the gearing is such that one quarter turn of the main driving gear 69 effects one complete revolution of each feed screw 33.

Clutch mechanism driven from pusher bar 57 is provided to turn main driving gear 69 intermittently. With particular reference to Figs. 1, 2, 3 and 7 through 11, the right hand portion of pusher bar 57 appearing in Fig. 2 is pivotally connected at 71 to a horizontally extending link member 72 in turn pivotally connected at 73 to an upright connecting link 74. The latter is

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fixed to a sleeve 76 journaled on a pin 77 supported on brackets 78 fixed to the previously mentioned posts 12. Also secured to sleeve 76 is another upright link member 79 which is provided with a universal connection 81 to a horizontal link 82. From the preceding, it will be seen that as pusher bar 57 is reciprocated back and forth, link 82 will also be pushed back and forth, but always in a direction opposite to the direction of movement of bar 57, by virtue of the intermediate pivotal connection at 76 of the linkage which the two links 74 and 79 provide.

Link 82 is also universally connected at 83 to a horizontal bar 84 which provides the driving clutch element of the clutch mechanism for intermittently driving the feed screws 33. Bar 84 is journaled for turning about an upright pin 86 fixed in top plate 9 of the sterilizer, and is adapted upon back and forth oscillation thereof as determined by reciprocation of link 82 to drive intermittently a driven clutch element in the form of a plate 87 located below bar 84 and also journaled on pin 86. Master drive gear 69 is also journaled on pin 86, and is fixedly secured to clutch plate 87 by means of cap screws 88.

Clutch plate 87 is provided on its upper surface with four equi-spaced (90° apart) clutch teeth 89, the upper surfaces 91 of which are inclined to provide cam surfaces. At the end opposite universal connection 83, bar 84 is provided with a clutch tooth in the form of a spring pressed pin 92 having an inclined under-cam surface 93 adapted to ride over surface 91 of the respective clutch teeth 89 in one direction of oscillation of bar 84, and to engage the upright surface 94 of the respective clutch teeth 89 in the opposite direction of oscillation of clutch bar 84. Thus, as clutch bar 84 is oscillated in one direction, it will drive clutch plate 87 one-quarter turn as its tooth 92 engages upright surface 94 of the respective clutch teeth 89; and on the next stroke of bar 84 in the opposite direction, its clutch tooth 92 will ride over the next adjacent clutch tooth 89 without driving the clutch plate because of the yieldable mounting of tooth 92 and the inclined clutch tooth surfaces 91 and 93.

Means is provided for holding clutch plate 87 centered in a fixed position during the period that clutch bar 84 is moved in the non-driving direction by link 82. Such means comprises four equi-spaced (90° apart) stops 96 on the edge of clutch plate 87, each of which is positioned midway between a pair of adjacent clutch teeth 89. In the non-driving direction of bar 84, the respective stops 96 are adapted to engage against a stop 97 formed on a latch member 98 pivotally mounted on an upright pin 99. Latch member 98 has secured thereto an arm 101 which projects beyond pin 99; and a spring 102 is connected to arm 101 to urge normally stop 97 on latch member 98 toward clutch plate 87. Stop 97 is adapted to engage against one side of each stop 96 while a non-return spring 100 is adapted to engage against the opposite side of an adjacent stop 96, thus holding clutch plate 87 fixed during the time it is not driven, as can be seen from Fig. 7.

In Fig. 3 the parts are shown in position at about the middle of the driving stroke with link member moving toward the left of the figure. In Fig. 7, the parts are shown in the position at the commencement of the idle or non-driving stroke of clutch bar 84; and Fig. 8 illustrates the position of the parts at the commencement of the driving stroke of clutch bar 84.

Referring to Fig. 7 and comparing it with Fig. 8, it will be noted that near the end of the non-driving stroke of bar 84, a cam member 103 at the end thereof opposite the end on which clutch tooth 92 is positioned, will engage the free end of latch member 98 to disengage the engaged stops 96 and 97 so as to hold latch member 98 out of latching position during the initial part of subsequent driving stroke. Also, near the end of

such non-driving stroke, clutch tooth 92 on bar 84 will ride over the clutch tooth numbered 89a in Fig. 7. Hence, on the opposite return or driving stroke of clutch bar 84, the commencement of which is illustrated in Fig. 8, clutch plate 87 will be driven by virtue of engagement of tooth 92 against the upright surface 94 of clutch tooth 89a.

In this connection, right after the driving stroke commences, cam 103 on clutch bar 84 will be moved out of engagement with latch member 98 which will hence be released, but only after the previously engaged stop 96 has moved past stop 97, so that when the subsequent non-driving stroke commences, the latch mechanism will be effective to engage the next adjacent stop 96 and hold clutch plate 87 against movement in one direction. As was previously mentioned, movement of the clutch plate in an opposite direction during the non-driving stroke is effected by the non-return spring 100 which extends in the direction of driving rotation of clutch plate 87 so that the respective stops 96 may readily pass thereby during the driving stroke.

It will be noted by reference to Fig. 2 of the drawings that when link 82 is moved to the left (the driving stroke during which screws 33 are rotated for conveying the covers through the sterilizer), cover pusher bar 57 will be moved to the right to position it for pushing the lowermost cover into the closing machine. When link 82 is moved to the right (the idle stroke during which screws 33 are not rotated), pusher bar 57 will be moved to the left to push the successive covers into the closing machine. The linkage fulcrums and lengths are such that the pusher bar will be in position to push the successive covers into the closing machine, at the time the feed screws drop the same onto the feed guide part 7 of the closing machine; and during the entire pushing stroke of the pusher bar, the feed screws are not rotating. Rotation of the feed screws 33 commences at the time the pusher bar is moved to the right on its return or idle stroke.

In the event the sterilizer is adapted for use with a multi-spindle closing machine wherein the cans are moved continuously and the covers applied continuously, any suitable drive and timing mechanism may be provided with the sterilizer to rotate screws 33 continuously in the same direction and feed the covers in timed relationship with such closing machine.

The sterilizer when assembled will handle covers only of the same size, but by the interchange of different size parts, the sterilizer can be readily made up as varying units each of which can handle a cover of any conventional size. Since the sterilizer unit is detachably mounted on the closing machine guide part 7, such conversion can be readily effected. In this connection, the conventional closing machine is provided with the usual mechanism enabling handling of varying size covers.

I claim:

1. Apparatus for sterilizing container covers comprising, an enclosure having an entrance for the covers which is open to the atmosphere and an exit therefor from which the covers are carried to a closing machine for applying the covers to sterile containers containing a sterile product, means for conveying the covers through said enclosure, said conveying means including a plurality of substantially parallel cooperable rotatable screws spaced apart a distance substantially equal to the diameter of said covers, for supporting said covers in a spaced apart columnar ar-

rangement and for rotating them as they are thus supported, gas distributing means adjacent to and extending in an axial direction along said screws, said gas distributing means having a plurality of gas-emitting apertures spaced axially along said gas distributing means and along said screws for directing a sterilizing gas into the spaces between the covers and against the edges of the covers as they are rotated, and means for introducing a flow of sterilizing gas into said gas distributing means, said gas being heated to a temperature at substantially atmospheric pressure substantially in excess of 212° F. for sterilizing said covers as they are moved through said enclosure and maintaining sterile conditions in said enclosure.

2. Apparatus as claimed in claim 1 in combination with feeding means to feed said covers in a horizontal direction to said closing machine, wherein said gas distributing means is upright and has spaced apart apertures disposed in the vertical direction.

3. Apparatus as claimed in claim 2 wherein said enclosure is heat-insulated.

4. In combination, a container-closing machine in which sterile container covers are applied to sterile containers containing a sterile product and apparatus for sterilizing said covers, said sterilizing apparatus comprising, an enclosure having an entrance for the covers which is open to the atmosphere and an exit therefor; means for securing said enclosure to said closing machine; means for conveying the covers through said enclosure including a plurality of upright substantially parallel cooperable rotatable screws spaced apart a distance substantially equal to the diameter of said covers for supporting the covers in spaced apart upright columnar arrangement and for rotating them as they are thus supported, transfer conveying means below said screws for receiving the covers from said screws and for feeding them in a horizontal direction to said closing machine; means for timing rotation of said screws and said transfer conveying means in correlation with said closing machine; gas distributing means adjacent to and extending in an axial direction along said screws, said gas distributing means having a plurality of gas emitting apertures spaced axially along said gas distributing means and along said screws for directing a sterilizing gas into the spaces between the covers and against the edges of said covers as they are rotated; and means for introducing a flow of gas into said gas distributing means which gas is heated to a temperature at substantially atmospheric pressure substantially in excess of 212° F. for sterilizing said covers as they are moved through said enclosure and maintaining sterile conditions in said enclosure.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|    |           |               |               |
|----|-----------|---------------|---------------|
| 55 | 1,070,182 | Robinson      | Aug. 12, 1913 |
|    | 1,247,045 | Wegner et al. | Nov. 20, 1917 |
|    | 1,270,797 | Dunkley       | July 2, 1918  |
|    | 1,270,798 | Dunkley       | July 2, 1918  |
|    | 1,350,104 | Lowe          | Aug. 17, 1920 |
| 60 | 1,562,938 | Bisset        | Nov. 24, 1925 |
|    | 1,634,566 | Wessman       | July 5, 1927  |
|    | 1,662,371 | Troyer et al. | Mar. 13, 1928 |
|    | 1,902,625 | Dunham        | Mar. 21, 1933 |
|    | 2,162,336 | Johnstone     | June 13, 1939 |
| 65 | 2,232,803 | Rodda         | Feb. 25, 1941 |
|    | 2,433,736 | Carew         | Dec. 30, 1947 |