Nov. 7, 1950 H. E. STOVER 2,529,199

MACHINE AND METHOD FOR HERMETICALLY SEALING CLOSURE CAPS TO CONTAINERS

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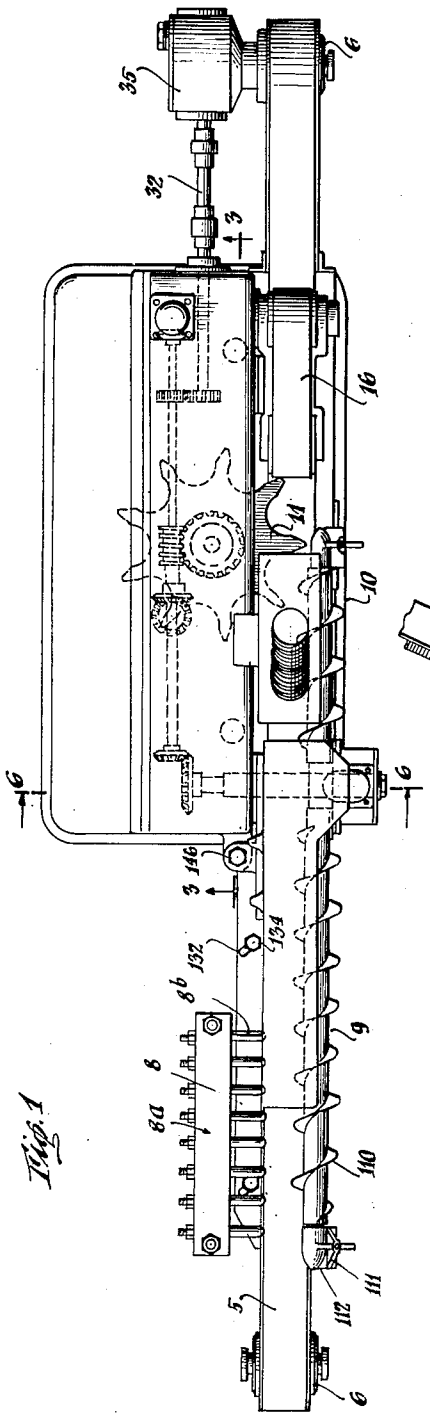


Fig. 1

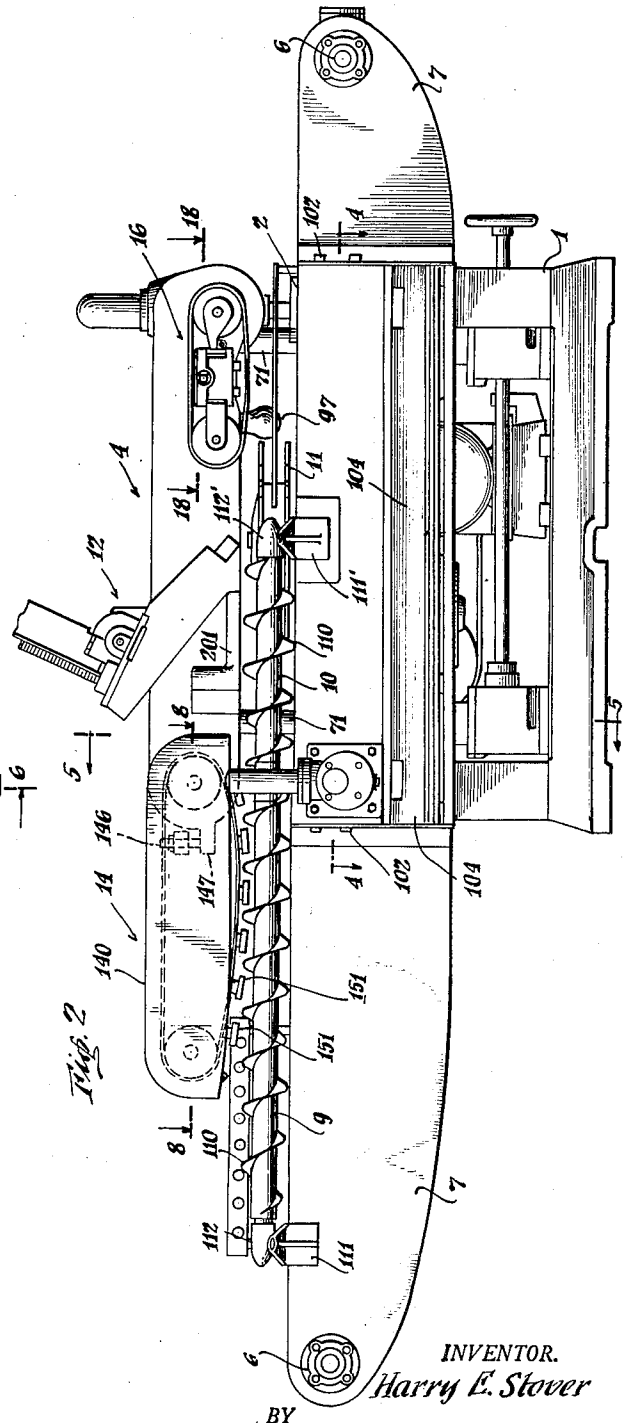


Fig. 2

INVENTOR.
Harry E. Stover
BY
Norman R. Holland
ATTORNEY

Nov. 7, 1950

H. E. STOVER

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10 Sheets-Sheet 2

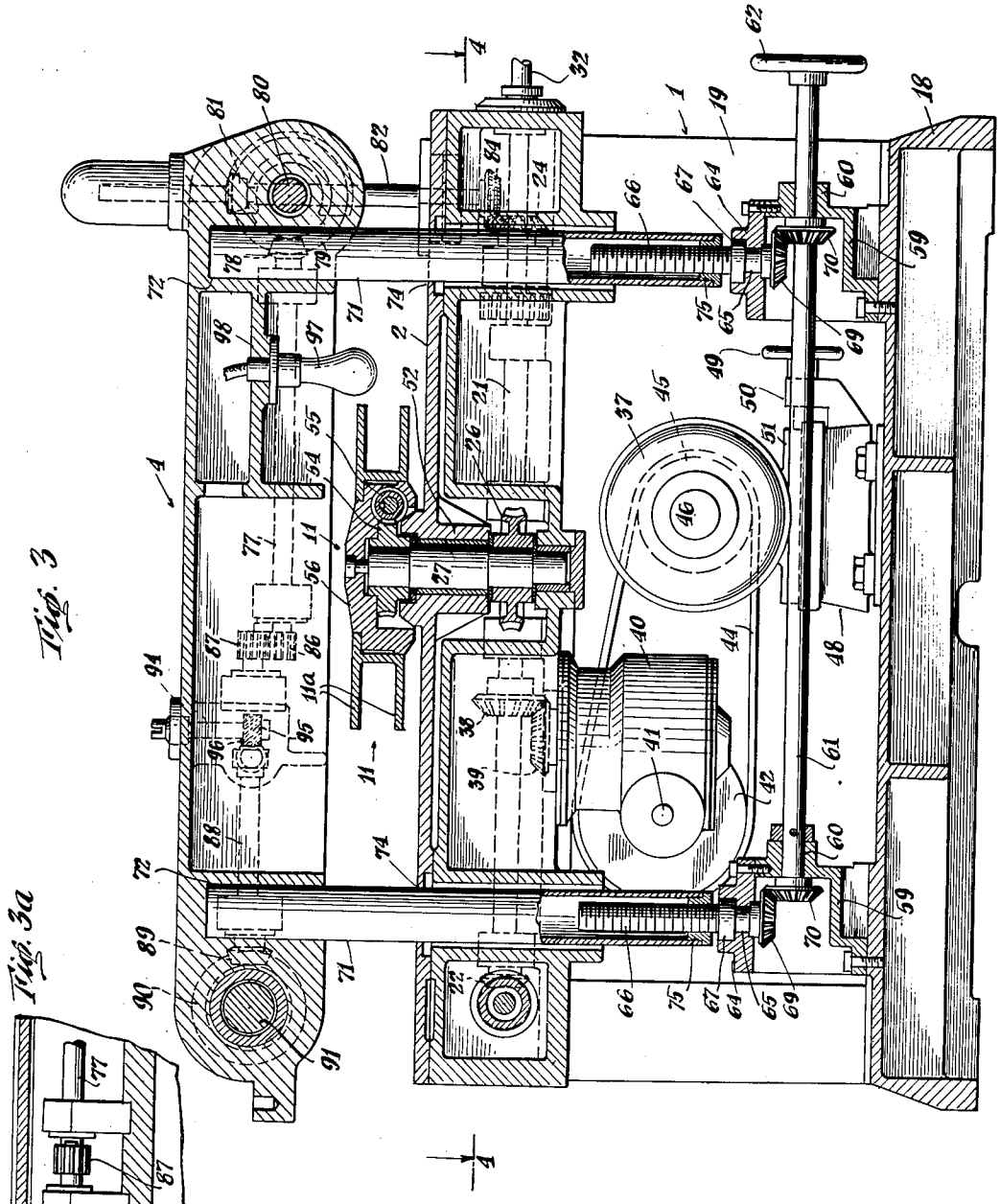


Fig. 3

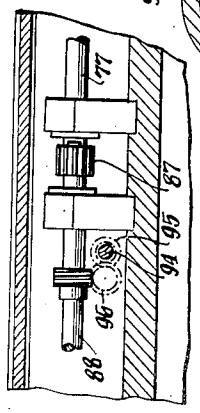


Fig. 3a

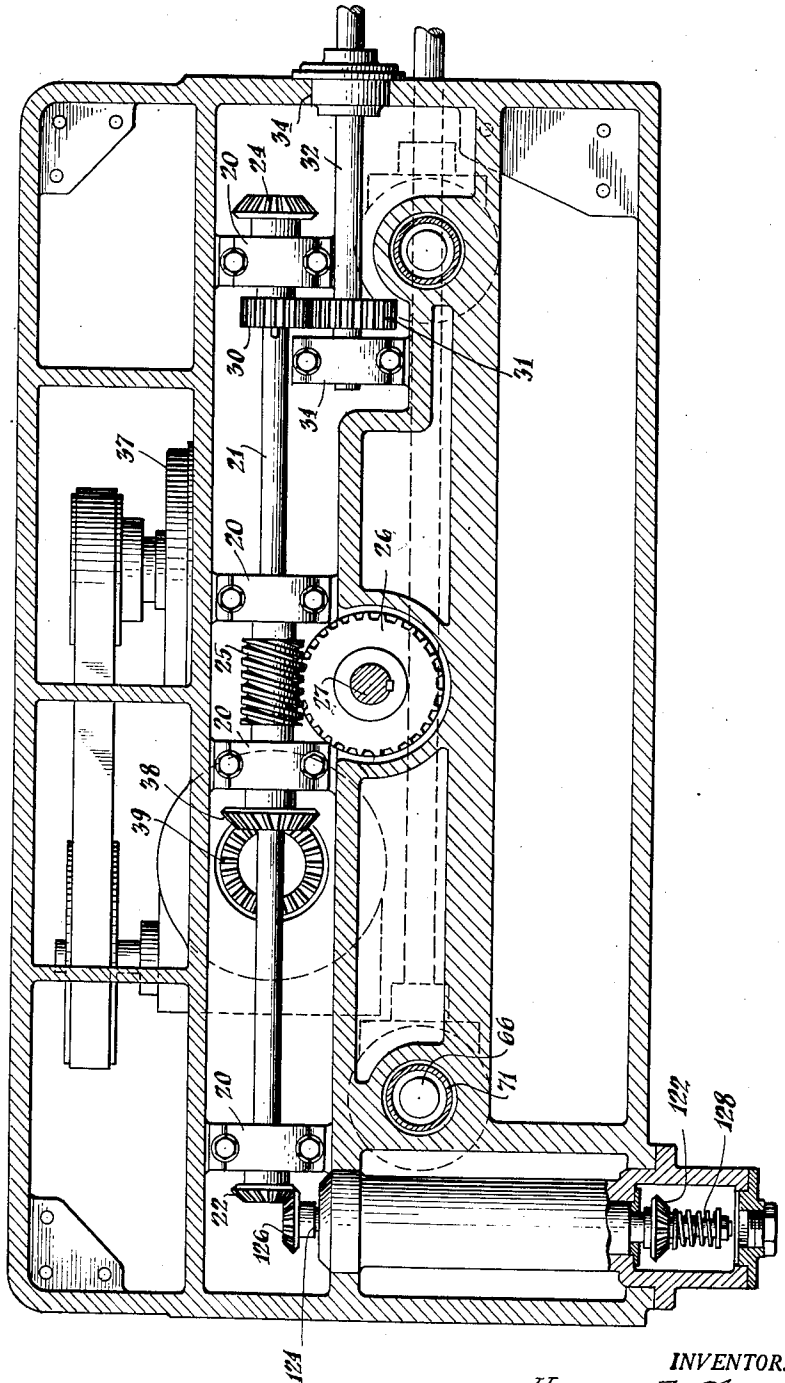
INVENTOR.
Harry E. Stover
BY
Norman W. Holland
ATTORNEY

Nov. 7, 1950 H. E. STOVER 2,529,199

MACHINE AND METHOD FOR HERMETICALLY SEALING CLOSURE CAPS TO CONTAINERS

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Fig. 4



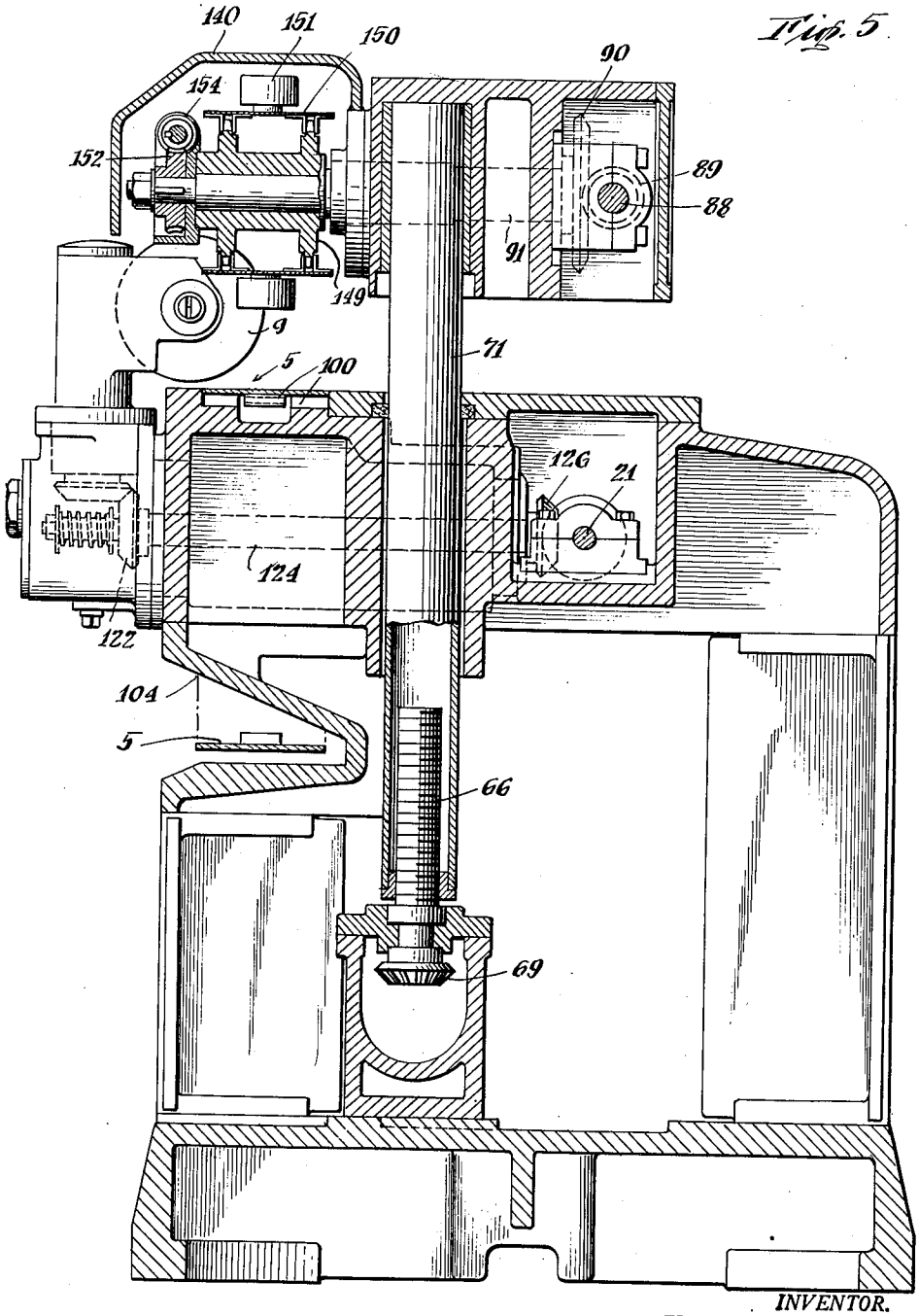
INVENTOR.
Harry E. Stover
BY
Norman N. Holland
ATTORNEY

Nov. 7, 1950 H. E. STOVER 2,529,199

MACHINE AND METHOD FOR HERMETICALLY SEALING CLOSURE CAPS TO CONTAINERS

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Fig. 5



INVENTOR.
Harry E. Stover
BY
Norman N. Holland
ATTORNEY

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Fig. 6

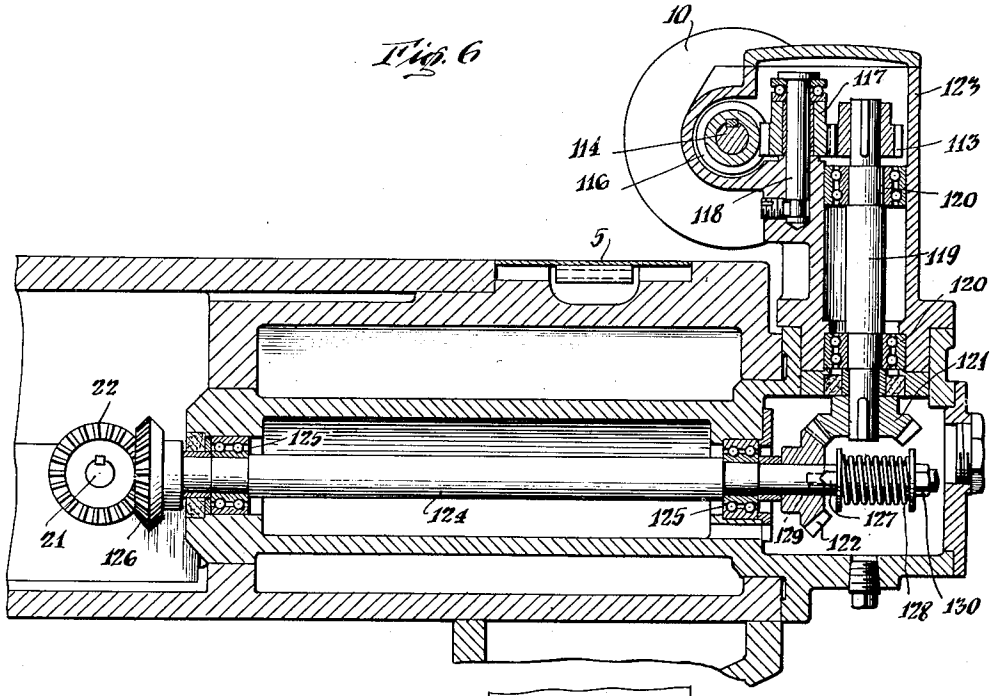
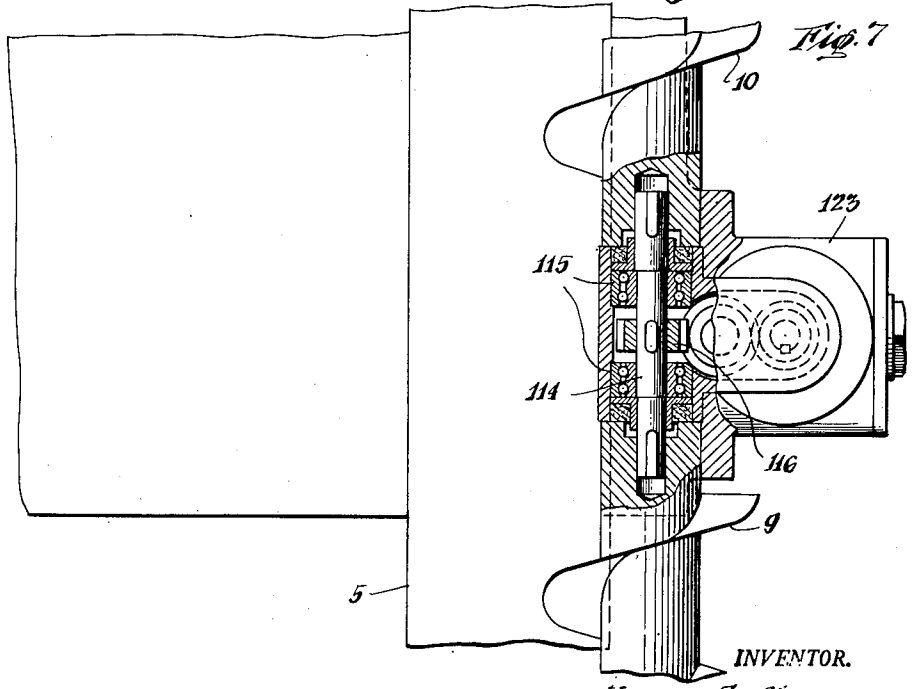


Fig. 7



INVENTOR.
Harry E. Stover
BY
Norman K. Holland
ATTORNEY

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Fig. 8

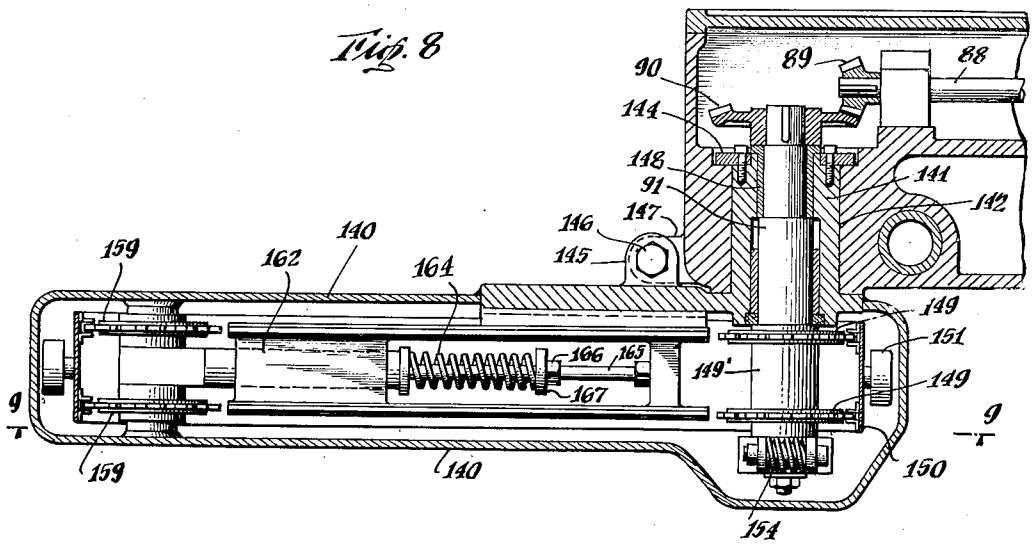


Fig. 9

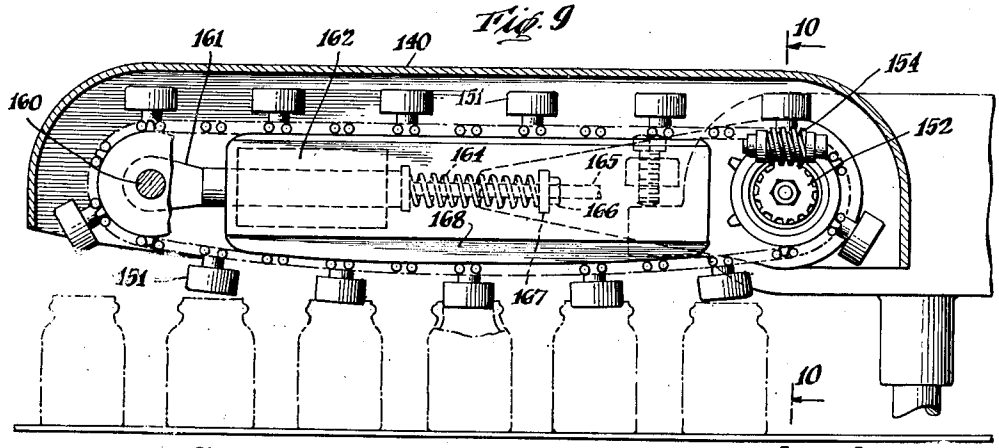


Fig. 10

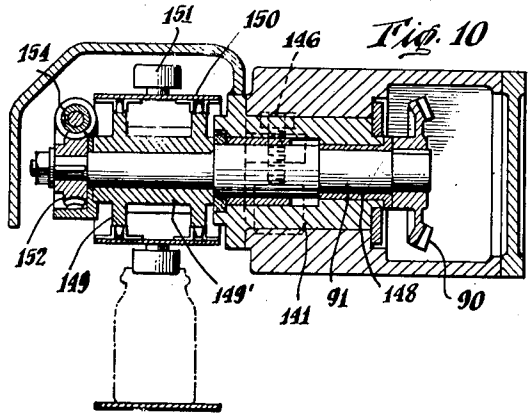
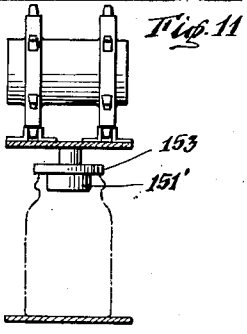


Fig. 11



INVENTOR.
Harry E. Stover
BY
Norman N. Holland
ATTORNEY

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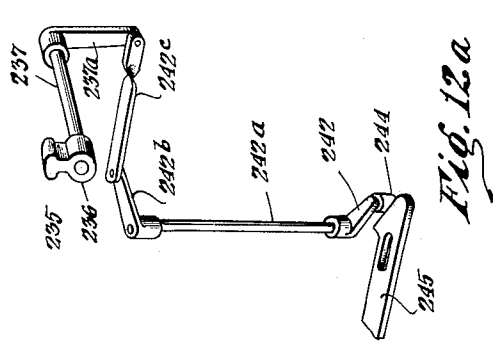


Fig. 12a

Fig. 12

INVENTOR.
Harry E. Stover
BY
Norman N. Holland
ATTORNEY

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MACHINE AND METHOD FOR HERMETICALLY SEALING CLOSURE CAPS TO CONTAINERS

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Fig. 13

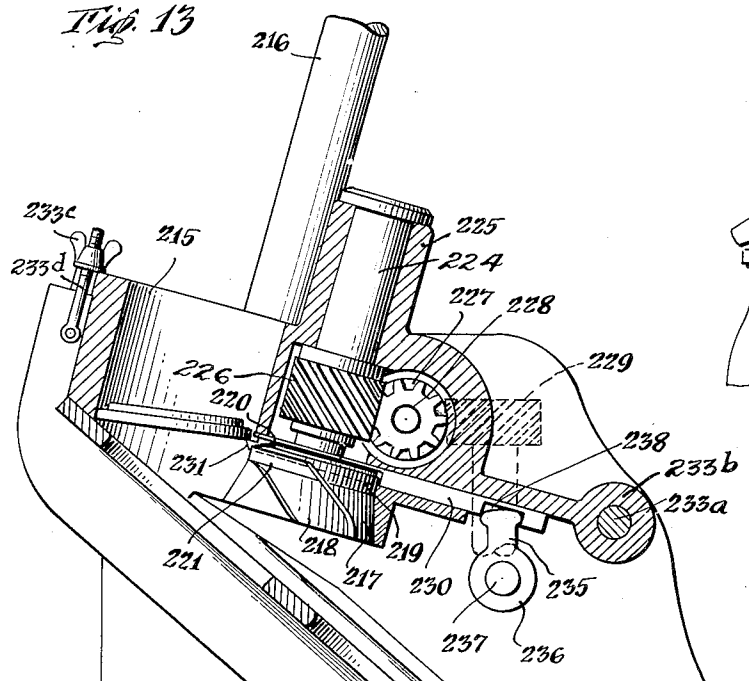


Fig. 14

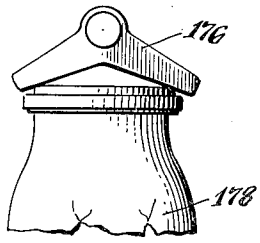
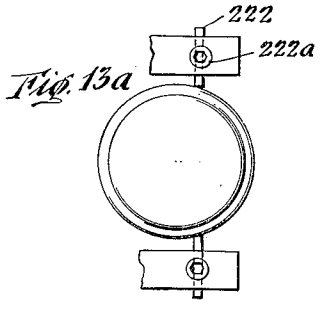


Fig. 13a



INVENTOR.
Harry E. Stover
BY
Norman N. Holland
ATTORNEY

Nov. 7, 1950 H. E. STOVER 2,529,199

MACHINE AND METHOD FOR HERMETICALLY SEALING CLOSURE CAPS TO CONTAINERS

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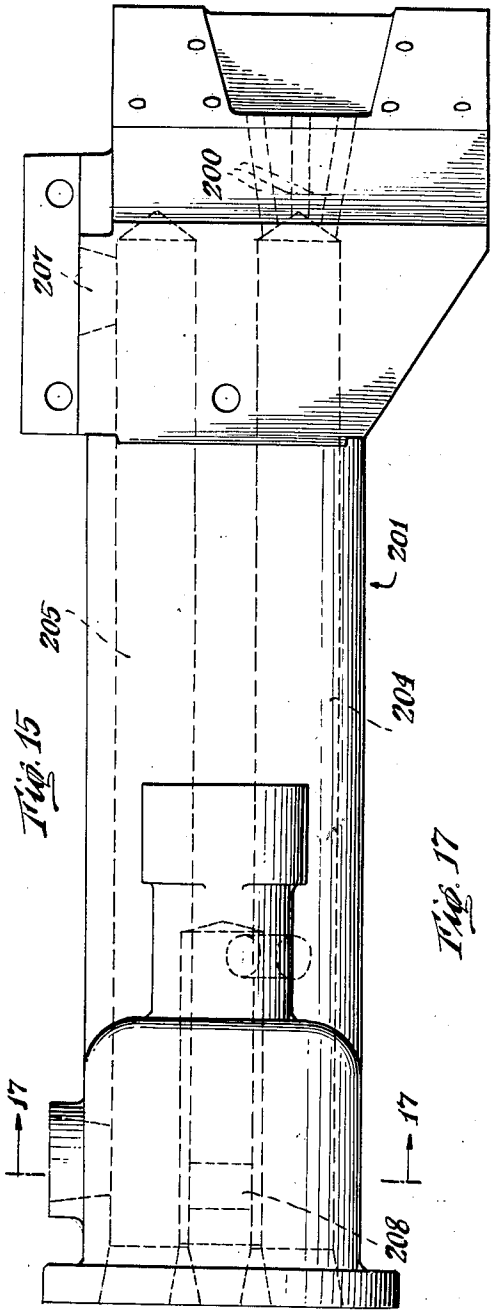


Fig. 15

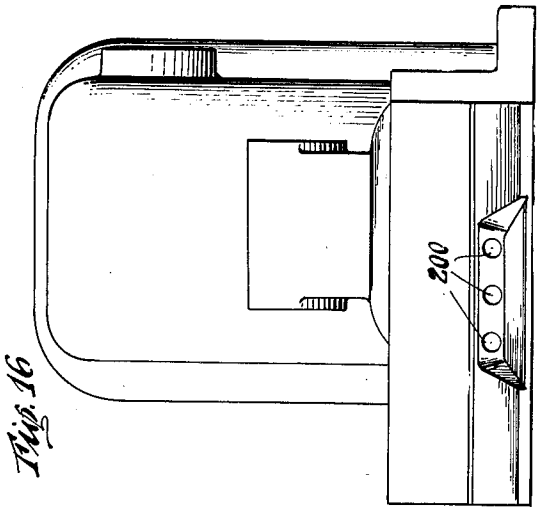


Fig. 16

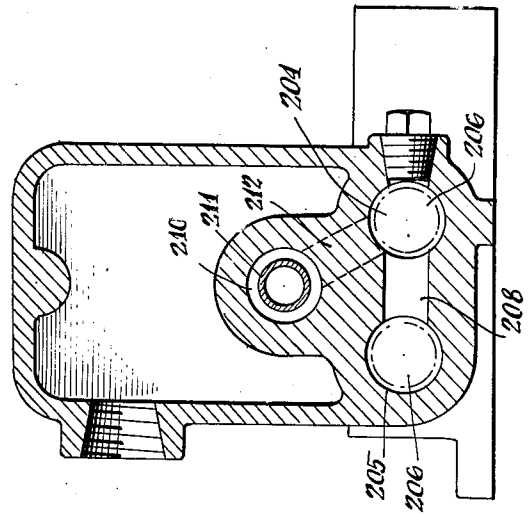


Fig. 17

INVENTOR.
Harry E. Stover
BY
Norman N. Holland
ATTORNEY

Nov. 7, 1950 H. E. STOVER 2,529,199

MACHINE AND METHOD FOR HERMETICALLY SEALING CLOSURE CAPS TO CONTAINERS

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Fig. 18

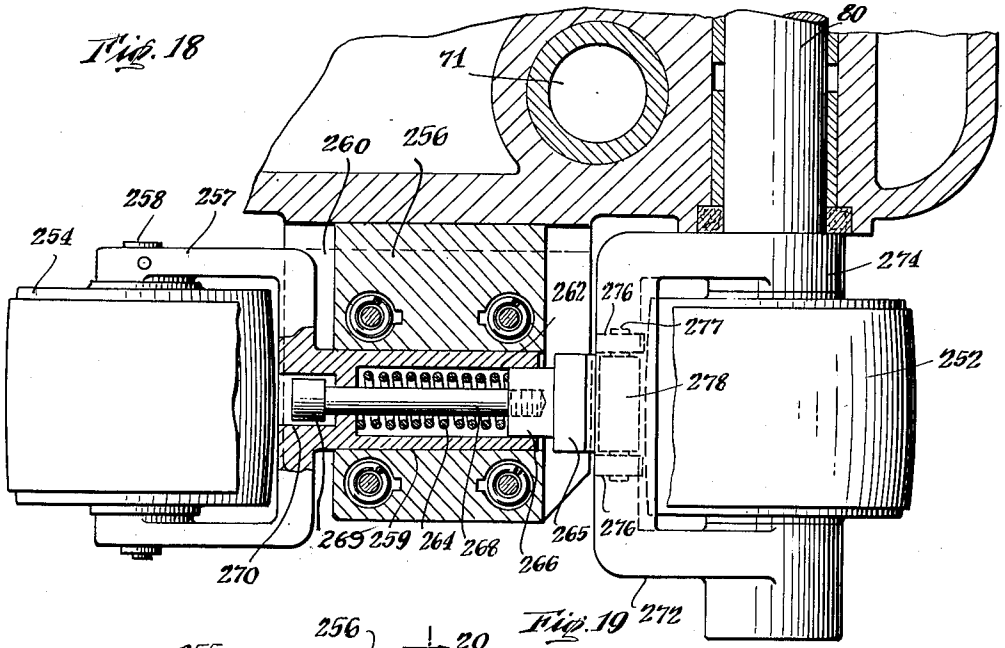


Fig. 19

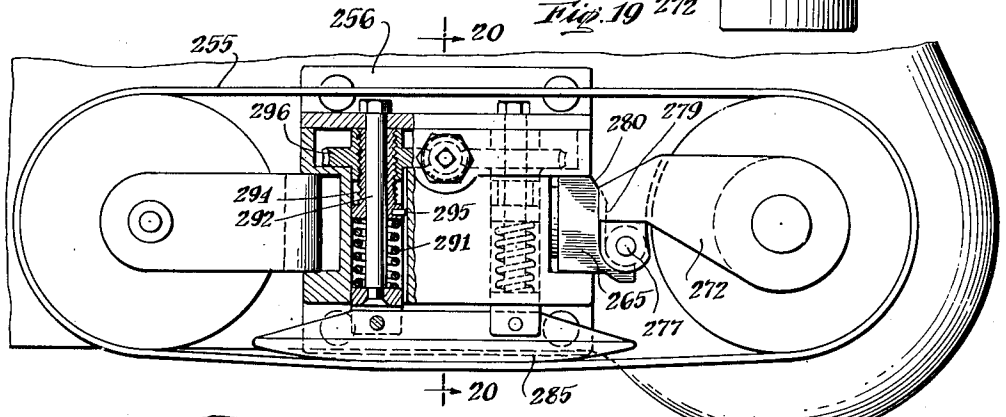
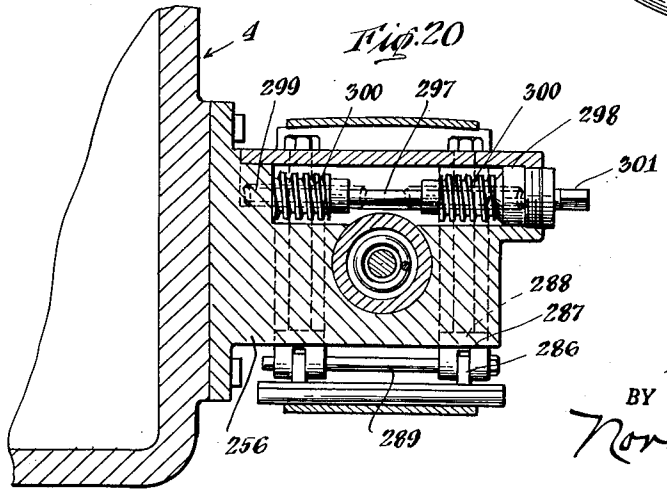


Fig. 20



INVENTOR.
Harry E. Stover
BY
Norman R. Holland
ATTORNEY

Patented Nov. 7, 1950

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UNITED STATES PATENT OFFICE

2,529,199

MACHINE AND METHOD FOR HERMETICALLY SEALING CLOSURE CAPS TO CONTAINERS

Harry E. Stover, Lancaster, Ohio, assignor to Anchor Hocking Glass Corporation, Lancaster, Ohio, a corporation of Delaware

Application February 24, 1945, Serial No. 579,671

31 Claims. (Cl. 226—82)

1

The present invention relates to the sealing art and more particularly to a machine and method for sealing closure caps to containers.

While certain features of the invention may be embodied in sealing machines generally the preferred embodiment utilizes hot vapor for forming a high vacuum (low pressure) in the package. Some of the objections to vapor sealing are the escape of excessive vapor, its condensation on the ceiling of the room or factory where the machine is, and the constant dripping of the condensate from the parts of the room which is unsanitary and objectionable both as to working conditions and as to cooking and packing food products. Other objections are excessive condensate in the package, formed during the sealing operation, which may impair the quality of the product, higher cost of sealing due to waste of vapor and low vacuum from inefficient sealing.

Certain machines convey the uncapped containers through a long chamber filled with steam which escapes from both ends. Water is flowed into the chamber to cool the capped containers thereby to condense the steam therein to form a vacuum. Thus running water and steam mingle in the same chamber which requires an excessive volume of steam resulting in excessive condensation.

The present invention minimizes or overcomes the above difficulties by injecting steam, which may be highly superheated, under the side of a closure as it is applied to a container to displace the air and form a vacuum when the steam condenses in the container. The amount of steam required is reduced to a minimum by eliminating the necessity of heating up the end of the container. The steam in the head-space rapidly condenses due to the much lower temperature of the container and contents, forming a vacuum seal and eliminating the necessity of running cooling water on the closures to prevent their "popping" off after being sealed. The high temperature of the superheated steam minimizes the quantity required, expedites condensation in the head-space, forms a higher vacuum and effectively sterilizes the head space of the container. The mechanism for attaining the above results is simple, effective, easily adjusted for different sizes and heights of containers and is fully reliable for continuous operation.

An object of the present invention is to provide an improved sealing machine and method for sealing containers.

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Another object of the invention is to provide an improved method and means of obtaining a high vacuum with vapor.

Another object of the invention is to effectively sterilize the head space of the container during the sealing operation.

Another object of the invention is to minimize the amount of vapor required in vacuum sealing to reduce the cost thereof and to reduce the amount of condensate in the package and on the surrounding objects.

Another object of the invention is to provide an improved means for superheating the steam adjacent the point of injection into the containers.

Another object of the invention is to provide an improved means for applying the closure to the container at the time of the injection of steam therein.

Another object of the invention is to provide an improved head spacer for use with the sealing machine.

Another object of the invention is to provide an improved mechanism for feeding closures for sealing on the containers.

Another object of the invention is an improved means of simultaneously adjusting the several mechanisms for different heights of containers.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described or will be indicated in the appended claims and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings forming a part of the specification, wherein

Fig. 1 is a top plan view of a preferred embodiment of the sealing machine;

Fig. 2 is a side elevational view of the machine;

Fig. 3 is a sectional view along the line 3—3 of Fig. 1 showing details of the height adjustment and other features of the machine;

Fig. 3a shows elements of the driving mechanism in the superstructure.

Fig. 4 is a sectional view along the line 4—4 of Fig. 2 illustrating details of the drive for the machine;

Fig. 5 is a sectional view on the line 5—5 of Fig. 2 which is along one of the adjustable supporting columns, illustrating features of the machine;

Fig. 6 is a sectional view along the line 6—6 of Fig. 1 illustrating the drive for the helicoid;

Fig. 7 is a fragmentary top plan view of the mechainsm shown in Fig. 6 with parts shown in section;

Fig. 8 is a sectional view along the line 8—8 of Fig. 2 illustrating features of the head spacing unit;

Fig. 9 is a sectional view along the line 9—9 of Fig. 8;

Fig. 10 is a sectional view along the line 10—10 of Fig. 9;

Fig. 11 is a detailed view illustrating another embodiment of the displacement member which enters the mouth of the container;

Fig. 12 is a perspective view illustrating parts of the machine and particularly the cap feed, vapor injector and related parts;

Fig. 12*a* is a diagrammatic perspective view of the mechanism for operating the cap feed to feed a closure to each container;

Fig. 13 is a sectional view through the cap feed and through the injector illustrating the feeding of closures and the injection of vapor under the side of the closure as it is placed on the container;

Fig. 13*a* is a fragmentary detailed view illustrating the adjustable members for positioning the closure at the bottom of the chute;

Fig. 14 is an end view of a closure being placed on a container illustrating the operation of the pressure fork;

Fig. 15 is a top plan view of the vapor injector apart from the cap feeding mechanism;

Fig. 16 is an end view of the injector;

Fig. 17 is a sectional view along the lines 17—17 of Fig. 15;

Fig. 18 is a sectional view along the lines 18—18 of Fig. 2, showing the details of the pressure applying mechanism for forcing the closures on the containers;

Fig. 19 is a side elevational view with parts in section of the mechanism shown in Fig. 18; and

Fig. 20 is a sectional view along the lines 20—20 of Fig. 19.

The preferred embodiment of the sealing machine illustrated in the drawings will be described in detail under headings; (1) General Description, (2) Frame and Drive, (3) Conveyor, (4) Helicoids, (5) Head Spacer, (6) Cap Delivery, (7) Cap Feed, (8) Pressure Head, and (9) Operation.

General description

Described generally with reference more particularly to Figs. 1 and 2 the preferred embodiment of the inventions comprises a base 1, which serves to house the drive and to support a table 2 with its associated mechanisms and a superstructure 4 vertically adjustable with respect to the table. The table 2 has a conveyor 5 extending longitudinally thereof and over the sprockets 6 mounted on extensions 7 bolted to the ends of the base 1. An adjustable guide rail 8 cooperates with helicoids 9 and 10 to space and guide the containers on the conveyor as they enter at the left end of the machine as shown in Figs. 1 and 2. A suitable star wheel 11 cooperates with the helicoid 10 in holding the containers in upright position as they pass the cap feed 12 and its associated mechanism. The superstructure 4 carries a pivotally mounted head spacer 14 with displacing discs 15 for entering the mouths of the containers to displace the excess contents of overfilled containers

thereby to provide substantially uniform head spaces, in the sealed containers. As the filled containers leave the head spacer, they pass under the cap feed, also mounted on the superstructure 4, where a cap is forced on the containers sufficiently far to form a hermetic seal. Simultaneously highly superheated vapor is injected under the side of the cap as it is set on the container to displace the air therein, and to form a substantially sterile vacuum seal. Preferably the pressure applied is insufficient to force the cap entirely on the container, thus permitting a simple mechanism to be utilized. A pressure head 16 forming a part of the superstructure 4 forces the closures fully down on the containers after the containers leave the injector.

Frame and drive

Referring more particularly to Figs. 1 to 7, there is shown a frame 1 having a base in the form of a casting 18 adapted to rest on the floor. Legs 19 are bolted to the upper side of the base to support the table 2 having the conveyor 5 on its upper surface and having end structures 7 for supporting and housing the conveyor sprockets.

Within the frame suitable bearings support a horizontal main drive shaft 21 (Figs. 3 and 4) extending substantially the length of the table with a bevel gear 22 on one end for driving the helicoids 9 and 10 and a bevel gear 24 on its other end operatively connected to drive the parts mounted on the superstructure 4. A worm gear 25 on shaft 21 (Fig. 4) meshes with a gear 26 keyed to a vertical shaft 27 to drive the star wheel 11. A gear 30 is keyed to shaft 21 and meshes with a gear 31 on shaft 32, mounted in bearings 34, to drive a reduction gear 35 operatively connected to the conveyor sprocket 6 (Figs. 1 and 2) for driving the conveyor 5. The drive shaft 21 may be driven by a motor 37 through the intermediation of a bevel gear 38 (Figs. 3 and 4) on shaft 21, meshing with bevel gear 39 operatively connected to a reduction gear 40, shaft 41, pulley 42, and belt 44 extending over pulley 45 on the shaft 46 of the motor 37.

The motor 37 (Figs. 2 and 3) is movably mounted on a base 48, and movable to and from the pulley 42 on the reduction gears by means of a handwheel 49 in extension 50 threaded into the part 51 of the movable motor base. The movement of the motor to and from the pulley 42 increases and decreases the speed of the drive by reason of the belt being drawn further into a V-shaped groove in one of the pulleys. This type of variable speed drive is sometimes known as a "Reeves Drive." Thus operating machinisms associated with the table 2 are driven in an efficient and convenient manner from the main drive shaft 21.

The star wheel 11 (Fig. 3) is mounted on the shaft 27 which is housed in a bearing 52 in the table. The upper end of the shaft has a gear 54 keyed thereto meshing with a worm gear 55 operatively connected to a hub 56. By rotating the worm gear 55 with a suitable wrench the hub 56 and the star wheel 11 thereon may be rotated with respect to the shaft 27 to synchronize the star wheel with reference to the helicoid drives both of which are driven from the horizontal shaft 21 mounted beneath the table. Preferably the star wheel 11 has spaced upper and lower stars 11*a* for engaging containers at two points thereby to prevent their toppling

in passing under the cap delivery where the closures are set on the containers.

The superstructure 4 is also mounted on the base casting 18. As shown more particularly in Figs. 3 and 4, castings 59 are bolted to the base member 18 with bearings 60 therein for receiving the ends of a horizontal shaft 61 having a handwheel 62 at one end thereof. A top casting 64 is bolted to each of the castings 59 with bearings 65 therein.

In housing and supporting threaded shafts 66 a suitable enlargement 67 is provided on each of the shafts 66 to furnish a support for the weight imposed thereon. The lower end of each of the threaded shafts 66 has a beveled gear 69 thereon meshing with a beveled gear 70 on the horizontal shaft 61. Thus by rotation of the handwheel 62 the threaded vertical shafts 66 are rotated for vertical adjustment of the parts mounted thereon.

A pair of hollow columns 71 are fixed at their upper ends in the recesses 72 of the superstructure 4. The middle portions of the columns 71 pass through bearings 74 in the table 2 and their lower ends have plugs 75 therein threaded to the vertical shafts 66. The columns 71 furnish rigid supports for the superstructure 4 and serve to move the superstructure upwardly and downwardly by rotation of the handwheel 62 through the intermediation of the horizontal shaft 61, bevel gears 70 thereon, meshing bevel gears 69 on the vertical shafts 66 threaded into the lower ends of the columns 71. In this way the superstructure 4 and the parts thereon may be raised and lowered to accommodate containers varying in height.

As illustrated more particularly in Fig. 3 the superstructure has a main horizontal drive shaft 77 for driving the mechanism mounted thereon. The shaft 77 has a bevel gear 78 at one end meshing with a bevel gear 79 on the shaft 80 which in turn meshes with a bevel gear 81 on shaft 82 which has a bevel gear 84 at its lower end meshing with bevel gear 24 on the main drive shaft 21 extending beneath the table 2. The bevel gear 81 is free to slide along the shaft 82 so that vertical movement of the superstructure 4 is possible without interfering with the drive therefor.

The other end of the horizontal drive shaft 77 in the superstructure has a gear 86 thereon meshing with a gear 87 on shaft 88. The opposite end of the shaft 88 has a bevel gear 89 thereon meshing with a bevel gear 90, on shaft 91 (Figs. 3, 5 and 8) for driving the head spacer, which will be described hereinafter.

The cap feed may be driven from the upper end of a shaft 94 geared at its lower end to the shaft 88 by means of gears 95 and 96.

The mechanism for forcing the closures on the containers may be driven by shaft 80 (Figs. 3 and 18) operatively connected to the vertical shaft 82 by means of the bevel gears 79 and 81.

A suitable light 97 is mounted on the bracket 98 back of the containers as they pass the cap feed so that the light will emphasize the passage of bubbles up through the contents of the container. As a result of the condensation of the steam in the head space and the resulting formation of a partial vacuum, any small air bubbles in the contents are expanded and drawn to the top. The light shining through the container gives a vivid indication of whether or not a vacuum has formed in the package. This enables the inspector or operator to spot and remove any containers which do not have a vacuum formed in them for any reason and such containers may be removed and passed through the machine a second time before the cap is completely forced thereon by the pressure head. It likewise enables the operator to stop the machine for adjustment the instant that the machine fails to form vacuum seals.

Conveyor

The conveyor 5 is illustrated more particularly in Figs. 1, 2 and 5. While indicated as a continuous belt in Figs. 1 and 2 it is preferably a series of plates (Fig. 5) hinged together so that they pass over the sprockets 6. Suitable castings 7 are bolted to the respective ends of the table 2 as illustrated at 102 (Fig. 2). These castings form extensions on the respective ends of the machine and support in suitable bearings the sprockets 6 over which the conveyor chain passes. In this way it is feasible to extend the conveyor at the respective ends of the table so that ample room may be provided at one end for placing the containers on the conveyor and for the operation of the head spacer and ample space may also be provided at the other end of the machine for removing the containers after they have been sealed. The castings 7 may be made in two or more parts to facilitate manufacture and preferably are closed at their bottoms to enclose the lower strand of the conveyor. In operation some of the material gets on the conveyor and from time to time it is desirable to wash the conveyor. To facilitate the cleaning operation a V-shaped channel casting 104 (Figs. 2 and 5) is provided through which the lower strand of the conveyor passes. By flushing the conveyor in this channel it may be readily cleaned without stopping the machine.

Referring more particularly to Figs. 1 and 4 it will be noted that the conveyor is driven through the sprocket 6 at the right end of the machine by means of the reduction gear 35, shaft 32 in bearing 34, and gear 31 meshing with gear 30 on the main drive shaft 21 of the machine. Thus the conveyor is driven from the motor drive in timed relation with the other devices on the machine.

It is not believed necessary to describe the conveyor in more detail as various types of conveyors may be utilized if desired. A conveyor with hinged metal plates has been found satisfactory and is shown as illustrative in the preferred embodiment.

Helicoids

The helicoids are shown more particularly in Figs. 1, 2, 5 and 6 and are for the purpose of spacing the containers as they pass beneath the head spacer on the conveyor and into the star wheel. In addition the helicoids serve to retain the containers in upright position while moving along the conveyor, thereby to prevent their toppling over.

In the preferred embodiment two helicoids are shown one designated 9 for spacing the containers as they pass into and through the head spacer and another designated 10 for spacing them as they enter the star wheel. Each helicoid may comprise a cylindrical portion with a helical fin 110. In some instances it is desirable, because of a change in size or shape of the containers being sealed, to substitute a different helicoid. In other cases it may not be desirable to use the head spacer, then the helicoid 9 becomes unnecessary and may be removed, al-

though there is no particular objection to its remaining on the machine. For these reasons it is desirable to mount and drive helicoids so that substitutions and removals may be readily made. To accomplish this a bracket 111 is provided with a bearing 112 to rotatably support one end of the helicoid 9. A similar bracket 111' with a bearing 112' is provided for supporting the far end of the helicoid 10. These brackets may be adjustably secured in position or the bearings 112 and 112' may be removably mounted so that the ends of the helicoid may be quickly freed. The bracket 111 may be bolted or otherwise secured to the casting 7 and the bracket 111' may be similarly secured to the frame of the machine. The adjoining ends of the helicoids 9 and 10 are mounted upon and keyed to a shaft 114 mounted in bearings 115 as shown more particularly in Figs. 6 and 7. It will be noted that the ends of the shaft 114 project into recesses in the adjoining ends of the helicoids 9 and 10 so that the helicoids may be readily moved from the shaft. A gear 116 (Figs. 6 and 7), preferably a 45° helical gear, is keyed to shaft 114 and meshes with a corresponding gear 117 on shaft 118. The gear 117 meshes with a gear 113 keyed to shaft 119 in bearings 120 and has a bevel gear 121 at its end meshing with a bevel gear 122 on shaft 124, which is mounted in bearings 125. The shaft 124 has a gear 126 at its opposite end meshing with bevel gear 22 on the main drive shaft 21 (Figs. 4, 5 and 6).

Thus the helicoids 9 and 10 are driven from the main shaft 21 through the intermediation of bevel gear 22 thereon, bevel gears 126 and 122 on shaft 124, gears 121 and 113 on shaft 19, gear 117 on shaft 118, and gear 116 on shaft 114, which is operatively connected to the adjoining ends of the helicoids 9 and 10.

In some instances obstruction may be encountered by the helicoids which render it desirable for them to stop automatically to avoid breaking containers. For this purpose the bevel gear 122 (Fig. 6) is operatively connected to its shaft 124 through one or more pins 127 resiliently held in one or more slots 129 in the bevel gear 122 by means of a spring 128. The force applied by the spring 128 may be increased or decreased by the adjustment nut 130 so that the shaft 124 will cease to drive the gear 122 when a given obstructing force is encountered.

Referring more particularly to Figs. 1, 2, 6 and 7, it will be noted that the casting 123 houses the vertical shaft 119 and the associated parts of the drive for the helicoids. This permits a neat and compact enclosure of the drive and a convenient connection to the horizontal shaft 124 and to the main drive shaft 21.

The guide rail 8 is preferably mounted in inclined slots 132 by bolts 134 so that it may be maintained in parallel relation with the helicoid 9 when adjustments are made toward and away from the conveyor 5. The guide rail preferably extends in one or more sections past the star wheel 11 and the pressure head 16.

Preferably, devices 8a are mounted at the entrances to the respective helicoids and provided with resiliently mounted fingers 8b adapted to engage the containers at these points to facilitate their entry into the helicoids.

Preferably the second helicoid 10 extends to the star-wheel 11 and cooperates with the star-wheel in supporting the container as it removes a closure from the inclined chute. At this point there is a force due to the engagement of the container with the closure tending to pull the container backward. The starwheel and the helicoid 10 cooperate to counteract this force and to prevent the container from toppling.

Head spacer

It is not feasible for a filling machine to fill each container within a given distance of its top as the containers vary slightly in capacities. Hence in normal operations one container may be filled to a greater height than another. This causes dissatisfaction on the part of purchasers particularly where the container is glass and the difference in head space is visible. In order to overcome this many packers fill the containers beyond their normal height and force a disk into the mouth of the container to displace the excess contents so that each container will be filled to the same heighth. This also has the advantage of providing a more uniform seal. If the head space is too small the air in the products will impair the vacuum.

The present machine in its preferred embodiment provides an improved head spacer effective upon the containers as they enter the machine. Referring more particularly to Figs. 1, 2, 8, 9 and 10 a casting 140 has a cylindrical extension 141 mounted in a bearing 142 formed at one end of the superstructure 4. The casting 140 is held in position by means of a collar 144 bolted to the end of the cylindrical extension 141. A lug 145 is formed on one side of the casting and has a bolt or set screw 146 therein which rests on a corresponding lug 147 formed on the end of the superstructure 4. By reason of the bearing 142 and the cylindrical extension 141 the casting 140 is pivotally mounted and is held in its horizontal position by the set screw 146 and supporting lug 147, thus the free end of the casting 140 with the mechanism mounted therein may be rotated about its bearing from a horizontal to a vertical position. This is advantageous in affording access to the interior for cleaning and adjusting and is even more important in permitting the casting to rise when a displacing disc engages the rim of a container to avoid breaking the container.

The extension 141 of the casting 140 has an internal bearing 148 for receiving the shaft 91, which carries at its end a pair of sprockets 149 for mounting a suitable conveyor or link belt 150 having the displacement disks 151 secured thereto.

The sprockets 149 are operatively connected to the shaft 91 by means of a gear 152 keyed to the end thereof and meshing with a worm adjustment gear 154 which is operatively connected to the cylindrical member 149' which carries the sprockets 149. By reason of this connection the collar 149' and the sprockets 149 may be angularly adjusted about the shaft 91 so that the disks 151 may be timed with respect to the helicoids to make them register with the containers as they pass thereunder.

The second pair of sprockets 159 are mounted at the other end of the casting 140. A shaft 160 for these sprockets is mounted in a bearing in the end of a member 161 which in turn is slidably mounted in a fixed block 162 within the casting 140. A suitable spring 164 extends about a rod 165 and is held in compressed position by a nut 166 effective upon a collar 167. In this, manner the sprockets 159 are resiliently forced away from the sprockets 149 thereby to maintain the link belt 150 under tension. The lower strand of the link belt passes under a shoe 168

having its lowest point substantially at the middle of the casting.

While the disks 151 may be of any suitable shape, for example a cylindrical member as shown in Figs. 8 to 10, they also may be in the form of disk 151' having an annular flange 153 adapted to engage the rim of the container as shown more particularly in Fig. 11.

The head spacer is driven from the horizontal shaft 88 in the superstructure through the intermediation of bevel gear 89 thereon, and bevel gear 90 on shaft 91 which carries the sprockets 149 operatively connected to the shaft by the gear 152 and worm adjustment gear 154. The link belt 150 and the displacing disks 151 thereon are geared to the main drive of the machine and are driven in time relation to the conveyor and the helicoids, the star wheel, the cap feed, and the pressure applying head. The link belt 150 may be timed with respect to the drive by means of the worm gear 154. If a container should be out of place or if a disc should fail to register with it the casting 140 is free to rise to avoid breakage of the container and will return to its normal position after the container has passed. The casting 140 may be raised about its pivot for making adjustments or for any other purpose.

Injector mechanism

As containers pass the head spacer they move from the first helicoid 9 into the second helicoid 10 and continue properly spaced past the injector mechanism as shown more particularly in Figs. 2, 12 and 13. The injector mechanism injects steam under the side of the closure as the closure is placed on the container.

Referring more particularly to Figs. 12 and 13 a cap chute 175 in the form of a guideway directs the closures, fed thereto by any suitable mechanism, to a position at the bottom of the chute as shown in Figs. 13. In this position the bottom of the closure is resting upon the bottom of the guideway with the lower edge of the closure projecting beyond the end of the bottom of the guideway. The position of the closure is determined by means of pins or rods 222 engaging the sides of the closure below the center thereof. These pins are held in position by set screw 222*a* to facilitate adjustment for wear. A container moving on the conveyor engages the bottom edge of the cap as shown in Fig. 13. The movement of the container raises or moves the cap past the pins 222 and forces the bottom edge of the cap against the fork 176. The fork is pivotally mounted on a shaft 179, which is secured in bearings in extensions 180 and the fork is held in its lower position by means of a spring 181 attached at one end to an extension 182 of the fork and at its other end to a set screw 184 for controlling the tension applied by the spring. The set screw 184 is mounted in an arched bracket 185 spanning the sides of the guideway. Preferably the fork 176 is arched as shown at 189 to engage the annular projecting sides of the closure as the container forces the closure thereunder. Preferably the fork is made of smooth metal to prevent damage to the lacquer on the closure and has a sufficient arch to cause the engagement with the closure to be with the edge of the closure. The fork serves to wipe the closure down onto the container without excessive back pull on the container tending to tilt it. Preferably the fork is bolted in position as shown at 190 so that it may be readily replaced when desired.

An arm 192 pivoted about a shaft 194 is preferably provided to rest on the upper surface of the closure to cooperate in retaining the closure in position for proper engagement with the container as the container passes thereunder. Extension 187 on the arm 192 may engage the sides 188 of the guideway to limit its downward movement. The arm 192 holds the closure down in the guideway and prevents the closure from rising prior to engagement with a container.

In order to inject steam under the side of the closure at the time the closure is placed on the container there is provided a steam injector having outlets 200 (Figs. 13, 15 and 16) terminating at the bottom of the guideway between the container and the raised side of the closure as the closure is engaged by the container. The outlets 200 are over the upper end of the container as the container passes it and is between the raised side of the closure and the rim of the container. In this way steam in injected under the side of the closure up to the time that the closure gasket is in contact with the container completely about the rim thereof. An effective injection of steam is obtained at the time the closure is placed on the container without undue heating and with a minimum waste of steam. The gasket in the closure engages the sealing surface of the container and the vacuum formed in the container as a result of the rapid condensation of the steam pulls the closure down on the container and forms a seal. The quick condensation of the steam eliminates any tendency for the steam to raise the closure off its seat. The exact opposite occurs, namely vacuum formed by the condensation of the steam holds the closure on its seat.

While any suitable means may be utilized for supplying steam or vapor to the outlets 200 there is provided herein an attachment 201 which may be bolted to the bottom of the cap chute 175 at 202 (Fig. 13). Preferably the attachment 201 comprises a pair of elongated cylindrical chambers 204 and 205 (Fig. 15). These chambers may have in them any suitable heating means, for example, electric heating units 206. Steam may be delivered to the lower end of the cylindrical chamber 205 through the inlet 207. The steam passes along the chamber and along the heating unit therein to the other end of the chamber where the chamber connects by means of a bore or conduit 208 (Fig. 15) with the adjoining end of the chamber 204. The steam then passes through the chamber 204 about the heating unit 206 therein to the outlets 200. Preferably the exterior of the heating units is spaced slightly from the walls of the chambers to serve as passageways for the steam. A space of one sixteenth of an inch has been found to be excellent. While good results may be obtained with a single injector outlet, preferably a plurality of outlets are provided as shown more particularly in Fig. 15 to spread the steam and displace the air in the head space.

The purpose of the heating units is to superheat the steam to a relatively high temperature. It has been found that this can be conveniently done by electric heating units which automatically cut off and cut on as the temperature goes beyond predetermined limits. It has been found also that temperatures from 300 to 800° F. provide excellent results. The superheating of the steam to temperatures substantially above 240° F. has unexpected results. First the dry steam forms little condensate in the container and hence products such as peanut butter which heretofore could not be sealed by a vapor ma-

chine may be sealed in this manner without subsequent spoilage. The mold spores in the head space are killed substantially instantaneously during the sealing operation, which gives a sterile package. The spores within the product are killed during the cooking. Likewise the product when packed in the glass is sufficiently hot to kill spores on the inside of the container. If desired the containers may be heated to a temperature sufficiently high to render them sterile prior to the filling. The filling is usually done by a filling machine immediately prior to delivery to the sealing machine. The containers leave the filling machine and go directly to the sealing machine within a few seconds, generally in less than a minute, after the filling. The high degree of superheating also produces a higher vacuum and less condensate around the machine and on the walls of the building in which the machine is used. Constant dripping of condensate from the ceilings is unsanitary and produces objectionable working conditions.

In order to automatically control the temperature of the superheated steam a third cylindrical recess or cavity 210 is provided in the casting and a thermostat 211 of any suitable design is placed within the cavity and operatively connected in the circuit of the heating units. The cavity connects with the chamber 204 by means of a conduit 212 exposed to the vapor passing along the heating units 206 to the injector outlets 200. As the temperature of the superheated steam exceeds a predetermined desired maximum the heating units are cut off and when the temperature drops to a predetermined desired minimum the heating units are cut in. The superheated vapor reaches the injector outlets directly from the heating units. If desired the injector unit may be heat insulated by asbestos or any other suitable coating. The containers pass the injector sufficiently rapidly so that the steam may issue continuously from the injector without substantial loss; however, the steam jets may be operated, intermittently if desired, as each container passes the injector.

Cap feed

Any suitable means may be utilized for feeding closures to the guideway 175. For example, an operator may feed them manually. It is preferred, however, to feed them automatically. For this purpose a preferred embodiment of automatic feeding device is illustrated more particularly in Figs. 2, 12 and 13. The rotary cap separating mechanism illustrated more particularly in Fig. 13 for delivering closures to the inclined guideway therefor is claimed in a co-pending application of Harry E. Stover, Serial No. 118,802, owned by the assignee of the present application. The preferred embodiment of a closure is illustrated in the assignee's, Norman N. Holland, Patent No. 1,909,406. A stack of such closures is placed in the cylindrical chamber 215 and may be inclined to the vertical to rest against the rods 216 or if desired the stack may be vertical without impairing the operation of the device.

The closures are fed from the bottom of the stack into the guideway 175. The mechanism for accomplishing this may comprise a rotary drum 217 having a spiral channel 218 thereon. Directly above the drum is a cylindrical part or disc 219 having a peripheral tongue 220 with a pointed end adapted to cut between the bottom two closures in the stack and to separate the bottom closure therefrom. A channel 221 below the tongue leads to the spiral channel 218 in the outer surface of the drum 217. Thus the closure separated is guided downwardly until it drops into the guideway 175 and slides by gravity to the end thereof as shown in Fig. 13. Thus each time that the drum 217 and the disc 219 are rotated one revolution a closure is delivered. The drum 217 and the disc 219 are mounted on a vertical shaft 224 (Fig. 13) in the bearing 225. Shaft 224 has a 45° spiral gear 226 meshing with a corresponding gear 227 on shaft 228. The shaft 228 may be operatively connected to the shaft 94 (Figs. 3 and 12) by suitable gears in the housing 93. The gear 95 on the shaft 94 is driven by a gear on shaft 88 connected to the drive shaft 77 through gears 86 and 87. The cap feed is adapted to be operated at a high speed to feed closures one at a time consecutively to the guideway 175.

If the containers move into the sealing machine in consecutive order the cap feed can be timed to feed a closure for each container. In practice however the filling machine may be stopped for some reason or the container may be removed before it reaches the sealing machine. For this reason it is desirable to have a closure fed as each container approaches the steam injector. To accomplish this a latch member 230 is provided having a latch portion 231 at its end adapted to be inserted under the edge of the stack of closures to prevent the closures from being fed by the tongue 220 and the channel 221. This latch member 230 has a recess fitting about the shaft 224 and has an upper surface at its pointed end 231 substantially at the height of the disc member 219. When the latch member 230 is forced to the left in Fig. 13 closures cannot be fed. When the latch member 230 is moved to the right in Fig. 13 the drum 217 and the tongue 221 feed a closure once during each revolution of the shaft 224. The rotation of the shaft 224 is timed to rotate once whenever a container passes the injector.

The latch member 230 may be controlled in any suitable manner, as illustrated herein (Figs. 12*a* and 13), an arm 235 integral with the sleeve 236 on shaft 237 engages in a slot 238 in the slidable latch member 230 to control the movement of the latch member. The sleeve 236 is operatively connected to an arm 242 (Figs. 12, 12*a* and 13) by means of a vertical shaft 242*a*, arm 242*b* thereon, link 242*c* and arm 237*a* on shaft 237. The cam roller on arm 242 (Fig. 12) engages a cam surface 244 on a feeler or arm 245 pivoted at 246. The movement of the feeler about its pivot is limited by means of a pin 247 extending through a slot 248 in the feeler. The feeler 245 is normally in the path of the containers moving on the conveyor 5 and spaced from the helicoid 10. Whenever a container passes, the arm 245 is forced outwardly by the container which causes the cam surface 244 to move the arm 242 and rock the vertical shaft 242*a* which in turn rocks the sleeve 236 on shaft 237 and retracts the latch member 230 thus permitting a closure to be fed. Preferably the inclination of the cam surface 244 is the same as the inclination of the sides of the adjustment slots 132 in the guiderails 8 so that adjustment of the guiderail does not interfere with the operations of the feeler 245 mounted thereon. The timing of the operations is such that a closure is fed to the bottom of the guideway in the position shown in Fig. 13 at or prior to the time that the container 178 reaches the position shown

in Fig. 13. Thus a closure is fed for each container approaching the injector mechanism. When a container fails to pass the arm 245 the latch member 230 is not retracted and hence prevents the feed of a closure. In this way the guideway 175 is free of closures except when a container approaches the injector mechanism.

There is an advantage in this method of feeding closures singly as needed. Where the chute or guideway 175 is kept filled with closures the heat of the steam injector over a period of time will damage the rubber forming the gasket in the closure and prevent proper sealing. Thus if the chute is filled with closures when the machine is shut down for a time, several improperly sealed packages may result when the machine is started up. The preferred embodiment eliminates this contingency.

Preferably the casting 233 (Figs. 12 and 13) is mounted on a stud 233*a* extending through a bearing in the embossment 233*b* at one end thereof. The other end is held in position by a wing nut 233*c* on bolt 233*d*. By loosening the wing nut to release that end, the member 233 may be swung about the shaft 233*a* to afford access to the guideway 175 and to the interior of the cap feed. This preferred mounting also permits ready removal of the cap feed block by pulling it off the stud 233*a* after the wing nut 233*c* is loosened.

Pressure head

As the container leaves the injector mechanism the fork 176 does not ordinarily force the closure completely down on the container. It does place the cap on the container with sufficient force to cause the gasket to engage the sealing zone. The rapid condensation of the steam in the container holds the cap on. However, any slight leak between the cap and container would break the vacuum and the cap would come off. In the preferred embodiment it is desirable to force the cap on the container so that the gasket is expanded over a sealing zone to form a friction seal which will hold the closure independently of the vacuum within the package. It will be understood, of course, that the invention is also applicable to other types of seals, for example closures which form a top seal and which are held on primarily by vacuum.

The pressure head for forcing the closing completely down on the container is shown at 16 in Fig. 2 and is shown in detail in Figs. 18, 19 and 20. The pressure head may comprise a pair of pulleys 252 and 254 having a belt 255 thereon. The lower strand of the belt forces the closures down on the container. The pulley 252 is keyed to the shaft 80 which in turn is geared (Fig. 3) to vertical shaft 82 operatively geared at its lower end to the main drive shaft 21 in the lower part of the machine. Thus the pulley 252 is continuously driven to drive the belt 255 and pulley 254.

The pulley 254 is mounted upon a bracket 256 bolted to the superstructure 4 of the machine. The mounting may comprise a fork member 257 having a shaft 258 bridging the ends of the fork members with the pulley 254 mounted on the shaft. The opposite end of the fork member fits into a cylindrical bearing or bore 259. A suitable recess 260 in the end of the bracket receives the laterally extending portions of the fork members 257 to hold the shaft 258 in substantially horizontal position. The cylindrical end of the fork member in the bearing 259 has a recess 262 therein, housing a coiled spring 264. A member 265 has a cylindrical portion 266 fitting against the end of the spring 264 in the cavity 262. A bolt 268 is threaded into the member 265 with its opposite enlarged end fitting in a recess 270 in the fork 257. The bolt 268 with its enlarged head 269 limits the movement to the right of the member 265. The pressure upon the member 265 occasioned by the coiled spring 264 forces the fork 257 to the left, thus supplying tension to the belt 255 extending over the pulleys 252 and 254. Any suitable means may be utilized for supplying pressure to the member 265 in order to obtain the necessary tension in the belt. In the preferred embodiment an L-shaped member 272 is pivotally mounted on shaft 80 on one side of the pulley 252 and a second L-shaped member 274 is pivotally mounted on the shaft 80 on the other side of the pulley 252. The ends of the L-shaped members 272 and 274 have downwardly extending portions 276 provided with bearings to receive the ends of a shaft 277 mounting a roller 278. The member 265 has a cam surface 280 leading to a vertical surface 279. When the arms 272 and 274 are in the position shown in Figs. 19 and 20 the member 265 is forced inwardly against the spring 264 to tension the belt 265 extending about the pulleys. When it is necessary to remove the belt for any reason, the arms 272 and 274 may be raised so that the roller 278 rides up the surface 279 and the cam 280 to release the pressure on the member 265. This permits the pulley 254 to move inwardly so that the belt may be readily removed and another replaced. To tension the new belt, it is merely necessary to force the arms 272 and 274 downwardly so that the roller 278 engages the cam surface 280 and the vertical surface 279 on the member 265 to force the member 265 against the spring 264 which tensions the belt as described above. Thus, the belt 255, may be removed and another substituted in a minimum of time without requiring adjustment.

Considerable pressure is required to force the closure down on the container which makes it desirable to have a shoe or other backing to hold the lower strand of the belt in position. For this purpose a shoe 285 is provided for resting against the upper side of the lower strand of the belt 255 and is supported by integral projections 286 thereon which fits into slots 287 in four supporting members 288. A pair of shafts 289 extend through apertures in the members 286 and 288 to hold the shoe in position on the supporting members. It is desirable that the members 288 be resiliently mounted to provide a yielding pressure of proper magnitude. For this purpose the mounting bracket 256 is provided with four cylindrical recesses which receive the upper ends of the members 288 and which house springs 291. Suitable bolts 292 limit the downward movement of the members 288 and the shoe 285 thereon. Threaded sleve 294 keyed in the recess by means of pins 295 exert the necessary pressure on the upper ends of the coil springs 291. The position of the members 294 is controlled by gears 296. As the gears 296 are rotated in one direction, the members 294 move downwardly to increase the compression in the springs 291 and when rotated in the opposite direction move upwardly to decrease the compression in said springs.

It is desirable that these springs have the same compression in them and be adjustable simultaneously. For this purpose a shaft 297 is provided in bearings 298 and 299 with a pair of worm gears 300 thereon, each meshing with two

of the gears 296. The end of the shaft 287 is preferably square as shown at 301 so that a wrench may be applied for making a quick adjustment of the pressure on the shoe 285.

By means of the construction shown any desired pressure may be applied to force the caps on the containers and the amount of pressure may be adjusted quickly. The pressure is maintained the same at the four supporting points for the shoe. The belt may be quickly removed and replaced without changing the adjustment by raising the arms 272 and 274 to remove the pressure on the fork 257 which supports the pulley 254 and tensions the belt 255.

In the preferred embodiment an incandescent lamp 97 is mounted, as shown particularly in Fig. 3, back of the containers and preferably adjacent the pulley 254. When the vapor condenses in the head space of the container, the vacuum created draws air bubbles up through the product. The incandescent light shining through the product renders them visible at a substantial distance. If the bubbles fail to come to the top in somewhat violent action the operator knows that a seal has not been properly formed and can remove the container for examination and passage through the machine a second time. This prevents the sale of improperly sealed packages and the spoilage resulting therefrom.

Operation

In operating the machine the first step is to adjust the height of the superstructure 4, to accommodate the necessary height of the containers to be sealed. This is done by rotation of the hand wheel 62 on shaft 61 (Fig. 3), which, through the beveled gears 70 thereon meshing with the bevel gears 69 on the threaded members 66, raises the columns 71 on which the superstructure 4 is mounted. In view of the fact that the head spacer 14, the cap feed and steam injector 12 and the pressure head 16, are all mounted on the superstructure, these several parts are raised simultaneously, hence rotation of the hand wheel 62 raises or lowers the superstructure with these associated mechanisms. The proper height can be obtained from suitable scales on the colums 71 or by passing containers through the machine. For different diameters of containers, the guideway 8 may be moved toward or away from the helicoid 9. After these adjustments have been made, containers are delivered to the conveyor 5 preferably from a filling machine. As the containers reach the helicoid 9, they are spaced properly to register with the discs 151 of the head spacer 14. These discs displace any excess contents so that all of the containers will be filled to substantially the same level. If by any chance the disc 151 should not telescope within a passing container but should engage the rim of it, the head spacer being rotatably mounted about the shaft 91 (Fig. 8), can move up and down. Its lower position is controlled by the set screw 146. The head spacer discs are mounted on chains which rotate about sprockets 149 and 159 (Fig. 8). Where it is unnecessary to use the head spacer it may be removed from the machine or raised to a tilted position. Likewise, the helicoid 9, may be removed from the machine when the head spacer is not used. As the containers leave the head spacer they pass in to the helicoid 10 and pass under the vapor injector as shown more particularly in Figs. 2, 12, 13 and 14. The upper end of the container engages the edge of a closure cap at the bottom of the cap chute 175 and moves the closure cap against the arched fork 176 to raise the fork about its pivot 179 in opposition to the spring 181. The fork passes over the rim of the closure as shown more particularly in Figs. 13 and 14 to wipe the cap down on the container. Simultaneously the injector outlets 200 inject steam under the side of the closure so that the head space is filled with vapor as the closure is wiped down on the container so that the head space is filled with vapor by the time the closure is down on the container. The vapor is delivered to one end of a cylindrical chamber 205 (Fig. 15) having a heating unit therein and is delivered to the end of a second chamber 204 having a heating unit therein so that the steam is highly superheated prior to delivery to the injector outlets 200. A suitable thermostat 211, controls the degree of superheat. The container with the closure thereon and with a vacuum formed in the head space passes under the belt 255 of the pressure head 16 to force the cap down on the container. The light 97 shining through the glass container visually indicates the security of the seal by rendering visible the upward rush of bubbles through the material as a result of the formation of the vacuum. The containers leave the machine at a rapid rate with a high vacuum formed therein and with the head space of the container sterilized by the high temperature vapor.

The drive for the machine is shown more particularly in Fig. 3 where the motor 37 having an adjustable speed drive, drives the pulley on shaft 41, which is operatively connected to the reduction gear 40 having a shaft with a bevel gear 39 thereon meshing with the bevel 38 on shaft 21 (Fig. 4). The shaft 21 has a worm gear thereon for driving a gear 26 on the shaft 27 of the star wheel 11, (Fig. 4). The gear 24 meshes with a bevel gear 84 on the vertical shaft 82 for driving the mechanisms in the superstructure 4. The conveyor is driven by a shaft 32 geared to shaft 21 by gears 30 and 31.

It will be seen that the present invention provides a simple inexpensive machine for vacuum sealing containers. A small amount of highly superheated vapor is injected into each container at the time the closure is placed on it. The condensate within the container is reduced to a minimum by reason of the small amount of steam required. The high temperature of the vapor sterilizes the closure, the exposed mouth of the container and the contents of the container thereby minimzing spoilage. The high temperature vapor contracts and condenses rapidly to form a partial vacuum which draws the closure against the sealing surface to form a vacuum seal. By eliminating the use of steam tunnels and chambers, and by eliminating long exposure of the closure to the vapor and the resulting heating of the parts and by using a small amount of highly superheated vapor, it is unnecessary to cool the closure and head space with water to condense the vapor to prevent the steam from expanding and popping the closures off the containers. An inspection lamp visually indicates to the operator any package which fails to have a vacuum seal so that the package can be removed at once. The parts are readily adjustable for different sizes of closures and containers and are rugged in construction and fully capable of standing the rough usage to which they may be subjected.

As various changes may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without sacrificing

any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In a device for forcing closure caps down on containers passing thereunder, the combination of a pair of spaced pulleys, a belt passing over said pulleys, and means including a cam surface and a swingable arm for engaging said cam surface to force said pulleys apart to create tension in said belt whereby said arm may be disengaged from said cam surface to permit said pulleys to be readily moved toward each other for removing and replacing said belt.

2. In a device for forcing closure caps down on containers passing thereunder, the combination of a pair of spaced pulleys, a continuous belt passing over said pulleys, resilient means for forcing one of said pulleys away from the other, and means including a cam surface and a swingable arm for engaging said cam surface to increase the pressure applied by said resilient means, the disengagement of said swingable arm from said cam surface permitting said pulleys to be moved a substantial distance instantaneously toward each other for removing and replacing said belt without changing the adjustment of said resilient means.

3. In a device for forcing closure caps down on containers passing thereunder, the combination of a pair of spaced pulleys, a continuous belt passing over said pulleys, a pressure foot resiliently mounted for applying pressure to the lower strand of the belt, resilient means for forcing one of said pulleys away from the other, means for increasing the pressure applied by said resilient means and means for instantaneously disengaging said resilient means to permit said pulleys to be moved a substantial distance toward each other for removing and replacing said belt without changing the adjustment of said resilient means.

4. In a device for forcing closure caps down on containers passing thereunder, the combination of a pair of pulleys, a continuous belt passing over the pulleys, a pressure member effective upon the lower strand of the belt, a plurality of members for supporting said pressure member at spaced points, resilient means extending about each of said supporting members for forcing said pressure member against the belt and means effective upon said resilient means for increasing and decreasing substantially equally the pressure applied by the respective resilient means.

5. In a machine of the class described, the combination of a base, a support mounted on said base, means for adjusting said support vertically, a conveyor on said base for conveying containers, a helicoid on said base for spacing the containers on said conveyor, a head spacer mounted on said support above a portion of the conveyor adjacent to said helicoid and having members adapted to enter the mouths of the containers as they pass along the helicoid, cap delivery means on said support, and means mounted on said support for forcing closures on containers, whereby the height of the head spacer, the cap delivery and the closure forcing means may be adjusted simultaneously to accommodate containers of different heights.

6. In a machine of the class described, the combination of a base, a support mounted on said base, means for adjusting said support vertically, a conveyor on said base for conveying containers, a helicoid on said base for spacing

the containers on said conveyor, a head spacer mounted on said support above a portion of the conveyor and adjacent to said helicoid and having members adapted to enter the mouths of the containers as they pass along the helicoid, cap delivery means on said support, means mounted on said support for forcing closures on containers, whereby the height of head spacer, the cap delivery and the closure forcing means may be adjusted simultaneously to accommodate containers of different heights and drive means enclosed in said support for said head spacer, said cap delivery and the closure forcing means.

7. In a machine of the class described, the combination of a base, a conveyor mounted on said base, a star wheel mounted on said base, a helicoid mounted on said base for spacing containers on said conveyor and means including a horizontal shaft in said base for driving said star wheel, said helicoid and said conveyor, a support mounted on said base, means for adjusting said support vertically, cap delivery means on said support, means on said support for forcing caps on containers, means on said support including a horizontal shaft for driving said cap delivery means and said means for forcing caps on containers and means for operatively connecting said horizontal shafts.

8. In a machine of the class described, the combination of a base, a conveyor mounted on said base, a star wheel mounted on said base, a helicoid mounted on said base for spacing containers on said conveyor, means including a horizontal shaft in said base for driving said star wheel, said helicoid and said conveyor, a support mounted on said base, means for adjusting said support vertically, a head spacer on said support, cap delivery means on said support, means on said support for forcing caps on containers, means on said support including a horizontal shaft for driving said head spacer, said cap delivery means and said means for forcing caps on containers and means for operatively connecting said horizontal shafts.

9. In a machine of the class described, the combination of a support, a horizontally extending head spacer having members thereon adapted to enter the mouths of containers passing thereunder, and means for pivotally mounting one end of said head spacer on said support to permit the other end of the head spacer to rise about the pivoted end under abnormal conditions.

10. In a machine of the class described, the combination of a base, a support on said base, means for adjusting said support vertically relatively to the base, a horizontally extending head spacer having members thereon adapted to enter the mouths of containers passing thereunder, and means for pivotally mounting one end of said head spacer on said support to permit the other end of the head spacer to rise under abnormal conditions and to be raised to a substantially vertical position for inspection and repairs.

11. In a head spacer the combination of a pair of sprockets, chains extending about said sprockets having head spacing members thereon adapted to enter the mouths of containers passing thereunder, and means for pivotally mounting one of the sprockets about the axis of the other, whereby one end of the head spacer may rise if a head spacing member engages the rim of a container.

12. In a head spacer the combination of a pair of sprockets, chains extending about said sprockets having head spacing members thereon adapted to enter the mouths of containers passing there-

under, means including a hub for pivotally mounting one of the sprockets about the axis of the other, and a shaft extending through said hub for driving the sprockets whereby one end of the head spacer may rise if a head spacing member engages the rim of a container.

13. In a head spacer the combination of a vertically adjustable support, a hub rotatably mounted on said support, an extension on said hub, a rotary member mounted on the end of the extension, a shaft extending through said hub, a second rotary member on said shaft, means extending about said rotary members for carrying displacing members adapted to enter the mouths of containers and means for driving said shaft to operate said means for carrying the displacing members.

14. In a head spacer, the combination of a vertically adjustable support, a hub rotatably mounted on said support, an extension on said hub, a rotary member mounted on the end of the extension, a shaft extending through said hub, a second rotary member on said shaft, means extending about said rotary members for carrying displacing members adapted to enter the mouths of containers, means for driving said shaft to operate said head spacer and adjustable stop means for holding said extension substantially horizontal under normal operating conditions.

15. In a machine of the class described, the combination of a member having a substantially V-shaped undersurface adapted to pass over and engage the opposite sides of the periphery of a closure, means for forcing the V-shaped portions of said member downwardly as it passes over the closure to force the closure on a container, and means for injecting vapor under the closure as it is being forced on the container by said fork to form a vacuum seal by the condensation of the vapor.

16. The method of sealing closure caps to containers which comprises sealing a closure cap to a container while the container is passing under a sealing mechanism and during the sealing of the cap to the container directing into the mouth of the container and into the interior of the closure a sterilizing and vacuum forming vapor superheated to a temperature substantially above the temperature of 240° F. to kill microbes and spores substantially instantaneously, whereby said microbes and spores in the head space of the container are killed during the sealing operation and spoilage prevented.

17. The method of sealing closure caps to containers which comprises forcing a closure cap on a container to form a seal thereon, directing steam, superheated to a temperature of 300° to 800° F., between the closure and the container during the sealing operation to kill microbes and spores in the head space substantially instantaneously during the sealing operation and to form a vacuum therein.

18. The method of sealing closure caps to containers which comprises partially forcing a closure cap on a container to form a hermetic seal thereon, injecting steam, superheated to a temperature of 300° to 800° F., between the closure and the container during the sealing operation to kill microbes and spores in the head space substantially instantaneously during the sealing operation and to form a vacuum therein, and subsequently forcing the cap fully on the container to increase the security of the seal.

19. The method of sterile packing of products which comprises filling a container with a product which is sufficiently hot to kill mold spores therein, and killing the mold spores in the head space of the container and the inside of the closure substantially instantaneously at the time of sealing by directing therein superheated steam at a temperature substantially above 240° F. as a part of the sealing operation.

20. In a closure sealing machine of the class described, the combination of an arched member for applying downward pressure to force a closure cap on a container as the container passes through the arch by moving the depending parts of the arched member over the opposite sides of the periphery thereof, and means for directing vapor under the side of the closure cap as it is being applied to the container until substantially complete engagement of the closure with the container to form a vacuum seal by the condensation of the vapor.

21. A sealing machine in accordance with claim 20 in which means is provided for limiting the lowermost position of said arched member.

22. In a closure sealing machine of the class described, the combination of a fork having spaced depending arms for applying downward pressure to partially force a closure cap on a container as the container passes between the arms by wiping the arms over the opposite sides of the periphery thereof, means for injecting vapor under the side of the closure cap as it is being applied to the container until substantially complete engagement of the closure with the container to form a vacuum seal by the condensation of the vapor, and means for subsequently applying additional pressure to the closure cap to force it further on the container.

23. In a closure sealing machine of the class described, the combination of means having an inverted substantially V-shaped portion for forcing a closure cap on a container as the upper end of a moving container pulls a closure through the V-shaped portion, and means for directing steam between the cap and the container until the cap is forced on the container during the sealing operation to form a vacuum therein.

24. In a closure sealing machine of the class described, the combination of a fork having spaced depending arms for forcing a closure cap on a container as the container pulls the closure between said arms to form a hermetic seal in a single sealing operation, means for superheating steam to a temperature substantially above 240° F., means for injecting the superheated steam between the cap and the container during the sealing operation until the cap is forced on the container, to sterilize the head space and form a vacuum therein, and means for subsequently applying additional pressure to the closure cap to force it further on the container.

25. In a sealing machine of the class described, the combination of means including a fork having spaced depending arms for applying downward pressure to a closure cap to force it on a container and to form a hermetic seal thereon as a moving container pulls a closure between said spaced arms, an injector head for directing steam between the closure and container as the closure is applied to the container until prevented by substantially complete engagement of the cap with the container, an electric heating unit in said injector head for superheating the steam to a temperature sub-

stantially above 240° F., and temperature responsive means for energizing and de-energizing the heating units to control the temperature of the steam.

26. In a machine of the class described, the combination of an inclined guideway for closure caps, means at the lower end of the guideway for forcing a closure cap on a container, an injector head having an outlet for directing steam between the closure cap and the container as the closure is being applied to the container until prevented by substantially complete engagement of the cap with the container, said head having a pair of conduits therein, an electric heating unit in each conduit to heat the steam passing therethrough, and means for directing steam through one of said conduits in one direction into the other conduit and through said other conduit to the outlet in the opposite direction.

27. A sealing machine in accordance with claim 26 in which said other conduit has a series of downwardly directed ducts leading therefrom for directing steam into the mouths of containers passing thereunder.

28. In a machine of the class described, the combination of means for partially sealing a closure cap to a glass container, means for injecting steam under the closure as it is sealed to the container to form a vacuum in the container which causes bubbles to rise through the product therein, a second sealing means for further sealing the cap, and illuminating means intermediate said two sealing means and adjacent to the path of the container as it moves from one sealing means to the other to illuminate the container passing between the two sealing means for indicating the effectiveness of the first sealing by illuminating the rush of bubbles to the head space of the container.

29. In a device for forcing caps down on containers passing thereunder, the combination of a pair of spaced pulleys, a belt passing over said pulleys, and means including a cam surface and a swingable arm for engaging said cam surface to force one of said pulleys away from the other to create tension in said belt whereby said arm may be disengaged from said cam surface to permit said pulley to be readily moved toward the other pulley for removing and replacing said belt.

30. In a sealing machine of the class described, the combination of a base, a supporting structure above said base and fixed thereon and having a drive shaft thereon, a second supporting structure having a drive shaft thereon above said first structure, a plurality of members extending through said first structure for supporting said second structure on said base, means for interconnecting the drive shafts in said structures, and means below said first structure for raising and lowering said members to raise and lower said second structure with respect to the first.

31. A sealing machine in accordance with claim 30 in which a head spacer is mounted on said second supporting structure.

HARRY E. STOVER.

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