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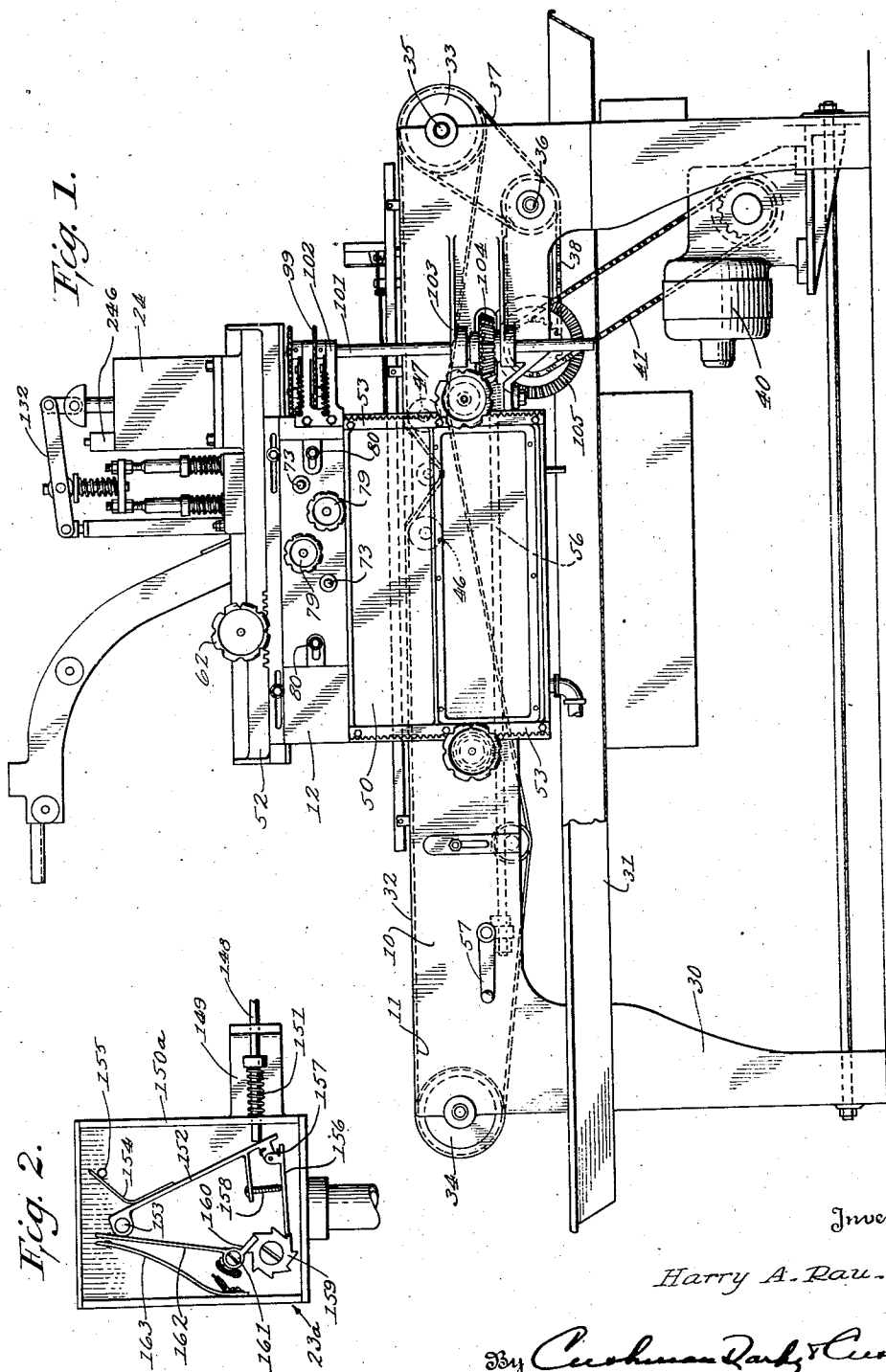
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APPARATUS FOR SEALING CONTAINERS

Filed Dec. 27, 1940

5 Sheets-Sheet 1



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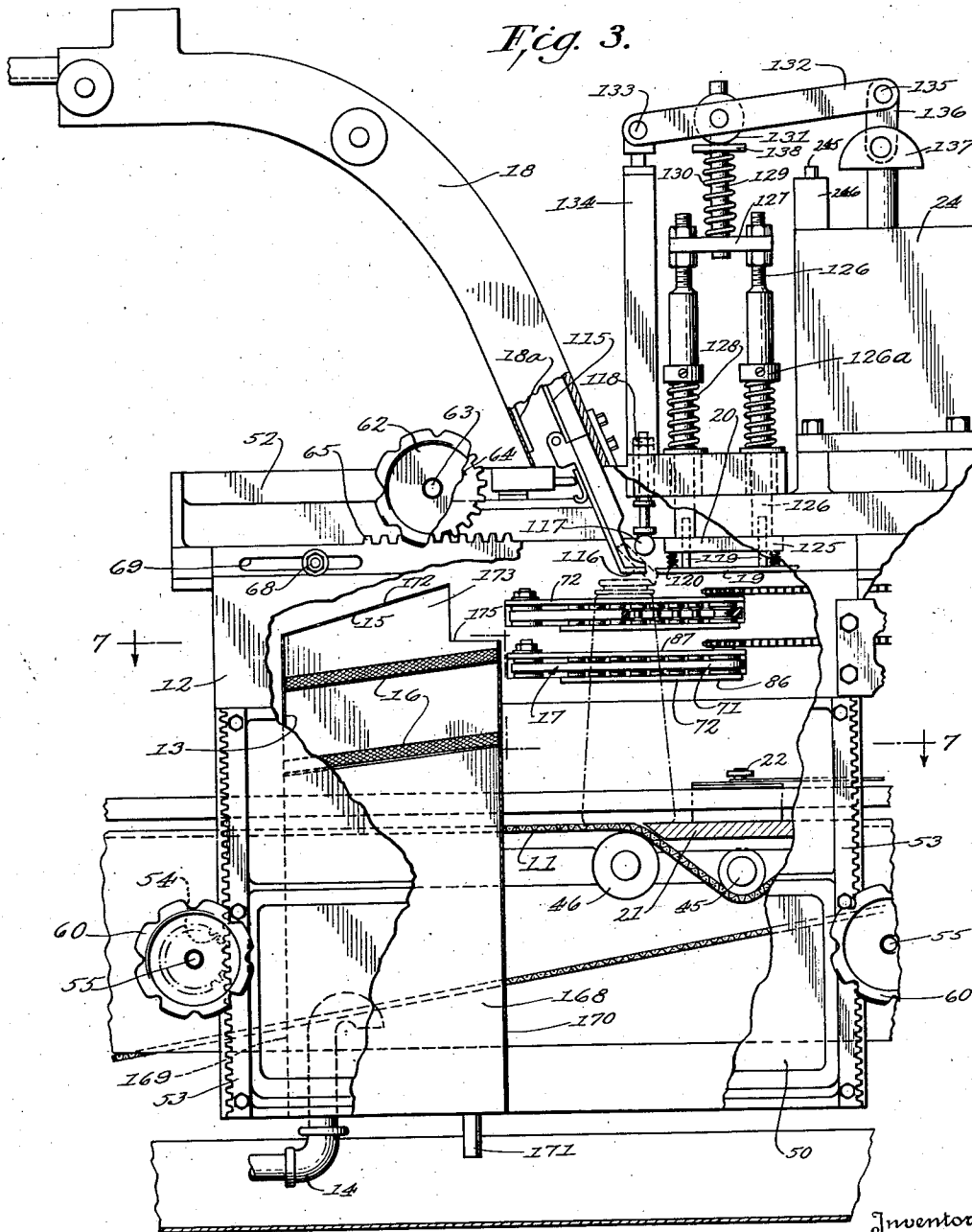
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5 Sheets-Sheet 2



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5 Sheets-Sheet 3

Fig. 4.

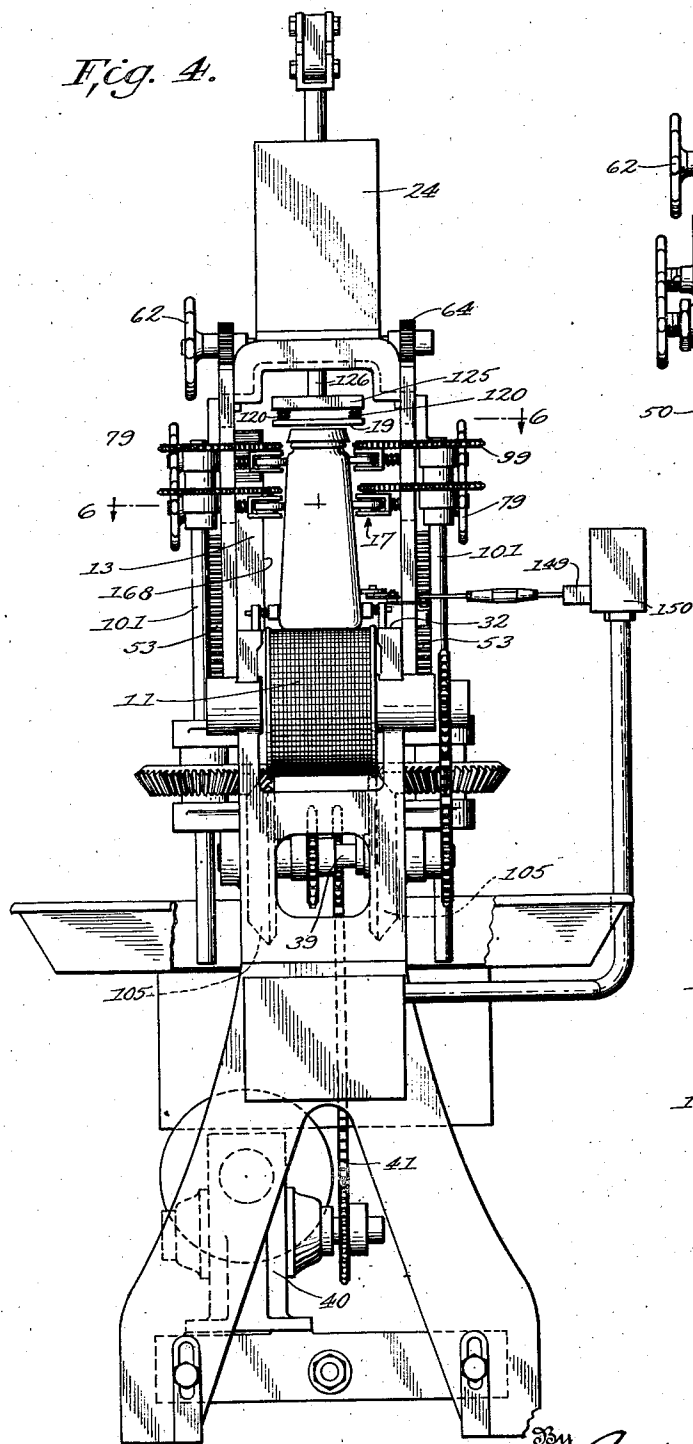


Fig. 5.

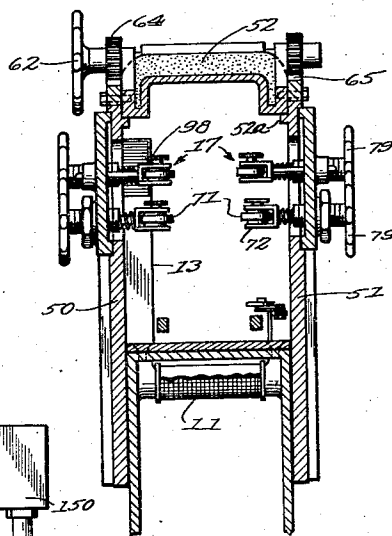
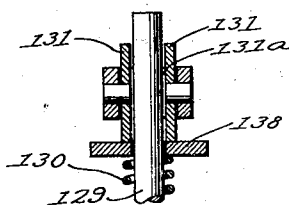


Fig. 8.



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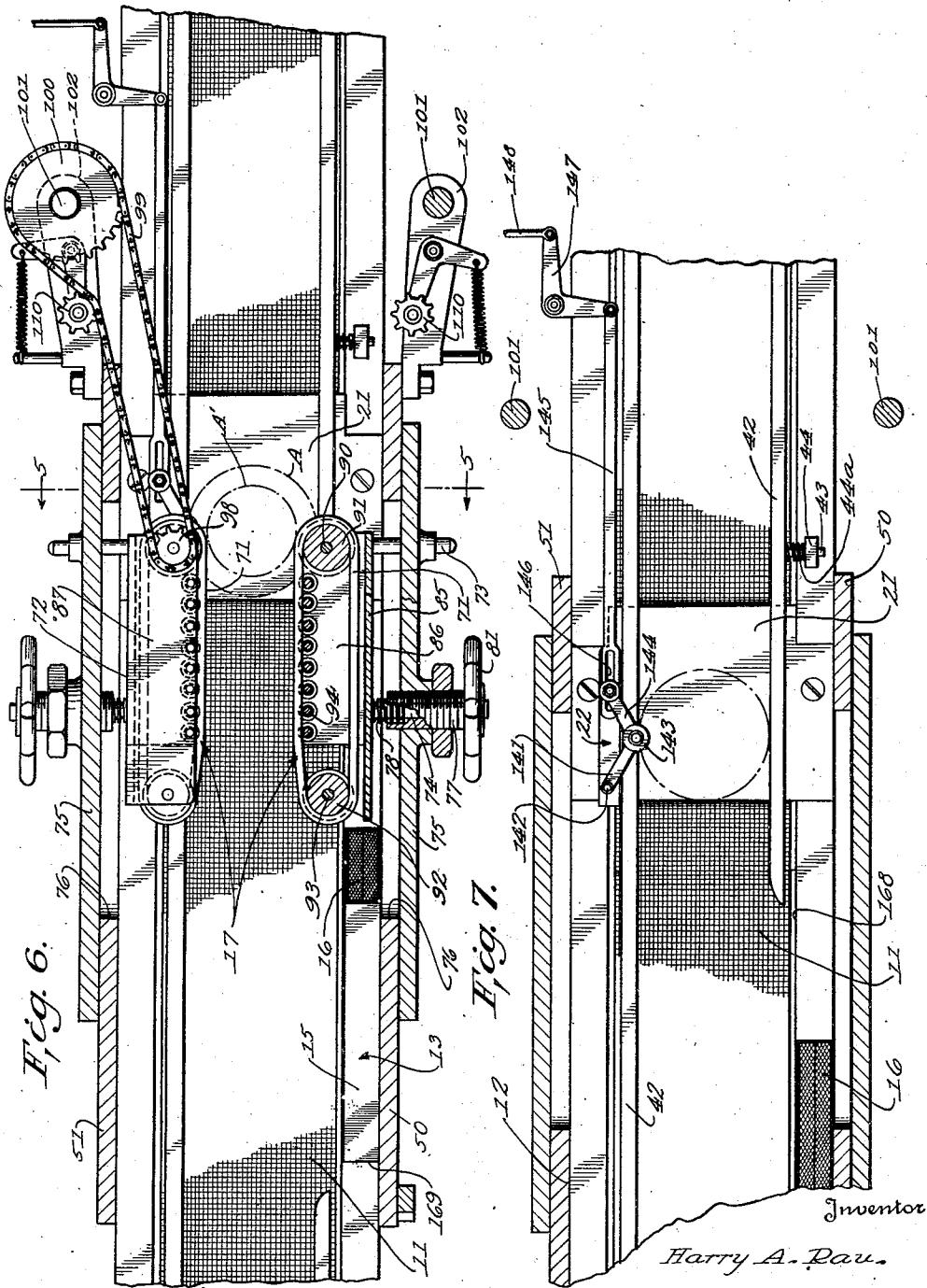
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APPARATUS FOR SEALING CONTAINERS

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5 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,408,447

APPARATUS FOR SEALING CONTAINERS

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2 Claims. (Cl. 226—82)

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The present invention relates to an apparatus for sealing containers.

An important object of the invention is to provide an efficient apparatus whereby a cap or other closure may be applied to a container in the presence of steam or other expanded fluid so as to establish a vacuum effect or low pressure condition in the head space of the container when the steam or other heated fluid subsequently cools and contracts.

Various methods and apparatus have heretofore been provided for the purpose of sealing a cap upon a container while filling the container head space with steam and subsequently condensing the steam to create a low pressure in the head space. The principal objection to these prior developments is that they do not uniformly provide an optimum low pressure effect in the container and frequently result in the presence of moisture in the container.

It has been found that one reason for lack of uniformity in the low pressure effect obtained by prior methods and apparatus is the fact that drafts moving through the usual steam tunnel cause the temperature of the steam to be reduced. Naturally, if the temperature of the steam is reduced, the vacuum effect will likewise be reduced. Also, reduction of the temperature of the steam while uncapped containers are moving through it enables particles of condensed moisture to fall upon the container contents. The presence of such moisture is very harmful to numerous products.

Drafts are created within the steam tunnels of prior apparatus because such apparatus have relied upon jets of steam to create a steam atmosphere within the tunnel. It is found that these incoming jets, by an injector effect, serve to draw air into the steam tunnel with an immediate cooling of the jetting steam. In an effort to counteract incoming air and establish a high temperature within the steam chamber adjacent the point of application and sealing of caps, the steam tunnels have been made relatively long with a view of isolating the cap applying chute and the sealing means from the ends of the tunnels. However, these modifications have not had the desired result.

In more recent developments of the steam jetting methods, the concentration of jets at the cap applying and sealing point has been increased, and the direction of jetting carefully regulated. These systems have proceeded on the presumably reasonable ground that an increase in the number of jets at the critical point and a

theoretically correct direction of jetting will provide high temperature steam at such point.

However, concentration of jets, regardless of direction, in no way prevents draft effects but, instead, results in aggravating drafts because of the increased injector effect. I have found that if prior commercial methods are entirely discarded and steam is delivered to the tunnel at an extremely low pressure and with no jetting action whatever, a quiet body of steam at high temperature will be maintained in the tunnel with no inducing of drafts. Because of the high temperature thus maintained in the tunnel, even the head space of a container with its contents entirely at room temperature is quickly brought to a sufficiently high temperature that no condensation can form in the head space and all air within the head space is quickly replaced by steam at high temperature. Furthermore, because a high temperature can quickly be imparted to a container and all air driven from its head space, there is no necessity for providing the long tunnel heretofore regarded as essential.

Use of low pressure steam, as contemplated by the present invention, is economical in that a large steam boiler is not required.

Prior developments have invariably flowed the steam horizontally into the tunnel, usually by jets positioned in planes adjacent the mouths of the containers. As has been hereinbefore stated, the use of jets has the effect of drawing air into the steam tunnel. Furthermore, if the jets are arranged in the manner just described, this incoming air forms a blanket at the top portion of the tunnel above the steam jets. As a result, the temperature of the tunnel is lowered because this blanket of air can constantly move through the tunnel above the jets.

In an effort to combat the above difficulty, recent developments have included a steam jacket above the tunnel, the top wall of the tunnel serving as the lower wall of the steam jacket and the purpose being to thoroughly heat the extreme upper portion of the tunnel interior. Such an arrangement does not overcome jet-induced drafts and I have found that the provision of a steam jacket is altogether unnecessary if the steam is so flowed into the tunnel that it may freely rise. It is also desirable to have the top wall of the tunnel fairly close to the mouths of the containers. With the top wall at such point and with the steam entering without force at a point below the mouths of the containers and enabled to rise, there is no possibility

of a superimposed layer or stream of air within the tunnel.

Furthermore, the use of slowly rising low pressure steam avoids the waste which occurs when pressure jetted steam is used, most of the pressure jetted steam being blown almost directly from the tunnel.

Another object of the invention is to provide a container sealing apparatus which will occupy a minimum of floor space.

Prior container sealing apparatus, and particularly those which include a steam chamber, occupy a comparatively long area. As hereinbefore indicated, one purpose in providing a long steam tunnel has been to form a long enclosed area at each end of the critical cap applying and sealing points, with a view of isolating these points from outside air and obtaining high temperature at least at such points. With jetting, the length of the tunnel in no way counteracts drafts. Some types of such apparatus have been provided with capping elements of endless type and it has been thought desirable to have at least a substantial portion of the same enclosed by the tunnel, particularly since the element might induce drafts in the upper portion of the tunnel. By the present invention, a long tunnel is not necessary to obtain a high temperature adjacent the cap applying and sealing means and since the use of a longitudinally moving sealing element preferably is avoided, the tunnel need not be extended to enclose such a device.

Use of a short tunnel, with its lower portion clear of steam, permits each container to be constantly visible. This is a highly desirable feature particularly during the initial portion of a run when it is necessary to ascertain whether the cap applying and sealing adjustments are correct.

The principal purpose of providing a lengthwise moving capping element has apparently been to enable the containers to move continuously during the sealing operation. While this procedure theoretically gives high production, the sealing action afforded thereby is not always satisfactory, particularly when handling caps provided with holding lugs upon their skirts. Also, containers may be upset or any type of cap may be bent or dislodged when it first comes into contact with the sealing element as well as when it finally moves out of contact with the element. This is particularly true if there is the slightest slippage of the upper capping belt with respect to the lower container supporting belt, or if the container slips with regard to either belt.

I have found that a high rate of production with completely uniform sealing can be obtained by stopping the containers in order to seal the same. The high rate of satisfactory production obtained is due to the fact that there is less likelihood of containers being upset during the sealing action, with resultant long stoppages to clear out the spilled contents, and also because no containers need be discarded and returned through the machine because of improperly applied caps. At the same time, the arrangement of the present invention occupies a minimum floor space. It is also to be noted that the use of a sealing head of non-continuous type contributes to a more efficient and uniform vacuum effect within the containers because of certain factors hereinafter discussed in connection with the operation of the device.

Another object of the invention is to provide a capping element which is particularly adapted

for the quick and proper sealing of containers.

A further object of the invention is to provide a control for a capping mechanism which is actuated by contact of a container therewith. Such an arrangement is highly desirable because it eliminates the necessity of moving containers through the machine in carefully spaced relation.

Another object of the invention is to provide a container actuated capping control of such design as to insure that the container will be stationary when the sealing is performed, thereby making it certain that every type of cap will be properly sealed and not damaged and that a high net rate of production will be obtained.

One reason why container sealing machines of the present type have heretofore been provided with continuously moving sealing elements was because it was thought that any stoppage of the containers to seal the same might cause the containers to be upset, or their contents to be so disturbed that some portion thereof would be spilled. It has been found that the present invention, involving moving the container onto a stationary support while its upper portion is gripped, prevents upsetting and causes no spilling of containers filled to the customary levels. Also, by stopping the containers to seal the same, all of the disadvantages of a continuously movable sealing element are eliminated and every type of cap can be efficiently sealed upon containers. As has been stated above, the continuous system is only efficiently applicable with certain types of caps.

Still another object of the invention is to provide a container holding and centering arrangement which is adapted to engage the containers while caps are being applied thereto.

As has been hereinbefore indicated, considerable difficulty has been experienced in prior capping machines because containers were frequently upset upon contact with the cap applying device. By the present invention, the containers are securely held at the time that they come into contact with the cap applying mechanism, all possibility of the containers falling over being thereby eliminated.

Another object of the invention is to provide a holding mechanism which is simple in construction, will smoothly and efficiently engage and center containers, and which is readily adjustable for containers of various sizes and shapes.

Another object of the invention is to provide a cap applying and sealing arrangement which includes means to properly level caps upon containers immediately prior to the sealing action.

Other objects and advantages of the invention will be apparent from the following drawings, wherein:

Figure 1 is a side elevation of the apparatus included in the present invention;

Figure 2 is a detail view showing a sealing head control mechanism;

Figure 3 is a side elevation of the central portion of the apparatus, with parts broken away;

Figure 4 is an elevation of the outfeed end of the apparatus;

Figure 5 is a transverse vertical sectional view on the line 5-5 of Figure 6;

Figure 6 is a horizontal sectional view on the line 6-6 of Figure 4;

Figure 7 is a horizontal sectional view on the line 7-7 of Figure 3;

Figure 8 is a transverse vertical section through the capping head operating link;

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Figure 9 is a front view of a preferred form of sealing head control mechanism;

Figure 10 is a vertical sectional view on the line 10—10 of Figure 9; and

Figure 11 is a diagrammatic view of the control wiring of the apparatus.

The construction of the present apparatus and its operation may be generally described as follows: The numeral 10 designates the table of the machine along which moves a continuously moving endless conveyor 11. A chamber or tunnel 12 extends above the table 10 and a steam atmosphere is maintained therein by steam flowing from a supply duct 13. Steam under low pressure is supplied to the duct 13 by an inlet pipe 14, the steam passing up through the duct to issue from its wide-mouthed open end with no jetting action. In order to insure that any force behind the steam will be substantially eliminated, the steam rising in duct 13 passes through one or more fine mesh wire screens indicated at 16. If more than one screen is used, they are spaced a substantial distance apart as shown in Figure 3. A hood 15 at the upper end of duct 13 permits the steam to move upwardly and longitudinally with respect to the steam tunnel 12 to form a cloud of steam at approximately atmospheric pressure in the upper portion of the tunnel.

Containers moving through the apparatus enter at the left hand end (Figures 1 and 3) upon the endless belt 11 and are conducted past the hooded steam duct 13 into the steam cloud or atmosphere which exists in the upper portion of the tunnel from a point alongside the duct to the outfeed end of the tunnel. As a container moves past the duct its upper portion comes into contact with the belts of a holding and centering device 17 so that the container will be held upright. The belts of device 17 move at the same speed as conveyor 11. Immediately thereafter the leading edge of the mouth of the container will contact with the lowermost cap in a cap chute or cap applying means 18 and the continuing movement of the container will cause this cap to be withdrawn from the chute and drop to a loose position upon the mouth of the container. Chute 18 is enclosed and may include an electrical heating element to insure that caps will be brought to a sufficient temperature to prevent steam from condensing upon them before entering the chamber 12.

As soon as the cap has been substantially removed from the chute 18, its upper portion will come into contact with the forward edge of a plate 19 resiliently mounted upon and forming part of the capping plate or member 20 and plate 19 will level the cap upon the container mouth.

While the above leveling action is taking place, the container base will be moving on to a fixed supporting plate 21 and its lower portion will come into contact with a trip device 22. As the movement of the container with conveyor 11 and holding device 17 continues, the container will force the trip device laterally out of its path. As the forward movement of the container stops, because its base has moved entirely off conveyor 11 and will stand entirely upon plate 21 as indicated at A in Figures 6 and 7, and also because its upper portion, indicated at A' in Figure 6, has moved out of contact with the holding device 17, trip 22 will be actuated to cause circuit controlling device 23 (Figure 9) to actuate the delayed action electrical circuit diagrammatically shown in Figure 11. When the Figure 11 circuit is finally completed, by which time all movement of

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the container will have stopped, the electromagnet indicated at 24 will be energized, so that the capping plate 20 will move downwardly to compress the light springs above plate 19 and positively force the loosely applied cap to a sealed position upon the stationary container. The circuit of the capping member 20 will be broken when the latter has moved down the proper distance and it will immediately rise so as to leave the container standing free upon the fixed plate 21. Contact of a succeeding container with the container standing at A will push the latter off plate 21 and upon the outfeed portion of endless conveyor 11. It will be noted from Figure 3 that the upper run of conveyor 11 dips down beneath the stationary plate or support 21.

It will be understood that during the movement of the container through the steam chamber 12 and before a cap is applied thereto the head space of the container will be filled with steam from the cloud present in the upper portion of the steam chamber 12 and steam will be entrapped in the head space when the container is capped or sealed. As the sealed container moves from the steam chamber through a gradually dissipating cloud of steam, the steam in its head space will condense to create a low pressure condition therein.

Referring to the apparatus in detail, the table 10 is supported upon legs 30 which also support the usual tray 31 immediately below the table. The upper surface 32 of table 10 is cut away to provide a space in which the upper run of the conveyor 11 may move and conveyor 11 is preferably of wire mesh and moves about pulleys 33 and 34 journaled at the ends of the table 10. Pulley 33 is fixed to a shaft 35 driven from a shaft 36 by means of a sprocket chain 37. Shaft 36 is in turn driven through a chain 38 from a shaft 39. A motor 40 including a speed reducing mechanism drives the shaft 39 through a sprocket chain 41.

In order to maintain containers in line, guide strips 42 are provided with rearwardly extending pins 43 which extend through posts 44 fixed to table 10. These strips are adjustable for different size containers and are preferably spring mounted by means of springs 44a surrounding the pins 43.

As best shown in Figure 3, at a point near the outfeed end of the steam chamber 12 the upper run of the container supporting conveyor 11 is guided downwardly about a roller 45 over guide rollers 46 and 47 (Figure 1) and the supporting plate 21 fixed to table 10 bridges the gap thus provided in the upper run of the conveyor.

The steam chamber 12 includes side walls 50 and 51 and a top wall 52. Each side wall 51 and 52 has a toothed rack 53 fixed to its vertical edges, which racks are engaged by pinions fixed to shafts 55 journaled in the side walls of the table 10 so that rotation of the shafts 55 will cause the steam chamber to be either raised or lowered with respect to the table 10 and the container supporting conveyor 11. The shafts 55 have worm gears secured thereto engaged by worm wheels on a longitudinal shaft 56 and shaft 56 is suitably geared to a shaft provided with a handle 57 adapted to control the lifting or lowering of steam chamber 12. The steam chamber is held in adjusted position by means of locking nuts or hand wheels 60 on the shafts 55 which bear against the sides of the table 10.

The top wall 52 of the steam chamber is longitudinally adjustable with respect to the side walls

and since it supports the cap applying chute 18 and capping mechanism 20, the position of these devices with respect to the stationary supporting plate 21 may thereby be adjusted longitudinally of the machine. The purpose of this adjustment is to insure that caps will be loosely seated and leveled before the trip 22 is actuated. Adjustment of the top wall 52 is effected by operation of a hand wheel 62 secured to a cross shaft 63 provided with pinions 64 which mesh with toothed racks 65 formed on the upper edges of the side walls 50 and 51. The top wall 52 may be locked in adjusted position by means of nuts 68 threaded on bolts extending through longitudinal slots 69 in the side walls and thence into the top wall 52. As best shown in Figure 5, the top wall 52 is closely fitted with respect to the side walls and is supported by the ledges 52a shown in Figure 5.

The holding and centering device 17 comprises an upper and a lower endless belt 71 on each side of the endless conveyor. Each belt 71 is supported in a U-shaped bracket 72 (Figures 4 to 6) which includes two outwardly extending pins 73 and 74. The pin 73 is slidable in a bore in a plate 75 secured against a large rectangular opening 76 in the corresponding side wall of the steam chamber. The other pin 74 is slidable in the bore of a sleeve 77 threaded in the plate 75. As shown in Figure 6, the inner end of each sleeve 77 is counter-bored and a coil spring 78 surrounding pin 74 seats in this counter-bore. The position of each bracket 72 with respect to the center line of the container supporting conveyor 11 may be adjusted inwardly by rotation of the hand wheel 79 fixed to each threaded sleeve 77, since the sleeve will act upon the coil spring 78 to force the bracket inwardly by a straight line or rectilinear movement. The brackets can be moved outwardly by pressure upon the same and because of their resilient mounting, will accommodate themselves to variations in containers. As best indicated in Figure 1, the hand wheel 79 of each upper centering device is longitudinally reversed with respect to the position of the corresponding element of each lower centering device.

The holding and centering devices may be adjusted longitudinally of the machine by releasing the bolts 80 (Figure 1) which extend through slots to hold the plates 75 to the side walls of the chamber 12.

Each U-shaped bracket 72 includes a rear wall 85, a lower wall 86 and an upper wall 87. As shown at the bottom of Figure 6, each lower wall 86 is cut away at its infeed end. The outfeed end of each bracket has journaled therein a vertical shaft 90 to which is fixed, between the upper and lower plates 86 and 87, a pulley 91. An idler pulley 92 is supported on a stud 93 at the infeed end of each bracket and the belts 71 move about these pairs of pulleys. The inner run of each belt 71 is supported or held inwardly with respect to the center line of the machine by small idler rolls 94 positioned in the brackets 72. As best illustrated in Figure 6, the series of rolls 94 does not extend entirely to the infeed end of a bracket 72 and because of this, as well as because of the fact that the infeed end pulley 92 is of reduced diameter, each belt 71 will have the infeed portion of its inner run slightly inclined so as to assist in the centering action of containers. However, it will be noted that the remaining portion of the inner run of each holding belt is positively held straight by the small rolls

so that a uniform pressure will be applied to containers during their movement with such portion of the belts.

It will likewise be noted that each belt 71 and its supporting bracket 72 is resiliently mounted, as an entirety, for inward and outward movement. That is, as a container causes the holding belt to be forced outwardly to a slight extent through the side wall of the steam tunnel, that holding belt and its supporting bracket 72 will move bodily outwardly along a straight line and with no swinging movement.

As best shown in Figures 3, 4 and 6, each shaft 90 carrying a driven pulley 91 of a holding device has a sprocket wheel 98 fixed thereto which is engaged by a sprocket chain 99 extending from the outfeed end of the steam tunnel and about a large sprocket wheel 100 fixed to a vertical shaft 101 journaled in brackets 102 extending from the upper portion of the side walls of the steam chamber. As best shown in Figure 1, the two holding belts at each side of the steam chamber are both driven from the corresponding vertical shaft 101. The lower portion of each vertical shaft 101 is slidably journaled in brackets 103 fixed to the side wall of the table 10 and a beveled gear 104 is keyed to the shaft 101 between these brackets. Beveled gear 104 meshes with a beveled gear 105 fixed to the shaft 39.

It will be noted that the shafts 101 may move vertically with the steam chamber without affecting the driving connection with the beveled gears 104.

As illustrated in Figure 6, the sprocket chains 99 which serve to drive the holding brackets 72 may be held under proper tension by a roll 110 resiliently supported from the brackets 102.

The cap supply and applying chute 18 preferably comprises two spaced guideways 115, each of well-known angular form to provide a shelf to support one edge of the cap and a shoulder to guide the cap. The major portion of the chute is surrounded by a casing which may include an electric heater 18a. The guideways 115 terminate in lugs or shoulders 116 of well-known form which serve to stop the downward movement of the line of caps. As indicated in Figure 3, the lower portion of the skirt of the lowermost cap will bear against these shoulders with the intermediate unsupported portion of the skirt extending into the path of the lip of an advancing container. As a result, the container will lift the cap over the shoulders 116 so that it will drop to a substantially leveled position on the container mouth, the succeeding cap then dropping down against the shoulders 116. The movement of a cap from its substantially vertical position in the chute to a substantially horizontal position without sidewise tilt is assisted by roller 117 journaled at the lower end of a weighted plunger 118 slidably mounted in an aperture in the upper wall 52 of the steam chamber. During its leveling movement the top of the cap is also continually engaged by the spring plate 19 of the capping device. Plate 19 includes upwardly extending studs 119 which fit in sockets in the capping plate 20 to thereby guide the vertical movement of plate 19. Plate 19 is urged to the normal downward limit position illustrated in Figure 3 by relatively light coil springs 120, one of which is positioned between each corner of plate 19 and the corresponding corner of the capping plate 20. It will be noted that the infeed end of plate 19 is beveled to guide the caps beneath the plate.

The above cap applying arrangement including the roller 117 and plate 19 serves to loosely apply all caps in a substantially level position without possibility of the cap dropping from the container. A particularly desirable feature is that the cap is firmly held from the moment that it leaves the chute 18 until it is finally sealed.

Referring to Figure 3, the capping member or plate 20 is mounted immediately adjacent the cap applying chute 18 and is rigidly fixed to a pair of rods 126 extending through apertures in the top wall of chamber 12. The rods 126 are secured at their upper ends to a bar 127, this portion of each rod being threaded to receive nuts to bear on the upper and lower surfaces of bar 127 so that its position with respect to the rods can be adjusted. Intermediate its length each rod 126 is provided with an adjustable collar 126a and a coil spring 128 is positioned between each such collar and the upper wall of the steam chamber. These springs serve to urge the rods and thereby capping plate 20 to an upward position.

A plunger 129 is fixed to the bar 127 and carries a plate 138 which is urged to an upward position by a coil spring 130. The upper surface of plate 138 is adapted to contact with round disks 131 pivoted as shown in Figure 8 in a cut-out portion 131a of a link 132. Plunger 129 extends through the cut-out and between the disks as shown in Figure 8. The link 132 has one end pivoted as indicated at 133 to a post 134 and the other end of the link is pivotally connected as at 135 to a vertical link 136 pivoted to the armature 137 of electromagnet 24.

It will be noted that downward movement of armature 137 will cause the disks 131 to act upon spring mounted plunger 129 and thereby depress the capping plate 125. The upper spring 130 will serve as a resilient connection to compensate for containers of slightly greater than normal height and the lower springs 128 will serve to return the capping plate 125 to normal position.

As shown in Figure 7, the trip 22 for the capping member 20 is of toggle form and comprises a lever 141 pivoted at 142 to the stationary plate 21 and carrying a roller 143 at its free end. Also, the free end of lever 141 is pivotally connected to an arm 144 pivoted to a long link 145. As shown in Figure 7, the point at which arm 144 is connected to link 145 may be adjusted by a nut engaging a slot 146 in the link. The far end of link 145 is pivoted to one arm of a bell crank 147, the other arm of the bell crank having a link 148 extending therefrom to the circuit controlling device 23 shown in detail in Figures 9 and 10.

Referring to Figures 9 and 10, link 148 may include a turnbuckle and extends through an aperture in the side wall of the housing 150 of the device 23. Within the housing, the rod 148 has a block 200 fixed thereto and the rod is urged to the right as viewed in Figure 9 by a coil spring 201 which surrounds the rod between the far wall of the housing and block 200. Block 200 carries a swinging pawl 203 which normally hangs downwardly alongside a vertical shoulder 204 on the block 200 as shown in Figure 9 and has its lower face 205 inclined as indicated in Figure 9. A block of insulating material 206 is positioned in the lower portion of housing 150 by means of screws 207 and a pair of spring blades 208 and 209 are mounted on upper stepped faces of block 206 by means of screws 210 and 211, respectively, which also serve as binding posts for the contacts. The spring blades 208 and 209 carry contacts at their free ends and are normally in the

separated position illustrated in Figure 9, this position being controlled by the adjusting screws 212 and 213.

In the operation of the control mechanism 23, as a container is moved from the infeed portion of supporting conveyor 11 to the position on the stationary plate 21 indicated in Figure 7, the forward and lower portion of the container will engage the roller 143 of trip 22 to move the toggle mechanism towards straightened position. As a result, the long link 145 will move to the right with regard to Figure 7, thereby moving the link 148 to the left in Figure 9. Such movement of link 148 will carry the block 200 to the left so that the point of pawl 203 will contact with a triangular nub 214 which extends upwardly from the upper contact blade 208, depressing this plate so as to bring its contact into engagement with the upwardly facing contact on lower blade 209 to cause a circuit to be actuated as hereinafter described. Rod 148 will continue its movement to the left in Figure 9 so that pawl 203 will continue past the nub 214 to permit the blade 208 to rise so that only a momentary electrical current will flow between the contacts carried on the blades.

The container will remain in the stationary position indicated in Figure 7 as well as at A in Figure 6 until the succeeding container contacts with it to move it from the stationary plate 21 to the outfeed portion of conveyor 11 and the pawl 203 will remain on the left hand side of the nub 214 while the container is in this position. When the container shown in Figure 7 moves to the right to enable the toggle mechanism to resume its normal position in the path of the next container, rod 148 will return to the Figure 9 position causing pawl 203 to ride over the nub 214. However, since the right hand face of pawl 203 is inclined and because the pawl is free to swing in a clockwise direction, it will simply ride over nub 214 without depressing the spring blade 208. Hence, the contact element of blade 208 will not come into engagement with the contact of lower blade 209 during return movement.

Figure 11 shows the control circuit of the mechanism whereby the closing of the contacts of the device 23 will cause the capping plate 20 to be moved into engagement with a container on the stationary supporting plate 21. Referring to Figure 11, it will be noted that the spring blade 208 is connected to a main conductor 225 by a lead 226 while the stationary blade 209 is connected by a lead 227 to the coil 228 of a retarded relay, the coil being connected by a lead 229 to the other main conductor 230. When the contact of spring blade 208 is moved into engagement with the contact of spring blade 209, coil 228 will be momentarily energized. However, since the relay is of the retarded type, it will not move its armature 231 into engagement with contacts 232 and 233 until a fraction of a second has elapsed, thereby insuring that the movement of the container upon the stationary supporting plate 21 is entirely completed and the container is entirely stationary before the capping head 20 begins its descent.

When relay 228 moves its armature 231 to bridge the contacts 232 and 233, it will energize one coil 234 of a double-acting relay since the contact 233 is connected to one side of coil 234 by a lead 235 and the coil is also connected by a lead 236 to the main conductor 230. The other contact 232 is connected by a lead 237 with the

opposite main conductor 225. This energization of coil 234, which is only momentary, will draw an armature 238 into engagement with fixed contacts 239 and 240 but armature 238 is mechanically interlocked so as to remain in the position to which it is urged. Contact 240 is connected by a lead 241 with main conductor 230 while contact 239 is in circuit through a lead 242 with the coil 243 of the electromagnet 24 of the capping head, this coil being connected at its opposite end by a lead 244 to the main conductor 225. Energization of coil 243 will cause its armature 137 to be drawn downwardly so that the right hand end (Figure 3) will be drawn downwardly thereby depressing the capping plate 20. When the right hand portion of link 132 reaches its extreme lower position, it will engage a button 245 forming part of a switch element 246 mounted as illustrated in Figure 3, depressing the button 245 so as to cause the contact carried by the latter into engagement with a fixed contact 246. Moving contact 245 is connected by a lead 247 to the opposite coil 248 of the double-acting and mechanically interlocked relay and this coil is also connected by a lead 249 to the main conductor 230, while the fixed contact 246 is connected by a lead 250 with the opposite main conductor 225. Hence, when link 132 depresses button 245, it will close the circuit just described, so as to energize the coil 248 to thereby return the mechanically interlocked armature 232 of the double-acting relay to the position illustrated in Figure 11, thereby de-energizing the capping head actuating coil 243 so that the springs 123 may return the capping plate 20 and armature 137 to raised position. As soon as link 132 rises the contact 245 will also rise, but armature 238 will remain in the Figure 11 position until coil 234 is again energized.

It will thus be observed that the capping head cannot be moved downwardly to capping position until the container is absolutely stationary upon the stationary supporting plate 21 and that as soon as it reaches full downward position, its energizing coil 243 will be de-energized so that it will be promptly returned to a raised position out of the path of the succeeding container.

Figure 2 illustrates a modified form of circuit controlling device 23a which may be placed in the Figure 11 circuit instead of the device 23 of Figures 9 and 10. In the Figure 2 form the link 148 extends through a bracket 149 into a housing 150a of the device 23a. A spring 151 positioned between a collar on link 148 and the outer wall of the housing serves to urge the link 148 to an outward position, that is, to the right in Figure 2. The inner end of link 148 bears against the free end of a lever 152 pivoted at 153 and which lever is normally held to the right by means of a leaf spring 154 fixed to the lever and having its outer end bearing upon a pin 155. The opposite end of lever 152 pivotally carries a pawl 156 urged to upward position by means of a spring 157 surrounding its pivot. This upward position is limited by a set screw 158 adjustably mounted in a lateral extension of lever 152.

The outer end of pawl 156 engages a ratchet wheel 159 which is also engaged by a second pawl 160 pivoted at 161. Pawl 160 is secured to a movable contact 162 normally out of engagement with a fixed spring contact 163. It will be noted from Figure 2 that movable contact 162 bears against the pivot end of lever 152 when its pawl 160 is seated in one of the pockets of the

ratchet wheel and is then out of engagement with fixed contact 163. The pivot end of lever 152 thereby serves as a limit stop for movable contact 162. The contacts 152 and 163 are suitably insulated from their operating elements.

In the operation of the control mechanism 23a of Figure 2, as a container is moved from the infeed portion of supporting conveyor 11 to the position on the stationary plate 21 indicated in Figure 7, the forward and lower portion of the container will engage the roller 143 of trip 22 to move the toggle mechanism toward straightened position. As a result, the long link 145 will move to the right with regard to Figure 7, thereby moving the link 148 to the left in Figure 2. Such movement of link 148 will cause lever 152 to swing to the left and a corresponding movement will be imparted to the pawl 156. At the instant that the container entirely leaves conveyor 11 and holding device 17, the link 145 will have moved far enough to move link 148 a proper distance to rotate ratchet wheel 159 in a clockwise direction sufficient for one tooth of the ratchet wheel to move beneath the second pawl 160 and lift the same, thereby swinging contact 162 against contact 163. However, pawl 160 will immediately drop behind the tooth which has raised it and its engagement with contact 162 will thereby be broken.

The closing of the circuit between the contacts 162 and 163 will energize the retarded relay 228 as described in connection with Figure 11 so as to set up the Figure 11 circuit to move the capping plate 20 downwardly to move the applied cap to sealed position after the container has reached a fully stationary position, all in the manner described in connection with Figure 11.

With the Figure 2 device 23a, when the container shown in Figure 7 moves to the right to enable the toggle mechanism to resume its normal position in the path of the next container, link 148 will return to the right causing pawl 156 to ride back and drop behind the next tooth of the ratchet wheel. The second pawl 160 will, of course, prevent the ratchet wheel from rotating in a counter-clockwise direction during the dragging movement of pawl 156 along the ratchet wheel. Spring 154 moves lever 152 to the right as soon as the pressure on link 148 is released and the spring 157 holds pawl 156 in the upper position shown in Figure 2 though permitting it to swing downwardly sufficiently to ride back over the adjacent tooth of the ratchet wheel.

It will be understood that to adjust the machine for operation, the trip 22 will be so positioned that it will be actuated by the final movement of a container upon stationary plate 21 so that capping plate 20 will not descend until the container is absolutely stationary. The capping head will also be so positioned that it will be centrally over the container. Thus, the cap will be moved to sealed position by a force applied in an entirely vertical direction.

As is illustrated in Figures 3, 6 and 7, the steam duct 13 is cast in one side wall of the machine and is substantially rectangular in horizontal section. It extends from the bottom of the side wall 50 of the steam chamber to a point closely adjacent the under-surface of the top wall 52. The inner wall 168 of the duct is only spaced a short distance from the inner surface of chamber wall 50 in order to clear the adjacent edge of the conveyor 11. The edge wall 169 of duct 13 is closely adjacent the infeed end of the steam chamber 12 while the edge wall 170

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towards the outfeed end of the apparatus terminates immediately in advance of or closely adjacent to the infeed end of the holding and centering mechanism 17. Hood 15 is preferably removable from duct 13 to render the screen 16 accessible.

Superheated dry steam under a relatively low pressure, for example, from one to five pounds, is delivered to the lower portion of the duct 13 through the steam pipe 14. As shown in Figure 3, the outlet end of pipe 14 preferably has either a return bend upon the same or is so angled that it will not direct the steam upwardly.

The steam received through the pipe 14 will rise through the duct 13 and pass through vertically spaced fine mesh wire screens 16 which are preferably of inverted V-shape in transverse section. The screens 16 serve to entirely break the force of the steam and cause it to move from the wide mouth of the duct in a cloud. The V-shape of the screens 16 permits any condensate to move down along their inclined portions so as not to clog them. Such condensation may eventually move out of the duct 13 through a drain 171.

In order to guide the steam rising from the duct 13 toward the outfeed end of chamber 12 and at the same time enable it to rise to the extreme top portion of the tunnel, the upper end of duct 13 is provided with a hood comprising an inclined top plate 172 and vertical side plates 173. Screen 16 may be horizontal or may be slightly inclined as shown in Figure 3. The primary purpose of having screen 16 inclined as shown in Figure 3 is to position it substantially parallel to the top wall 172 of the hood and thereby provide an unrestricted path between the screen and the shield.

It will be observed that the steam flowing from the wide mouth of duct 13 over its top edge 175 will enter the extreme upper portion of the steam chamber and because the steam is directed upwardly rather than laterally, the cloud of steam formed in the chamber will extend from the roof of the chamber downwardly. That is, there can be no layer of air between the steam cloud and the roof as frequently occurs when the steam is directed laterally at a point spaced downwardly from the roof of the steam chamber.

Since the flow of steam into the steam chamber is not under force but is at substantially atmospheric pressure, no drafts are created at any point and a temperature of 212° is readily maintained within the upper portion of the steam chamber. The open filled containers entering the steam cloud will quickly have the air in their head spaces replaced by the body of steam so that when they move into engagement with the holding and centering mechanism 17 they will contain no air. Because the containers come into contact with some steam from the cloud just as they enter the tunnel they will be given a gradual heating effect, preventing condensation. In other words, containers do not suddenly move from open atmosphere into the path of a steam jet which will condense in the container head space. Since the caps are heated in the chute 13 to a temperature approaching 212°, no moisture will be condensed upon the same when they move into the lower portion of the chute and into contact with the steam cloud to have their interiors filled with steam. Therefore, when the applied cap is moved to sealed position upon the container by the capping head 20, the head space of the container will be filled with dry steam.

It is to be noted that since the steam locked in the head space of a sealed container has no

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pressure and because the container will be surrounded by steam at a temperature identical with that of the steam sealed within the head spaces, the sealed cap has no tendency whatever to rise from sealed position when the capping head rises. This same situation holds true when the sealed container is moved off stationary plate 21 by the succeeding container and into the open atmosphere upon the outfeed portion of conveyor 11. That is, because the steam in the container head space is only at atmospheric pressure, it cannot cause the cap to lift and, therefore, no means to hold the cap sealed during cooling is required. By the present apparatus and method, the container and particularly the cap will both be simultaneously and uniformly subjected to atmospheric temperature almost immediately after capping has been performed and quick uniform cooling to contract the steam is assured.

Since the present method and apparatus insures that caps will have no tendency to rise from containers between the moment they have been moved to a sealed position and the time when the steam condenses to create a low pressure condition in the container head space, the invention may be used with caps which are held sealed primarily by a low pressure condition as well as with caps provided with some type of locking means.

As has been indicated above, the inclusion of a vertically moving capping or sealing element in the present invention is found to be highly advantageous and a considerable improvement upon a continuously moving capping element of endless form. More particularly, while an endless capping or sealing element has the theoretical value of sealing containers at greater speed because it does not require that the movement of the containers be stopped, this theoretical advantage is altogether offset by the fact that containers may be upset or their caps either distorted or dislodged by the endless and moving element.

The capping element of the present invention, with its control so designed that the capping head cannot descend until the container is stationary, entirely eliminates all of the defects of the endless type of head. Also, since by the present invention the capping element is immediately retracted or raised so as to be out of contact with the container which has just been sealed, it is not necessary to widely space the containers delivered to the apparatus. That is, containers can be closely spaced when delivered to the apparatus because the stopping of a container for sealing is only momentary and the following container can, therefore, quickly contact with it to place it upon the outfeed portion of the supporting conveyor.

The use of a quickly operable sealing element such as provided by the present invention has the further advantage of insuring that steam will be quickly entrapped within the container head space while it is still at maximum temperature. That is, with the endless type of sealing element, the cap is only gradually applied to the container and the steam within the container head space may condense or be cooled before the sealing is entirely performed. Naturally, if any portion of the steam condenses, air may enter the head space to raise the final pressure in the container head space.

Continuously moving endless sealing elements usually extend from one end of the steam tunnel. The positioning of the present sealing element entirely within the highly heated steam chamber causes the sealing element to be maintained at a high temperature so that it cannot condense

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steam trapped in the container head space. In machines of the endless belt type, the belt becomes cooled, either because cooling liquid is directed upon it or because it moves into a cooler atmosphere as indicated above. Naturally, if a cap is not yet fully sealed upon the container at the time that this cooling begins, condensation of steam will occur, with a resulting higher head space pressure.

The use of a reciprocating capping element is particularly efficient in sealing caps of the type having locking lugs upon their skirts. That is, by the present invention the caps are moved directly downwardly by a straight line movement to a sealed position upon the container. Sealing apparatus of the endless belt type are particularly inefficient in applying this type of cap because such caps are more apt to become tilted upon initial contact with the sealing element due to the fact that the lugs prevent them from being readily moved to a sealed position upon the container. For example, if a lug type cap moves adjacent the sealing element with one of its lugs resting upon the mouth of the container, it may not be subsequently properly seated by an endless sealing element, but, instead, may be bent or otherwise distorted or entirely knocked off the container. The arrangement of the present invention is therefore equally useful and efficient in applying caps of both the lug type as well as those which rely primarily upon the lowered pressure within the head space to retain them in sealed position.

As has been stated above, it has heretofore been thought that if containers were stopped for sealing, they might fall over, or at least that any liquid contents would be so disturbed as to cause spilling. Therefore, continuously moving sealing elements were believed necessary, even though such elements themselves may cause upsetting and improper application of caps and are not satisfactory for sealing lug type caps. I have discovered that the stopping of containers filled to the usual extent by movement on to a stationary plate, as opposed to the stopping of a container by the positive stopping of a driven chain or other container engaging element, with its resultant vibration, does not cause upsetting of containers or any spilling of their contents. Hence, the use of the much more practical vertically moving sealing element is made entirely feasible.

The general operation of the present apparatus and method have been described in the opening portion of this specification and the specific operation of the various elements have been described in connection with the detailed description of the construction of such elements.

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Subject matter disclosed but not claimed herein may be claimed in my application for Container sealing apparatus, Serial No. 685,443, filed July 22, 1946, as a continuation-in-part of the present case.

The terminology used in the specification is for the purpose of description and not of limitation, the scope of the invention being indicated in the claims.

I claim:

1. In a container capping apparatus, a base, a straight-line steam tunnel mounted on said base, said tunnel including a top wall and two side walls to define an inlet and an outlet at the respective opposite ends of said walls, conveyor means carried by said base to move containers through the tunnel, the top wall of the tunnel being positioned to lie closely adjacent the mouths of the containers, means carried by and below the tunnel top wall to apply and seal caps upon containers, a steam duct fixed with respect to a side wall of said tunnel in advance of the cap applying means, means to deliver steam to said duct at a relatively low pressure above atmospheric pressure, pressure reducing means in said duct to reduce the pressure of steam flowing therefrom to substantially atmospheric pressure, said duct including an outlet mouth positioned at one side of said conveyor and below but closely adjacent the plane of the cap applying and sealing means, said outlet mouth facing upwardly and in the direction in which said conveyor means moves containers through said tunnel, said steam supply means, pressure reducing means and the facing direction of the duct mouth having the combined function of maintaining a quiet body of steam in the area occupied by said applying and sealing means and with the body of steam extending from the top wall of the tunnel to a point below and closely adjacent the plane of the container mouths, said tunnel being vertically adjustable with respect to said base and conveyor and means cooperating with a wall of said tunnel to move said tunnel and duct vertically with respect to said base and thereby enable containers of various sizes to be capped.

2. An apparatus of the character defined in claim 1 wherein the top wall of the tunnel and the cap applying and sealing means carried thereby are horizontally adjustable with respect to the side walls of the tunnel and said duct, and means is provided to move the top wall and applying and sealing means horizontally to thereby adjust the point with respect to said steam supply duct at which a cap is applied and sealed upon a container.

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