

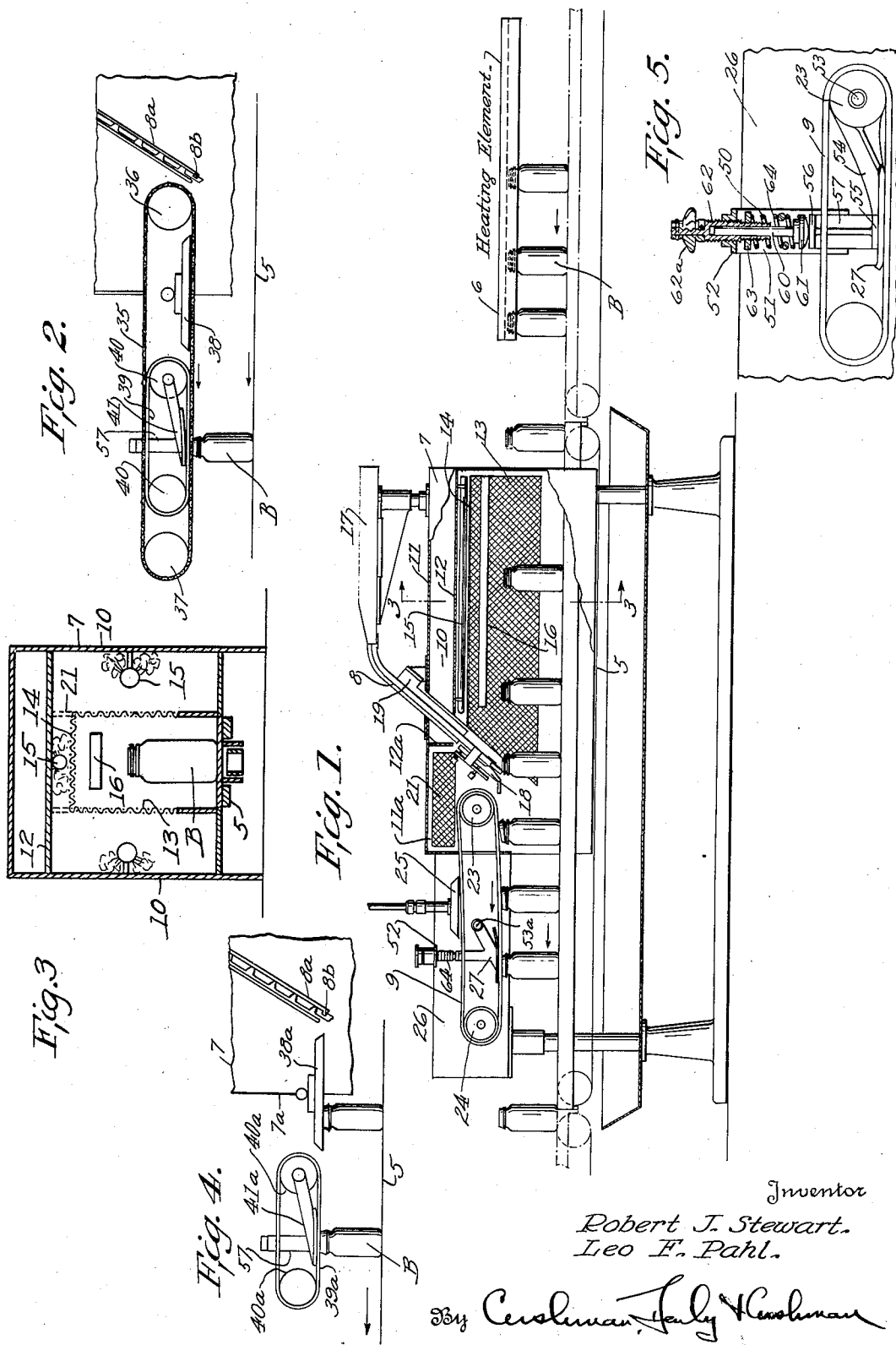
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APPARATUS FOR SEALING CONTAINERS

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APPARATUS FOR SEALING CONTAINERS

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The present invention relates to apparatus for sealing containers.

Numerous methods and apparatus have been provided for establishing a vacuum condition within the head space of a container at the time that a closure is applied thereto by filling the container head space with steam which will subsequently condense to establish the desired low pressure condition.

Most of such prior apparatus are not entirely satisfactory because they do not avoid the possibility of particles of water being present in the container head space after the completion of the operation, and also because they do not obtain optimum low pressure.

It is apparent that the deposit of water particles upon the wall of the container head space or upon the product within the container is highly objectionable, particularly in the case of dry products or products such as spoil in the presence of moisture.

With regard to the objection to prior apparatus on the ground that they do not prevent the presence of particles of water within the container head space, it is to be noted that prior arrangements do not provide means to prevent steam from condensing upon a cold or relatively cool container as the latter enters the apparatus. Obviously, if a container comes into contact with steam at a time when the container is at a lower temperature than the steam, some of the steam will condense upon the walls of the container head space or upon the container contents and will remain there throughout the entire container sealing operation.

It has heretofore been proposed to provide means within the steam tunnel to heat the containers when they initially enter the same. The purpose of such arrangements has been to preliminarily heat at least the head space of each container to steam temperature as it enters the steam tunnel so that when the container subsequently comes into contact with the steam jets positioned midway of the tunnel, no steam will condense upon the container. However, the positioning of the preliminary heating element within the inlet end of the steam chamber, that is, within an atmosphere of steam, is not satisfactory for the above purpose because the container will contact at least some of the steam within the chamber before it is ever heated to steam temperature and condensation within the container head space will therefore occur during the preliminary heating, defeating the entire purpose of the arrangement. Furthermore, in most cases,

steam is moving from the inlet end of the tunnel and it is, therefore, possible for containers to enter a cloud of steam before they enter the tunnel. If the containers are relatively cool at this time, condensation will form upon them before they reach the preliminary heating element within the tunnel.

A further cause of accumulation of moisture in the container head space has been because most prior apparatus have relied upon jets of steam forcibly jetted toward the container head space to supply the necessary steam. It will be apparent that when steam is forcibly jetted within a tunnel open at both ends, drafts will be induced by the jetting action and a stream of cool air will be drawn into and perhaps through the tunnel, tending to condense at least a portion of the body of steam in the tunnel. This will result in the deposit of moisture within the head space of containers and also prevent a uniform low pressure in successive containers.

The open ended tunnels ordinarily provided in apparatus of the prior type also permit drafts caused by external conditions to move through the tunnel, resulting in condensation of at least a portion of the steam.

The only way in which drafts within prior apparatus can be guarded against is to carefully regulate the temperature of the steam from time to time to make certain that it is always sufficiently dry to offset such drafts. Such adjustment requires some degree of skill and the necessity of maintaining the steam at a high temperature, of course, increases the expense of operation.

The principal object of the present invention is to provide an apparatus for uniformly establishing a low pressure condition within the head space of containers.

A further object of the invention is to provide an apparatus whereby no moisture will be present in the container head space after the sealing operation.

A further object of the invention is to provide a container sealing apparatus which is extremely efficient and can be economically operated to uniformly provide an optimum low pressure condition in containers.

In one aspect, the invention involves heating containers to at least steam temperature before they come into contact with any steam and then immediately moving them into the steam tunnel or chamber. In another aspect, the invention involves maintaining the steam tunnel or chamber filled with a quiet body of steam through

which the containers will move to have their head spaces filled with steam, and with no jetting action within the tunnel. It is found that the use of a quiet body of steam in the tunnel avoids the inducing of drafts which occur when steam is forcibly jetted into the open ended tunnel passage.

In some instances, a radiant heating element may be provided in the steam atmosphere to keep the steam at proper temperature and thereby fully offset the effect of drafts.

The invention further contemplates the provision of means to heat the container caps before they come into the steam atmosphere, thereby avoiding condensation upon the caps such as occurs when they are cold when delivered to the steam atmosphere. The caps will then move into the steam atmosphere before being applied to the container, with the result that air previously in the cap head space is forced out before the cap is applied and possibility of any air being entrapped between the cap and the container contents will be minimized. After application of the cap loosely to the container, the cap moves in contact with a heated element which either maintains the entrapped steam at its original temperature, or increases its temperature, depending upon the degree of vacuum desired. It is found that the application of heat to the cap after the steam has been entrapped between the cap and container produces a maximum vacuum effect because it expands the steam to the highest possible degree. Also, the application of heat to the cap at this time fully overcomes the effect which drafts might have had upon the steam before it was entrapped. In other words, even if the steam was not at the desired temperature when entrapped, due to extreme conditions peculiar to the particular plant where the apparatus is installed, the temperature of the steam can readily be increased by the subsequent heating of the cap.

Another object of the invention is to provide a capping structure adapted to be used with an endless belt.

Other objects of the invention will be apparent from the following specification and drawing, wherein

Figure 1 is a view, generally in longitudinal vertical section, of the apparatus of the present invention.

Figure 2 shows a modified form of sealing arrangement.

Figure 3 is a transverse vertical sectional view on the line 3—3 of Figure 1.

Figure 4 shows a second modified form of sealing arrangement, and

Figure 5 shows the sealing or capping element, with portions in vertical section.

Referring to Figures 1 and 3, the apparatus there illustrated comprises an endless container supporting conveyor 5, a preliminary heating element 6, a steam chamber or tunnel 7 including a cap applying chute 8 and a heated cap leveling and sealing belt 9. As indicated in Figure 1, the conveyor 5 may be in several sections all suitably driven.

The preliminary heating element 6 preferably comprises a radiant heater of electric type positioned at such height above the supporting conveyor 5 that it will be closely adjacent the mouths of containers. The element 6 should have sufficient heating capacity to heat the head space walls and the upper portion of the container contents to a temperature above that of steam

so that steam in the tunnel 7 will not condense thereon. Depending flanges may be provided as shown in order to concentrate the heat of the element. It will be noted that the outlet end of element 6 is spaced far enough away from the steam tunnel 7 that no steam from the latter will reach containers moving through the heating element; also, that the heating element is nevertheless close enough to the tunnel that containers will not lose the heat imparted to them by the heating element before they enter the tunnel.

The chamber 7 is in the form of a tunnel including outer side walls 10, a top wall 11, and a false top wall 12 which latter extends from the infeed end of the chamber to a point adjacent the chute 8. The walls 10 and 11 may be suitably insulated.

The containers move in chamber 7 within inner side and top walls 13 and 14 formed principally of reticulated material such as fine wire screening, walls 13 and 14 being sufficiently spaced from the outer side walls 10 and the false top wall 12 to enable steam jet pipes 15 to be positioned in the space between the inner walls and the adjacent imperforate walls. The pipes 15 have jetting apertures provided therein on their surfaces facing away from the inner reticulated walls with the result that no steam will be jetted into the reticulated tunnel portion, but this portion, through which containers move, will simply be filled with a cloud of steam at high temperature. The spacing of false top wall 12 from the exterior of the chamber insures that this wall will not be cooled by the exterior atmosphere and thus will prevent condensation forming and dropping into the reticulated tunnel portion. In some instances, a radiant heating element 16 will be positioned just beneath the top reticulated wall 14 so as to maintain the steam within the reticulated tunnel element at a sufficiently high temperature to keep the same dry.

The positioning of a radiant heater at this point to keep the steam at proper temperature is particularly desirable because air is most apt to be swept into the tunnel with the incoming containers. The radiant heater immediately heats such incoming air to prevent steam from being cooled and condensed. Furthermore, the use of a heating element heated by electricity or other arrangement entirely dependent of the steam supply adequately serves the above purpose. When an auxiliary steam heated element is used to overcome the effect of inswept air, the incoming air reduces the temperature of the auxiliary element to such an extent that it does not serve its purpose, at least not unless an extremely high temperature steam is used at the heater. The production of such steam is not practicable in most plants and, in any event, increases the cost of the process.

A cap supplying device 17 of any suitable form is mounted upon the upper wall 11 to furnish caps to the downwardly inclined chute 8, and the lower end of the chute terminates at a proper point to position the caps loosely upon the containers and being of such construction, as shown at 18, as to deliver a cap to each container.

A heating means 19, preferably including an electrical heating element, is positioned alongside the upper portion of chute 8 so that caps moving downwardly through the chute will be heated at least to the temperature of steam, namely, 212°. It will be observed from Figure 1 that the heating

element 19 extends sufficiently far upwardly along the chute 18 that caps will be thoroughly heated by the same before they move downwardly into the steam-filled portion of the casing 11 or come into contact with any steam which may rise in the chute.

It will also be noted from Figure 1 that the side walls 13 of the screen element terminate adjacent the lower end of the chute 8 and that the false top wall 12 terminating in a vertical transverse wall 12a. The side walls designated 11a extend from this point to the outlet end wall of the chamber 7, the walls 11a lying in the same plane as the walls 13 but extending to the top outer wall 11. As appears from Figure 1, the major portion of the extended side walls 11a are blank, but reticulated elements 21 are provided at the top portion of the extended walls 11a in order to enable steam to reach the extreme upper portion of the casing adjacent the capping element 9.

Capping element 9 is in the form of a belt and extends from within the outfeed end of the chamber 7, with its lower run positioned at such height that caps applied to containers by the device 18, will be leveled upon the containers and subsequently moved to sealing position upon the containers. This is accomplished by having the sprocket or pulley 23 over which the inner end of the belt moves positioned slightly above the pulley or sprocket 24 at the opposite end of the belt so that the lower run of the belt will be downwardly inclined from within the casing 7.

Element or belt 9 is preferably of metal link construction in order that heat may be applied to the same by a radiant heater 25 positioned adjacent the upper run of the belt and just beyond the outer end of the casing 7. A secondary heating action is thus obtained. If desired, vertically extending plates 26 may extend from the outfeed end of the casing 11 on each side of the belt 9. The function of these plates is to enclose the belt sufficiently that the portion of its lower run adjacent the casing 11 will be kept heated and drafts will also be more certainly excluded from the casing 7. For that purpose the plates preferably only extend sufficiently far in a vertical plane to lie alongside the belt, so that containers moving beneath the outer portion of the belt are in the open atmosphere.

A spring loaded capping shoe 27 of the construction hereinafter described is provided to contact with the upper surface of the lower run of belt 9 at a point spaced from the outfeed end of the casing 11. It will be observed that the end of the shoe 27 toward which containers approach is inclined upwardly, thereby serving to further guide to a horizontal position any caps which may still be at a slight angle. The belt 9 is driven by suitable means at the same speed as the container supporting belt 5.

Figure 2 shows a modified form of cap leveling and sealing arrangement comprising a belt of screen wire 35 extending from a pulley 36 adjacent the cap chute 8a to an outer pulley 37 and with a radiant heating element 38 positioned adjacent the lower end of the belt at a point quite close to the inner pulley 36. By this arrangement, containers moving beneath belt 35 will have the loosely applied caps properly leveled upon the same and, at the same time, will be more intimately exposed, through the mesh belt, to heating action from the heating element 38. A second belt 39 is provided within the belt 35 at a point between the heating element 38

and the outer pulley 37, belt 39 moving on pulleys 40 and with its lower run in contact with the lower run of the wire belt 35. A spring loaded capping shoe 41 bears upon the lower run of belt 39 so that caps will be sealed to containers as they move together beneath this portion of belt 35 and the lower run of belt 39. The two belts are driven at the same speed by any suitable means.

The operation of the structure shown in Figures 1 and 3 is as follows: Filled containers move to the casing 7 on the series of belts including the belt 5 and first pass beneath the heating element 6 so that at least the upper portion of the container as well as the upper portion of the contents will be heated to steam temperature. If any condensation is present upon the upper portion of the containers when they reach the element 6, such moisture will be dried by the radiant heat. From the element 6, the containers move into the steam chamber 7, element 6 being spaced such distance from the chamber to prevent steam from the latter moving adjacent the heating element but nevertheless being sufficiently close that the containers will not have an opportunity to cool to a point below steam temperature before they reach the chamber.

The body of quiet steam within chamber 7 will displace air from the container head space so that the container head space will be filled with steam. If the heating element 16 is provided within the steam chamber, it will prevent the steam therein from becoming cool. As the containers move beneath the cap applying device 18, a heated cap will be positioned thereon. The use of the heating element 19 on the cap chute 8 will insure that the caps are heated to steam temperature before they contact with any steam atmosphere rising through the chute. Application of the cap in the steam atmosphere will, of course, further insure that all air will be displaced from both the container head space and the cap interior.

Immediately beyond the cap applying device 18, the caps will contact with the slightly downwardly inclined lower run of the capping belt or element 9. The portion of the belt with which a cap contacts has already been heated by the radiant heating element 25 and maintained at such raised temperature by steam issuing from the upper reticulated element 21. Sufficient heat is applied to the belt to raise its temperature substantially above that of steam and therefore the temperature of the steam entrapped within the container head space will be further raised before the cap moves beneath the capping shoe 27. Since the caps are not in sealed position upon the containers during the heating thereof by element 9, a portion of the entrapped atmosphere will escape when it is expanded by the heating action. This, of course, produces a high vacuum effect after the fluid within the head space is subsequently contracted.

Capping shoe 27 will force the caps to sealed position upon the containers, the caps used with the present method and apparatus being of the type including container engaging locking elements to hold them in sealed position. Hence, when the containers move out of contact with capping element 9, the expanded fluid within the container head space cannot force the cap from sealed position. Shortly after movement of the containers out of contact with the capping element 9, the head space atmosphere will

contract to establish a high vacuum condition within the head space.

The form of invention illustrated in Figure 2 operates in the same manner as that of Figures 1 and 3 except that it is possible with the Figure 2 construction to apply a higher degree of heat to the loosely applied cap because the cap will be more thoroughly exposed to the heat of radiant heater 38, due to the fact that the endless leveling element 35 is formed of a wire mesh screen or other reticulated element. This form of the invention may also be used with caps of the type which rely primarily upon a low pressure condition within the container head space to keep the caps in sealed position. This is due to the fact that the caps will only momentarily be exposed to heating action, that is, only while under the heating element 38, and during the remainder of their travel with the belt 38 the cap and the aligned portion of the belt 35 may cool. Thus, the expanded heated fluid within the container head space may likewise cool and contract to hold the cap securely in sealed position before the cap and container move from beneath the element 35.

Figure 4 shows a modified form of secondary heating and capping structure, particularly adapted for use with caps of the type which require no special leveling treatment other than that which may be given them by the cap applying chute and the capping means. In the Figure 4 construction, the containers, with the caps loosely applied, move beneath a radiant heating element 38a positioned in or adjacent the outfeed opening of the steam chamber 7 and the containers then move beneath a capping belt 39a moving about pulleys 40a and with a spring loaded capping element 41a acting upon the lower run of the belt. By this arrangement, the caps are more directly exposed to the heating element 38a, and hence the temperature of the steam within the container head space can be more quickly raised before the container moves beneath the capping element.

It will be understood that the side plates 26 illustrated in Figure 1 may be provided with the structures shown in Figures 2 and 4, so that heat may be more readily maintained adjacent the capping structures shown in Figures 2 and 4.

The cap applying chutes 8a diagrammatically illustrated in Figures 2 and 4 are of the type wherein the lowermost cap bears against lugs 8b on the sides of the lower extremity of the chutes so that an advancing container may lift the lowermost cap over such lugs. It will be understood that suitable leveling devices may be applied to these chutes.

The steam chambers illustrated in Figures 2 and 4 would preferably be of the same construction as that illustrated in detail in Figure 1. That is, Figures 2 and 4 merely diagrammatically illustrate the steam chambers.

It will, of course, be understood that the elements 9 and 35 of Figures 1 and 2, respectively, and also the element 39a of Figure 4, may always be of sufficient length to permit the containers to move into a cooler atmosphere before they pass out of contact with these elements and, under such conditions, even the apparatus illustrated in Figure 1 could readily be used to apply caps of the type which rely primarily upon a vacuum condition to be held in sealed position upon the containers.

Figure 5 illustrates in detail the shoe 27 diagrammatically shown in Figures 1, 2, and 4 to

bear upon belt 9 to provide a capping element. The same arrangement is diagrammatically indicated at 41 in Figure 2 and at 41a in Figure 4. Referring to Figure 5, the numeral 50 designates an angled member having a vertical leg 51 fixed to a stationary structure, such as the vertical plate 26, and a horizontal leg 52 projecting above the belt 9. The shoe 27 is pivoted on the shaft 53 which carries sprocket or pulley 23, preferably by trunnions extending adjacent each end of the sprocket, as indicated in Figure 4, and which joins inwardly of the sprocket to form the arm 54 which lies between the runs of belt 9. In some instances, as in Figure 1, the arm 54 may be pivoted on a separate shaft 53a. At its free end arm 54 has integral therewith a U-shaped bracket including a lower plate 55, an upper plate 56 and a vertical plate 57, the latter braced by a web. Plate 57 lies outside the plane of belt 9 but upper plate 56 is directly above the upper run of the belt and also directly above lower plate 55. In other words, the U-shaped bracket may be said to laterally straddle the upper run of belt 9.

A plunger 60 has a rounded base 61 which bears on upper plate 56, the stem of the plunger being slidable in a sleeve 62 threaded in the horizontal arm of fixed member 50 and including a fixed hand wheel 62a. A nut 63 is threaded on sleeve 62 below leg 52 and a coil spring 64 extends between this nut and the base 61 of plunger 60 so as to maintain the latter and also shoe 27 under pressure. The tension of spring 64 can be adjusted by adjustment of nut 63, while the position of shoe 27 with respect to the lower run of belt 9 can be adjusted by rotation of sleeve 62 in member 50.

Containers of the same size usually vary in height from a known minimum to a known maximum. In setting shoe 27 for a run of containers, its position will ordinarily be so adjusted by rotation of sleeve 62 that belt 9 will exert the proper sealing pressure upon a cap on a container of minimum height of the size being operated upon. Spring 64 will then compress or "compensate" so that only capping pressure, and not crushing pressure, will be exerted upon containers of greater height. The rounded surface of plunger base 61 will permit shoe 27 to rock upwardly beneath the same.

The terminology used in the specification is for the purpose of description, the scope of the invention being defined in the claims.

We claim:

1. In an apparatus for vacuumizing containers, a tunnel open at both ends, means to continuously move containers through the tunnel, steam supply means to maintain a steam atmosphere in the tunnel, cap feeding means having a delivery end in the tunnel, and means heated independently of the steam supply means to heat the portion of the tunnel adjacent the inlet end and in advance of said delivery end.

2. In an apparatus for vacuumizing containers, a steam tunnel comprising outer side and top walls and an inner passageway for containers defined by inner walls spaced from the outer walls and including reticulated portions extending inwardly from the inlet of the tunnel, steam supply pipes in the space between said walls and having jets facing the outer walls, cap applying means at the inner end of the reticulated wall portions, a cap heating element beyond the cap applying means, and a reticulated element in the inner walls adjacent said element.

3. In an apparatus for vacuumizing containers, a steam tunnel comprising outer side and top walls and an inner passageway for containers defined by inner walls spaced from the outer walls and including reticulated portions extending inwardly from the inlet of the tunnel, steam supply pipes in the space between said walls and having jets facing the outer walls, cap applying means at the inner end of the reticulated wall portions, and an endless cap heating and sealing element beyond the cap applying means and extending to the exterior of the tunnel.

4. In an apparatus for vacuumizing containers, a steam tunnel comprising outer side and top walls and an inner passageway for containers defined by inner walls spaced from the outer walls and including reticulated portions extending inwardly from the inlet of the tunnel, steam supply pipes in the space between said walls and having jets facing the outer walls, cap applying means at the inner end of the reticulated wall portions, an endless cap heating and sealing element beyond the cap applying means and extending to the exterior of the tunnel, and vertical

plates extending alongside said endless element exteriorly of the tunnel.

5. In an apparatus for vacuumizing containers, means to displace air from a container head space, fill the head space with steam and loosely apply a cap thereto, and means to heat and level the cap upon the container comprising a radiant heater and a metal mesh endless element having upper and lower runs, the lower run being adapted to engage the cap and the heater being disposed immediately above said lower run, and means to move the cap to sealing position on the container.

6. In an apparatus for vacuumizing containers, means to heat and level a loosely applied cap upon the container comprising a radiant heater and a metal mesh endless element having upper and lower runs, the lower run being adapted to engage the cap and the heater being disposed immediately above said lower run, and means to move the cap to sealing position on the container.

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