March 7, 1950 E. O. HILLER 2,500,075

APPARATUS FOR AND METHOD OF DRYING CONTAINERS

Filed Jan. 12, 1948 3 Sheets-Sheet 1

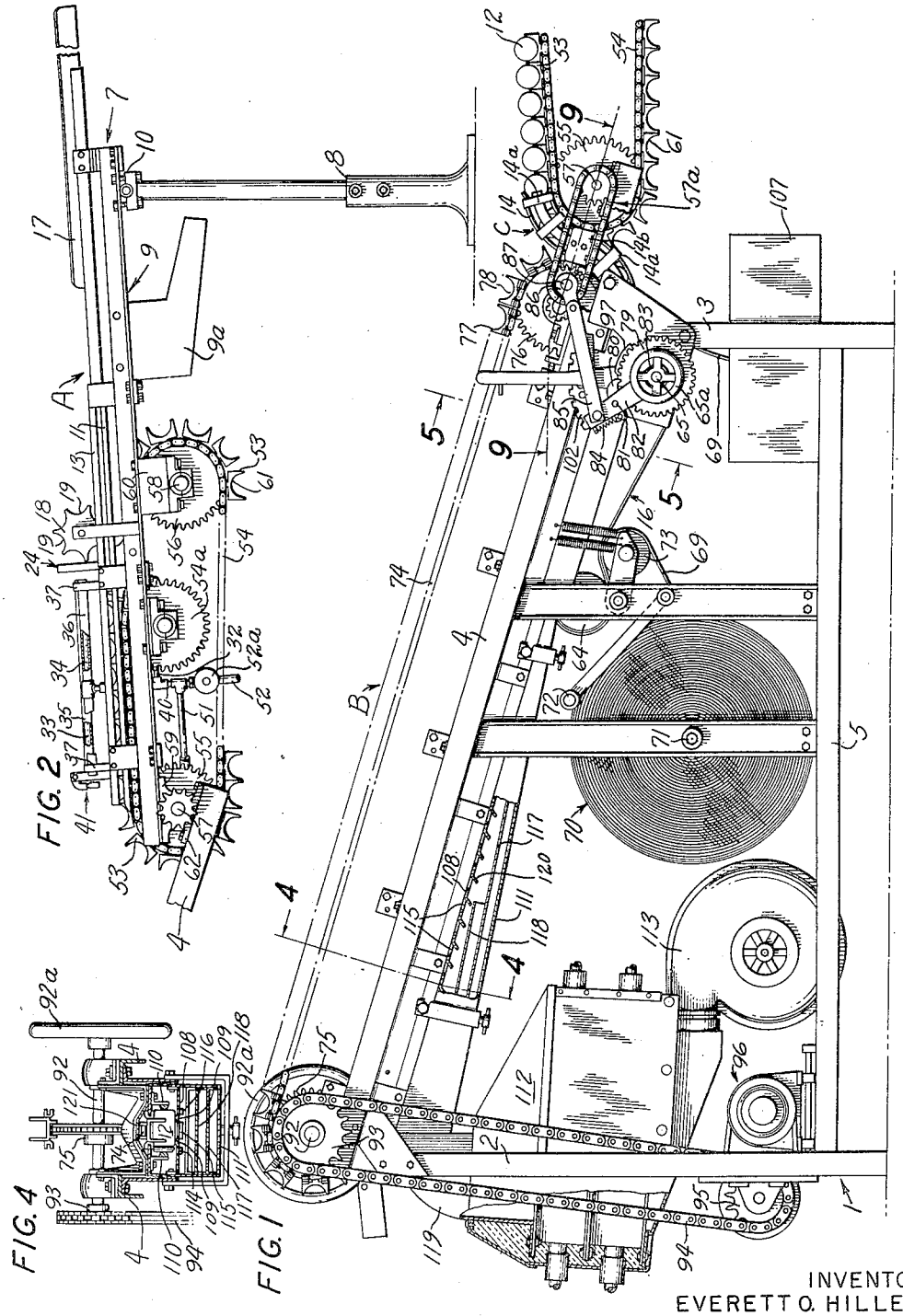


FIG. 2

FIG. 4

FIG. 1

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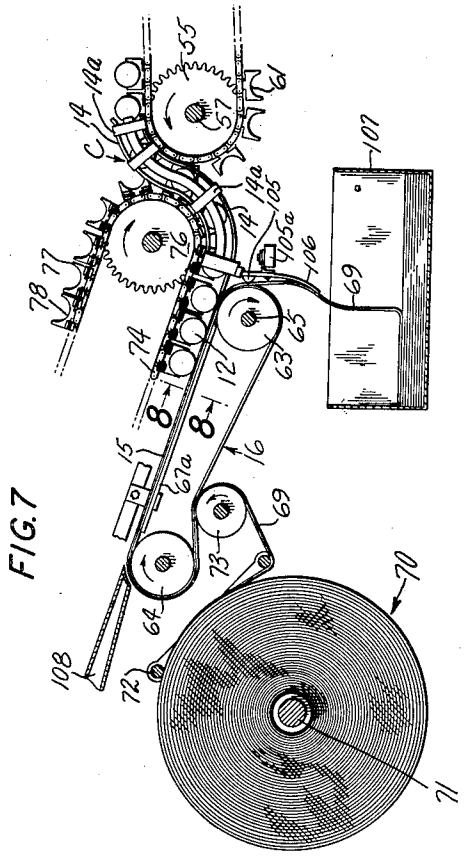


FIG. 7

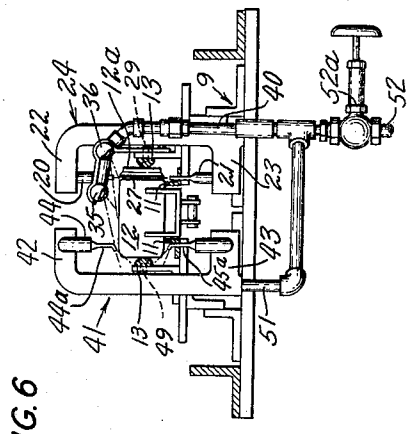


FIG. 6

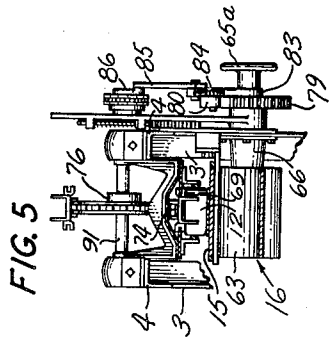


FIG. 5

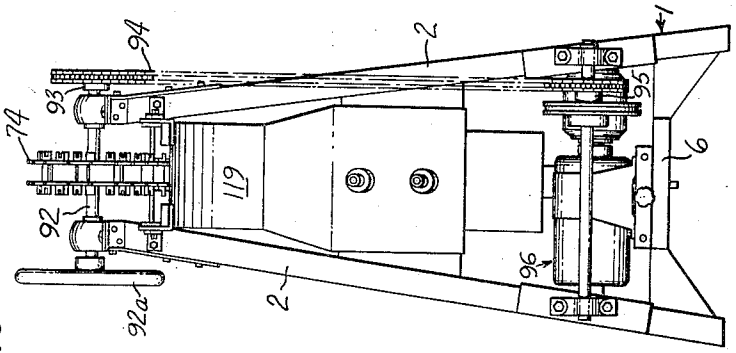


FIG. 3

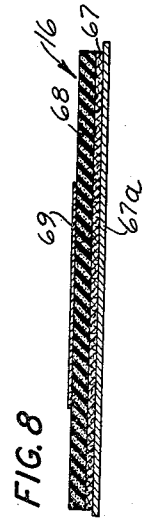


FIG. 8

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FIG. 9

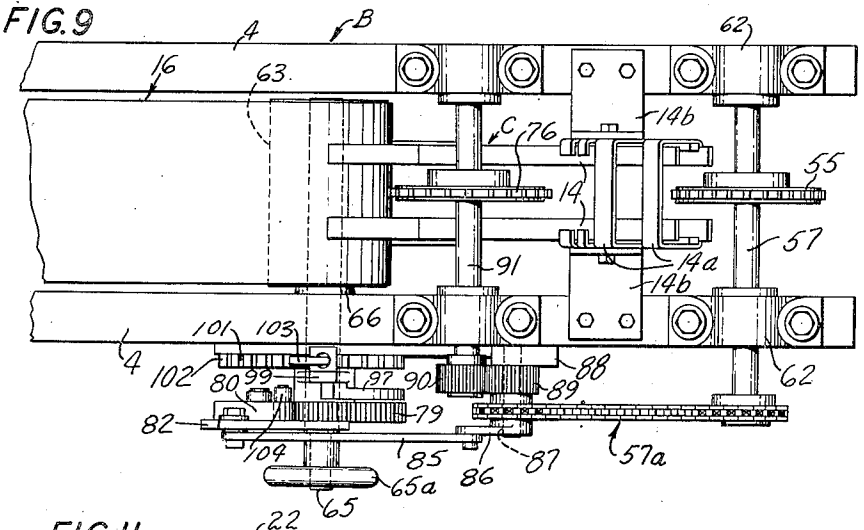


FIG. 11

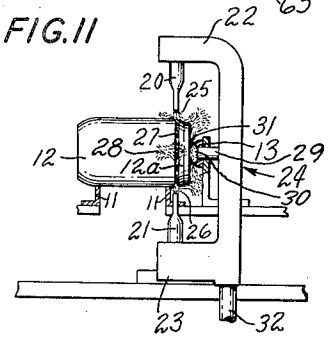


FIG. 10

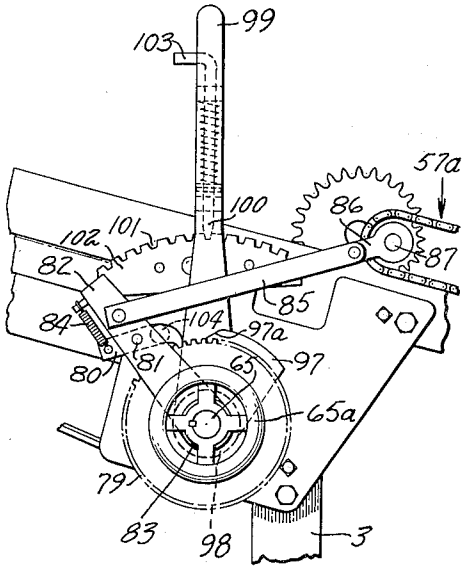


FIG. 12

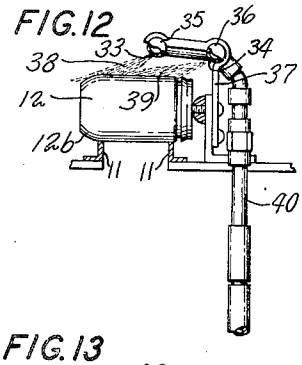
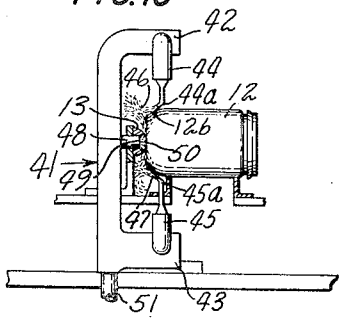


FIG. 13



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UNITED STATES PATENT OFFICE

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APPARATUS FOR AND METHOD OF DRYING CONTAINERS

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Application January 12, 1948, Serial No. 1,684

17 Claims. (Cl. 34—9)

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This invention relates to the drying of containers, such as jars and cans, which are wet for any reason, as because of sterilization, pasteurization, washing or other wet processing or because of condensation when cool containers are brought into a warm, humid atmosphere.

An object of the invention is to provide an efficient and economical apparatus for and method of drying wet containers, especially containers which have been packed or filled and sealed, while the containers are en route to a place at which they are to be labeled, decorated, or otherwise treated or handled.

Another object of the invention is to provide an apparatus for and method of drying containers thoroughly, rapidly and completely while the containers are being moved along a predetermined part of a packing line or other path in a container packing plant or like place.

A further object of the invention is to provide an apparatus and a method which is particularly well adapted for the drying of wet filled and sealed glass jars, as capped baby food jars, having a peripheral gap or recess extending partially under the edge of the skirt of the jar cap and from which moisture is difficult to dislodge, so as to drive out all droplets and concentrations from such gap or recess, including the portion thereof extending under the edge of the skirt of the cap and to assure a completely dry labeling surface on each of such jars at the time it is presented in the normal course of jar packing and handling operations to a labeling machine or at a station at which the jar is to be labeled, decorated or otherwise treated or handled.

Most prior devices and methods used for drying wet containers prior to labeling, of which I have any knowledge, rely on evaporation of the moisture on the containers and therefore require a relatively long drying time as evaporation, being a surface phenomenon, is very slow for droplets or globules of moisture. Removal of moisture from the surfaces of such containers by means of fixed felt pads has been attempted but has been attended by practical disadvantages, because of the necessity of frequent replacement and laundering of the felt pads and serious shortening of their effective life because of surface glazing which soon reduced and often destroyed the moisture absorbing capacity of such pads. Residual moisture on the surface of food containers just prior to labeling usually contains food particles, and, in the use of prior devices having fixed felt pads as a blotting means, such food particles may be imbedded in the fixed blotting means and decompose, thereby producing a highly unsanitary condition.

The present invention avoids the above and other shortcomings of the prior devices. It provides at an advantageous place in the handling

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and drying of the wet containers an efficient and economically usable blotting medium, of which paper is an example, together with a feeding mechanism for the blotting paper of such a character as to allow use of the blotting paper at its most efficient blotting condition, i. e., slightly moist so that capillarity is at its maximum, and to replace the used blotting paper during operation with fresh paper. The paper feeding mechanism of the apparatus of the present invention may feed paper from a supply roll to a container blotting position so that used blotting paper will be replaced automatically by fresh paper at a predetermined rate suitable for efficient operation and result. Such mechanism may include a manual control which may be utilized when circumstances require. Thus, if the cap of a filled food jar undergoing blotting treatment should come off so that the contents of the jar were spilled on the active blotting paper surface, it is only necessary with the mechanism of the present invention to turn a hand wheel of the paper feed mechanism until all soiled blotting paper has been replaced by fresh, clean paper.

Other objects and advantages of the invention will hereinafter be pointed out or will become apparent from the following description of a practical embodiment of the invention as illustrated in the accompanying drawings, in which:

Fig. 1 is a side elevation of one of two cooperative sections of a drying apparatus embodying the invention and of a fragmentary portion of the second of such sections;

Fig. 2 is a side elevation of the second section of the drying apparatus and of a fragmentary portion of a frame structure of the first section;

Fig. 3 is an end view of the structure shown in Fig. 1 as viewed from a position at the left-hand end thereof;

Fig. 4 is a section substantially along the line 4—4 of Fig. 1;

Fig. 5 is a section along the line 5—5 of Fig. 1;

Fig. 6 is a view partly in transverse vertical section and partly in end elevation, showing parts of the supporting structure and the system of air jets for scavenging moisture from the containers while they are moving along a runway of the structure shown in Fig. 2;

Fig. 7 is a fragmentary view, partly in longitudinal vertical section and partly in side elevation of adjacent portions of the two cooperative sections of the apparatus and of a connecting transfer chute, showing particularly a roll of moisture blotting material and the provisions for bringing successive portions of this material into blotting contact with the containers to be dried;

Fig. 8 is a section along the line 8—8 of Fig. 7;

Fig. 9 is a plan view of a portion of the structure of Fig. 1, substantially as viewed from the plane indicated at 9—9 of that view and showing

details of driving mechanism of the apparatus;

Fig. 10 is a side elevation of a fragmentary portion of the structure shown in Fig. 9, showing an adjustable, crank-driven, pawl-and-ratchet drive mechanism that is included in the apparatus;

Fig. 11 is an elevation showing in a somewhat schematic fashion air jet means for scavenging moisture from an end portion of a container at one place along its path of movement in the apparatus;

Fig. 12 is a view similar to Fig. 11 but showing means for applying jets or streams of air to the body of the container at a subsequent place along its path of movement; and

Fig. 13 is a view similar to Figs. 11 and 12 but showing air jet means for driving moisture from the end portion of the container opposite that dealt with in Fig. 11.

The present invention contemplates application of a plurality of specifically different drying treatments to a wet container at different places along its path of travel. Thus, each such container may be subjected to suitably located, suitable air jets and streams to break up droplets or relatively large accumulations of residual water in the grooves and depressions and other portions of the surface of the container and to atomize and drive off most of such moisture, especially from the end portions of the container. Thereafter, the container may be subjected to a blotting treatment of its peripheral surface to remove therefrom any remaining droplets and substantially all moisture in any form, leaving at the most only a very thin film of moisture. After the blotting treatment, the container may be subjected to the drying and warming action of preheated air or streams or currents of warm air completely enveloping the entire container or at least any surface portion thereof that might bear any residual film of moisture, whereby to assure complete absence of moisture from and dryness of the surface of the container and especially of the portion thereof to which a label or other decoration or marking is to be applied.

An apparatus embodying the invention may comprise a section shown in Fig. 2 and generally designated A in which the wet containers are subected to the action of jets of air, a cooperative section shown in Fig. 1 and designated B in which the containers are first blotted and later dried by preheated air, and a connecting gravity transfer conveyor runway or chute, shown in Figs. 1 and 7 and designated C, between the sections A and B.

The section B comprises a framework, generally designated 1, comprising a pair of end uprights 2 at one end of the section, Figs. 1 and 3, shorter uprights 3 at the opposite end of the section, Figs. 1 and 5, inclined upper longitudinal frame members 4, Figs. 1 and 4, operatively connected with the supporting end uprights 2 and 3 in any conventional manner, lower longitudinal frame members, one of which is shown at 5 in Fig. 1, similarly connected in any conventional manner with the end uprights 2 and 3, together with such further conventional transverse, vertical and longitudinal frame members as may be deemed necessary or desirable to provide a suitably strong and stable supporting framework 1 in accordance with known practice. Such further frame members may include a transverse lower supporting member or base, as indicated at 6 in Fig. 3.

The section A may have its own framework, generally designated 7 in Fig. 2, comprising a floor stand 8 and an elongate head frame 9 supported at one end, as at 10, on the floor stand so that its oposite end may be suitably positioned at the desired height above the floor and in relation to the adjacent, relatively lower ends of the inclined upper longitudinal members 4 of the framework 1 of the section B. The head frame 9 is downwardly inclined, in the example shown, from its floor stand supported end toward the adjacent end of the framework 1.

The head frame 9 of section A includes a gravity runway for containers comprising a pair of rails 11, Fig. 6, located in parallel relation and spaced suitably for the particular container that is to be dried. In Fig. 6, and in other views of the drawings, the container shown is designated 12 and is a baby food jar. The rails 11 are spaced apart less than the length of the body portion of this jar so that it may roll on these rails between a pair of longitudinally extending guide rails 13 which also are provided in the head frame 9 to prevent, by contact with the opposite ends of the containers 12, any appreciable axial shifting of such containers as they roll on the rails between these guide bars. At the lower end of the runway, the containers 12 may roll off the ends of the rails 11 into the transfer runway or chute C, Fig. 1. This comprises suitably curved and relatively positioned longitudinal members 14 connected by spaced holding bands 14a so as to define an open-ended longitudinally reversely curved open-work structure through which the containers 12 may have guided rolling movement from the runway of the section A to a lower level receiving portion of the section B, as onto the adjacent end of the upper stretch 15 of an endless conveyor belt 16, the function of which in the apparatus will hereinafter be explained. The runway or chute C may be held in place by conventional means, as by being fastened at 14b, Figs. 1 and 9, to the framework of the section B.

It may be noted at this point that the containers 12 may be delivered onto the rails 11 in the section A by a feed chute 17, Fig. 2, or placed thereon in any other suitable way so that the containers roll upon their sides in a series or single file order. The downward inclination of the rails 11 will cause them to roll thereon toward the transfer runway or chute C. While moving along the rails 11, they are subjected to the scavenging action of jets of air and the section A therefore may be termed the scavenging section.

The head frame 9 of this scavenging section may carry a waste or refuse receptacle 9a into which any broken containers or other discardable matter may drop.

In rolling downward on the rails 11, each container 12 may pass beneath and be engaged by a suitable container feed member, such as a freely turnable star wheel 18, the peripheral surface of which comprises a series of pockets 19, each shaped to conform generally to the curvature of an arcuate part of the body of the container 12 so as to space successive containers apart as they pass beneath the star wheel or the containers may be spaced apart by any other suitable means so that each may be subjected to the action of suitably placed jets of air under pressure for the desired moisture scavenging action. Thus, the end of the container that carries the sealing cap, designated 12a, passes between vertically aligned, opposed upper and lower air nozzles 20 and 21, respectively, on the upper and lower branches 22 and 23, respectively, of a substantially C-shaped

air discharge head or manifold 24, Figs. 6 and 11, which is positioned on the head frame 9 of the scavenging section so that each container 12 as it rolls on the rails 11 between the side guide rails 13 will be subjected to opposed jets of air, indicated at 25 and 26, respectively, Fig. 11, from the upper and lower nozzles 20 and 21, these jets impinging radially upon the container at the groove, indicated at 27, between the edge of the sealing cap 12*a* and the adjacent shoulder on the body of the container. The jets or streams of air from the opposed upper and lower nozzles 20 and 21 will be spread by the periphery of the rotating jar so as to pass around that periphery, mainly at the groove 27 and into any space beneath the edge of the skirt of the cap 12*a*, until they meet, as indicated at 28, at each of the opposite sides of the container. The meeting streams or jets of air and the moisture driven by them out of the groove 27 and from underneath the edge of the cap skirt will be diffused and scattered as they come together so as to effectively break up and atomize any drops or relatively large masses of water. These jets also will act sufficiently on the portions of the jar and the jar cap adjacent to the groove 27 to break up and drive off any accumulated masses of water or water that otherwise would adhere thereto or lodge underneath the edge of the skirt of the cap. They also impart a motion to residual liquid on the adjacent part of the body in the direction of the opposite end of the body. An air jet also may be directed against the head of the jar cap or in other words against the adjacent end of the closed container. As shown, Figs. 6 and 11, an air nozzle 29 extends from the body of the air head or manifold 24 through a suitable aperture 30 in the adjacent guide rail 13 so as to discharge a jet of air 31 against the adjacent end of the sealed container. This will break up any residual moisture thereon and drive the diffused moisture radially outward on the end surface of the container to the edge thereof whence the air from the end nozzle may meet air from the opposed radial nozzles 20 and 21 and at which the resulting turbulence will be highly effective in breaking up and driving off moisture.

The head or manifold 24 is shown as being operatively connected at its lower end with an air pressure supply pipe 32.

Use of an axially directed end air jet also will be effective to prevent any drawing of moisture to the head of the cap or end of the container by any partial vacuum action there by reason of the outward sweep of air and moisture from the skirt of the cap.

On leaving the zone of treatment by jets from the head 24, the container 12 is acted upon by laterally directed jets or streams from jet holes 33 and 34, respectively, in longitudinally extending, closed ended air discharge pipes 35 and 36, respectively. These are supported, as by one or more brackets 37, Figs. 2, 6 and 12, on the head frame 9 of the scavenging section of the apparatus so that the respective pipes 35 and 36 are suitably located in respect to each container 12 rolling on the rails 11 therebeneath to subject successive zones of the periphery of the body of the container to the action of air jets or streams 38 and 39, respectively, from the jet holes 33 and 34 so as to sweep any moisture on the periphery of the body of the container from the end thereof bearing the cap 12*a* to and at least in part from the opposite or bottom end of the container. These jets impinge against the periphery of the body of the container in directions having components both downward toward the surface of the container body and toward the bottom end of the container. The respective pipes 35 and 36 are spaced so that the pipe 35 is in advance of and slightly above the level of the pipe 36, these relative positions assuring complete longitudinal sweeping of the periphery of the container body by the component action of the air jets or streams 38 and 39.

As shown, the pipes 35 and 36 receive air under pressure from an air pipe 40.

The container 12 may be acted upon further after it has rolled downward on the rails 11 beyond the zone of jets or streams from the pipes 35 and 36. A second substantially C-shaped air discharge head or manifold, designated 41, Figs. 2, 6 and 13, is mounted on the supporting head frame 9 of the scavenging section A at the opposite side of the runway from the manifold 24 and at the opposite end of the pipes 35 and 36. The air discharge head or manifold 41 has upper and lower end portions 42 and 43, respectively, Figs. 6 and 13, provided with opposed air nozzles 44 and 45, respectively, for directing opposed jets or streams of air 46 and 47, respectively, onto the tapering or somewhat rounded end portion 12*b* of the container 12 by which the body of such container is merged into its bottom portion. It will be noted that the jets 46 and 47 are inclined toward the plane of the bottom of the container 12, the discharge ends 44*a* and 45*a* of the nozzles 44 and 45, respectively, preferably being at about 45° to the horizontal when the portion 12*b* of the body of the container has a curvature substantially as shown so that these jets not only are divided on striking the container so as to tend to pass around the periphery of the portion of the container adjacent to the bottom and to meet in part at the sides of this portion of the container body but the divided and subdivided jets also sweep over the edge of the container body at its juncture with the bottom and effectively break up and drive from such container body any residual drops of moisture and atomize any moisture reaching the bottom edge of the container. Preferably, additional scavenging air is directed against the bottom of the container. Thus, as best seen in Fig. 13, an air nozzle 48 projects from the body of the air discharge head or manifold 41 through a suitable aperture 49 in the adjacent guide rail 13 so as to direct a jet or stream of air 50 directly against the center of the bottom of the container 12. This air will be spread and diffused radially outward on the bottom surface of the container so as to effectively drive off any drops of moisture and to cooperate with air from the opposed nozzles 44 and 45 to create a turbulent condition at the edge of the bottom surface of the container with attendant results such as have been pointed out in the description of the use of the other end air jet.

As described so far, the containers 12 are subjected to moisture scavenging treatment by three specifically different air-applying units as such containers roll downwardly on the rails 11 of the head frame 9, the action of each air jet or stream complementing that of the others. The air discharge head or manifold 41 may be supplied with air under pressure by a pipe 51 and all of the several pipes 32, 40 and 51 for the several heads or jet discharge elements hereinbefore described may be connected with a common air supply pipe 52. This may be provided with a conventional valve 53, Fig. 6, or any other suitable known control

means. The scavenging air may be pre-warmed, if desired.

The rate of movement of the containers along the rails 11 may be controlled and a desirable relative spacing of the individual containers may be provided and maintained by a mechanism comprising container engaging members 53 on a suitably positioned and operated endless chain 54. The chain 54 is trained about sprockets 55 and 56, respectively, on shafts 57 and 58, respectively, mounted in bearings 59 and 60, respectively, carried by the head frame 9. The chain 54 may be driven by means presently to be described so that the upper stretch thereof moves in the same direction as the gravity movement of the containers 12 down the inclined rails 11 so that the members 53 on the upper stretch of the chain 54 engage and space apart and control the rate of forward movement of the containers. As shown, each of the members 53 is formed or provided with a reentrant, preferably arcuately curved surface 61, defining a shallow pocket for partially embracing the body of an overlying container 12 on the runway rails 11. The upper stretch of the chain 54 may pass over an idler sprocket 54a, Fig. 2, so as to be supported intermediately and positioned thereby suitably to assure dependable engagement of the members 53 with the overlying containers on the rails 11, at least while such containers are being treated by the several jets of air, as hereinbefore described. It may be noted at this point that the shaft 57 on which the sprocket 55 is not only mounted in bearings 59 carried by the head frame 9 of the scavenging section A of the apparatus but also is mounted in bearings 62, Figs. 2 and 9, on the projecting lower end portions of the top inclined side rails 4 of the framework structure of the section B of the apparatus, thereby stably connecting the adjacent ends of the two framework structures and providing a firm support for the connecting transfer chute or runway C.

The containers 12 are caused to travel from the lower receiving end of the section B of the apparatus to the higher end of the head structure thereof and are subjected to a moisture blotting treatment during one part of this travel and to the action of preheated air enveloping or sweeping over them during a subsequent part of this travel. The conveyor belt 16 onto which each container 12 passes from the transfer chute C is supported at its lower or container receiving end upon a pulley or roll 63, Figs. 5, 7 and 9, and at its opposite or relatively higher end upon a pulley or roll 64, Fig. 7. One of these pulleys or rolls, as 64, may be an idler roller. The pulley or roll 63 is mounted on a shaft 65, suitably journaled, as at 66 in Figs. 5 and 9, on a part of the framework structure of the section B and driven intermittently in a clockwise direcction by a mechanism presently to be described. A hand wheel 65a may be provided on an end of the shaft 65. The belt 16 may comprise a strand 67, Fig. 8, of any suitable material sufficiently tough and strong for service as a belt, such as leather, rubber composition, canvas, or other fabric. The strand 67 may rest upon a rigid supporting plate 67a. See also Fig. 7. This strand or layer 67 carries a relatively thick layer or facing 68 of a suitably resilient and yielding material, such as sponge rubber. Carried on the layer 68 is a sheet 69 of moisture blotting material, as paper. This may be a portion of a supply sheet of the blotting material, wound to form a roll 70, this roll being suitably mounted, as on an axle 71, Figs. 1 and 7, and suitably located, as in the frame work structure of the section B, Fig. 1, so that successive portions thereof may be drawn from the roll into the upper stretch of the belt 16 as required. A suitable presser element 72 bears against the outer turn of the blotting sheet of the roll 70 so as to prevent unintended or too rapid unwinding thereof from the roll. This blotting sheet, on leaving the roll 70, may pass around a spring tensioned pinch roll 73 by which it is pressed against the lower stretch of the belt 16 near the roll 64 so as to be wound over the roll 64 onto the upper stretch of the belt 16 and advanced toward and over the roll 63 as the belt 16 is given a clockwise step-by-step movement by means presently to be described. The roll 73 also functions as a tightener for the belt 16. Each container 12 thus is deposited, on leaving the transfer chute C, transversely across the blotting sheet 69 on the upper stretch of the belt 16. The movement of the underlying support thus provided for the container is counter to the direction of travel of the container to reach the opposite and higher end of the section B of the apparatus.

Rolling of the containers up along the upper stretch of the conveyor 16 and specifically over the blotting sheet 69 thereon may be effected in various ways. The apparatus shown includes an endless chain 74, Fig. 1, trained about a sprocket 75 on the higher end of the framework structure 1 and about a sprocket 76 on the lower end of such framework. This chain 74 carries container engaging members 77 which may be substantially like the container engaging members 53 hereinbefore described, each member 77 having a curved surface, designated 78, forming a pocket for partially embracing and engaging with the body portion of a container 12. The chain 74 is appropriately positioned with relation to the containers 12 on the upper stretch of the belt 16, Figs. 5 and 7, so that when such chain is driven clockwise, as viewed in Figs. 1 and 7, the container engaging members 77 on the lower stretch of the chain will partially embrace successive containers moving onto the upper stretch of the belt 16 and will impel them in a rolling fashion upwardly along the upper stretch of the belt 16, thereby subjecting the body of each individual container so moved to a moisture blotting treatment. The strip or sheet 69 of blotting material may have a width substantially the same as the over-all length of the container 12, as indicated by the showing of Fig. 5, and in any event is of sufficient width to contact the body of the container throughout all portions thereof on which residual moisture may cling and especially throughout all portions of the container body which may be labeled or receive any decoration or be given other surface treatment.

The movement of the belt 16 will feed blotting paper from the roll 70 at a sufficiently rapid rate to assure sufficient blotting of each container when these containers are being moved through the apparatus at the rate required for coordination with other operations involving the containers in question. As shown, Figs. 1, 5 and 10, the shaft 65 on which the driving roll 63 is mounted carries a ratchet wheel 79 with which a pawl 80 is engageable to turn the ratchet wheel clockwise about the axis of the shaft 65. The pawl 80 is pivoted at 81 on an arm 82 projecting from a hub 83 loose on the shaft 65. A tension spring 84 operatively connects the tail end of the pawl 80 with the outer end of the arm 82 and tends to urge the pawl 80 about the axis of its

pivot 81 into engagement with the teeth of the ratchet wheel 79. The arm 82 is operatively connected by a link 85 with a crank 86 on a shaft 87 projecting from a suitable bearing 88, Fig. 9, on a part of the frame structure of the section B. The shaft 87 carrying the crank 86 also carries a pinion 89 engaged with a pinion 90 on the end of a shaft 91 which carries the sprocket 73. The sprocket 76 is driven by the chain 74 which receives motion from the sprocket 75; the latter is mounted on a shaft 92, Fig. 1, carrying a sprocket 93 connected by a chain 94 with a sprocket 95 having a driven connection with a suitable motor and speed change unit or other driver, represented more-or-less diagrammatically by the showing at 96 in Fig. 1. A hand wheel 92*a*, Figs. 1 and 3, may be provided on the shaft 92 to reel off blotting paper when a clean sheet is required, as because of contamination of the then active blotting surface. The crank 86 will be rotated clockwise continuously by the driving mechanism described when the driver 96 is in operation and the pawl 80 likewise will be oscillated back and forth along a path of constant amplitude. To adjust the amplitude of the angular movement of the ratchet wheel by the pawl, provision is made to predetermine the time in each forward stroke of the pawl at which it is thrown out of engagement with the ratchet wheel. For this purpose, a pawl throw-out cam 97, Fig. 10, is provided on a hub 98 on the shaft 65, this hub being provided with an upstanding arm 99. A spring loaded latch 100, carried by the arm, is engageable with one of a series of teeth or notches, 101, in the arcuate upper surface of a fixed latching plate 102. By releasing the latch 100, as may be done by the thumb piece 103, and swinging the arm 99 around the axis of the shaft 65, the inclined end surface 97*a* of the pawl throw-out cam 97 may be located suitably to be engaged by a roller 104 on the forward end of the pawl 80 to throw the pawl out of engagement with the ratchet teeth at any predetermined time in the working stroke of the pawl. Thus, the location of the throw-out cam 97 may be adjusted angularly about the axis of the shaft 65 to prevent the pawl from engaging with the ratchet wheel during any of its forward or normal working stroke so that the belt 16 will be left stationary or the pawl throw-out cam may be adjusted away from the pawl angularly around the shaft 65 so that the pawl may remain engaged with the ratchet wheel during its entire working stroke or the adjustment may be between these two extremes. Numerous adjustments thus may be made to vary the rate of feeding of the blotting strip from the roll 70 and also the wiping contact of such strip with the containers as the latter are moved upwardly along the upper stretch of the belt 16.

The shaft 57 is driven, as by means of a chain-and-sprocket mechanism, designated 57*a* in Figs. 1 and 9, operatively connecting such shaft with the short shaft 87 so that the chain 54 of the section A and the chain 94 of the section B are driven in series, whereby to synchronize the movements of the containers along the runways of the two sections as controlled by the movements of the container engaging members 53 and 77 which respectively are carried by these two chains.

A pivoted presser element 105, adjustably weight loaded at 105*a*, bears against the used paper at the periphery of the roll 63 at about the level of the axis of such roll or median line of the roll. The pressure thus exerted along a line extending across the paper strip before it starts to turn around the lower half of the roll 63 has the effect of keeping the paper strip desirably flat and taut for the upper stretch of the belt. The adjusted pressure of the pivoted presser element 105 on the used paper on the portion of the belt passing around the driving roll 63 serves to maintain sufficient tension in the paper on the upper stretch of the belt to keep such paper desirably flat despite the rolling contact of the containers therewith and the resilient character of the supporting belt which tend to make the paper "crawl" and form surface waves therein. The paper is largely wet when it reaches the roll 63 and has relatively little wet strength. Tension on the paper to keep it flat and smooth on the upper stretch of the belt therefore could not be applied by a pressure roll against the belt as it passes off the driving pulley 63 as would be conventional in the feeding of dry paper as the wet paper adhering to the portion of the relatively thick, resilient, belt on the roll 63 would break under the stretching force applied thereto and paper having sufficient wet strength to stretch the amount required without breaking cannot be provided without undue sacrifice of blotting capacity and speed.

The pivoted presser element 105 has a thin gauge curved metallic guide strip 106 depending therefrom below the line of contact of such presser with the wet paper on the roll 63. Below this line of contact, the wet paper, on being directed against the smooth metallic surface of the guide strip 106, will thereafter follow such surface rather than clinging to the belt 16 as would be the case without the combined paper tensioning presser and stripper 105—106 as just described. The used paper may be directed by the guide 106 into a waste receptacle 107.

From the higher end of the upper stretch of the belt 16, the containers 12 are moved over the roll 64 on to an inclined, generally plate-like member 108, Figs. 1 and 7, appropriately spaced parallel longitudinal portions of which may be raised as indicated at 109, Fig. 4, to serve as runway rails for the containers 12. Side guide and axial motion limiting rails, as 110, are provided at the sides of and appropriately above the level of the rails 109 to maintain suitable direction of movement of the rolling containers while they are being rolled upwardly over the upper stretch of the belt 16 and over the plate-like member 108. The plate-like member 108 may be the top of a warm or heated air discharge head 111 to which preheated air is supplied through a heater 112, Fig. 1, the latter being of any conventional construction and mode of operation and being provided with air to be heated in any suitable known way, as by a blower 113. The top plate 108 of the head 111 may be provided with apertures, as indicated at 114, 115 and 116, respectively, in Fig. 4, these apertures being arranged to discharge air upwardly around or against the container at different places along the length of the latter. Any suitable number of the several specifically designated apertures may be provided and additional apertures may be provided if desired. The apertures may be arranged in longitudinal rows, as shown for the apertures 115 in Fig. 1. The important consideration is to assure envelopment of each container by warm air, preferably in motion, to complete the drying and warming of the surface of the container or at least of any portion of that surface that is to be further treated, as by labeling or decorating. In order to assure effective distribution of the preheated air to the

several discharge apertures in the top of the head 111, the space within the head may be partially divided by partial horizontal, transverse partitions, such as indicated at 117 and 118, respectively, in Fig. 1, these partial partitions terminating at different places along the length of the head so that some of the heated air entering the heated air inlet 119 will be carried forward to the extreme opposite end of the head while still other portions of the air will be allowed to pass to nearer apertures in the top plate. Also, the apertures may be provided with air directing tongues or internal projections, such as indicated at 120 for apertures 115 in Fig. 1, these being conveniently formed or original portions of the top plate of the head when the apertures are punched or otherwise formed in the latter.

From the higher end of the runway of section B, the containers may pass to any suitable associate mechanism, none shown, as to a labeling machine.

A top plate or cover, such as indicated at 121, may be provided on the head structure of the framework 1 of section B so as to house the chain 74 and cover the operating parts of this section.

The invention assures complete and thorough drying of wet containers, such as freshly filled baby food jars, at a rate sufficiently rapid to permit use of the apparatus in cooperation with other machines normally used in a packing plant or like place when such other machines are operated in a normal manner. The structural features of the invention and the steps of the method thereof obviously may be varied widely from the details of the illustrative embodiment of the invention and the operation thereof herein particularly described and I therefore do not wish to be limited to such details.

I claim:

1. Apparatus for drying containers having moisture adhering to the surface thereof and having a peripheral groove adjacent to one end thereof comprising means to apply opposed jets of scavenging air to the peripheral groove in the surface of said container, means thereafter to apply other jets of air to the surface of the container in directions having components toward the other end of the container, means still later to apply opposed jets of air to the container adjacent to said other end thereof in directions having components toward the plane of said other end, means subsequently to apply a moisture blotting surface to the periphery of the container, means still later to apply warm drying air to the surface of the container, and conveyor means for carrying said containers adjacent to the aforesaid respective means to apply jets of air, a moisture blotting surface and warm drying air thereto, said conveyor means being constructed and arranged to position each such container suitably to be acted on by said respective means successively.

2. Apparatus as defined by claim 1 and, in addition, means to apply an air jet directly against said first-named end of said container concurrently with the application of said first-named opposed jets of said peripheral groove and means to apply an air jet directly against the other end of said container concurrently with the application of said second-named opposed jets of air to the container.

3. Apparatus for drying containers having moisture adhering thereto comprising a track upon which such containers may roll, the track having a downward inclination from its receiving end, a plurality of air jet discharge means located in spaced relation along said track in positions to discharge jets of air locally upon different portions of each container during its rolling movement upon said track, means providing a second inclined track, said second inclined track being inclined upwardly from its receiving end, means providing a moisture blotting surface to which such containers may be transferred from said first-named inclined track and upon which said containers may be rolled onto the receiving end of the second inclined track, means to transfer said containers from the lower first-named inclined track to said blotting surface, means to effect rolling of said containers upon said blotting surface and onto said second inclined track, means to move said containers along said second-named inclined track, and means to discharge warm air upon the containers on said second-named inclined track.

4. Apparatus for drying containers having moisture adhering to the surface thereof comprising a track upon which such containers may roll, said track being inclined downwardly from its receiving end, an endless belt conveyor having an inclined upper stretch located so that its lower end is adjacent to the lower end of said inclined track, means to provide a moisture blotting surface covering for said upper stretch of the conveyor, means to direct jets of air upon the surface of said containers during their movement opon said inclined track, a transfer container runway for conducting said containers from the lower end of the inclined track onto said blotting surface, a second inclined track upon which said containers may roll, said second inclined track having its lower end located in position to permit containers to be rolled thereonto from said blotting surface, means for engaging said containers successively upon reaching the blotting surface for rolling said containers upon said blotting surface and therefrom onto and up the second-named inclined track, and means to discharge warm, drying air upon said containers during their movement along said second-named inclined track.

5. Apparatus as defined by claim 4, and, in combination therewith, means positioned to engage successive containers rolling upon said first inclined track to position said containers transversely of the track and to space adjacent containers apart before they arrive at the means to direct jets of air thereupon.

6. Apparatus as defined by claim 4 and, in combination therewith, an endless chain having an upper stretch positioned below and adjacent to the containers upon said inclined track when said containers are in the zone of treatment thereof by said jets of air, means to drive said chain to move the upper stretch thereof in the direction of movement of the containers upon said inclined track, and container engaging elements carried by said chain for engaging and controlling the advance of said containers upon said inclined track during treatment thereof by said jets of air.

7. Apparatus as defined by claim 4, and, in addition, means to drive said endless conveyor to move the blotting surface thereon counter to the movement of the containers thereon and means to feed fresh moisture blotting surface forming material onto the upper stretch of said conveyor in accordance with the movement thereof.

8. In apparatus for drying containers, such as jars having caps applied to one end thereof so as that a peripheral gap or groove is provided be-

tween and partially under the cap skirt and the adjacent portion of the body of such a jar, said container having moisture adhering thereto and lodging in said gap, of a track upon which such containers may roll, said track being inclined downwardly from its receiving end, a pair of opposed air jet nozzles located at one place along said track to discharge opposed jets of air into said gap to break up and drive out globules of moisture therefrom and from under the edge of said cap skirt, a pair of longitudinally extending, closed-ended air pipes positioned above said track beyond said opposed air jet nozzles, said pipes having spaced jet holes to discharge jets of air downwardly upon the body of the containers, during movement thereof upon the adjacent portion of the track, in directions having components toward the bottoms of the containers, other opposed air jet nozzles located along the inclined track beyond said air pipes to discharge opposed jets of air upon the bodies of the containers adjacent to the bottoms thereof in directions having components toward the plane of said bottoms, and means to control rolling movement of said containers upon said inclined track during application thereto of said jets of air.

9. Apparatus as defined by claim 8 and, in addition, an air jet nozzle associated with said first-named opposed air jet nozzles to discharge a jet of air axially against said cap, and an air jet nozzle associated with said second-named opposed air jet nozzles to discharge a jet of air axially against the bottom of the container being acted upon by the second-named opposed air jets.

10. In apparatus for drying rollable containers, an endless belt having an upper stretch, a roll of moisture absorbent material in sheet form, means to direct successive portions of the sheet of moisture absorbent material from the roll, on being unwound therefrom, upon one end of the upper stretch of said endless belt and in the direction of length of said upper stretch of the belt, means to apply power to said belt at the opposite end of the upper stretch thereof to move said upper stretch and the sheet of moisture absorbent material thereon toward the end at which the power is applied, means to deliver rollable containers upon their sides upon the sheet of blotting material upon the second-named end of the upper stretch of said belt, and means to roll said containers successively upon said sheet of blotting material toward the first-named end of the upper stretch of said belt.

11. In apparatus for drying rollable containers, an endless belt having an inclined upper stretch, a roll of moisture absorbent material in sheet form, means to direct successive portions of the sheet of moisture absorbent material from the roll, on being unwound therefrom, upon the higher end of the upper stretch of said endless belt and in the direction of length of said upper stretch of the belt, means to drive said belt intermittently to move the upper stretch thereof and the sheet of moisture absorbent material thereon from the higher to the lower end of said upper stretch, means to deliver rollable containers upon their sides upon the sheet of blotting material upon the lower end of the upper stretch of said belt, and means to roll said containers successively upon said sheet of blotting material toward the upper end of the upper stretch of said belt.

12. Apparatus as defined by claim 10 and, in addition, a pivoted, adjustably weight loaded presser element arranged to press against the largely wet used absorbent sheeet material on said belt at the place power is applied to the latter to keep the absorbent sheet material on the upper stretch of the belt under sufficient tension to remain substantially flat despite a tendency of the rolling contact of the containers therewith to cause crawling of and waves therein and without causing rupture of the wet used material.

13. Apparatus as defined by claim 10 wherein said belt comprises a plurality of superimposed layers, including an outer, relatively thick layer of resilient material.

14. Apparatus as defined by claim 10 and, in addition, means to effect stripping of the sheet of used absorbent material from said belt upon movement thereof beyond the lower end of the upper stretch of the belt.

15. Apparatus as defined by claim 10 and, in addition, a warm air discharge head having an inclined plate-like top part positioned so that containers may roll from the absorbent material on the upper stretch of said belt onto the low end of the top part of said heat, said plate-like top part of said head being formed in part to provide a longitudinally extending track thereon upon which said containers may roll and having air discharge apertures for the discharge of air from the head onto the containers during rolling movement of the latter upon said track, and means to deliver preheated air to said head.

16. The method of drying wet containers, such as a glass jar having a cap closure on one end thereof so that a gap remains between the cap and a spaced portion of the body of the jar, said method comprising the steps of first applying opposed air jets to the container at said gap to drive therefrom, break up and partly atomize drops and relatively large masses of water and another jet of air to the head of the cap on the jar to break up residual moisture thereon and to drive the diffused moisture to the periphery of the cap into said opposed jets, thereafter applying jets of air to the body of the jar adjacent to said gap and farther toward the bottom thereof in directions having components toward said bottom to sweep any moisture on the jar body to and in part from the bottom end thereof, and still later applying opposed jets of air to the body of the jar adjacent to its bottom to break up and drive therefrom residual moisture on the bottom edge of the jar and another jet of air directly to said bottom for diffusing and driving off any moisture thereon and for cooperating with said last named opposed jets to create a turbulent air condition at the bottom edge of the jar.

17. The method as defined by claim 16 and, in addition, the step of applying a sheet of moisture absorbent material to the body of the jar.

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