Dec. 24, 1968 R. A. ENGLANDER 3,417,973

TEMPERATURE MODIFYING APPARATUS FOR CONTAINERS WITH SHIFTABLE CONTENTS

Filed June 1, 1967 4 Sheets-Sheet 1

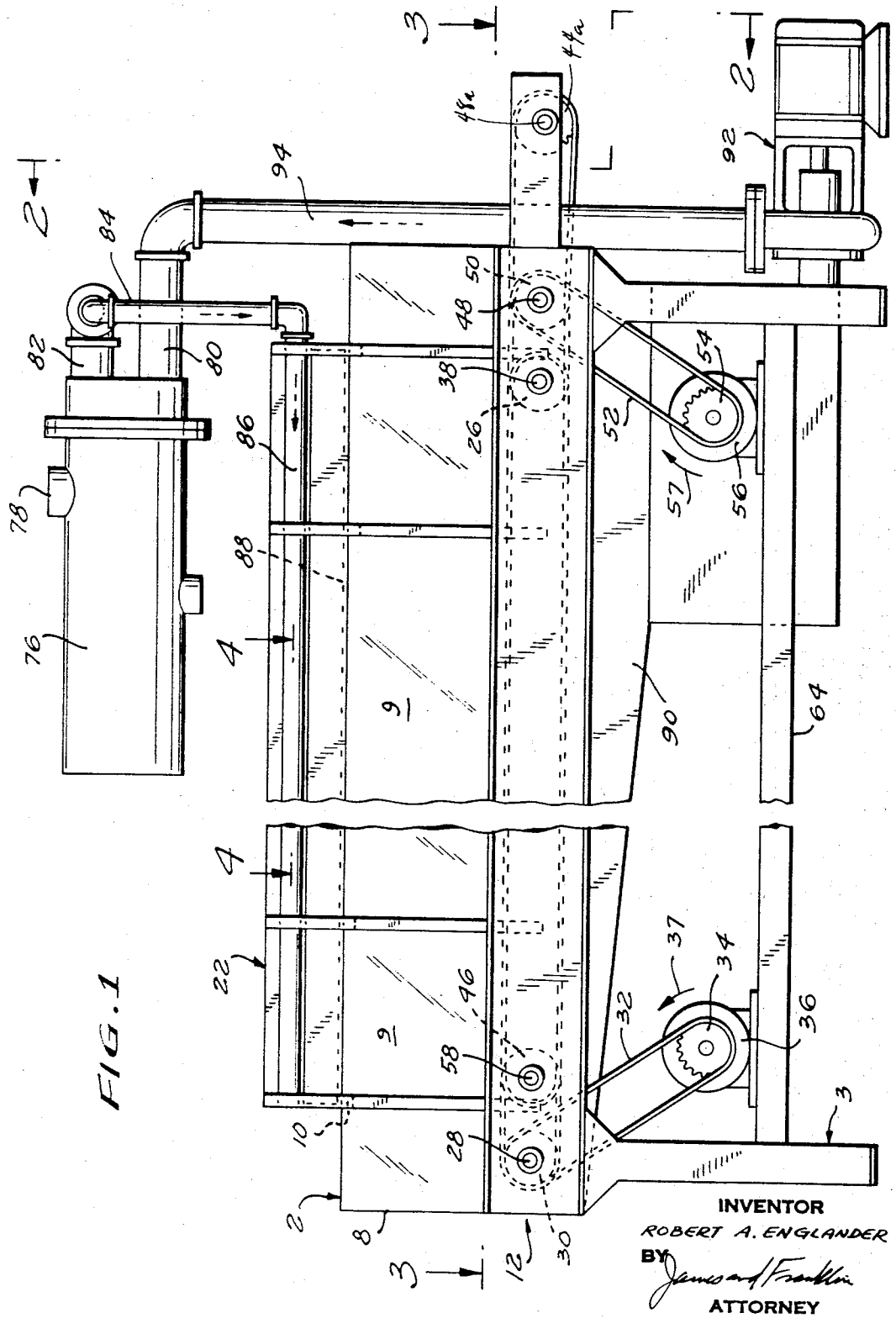


FIG. 1

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FIG. 2

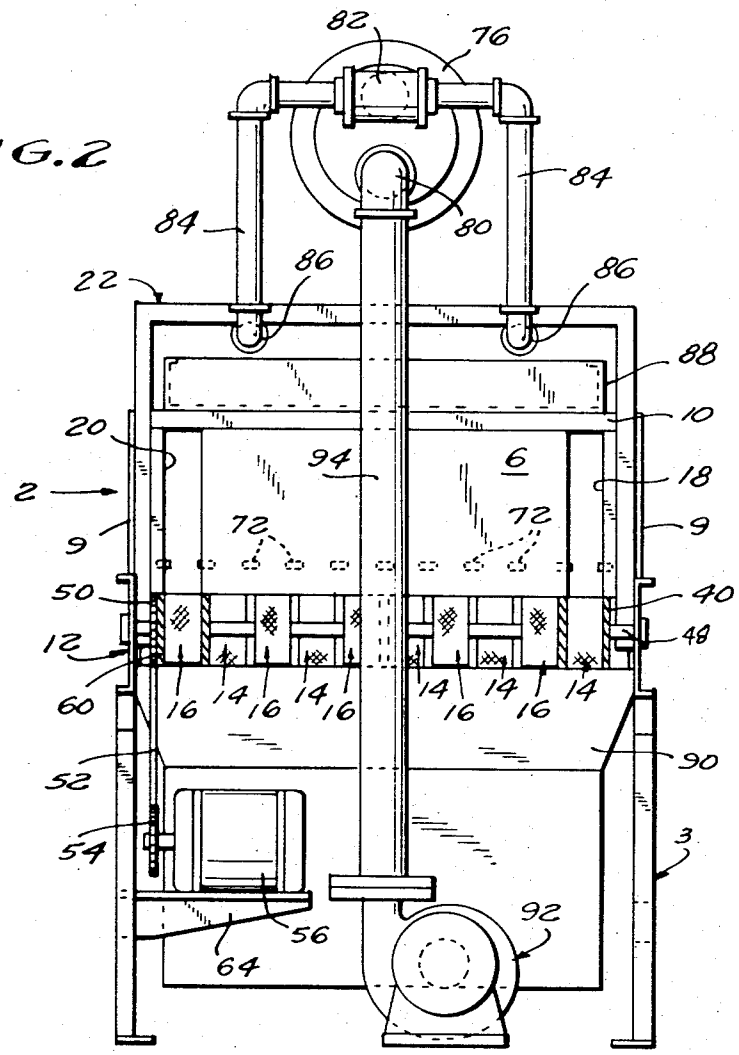
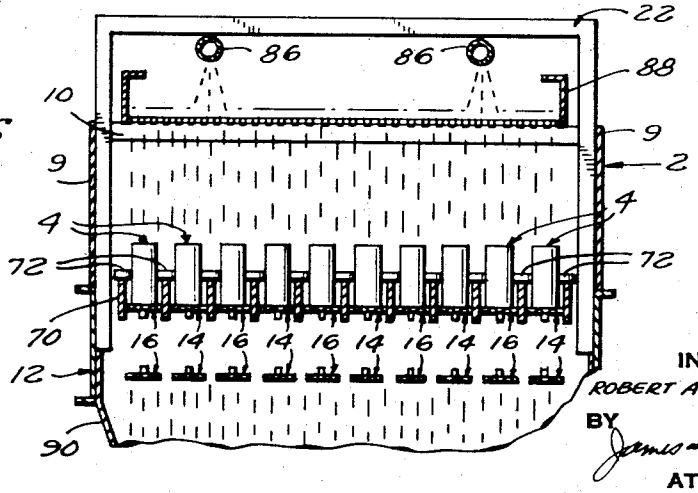


FIG. 5



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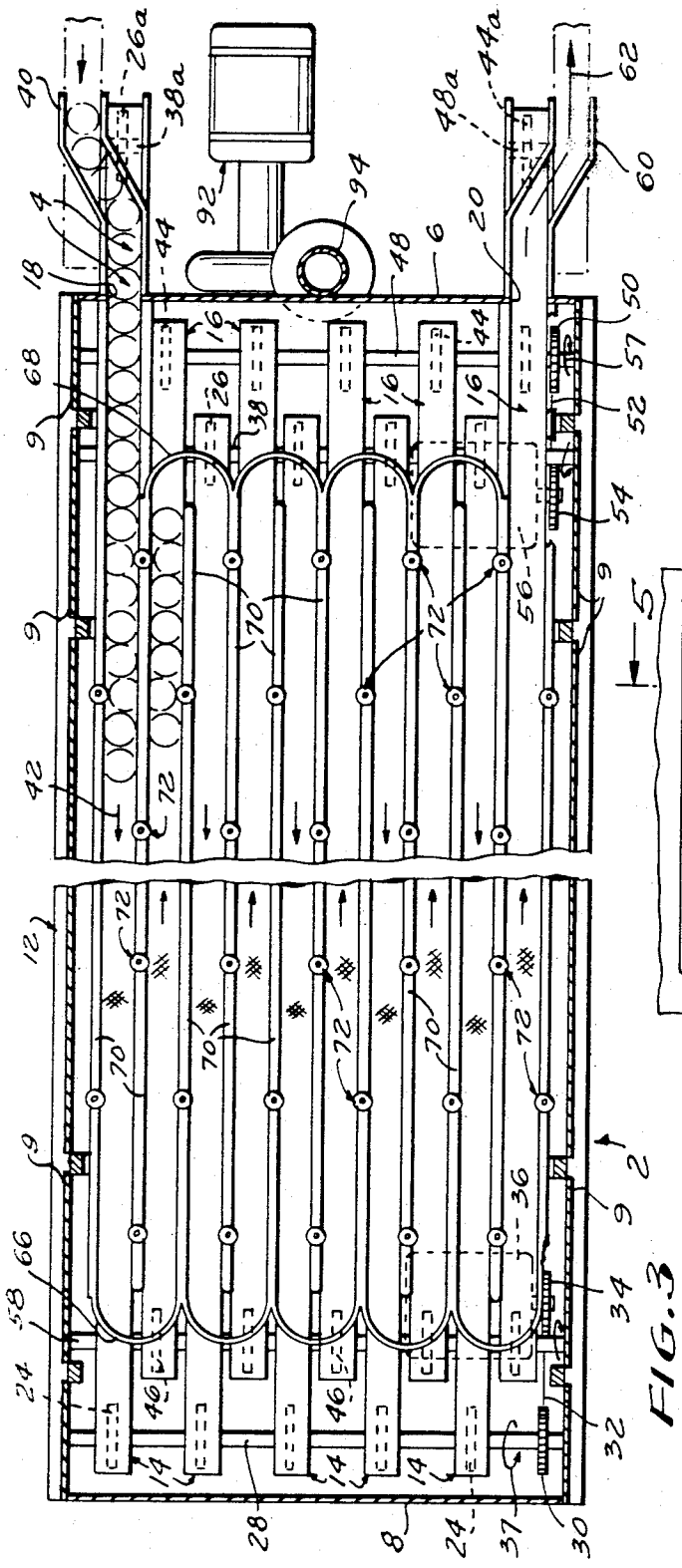


FIG. 3

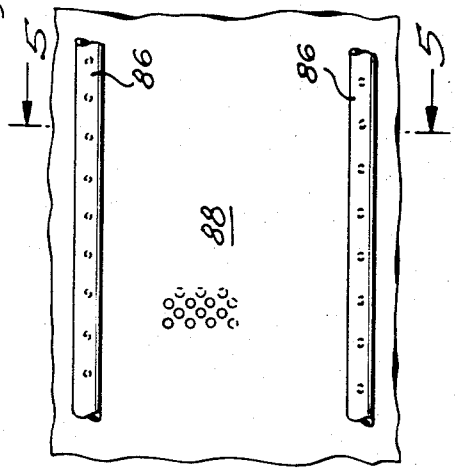


FIG. 4

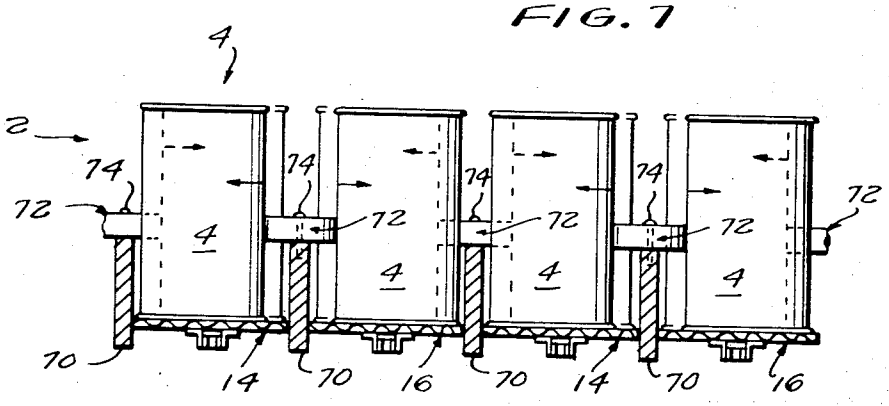
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FIG. 7



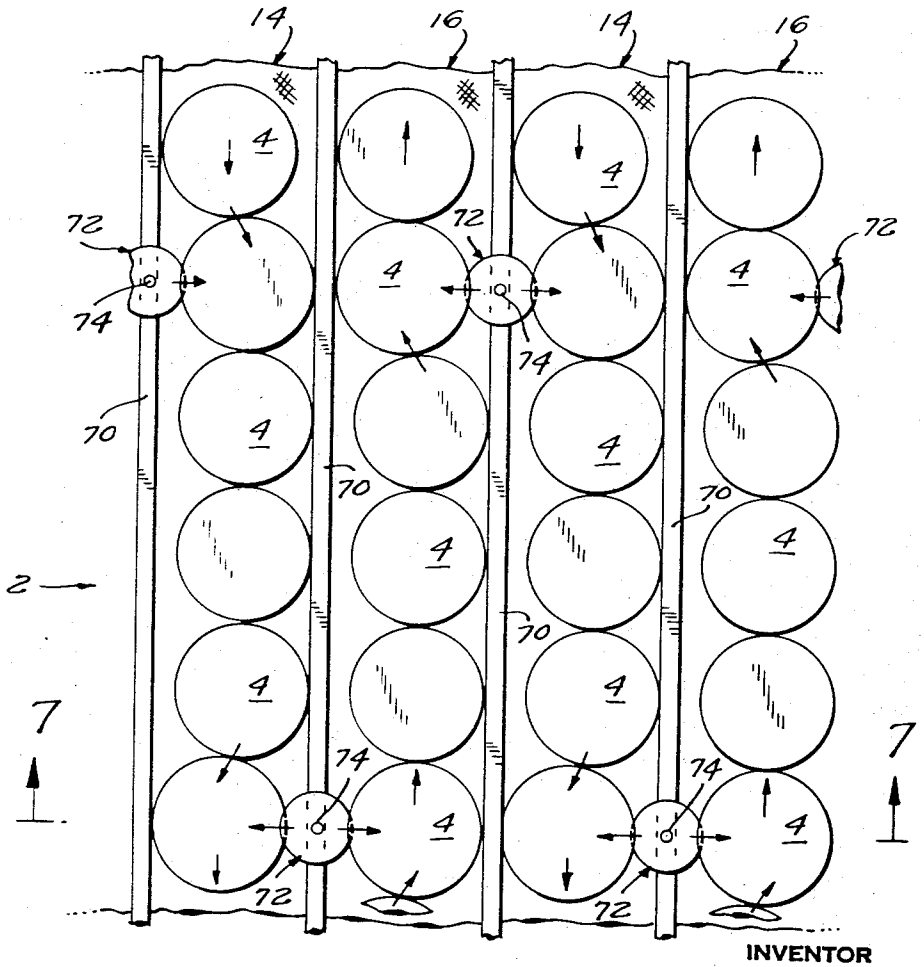


FIG. 6

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3,417,973

TEMPERATURE MODIFYING APPARATUS FOR CONTAINERS WITH SHIFTABLE CONTENTS

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Filed June 1, 1967, Ser. No. 642,940
22 Claims. (Cl. 259—54)

ABSTRACT OF THE DISCLOSURE

A cooling or heating chamber is provided through which containers are conveyed as they are subjected to a change in temperature, the contents of the containers being shiftable therein and the containers being so manipulated as they pass through the chamber as to cause their contents to shift, thereby producing a rapid temperature change of the containers and their contents, the manipulation of the containers being effected by mechanical displacement thereof, as through rapid changes in direction of movement, jogging and the like.

The present invention relates to a heating or cooling device through which a series of containers are adapted to be conveyed and in which those containers are so treated and manipulated as to produce a rapid, effective and substantially uniform change in the temperature of the containers and their contents.

There are many instances where the temperature of objects is to be changed. When this must be done on a production scale it is important that the change be effected as rapidly and reliably as possible. When the objects are in the nature of containers the temperature of their contents must be similarly changed, for if the contents are at a different temperature from the container itself when the assembly leaves the temperature-modifying apparatus the thermal effect of the contents, usually much more massive than the container proper, on the end temperature of the assembly will have a predominating effect on the final temperature of the assembly. Usually the containers proper, the outer surfaces of which are exposed as the units pass through the apparatus, can have their temperature modified relatively quickly and easily, but it is a more difficult and time consuming task to correspondingly modify the temperature of the contents, since the temperature-modifying action must occur from the outside in.

One instance where this problem is of particular commercial significance is in connection with the packaging of cans or bottles of beer or soft drinks, particularly where the containers are non-returnable or where the beverage is constituted by draft beer. In both of these instances—the use of non-returnable cans or bottles and the canning or bottling of draft beer—the canning or bottling process is carried out at exceedingly low temperatures, such as 35° F. The next step is to package the containers, be they cans or bottles, in groups, such as the now conventional "six-pack." This type of what is now termed "multi-packaging" is accomplished by assembling a number of individual cans or bottles in a carton or wrapping them in a paperboard sleeve. Because the cans or bottles are at a quite low temperature after they are filled condensate forms thereon, often in comparatively copious amounts, when their temperature rises to room temperature. This condensate has two primary deleterious effects—it promotes rust and corrosion when cans are employed, and it wets and hence softens the containers or wrappers which are used in the multi-packaging operation. Both of these effects must be held to a minimum, since a can with rust showing is not saleable

and a multi-packaging wrapper or carton which is wet will not have the requisite strength.

In order to minimize this effect, it has been found necessary to subject the cans and bottles to a warming operation prior to the multi-packaging operation. Conventionally this is accomplished by passing the cans or bottles through a heating tunnel where they are subjected to the action of hot water and then dried. The hot water or other source of heat acts on the exposed surfaces of the objects passed therethrough, and affects the central portions of those objects only indirectly, by the transmission of heat through the container walls and through the mass of the contents of the container. In the past the cans or bottles have been passed through the heating tunnel at a steady and slow rate, so that the contents thereof do not circulate therewithin. Hence the only fluid that is being effectively warmed is that which is in contact with the container wall. Once the container walls and the fluid directly in contact therewith has attained a temperature substantially that of the heating fluid, very little heat transfer from the fluid to the container ensues, since the amount of heat transferred from one object to the other is directly proportional to the temperature differential between them. Hence it takes a very long time to raise the temperature of all of the contents of the containers to desired value so long as the heating procedure depends upon direct heat transmission and such minor convection currents within the container contents as occur in conventional heating apparatus.

It is the prime object of the present invention to devise a temperature modifying apparatus in which the desired temperature modification is achieved more quickly and reliably than has heretofore been the case. The principles of operation are the same whether the apparatus is used for raising or lowering the temperature of the object being conveyed therethrough. In accordance with the present invention this is done by producing a degree of turbulence within the contents of the objects in question as they pass through the apparatus, thereby to promote a mixing of the contents adjacent to the container walls with the contents near the center of the container. The present invention is thus applicable for use with containers the contents of which are shiftable, this including not only fluids in the strict sense but also contents which are particulate in nature and flowable.

The turbulence or shifting of the contents of the containers is accomplished by conveying the containers through the apparatus in an unsteady or discontinuous fashion while they are being subjected to the influence of the temperature-modifying agent, be it radiation, heated water or whatever. More specifically, the containers are caused to pass through the apparatus at relatively high speed along a path which has a plurality of abrupt changes in direction. Each time that the container has its direction of movement shifted abruptly the contents thereof will be stirred up and rendered turbulent, and hence the heated contents adjacent the side wall will move toward the interior of the container while the material normally at the interior will move toward the side wall, there to be more rapidly heated.

The unsteady or abruptly discontinuous movement is perhaps best accomplished by abrupt changes in direction of movement of the containers. For example, the containers may be caused to pass through the apparatus along a series of substantially parallel paths joined at their ends by abrupt turns or connections; each time that a container has its direction of movement reversed rapidly in shifting from one path to the next the contents thereof will be shaken up. In addition or alternatively, elements may be placed along the path of travel of the containers which are adapted to engage those containers and jog or jostle

them as they move past, again agitating the container contents. As here specifically disclosed the path along which the containers are constrained to move is somewhat wider than the containers themselves, and the jogging elements are so located as to shift the containers from one side of the path to the other, thus effectively agitating the containers and their contents without appreciably disturbing their equilibrium and without tending to cause them to become upset. The jogging of the containers can also be accomplished by tilting them and then permitting them to return to normal vertical orientation, and this may happen to some extent in connection with the apparatus as here specifically disclosed, but it is considered that the shiftability of the containers from one side to the other of the somewhat enlarged width of their path of travel without appreciable tilting makes for greater reliability, particularly at high speeds with bottles formed of glass or other fragile materials.

Because the direction of travel of the objects is preferably changed as they move through the apparatus, it becomes feasible to have the containers enter the apparatus and leave the apparatus at the same end, thus facilitating supervision of the equipment. Because the elongated path of travel of the containers is abruptly sinuous and uniform heating is accomplished rapidly, the total amount of floor space which the apparatus of the present invention will take up is significantly limited, and hence the apparatus is especially suitable for use in small bottling plants, or any plants where available floor space is at a premium. Indeed, it has been found that with the apparatus of the present invention the floor space required is only approximately one-quarter of that needed by direct flow warming devices presently used in the bottling and canning industry.

Because of the sinuous nature of the path along which the containers are adapted to travel and because of the desirability that shifts in direction of movement of the containers be accompanied by appreciable agitation of the container contents, high speed travel of the containers through the apparatus is preferred. This, coupled with the more efficient heating or cooling of the container contents which results, enables a relatively small piece of equipment to handle a large number of bottles or cans per unit time. As a result the bottles or cans may be passed through the apparatus of the present invention in single file without adversely affecting the productivity of the apparatus; this is advantageous in eliminating the necessity for an additional piece of equipment to take the cans or bottles coming from warming devices of the prior art in multiples lines and convert that carton flow into one or more single file flows. Such single filing is needed not only in connection with the multi-packaging operation but also because the drying of the treated cans or bottles, as through the use of airblasts which blow off the hot water that remains on the surface of the containers and in the top recesses of cans, is best carried out when the containers are in single file.

The approach involved in the present invention may be embodied in extremely simple, rugged and reliable structure. For example, as here specifically disclosed, a plurality of chain or belt conveyors may be arranged in parallel rows so as to be driven in alternately opposite directions, with deflection guides being provided at the ends of each of the reaches of adjacent pairs of paths so as to deflect the container from one conveyor onto the adjacent one, and the jogging elements may be located between the adjacent paths so as to partially extend over each of them.

To the accomplishment of the above, and to such other objects as may hereinafter appear, the present invention relates to temperature-modifying apparatus adapted to act on objects conveyed therethrough, as defined in the appended claims and as described in this specification, taken together with the accompanying drawings, in which:

FIG. 1 is a side elevational view of one embodiment of the present invention;

FIG. 2 is a cross-sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view taken along the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary cross-sectional view taken along the line 4—4 of FIG. 1;

FIG. 5 is a fragmentary cross-sectional view taken along the line 5—5 of FIG. 4;

FIG. 6 is a fragmentary plan view, on an enlarged scale, showing the manner in which the jogging elements act upon the containers passing through the apparatus; and

FIG. 7 is a cross-sectional view taken along the line 7—7 of FIG. 6.

The apparatus of the present invention, as here specifically disclosed, comprises a substantially closed chamber generally designated **2** through which the contents-carrying objects, generally designated **4** and here specifically illustrated in the form of cans, are adapted to be conveyed in order to have their temperature changed. The invention is applicable either to heating or cooling; it will here be described for purposes of exemplification in connection with a heating apparatus. The chamber **2** is mounted on a support generally designated **4** and comprises end walls **6** and **8**, side walls **9**, a top wall **10**, and a bottom generally designated **12** which is defined at least in part by a plurality of alternately arranged conveyor belts or chains generally designated **14** and **16** respectively. The end wall **6** is provided with an inlet opening **18** registering with the first of the conveyors **14** (uppermost in FIG. 3) and it is also provided with an exit opening **20** registering with the last of the conveyors **16** (lowermost in FIG. 3). Located on top of the chamber and communicating with the interior thereof is a heating assembly generally designated **22**.

As may best be seen from FIGS. 1 and 3, the conveyors **14** comprise endless belts, chains or the like mounted on drive wheels **24** at one end and idler wheels **26** at the other end. The drive wheels **24** are fast on shaft **28** which carries gear **30** driven by belt or chain **32** connected to the output gear **34** of a drive motor **36** and rotated in the direction of the arrow **37**. The idler wheels **26** for all of the conveyors **14** except for the first are mounted on shaft **38**. The first conveyor belt **14** extends out through the inlet opening **18** and is mounted on idler wheel **26***a* which is in turn mounted on shaft **38***a*, both of these being located outside the chamber **2**. Rails or other guide means **40** are adapted to direct a line of containers **4** onto the upper length of the first conveyor **14** which, as indicated by the arrow **42**, is moved in such a direction as to carry the cans **4** into the chamber **2**. The endless belts or chains which comprise the conveyors **16** are mounted on drive wheels **44** at one end and idler wheels **46** at the other end. The drive wheels **44** are fast on shaft **48** which carries gear **50** driven by belt or chain **52** connected to the output gear **54** of drive motor **56** and rotated in the direction of the arrow **37**. The idler wheels **46** are mounted on shaft **58** within the chamber **2**. The last conveyor **16** (shown at the bottom of FIG. 3) extends out through the exit opening **20**, where it is mounted on auxiliary idler wheel **44***a* which is in turn mounted on shaft **48***a*, and rails or other guide means **60** are designed to be engaged by containers **4** on the last conveyor **16** and to shift those containers off from the conveyor **16** to one side, as indicated by the arrow **62** in FIG. 3, from which point they are conveyed in any appropriate manner to the next operation in the packaging process, usually drying. Both of the drive motors **36** and **56** are mounted on table **64** located beneath the chamber **2**. The directions of rotation of the output gears **34** and **54** are opposite to one another, as disclosed, so that the upper lengths of all of the conveyors **14** are moved from right to left as viewed in FIG.

3, while the upper lengths of all of the conveyors **16** are moved from left to right as there viewed.

Adjacent the lefthand end of each pair of conveyors **14**, beginning with a pair comprising the first conveyor **16** conveyor **16**, and spanning the combined widths of the two conveyors, is a deflector wall **66** so shaped as to be engaged by a container **4** as it moves from right to left with the conveyor **14** and to shift it down (as viewed in FIG. 3) onto conveyor **16**, the latter carrying the container from left to right away from the wall **66**. Adjacent the righthand end of adjacent pairs of conveyors **16** and **14**, beginning with a pair comprising the lrst conveyor **16** and the second conveyor **14**, is a deflection wall **68** similar to the deflection wall **66** but effective to be engaged by a container **4** moving from left to right as viewed in FIG. 3 with conveyor **16** and shifting the conveyor down onto the associated conveyor **14**, which then moves the container from right to left away from the wall **68**. Hence it will be seen that each container, as it passes through the chamber **2**, will move along a series of parallel paths first in one direction and then the other, its direction of movement being abruptly changed adjacent the end of each path when it is shifted from one conveyor **14**, **16** to the other conveyor **16**, **14**, this continuing until a given can reaches the last conveyor **16** which conveys it out of the chamber **2** through the exit opening **20**.

As may best be seen in FIGS. 6 and 7, walls **70** are provided in the chamber **2** between the conveyors **14** and **16** and extending up therefrom, those walls thus constituting restraining means ensuring that the line of containers **4** will remain upright on the conveyors **14** and **16** as they are moved thereby, the walls **70** terminating short of the deflecting walls **66** and **68** so as to permit the containers **4** to shift from one conveyor to the next as described above. As may best be seen from FIGS. 6 and 7, the spacing between adjacent walls **70** is somewhat wider than the width of the containers **4**, thus defining container paths which permit some degree of lateral shifting of the containers therein.

Container jogging elements, generally designated **72**, are mounted in the chamber **2** so as to extend into the path of travel of the containers **4**, thereby to be engaged by those containers as the latter move through the chamber **2**, to the end that such engagement will cause a shifting of position and/or orientation of the containers without interfering with the passage of the containers through the apparatus. As here specifically disclosed the jogging elements **72** are in the form of disks or wheels rotatably mounted on top of the wall **70** by means of pins **74**. The jogging elements **72** are arranged along the length of adjacent pairs of walls **70** in an alternate fashion, first on one wall and then on the other, and each element **72** is designed to extend to both sides of the wall **70** on which it is mounted so as to engage and affect containers which pass to either side thereof. The degree to which elements **72** extend into the path of movement of the containers **4** is here shown as substantially corresponding to the difference between the width of the containers **4** and the lateral spacing between adjacent pairs of walls **70**. Hence, as may be seen from FIG. 6, as a given container **4** moves along a given length of its path, it will engage a jogging element **72** and be shifted to one side of that path, it will move along the path until it reaches the next jogging element **72**, that will shift it to the other side of its path, and so on along its path. When, as is here specifically disclosed, the jogging elements **72** are rotatably mounted, they will offer only minimal resistance to the forward movement of the containers **4** while still performing their jogging or lateral shifting function, and it will be noted that the direction of rotation of a given element **72** produced by the movement thereover of a container in one row will be the same as the directin of rotation produced thereon by the movement thereover of a container in the adjacent row, since the containers in adjacent rows are moving in opposite directions.

The means employed for altering the temperatures of the containers as they pass through the chamber **2** may take any appropriate form. The warming apparatus here disclosed is known in and of itself. It comprises a heat exchanger **76** to which steam is adapted to be fed for heating purposes through inlet **78**. Water circulates through the heat exchanger **76** and is heated by the steam, the water entering the inlet **80** and emerging at exit **82**. The heated water flows through pipe **84** to pipes **86** in a spray header generally designated **88** (see FIG. 5) where the heated water is deposited from the pipes **86** onto a perforated tray **88**, from which the hot water falls in the form of a shower onto the containers **4** which are being conveyed through the container **2**, thus heating those containers. The hot water then drops into a drain pan **90** the water from which is returned by pump **92** and pipe **94** to the water inlet **80** of the heat exchanger **76**. It will be appreciated that this represents but one embodiment of a heating apparatus, and that the particular means employed for heating or cooling forms no part of the present invention. For example, if cooling were desired instead of heating, substantially the same apparatus could be employed except that the input to the heat exchanger **76** would be a refrigerated fluid rather than a heated fluid. Also, heating or cooling of the containers could be accomplished through radiation, convection, or in any other desired fashion.

The cans **4**, as they pass through the chamber **2**, are heated by the water raining down from the tray **88** but that water directly affects only the external surface of the container. The degree to which heat is transferred from the heating water to the container is determined by the temperature difference between them. As soon as the external surface of the container is heated to a temperature approximately the same as that of the water raining down thereupon, substantially no further heat transfer will result. Such a situation will obtain fairly rapidly, and under ordinary circumstances while the contents of the container, except for a thin layer of those contents immediately adjacent the container walls, are still at an undesired low temperature. Thus it takes an exceedingly long time, under normal circumstances, to bring the bulk of the container contents to a desired elevated temperature. It is this which in the past has necessitated the use of very large and extensive heating apparatus through which the containers are conveyed slowly, so that they can be subjected to heating action for a sufficiently long period of time to produce the desired results.

In accordance with the present invention, however, the contents of the containers are constantly agitated while the containers pass through the heated chamber. This agitation results from the abrupt changes in direction of movement of the containers as they are shifted from each conveyor to the next and from the jogging action of the elements **72** as the containers move along each substantially straight path segment. The faster the movement of the conveyors, and hence of the containers, the greater the agitation of the container contents, but there is, of course, a practical limit to how fast the containers can be moved with safety. Because the contents of the containers are constantly being agitated as the containers pass through the chamber **2**, the temperature differential between the containers and the heating water is maintained, there is a greater degree of heat transfer to the containers than would otherwise be the case, and hence the temperature of the containers and their contents, viewed as a unit, are raised to desired value much more rapidly than has heretofore been the case.

As a result of the contents agitation that has been produced, with attendant more efficient and rapid heating, the apparatus of the present invention can be much more compact than has previously been thought feasible, thereby to occupy much less floor space and to permit better use of existing floor space. By increasing the efficiency of the heating operation, the cost of the steam or other source

of heat energy is materially reduced. Because the product can effectively be moved through the apparatus in single file the adaptability of the equipment to a production line is greatly facilitated, and the need for additional lining-up equipment is eliminated. Moreover, since the containers enter and leave the chamber **2** in single file, only small inlet and outlet openings **18** and **20** need be provided, thus reducing heat losses from the chamber **2**. This further increases the efficiency and decreases the cost of the heating operation, and it also makes the surrounding factory area more comfortable. The apparatus is here disclosed in an embodiment in which the containers enter and leave the chamber **2** from the same end, this being considered advantageous from a supervision and control point of view, but this is not essential, and the apparatus can be readily designed for entry at one end and exit from the other merely by using an odd number of individual conveyors instead of the even number here disclosed.

While but a single embodiment of the present invention has been here specifically illustrated, it will be apparent that many variations may be made therein, all within the scope of the instant invention as defined in the following claims.

I claim:

1. Temperature modifying apparatus comprising a substantially closed chamber having an inlet and an outlet, means for conveying contents-carrying objects substantially continuously through said chamber from said inlet to said outlet, temperature modifying means active on said objects as they are thus conveyed and effective to modify the temperature of their contents, and means active on said objects as the temperature of their contents is modified effective to agitate said objects without interrupting their substantially continuous movement through said chamber and thus cause internal shifting of their contents, thereby to cause more effective modification of the temperature of said contents.

2. The apparatus of claim **1**, in which said agitating means comprises said conveying means defining a path for said objects which includes a plurality of adjacent oppositely oriented reaches connected at their respective ends by substantially abrupt 180° turns, whereby said objects are conveyed back and forth through said chamber a plurality of times between said inlet and outlet.

3. The apparatus of claim **2**, in which said agitating means further comprises object-deflecting means positioned along said reaches in the path of said objects as they move therealong and effective to engage and mechanically jog said objects as they thus move.

4. The apparatus of claim **2**, in which said agitating means further comprises object-deflecting means positioned along said reaches in the path of said objects as they move therealong and effective to engage and mechanically jog said objects as they thus move, at least some of said object-deflecting means being located between adjacent pairs of reaches so as to simultaneously be in the paths of objects as they move along each of said reaches.

5. The apparatus of claim **1**, in which said agitating means comprises object-deflecting means positioned in the path of said objects as they are conveyed through said chamber and effective to engage and mechanically jog said objects as they thus move along said path.

6. The apparatus of claim **1**, in which said conveying means comprises a plurality of adjacent rows of object conveyors driven in alternately opposite directions, and, at the ends of adjacent rows, means for engaging in object moving theretoward in one row and shifting it to the next row where it is moved in the opposite direction, said agitating means comprising said shifting means.

7. The apparatus of claim **6**, in which said agitating means comprises a plurality of elements positioned alongside said rows and extending partially into the path of said objects as they move along said rows, said elements being mounted to be rotatable about an axis substantially perpendicular to the length of said rows and adapted to engage and mechanically jog said objects as they thus move without appreciably interfering with their progress along said path.

8. The apparatus of claim **6**, in which said agitating means comprises a plurality of elements positioned alongside said rows and extending partially into the path of said objects as they move along said rows, said elements being mounted to be rotatable about an axis substantially perpendicular to the length of said rows and adapted to engage and mechanically jog said objects as they thus move without appreciably interfering with their progress along said path, at least some of said elements being located between adjacent pairs of rows so as to simultaneously be in the paths of objects as they move along each of said rows.

9. The apparatus of claim **1**, in which said conveying means comprises guide means defining a path for said objects which is wider than said objects, and object-deflecting means positioned along said path and effective to engage said objects and shift them from one side to the other of said path, said object-deflecting means comprising said agitating means.

10. The apparatus of claim **9**, in which said conveying means comprises a plurality of adjacent rows of object conveyors driven in alternately opposite directions, and, at the ends of adjacent rows, means for engaging an object moving theretoward in one row and shifting it to the next row where it is moved in the opposite direction, said agitating means comprising said shifting means.

11. The apparatus of claim **9**, in which said conveying means comprises a plurality of adjacent rows of object conveyors driven in alternately opposite directions, and, at the ends of adjacent rows, means for engaging an object moving theretoward in one row and shifting it to the next row where it is moved in the opposite direction, said agitating means comprising said shifting means, and in which said object-deflecting means are positioned alongside said rows alternately at opposite sides thereof and extending partially into the path of said objects as they move along said rows, said means being mounted to be rotatable about an axis substantially perpendicular to the length of said rows.

12. The apparatus of claim **9**, in which said conveying means comprises a plurality of adjacent rows of object conveyors driven in alternately opposite directions, and, at the ends of adjacent rows, means for engaging an object moving theretoward in one row and shifting it to the next row where it is moved in the opposite direction, said agitating means comprising said shifting means, and in which said object-deflecting means are positioned alongside said rows alternately at opposite sides thereof and extending partially into the path of said objects as they move along said rows, said means being mounted to be rotatable about an axis substantially perpendicular to the length of said rows, at least some of said means being located between adjacent pairs of rows so as to simultaneously be in the paths of objects as they move along each of said rows.

13. The apparatus of claim **9**, in which said agitating means comprises said conveying means defining a path for said objects which includes a plurality of substantially abrupt changes in direction.

14. The apparatus of claim **9**, in which said agitating means comprises said conveying means defining a path for said objects which includes a plurality of adjacent oppositely oriented reaches connected at their respective ends by substantially abrupt 180° turns, whereby said objects are conveyed back and forth through said chamber a plurality of times between said inlet and outlet.

15. The apparatus of claim **9**, in which said agitating means comprises said conveying means defining a path for said objects which includes a plurality of adjacent oppositely oriented reaches connected at their respective ends by substantially abrupt 180° turns, whereby said

objects are conveyed back and forth through said chamber a plurality of times between said inlet and outlet, and in which said object-deflecting means are positioned along said reaches in the path of said objects as they move therealong.

16. The apparatus of claim **9**, in which said agitating means comprises said conveying means defining a path for said objects which includes a plurality of adjacent oppositely oriented reaches connected at their respective ends by substantially abrupt 180° turns, whereby said objects are conveyed back and forth through said chamber a plurality of times between said inlet and outlet, and in which said agitating means further comprises object-deflecting means positioned along said reaches in the path of said objects as they move therealong, at least some of said object-deflecting means being located between adjacent pairs of reaches so as to simultaneously be in the paths of objects as they move along each of said reaches.

17. Temperature modifying apparatus comprising a substantially closed chamber having an inlet and an outlet, means for conveying contents-carrying objects through said chamber from said inlet to said outlet, temperature modifying means active on said objects as they are thus conveyed and effective to modify the temperature of their contents, and means active on said objects as the temperature of their contents is modified effective to agitate said objects and thus cause internal shifting of their contents, thereby to cause more effective modification of the temperature of said contents, said agitating means comprising said conveying means defining a path for said objects which includes a plurality of adjacent oppositely oriented reaches connected at their respective ends by substantially abrupt 180° turns, whereby said objects are conveyed back and forth through said chamber a plurality of times between said inlet and outlet, and said agitating means further comprising object-deflecting means positioned along said reaches in the path of said objects as they move therealong and effective to engage and mechanically jog said objects as they thus move, at least some of said object-deflecting means being located between adjacent pairs of reaches so as to simultaneously be in the paths of objects as they move along each of said reaches.

18. Temperature modifying apparatus comprising a substantially closed chamber having an inlet and an outlet, means for conveying contents-carrying objects through said chamber from said inlet to said outlet, temperature modifying means active on said objects as they are thus conveyed and effective to modify the temperature of their contents, and means active on said objects as the temperature of their contents is modified effective to agitate said objects and thus cause internal shifting of their contents, thereby to cause more effective modification of the temperature of said contents, said conveying means comprising a plurality of adjacent rows of object conveyors driven in alternately opposite directions, and, at the ends of adjacent rows, means for engaging an object moving theretoward in one row and shifting it to the next row where it is moved in the opposite direction, said agitating means comprising said shifting means, and said agitating means comprising a plurality of elements positioned alongside said rows and extending partially into the path of said objects as they move along said rows, said elements being mounted to be rotatable about an axis substantially perpendicular to the length of said rows and adapted to engage and mechanically jog said objects as they thus move without appreciably interfering with their progress along said path.

19. The apparatus of claim **18**, in which at least some of said elements are located between adjacent pairs of rows so as to simultaneously be in the paths of objects as they move along each of said rows.

20. Temperature modifying apparatus comprising a substantially closed chamber having an inlet and an outlet, means for conveying contents-carrying objects through said chamber from said inlet to said outlet, temperature modifying means active on said objects as they are thus conveyed and effective to modify the temperature of their contents, and means active on said objects as the temperature of their contents is modified effective to agitate said objects and thus cause internal shifting of their contents, thereby to cause more effective modification of the temperature of said contents, said conveying means comprising guide means defining a path for said objects which is wider than said objects, and object-deflecting means positioned along said path and effective to engage said objects and shift them from one side to the other of said path, said conveying means further comprising a plurality of adjacent rows of object conveyors driven in alternately opposite directions, and, at the ends of adjacent rows, means for engaging an object moving theretoward in one row and shifting it to the next row where it is moved in the opposite direction, and in which said object-deflecting means are positioned alongside said rows alternately at opposite sides thereof and extending partially into the path of said objects as they move along said rows, said means being mounted to be rotatable about an axis substantially perpendicular to the length of said rows, said agitating means comprising said object-deflecting means and said shifting means.

21. The apparatus of claim **20**, in which at least some of said elements are located between adjacent pairs of rows so as to simultaneously be in the paths of objects as they move along each of said rows.

22. Temperature modifying apparatus comprising a substantially closed chamber having an inlet and an outlet, means for conveying contents-carrying objects through said chamber from said inlet to said outlet, temperature modifying means active on said objects as they are thus conveyed and effective to modify the temperature of their contents, and means active on said objects as the temperature of their contents is modified effective to agitate said objects and thus cause internal shifting of their contents, thereby to cause more effective modification of the temperature of said contents, said conveying means comprising guide means defining a path for said objects which is wider than said objects and which includes a plurality of adjacent oppositely oriented reaches connected at their respective ends by substantially abrupt 180° turns, whereby said objects are conveyed back and forth through said chamber a plurality of times between said inlet and said outlet, said agitating means comprising said conveying means and further comprising object-deflecting means positioned along said reaches in the path of said objects as they move therealong, at least some of said object-deflecting means being located between adjacent pairs of reaches so as to simultaneously be in the paths of objects as they move along each of said reaches, said object-deflecting means being effective to engage said objects and shift them from one side to the other of said path.

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