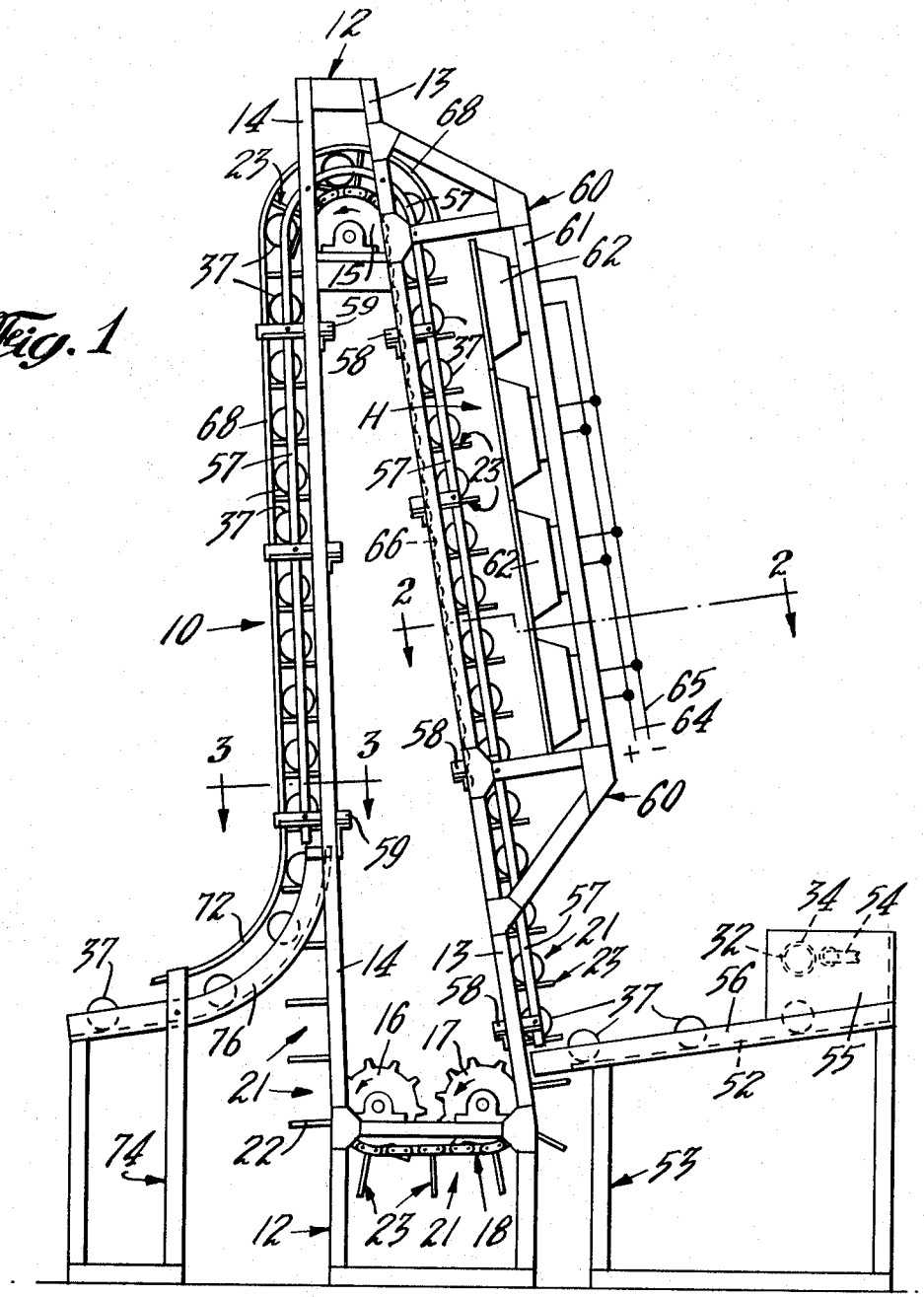
March 21, 1967 D. P. CROCKETT 3,310,653

APPARATUS FOR TREATING FIBRE CONTAINER BODIES

Filed Nov. 12, 1963 3 Sheets-Sheet 1

Fig. 1



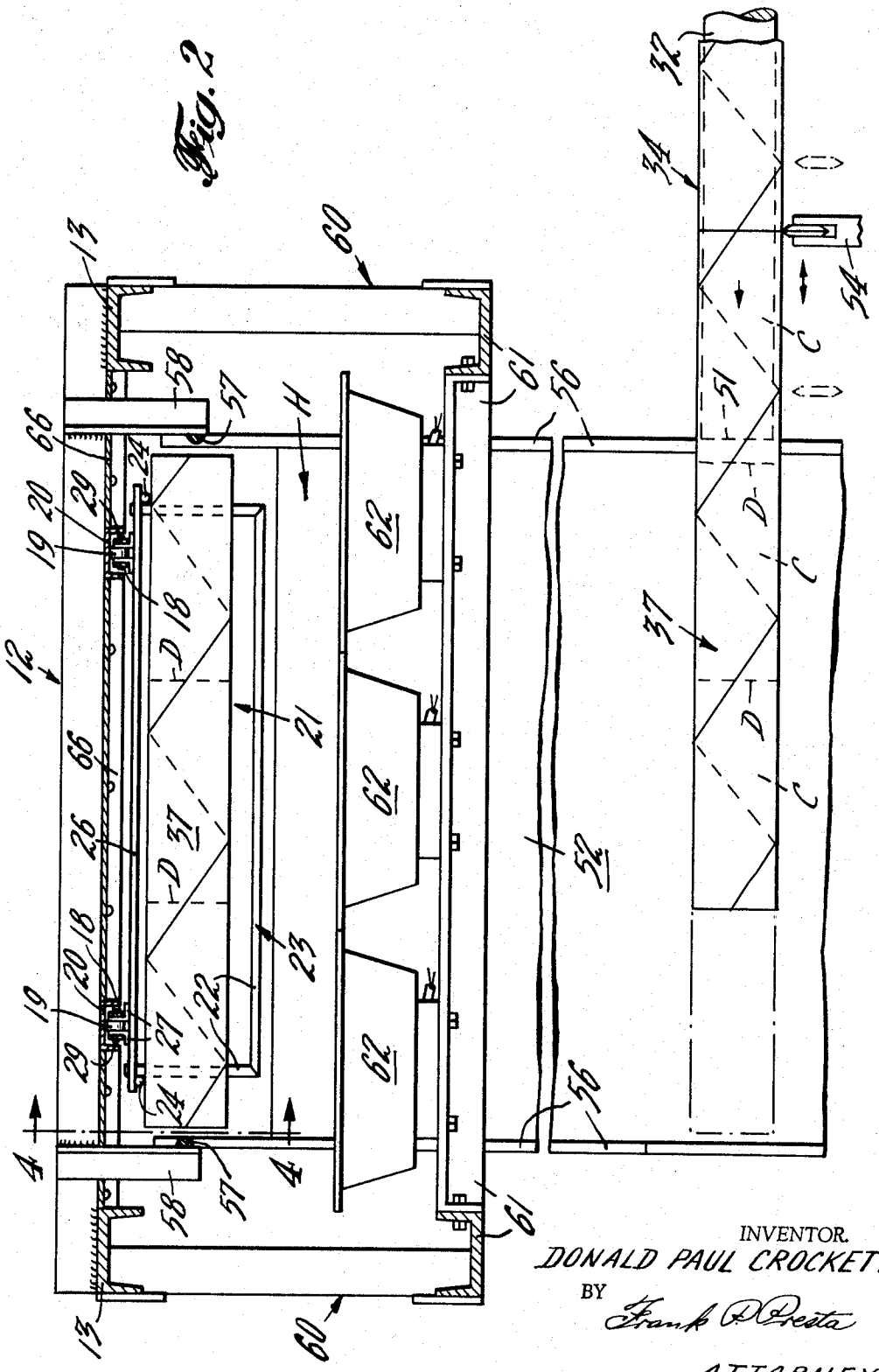
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Fig. 2



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Filed Nov. 12, 1963 3 Sheets-Sheet 3

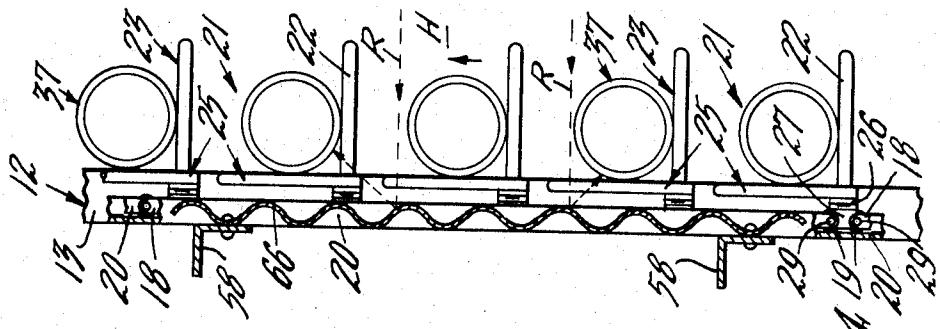


Fig. 4

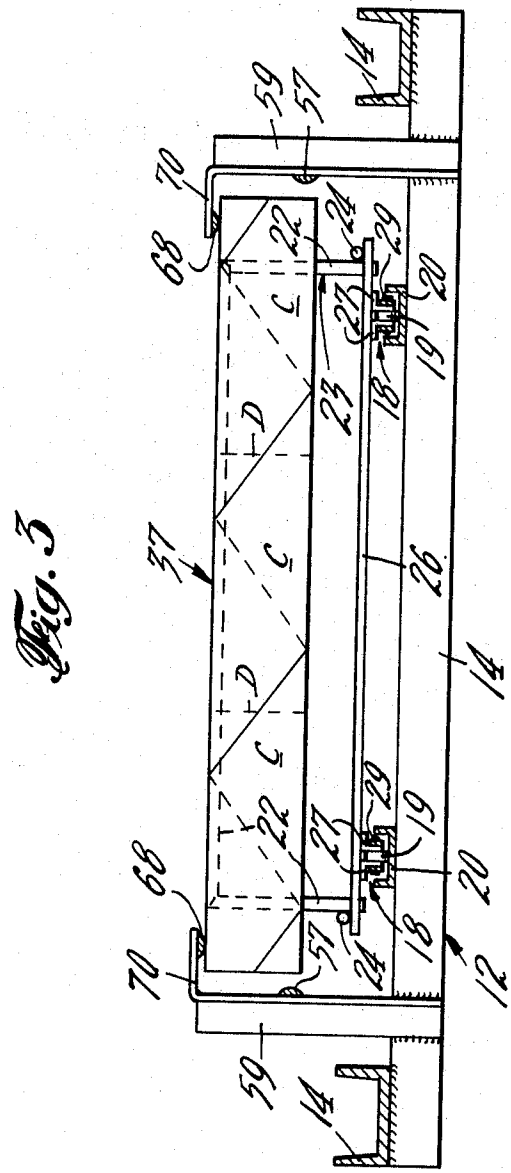


Fig. 3

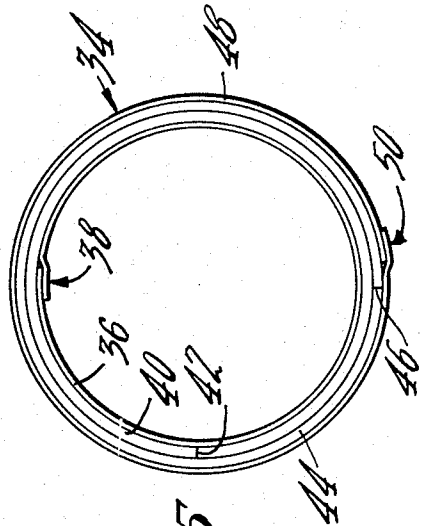


Fig. 5

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Patented Mar. 21, 1967

3,310,653

APPARATUS FOR TREATING FIBRE CONTAINER BODIES

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3 Claims. (Cl. 219—388)

The present invention relates to the heating or "aging" of fibre container bodies and more particularly to apparatus for heating multi-ply fibre container bodies to rapidly effect the hardening or "aging" thereof by promoting an even distribution of water throughout the body plies from the water base adhesive which is interposed between the plies and utilized in the side seam of the plies.

In the manufacture of multi-ply fibre container bodies having a water base adhesive between the plies and in the side seams thereof, and especially in the case of spirally wound container bodies, it has heretofore been necessary to store or "age" the bodies for periods of approximately twelve to twenty-four hours after the formation thereof in order to permit them to harden sufficiently to undergo a subsequent end seaming operation without collapsing. This "aging" procedure was required because shortly after the formation of the bodies, the water from the adhesive is concentrated in the body plies at the glue lines or at the portions thereof adjacent to the adhesive.

This concentration of water at the glue lines of the body plies tends to soften the container bodies to an extent that it is possible that some may collapse during the subsequent end seaming operation, thereby preventing a proper end seam and/or producing unsightly wrinkles in the outer or label ply. By storing the bodies at room temperature prior to the end seaming operation, as has heretofore been done, the adhesive or glue has been allowed to harden normally and the water concentrated at the glue lines of the body plies has been allowed to slowly migrate throughout the body stock, thereby resulting in an even distribution of water in the body stock which has been found to harden the body sufficiently to resist the end seaming operation without collapsing.

The general purpose of the instant invention is to provide apparatus for hardening the container bodies substantially immediately after the formation thereof so as to eliminate the long waiting or "aging" period which previously has been required prior to the end seaming operation. This is accomplished by heating the fibre container bodies to a predetermined temperature below the boiling point of water for a predetermined time. This increase in temperature causes the vapor pressure of the water concentrated at the glue lines of the body plies to increase and results in an increased dispersion rate of the water in the body plies. Thus, the water is rapidly dispersed throughout the body stock so as to be evenly distributed therein. This even distribution of water in the body stock results in a stronger and harder container body, since it has been found that for a given moisture content the body stock is harder when the water is evenly distributed therein than when the water is concentrated in certain portions thereof.

It is an object of the present invention, therefore, to provide an apparatus for rapidly hardening multi-ply fibre container bodies shortly after the formation thereof.

Another object is the provision of apparatus for heating multi-ply fibre container bodies shortly after the formation thereof to harden them sufficiently to resist a subsequent end seaming operation without collapsing.

A further object is to provide apparatus for heating multi-ply fibre container bodies substantially immediately after the formation thereof to rapidly harden the water base adhesive between the plies thereof and to effect an even distribution of water from the adhesive throughout the body plies of the container bodies.

Still another object is the provision of such an apparatus which is capable of rapidly hardening or "aging" a large number of such container bodies and which can be incorporated in an assembly line operation.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

FIG. 1 is a side elevational view of an apparatus constructed according to the principles of the instant invention;

FIG. 2 is an enlarged sectional view taken substantially along line **2—2** in FIG. 1, with parts broken away;

FIG. 3 is an enlarged sectional view taken substantially along line **3—3** in FIG. 1;

FIG. 4 is a sectional view taken substantially along line **4—4** in FIG. 2, with parts broken away; and

FIG. 5 is an end view of a multi-ply, spirally wound fibre container body which is an example of a type of container body to be hardened or "aged" by the apparatus of the instant apparatus.

As a preferred or exemplary embodiment of the instant invention, FIG. 1 illustrates a heating and conveying apparatus or elevator **10** comprising a supporting frame **12** having upwardly extending front and rear frame assemblies **13** and **14** respectively. A pair of driving sprockets **15** are rotatably mounted in transverse alignment on the supporting frame **12** adjacent the upper portion thereof, and two pairs of idler sprockets **16** and **17** are rotatably mounted in transverse alignment on the lower portion of the frame **12**. A pair of endless conveyor chains **18** are mounted on the sprockets **15**, **16** and **17** and are driven at the same speed in a counter-clockwise direction by the driving sprockets **15** which in turn are driven in any suitable manner (not shown). The conveyor chains **18** are provided with rollers **19** in spaced relation thereon which ride in U-shaped front and rear channels **20** which comprise portions of the upwardly extending frame assemblies **13** and **14**, thereby insuring easy movement of the chains **18** around the frame members **13** and **14** (see FIGS. 2 and 3).

A plurality of support pockets or carrier members **21** are mounted on and equally spaced completely around the outer portion of the chains **18**. As shown in FIGS. 2 through 4, each of the carrier members **21** comprises a substantially open framework composed of rigidly attached, rod-like elements **22** which are disposed in perpendicular relationship to define a first supporting platform **23**, and rigidly attached, rod-like elements **24** disposed in perpendicular relationship to define a second supporting platform **25** which is perpendicular to the first supporting platform **23**. Each carrier member **21** also includes a support plate **26**, to which the first supporting platform **23** and the second supporting platform **25** are rigidly attached. Each support plate **26** is secured to the chains **18** by means of a pair of link members **27** rigidly attached thereto and mounted between adjacent links of the chains **18**, these link members also functioning as bearings for the small shafts **29** on which the rollers **19** are mounted.

A winding mandrel **32** (FIGS. 1 and 2) is disposed adjacent to the front frame assembly **13** of the supporting frame **12**, and a multi-ply tube **34** is spirally wound on the mandrel **32** and advances axially therealong in a conventional manner as shown in the United States patent to Magill 2,539,450.

As shown in FIG. 5, the spirally wound tube **34** is

formed of four plies helically wound in the same direction and at the same angle and glued together with a water base adhesive such as dextrine (not shown) to form a moisture and water-proof body. These plies, reading from the inside out, comprise first, an inner liner **36**, comprising thin aluminum foil or a suitable plastic layer prelaminated to a supporting paper backing and having its edges overlapped to form a helical lap joint **38** to prevent the leakage therethrough of gases, grease or moisture. The liner **36** is glued to an inner body ply **40**, formed of comparatively heavy stock such as chipboard or kraft, and havings its edges butted to form a helical butt joint **42** which is circumferentially offset from the lap joint **38** of the liner ply **36**. The inner body ply **40** in turn is adhesively secured to an outer body ply **44**, the spiral edges of which are butted to form a helical butt joint **46** which is circumferentially offset from the butt joint **42** of the inner body ply **40**. The outer body ply **44** is adhesively secured to a label ply **48** having the spiral edges thereof lapped to form a helical lap joint **50**. The label ply **48** preferably is made of a thin layer of aluminum foil or a suitable plastic which is prelaminated to a strengthening paper backing.

Since an adhesive such as dextrine having a large percentage of water (approximately 60%) is utilized between the plies of the spirally wound tube **34**, and because the body plies are made of clipboard or kraft which readily absorbs water, there is a concentration of water from the adhesive in the body plies at the portions thereof immediately adjacent to the adhesive shortly after the formation of the spirally wound tube **34**. This concentration of water at the glue lines of the body plies tends to soften the tube **34** to an extent that it is possible that container bodies cut from the tube **34** may collapse under the axial pressures exerted on them during a subsequent end seaming operation if it takes place shortly after the tube winding operation on the mandrel **32**.

In order to alleviate this concentration of water in the body plies and thus to harden the tube **34** prior to the end seaming operation, the tube **34** is cut along lines of severance S (see FIG. 2) into individual sections **37** as it is advanced along the mandrel **32**, and these sections **37** are then fed into the heating and conveying apparatus **10** of the instant invention along a downwardly inclined ramp or runway **52** which is supported on a frame **43** and is disposed adjacent to and below the end of the mandrel **32** (see FIG. 2).

The severance of the tube **34** is effected by a reciprocating cutting tool **54** which is mounted adjacent the end of the mandrel **32** and is adapted to engage the axially advancing, spirally wound tube **34** at predetermined times and to advance axially therewith to cut predetermined lengths or sections **37** from the tube **34**. A cutting mechanism of this type is conventional and forms a part of the tube winding apparatus.

Each of the individual tube sections **37** may be of a length comprising one or more container bodies C, and, for the purpose of illustration, the tube sections **37** are shown in FIGS. 2 and 3 as consisting of three container bodies C, which subsequently are to be separated from each other along lines of division which are designated by the letter D.

As the tube sections **37** advance beyond the end **51** of the mandrel **32**, they engage an upstanding end wall **55** secured to the ramp **52** and then fall onto the ramp **52** which is inclined downwardly towards the front frame assembly **13** of the supporting frame **12** (see FIGS. 1 and 2). The tube sections **37** roll downwardly on the ramp **52** between upright guides **56** rigidly mounted thereon and, as the tube sections **37** roll beyond the end of the ramp **52**, they are received on the supporting platform **23** of the carrier members **21** mounted on the conveyor chains **18**, the supporting platforms **23** being of a length less than that of the tube sections **37** for a reason to be described hereinafter. It is noted that the speed of travel of the conveyor chains **18** preferably is synchronized with the speed of travel of the tube sections **37** on the ramp **52** so that each successive carrier member **21** normally will receive a tube section **37** from the ramp **52**.

Since the frame member **13** is inclined towards the frame member **14**, each tube section **37** received on the carrier member **21** rolls (to the left as seen in FIG. 1) on its respective supporting platform **23** until it engages the substantially vertically extending supporting platform **25** which is perpendicular to the platform **23**. The inclination of the frame member **13** and thus that of the supporting platforms **23** retains each of the tube sections **37** on its respective carrier member **21** while it is traveling upwardly therewith.

As shown in FIGS. 1 and 2, any axial movement of the tube sections **37** on the carrier members **21** which may be caused by vibration, bouncing, etc., is limited by rods or stop members **57** of arcuate cross section which are disposed on either side of the carrier members **21** and are in parallel relationship with the conveyor chains **18**. The rods **57** preferably are formed of any suitable smooth material which will not damage the ends of tube sections **37** coming into contact therewith, and are rigidly attached to support brackets **58** rigidly mounted on the front frame assembly **13** and to support brackets **59** rigidly mounted on the rear frame assembly **14** (see FIGS. 1 and 2).

As the tube sections **37** travel upwardly on the carrier members **21**, they pass through an auxiliary frame **60** (FIGS. 1 and 2) which is rigidly attached to the front frame assembly **13**. The auxiliary frame **60** comprises an upwardly extending mounting plate **61** which is substantially parallel to and laterally spaced from the front frame assembly **13**. A plurality or bank of heating units **62**, preferably of the infra-red type, are removably mounted on the inner surface of the mounting plate **61** and are electrically fired by a suitable source of power (not shown) connected to the conductors **64** and **65**. It is noted that, alternatively, the infra-red heating units **62** could be gas-fired, or the heating units **62** could be of any other suitable type other than the infra-red type, without departing from the scope of the instant invention.

As shown in FIGS. 1, 2 and 4, a corrugated reflecting plate **66**, preferably of aluminum or any other suitable reflective material, and of a width and length approximately the same as that of the bank of heating units **62**, is rigidly mounted on the front frame assembly **13** in facing relationship to the heating units **62**. The heating units **62** and the reflecting plate **66**, therefore, define a heating chamber H therebetween through which the tube sections **37** are conveyed by the carrier members **21** on the conveyor chains **18**.

The temperature to which the tube sections **37** are raised in the heating chamber H is controlled by the amount of radiation from each of the infra-red heating units **62**, the number of heating units **62** utilized in the chamber H, the spacing of the tube sections **37** from the heating units **62**, and the speed at which the tube sections **37** are conveyed on the carrier members **21** through the chamber H. Preferably, the tube sections **37** are raised to a temperature which is sufficient to substantially increase the vapor pressure of the water concentrated at the glue lines of the body plies and thus to increase the dispersion rate of the water in the body plies. It is noted that the temperature of interior portions of the tube sections **37** in the chamber H should be kept below the boiling point of water, since any steam formed from the water in the body plies may cause unsightly blistering of the plies and possible damage to the helical seams of the plies in the tube sections **37**.

The increased dispersion rate of the water concentrated in the body plies results in an even distribution of the water throughout the body plies as the tube sections **37** leave the chamber H. Since, for a given moisture content, it has been found that a body ply is stronger and harder when the moisture is evenly distributed throughout the ply

rather than concentrated in certain portions thereof, the tube sections **37** are hardened in the heating chamber H to an extent that they can resist subsequent end seaming operations without collapsing.

It will be noted that the tube sections **37** do not rotate as they move upwardly through the heating chamber H, since they are completely supported on the carrier members **21**, the reason for this being that it would be undesirable to have the tube sections **37** in rolling contact with any stationary guide bars which would be permanently positioned in the heating chamber H and would thus become intensely hot and cause localized overheating of the tube sections **37**. Because the sections **37** do not rotate, one of their sides always faces the bank of heating units **62**, whereas their other sides, which may be termed their rear sides, always face away from them.

The reflecting plate **66**, therefore, is provided to insure that the radiation from heating units **62** is substantially uniformly received by the tube sections **37** in the heating chamber H to thereby provide a substantially uniform temperature of the water in the body plies. They function to do this by reflecting the radiated energy from the heating units **62** which passes between the spaced tube sections **37** onto the rear sides of the tube sections **37**. This reflecting action is efficiently effected by the corrugated surfaces of the reflecting plate **62** which scatter the energy rays in all directions and thus insure that a substantial portion of this energy is directed against the rear sides of the sections **37**, as indicated by the lines R in FIG. 4, which illustrate how the energy from the heating units is directed onto the rear sides of the tube sections **37**. It will be noted that the carrier members **21** do not materially interfere with this reflecting process, since these members, being formed of thin rods **22**, **24**, are little more than open frames which intercept only a small portion of this reflected energy.

It is to be understood that, while twelve infra-red heating units **62** are shown in the drawings, any suitable number may be used depending on the amount of radiation or heat to which the tube sections **37** are to be exposed. Since the heating units **62** are removably mounted on the mounting plate **61**, the number of heating units **62** to be utilized may be conveniently varied.

As the hardened tube sections **37** are conveyed upwardly on the carrier members **21** above the heating chamber H, they travel over the driving sprocket **15** and are retained on the carrier members **21** by a pair of retaining members or rods **68** of arcuate cross-section which are parallel to the path of the conveyor chains **18** (see FIG. 1). The retaining members **68** are formed of a suitable material which will not mechanically damage the outer surface of the tube sections **37** in contact therewith, and are rigidly mounted on laterally extending flanges **70** (FIG. 3) on the spaced support brackets **59** mounted on the frame member **14**. Since these members **68** are not in the heating chamber H, they do not become hot, and therefore do not cause localized overheating of the tube sections **37**.

As each tube section **37** and its respective carrier member **21** leave the driving sprocket **15**, the tube section **37** rolls downwardly on the supporting platform **25** of the carrier member **21** and falls onto the supporting platform **23** of the preceding carrier member **21**. The tube section **37** is then downwardly conveyed on the supporting platform **23** of the preceding carrier member **21** and is retained thereon by the pair of retaining members or rods **68**.

Each of the retaining members **68** is provided with a lower curved section **72** which is rigidly mounted on a frame **74** (see FIG. 1). A curved guide member or ramp **76** which is parallel to the curved sections **72** of the retaining members **68**, is rigidly mounted at its upper end to the lowermost support bracket **59** on the frame member **14** and is supported at its lower end on the frame **74**. The

upper portion of the guide member **76** is provided with a longitudinal slot therein (not shown) having a width greater than that of the carrier members **21** but less than that of the tube sections **37**, whereby the tube sections **37** are deposited on the guide member **76** as their respective guide members **21** pass through the longitudinal slot of the guide member **76** and continue downwardly towards the idler sprockets **16** and **17**. The tube sections **37** deposited on the guide members **76** roll downwardly thereon to another conveying means (not shown) leading to a final cutting means (not shown) wherein the heated tube sections **37** are cut into container bodies prior to an end seaming operation.

It is noted that the instant apparatus is not limited in use to the heating of only spirally wound container bodies. The instant apparatus may be utilized to heat treat in any manner any type of multi-ply fibre container body.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. Apparatus for heating fibre container bodies having a plurality of plies which are joined together by a water-based adhesive to a temperature which is below the boiling point of water but sufficiently high to effect an even distribution of the water throughout the plies comprising; a conveyor, said conveyor including a pair of chains and rod-like members extending outwardly from said chains and spaced apart on each chain a distance considerably greater than the diameter of said bodies, means to drive said conveyor, radiant heating means disposed only along one side of and generally parallel to said conveyor, a reflecting surface positioned on the other side of said conveyor and generally parallel to said conveyor and said radiant heating means, said reflector surface having outwardly convex corrugations extending perpendicularly to the direction in which said conveyor is driven, and means to feed said bodies to said conveyor and place said bodies upon said rod-like members in a position parallel to said corrugations.

2. The apparatus defined in claim **1** wherein said reflecting surface and said radiant heating means are upwardly inclined so that said conveyor moves said bodies upwardly between said radiant heating means and said reflector.

3. Apparatus defined in claim **2** wherein said means to feed said bodies to said conveyor includes a ramp positioned below said radiant heating means and said reflector, said ramp adapted to permit said bodies to roll thereon and onto said rod-like members.

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