March 27, 1962 H. B. REED ETAL 3,027,443

CARTON GLUING APPARATUS

Filed Dec. 30, 1958 4 Sheets-Sheet 1

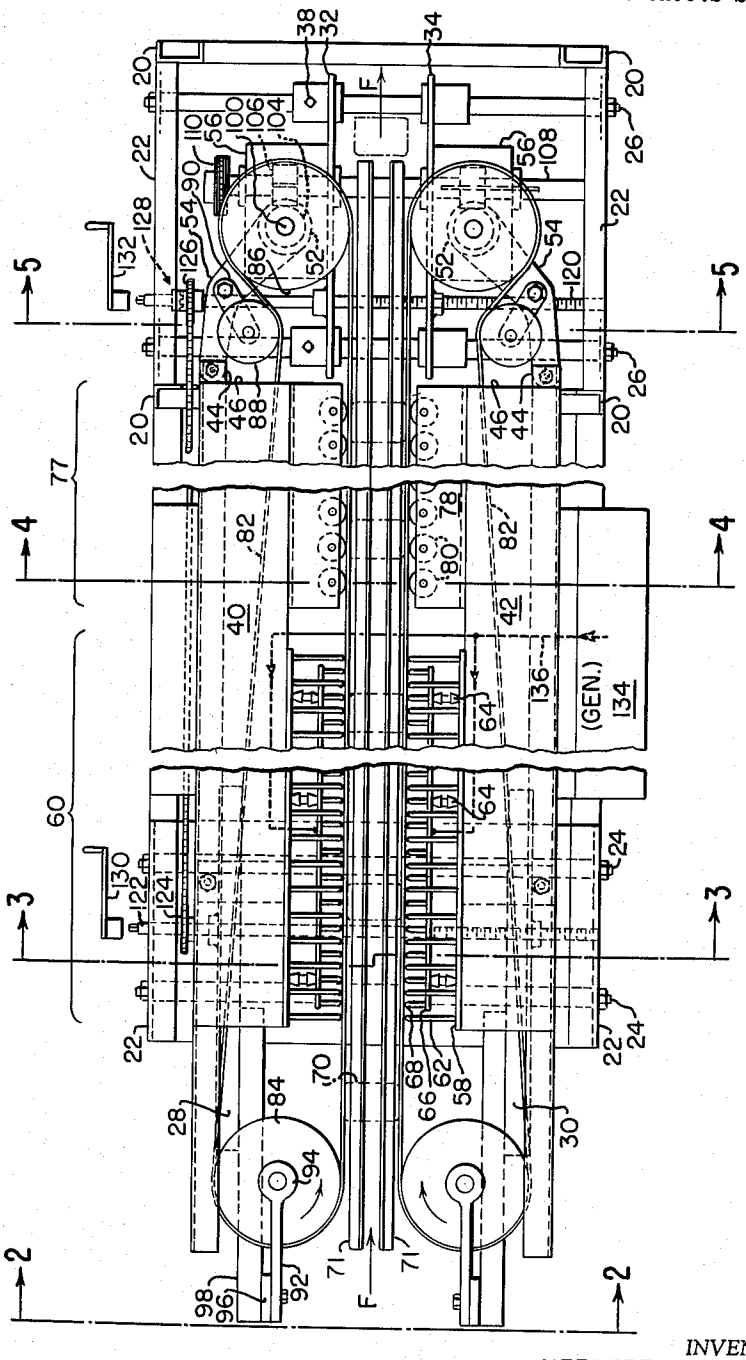


FIG. 1

INVENTORS
HERBERT B. REED
WALLACE J. ROSS
BY KENWAY, JENNEY, WITTER & HILDRETH

ATTORNEYS

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4 Sheets-Sheet 2

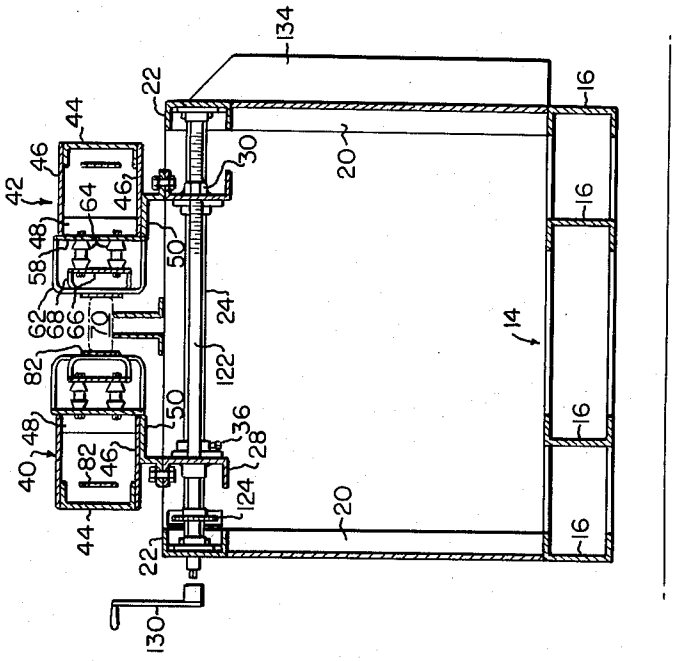


FIG. 3

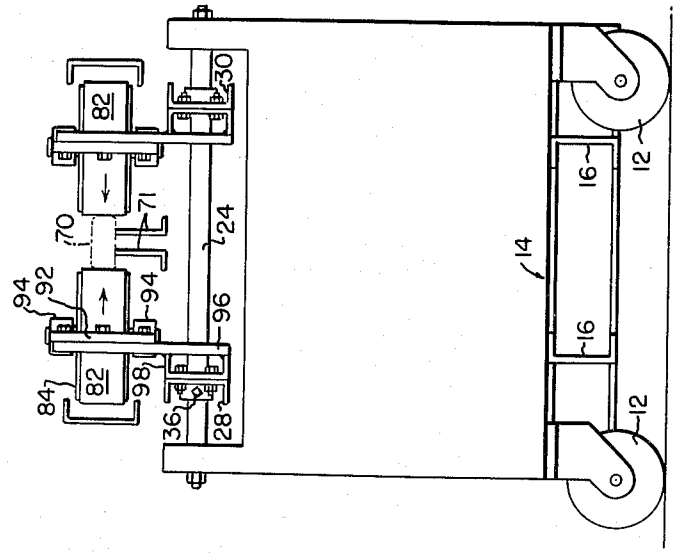


FIG. 2

INVENTORS
HERBERT B. REED
WALLACE J. ROSS
BY KENWAY, JENNEY, WITTER & HILDRETH

ATTORNEYS

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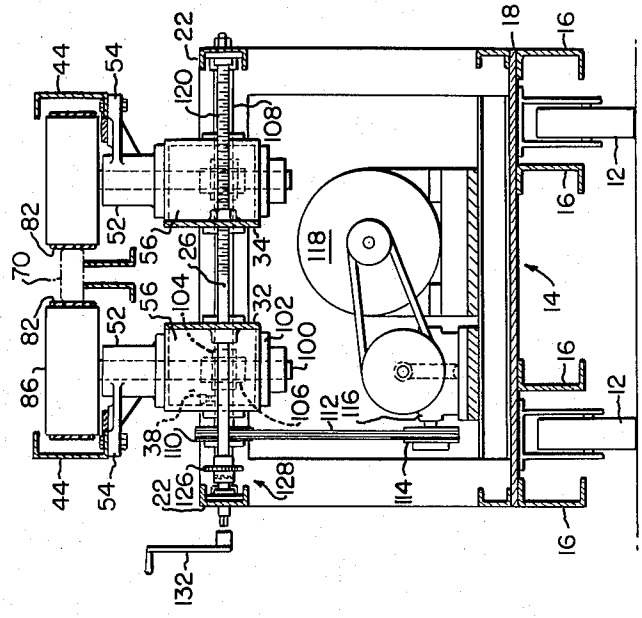


FIG. 5

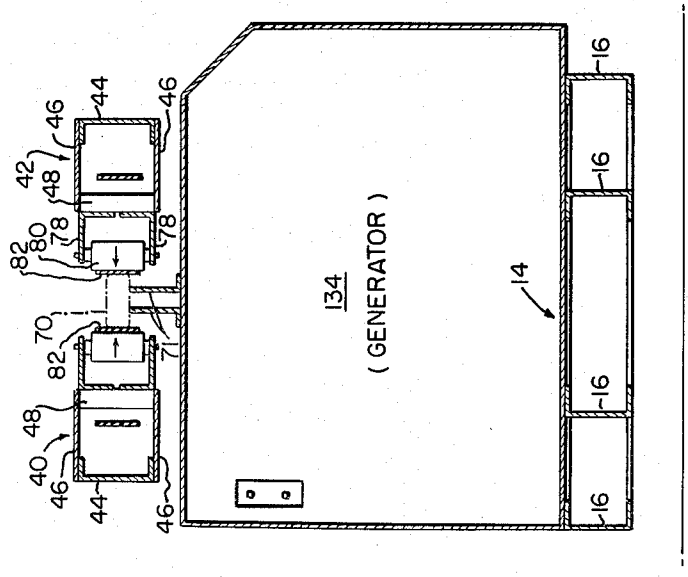


FIG. 4

INVENTORS
HERBERT B. REED
WALLACE J. ROSS
BY KENWAY, JENNEY, WITTER & HILDRETH

ATTORNEYS

March 27, 1962 H. B. REED ETAL 3,027,443

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4 Sheets-Sheet 4

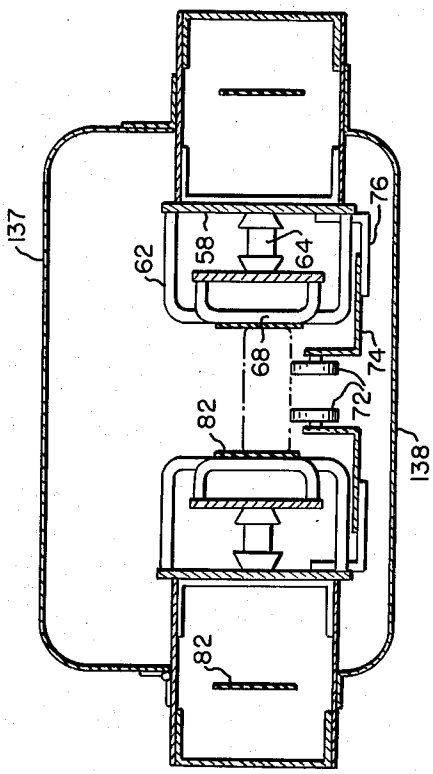


FIG. 6

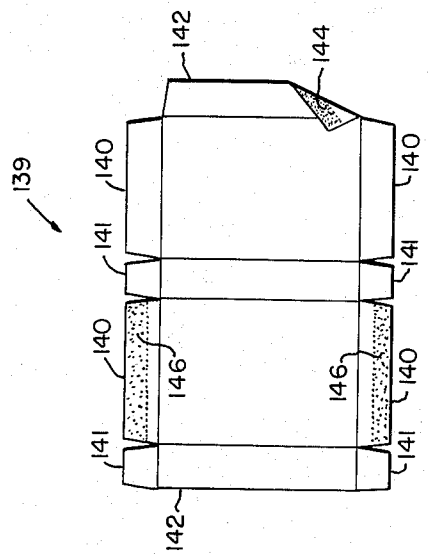


FIG. 7

INVENTORS
HERBERT B. REED
WALLACE J. ROSS
BY KENWAY, JENNEY, WITTER & HILDRETH

ATTORNEYS

United States Patent Office 3,027,443 Patented Mar. 27, 1962

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CARTON GLUING APPARATUS

Herbert B. Reed, Dover, and Wallace J. Ross, Wellesley, Mass., assignors to Raybond Electronics, Inc., Newton Highlands, Mass., a corporation of Massachusetts

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12 Claims. (Cl. 219—10.69)

The present invention relates generally to the art of gluing cartons, and more particularly to a machine for accelerating the hardening of glue applied to the glue flaps of loaded and set-up cartons delivered to the machine.

In mass production of packaged food stuffs, for example frozen foods, it is desired to provide stiff paper or cardboard cartons for suitable protection and moisture-proofing of the contents. The characteristics of glue do not permit it to harden with great rapidity in ordinary atmospheric conditions, and therefore after application of glue to the flaps of the carton, a problem arises in providing suitable means to hold the flaps tightly against the carton until the glue is sufficiently hard to resist plastic flow.

It is a principal object of this invention to provide means for greatly accelerating the hardening of the glue by inducing dielectric heat therein.

In certain applications, particularly in the packaging of food stuffs, it is desired to provide a carton having a water resistant coating thereon. Such coatings may be of various forms, paraffin wax being the most common in present use. This wax tends to inhibit the adhesive power of the glue under ordinary circumstances, and in the prior art it has often been necessary to "dewax" the glue flaps by heat or the application of wax dispersants before application of the glue. It is a second object of this invention to eliminate "dewaxing" and to provide an improved machine which will effect a strong and uniform bond between the glue flaps when the glue is applied directly over a wax coating.

Still another object is to provide a machine which will produce a uniformly-glued flap, as distinguished from certain products according to the prior art in which the principal glue-bond is produced only along spaced lines having a relatively smaller, nonuniform total area of adhesion.

A still further object is to provide a machine which will effect the necessary hardening of the glue without adverse effect upon the contents of the package, such as a perishable food in the frozen condition, or otherwise.

With the foregoing and other objects in view, the features of the invention include the provision of a plurality of electrodes spaced with their principal dimensions transverse to the motion of the carton and connected with alternating polarity to a source of high frequency electrical energy. These electrodes generate a so-called "stray" field of high-frequency electrical energy in a restricted zone or area into which the glued end of the carton is introduced. This end is carried in contact with a moving belt which passes close to the electrodes, whereby considerable heat is generated in the glue with negligible heat being absorbed by the contents of the package.

Another feature resides in the provision of pressure rolls which continue the pressure upon the glued flaps after they pass from the high frequency electrical field, whereby the glue is hard enough to resist plastic flow when the cartons leave the machine.

Another feature resides in an arrangement whereby repetitive pressure strokes are applied to the ends of each carton by the electrodes through the belts during the subjection of the carton to the high frequency electrical field, thereby assisting in dispersing the wax and improving the bond.

Still another feature resides in the foregoing and other arrangements herein described, whereby the glue is enabled to pass through the wax coating on the carton, so that a strongly adhesive bond may be made between the glued end flaps of the carton while the wax is in a softened condition due to the production of localized heat.

Other features of the invention reside in certain details of the construction of the machine, and in certain arrangements of the parts and modes of operation which will be more fully understood from the following description of a preferred embodiment, having reference to the appended drawings in which

FIG. 1 is a plan view of the machine with repetitive longitudinal sections removed;

FIGS. 2, 3, 4 and 5 are elevations in section taken on corresponding lines 2—2, 3—3, 4—4 and 5—5, respectively, of FIG. 1;

FIG. 6 is a view illustrating an alternative means for supporting the cartons; and

FIG. 7 is a view illustrating a carton blank adapted for use in the described machine.

The machine herein illustrated and described is exemplary of the invention, but it will be understood that the teachings herein have application to other types of machines, for example book-binding machines and the like in which it is desired to accelerate the hardening of glue applied to objects on a continuously-moving conveyor or belt. The structure and operation are as follows.

Frame

The principal frame members of the machine are described as follows. Referring to the drawings, the machine is provided with casters 12 which are received in a rigid frame 14. The frame includes four longitudinal channel members 16 secured transversely by a number of spaced flat plates 18 (FIG. 5). The casters are secured to these plates 18. Extending vertically from the members 16 are a number of channel members 20 which support upper horizontal channel frame members 22 on each side of the machine. Bolted between the opposing members 22 at each end of the machine are two pairs of transverse round bars 24 and 26 which support substantially all of the other parts of the machine hereinafter described, except the drive motor, the speed changer and the generator. The bars 24 are located near the input end of the machine and the bars 26 near the output end, the direction of movement of the cartons through the machine being indicated in FIG. 1 by the arrows F.

Electrodes and Rollers

The electrode and roller sub-assemblies are supported on the frame as follows. A pair of horizontal channels 28 and 30 at the input end are fitted with suitable collars and received in opposing relationship on the bars 24. Similarly, a pair of flat, vertically-oriented plates 32 and 34 at the output end are fitted with collars and received in opposing relationship on the bars 26. The channel 28 is fixed on the bars 24 by set screws 36, the channel 30 being slidable on the bars 24. Similarly, the plate 32 is fixed on the bars 26 by set screws 38, the plate 34 being slidable on the bars 26. Extending longitudinally of the machine are a pair of longitudinal support box frames 40 and 42, each frame comprising a channel member 44, a pair of horizontal plates 46 and a number of spaced vertical channel brackets 48. The supports for the input ends of the frames 40 and 42 comprise a pair of Z-brackets 50 (FIG. 3) which are bolted to the channels 28 and 30 and welded to the bottom plates 46. The supports for the output ends of the frames 40 and 42 com-

prise a pair of brackets **52** (FIGS. 1 and 5) having arms **54** which are bolted to the channel members **44**. The brackets **52** are secured to gear boxes **56** which are in turn secured to the plates **32** and **34**.

The electrode sub-assemblies on the two sides of the machine are identical in construction, and therefore only one is described. A flat vertical metal ground plate **58** (FIG. 3) is secured to the spaced channel brackets **48** and extends the full length of the electrode section of the machine, this section being designated **60** in FIG. 1. Rectangularly-formed, solid metallic ground electrode bars **62** of circular cross-section are secured directly to, and in good electrical contact with, the plate **58**. In turn, the plate **58** is in good electrical contact with the frame of the machine through the supporting structures previously described. The spacing between the electrodes **62** is preferably equal throughout the section **60**. Also secured to the plate **58** are a number of spaced insulators **64** which support a "hot" plate **66** in insulated relation to the plate **58**. A number of "hot" electrode bars **68**, similar in shape and construction to the ground electrodes **62** and also of circular cross-section, are secured directly to, and in good electrical contact with, the plate **66**. The electrodes **68** are spaced midway between adjacent pairs of ground electrodes, and are arranged to have their vertical portions in alignment with the vertical portions of the ground electrodes. The electrical connections to the electrodes are described below.

In the embodiment of FIGS. 1 to 5, the cartons **70** are supported on a pair of rails **71** secured to the frame of the machine (FIG. 4). Alternatively, they may be supported on a line of grounded ball bearing wheels **72** (FIG. 6) which may in turn be supported on the ground plate **58**. According to the alternative construction of the latter figure, the wheels may have their shafts secured on a longitudinal metal angle member **74** which is bolted to a number of spaced metal angle brackets **76**, the brackets being welded or otherwise secured to the plate **58**. It will be understood that the distance between the wheels **72** and the "hot" electrodes **68** is substantially greater than that between the latter and the ground electrodes **62**, whereby the current flowing between the "hot" electrodes and the wheels is negligible.

The roller sub-assemblies comprise a pressure roller section designated **77** in FIG. 1. These sub-assemblies on the two sides of the machine are also identical in construction, and therefore, only one is described. Two longitudinal angle members **78** (FIG. 4) are secured to the spaced channel brackets **48** and support a number of rollers **80**. These rollers are of any suitable construction and are preferably provided with low-friction metal surfaces. The distance between the surfaces of opposite rollers is preferably identical to the distance between the vertical portions of opposite electrodes, this distance corresponding closely to a dimension of the cartons to be sealed.

Belt Drive

The cartons **70** are propelled through the machine by lateral pressure delivered by a pair of continuous belts **82**. Since these belts are supported and driven in an identical manner, only one is described. Each belt is supported on an input roll **84** (FIGS. 1 and 2), an output roll **86** (FIGS. 1 and 5) and an idler roll **88** (FIG. 1). The roll **88** is supported on an arm **90** which may be pivoted to adapt the rolls for belts of various lengths and for tension adjustment.

The roll **84** is supported as follows. Referring to FIGS. 1 and 2, the shaft of the roll is vertically and rotatably supported by a bracket **92** having integral sleeve bearings **94** above and below the roll. The bracket **92** is bolted to a vertical member **96** which is in turn welded to a channel member **98**. The member **98** is bolted to the channel **28**, the bolt holes being preferably elongated to allow for longitudinal adjustment of the axis of the roll. An additional adjustment is preferably provided by elongating the bolt holes between the members **92** and **96**, thereby permitting adjustment of the angle formed by the axis of the roll with the vertical to prevent slippage of the belt on the roll.

The roll **86** is supported as follows. Referring to FIGS. 1 and 5, the shaft 100 of the roll is vertically and rotatably supported in a gear box **56** in bearings provided by a bracket **52** and a collar **102**. As previously described, the idler roll **88** is adjustably supported on the same bracket **52**.

As seen in FIG. 1, the belts **82** are supported in alignment with and touching the electrodes **62** and **68** and the rollers **80**. Lateral pressure is exerted by the electrodes and rollers through the belts upon the cartons **70** as the latter pass through the machine. Since the belts are disposed in the electrostatic fields set up in the machine, it is essential that they have a low dielectric loss factor. Also, they must be able to withstand the heat generated during operation. Preferably, they also have a reasonably low coefficient of friction against the electrodes and rollers and good wear properties. The preferred belt is fabricated of woven "Dacron" (a trademark designating a synthetic fiber made by the condensation of dimethyl terephthalate and ethylene glycol), this fiber being impregnated with silicone rubber. However, it will be understood that the belts may be constructed of other materials having similar properties.

The power drive for both belts is the same, and is described as follows. (See FIGS. 1 and 5.) The shaft **100** of the pulley **86** is secured to a spiral gear **104** which engages a similar gear **106**. The gear **106** is secured to a transverse shaft **108** rotatably received in a frame member **22** and in collars on the gear boxes **56**, the shaft being provided with a belt pulley **110**. A belt **112** connects the pulley **110** to a pulley **114** on a shaft extending from a speed changer **116** which is a variable speed drive of conventional construction. The speed changer is operated by a motor **118**, both parts being supported on the frame **14** of the machine.

Transverse Adjustment

To permit the gluing of cartons of various dimensions, and also to permit adjustment of the pressure of the electrodes and rollers through the belts upon the cartons, lateral adjustment means are provided as follows. A transverse shaft **120** is rotatably received in a frame member **22** and through a collar on the plate **32**. This shaft is threaded throughout approximately half its length and passes through a threaded nut secured to the plate **34**. At the other end of the machine, a transverse shaft **122** is rotatably received at both ends in frame members **22** and through a collar on the channel **28**. This shaft is threaded throughout approximately half its length and passes through a threaded nut secured to the channel **30**. A sprocket **124** is secured on the shaft **122** and a sprocket **126** is freely supported on the shaft **120**. A hand-operated clutch **128** of conventional form causes normal engagement of the sprocket **126** and shaft **120**. Hand cranks **130** and **132** are received, respectively, on the shafts **122** and **120**.

From the foregoing description, it will be apparent that simultaneous adjustment of the electrodes, rollers and belt on the lower side of the machine as viewed in FIG. 1, relative to the corresponding parts of the upper side of the machine, is accomplished by rotating either of the cranks **130** or **132** to cause transverse movement of the channel **30** and the plate **34**. Also, transverse adjustment of either end of the machine independently of the other may be effected by disengaging the clutch **128** temporarily and turning the appropriate crank **130** or **132** while holding the other crank fixed, whereupon the clutch **128** is reengaged.

Generator

A high voltage, high frequency generator **134** is sup-

ported on the frame **14** of the machine and is located approximately an equal distance from each end thereof. This generator is provided with a circuit of any well-known form, for example a Hartley or Colpitts type oscillator such as those hitherto used in gluing plywood structures and the like through the creation of high frequency electrostatic fields, the frequency preferably being of the order of 15 to 20 megacycles. The generator is suitably grounded to the frame of the machine and to the ground plates **58**. A "hot" lead **136** schematically represented in FIG. 1 connects the generator with the "hot" plates **66**. These connections to the plates are made in accordance with the principles of high frequency circuit theory and may be made at any suitable place. The illustrated connections are preferred, being made at a point midway between the ends of each plate. It will be understood that the length of each of the plates **58** and **66** is small relative to the wavelength of the generated frequency. In the preferred embodiment, the plates are approximately one-eighth of a wavelength from end to end, and with the center connections illustrated the voltage is reasonably uniform over the entire length of the electrode assembly.

It will be understood that suitable covers **137** and **138** (FIG. 6) for shielding are preferably provided on the machine to insure the protection of the operators. These covers are omitted from FIGS. 1 to 5 for clarity of description.

Operation

Referring to FIG. 7, there is shown a box blank **139** which is made of a stiff paper or light cardboard, cut to provide end glue flaps **140**, corner flaps **141** and side glue flaps **142**, and scored as indicated by the solid lines to define fold lines between the panel portions and said flaps. The blank **139** is intended for the packaging of frozen foods, and is accordingly covered on both sides with a suitable waterproof coating such as paraffin wax, after any desired printing has been applied. The blank is initially set up in a conventional manner by applying glue at **144** to a side flap **142** and attaching the two side flaps to form an open-ended closure.

The contents of the carton may consist of a package of the correct rectangular dimensions containing frozen food and having a thin paper wrapping. This package is inserted in the carton. One of the flaps **140** on each end is then coated with glue on the side which will face inwardly when the carton is fully glued, as indicated at **146**. Both end flaps on each end are then turned inwardly in overlapping relation against the contents with the glue located between the flaps. Alternatively, it is equally possible to apply the glue to the sides of the end flaps which will face outwardly when the carton is fully glued. It will be understood that the corner flaps **141** are folded in the conventional manner, and that glue may also be applied to these flaps, if desired, for further moisture-proofing.

The carton is then placed in the machine with the end flaps **140** in contact with the belts **82**. The belts **82** provide lateral pressure against the carton to hold the end flaps in good mechanical contact with each other. This pressure is maintained throughout both the electrode section **60** and the pressure roller section **77**.

The generator **134** sets up a localized alternating electrostatic field between each "hot" electrode **68** and the adjacent ground electrode or electrodes **62**. The conditions and adjustments are such that these so-called "stray fields" are intense in the regions of the cartons including the end flaps **140**, and entirely negligible or non-existent throughout the portion of the carton between these regions.

The glue is selected for its non-toxicity and its ability to absorb heat from the dielectric field. The preferred glue is in the form of an emulsion from which certain solvents and water are driven off on heating. The heating produced by the "stray flelds" hardens the glue, while the contents of the package remain unheated, having little tendency to absorb dielectric energy and also being outside the fields of the electrodes except immediately adjacent the glue flaps. It will also be noted that the heating of the glue is relatively efficient and more rapid due to the fact that the material of the carton itself also has less tendency to absorb dielectric energy than has the glue.

It will be observed that each carton introduced at the input end of the machine passes a plurality of electrodes **62** and **68** of alternate polarity in seriatim fashion, the portions of the electrodes which bear on the carton through the belts **82** extending substantially transversely of the direction of movement. The spacing between adjacent electrodes is preferably less than the length of the end glue flaps, whereby there are always two or more electrodes bearing directly through a belt **82** on each end of the carton. However, because of the belts **82**, there is no friction between the electrodes and the cartons.

The speed of the machine is such that the glue on each carton is relatively tacky as it leaves the electrode section **60** and enters the pressure roller section **77**. This latter section continues to apply end pressure to the carton for a sufficient length of time to allow the glue to harden, whereby the glue is in condition to resist appreciable plastic flow when the carton emerges from the output end of the roller section **77**.

As stated above, the blank **138** is coated with wax, and the glue is applied to the flaps over the wax. This procedure has met with considerable difficulty in the prior art because the wax ordinarily inhibits the penetration of the paper or cardboard by the glue, thereby tending to produce a weak bond. However, in the practice of the present invention it has been found that a strong and satisfactory bond is readily achieved. The heat generated in the region of the end flaps of each carton, as previously described, is of sufficient intensity to melt the wax. Moreover, the belts **82** are relatively thin, whereby the action of the electrodes on each end of the carton is similar to repeated strokes of a rolling pin over the end flaps. This repeated mechanical action of the electrodes on the ends of the carton assists in dispersing the wax and also firmly presses the flaps together, the maximum pressure per unit area being much greater than the average over the whole glue flap. This pressure applied against the ends of the carton causes the glue to penetrate the wax coating, and to adhere to and penetrate a portion of each contacting glue flap. Moreover, a similar repeated rolling-pressure is continued by the rollers **80** after the carton leaves the electrode section **60**, whereby the wax is repeatedly subjected to mechanical kneading so that it is kept dispersed until the glue has become so hard that plastic flow in the glue is no longer possible. It will, of course, be apparent that the aforesaid rolling action is also of advantage in gluing unwaxed cartons because it presses the flaps together and presses the glue against and into the flaps.

A further and important result of the structure of this machine is that each end of the carton is uniformly heated and is uniformly glued throughout the area to which the glue is applied. This is because all parts of the cartons pass consecutively through the same fields. Therefore, the maximum adhesive power is obtained from the glue.

From the foregoing description, it will be appreciated that there has been provided a machine which seals cartons by acceleration of the setting-up or hardening of glue. This hardening, although being effected by the agency of heat, is limited substantially to the glue itself and the contacting glue flaps, whereby frozen foods may be put through the machine without thawing or substantial inhibition of the glue-hardening process. The resulting bond is strong and uniform, even when the carton has been previously coated with wax.

While the invention has been described with reference to a preferred embodiment thereof, it will be understood that various modifications and rearrangements of the parts may be effected in accordance with practices familiar to

those skilled in this art, without departing from the spirit or scope of the invention.

Having thus described the invention, we claim:

1. Apparatus for accelerating the hardening of glue having, in combination, a conveyor belt, means to hold an article to be glued in frictional engagement with the belt, a number of electrode bars arranged on one side of and along the belt, said bars having their principal dimensions transverse to the direction of movement of the belt and applying pressure to said article through the belt, and means to apply a high frequency electric field between each adjacent pair of electrodes.

2. Apparatus for accelerating the hardening of glue having, in combination, a movable conveyor belt, means for driving the belt continuously, means arranged generally parallel to the belt to hold an article to be glued in frictional engagement with the belt, a number of electrode bars arranged on one side of and along the belt, said bars having their principal dimensions transverse to the direction of movement of the belt and applying pressure thereto, and means to apply a high frequency electric field between each adjacent pair of electrodes.

3. Apparatus for accelerating the hardening of glue having, in combination, a pair of generally parallel movable conveyor belts, a number of stationary electrodes arranged on one side of and mutually spaced along at least one of the belts in position to apply pressure thereto in the direction toward the other belt, means to adjust the distance between the belts, and means to apply a high frequency electric field between each adjacent pair of electrodes.

4. Apparatus for accelerating the hardening of glue in an article having, in combination, a conveyor mechanism having a conveyor belt adapted to engage and carry the article, a number of electrodes arranged with their principal dimensions having substantial components transverse to the direction of movement of the belt, the electrodes being disposed on the side of the belt opposite the article, and means to apply a high frequency electric field between each adjacent pair of electrodes, said field reaching the article by penetration of the belt.

5. Apparatus for accelerating the hardening of glue in an article having, in combination, a conveyor mechanism having a pair of parallel conveyor belts adapted to engage and carry the article between them, a number of electrodes arranged with their principal dimensions having substantial components transverse to the direction of movement of the belts, the electrodes being disposed on the side of one of said belts opposite the article, and means to apply a high frequency electric field between each adjacent pair of electrodes, said field reaching the article by penetration of said last-mentioned belt.

6. Apparatus for accelerating the hardening of glue in an article having, in combination a conveyor mechanism having a conveyor belt adapted to engage and carry the article, a number of electrodes arranged with their principal dimensions having substantial components transverse to the direction of movement of the belt, the electrodes being parallel to one another and uniformly spaced in said direction, the electrodes being disposed on the side of the belt opposite the article, and means to apply a high frequency electric field between each adjacent pair of electrodes, said field reaching the article by penetration of the belt.

7. Apparatus for accelerating the hardening of glue in an article having, in combination, a conveyor mechanism having a conveyor belt adapted to engage and carry the article, a number of electrodes arranged with their principal dimensions having substantial components transverse to the direction of movement of the belt, the electrodes being disposed on the side of the belt opposite the article and applying pressure to the article through the belt, and means to apply a high frequency electric field between each adjacent pair of electrodes, said field reaching the article by penetration of the belt.

8. Apparatus for accelerating the hardening of glue having, in combination, a conveyor belt, means to drive the belt, the belt being adapted to carry an article to be glued thereon, a number of electrodes arranged on one side of the belt opposite the article in position to apply pressure to the article through the belt and constrained from movement with the belt, whereby the belt slides over the electrodes, and means to apply a high frequency electric field between pairs of said electrodes on a common side of said belt.

9. The combination according to claim 8, in which the electric field is restricted substantially to a narrow region adjacent the belt.

10. Apparatus for accelerating the hardening of glue having, in combination, a conveyor belt, means to hold an article to be glued in frictional engagement with the belt, a number of spaced electrodes arranged on one side of the belt opposite the article in position to apply pressure to the article through the belt and constrained from movement with the belt, whereby the belt slides over the electrodes, and means to apply a high frequency electric field between pairs of said electrodes on a common side of said belt.

11. Apparatus for accelerating the hardening of glue having, in combination, a pair of generally parallel conveyor belts, means to drive the belts to carry an article to be glued therebetween, a number of electrodes arranged on one side of at least one of the belts in position to apply pressure to the article through the belt and constained from movement with the belt, whereby said last-mentioned belt slides over the electrodes, and means to apply a high frequency electric field between pairs of said electrodes on a common side of said last-mentioned belt.

12. The combination according to claim 11 in which said electrodes are arranged on a side of each belt opposite to the other belt.

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