

[54] **BLANK CONSTRUCTIONS FOR
HERMETICALLY SEALED CARTONS AND
METHODS OF FORMING SAME**

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[63] Continuation-in-part of Ser. No. 876,699, Nov. 14, 1969, abandoned.

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219/10.53**

[51] Int. Cl. **B31b 1/36**

[58] Field of Search **93/49 R, 49 M, 36.01,
93/36.6, 41, 46, 52, DIG. 1; 219/10.53, 10.49,
10.61; 53/DIG. 2, 388, 373, 375, 379**

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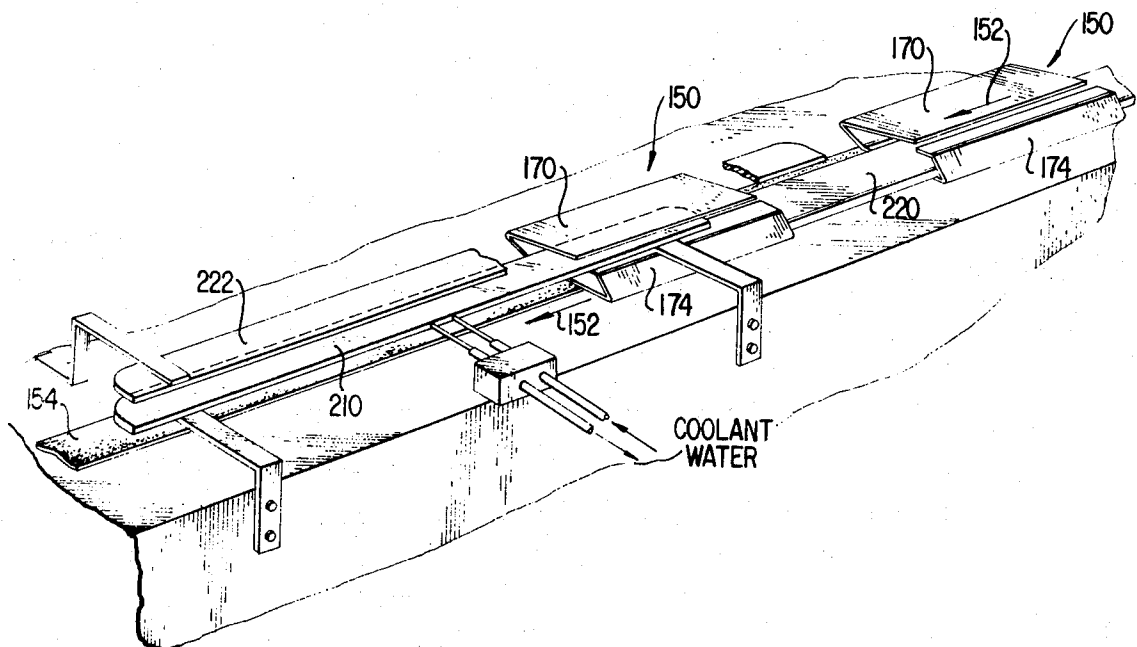
Attorney—Glenn, Palmer, Lyne, Gibbs & Thompson

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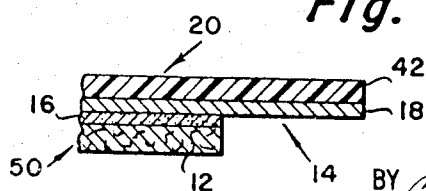
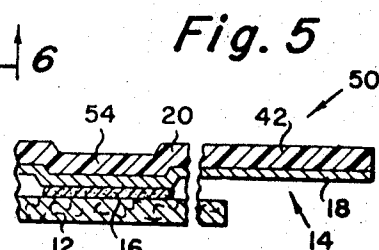
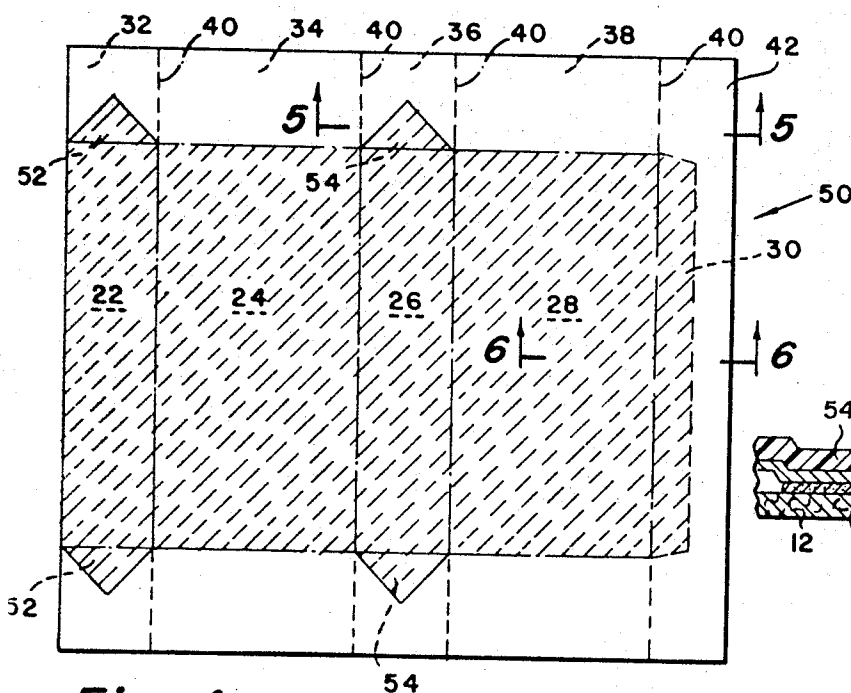
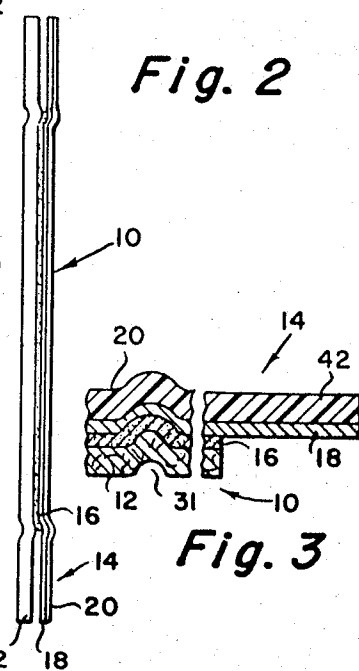
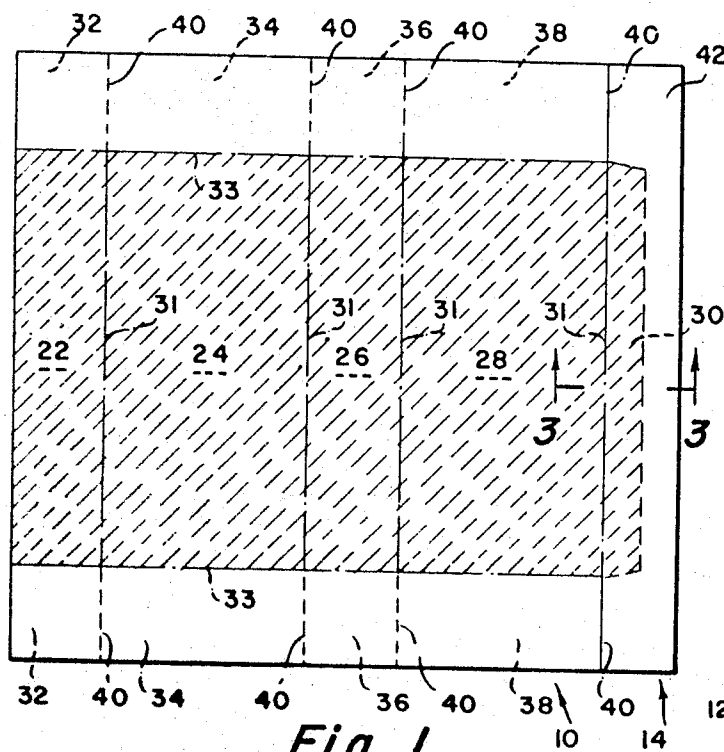
ABSTRACT

Blank constructions for use in making hermetically sealed, lined carton constructions formed continuously from strips of paperboard stock and liner material. An improved side seam construction is also disclosed wherein a paperboard-to-paperboard seal is obtained when using a liner material at least the outer surface of which is metal foil. The blank construction is formed by methods which permit one end of the liner material to overhang the paperboard stock material whereby covered side seams are provided which prevent air or liquid leakage through the pores of the paperboard stock. An R.F. induction heating method is disclosed for making side seams on lined cartons.

10 Claims, 49 Drawing Figures



9 Sheets-Sheet 1



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Fig. 7

Fig. 8

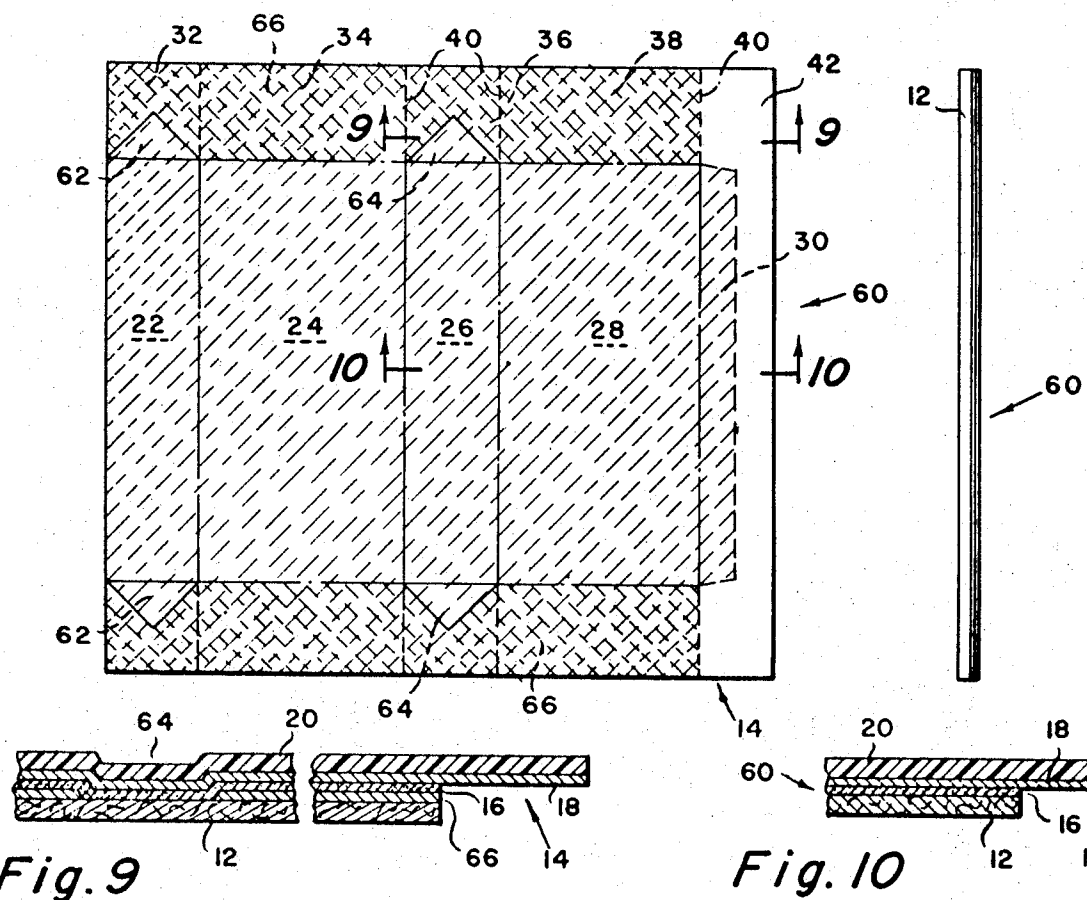
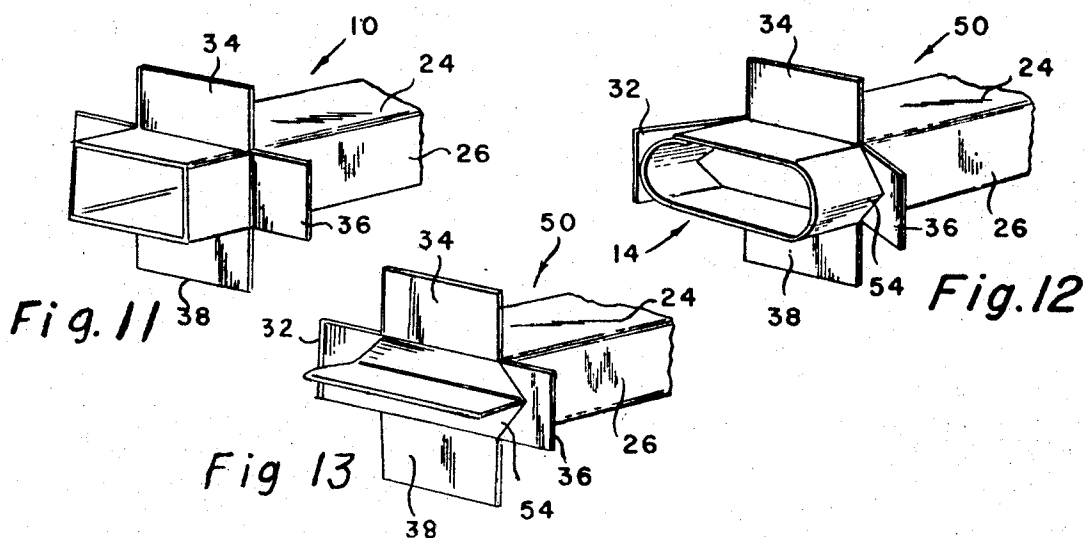


Fig. 9

Fig. 10



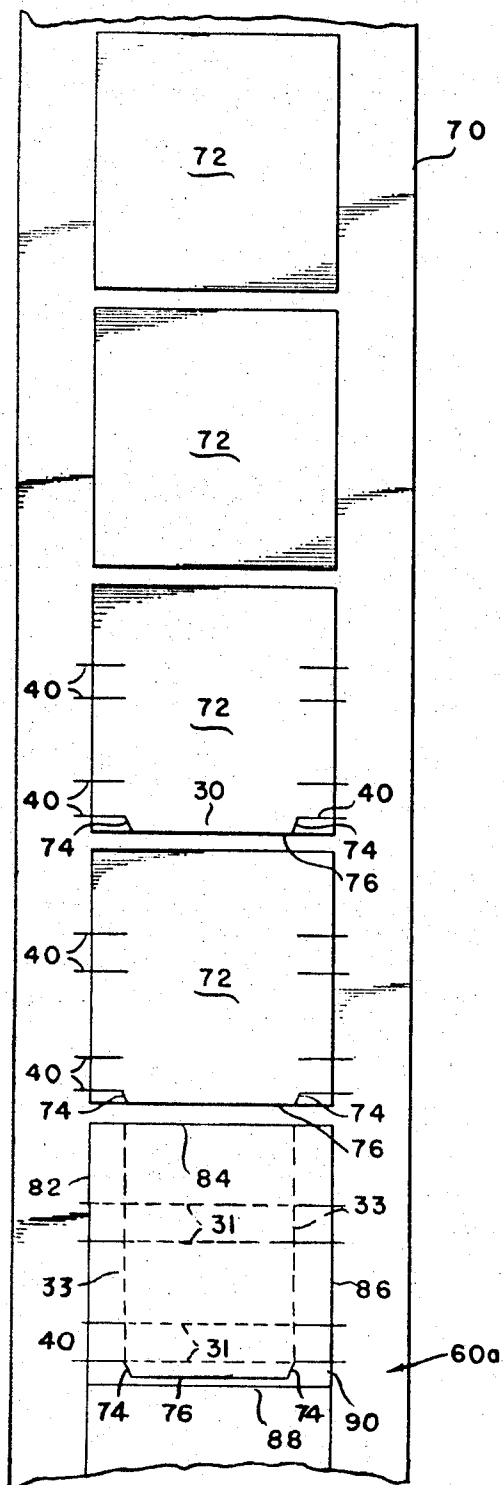


Fig. 14

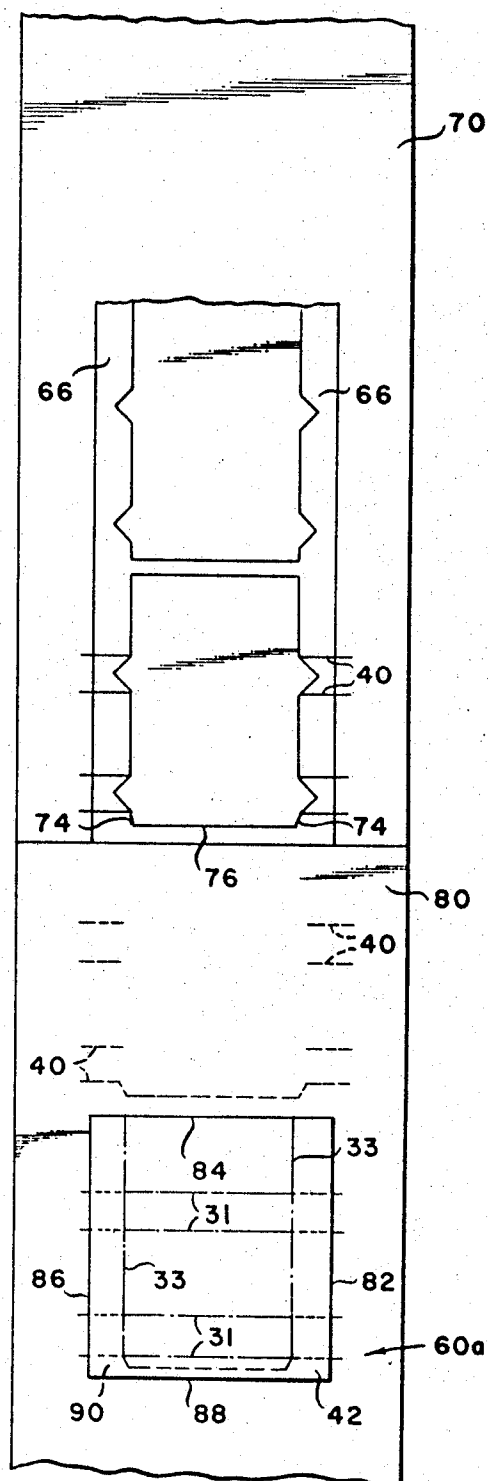


Fig. 15

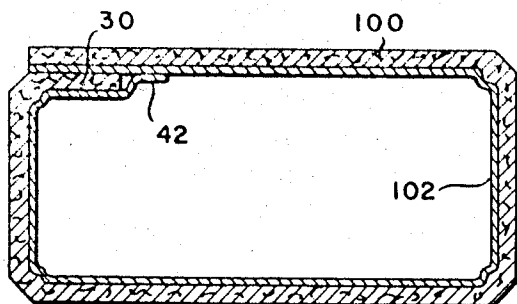


Fig. 16

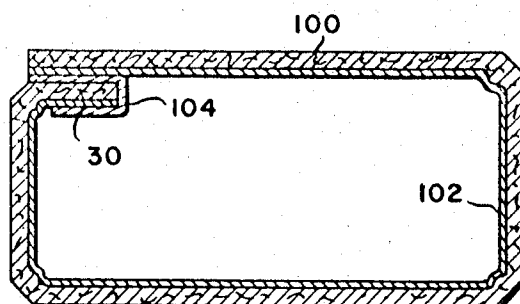


Fig. 17

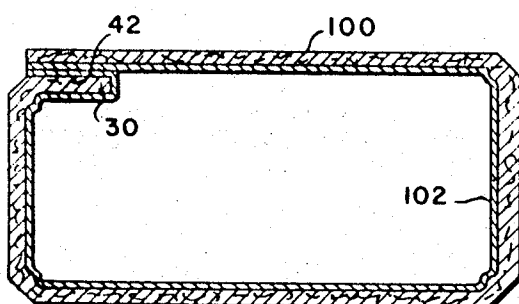


Fig. 18

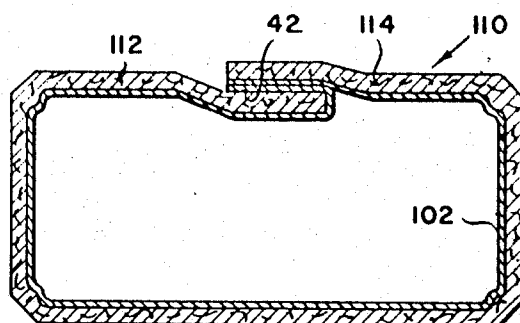


Fig. 19

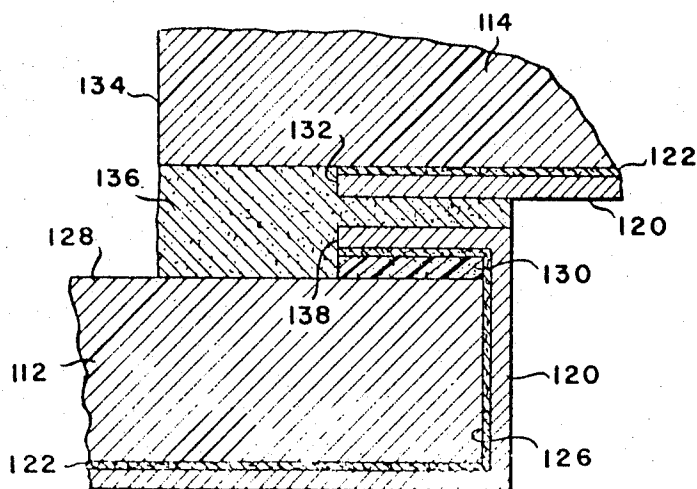


Fig. 20

Fig. 21

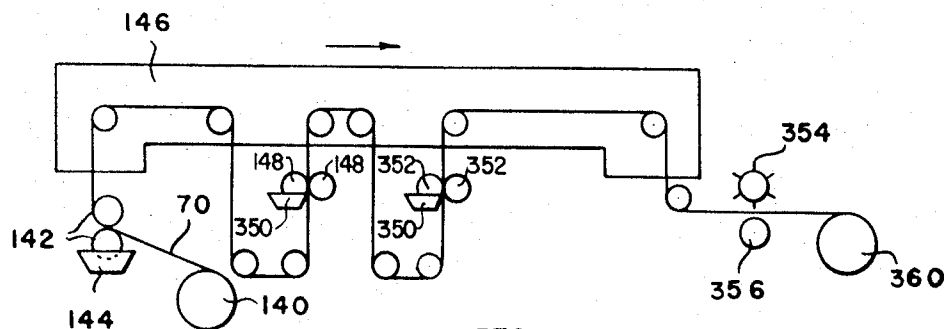


Fig. 22

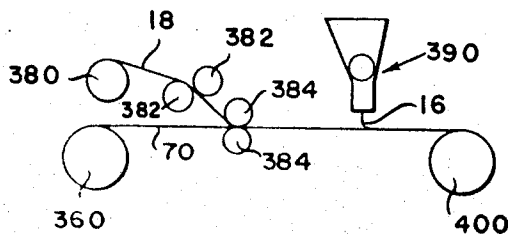
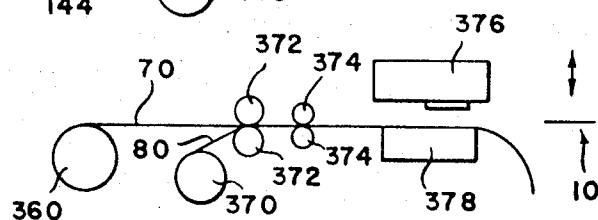


Fig. 23

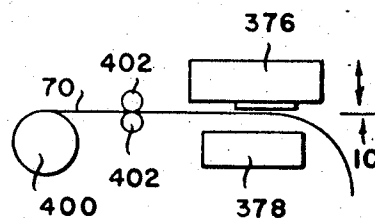


Fig. 24

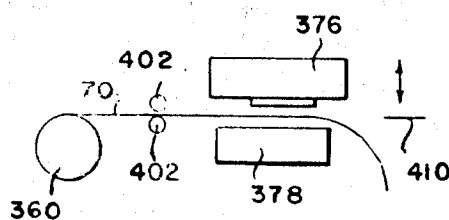


Fig. 25

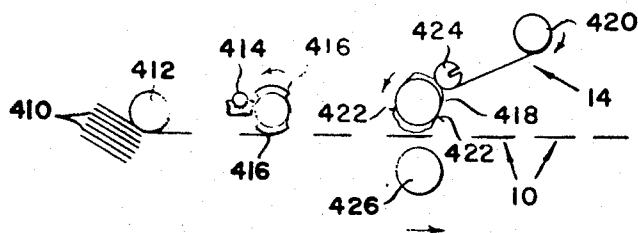


Fig. 26

FIG. 27

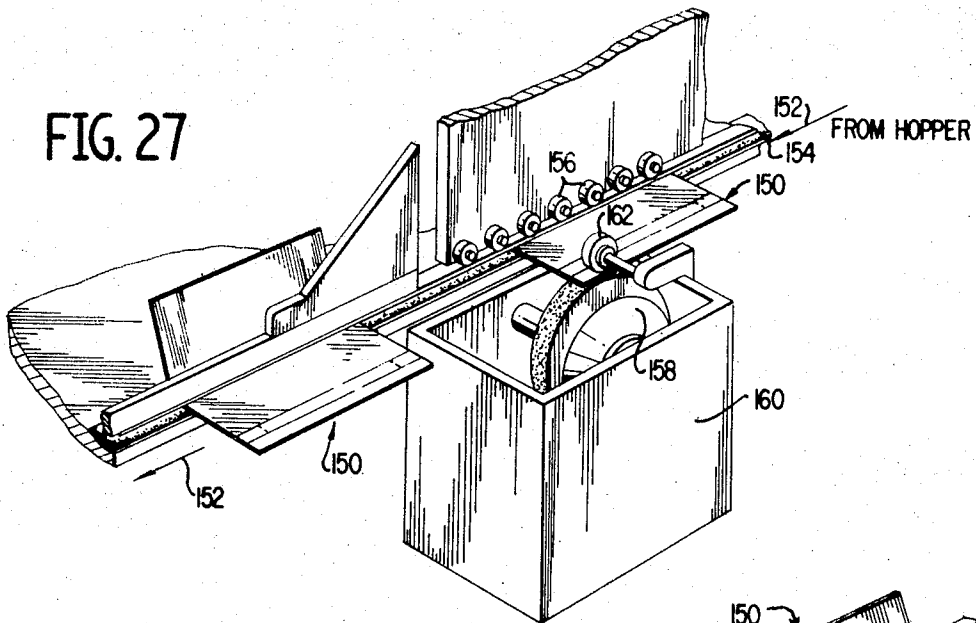


FIG. 28

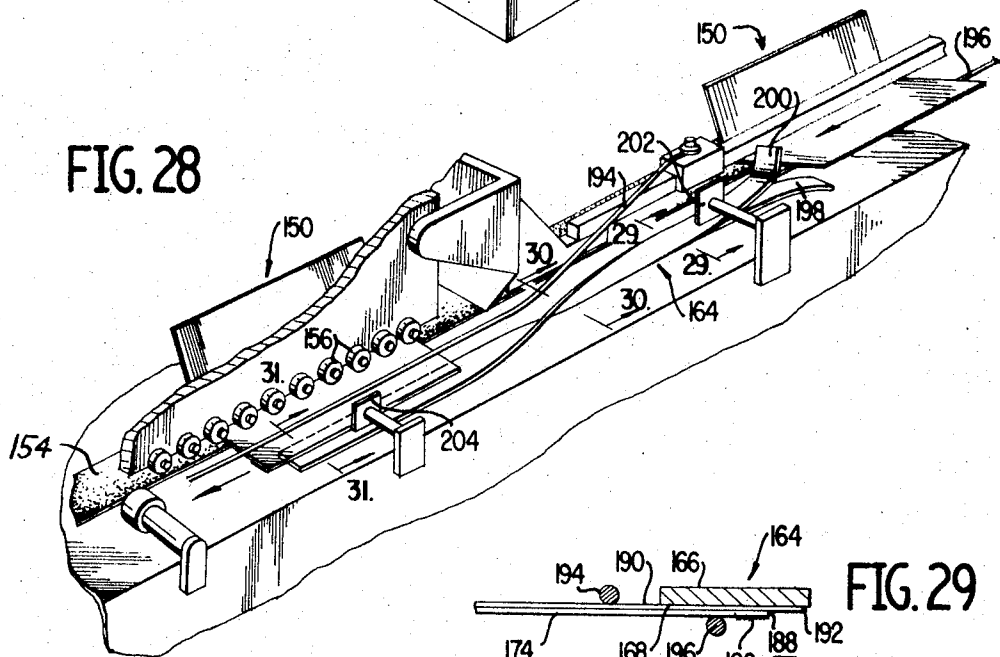


FIG. 29

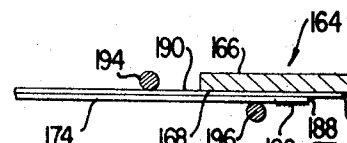


FIG. 30

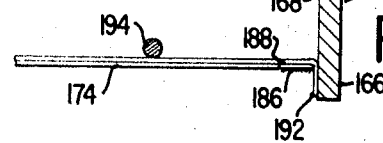


FIG. 31

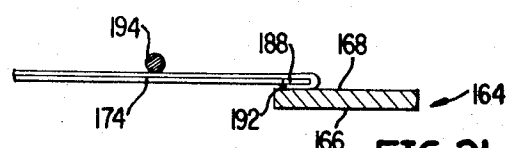


FIG. 32

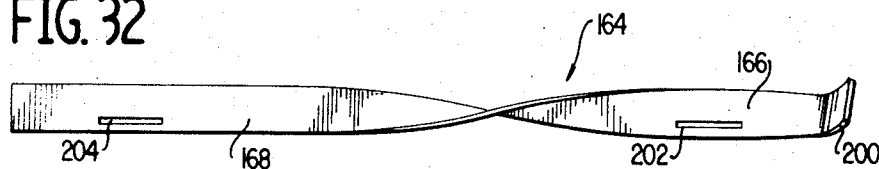


FIG. 33

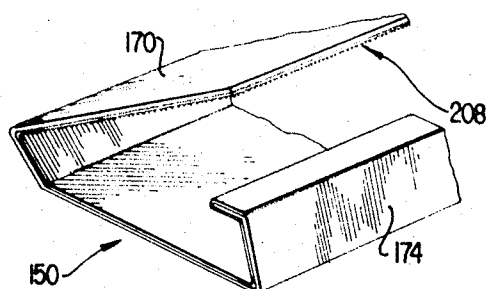
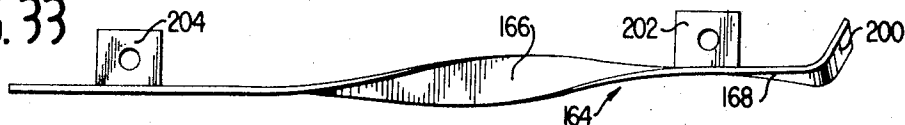


FIG. 34

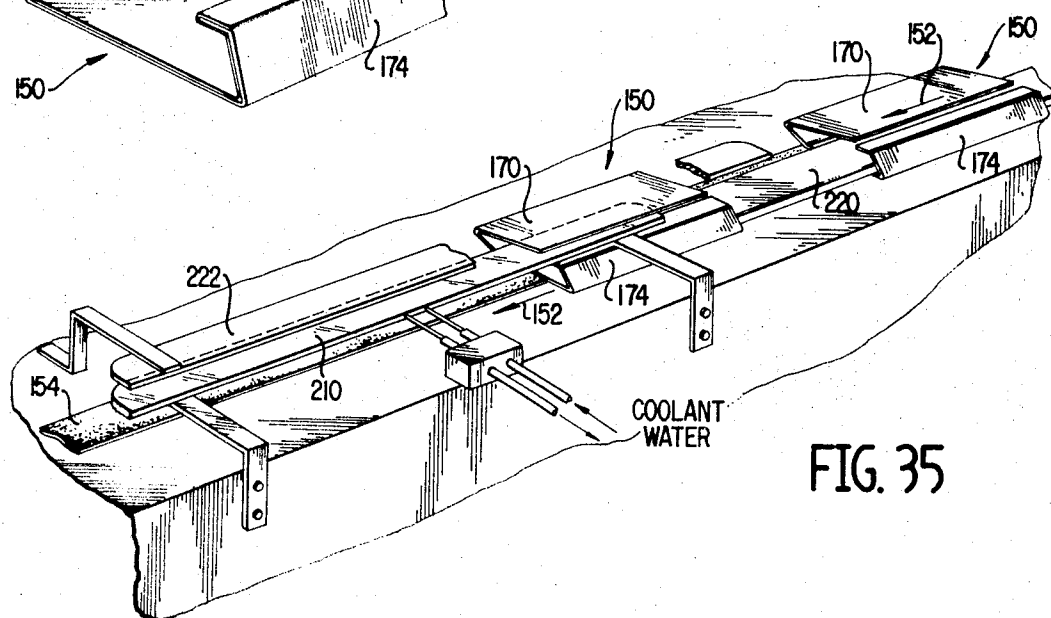


FIG. 35

FIG. 36

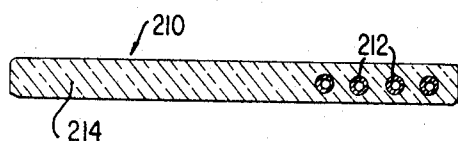
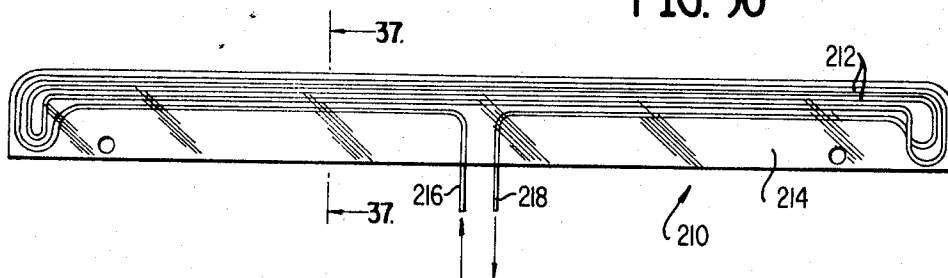


FIG. 37

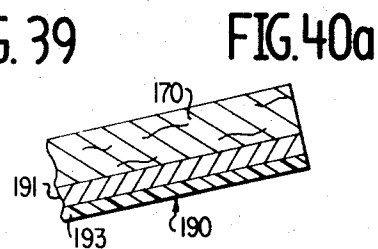
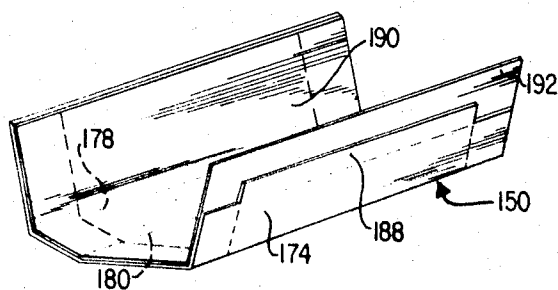
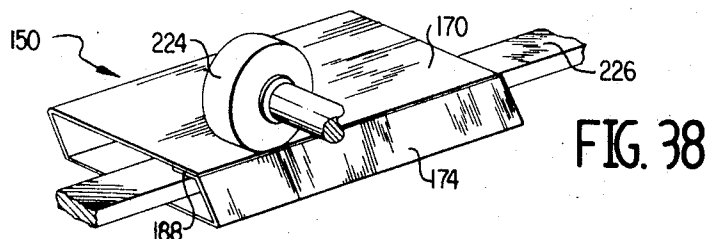


FIG. 40

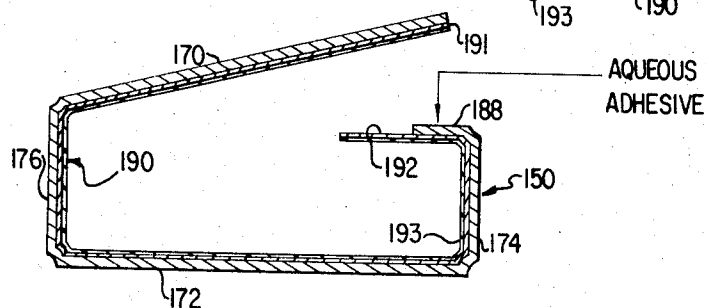


FIG. 41

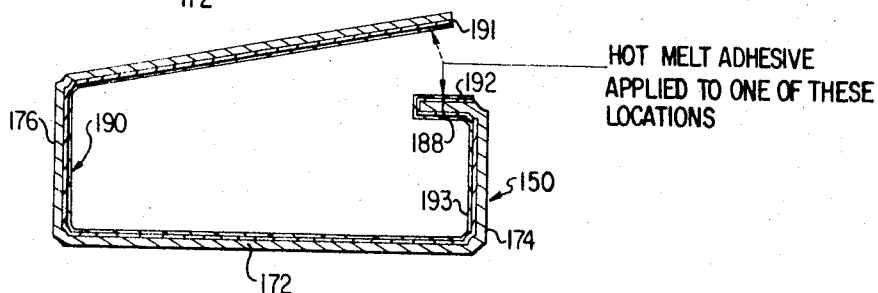
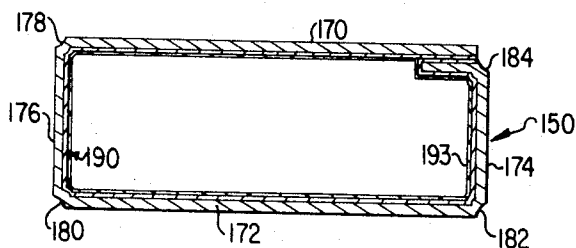
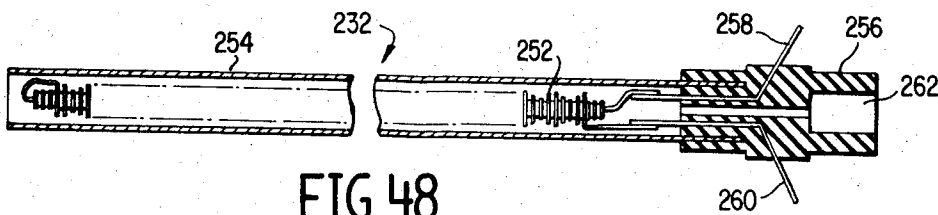
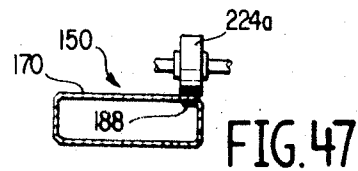
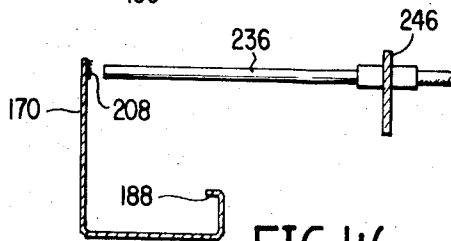
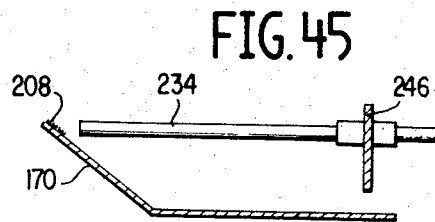
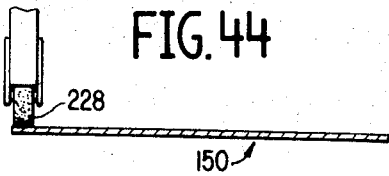
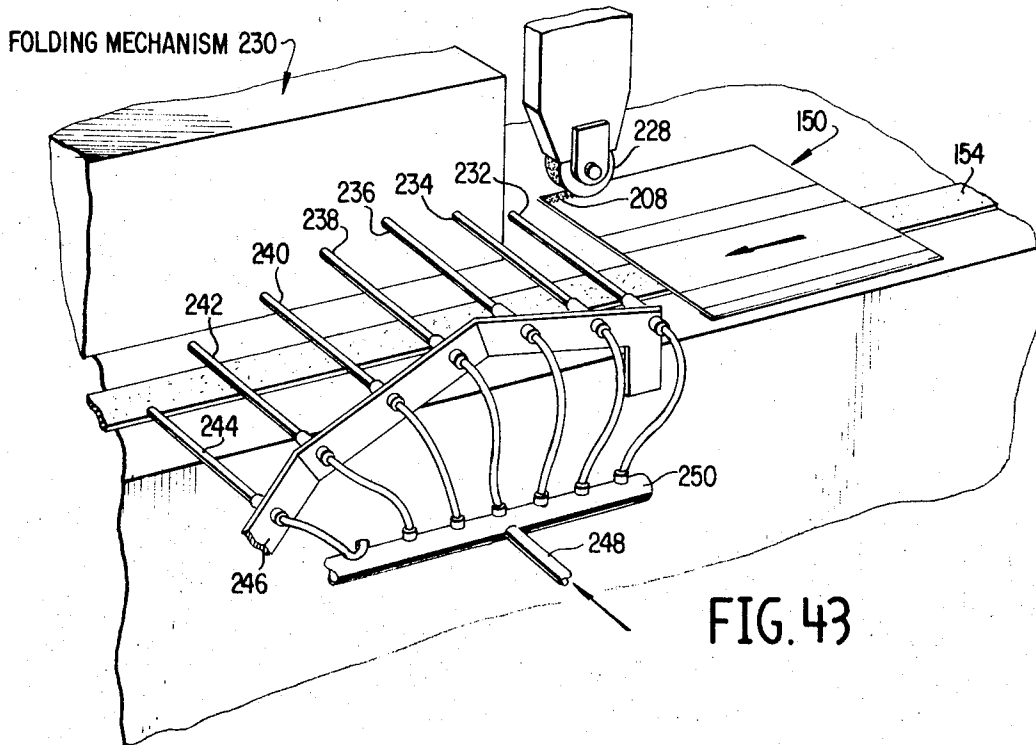


FIG. 42





BLANK CONSTRUCTIONS FOR HERMETICALLY SEALED CARTONS AND METHODS OF FORMING SAME

This is a continuation-in-part of Ser. No. 876,699, filed Nov. 14, 1969, now abandoned.

This invention relates to hermetically-sealed, lined carton constructions and, more particularly, to blank constructions for use therein and methods of forming same.

The use of paperboard cartons in the packaging industry has been limited by virtue of the inability to provide a hermetically sealed paperboard carton. Consequently, the paperboard carton, despite certain economic advantages, has not been able to compete with the all metal container. One limiting factor has been the inability to protect the longitudinal edge of the carton so as to make it impervious to air and moisture leakage through the pores of the paperboard stock. Attempts to wrap an impervious barrier around an edge of the seam area such as by the use of a foil liner has created sealing problems in that a foil-paperboard or foil-foil seal does not possess as much strength as a paperboard-paperboard seal area.

In accordance with the present invention, the foregoing problems are effectively overcome by providing a carton construction in which an edge adjacent the longitudinal seam is covered with an impervious foil-containing material while still providing a paperboard-paperboard seal area.

Additional factors have limited the use of paperboard cartons as a substitute for all metal containers. For example, manufacturers are reluctant to change from one type of container to another unless the equipment for handling the new container is already in existence. Accordingly, one feature of the present invention is to permit the manufacture of a hermetically sealed, lined paperboard carton on equipment which is already in existence and for which reliability has already been established.

An additional difficulty which is inherent in many paperboard cartons is the weakness of the longitudinal seam itself occasioned by the proximity thereof to the corner of the carton. Therefore, it is a further feature of the present invention to improve the strength of the side seam by devising a seam which may be spaced a substantial distance from the corner of the carton, if desired.

The inherent advantages and improvements of the present invention will become more readily apparent upon considering the following detailed description of the invention and by reference to the drawings in which:

FIG. 1 is a plan view of one carton blank construction made in accordance with the present invention;

FIG. 2 is an end view of the carton blank construction of FIG. 1;

FIG. 3 is a fragmentary elevational view taken in horizontal cross section along line 3—3 of FIG. 1;

FIG. 4 is a plan view of a modified carton blank construction made in accordance with the present invention;

FIG. 5 is a fragmentary elevational view taken in horizontal cross section along line 5—5 of FIG. 4;

FIG. 6 is a fragmentary elevational view taken in horizontal cross section along line 6—6 of FIG. 4;

FIG. 7 is a plan view of another modified carton construction made in accordance with the present invention;

FIG. 8 is an end of a carton blank construction of FIG. 7;

FIG. 9 is a fragmentary elevational view taken in horizontal cross section along line 9—9 of FIG. 7;

FIG. 10 is a fragmentary elevational view taken in horizontal cross section along line 9—9 of FIG. 7;

FIG. 11 is a fragmentary perspective view, drawn to a reduced scale, showing a liner within a partially erected carton blank of the type illustrated in FIG. 1;

FIG. 12 is a fragmentary perspective view, drawn to the scale of FIG. 11, showing a liner within a partially erected carton blank of the type illustrated in FIGS. 4 and 7;

FIG. 13 is a fragmentary perspective view showing a step subsequent to FIG. 12 in the formation of a completed carton;

FIG. 14 is a top plan view of the paperboard strip material;

FIG. 15 is a bottom plan view of the paperboard strip material of FIG. 14;

FIGS. 16—19 are cross sectional views of cartons illustrating various side seam constructions;

FIG. 20 is a fragmentary cross sectional view, drawn to an enlarged scale, of a modified side seam construction;

FIGS. 21—26 are schematic side elevational views illustrating the steps of several methods of making cartons in accordance with the present invention;

FIG. 27 is a schematic fragmentary perspective view illustrating the application of an aqueous adhesive to a blank such as is used to form the carton of FIG. 18;

FIG. 28 is a schematic fragmentary perspective view illustrating a spiral folding operation subsequent to the application of adhesive in FIG. 27;

FIGS. 29—31 are fragmentary elevational views taken in horizontal cross section taken along lines 29—29, 30—30 and 31—31, respectively, of FIG. 28;

FIG. 32 is a plan view of the spiral fold element of FIG. 28;

FIG. 33 is a right side elevational view of the spiral fold element of FIG. 28;

FIG. 34 is a fragmentary perspective view illustrating a carton of the type shown in FIG. 27 after a hot melt adhesive has been applied;

FIG. 35 is a simplified and fragmentary schematic perspective view illustrating R.F. induction heating of the side seam of a carton such as is shown in FIG. 34;

FIG. 36 is a top plan view of an R.F. coil heating element;

FIG. 37 is an elevational view taken in horizontal cross section along line 37—37 of FIG. 36;

FIG. 38 is a perspective view, schematic in nature, illustrating pressure roller means for sealing the side seam of the carton;

FIG. 39 is a perspective view of a partially folded blank illustrating the overhang of the liner with respect to the body of the carton blank;

FIGS. 40—42 are elevational views taken in horizontal cross section illustrating the relative position of the liner with respect to the glue flap and the application of two kinds of adhesive;

FIG. 40a is an enlarged fragmentary elevational view taken in vertical cross-section illustrating the laminated composition of the carton blank of FIG. 40;

FIG. 43 is a fragmentary perspective view illustrating another embodiment of the present invention;

FIG. 44 is a fragmentary end elevational view taken in vertical cross-section of the blank and adhesive applicator of FIG. 43;

FIG. 45 is a fragmentary end elevational view taken in vertical cross-section illustrating the blank and one of the radiant heaters of FIG. 44;

FIG. 46 is a fragmentary end elevational view taken in vertical cross section illustrating the blank and another of the radiant heaters of FIG. 44;

FIG. 47 is a fragmentary end elevational view taken in vertical cross-section illustrating the side seaming of the blank of FIG. 44; and,

FIG. 48 is a side elevational view taken in vertical cross-section of one of the radiant heaters of FIG. 44.

Referring now to FIGS. 1-3 of the drawings, there is illustrated a paperboard carton indicated generally at 10. The carton is shown to comprise a paperboard base member 12 to which a lining material indicated generally at 14 is secured by suitable means such as an adhesive or plastic film 16 which is shaded in FIG. 1 for purposes of illustration. The liner material 14 comprises metal foil 18, such as aluminum foil, which may be laminated to a plastic film 20. Alternatively, the liner material 14 may be composed entirely of foil or the foil may be laminated as a pre-prepared stock to a paper material such as tissue paper or the like.

Referring to FIG. 1, the main panels of the paperboard carton 10 are shown to comprise a side panel 22, top panel 24, side panel 26, bottom panel 28, and a glue flap panel 30. If desired, the glue flap panel may be attached to one of the side panels, such as side panel 22, in place of either the top or bottom panel. Each of the main panels 22 through 30 are hingedly connected in conventional manner by score lines 31 and their lateral extent is defined by a pair of parallel score lines 33. Attached to the main panels at the score lines 33 are pairs of dust flap panels 32, end flap panels 34, dust flap panels 36, end flap panels 38, each of which are separated by slits or cuts 40 which are substantially colinear with score lines 31, all conventional in construction.

As best seen in FIGS. 1 and 3, the liner material 14 is provided with an overhang area 42 at one end of the paperboard carton 10, in this instance, overhanging the glue flap panel 30. The opposite end of the liner material 14 is substantially coterminous with the free edge of side panel 22. It will also be observed, as seen best in FIG. 2 and as indicated by the shading in FIG. 1, that the lining material 14 is not secured to any of the dust flap panels 32, and end flap panels 34, dust flap panels 36, or end flap panels 38, whereby the liner material may be fin sealed in these areas in a manner disclosed hereinafter so as to provide a hermetically sealed carton.

Reference is now made to FIGS. 4-6 wherein a modified form of carton blank construction is illustrated. Specifically, the shaded area indicates an adhesive securement by adhesive 16 of the liner material 14 to the paperboard base 12. In this embodiment the area of adhesive securement also includes pairs of triangular areas on the pairs of dust flaps 32 and 36. These triangular areas are indicated by numerals 52 and 54 and are beneficial in forming the fin sealed areas in a manner to be described hereinafter. The base of each triangular adhesive area 52 and 54 is substantially equal to

its adjacent and associated side panel. In all other respects, the carton 50 is identical to the carton 10 illustrated in FIGS. 1-3.

Reference is now made to FIGS. 7-9 wherein a still further embodiment of a carton blank construction is illustrated. In these figures, and as best seen in FIG. 7, the adhesive securement by adhesive 16 of the liner material 14 to the paperboard base 12 is such that the entire blank is coated with adhesive. Thereafter, a release coating 66 indicated in FIG. 7 by the additional shading lines applied to each of the opposed pairs of dust flap panels 32 and 36 and pairs of end flap panels 34 and 38, whereby the liner material 14 is free from the paperboard base 12 in all areas corresponding to the free areas in the FIG. 4 embodiment. That is to say, the liner material 14 is adhesively secured to the paperboard base 12 in the triangular areas 62, 64 of the opposed pairs of dust flap panels 32 and 34 but in all other areas of dust flap panels 32 and 36 as well as from all areas of the end flap panels 34 and 38 the liner material is free from the paperboard base 12. Accordingly, the liner material may be fin sealed to itself in these areas of the carton in order to provide a hermetically sealed carton.

Referring to FIGS. 11 to 13, there is illustrated the manner of assembly of the liner material 14 with respect to the erected carton blank and of fin sealing the liner material 14 to itself. Thus in FIG. 11, it will be observed that the liner material 14 is completely free from the dust flap panels 32 and 36 as well as from the end flap panels 34, 38. The liner material, therefore, may be fin sealed to itself, with the plastic film 20 facilitating a heat seal therebetween. FIGS. 12 and 13, further illustrate the advantages which accrue to the use of triangularly-shaped adhesive portions such as at 52, 54 in FIG. 4 and at 62, 64 in FIG. 7 in effecting a fin seal. As the dust flap panels 32 and 36 are bent progressively backward from an in-line position with side panels 22, 26 to the position of being at right angles thereto as shown in FIG. 15, the gap between opposed faces of the liner material associated with end flap panels 34, 38 becomes less and less whereby it becomes relatively easy to fin seal the opposed faces together with the aid of plastic film 20 on each face. Since the end seal is identical at each end of the carton, only one end is shown.

One method of forming carton blanks is illustrated in FIGS. 14 and 15. FIG. 14 is a view of a web of blank forming material as seen from the outside of the carton, and FIG. 15 is a view of the same web as seen from the inside of the carton. As will become apparent from the discussion, five successive forming stations are shown in each figure proceeding from the top of the drawing to the bottom thereof. FIGS. 14 and 15 are related on a linear basis in indicating corresponding conditions for the outside and inside of the web at these stations. A paperboard strip 70 is advanced continuously and progressively (by conventional means, not shown) from the top of the drawing toward the bottom. Numeral 72 indicates a printed area on the outside of the paperboard strip 70 in the first station. Since nothing occurs to the inside of the blank at this station it remains unaltered. The area 72 generally conforms to the outline of the blank to be cut. At the second station a release coating 66 is printed on the underside or inside of the paperboard strip 70 which is in registry with the printing 72 on the outside of the strip.

At the third station, slits 40 are cut through the paperboard strip 72 as well as a cut pattern which defines the general contour of the adhesive flap 30. This cut pattern comprises a pair of opposed angled cuts 74, symmetrical about a central longitudinal axis, and a cut 76 which joins or interconnects the outermost ends of the opposed angle cuts 74.

At the fourth station, a strip of liner material 80 is laminated, by any suitable means, such as by an adhesive to the underside of the paperboard strip 70.

At the fifth station, die cuts 82, 84, 86 and 88 are made and four crease lines 31 and a pair of parallel crease lines 33 at right angles thereto are impressed into the blank construction whereby the entire blank is formed. As can be observed in FIG. 14, by virtue of the lowermost slits or cuts 40 along with angle cuts 74 and cut 76, a piece of paperboard 90 remains which is then stripped out from the paperboard strip 70. This paperboard piece 90 is identical to the amount of overhang 42 by which the strip of liner material 80 overhangs the edge of the finished blank.

Referring now to FIGS. 16-19, a number of typical longitudinal side seam constructions are shown. In FIG. 16, the paperboard body is indicated by numeral 100 and the liner material by numeral 102. The glue flap is shown at 30 and the overhang material 42 of the liner 102 is shown to be secured to the underside of the liner on the top flap.

A modification is shown in FIG. 17 wherein the overhang 42 is removed and a separate strip 104 is heat sealed to the liner material 102 and the underside of the liner attached to the glue flap 30.

In FIG. 18, the overhang 42 is brought upwardly and rearwardly over the glue flap panel 30 and then heat sealed to the underside of the liner 102 on the top flap of the paperboard body 100.

In FIG. 19, the overhang 42 is secured to a main panel of the carton when the blank is erected. As in FIG. 18, overhang 42 is folded upwardly over the edge of an underlying flap 112 of the paperboard body 110 which underlies an overlying panel 114. The amount of overhang 42 is heat sealed to the adjacent liner material 102. The side seam as shown in FIG. 19 which is removed from the corner area for a more positive side seam is frequently employed in very small cartons.

Referring now to FIG. 20, a modification of the longitudinal seam shown in FIG. 19 is illustrated. In this embodiment, the underlying panel is shown at 112 and the overlying panel at 114 as in FIG. 19. The liner material, however, preferably has at least an outer layer of foil 120, such as aluminum foil, and may have as shown in FIG. 20 an inner layer of tissue paper 122. Alternatively, the entire liner may be of foil, such as aluminum foil. The liner is illustrated to be folded upwardly over the edge 126 of the paperboard underlying panel 112 and then rearwardly over the upper surface 128 of the underlying panel 112. An adhesive 130 secures this rearwardly bent portion of the liner material to the upper surface 128 of the underlying panel 112. The adhesive 130 may be a heat sealed adhesive or may be an aqueous adhesive, as desired. The edge 132 of the upper liner which is adhered to the overlying panel 114 is shown to be spaced inwardly from the edge 134 of the overlying panel 114. An adhesive 136, which may be of a hot melt adhesive or a heat seal adhesive or the like is therefore positioned directly between the underlying panel 112 and the overlying panel 114 and

extends between the liner material attached to upper panel 114 and the liner material which is bent rearwardly and attached to the upper surface 128 of the underlying panel 112. The edge 138 of the lower liner is preferably substantially coterminous with the edge 132 of the upper liner. Also, it is preferable that the inward spacing of the edges 132 and 138 of the upper and lower lining materials, respectively, are at least less than half of the amount of overlap of panel 114 over panel 112.

Referring now to FIG. 21, there will be described one of a number of methods by which the blanks of the present invention may be formed. Illustrated in FIG. 21, is a roll 140 of paperboard stock which is withdrawn by rolls 142 and reversely printed by the lowermost roll 142 which communicates with a supply of release coating in receptacle 144. The web 70 of paperboard material is thereafter passed through an oven 146 wherein the release coating is dried and the webs then fed through a first set of printing rollers 148 one of which communicates with ink in receptacle 350 and then through a second set of printing rolls 352, one of which communicates with ink in a similar receptacle 350. The web is reintroduced into the oven 146 where the ink is dried and the web 70 then passes out of the oven and is subjected to the action of cutters on a rotary die 354 and a back-up roll 356 therefor. This operation corresponds to station 3 in FIGS. 14 and 15 wherein the slits 40 and the pair of cuts 74 and 76 defining the contour of the glue flap panel 30 are placed on the strip 70. Web 70 is then preferably wound up on a take-up roll 360.

Referring now to FIGS. 22, 23 and 25, it will be observed that in each of these figures the starting position is the paying off of web material from the take-up roll 360. In FIG. 22, for example, the strip 70 is payed off from take-up roll 360 and simultaneously a pre-prepared liner stock is payed off from roll 370 and the two webs laminated with the aid of laminating rolls indicated schematically at 372 and the resulting web being under the influence of feed rolls 374. This corresponds to the fourth station in FIGS. 14 and 15. The laminated stock is then fed between a die cutter 376 and an anvil 378 with relative motion between the die cutter 376 and anvil 378 being indicated by the reciprocating arrow thereby producing a finished blank 10.

In the alternate method shown in FIGS. 23 and 24, the stock material is fed from take-up roll 360 and a roll of metal foil such as aluminum foil is payed off from roll 380. Feed rolls are shown at 328 and laminating rolls at 384 effect an initial lamination between the web of material from take-up roll 360 and roll 380 of metal foil. The composite is then fed to a plastic extrusion means indicated generally at 390 which extrudes a plastic material 16 onto the upper surface of the metal foil. The web is then rewound on take-up roll 400 and this roll is then used as the starting material in FIG. 24 in which the material is fed from take-up roll 400 under the influence of feed rolls 402 to a die cutter means 376 and anvil 378 therefor comparable to those shown in FIG. 22 which again produce a finished blank 10. The die 376 reciprocates vertically as indicated by the arrow. As a modification, it is possible to go directly from the laminating step from the plastic extrusion means 392 to the die cutting step by passing the web directly between die cutter 376 and anvil means 378.

In FIG. 25, the take-up roll 360 again is the starting material and the web is fed by means of rollers 402 directly to a die cutter 376 and anvil means 378 where individual paperboard blanks are formed.

These paperboard blanks 410 are then stacked as shown in FIG. 26, and become the input material to a feed roll means indicated schematically at 412 which feeds individual blanks sequentially to an adhesive applying means 414 which applies adhesive to pattern applicators 416 which in turn engage individual blanks in synchronism so as to apply a register adhesive pattern thereon. The adhesively coated blanks are fed forwardly between a vacuum drum 418 and a back-up roll 426. Meanwhile, a pre-prepared liner stock is fed from roll 420 toward the vacuum drum 418. The liner stock is cut to individual blank size by means of rotation of knives 422 on the vacuum drum 418. Knives 422 mate with a slot in roller 424 so as to sever an individual blank of liner stock from the web of the material and the vacuum roll applies the precut liner material in registry with the adhesively coated blank whereby a completed container blank 10 is formed therefrom with the aid of back-up roll 426. The method shown in FIGS. 25 and 26 may be practiced in conjunction with so-called "window" applying machines which are standard in the packaging industry for applying a heat sealable plastic material to a paperboard carton so as to make the contents thereof visible. Thus no new equipment need be designed.

As will be apparent, the contemplated blanks may be formed such as are shown in FIGS. 1, 4 and 7 with the liner material overhanging one end of the blank at 42 to facilitate formation of the side seams such as are shown in FIGS. 15-19. The liner material is free in the areas of dust flap panels 32, 36 and end flap panels 34, 38 whereby the freely extending liner material as shown in FIGS. 11-13 may be fin sealed together with or without the aid of the triangular attachment of the liner to the dust flaps 32, 36 in the embodiments of FIGS. 4 and 7.

Referring now to FIGS. 27, 28 and 35, a disclosure is made depicting the method steps employed in an R.F. induction heating process for making side seams on lined cartons. Carton blanks, indicated generally at 150 in FIG. 27 and similar to the blank shown in FIG. 18, are fed in the direction of arrows 152 from a suitable hopper supply of carton blanks. Propulsion is provided for the carton blanks 150 by means of one of a number of conveyor belts 154 which are provided as standard equipment on a straight line gluer such as is manufactured by the Post Machinery Company of Beverly, Mass.

Roller followers 156 cooperate with conveyor belt 154 to convey carton blanks 150 toward an adhesive roller applicator 158. The carton blank 150 is fed in the longitudinal direction of the blank itself with its liner side up. The adhesive roller applicator 158 is suitably mounted for rotation on a shaft in glue pot 160 so as to place a stripe of adhesive on the glue flap of the carton blank 150 as it is fed in the direction of the arrows 152. A roller follower 162 provides a suitable back-up for the application of the adhesive. For the attachment of the overlap of the liner to the glue flap, it is preferred to use an aqueous adhesive rather than a hot melt adhesive since the aqueous adhesive is less expensive and will suffice for this particular adhesive application.

In FIG. 28, the blank 150 is fed toward a spiral indicated generally at 164 having substantially flat opposed surfaces 166 and 168. In a preferred embodiment, the spiral 164 is made from aluminum.

Reference to FIGS. 39 through 42 will illustrate in greater detail the features of carton blanks 150. Thus each carton is illustrated to have main panels comprising a top panel 170, a bottom panel 172, a front wall panel 174 and a rear wall panel 176. The carton blank 150 is also provided with suitable end panels and dust flap panels but these are immaterial insofar as the present invention is concerned. The main panels 170 through 176 are separated from though hingedly secured to adjacent panels by score lines 178, 180, 182 and 184 in conventional manner.

The locus of deposition of an aqueous adhesive, identified at 186 in FIGS. 29-31, is shown schematically by the legend and arrow in FIG. 40. The blank 150 is further provided with a glue flap 188 and a liner indicated generally at 190 with the latter being provided with an overhang portion 192 illustrated best in FIGS. 39 and 40. The liner 190 has at least a portion thereof indicated at 191 made from metallic foil, such as aluminum foil, and an external plastic coating thereon at 193. Plastic coating 193 is preferably an extrusion coating.

Referring again to FIG. 28, as the carton 150 approaches spiral 164 an entrance guide means is provided at 198 which, coupled with an upturned end 200 of spiral 164, ensures that the blank 150 is fed properly into engagement with spiral 164. Wire-like guiding members 194 and 196 suitably mounted to the frame of the in-line gluer entrain the glue flap 188 and overhang 192 of liner 190 against the flat opposed surfaces 166 and 168 of spiral 164.

As is illustrated sequentially in FIGS. 29-31, the net effect of the spiral 164 with its cooperating guiding wires 194 and 196 is to achieve a 180° turning of the overhang portion 192 of liner 190. In this manner, the overhang portion 192 is brought into engagement with the stripe of aqueous adhesive 186 previously applied to glue flap 188 by the adhesive roller applicator 158 of FIG. 27.

The details of the aluminum spiral 164 are further illustrated in FIGS. 32 and 33 together with its associated mounting blocks or brackets 202 and 204 which facilitate the attachment of the spiral 164 to the frame of the in-line gluer. After the overhang 192 of liner 190 has been folded against the glue flap 188, the plastic extrusion coating 193 on the aluminum foil 191 of liner 190 is in position to be activated by an R.F. induction coil in a manner to be described.

The carton 150 is then progressively folded in conventional manner by folding plows which are standard equipment for the in-line gluer so as to fold the carton into substantially tubular shape so as to bring the top panel 170 into a position closely adjacent the glue flap 188. An R.F. induction coil, indicated generally at 210 in FIGS. 35-37, is mounted on the in-line gluer so that when a continuously advancing blank 150 reaches its folded condition where the top panel 170 is closely adjacent glue panel 188, the R.F. induction coil 210 becomes interposed therebetween.

R.F. induction coil 210 is shown to be of the folded butterfly type with the coils 212 thereof being hollow and being encased within an epoxy plastic 214. The coils 212 are thereby adapted to receive water there-through in order to cool the R.F. induction coil 210. An

inlet tube 216 and an outlet tube 218 cooperate with a water coolant source indicated schematically in FIG. 35. The R.F. induction coil 210 is positioned downstream from a suitable forming mandrel 220 about which the final folding of the carton 150 may occur as it is being fed continuously in the direction of arrows 152. In order to ensure that the natural resiliency of the carton does not remove the main top panel 170 from its folded position closely adjacent the glue flap 188, a stationary guide means 222 in FIG. 35 may be positioned so as to contact and hold top panel 170 in its desired position.

As is illustrated in FIGS. 35-37 of the drawings, the R.F. induction coil 210 is essentially in the form of a blade and is relatively long with respect to the length of a carton 150. Thus it is preferred that the length of the R.F. induction blade coil 210 be at least twice as long as the length of the carton blank 150 and may approach three or more times the length. The blanks 150 are fed over the blade R.F. induction coil 210 at linear speeds in excess of 400 feet per minute so as to process from 500 to 600 per minute. The energy applied to the R.F. induction coil from a suitable source, not shown, in one illustrative example is in the order of 3,500 watts of R.F. energy at a frequency of 450 kHz. As the frequency increases there is a tendency to heat only the surface of the blank in what amounts to a skin effect. It is preferred to have the closely positioned panels, namely, panel 170 and glue flap 188, as close as possible since the energy received varies inversely as the square of the distance that the panels are from the induction coil.

After being subjected to the inductive heating action of R.F. coil 210, the blank is fed into the compression section of the gluer where the final side seam is made. This is illustrated schematically in FIG. 38 wherein a pressure roller 224 having a suitable anvil or back-up means completes the side seam. Finally, in this section of the in-line gluer, the tubular blanks are overlapped in a shingled arrangement.

While the operation of the in-line gluer on the blank 150 will appear from the previous discussion, a brief summary thereof is believed to be in order. The blanks 150 are fed from a suitable source such as a hopper in the direction of arrows 152 with the liner side up and fed in the longitudinal direction of the blank. Thus there is no registration problem with respect to the application of an aqueous adhesive by adhesive roller applicator 158 to the glue flap 188 and marginal portions of the overhang portion 192 which is in line therewith.

The blank 150 is then continued on its continuous feed to a spiral 164 which facilitates the folding of the overhang portion 192 of liner 190 through substantially 180° as is depicted sequentially in FIGS. 29-31. In this position, the plastic extrusion coating 193 on the aluminum foil 191 of liner 190 is in position to be activated by the R.F. induction coil 210.

In order to effect this, the carton blank is folded into substantially tubular shape to bring the top panel 170 closely adjacent and preferably substantially parallel to the glue flap 188 having the plastic extrusion coating 193 uppermost. At this point of travel of the carton blank, the R.F. induction coil 210 is interposed therebetween and the plastic extrusion coating 193 is heated and activated thereby. Thereafter, pressure roller 224 compresses the top panel 170 and glue flap 188 against

a suitable anvil or back-up means 226 to complete the side seam.

While the present embodiment has been illustrated and described specifically with respect to the blank of FIG. 18, the method of forming side seams for lined cartons may be practiced on other blank constructions including those shown in FIGS. 17 and 19.

An alternative embodiment is illustrated in FIGS. 43-47 wherein a hot melt adhesive 208 is applied to blank 150 by means of a roller applicator 228. As in the embodiment of FIGS. 27, 28 and 35, the blank 150 is fed continuously forward in a straight line path by means of conveyor belt 154. Prior to the arrival of a particular blank 150 at the station illustrated in FIG. 43, the overhang 192 has been folded by spiral 164 and adhesively secured to glue flap 188 in the manner previously described.

In this embodiment, it is essential to maintain the hot melt adhesive 208 hot during the folding operations of the blank. This is preferably accomplished by directing heat toward the hot melt adhesive while simultaneously folding the blank into tubular shape.

Accordingly, FIG. 43 illustrates a bank of radiant heaters 232, 234, 236, 238, 240, 242 and 244. The ends of each of the radiant heaters 232 through 244 are so arranged so as to be directed at the hot melt adhesive 208 while the blank 150 is being folded by a suitable folding mechanism, indicated generally at 230 in FIG. 43. FIGS. 44 and 45 disclose two illustrative examples of how two different radiant heaters, namely 234 and 236 are positioned to be pointed substantially at the hot melt adhesive 208 in different folded positions and thereby maintain the adhesive hot until the blank is folded into the position of FIG. 47 where a suitable roller 224a presses the main top panel 170 against the glue flap 188 to effect a side seam with the aid of hot melt adhesive 208.

The radiant heaters 232 through 244 are held by support mechanism 246 so as to effect the desired positional relationship with respect to the hot melt adhesive. An input pipe 248 delivers compressed air into a manifold 250.

Reference to FIG. 48 shows the details of an individual radiant heater, such as radiant heater 232. A heating element 252 is shown encased within an open ended glass tube 254 each of which is held by holder 256. Electrical connecting leads 258 and 260 are shown for the heating element 252 and connected to a suitable source of electrical power, not shown. Chamber 262 is provided for admittance of the compressed air which then enters tube 254 and is heated as it passes over the heating element 252 and directed toward the hot melt adhesive through the open end of tube 254. Thermostat control means may be used for each of the radiant heaters 232-244.

In the embodiments of FIGS. 43-47, it is possible to apply the hot melt adhesive atop the glue flap 188, as indicated schematically in FIG. 41, and to utilize radiant heaters to maintain the hot melt adhesive sufficiently hot while the carton blank is being folded into tubular shape. As in the previous embodiment, the blanks may be fed continuously forward at linear speeds in excess of 400 feet per minute.

While presently preferred embodiments of the invention have been illustrated and described, it will be recognized that the invention may be otherwise variously embodied and practiced.

What is claimed is:

1. A method of forming a side seam for a lined carton comprising the steps of
 1. forming a paperboard blank having a liner material adhesively secured thereto, said liner material including a metallic foil portion into which R.F. energy may be inductively coupled,
 - a. said paperboard blank having score lines thereon to define main panels and a glue flap thereon hingedly secured to one of said main panels with said glue flap having an unattached outer edge opposite its hinged securement to one of said main panels.
 - b. said liner having an overhang portion which extends beyond the unattached outer edge of said glue flap,
 2. feeding said paperboard blank continuously and while being fed continuously, performing the following additional steps:
 - a. applying a first adhesive material to said glue flap,
 - b. folding said overhang portion of said liner through approximately 180° in order to secure said overhang portion to said first adhesive on said glue flap,
 - c. applying a second adhesive material to one of the following:
 1. the exterior surface of the liner material in the region of said glue flap,
 2. the underside of the marginal edge of the main panel of said carton blank most remote from said glue flap,
 - d. substantially completely folding said carton blank into substantially tubular shape so as to bring said main panel of said carton blank most remote from said glue flap to a position closely adjacent said glue flap,
 - e. interposing an R.F. induction coil between said glue flap and said closely positioned main panel and inductively heating said metallic foil portion and, by contact with said metallic foil portion, thereby activating said second adhesive material,
 - f. and, thereafter, pressing said glue flap and said main panel of said carton blank most remote therefrom together to complete said side seam.
2. A method of forming a side seam for a lined carton as claimed in claim 1 including using an aqueous adhesive for said first adhesive material and using a hot melt adhesive for said second adhesive material.
3. A method of forming a side seam for a lined carton as claimed in claim 1 including the step of feeding said carton blanks in substantially a straight line throughout the formation of said side seam.
4. A method of forming a side seam for a lined carton as claimed in claim 1 including the step of feeding said blanks continuously at linear speeds in excess of 400 feet per minute in the course of forming said side seam.
5. A method of forming a side seam for a lined carton with the liner thereof having an adhesive plastic coating

on its exterior surface, said method comprising the steps of:

1. forming a paperboard blank with said liner material adhesively secured thereto, said liner material including a metallic foil portion into which R.F. energy may be inductively coupled,
 - a. said paperboard blank having score lines thereon to define main panels and a glue flap thereon hingedly secured to one of said main panels with said glue flap having an unattached outer edge opposite its hinged securement to one of said main panels,
 - b. said liner having an overhang portion which extends beyond the unattached outer edge of said glue flap,
2. feeding said paperboard blank continuously and while being fed continuously, forming the following additional steps:
 - a. applying a first adhesive material to said glue flap,
 - b. folding said overhang portion of said liner through approximately 180° in order to secure said overhang portion to said first adhesive on said glue flap,
 - c. substantially completely folding said carton blank into substantially tubular shape so as to bring said main panel of said carton blank most remote from said glue flap to a position closely adjacent said glue flap,
 - d. interposing an R.F. induction coil between said glue flap and said closely positioned main panel and inductively heating said metallic foil portion and, by contact with said metallic foil portion, thereby activating said adhesive plastic coating on the exterior surface of said liner,
 - e. and, thereafter, pressing said glue flap and said main panel of said carton blank most remote therefrom together to complete said side seam.
6. A method of forming a side seam for a lined carton as defined in claim 5 including using an extruded coating on said liner material for said adhesive plastic coating.
7. A method of forming a side seam for a lined carton as defined in claim 5 including the step of feeding said carton blanks in substantially a straight line throughout the formation of said side seam.
8. A method of forming a side seam for a lined carton as defined in claim 5 including the step of using an R.F. induction coil having a length more than twice the length of said paperboard blank.
9. A method of forming a side seam for a lined carton as defined in claim 5 including the step of feeding said blanks continuously at linear speeds in excess of 400 feet per minute in the course of forming said side seam.
10. A method of forming a side seam for a lined carton as defined in claim 5 including the step of water cooling said R.F. induction coil.

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