Aug. 6, 1957 F. J. BAYLEY 2,801,578

AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

Filed Sept. 23, 1954 10 Sheets-Sheet 1

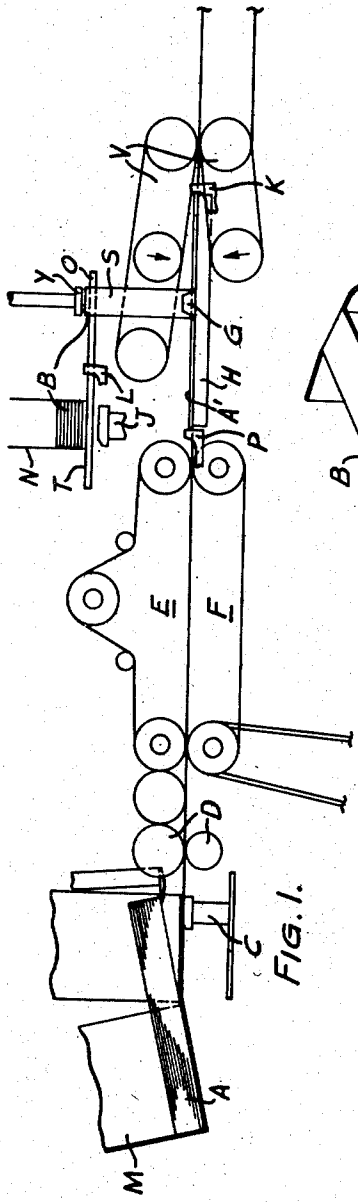


FIG. 1.

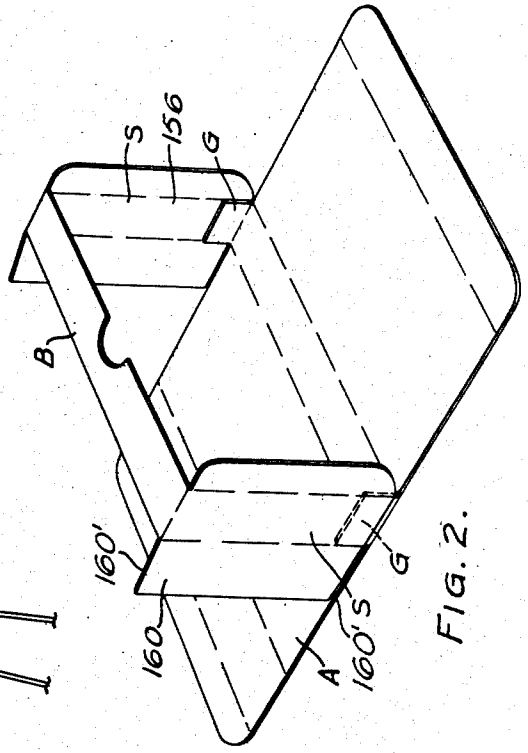


FIG. 2.

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AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

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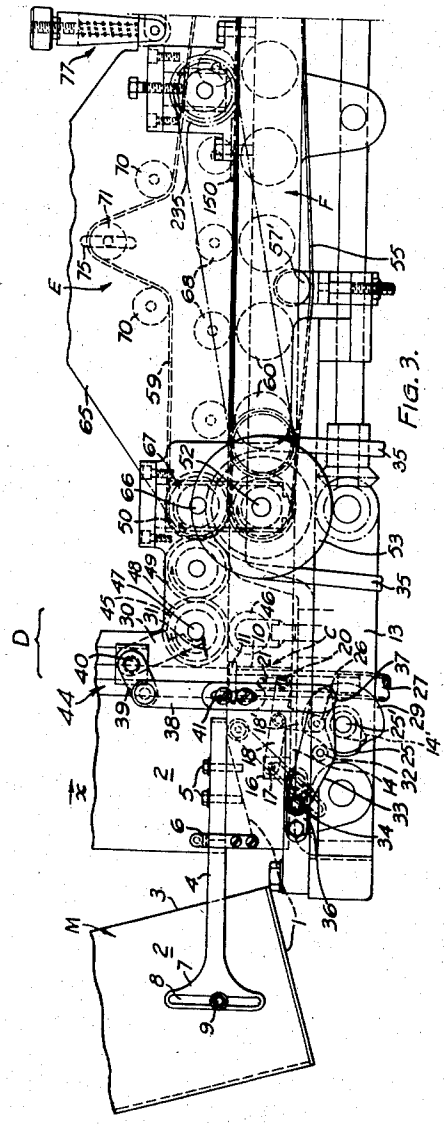


FIG. 3.

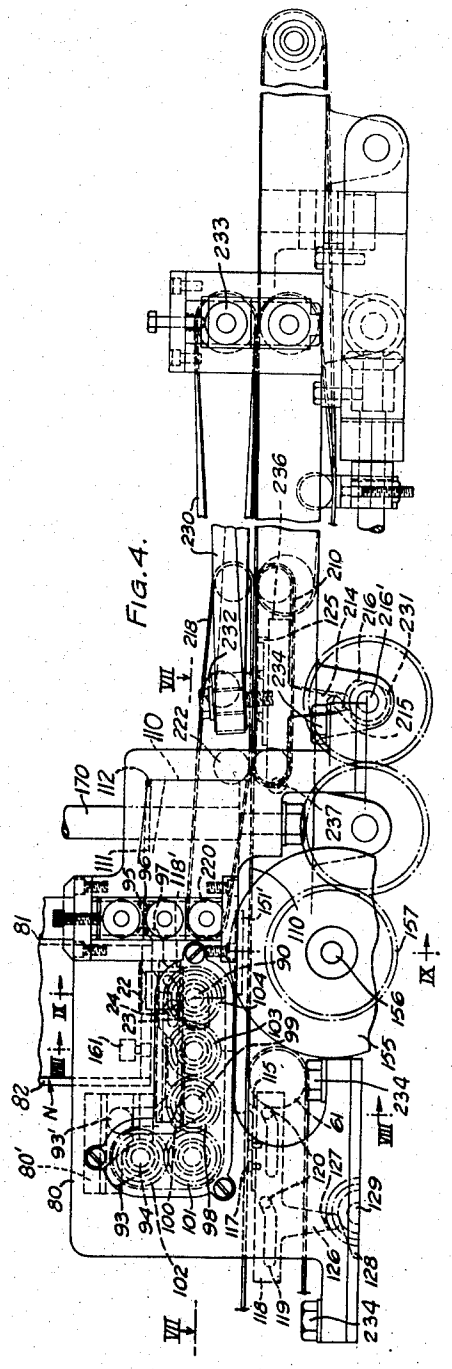


FIG. 4.

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AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

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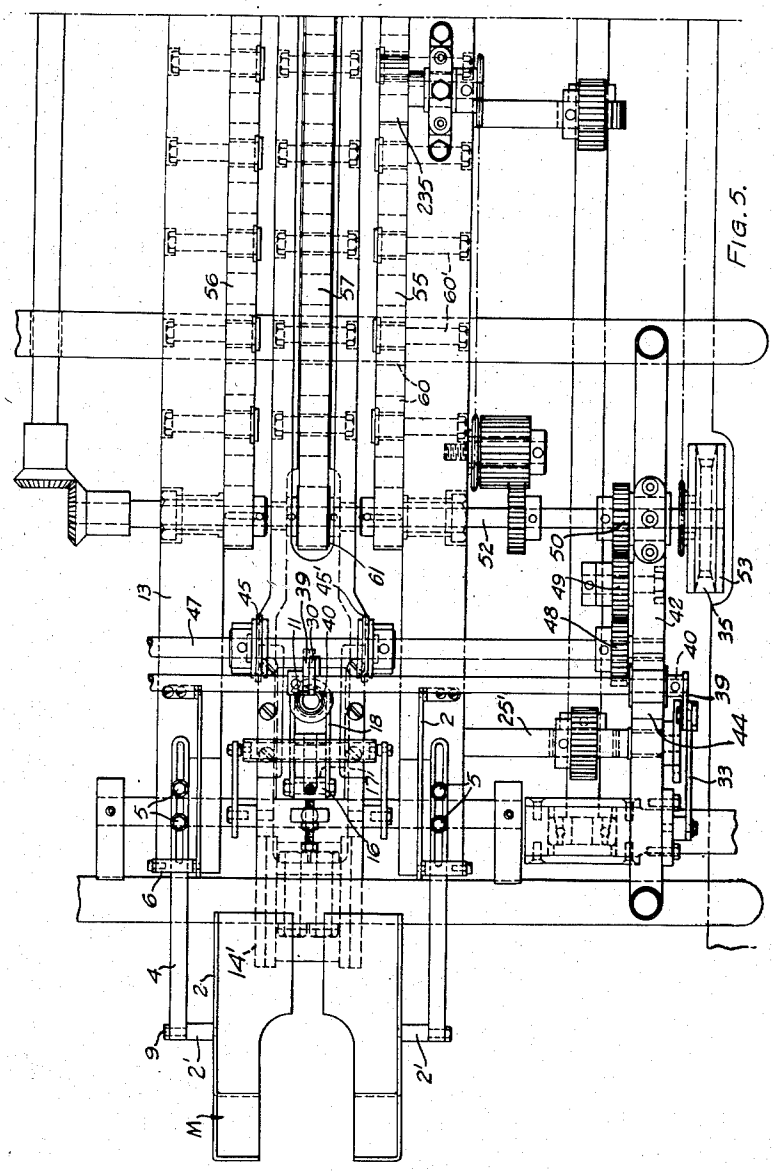


FIG. 5.

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AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

Filed Sept. 23, 1954 10 Sheets-Sheet 4

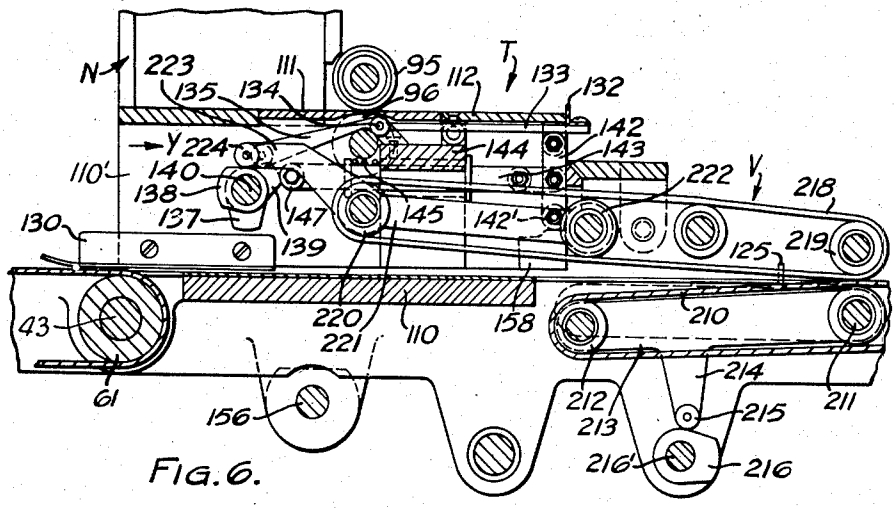


FIG. 6.

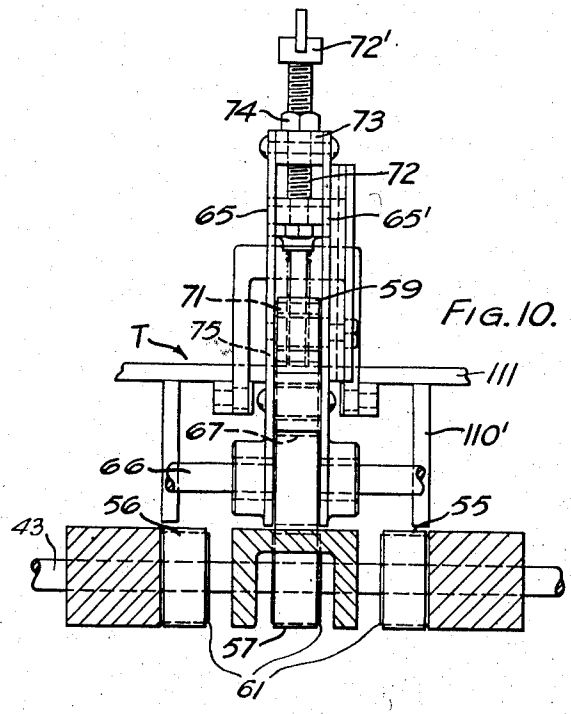


FIG. 10.

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AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

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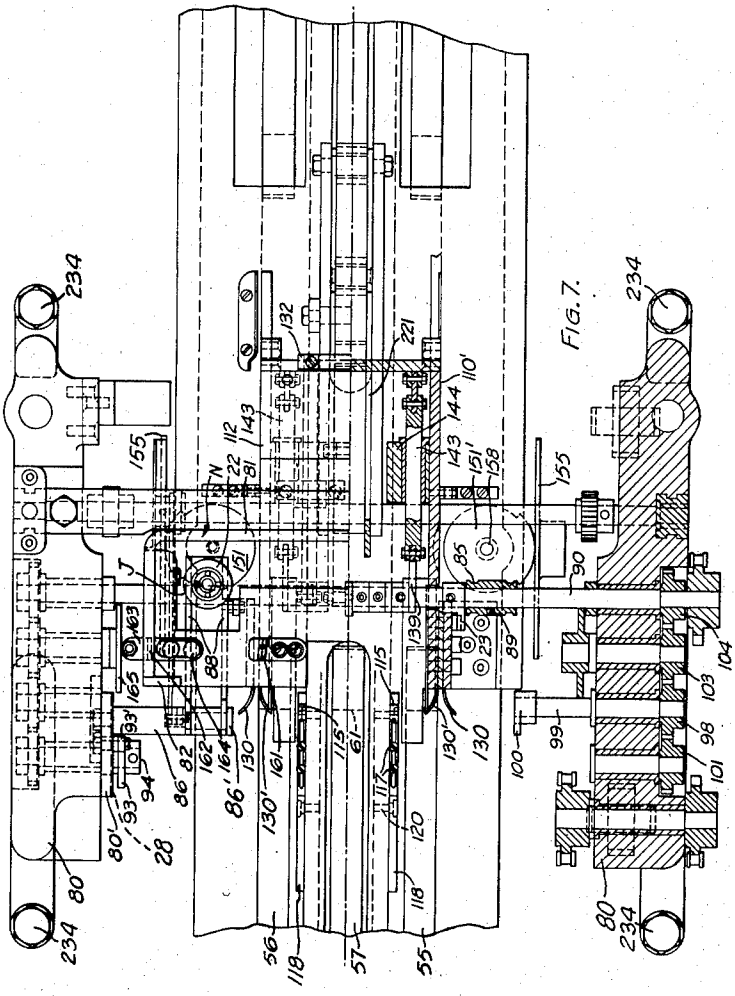


FIG. 7.

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AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

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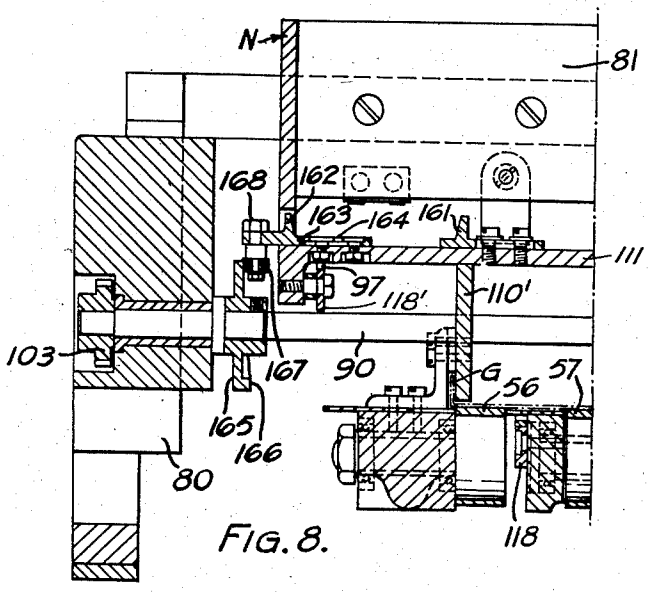


FIG. 8.

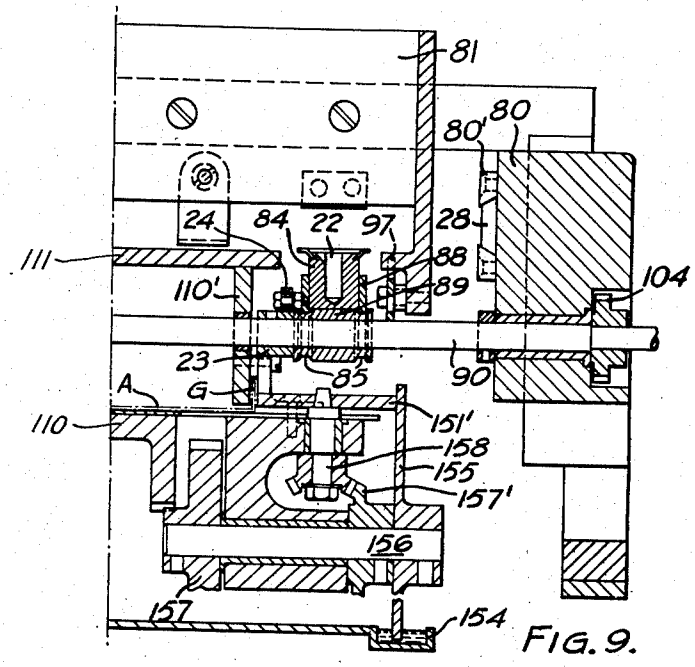


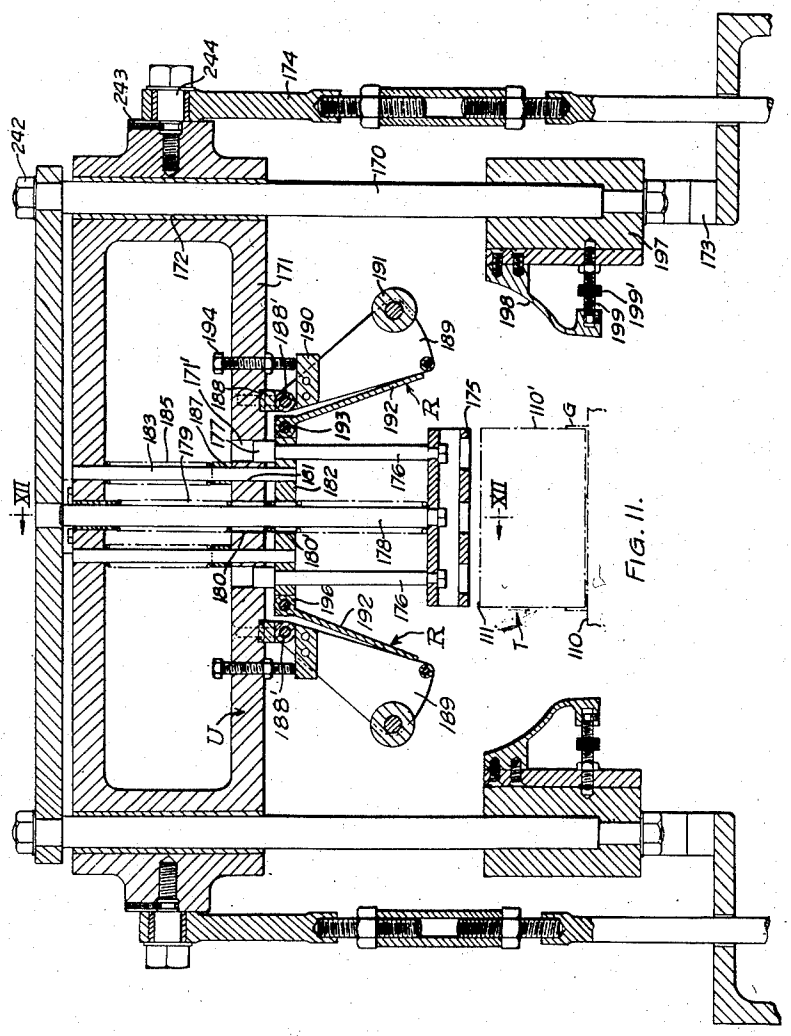
FIG. 9.

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AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

Filed Sept. 23, 1954 10 Sheets-Sheet 7



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Aug. 6, 1957 F. J. BAYLEY 2,801,578

AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

Filed Sept. 23, 1954 10 Sheets-Sheet 8

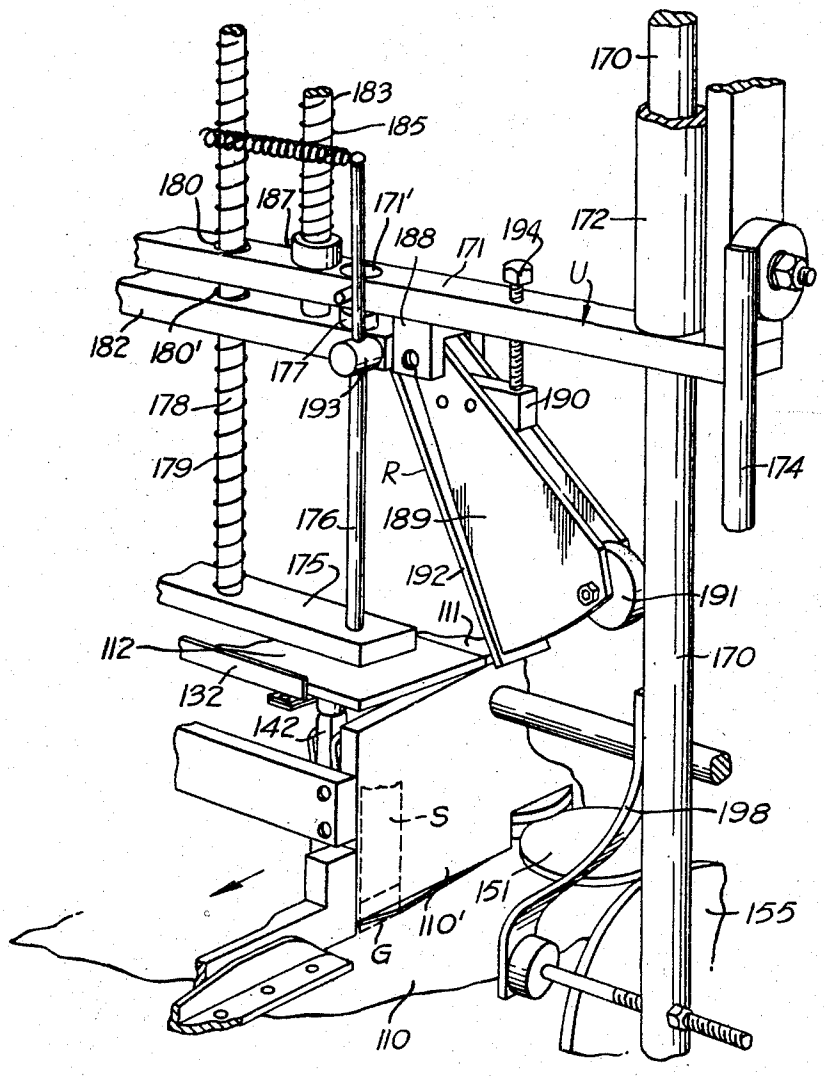


FIG. 11a.

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AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

Filed Sept. 23, 1954 10 Sheets-Sheet 9

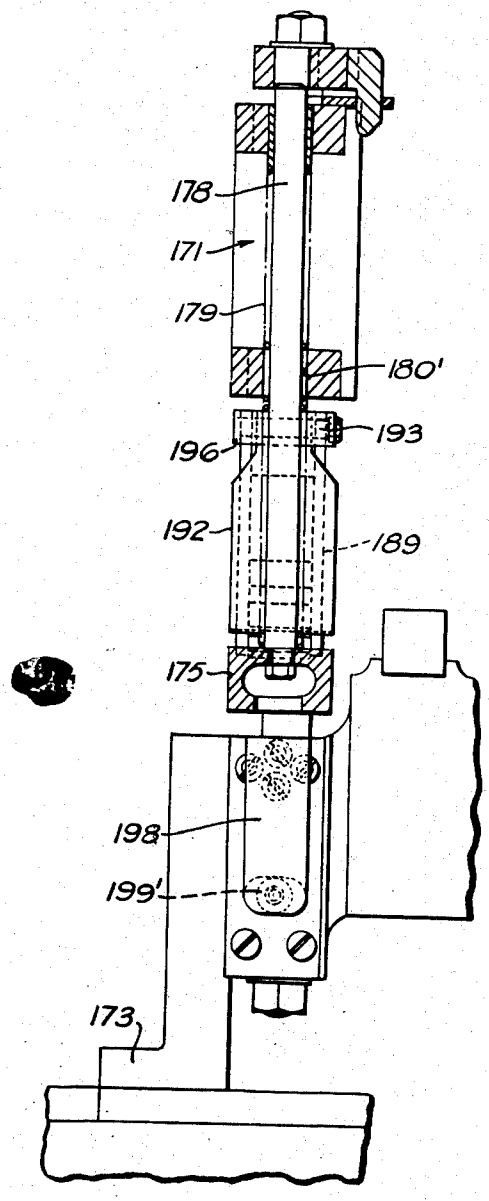


FIG. 12.

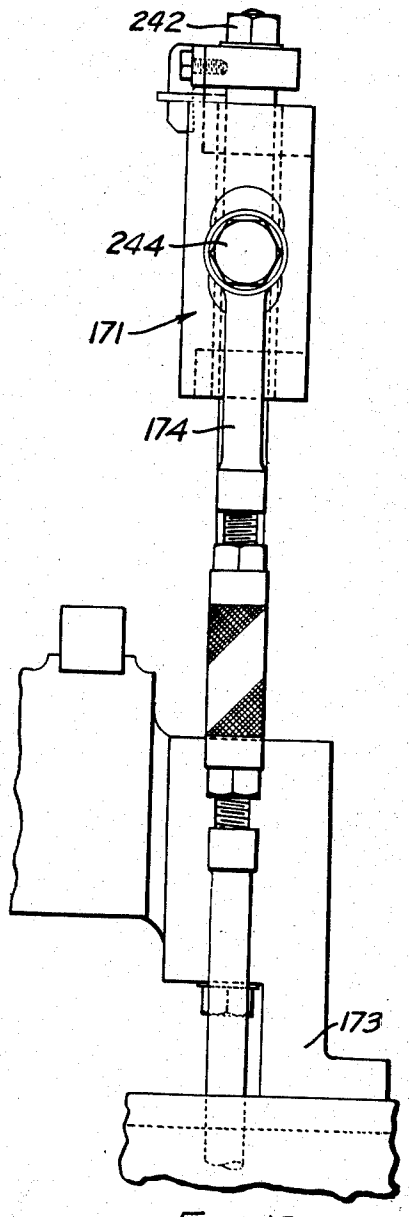


FIG. 13.

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Aug. 6, 1957 F. J. BAYLEY 2,801,578

AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

Filed Sept. 23, 1954 10 Sheets-Sheet 10

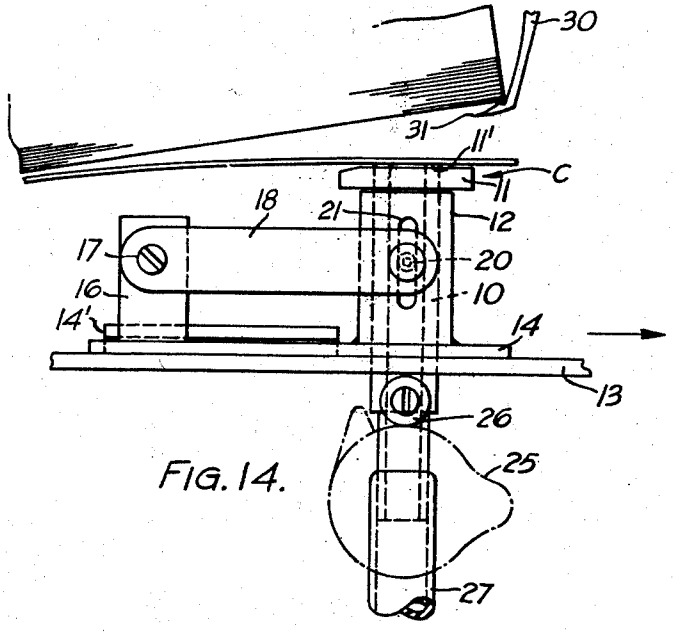


FIG. 14.

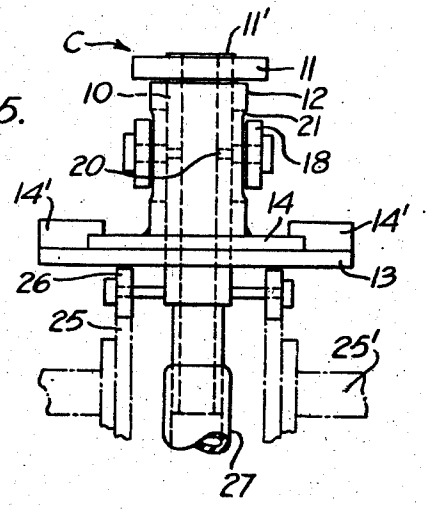


FIG. 15.

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United States Patent Office

2,801,578

Patented Aug. 6, 1957

2,801,578

AUTOMATIC MACHINE FOR ASSEMBLING CARTONS FROM BLANKS

Frederick James Bayley, Potters Bar, England, assignor to Pembroke Carton and Printing Company Limited, London, England, a company of Great Britain

Application September 23, 1954, Serial No. 457,910

24 Claims. (Cl. 93—39)

This invention relates to the manufacture of cartons of the type which are made up from two blanks, referred to in the trade respectively as the box and the band, the box portion in the finished article providing a bottom, top and one side of the carton, while the band portion forms the other three sides of the carton being united to the box portion by gluing or in certain sizes by stapling the two sides of the band portion to glue-flaps on the box portion.

Previously it has been the practice in making up these cartons to carry out the gluing operation by hand, which unless the labour force is considerable curtails production.

The type of carton with which the present invention is particularly concerned is commonly used in packaging chocolates and other sweetmeats in ¼-lb. and ½-lb. packs, and since these cartons frequently contain printed matter on the outside, considerable accuracy is required by the person carrying out the gluing operation to ensure that the band and box are accurately positioned so that the printing matter on the exterior is correctly registered.

The object of the present invention is to provide a machine capable of automatically assembling by gluing the blanks to make up the carton. A further object of the invention is to eliminate the stapling operation and to unite the blank forming the band to the box by adhesive applied between what is known as the glue-flaps on the box portion and the matching ends of the band.

According to the present invention, an automatic machine for use in the manufacture of a four-sided carton from two separate blanks, one of which is provided with tongues called glue-flaps by means of which it is united to two opposite sides of the other blank, comprises means for advancing blanks singly from separate piles or magazines containing the same to an assembly position where each blank is held in spaced relation and in parallelism with its component blank by a table or other supporting means, means for applying adhesive to said glue-flaps on the one blank prior to arrival at the assembly position, means operating to depress two sides of the other blank on its arrival in assembly position into engagement with the adhesive bearing faces of the flaps of the first blank and to apply the necessary pressure thereto to cause adhesion.

According to a further feature of the invention, the table or other support means or a part of it by which the blanks are maintained in spaced relation during the gluing operation is capable of displacement to-and-from a carton release position so that, when the two blanks have been united to one another, the table can be partially collapsed or withdrawn to free the carton and enable it to be removed by conveyor mechanism.

In the assembly position the blanks may conveniently be aligned one above the other with the box portion undermost, and in order to ensure that the blanks are in correct alignment for the gluing operation, preferably stop elements are provided for engagement with the leading edge of each blank, said stop elements operating to arrest the motion in one direction of the blanks.

By arranging for the blanks in the assembly position

to be superimposed one above the other with that side of the band portion above its opposite side of the box portion, which forms the back of the carton to which the lid is hinged, it automatically ensures the required parallelism between the back and front sides and consequently of the two ends of the band, which fold downwardly and, when united to the flaps of the box portion, constitute the outer sides or ends of the carton.

For this purpose the table may include an upper platform, on which the blank forming the band is received when in the assembly position so that it is vertically above the blank forming the box portion. Side flanks or cheeks extend between the table proper and the upper platform to provide a support for the glue-flaps and against which the sides of the band are pressed.

The stop elements can then be utilised to secure alignment in a plane at right angles, and for this purpose are arranged to be capable of displacement into and out of the path of the blanks as they are advanced to assembly positions.

Finger elements may be provided to co-operate with the stop elements with the object of ensuring a positive movement of the blanks into engagement with the stop elements.

The blanks may be advanced singly from each pile or magazine by conveyor belts mounted on rollers, and preferably the magazines into which the blanks are fed by hand in bulk are so arranged that the blanks are extracted one by one from the bottom of the magazine. Extraction of the blanks may be by means of a suction device, one such suction device being provided for each magazine and operated in timed relation with each other to extract and advance the blanks. Each suction device may comprise one or more nozzles, the nozzles, when more than one is required being arranged to operate in groups of two or three, according to the size of the blank, and mounted to have a combined rising and falling and to-and-from oscillatory motion so as to swing into and out of position below the magazine containing the blanks.

For convenience when loading the magazine with blanks and in order to reduce friction in removing the blank from the pile, it is preferred to set each magazine, and thus the blanks therein, at an angle to the plane of advancement so that the initial operation of the suction nozzle or nozzles will be to draw the blank in a downwards direction causing the leading edge to separate from the pile, thereby reducing friction between the contiguous faces of the undermost blank and the next to be removed to a minimum.

Having separated a blank from the bottom of the pile, the nozzle with the blank adhering thereto is caused to swing forwardly and carry the blank to a position where its leading edge is engaged between co-operating feed rollers and/or conveyor bands mounted on guide rollers.

The invention is illustrated in the accompanying drawings in which:

Figure 1 is a diagrammatic view in side elevation illustrating an automatic machine for assembling cartons from blanks in accordance with the invention;

Figure 2 is a perspective view showing the two blanks referred to as the box and the band is the assembled position with the glue-flaps on the box blank bent upwardly to receive the matching ends of the band;

Figure 3 is a side elevation showing the rear (start) end of the machine including the magazine for the box blanks and feed mechanism for advancing the blanks to the assembly point;

Figure 4 is a side elevation showing the forward end of the machine including the magazine for the band blanks, the assembly table and conveyor mechanism by which the completed boxes are carried away and flattened for stacking;

Figure 5 is a plan view showing the rear end of the machine with the upper conveyor band and support frame therefor removed;

Figure 6 is an enlarged vertical section of the assembly table and showing the discharge conveyor and mechanism by which it is periodically brought into operation;

Figure 7 is a half section and plan view showing the suction feed for the band blanks and mechanism for advancing the box blanks to the assembly position; the section view being taken on the line VII—VII of Fig. 4.

Figures 8 and 9 are transverse sections on the lines VIII—VIII and IX—IX of Figure 4;

Figure 10 is a detail view from one end of the central conveyor band and adjusting mechanism therefor;

Figure 11 is a front sectional view showing the mechanism which performs the operation of pressing the sides of the blank constituting the band into engagement with the glue-flaps on the blank forming the box;

Figure 11*a* is a diagrammatic showing in perspective of the mechanism of Figure 11 together with the assembly station and adhesive applying members;

Figure 12 is a sectional view on the line XII—XII of Figure 11;

Figure 13 is a side elevation corresponding to Figure 11; and

Figures 14 and 15 are enlarged diagrammatic showings, Figure 14 being a side elevation and Figure 15 an end on view of the suction mechanism as described in connection with Figure 3.

In Figure 2 of the drawings there is shown a box carton made up from two blanks A and B, the blank A being referred to as the box and B the band. Projecting laterally from each side of the blank A are glue-flaps G, which are bent up at right angles to the plane of the blank to receive the sides S of the band B and secured thereto by gluing, which operation in the machine according to this invention is performed automatically.

Referring now to Figure 1 the machine of this invention essentially comprises a magazine M for the box blanks A and a second magazine N for the blanks constituting the bands B. H indicates an assembly head including a table T on which can be seen the blank A' with the glue-flaps G bent up in position to receive the sides S of the band B.

GENERAL OPERATION

Blanks from the magazine M are detached one by one from the bottom of the pile by means of a suction device indicated at C, to which is imparted an up-and-down and to-and-fro movement in a horizontal plane so that the detached blank having been removed from the bottom of the pile is carried forward by the sucker head to a pair of take-over rollers D between which the blank is gripped and advanced to upper and lower conveyor belts indicated generally at E and F.

On passing from the conveyor belts E and F, the blank moves forwardly on to the table H, this last movement being completed by pusher fingers P when the forward end of the blank is arrested by engagement with stops K, these stops being caused alternately to rise and fall to arrest the blank and to release the completed box following the gluing.

Blanks from the second magazine N are withdrawn therefrom by a suction device J, which likewise receives an up and down movement and operates in conjunction with a feed arm L, in order successively to detach the blanks from the bottom of the pile in the magazine and to place them upon a shelf or upper portion O of the table T. When in position on the shelf O a pressure plate Y comes into operation to hold the blank to enable folding levers R (see Fig. 11) carried by a bridge member U (see Fig. 11) to descend to fold the sides S of the band downwardly into position where they overlie the glue-flaps G. Just previous to this operation glue is applied to the glue-flaps by a gluing mechanism.

Referring now to Figures 3 and 5 of the drawings there is shown a machine frame, indicated generally at **13**, supported by uprights.

Magazines

At the rear end thereof, which is to the left, as seen in Figure 3, is the magazine M for the box blanks. The magazine M is in two portions each comprising a base **1** with sides **2** and an open front **3** and for convenience in loading blanks therein is set at an incline to the horizontal. As shown in Figure 3 the two portions of the magazine are supported by arms **4** adjustably secured by bolts **5** to the machine bed the latter passing through slots in the arms. **6** is a steady bracket.

Each arm has an enlarged end **7**, in which is a vertical slot **8** to receive a fixing stud **9**, by which the two halves of the magazine are secured so as to permit adjustment of the angle of inclination of the magazine and thus of the angle, at which the lowermost blank in the pile in the magazine is presented to the plane of advance of the blanks (indicated by arrow X) and below which plane are mounted various feed rollers and conveyors.

The second magazine in which the other blanks forming the bands are piled is shown at N.

"Box" blank feed

Extraction of the lowermost blank in the pile is by means of a suction nozzle device C (see also Figures 14 and 15) which comprises a short rigid tube section **10** telescopically carried within a hollow post or sleeve **12** fast on one end of a slide **14**, the slide **14** being slidable to and fro in the direction of advance of the blanks between guides **14'** on the bed of the machine frame **13** as hereinafter described.

The tube section **10** terminates in a suction head **11** adapted to make suction contact with the underside of the lowermost blank in the pile in the magazine and against the upper face **11'** of which the blank is drawn when suction is applied via the tube **10**.

It should be understood that for normal sizes of carton a single suction head and slide **14** is sufficient being located on the centre line of advance, although, when handling large sized cartons, it may be found that more than one suction head is necessary. For this purpose the arms **4** are laterally adjustable as permitted by the steady guide **6** to accommodate different sizes of blanks and obviously the fact that the magazine M is in two portions enables them to be closed in or further separated one from the other by means of suitable distance members **2'** (Figure 5).

The slide **14**, is itself mounted for to-and-fro sliding movement in guides **14'** of which there are two, one on each side, and extending in the longitudinal direction parallel to the direction of advance of the conveyors. Fast on the other end of the slide **14** is a bracket or brackets **16** in which is carried a pivot pin **17** for mounting forwardly extending lever arms **18**. Studs **20** are secured at their inner ends to the suction head **11** and extend through diametrically opposite vertical slots **21** in the tube section **10**, the studs **20** being journalled at their outer ends in the arms **18**. It will be obvious therefore that the suction head and nozzle **11** is supported by means of the lever arms **18** for vertical up and down movement in relation to the slide **14**. The rise and fall of the nozzle **11** is controlled by a cam **25** fast on a cam shaft **25'** and on which runs a roller **26** on a depending limb **18'** (Figure 3) of the lever arms **18**. To-and-fro movement is imparted to the slide **14** by a second cam **14'** fast on the cam shaft **25'** which engages with the roller **26**.

The lower end of the suction head **11** is connected by a length of flexible piping **27** to a source of vacuum so that the necessary suction can be applied through the noozle **11** to the blank to be removed from the pile.

Control of the suction is by means of a rotary valve (not shown) which also controls the suction to the

nozzle associated with mechanism for advancing the blanks constituting the band as will hereinafter be described. In operation the suction is "on" as the nozzle **11** rises to engage the underside of the blank and remains in this condition, i. e. "on," as the nozzle falls. On completion of the downwards movement, the plate **14** starts to move forwardly in the direction of the arrow *"x"* so as to cause the blank to move into engagement with the take over rollers D by which it is advanced to the conveyors E, F that carry it forwardly to the assembly position on the platform the suction being released during the return movement of the nozzle.

To prevent the suction effect being transmitted to the next blank at the bottom of the pile, a finger element **30** (see Figure 14) having a toe **31** is swung into engagement with the pile. Movement of the finger element 30 is controlled by a third cam **29** fast on the cam shaft **25'** and with which cam **29** engages a roller 32 carried by a one arm lever **33** fulcrumed at **34** to a stud carried by a bracket **36** fast on the machine bed. Pivotally secured to the forward end of the lever **33** is one end **37** of a two part vertically operating link, the other part **38** of which is pivotally secured to a short arm lever **39** fast on a rock shaft **40**. It will be seen that the two parts **37**, **38** of the link are interconnected by a pin and slot connection **41** so as to permit of relative adjustment and thus of the throw of the finger element **30**.

Intermediate feed rollers and conveyors

A super-structure including side plates **42** is provided on the machine bed, the two side plates of which provide mountings for the two rollers forming the take-over roller unit D and the conveyor belts E and F by which the blank extracted from the pile in the mechanism M is advanced to the assembly table H. The take-over roller unit D comprises spaced large upper rollers **45**, **45'** (see Fig. 5) cooperating with an idler roller **46** located beneath the plane of advance. Fast on the spindle **47** of the driving roller **45** is a pinion **48** which is in constant mesh with an intermediate pinion **49** itself meshing with a pinion **50** which takes its drive from a main transverse driving shaft **52**. The shaft **52** is provided on its outer end with a driving pulley **53** driven by a belt drive **35** from an electric motor or other source of power (not shown).

As can be seen from Figure 5 and Figure 10 there is provided a set of three conveyor belts below the blank comprising two support belts **55**, **56** and a central belt **57**. The central belt **57** is positively operating in that it co-operates with a single upper conveyor belt **59**. The lower set of conveyor belts, **56**, **57**, **55** are each mounted on a series of idler rollers indicated generally at **60** and at their forward ends on a driving roller **61** which is fast on an auxiliary transverse shaft **43**. Provision is made to adjust the tension of the belts **56**, **57**, **55** by a jockey pulley **57'** (Fig. 3) carried on a screw adjustable bracket. The central and upper conveyor belt **59** is supported between a pair of side support plates **65**, **65'** (see Fig. 10) which are mounted to hinge at the incoming end of the belts about a transverse shaft **66** carrying the driving roller **67** for the conveyor belt **59**. The horizontal run of the belt **59** is controlled by a series of idler rollers **68** including a front roller, and on the return run between the front and rear rollers the belt is passed over two jockey rollers **70** and an intermediate adjustable roller **71** (see also Figure 10) in order to enable the tension in the belt to be adjusted. Adjustment of the roller **71** is by means of a screwed spindle **72** carried by a bridge piece **73** secured to the support plates **65**, **65'**, the screwed spindle **72** having a wing nut **72'** and a lock nut **74**. The support plates **65**, **65'** are provided with vertical slots **75** in which the outer ends of the shaft mounting the adjusting roller **71** is slidable.

Provision is made to adjust the pressure of the belt **59** and for this purpose the support plates **65**, **65'** can be raised or lowered about their fulcrum **66** by means of screw adjusting mechanism indicated generally at **77** (Figure 3).

Band blank feed

Referring now to Figures 4 and 7–9 the blanks B forming the band are extracted from the second magazine N by a suction nozzle device J similar to the device C used to withdraw the box blanks A from the magazine M.

Secured to the machine bed **1** is a second and detachable superstructure comprising side blocks **80** supporting the magazine N and the suction device J and operating mechanism therefor, by which the suction heads, of which there are two indicated at **22**, are caused to rise and fall and to receive a to-and-fro horizontal motion so that having extracted a blank constituting the band from the magazine N the band will be advanced to the assembly position.

The magazine N comprises a vertical box shaped chute the front and rear walls of which are indicated at **81** and **82**.

Each suction device J comprises a block **84** secured between the forward ends of pairs of elongated L-shaped lever arms **88** the arms **88** being (Figures 7 and 9) mounted to pivot about a stud **86'** on a bracket **86** carried by a slide **28** which is slidable in guides **80'** fast on the block **80** as can be seen from Figure 9.

Motion is imparted to the slide **28** by a rotating cam plate **93** fast on a cam shaft **94** (Figure 4), which cam shaft **94**, as hereafter described, is driven through a series of pinions **101**, **98**, **103** and **104**. On the cam shaft **94** the cam member **93**, said member **93** being adapted once on each revolution of shaft **94** and of shaft **90** (both shafts being geared to rotate at the same speeds) to engage a roller **93'** on the slide **28**.

At their forward ends the lever arms **88** come to rest in their lower position in circumferential grooves **85** (Figure 9) formed on bushes **89** freely mounted on the cam shaft **90**. Also fast on the cam shaft **90** is a cam plate **23** engaging a roller **24** fast on a laterally projecting pin carried by the arms **88**.

There are also provided horizontally reciprocating fingers **97** having upturned ends adapted to engage the rear edge of the band when the latter has passed between the rollers **95**, **96**. Movement of the fingers **97** is controlled by a second cam **100** fast on a cam shaft **99**, the cam shaft **99** having a pinion **98** fast thereon which meshes with an intermediate pinion **101** for transmittting drive to a pinion **102** fast on the first cam shaft **94**, by which the lever arms **88** through the intermediary of cam **93** are advanced, spring means (not shown) being provided to ensure the return motion. A second pinion **103** in mesh with **98** is in driving connection with a pinion **104** on the shaft **90**.

In order to ensure that the blanks are extracted singly from the magazine N and to prevent the possibility of two bands being removed simultaneously, there is preferably provided mechanical means of separating the lowermost blank in the pile by subjecting the pile to a squeezing action.

In the flat (stacked) position int he magazine N, the end parts **160** lie in a horizontal plane and present two rearward longitudinally extending edges **160'** and **160''**.

As can be seen from Figure 2 the band B comprises a comparatively narrow strip which represents the depth of the carton having enlarged ends **160**. A shelf **111** (see also Fig. 8) which extends below the open end of the magazine N is provided at each side of the magazine with a fixed lug **161** (Figure 8) and cooperating with each fixed lug is a movable lug **162**. The lug **162** forms part of a plate **163** slidably fixed by means of a pin and slot connection indicated at **164** to the shelf **111**. The fixed and moving lugs **161**, **162** extend in a longitudinal direction and are spaced apart to be in alignment with the suction device **88**—**84** and vertically above the shaft **90** on which the sleeves **89** mounting the cups for the suction

nozzles 84 are mounted. The distance, measured transversely, between the fixed and moving lugs 161, 162 is so arranged that it is slightly greater than the width of the parts 160 between the edges 160'.

Fast on the shaft 90 are cams 165 having a cam flange 166 for cooperation with a roller 167 fast on a pin 168 carried by the slidable plate 163 (see Figure 8). It follows therefore that once for each rotation of the shaft 90 the rising face 165 of the cam 165 will force the plates 163 inwardly towards the fixed lugs 161 with the result that a squeezing action will be applied to the enlarged ends 160 of the blank because the moving lugs 162 will engage the edge 160'' and press the other edge 160' against the fixed lug 161. As a result the blanks at the bottom of the pile in the magazine will separate in a manner somewhat similar to that of a pack of cards when gripped between the fingers as when shuffling the same. This will ensure that suction applied by the nozzles is effective only on the lowermost blank since the pressure on the opposite face of the blank will be atmospheric.

In its advance to the assembly position the box blank A is subjected to the action of means adapted to engage the glue-flaps G to bend them upwardly to an angle at right angles to the plane of the blank (see Figure 2) so that when the blank arrives at the assembly position where it is held flat on a table 110, the glue-flaps will stand upright and in a position to receive a coating of adhesive material. The bending operation is performed by co-operating folding plates 150, shown diagrammatically in Figure 3, of which there are two pairs arranged one to engage each flap, the plates of each pair being arranged one above the other and above and below the thickness of the blank, the lower plate of each pair merging with a ramp or inclined portion up which the flap rides as the blank advances.

The operation of the ramp is first to lift the flap out of the plane of the blank and then to fold it inwardly and downwards so that it lies flat against the blank, this folding operation being performed by the overlapping plates, the uppermost plate having an overhanging edge beneath which the flap is turned until it is completely folded flat against that part of the blank constituting the side of the finished carton. On leaving the folding plates, the flaps are passed between ironing rollers 235.

Gluing mechanism

Provision is made to apply a coating of adhesive glue to the flaps just prior to or on arrival at the assembly position. Conveniently and in the embodiment illustrated the gluing operation takes place when the blank has passed the ironing rollers and prior to arrival at the assembly position.

When the flap emerges from the ironing rollers, the inherent resiliency of the material causes it to spring back to the upright position at right angles to the plane of the side or back of the carton and it then passes between vertical guide blades 130, 130' to maintain it in this position. When in this position it is subjected to the action of a wiper device which includes horizontally operating rollers 151, 151' (see Figures 7 and 9) for applying a coating of glue to the outer surface of each flap as will hereinafter be explained.

Referring now to Figure 9 the machine is equipped with two containers 154 for glue or a single container which extends transversely of the machine and has two openings above each of which is rotatably suspended a disc 155 fast on a spindle 156 (see also Figure 11*a*). Each of the spindles 156 has fast on its inner end a pinion 157 which receives its drive through intermediate gearing from the main drive shaft. Drive is taken from the other end of the spindle 156 through bevel gearing 157' to a short vertical spindle 158 mounting the glue applying disc 151, or 151'.

It will be seen from Figure 7 that the discs 151, 151' are cut away so that only a short sector of the periphery will contact the gluing discs 155. It follows therefore that once for every complete rotation of the discs 151, 151', the sector of larger radius will rub against the glue-flaps G to apply a coating of glue thereto.

Assembly table

As can be seen from Figures 6 and 11, the assembly table T comprises the lower plate 110 constituting the table proper upon which the blank A forming the box is received and an upper part hereinafter termed the platform or shelf 111 onto which the second blank B forming the band is advanced by the feed rollers 95, 96. The shelf 111 is provided with a forwardly extending extension or lip 112 which normally remains in parallel alignment with the table 110 but is capable of being withdrawn as represented by the chain line 112 in Figure 4 in order to facilitate release of the completed carton following the gluing operation and to enable the carton to be removed by means of the discharge conveyor bands V.

In order to secure vertical alignment between the two blanks, which have respectively been advanced to positions one above the other, the band on the shelf 111, 112 and the box on the table 110, stop elements are provided. One stop element 125 locates the box blank and another element 132 the band blank.

In the case of the box blank A, the blank on issuing from the two sets of conveyors 55, 56, 57 and 59 is engaged by a finger mechanism including transversely spaced fingers 115, each finger being part of a plate, which is adjustably secured by screw studs 117 to a reciprocating bracket 118, the bracket 118 having slots 119 for engagement with studs 120 fast on the machine frame. It will be seen that the slots 119 have an upwardly inclined portion so that movement of the bracket 118 will cause the slots to ride up the studs 120 until the latter enter the horizontal portions of the slots when the bracket, together with the fingers 115, will move forwards with the fingers 115 in a position above the plane of the advancing box blank A' to engage its rear edge and carry the box blank A forward into the assembly position where it is arrested by a stop blade 125, which has been positioned in its path and subsequently withdrawn this operation being brought about by a cam 231 fast on a cam shaft 216'.

The cam shaft 216' serves a double purpose. Firstly it controls the action of one of two conveyor bands, as hereinafter described, to remove the finished carton from the assembly position. Secondly it actuates the stop element 125. Stop 125 is on a plate secured to a rocker plate 236 anchored at one end to rock about a centre 237 and having a depending leg which rests in engagement with the cam 231 fast on shaft 216'. It will be seen therefore that the rocker plate 236 will rise and fall with rotation of cam 231 and hence move stop element 125 into and out of the path of the advancing blank.

Each bracket 118 has a downwardly depending portion 126 carrying a roller 127 for engagement with a cam 128 fast on a shaft 129. Rotation of the cam 128 will therefore produce displacement of the bracket 118 to perform the operation just described.

During this last movement of the blank A the glue-flaps G which, as previously explained, have been bent up out of the plane of the blank into a position at right angles thereto, pass between the spaced pairs of guide blades 130, 130' in order to hold them upright.

As previously explained, the blank B forming the band is advanced by fingers 97 (Figure 4), which fingers form part of bracket plates 118' similar in construction and operation to the bracket plates 118, the bracket plates 118' being controlled by the cams 100 on shaft 99 (see also Fig. 7). Forward movement of the blank B is arrested by a lip 132 (see Figs. 6 and 7) carried on one arm 133 of a two-arm lever having a fulcrum 134 and the other arm 135 of which carries a roller cooperating with one of three cams 137, 138 and 139 fast on a cam shaft 140. As can plainly be seen from Figure 6, once for

every rotation of the cam shaft **140**, the cam **137** will strike the roller on the lever **135** in order to produce displacement of the other arm **133** and thus withdraw the lip **132** to a position where it is below the extension **112** of the shelf **111**.

Electrical contacts (not shown) may be provided on the outer end of lip **112** forming parts of a short circuit for tripping the motor drive, completion of the circuit being effected by metal to metal contact of the presser plate on the contacts.

It follows that should the blank B be missing or in the event of it being received in the assembly position, improperly aligned, i. e. with its forward edge at an angle, when the presser plate **175** descends it will complete the short circuit to arrest the machine.

Just after withdrawal of the lip **132** the cam **138** comes into operation to release the extension **112** of the shelf **111** as will now be explained. Atttached to the underside of the shelf **112** is a leg **142** to which is pivotally secured a thrust rod **143** slidably mounted in a bracket **144**. Mounted on the rod **143** is a compression spring **145**, one end of which bears against the bracket **144** and the other against a collar on the rod. Thus the spring normally urges the rod **143** in the direction of the arrow Y where a roller **147** presses against the cam **139**.

It will be seen that the lower end of the leg **142** has a roller **142'** which rides on a block **158**, the surface of which drops at one end with the result that when the rod **143** moves to the left the leg **142** will ride down the slope to the bottom end. When extension lip **112** falls the carton is virtually supported solely by its lower side resting on the table part **110** so that it can readily be removed by the conveyors V.

Box side folding mechanism

It will be understood that when the blank A is in position on the assembly table **110** it lies flat against the table with the two glue-flaps, to which a coating of glue has just been applied, projecting upwardly as can be seen from Figures 9 and 11, in which position it is ready to receive the opposite ends of the band blank B.

The particular blank forming the band on arrival at the assembly position on the shelf **111** is flat from end to end and it is necessary to depress the two end pieces **156** including the flaps **160** of the band until engagement is made with the upstanding glue-flaps of the box portion, which flaps are positioned against the side walls of the box forming table.

For this purpose there are provided folding levers **189** (see Figure 11) and associated with each lever is an ear plate **192** which, as will now be described, moves downwardly to engage the projecting ends **156** of the blank in order to bend the latter downwardly and bring them into contact with the glue flaps.

Referring now to Figures 11, 12 and 13 of the drawings, **170** indicates one of two vertical guide rods for a bridge member indicated generally at **171**. This bridge member **171** may consist of a hollow casting having machined holes to receive liners **172** which are a sliding fit on guide rods **170** secured at their lower ends to pedestals **173** fast on the machine frame.

Up and down movement of the bridge **171** is controlled by connecting rods **174** at each side thereof and driven from a cam (not shown), and it is by means of this bridge that the pressure is brought to bear on the sides **156** of the blank constituting the band, in order to bend said sides **156** downwardly and against the glued flap G of the box portion.

Retractably mounted on the underside of the bridge is a pressure plate **175** having upstanding guide rods **176** which are slidable through holes in a bridge plate **182**, the rods **176** terminating in shouldered ends **177** which limit by engagement with bridge plate **182** the downwards movement of the pressure plate **175** under the action of a compression spring **179** mounted on a guide bar **178** extending through holes **180—180'** respectively in the main bridge member **171** and the bridge plate **182**. Likewise the bridge plate **182** is itself capable of limited displacement in relation to the main bridge **171**.

For this purpose the bridge plate **182** is itself provided with guide rods **183** which extend through guide holes **181** in the lower part of the bridge **171**, springs **185** being mounted on the guide rods **183** for engagement with collars **187** so that in the normal position of the parts, before the bridge descends to complete the bending and gluing operation, the bridge plate **182** remains spaced apart from the member **171**, thereby providing a lost motion between the bridge plate **182** and the main bridge member **171**.

On the underside of the bridge member **171** are brackets **188**, each bracket having a pivoted folding lever **189**, which, as can be seen, comprises two plates of inverted V shape, between which is mounted a cam roller **191**. **190** is a stop block for cooperation with an adjustable set screw **194**. Fast on the guide rods **170** are seating blocks **197**, to which are secured adjustable cam tracks **198**, adjustment being by means of screw pins **199** and finger nuts **199'**.

Associated with each folding lever **189** is the ear plate **192** which plate is mounted to pivot about a centre **193** on the ends of the bridge plate **182**, the folding levers and their respective ear plates being maintained in the position shown by a single tension or return spring (not shown) anchored at its ends to lever arms fast on a hub element **196** mounting the plates **192**. It follows that the ear plates **192** and the folding levers by which they are actuated remain in the raised position shown, where they are inoperative.

On a downward movement of the main bridge **171**, however, both the folding levers and their associated ear plates will descend with it and, during this movement, the cam roller **191** will engage the cam track **198** (see Figure 11*a*) causing the former to move inwardly, carrying with it the ear plate **192**.

On descent of the bridge **171**, the presser plate **175** will descend with it and move into engagement with that side of the band B resting on the shelf **111**, continued movement of the bridge being possible since the rods **176** are free to pass through holes **171'** in the lower face of the bridge **171**, this movement taking place against the action of spring **179**.

During this time the sides S of the Band B will be folded inwardly due to the initial downward movement of the ear plates **192**.

By reason of the fact that the pivotal centres **193** of the ear plates **192** are in a plane slightly above that of their actuating levers **189**, the ear plates **192** will reach their final and operative position where no further movement of the latter in a downwards direction is possible, at which time the sides are bent downwardly but still remain at a slight angle to the vertical, where their ends remain out of contact with the glue flaps G. However as explained below their angular movement, caused by the actuating levers **189**, is not complete until further downward movement of the centres **188'** of levers **189** takes place.

Because of the lost motion connection between bridge plate **182** and the main bridge **171**, the lugs **188** will descend to a point below the centres **193** until this motion is taken up and the bridge member **171** is arrested by engagement with the bridge plate **182**. During this continued downward movement of the bridge **171**, the rollers **191** will ride still further along the cam track **198** to complete the squeezing operation and force the sides S into contact with the glue flaps. Side plates or cheeks **110'** are carried by the table **110** and it is against these cheeks that the ear plates **192** are pressed during the latter operation, due to the thrust exerted by the folding levers **189** so as to engage the box sides **156** and press

them against the glued faces of the glue-flaps on the box blank A.

As described above, the platform for the band in the assembly position is provided by the shelf **111** having at its forward edge a withdrawable shelf **112**, which constitutes the platform proper and is hinged to swing about a horizontal transverse axis on the shelf **111**; forward movement of the blank constituting the band portion on the platform is limited by the stop **132**.

It can be seen from Figures 3, 6 and 7 that both sets of conveyors E, F and V respectively for advancing blanks to the assembly position and removing the carton on completion of the gluing operation are mounted to operate in the same horizontal plane as that of the assembly table **110**, which is cut away to accommodate the conveyor bands.

On completion of the gluing operation, it will be appreciated that the two lower edges of the side cheeks **110'** plus the table support **110**, together with the lip **112** form a four-sided support about which the carton is a close fit. In order therefore to facilitate the withdrawing action of the carton by the conveyors, the shelf extension or lip **112** is depressed or withdrawn to a position where it is no longer in contact with the adjacent side of the carton. It follows therefore that the carton can easily be withdrawn, as there is no longer any friction between its supporting frame and the inside faces of the carton. The mechanism by which the extension **112** of the assembly platform **111** is depressed has already been described but briefly it is by means of the thrustbar **143** and second cam **139** mounted upon the cam shaft **140**.

It will be understood that the timing of the three cams **137**, **138**, **139** on the cam shaft **140** is so arranged that it is in step with the operation of the following levers **189** so that on completion of the folding operation by means of the ear plates **192** the cam **139** operates to depress the extension **112** of the platform.

Carton discharge

Referring to Figs. 4 and 6 discharge of the completed carton is by means of upper and lower spaced conveyor bands, the lower conveyor band comprising an endless band **210** supported at its trailing end by a roller **211** mounted to rotate about a fixed centre. At its other end the band is passed round an idler roller **212** carried by a lever arm **213** itself mounted to rock about the axis of the roller **211** and having a depending arm **214** provided with a cam roller **215** for engagement with a cam **216** on the cam shaft **216'**.

Thus once in each revolution of the cam shaft **216'** mounting the cam **216**, the lever arm **213** will lift and carry with it the conveyor band **210** in order to raise the latter to a position where it coincides with the plane of the support table **110** and thus the underside of the carton.

Cooperating with the lower conveyor band **210** is an upper conveyor band **218** which normally runs in a path above the plane of the table **110** as shown in Figure 6. At its trailing or discharge end the band is supported by a driven roller **219** the axis of which is in vertical alignment with that of the roller **211**. At its other end, the band **218** passes round a fixed driving roller **220**. Pivoted to rock about the axis of rotation of the roller **220** is a two-armed lever, one arm **221** of which supports a jockey roller **222** and the other arm **223** of which has an offset end and carries a cam roller **224** for engagement with the cam **138**.

It will be seen that on rotation of the cam shaft **140** which operates in timed relation with the cam shaft **216'** for the lower conveyor band **210**, a displacement of the arm **223** will be produced thus causing the roller arm **221** carrying the jockey roller **222** to be moved downwardly. This will bring about a displacement of the lower half of the run of the conveyor band when it will engage the inside of the carton and in conjunction with the band **210** remove it. The operative face of the cams **216** and **138** is such that they cause cooperation between their respective conveyor bands for a period sufficient to effect the removal of the carton and following this the conveyor bands are allowed to move to the inoperative position as shown in Figure 6.

Situated beyond the end of the conveyor bands **210**, **218** is a flattening device in the form of a conveyor band **230** (Fig. 4) which is twisted at right angles, one end passing over a pulley **232** at right angles to an adjustable pulley, the latter having a horizontal axis. The purpose of this band 230 is to permit pressure to be applied to one side of the band **156** by means of which the carton is caused to collapse to a flat condition for the purpose of packing.

Interchangeability

In order to change over from one size of carton to another it is possible, as already explained, to interchange or adjust magazine M for the box blanks. Adjustment is made possible by means of the spacing collars **2'**, **2'**, which enables the side walls **2**, **2** to be closed up or spaced further apart from each other. Provision is made to vary the operative width of the lower set of conveyor belts **55**, **56** and **57** by adjusting the two outer belts **55**, **56** laterally inwards or outwards. For this purpose the end support rollers and the idler rollers **60** are shifted on the spindles **60'** (see Figure 5) by means of screw winding or other adjusting mechanism.

It will be appreciated that any increase in the width of the carton may entail a relative increase in the breadth which will effect the distance separating the shelf **111** and its extension **112** from the support table **110**. To accommodate this change in dimension, the superstructure unit is replaced by another giving the required spacing between the shelf **111** and table **110**.

For this purpose the superstructure **80** which embodies the magazine N, suction device J and feed for the blanks constituting the bands together with the shelf **111** is releasably secured to the machine frame **13** (Figs. 3 and 7). As shown in Figures 4, 5 and 7 the entire superstructure can be removed simply by slackening off the six nuts **234** and fitting a new bridge member **171** which entails removing the nuts **242** (Figure 11) at the top of the posts **170** having first unscrewed the check screws **243** to permit of withdrawal of the screw studs **244**.

What is claimed is:

1. A machine for use in assembling blanks to form a four-sided carton in which each blank has a side and two end flaps, said flaps being united to one another to form two opposite sides by means of a bending and gluing operation, comprising magazines in which the blanks to be united are stacked flat one above the other, an assembly station defined by means adapted to support a blank drawn from each magazine in spaced relation one to the other and with the flaps in overlapping engagement prior to completion of the gluing operation, means for extracting blanks successively one at a time from each pile, and conveying the extracted blanks to their respective positions at the assembly station, a device by which the flaps on at least one of the blanks are bent in a plane at right angles to the main portion of the blank, members located in the path of one of said blanks for applying adhesive material to the flaps thereof, and presser devices operated in timed relation with the adhesive applying members by which pressure is applied to the two sets of flaps to complete the gluing operation.

2. In a machine for use in assembling blanks to form a four-sided carton, in which each blank has a side and two end flaps, said flaps being united to one another to form two opposite sides by a folding and gluing operation, the combination of magazines to receive the blanks to be united and in which they are stacked one above the other, an assembly station defined by means adapted to support two blanks, one drawn from each magazine, in spaced relation and with the flaps in overlapping relation prior to completion of the gluing operation, suction operating means by which a blank, which is next in the pile, can be

withdrawn from each magazine each of said means being normally inoperative but capable of movement into and out of operative position and adapted on engagement with the outer blank in the pile to extract it by means of suction, blank advancing means arranged to receive the extracted blank and to advance it to the assembly position, a device by which the flaps on one blank, in its passage from the magazine to assembly position, are bent in planes at an angle to the side of the blank, members located in the path of one of the oncoming blanks for applying adhesive to the flaps, and presser devices adapted to secure engagement between the flaps of both blanks to complete the gluing operation.

3. The combination claimed in claim 2 in which the flaps on one blank are bent to an angle at right angles to the side of the blank and in this position contact is made with the adhesive applying members and the presser devices are arranged for movement into engagement with the flaps of the other blank by means of which they are folded and applied against the glued faces of the flaps of the first blank.

4. A machine as claimed in claim 2 wherein the suction operating means comprises a suction nozzle for engagement with a blank, a sleeve element in which said suction nozzle is telescopically mounted and cam operated means for raising and lowering the suction nozzle into and out of its operative position.

5. A machine as claimed in claim 4 in which the sleeve element supporting the suction nozzle is attached to a slide supported for movement in a substantially horizontal plane and means is provided for causing a displacement of said slide in a direction to advance the blank engaged by the suction nozzle in a direction towards the assembly station.

6. A machine as claimed in claim 2 wherein blank control separating means is provided for movement into and out of engagement with the last blank in the pile to prevent more than one blank being detached therefrom at a time.

7. A machine as claimed in claim 6 in which said blank control separating means comprises a normally inoperative lever arm having a foot adapted to penetrate the pile from one side and means for causing movement of said arm into and out of operative position and actuated in timed relation with the suction nozzle to retain the remaining blanks against displacement due to suction.

8. A machine as claimed in claim 6 in which said blank control separating means comprises a gripping device adapted to move into and out of engagement with the pile of blanks and to subject it to a squeezing action in order to cause separation of the outermost blanks in the pile so that suction pressure is effective only on the last blank in the pile.

9. In a machine for use in assembling blanks to form a four-sided carton, in which each blank has a side and two end flaps, the end flaps on one blank being glue flaps, said flaps being united to one another to form two opposite sides by a folding and gluing operation, the combination of magazines to receive the blanks to be united and in which they are stacked one above the other, an assembly station provided by plates superimposed one above the other and adapted each to receive a blank and to maintain the same in spaced relation during the gluing operation, suction operating means, by which a blank, which is next in the pile, can be withdrawn from each magazine, each of said means being normally inoperative but capable of movement into and out of operative position and adapted on engagement with the outer blank in the pile to extract it by means of suction, blank advancing means arranged to receive the extracted blank and to advance it to the assembly position, said blank advancing means including upper and lower sets of rollers adapted to receive the blank from the suction operating means and to advance it to the assembly station, a device by which glue flaps on one blank, in its passage from the magazine to assembly position, are bent in planes at an angle to the side of the blank, adhesive applying members located in the path of the oncoming blank and positioned for engagement with the glue flaps of said one blank and adapted to apply a coating of glue thereto, and presser devices which are normally inoperative but are adapted to move to engage the flaps of the other blank and to bend them to a position in contact with the glue flaps of said one blank.

10. A machine as claimed in claim 9: wherein the means for conveying the blanks having the glue flaps to the assembly position also includes upper and lower endless belts adapted to engage the blank centrally and bending devices are provided in the path of said conveyor belt for bending the glue flaps through the required angle.

11. A machine as claimed in claim 10 having bending devices adapted to bend the glue flaps out of the flat and including rollers adapted to exert a flattening action on the glue flaps following the bending operation.

12. A machine as claimed in claim 9 in which the blank having the glue flaps to which adhesive is applied when in the assembly position is located in the lower position to enable the sides of the other blank in the upper position to be bent downwardly into engagement therewith.

13. A machine as claimed in claim 10 wherein the upper and lower conveyor belts are provided at each end with support rollers in which one of said belts is capable of angular displacement about the support roller at one end of its run in order to vary the pressure between the belts.

14. A machine as claimed in claim 13 wherein the support rollers for the upper endless conveyor belt are mounted on support plates and screw adjustable means is provided for raising and lowering said support plates and arranged at the trailing or discharge end thereof.

15. A machine as claimed in claim 9 having stop means to arrest at least one movement of both blanks on arrival in the assembly position, said stop means normally being in a position to prevent movement of the blanks beyond the assembly position, and means for withdrawing said stop means on completion of the carton.

16. A machine as claimed in claim 15 wherein a pusher device is provided for movement into and out of engagement with the rear edge of each blank in order to produce a positive displacement of the blank in a direction towards the stop means.

17. A machine as claimed in claim 9 wherein removal of the completed carton following the gluing operation is by means of conveyor belts which are normally inoperative, and comprises means actuated in timed relation with the gluing operation to render said conveyor belts operative to engage and remove the completed carton.

18. A machine as claimed in claim 17 wherein the belts are respectively upper and lower continuously running conveyor belts, said belts normally running in a path out of the plane of movement of the carton and means for causing displacement of the belts or a part thereof to bring them into engagement with the carton.

19. A machine as claimed in claim 18 in which an assembly table is provided to receive said one blank which constitutes a box blank on arrival in its assembly position, said other blank which constitutes a band blank being received by a shelf arranged in spaced relation with the assembly table and wherein the conveyor belts are adapted to engage that side of the carton supported by the assembly table and the shelf supporting the opposite side of the carton is adapted for displacement in order to move out of engagement therewith to facilitate release of the carton as a whole.

20. A machine as claimed in claim 9 in which the plates providing the assembly station include a lower plate providing a table to receive said one blank and an upper plate providing a shelf to receive said other blank.

21. A machine as claimed in claim 20 in which the means for engagement with said other blank to move the

sides or flaps thereof into overlapping engagement with the adhesive bearing flaps on said one blank comprises a bridge member slidably supported for movement towards and from the assembly station and moveable to an operative position in which said other blank is gripped between a presser plate on the bridge member and the shelf plate, and folding elements pivotally attached to the bridge member and so arranged that on movement of the bridge member to its operative position, the said elements will be actuated to bend the sides of said other blank into engagement with the flaps of said one blank.

22. A machine as claimed in claim 21 in which the presser plate is retractably supported by the bridge member.

23. A machine as claimed in claim 21 comprising a bridge plate capable of limited displacement in relation to the bridge member in which the bridge plate is provided with ear plates for engagement with the sides of the said other blank, and lever members are mounted on the bridge member for actuating the ear plates.

24. A machine as claimed in claim 23 wherein the lever members are provided with cam rollers for engagement with cam tracks on the machine frame.

No references cited.