

[54] **AUTOMATIC CARTON CASE  
MANUFACTURING DEVICE**

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[51] Int. Cl. .... **B31b 1/44**

[58] Field of Search ..... 93/51 R, 51 HW, 49 R

[56] **References Cited**

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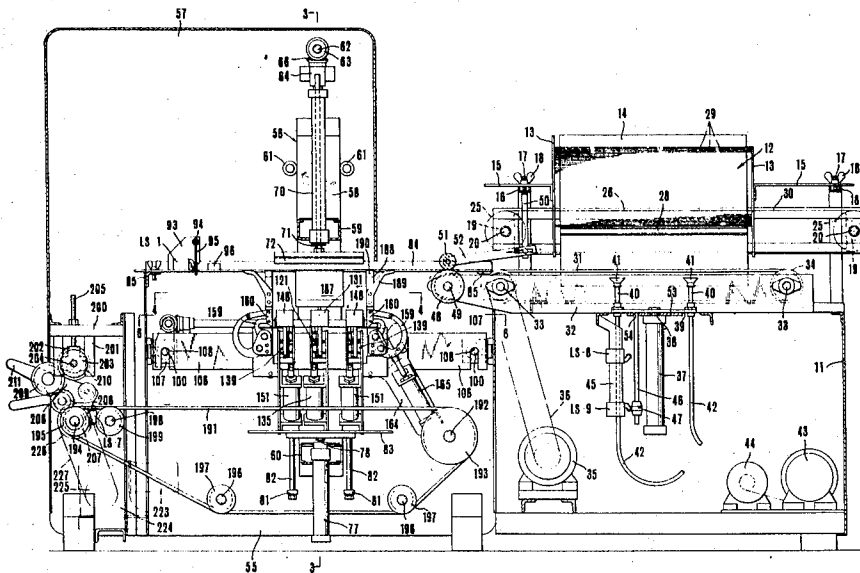
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[57] **ABSTRACT**

A carton manufacturing device. A push plate is provided for pushing down the bottom part of the carton located in the central portion of the blank, and guide members for bending the side walls and the end walls are positioned around the edges of the blank. The sequence of operation is such that pieces located at the ends of the end walls are bent upward before the side walls and end walls are bent upward. Guide rods are disposed outside the guide members for bending the end walls to bend pieces at the ends of the side walls upward before the side walls are bent upward. Parallel receiving plates are provided which support the lower surface of the bottom of the blank board while being lowered and raised during the bending operations. A plurality of turnable bending pieces are provided near the guide members to fold the side walls and end walls double by bending downwardly and inwardly the upper halves of the side walls and the end walls. A conveyor is provided for conveying the carton from the receiving members to the exit when the carton is completed after the bending operations as above described.

**7 Claims, 16 Drawing Figures**



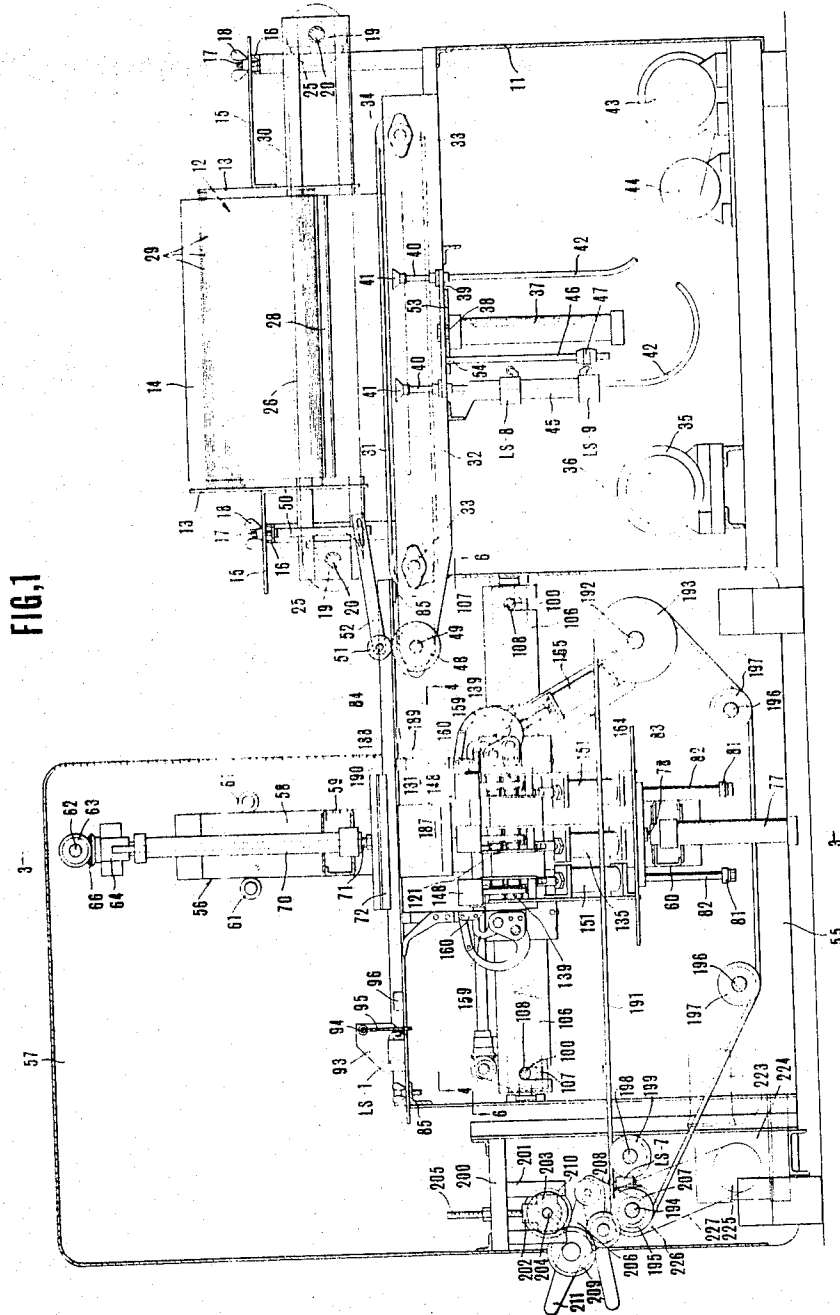
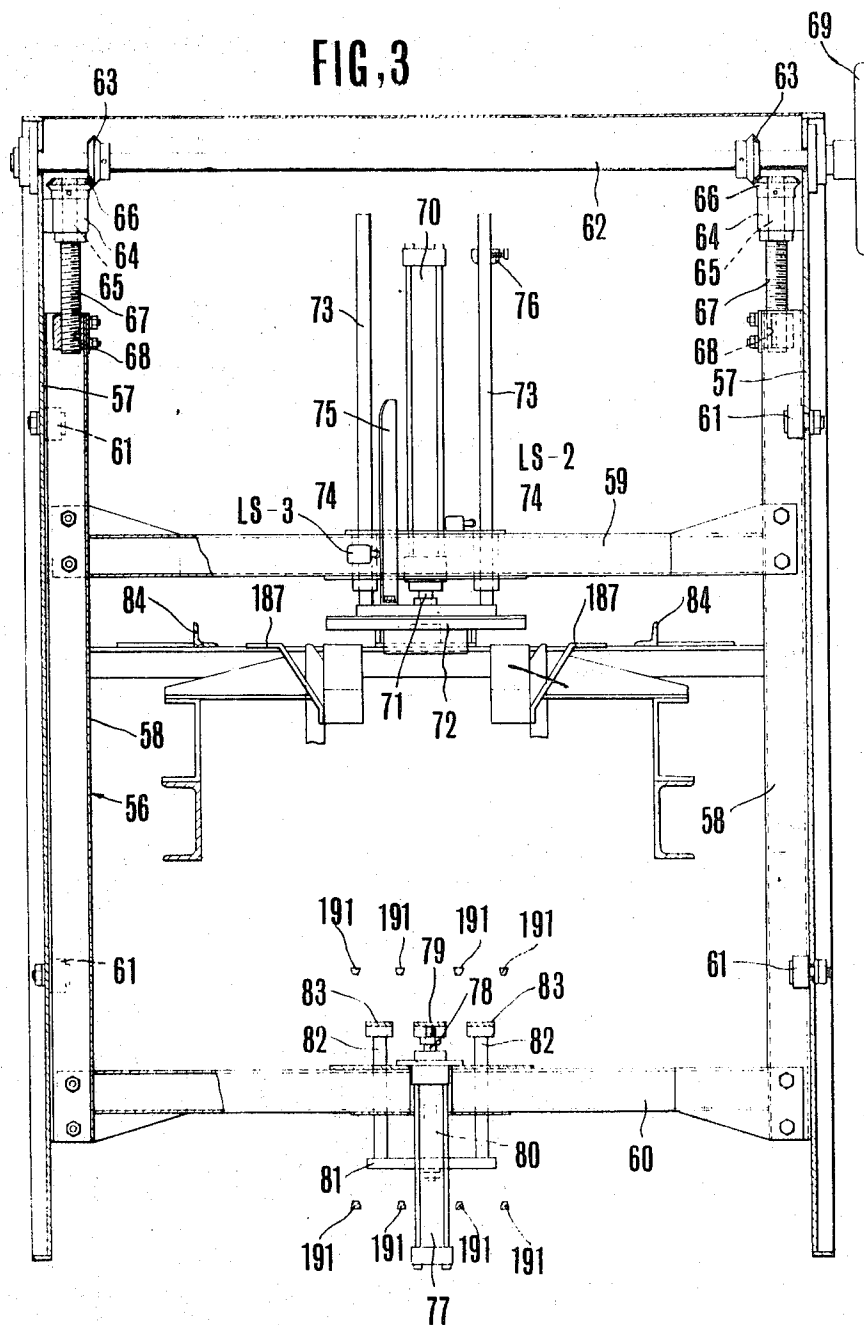


FIG. 1

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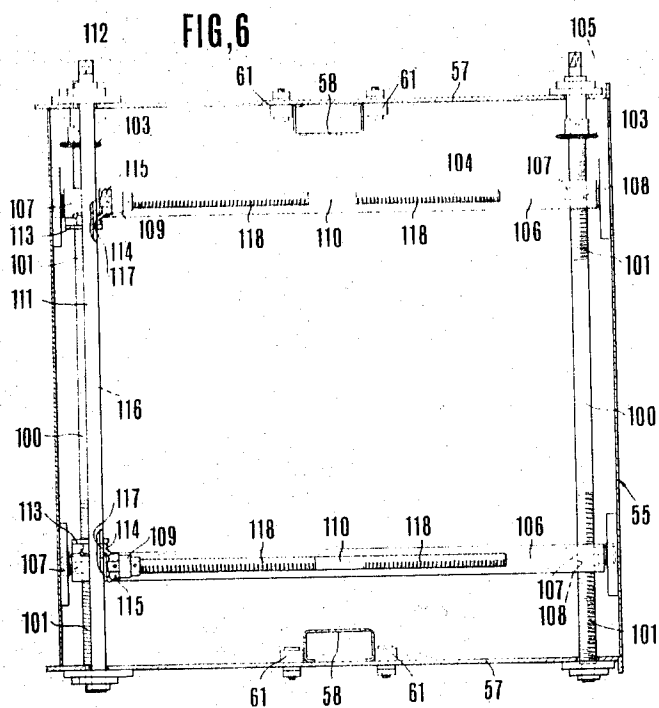
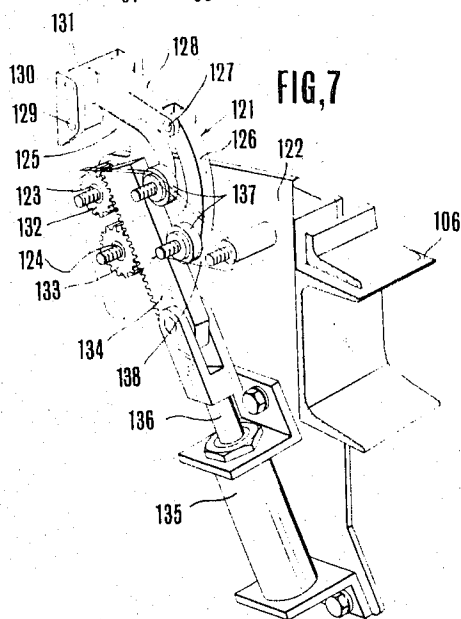


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FIG. 8

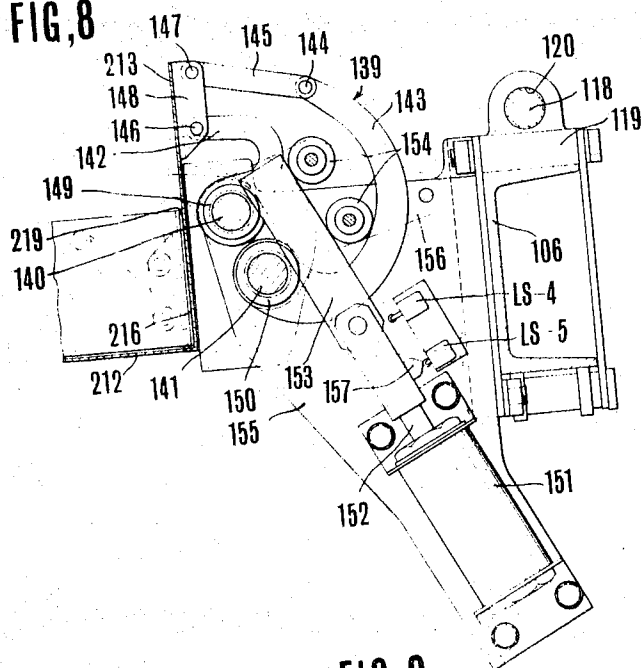
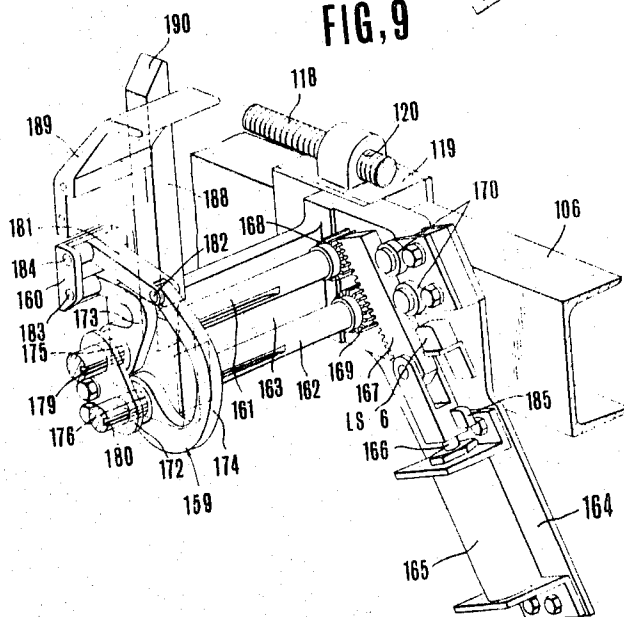


FIG. 9

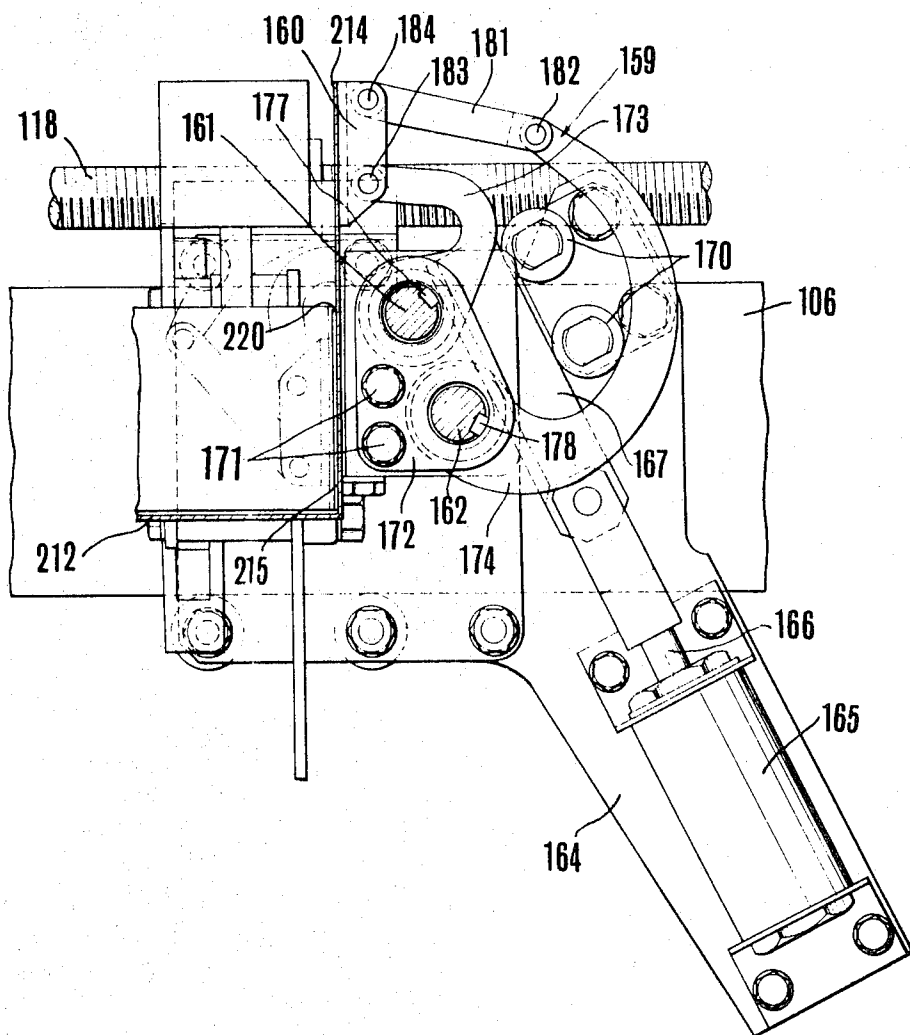


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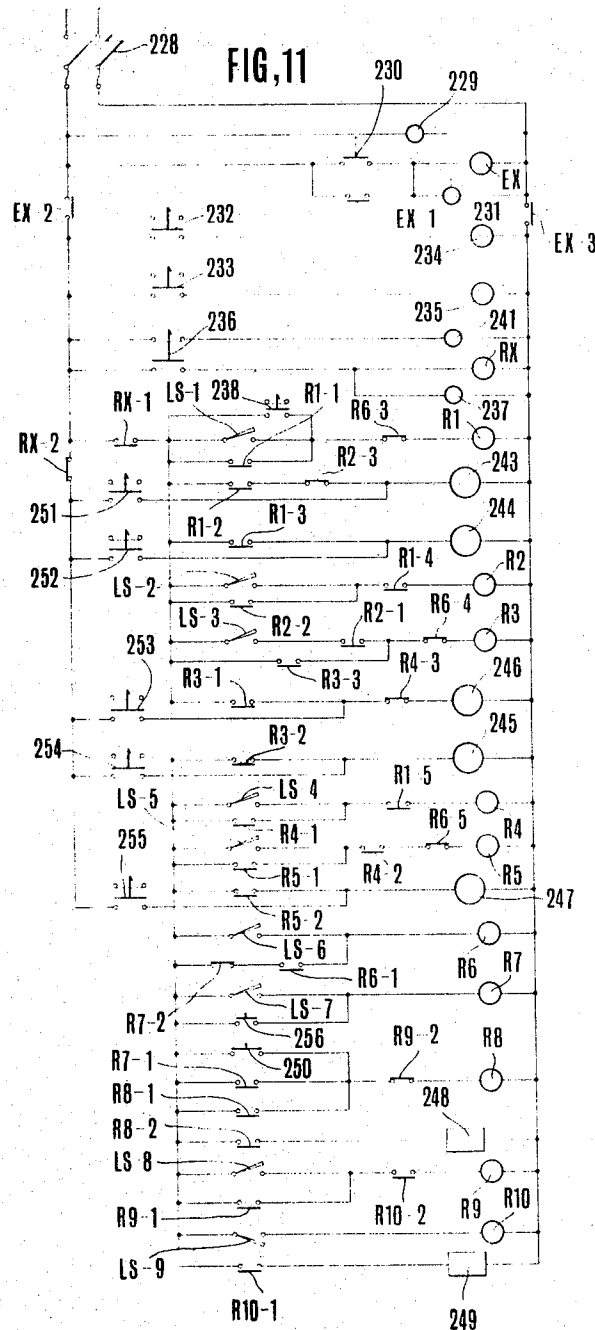
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FIG. 10



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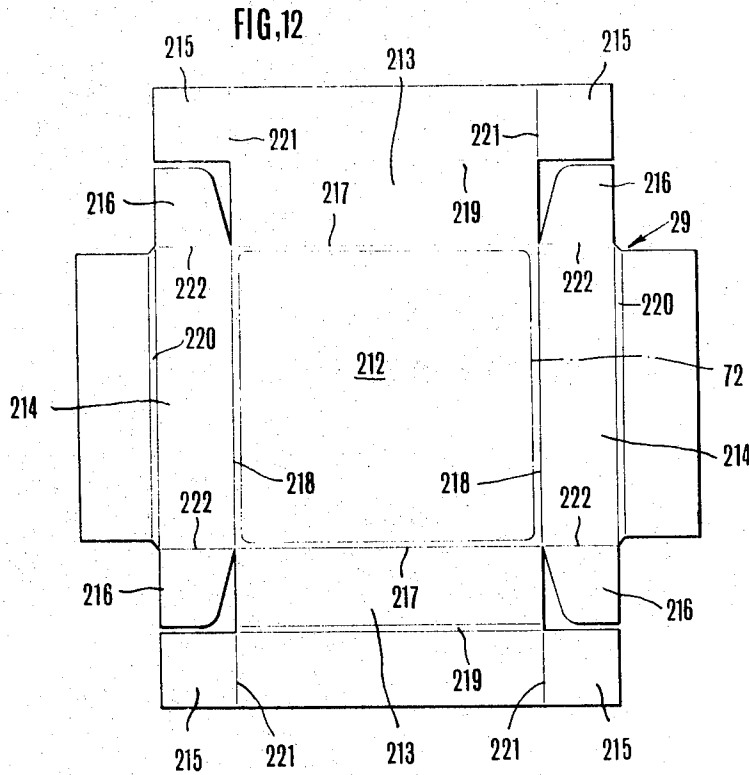
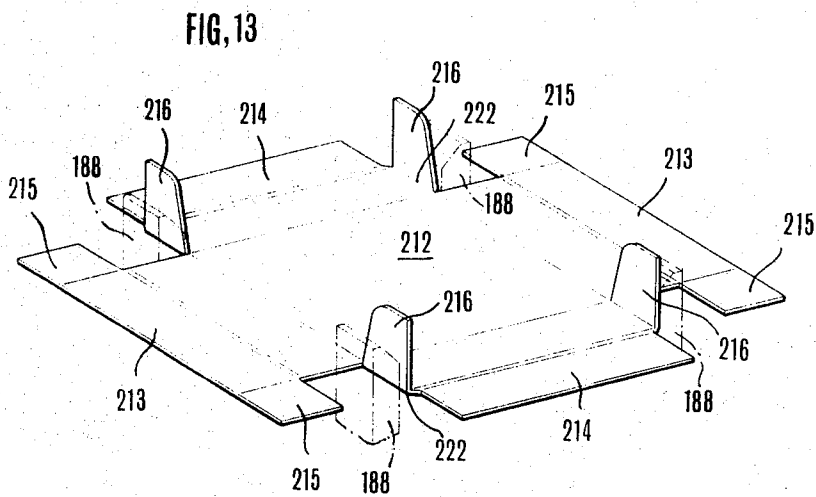
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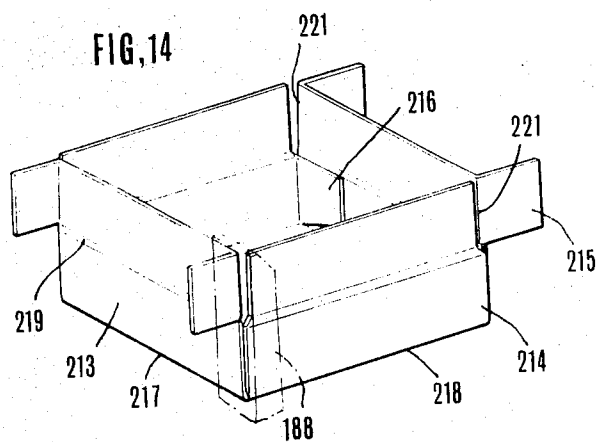
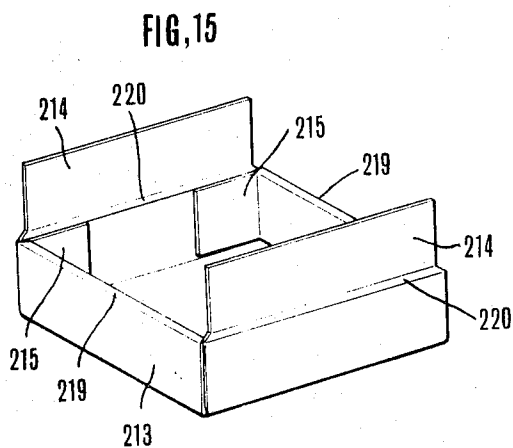
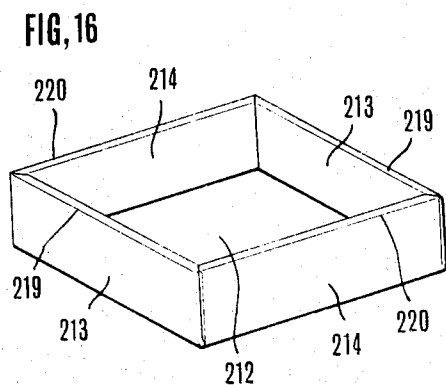
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# AUTOMATIC CARTON CASE MANUFACTURING DEVICE

This invention relates to an automatic carton case manufacturing device forming carton case by bending blank board of such as corrugated paper or cardboard and the like.

When manufacturing carton case with corrugated paper and the like, heretofore, blank board cut in a suitable shape and creased at desired position, is formed manually into case by bending.

And, a device for bending blank board automatically has been well known heretofore, but with such device, the bent portion must be fixed with binding metal or bonding agent.

The first object of this invention is to provide a device feasible to form wholly automatically blank board cut previously in a given shape and creased into carton case by only bending operation without any binding metal or bonding agent.

The second object of this invention is to provide a device for manufacturing wholly automatically rigid carton case having doubled wall without using any binding metal or bonding agent.

The third object of this invention is to provide a device having a supply means feeding automatically a plurality of blank boards laminated one by one and forming automatically the blank board supplied by said supply means into carton case.

The fourth object of this invention is to provide an automatic carton case manufacturing device having an adjusting means feasible to move easily a required portion to accommodate to a desired dimension when carton case differing in dimension is to be manufactured.

These and other object may be accomplished with improvement, combination and operation of each part construction the present invention, and embodiments thereof will be illustrated with the accompanying drawing and the detailed explanation described later.

Moreover, revision and modification with respect to the detail of the construction are included in the claim described later.

FIG. 1 is a side view of the carton case manufacturing device according to this invention, sectioned longitudinally.

FIG. 2 is an enlarged front view showing the main portion of the blank board supply device, sectioned longitudinally.

FIG. 3 is a longitudinal section on line 3—3 in FIG. 1.

FIG. 4 is an enlarged cross sectional plan on line 4—4 in FIG. 1.

FIG. 5 is an oblique view of the blank board guide portion.

FIG. 6 is a cross sectional plan on line 6—6 in FIG. 1.

FIG. 7 is an enlarged oblique view of the bent portion in the center of the side wall of a blank board.

FIG. 8 is an enlarged side view of the bent portion at the end of the side wall of a blank board.

FIG. 9 is an enlarged oblique view of the bent portion in the end wall of a blank board.

FIG. 10 is an enlarged side view of the same.

FIG. 11 is the wiring diagram of the control circuit.

FIG. 12 is a plan of a blank board.

FIGS. 13 through 16 are all views showing the sequence of bending a blank board.

In FIG. 1 and FIG. 2, 11 is the machine case of the blank board supply device, on which the blank board supporting frame 12 is mounted. This supporting frame comprises a pair of end plates 13, 13 located at front and rear thereof and a pair of side plates 14, 14 located at right and left thereof. The end plates 13, 13 are long vertically as shown in FIG. 2, and have outward arms 15, 15 respectively, and the arms 15, 15 are fixed respectively on the gate type supporting frames 16, 16 disposed at front and rear on the machine case 11. That is, the arms 15, 15 are secured on the supporting frames 16, 16 by fitting loosely the oblong holes formed longitudinally in the arms 15, 15 on the bolts 17, 17 set up-right in the center of the upper end of each supporting frame 16, 16 and clamping with the nuts 18, 18. Accordingly, when the arm 15 is moved longitudinally on loosening the nut 18, the distance between the front and rear end plates 13, 13 may be adjusted freely.

At the outside of the middle of both sides of each supporting frame are secured the bearings 19, 19 respectively, and in each bearing 19, 19 is journaled to be rotatable but not movable longitudinally the shaft 20, 20 disposed longitudinally outside of each supporting frame 16 respectively. On the right and left ends of each shaft 20, 20 are formed reverse male screw threads respectively as shown in FIG. 2, and on each male screw threads 21, 21 is screwed in the female screw threads 23, 23 provided in the frame 30 fixed on the outside of each side plate 14, 14, and the right and left side plates 14, 14 are constructed to be neared and parted by turn of the shafts 20, 20.

And, on each one end of the front and rear shafts 20, 20 is secured the sprockets 25, 25 of the same diameter respectively, both sprockets 25, 25 are connected with the endless chain 26, and on the other end of the shaft 20 of the front side is secured the handle 27, the front and rear shafts 20 are turned simultaneously with the handle 27, and thereby the right and left side plates 14, 14 are neared and parted as parallel each other.

On the insides of the side plates 14, 14 are provided the plural receiving edges 28. The receiving edges 28 at the lowermost positions are located at a level but the upper ones 28 are shifted zigzagly alternately on the right and left sides, and the blank boards 29 are supported obliquely thereon at every plural number of sheets and at every time when the lowermost blank board 29 is picked off, another blank board 29 is to be dropped on the lower receiving edge 28.

31, 31 are the endless belts of the feed conveyor, 32, 32 are a pair of the right and left supporting plates provided longitudinally on the machine case 11, 33, 33 are the shaft mounted rotatably at the front and rear portion of the supporting plates 32, 32, around the grooved pulleys 34, 34 on both the ends of each shaft 33 are wound said endless belts 31, 31, and the shaft 33 at the front portion is driven by the motor 35 with the reduction gear disposed within the machine case 11 through the transmission belt 36. 37 is the air cylinder for supplying blank board secured vertically in the center within the machine case 11, the piston rod 38 thereof is projected from the upper end of the cylinder 37. On the upper end of this piston rod 38 is fixed the fixing plate 39, and on this fixing plate 39 are set up-right the plural pipes 40 (four in the drawing), on the upper end of each pipe 40 is secured a suction disc made with soft flexible material such as rubber and the like respectively.

To each pipe is connected a flexible hose 42 respectively. 43 is a suction pump disposed within the machine case 11, and is driven with the motor 44, and to the suction port of this pumps is connected each of said hoses 42 through a solenoid valve. At the side of the cylinder 37 is arranged the vertical supporting rod 45. This supporting rod 45 is fixed to the machine case 11, and the limit switches (LS-8) (LS-9) are fixed at the upper and lower sides thereof. The shaft 46 fixed vertically on the lower surface of said fixing plate 39 is fitted loosely in the through hole 54 of the plate 53 fixed on the machine case 11, on the lower end of this shaft 46 is fixed the operating piece 47 of the limit switches (LS-8) (LS-9).

The front end of each of said supporting plates 32 is projected further than the front portion of the machine case 11, at the front end thereof is mounted rotatably the guide roller 48 through the horizontal shaft 49. 50 is a supporting rod provided downward on the front supporting frame 16, and at the lower end thereof is connected the rear end of the arm 52 on which the roller 51 is journaled rotatably, the roller 51 is rested on said roller 48. And, the roller 48 and the shaft 33 are made to cooperate together by means of such as transmission chain and the like.

55 is the machine case of the bending device arranged at the front portion of said machine case 11, the front portion thereof is fairly higher than the machine case 11, the rear portion thereof is substantially the same level with the upper side of the endless belt 31 on the machine case 11. 56 is a frame, and is mounted to be movable up-and-down between the inner sides of both the side walls 57, 57 of the machine case 55. Namely, the frame 56 is constructed by a pair of the right and left vertical members 58, 58 connected with the horizontal members 59, 60 at the middle and lower portions thereof, the front and rear of the vertical members 58, 58 are supported by each of the front and rear pairs of the guide rollers journaled rotatably on the shafts at the upper and lower portions inside of said side walls 57, 57 and are made movable up-and-down vertically.

Between the upper ends of both the side walls 57, 57 is mounted rotatably the horizontal shaft 62, near both the ends of this shaft are secured the bevel gears 63, 63. At the inner sides of both the side walls 57, 57 near the portions under both the ends of the shaft 62 are mounted rotatably the vertical shaft 65, 65 with the bearings 64, 64 respectively, and the bevel gear 66, 66 secured to the upper end of each of the shafts 65, 65 are meshed with said bevel gears 63, 63. And, on the periphery of the shaft 65, 65 are formed the male screw threads 67, 67, the male screw threads 67, 67 are screwed in the female screw threads provided at the upper ends of the vertical members 58, 58 of said frame 56, and at one end of said shaft 62 is secured the handle 69.

Consequently, when the shaft 62 is turned with the handle 69 the bevel gears 63, 63, 66, 66 are rotated and the right and left shafts 65, 65 are rotated reversely and thereby the right and left vertical members are to be moved upward or downward simultaneously, and also thereby the frame 56 is to be moved up-and-down without being slant. Accordingly, the right and left male screw threads must be formed reversely.

70 is an upper vertical cylinder secured in the center of the horizontal member 59 at the upper portion of

said frame 56, the piston rod 71 thereof is projected from the lower end of the cylinder 70, and at the lower end of the piston rod 71 is secured the push plate 72. This push plate 72 is of a square and fixed interchangeably to the fixing plate at the lower end of the piston rod 71 with set bolts, on the push plate 72 are set upright a pair of the right and left vertical guide rods 73, 73, and these guide rods 73, 73 are fitted slidably in the guide holes 74, 74 provided in the horizontal member 59.

On the push plate 72 is fixed the vertical operating piece 75, and the limit switch (LS-3) operated by this operating piece 75 is fixed to the horizontal member 59. And, near the upper end of one guide rod 73 is also fixed the operating piece 76, the limit switch (LS-2) operated by this operating piece 76 is fixed on the horizontal member 59.

77 is the lower vertical cylinder secured in the center of the horizontal member 60 at the lower portion of said frame 56, from the upper end of this cylinder is projected the piston rod 78, to the upper end thereof is secured the central portion of the longitudinal slender receiving plate 79. To the lower portion of the receiving plate 79 are fixed a pair of the front and rear supporting rods 80, 80 as shown in FIG. 3 and FIG. 4. At the lower end of each supporting rod 80, 80 is fixed the transverse supporting plate 81, 81 respectively as shown in FIG. 3 and FIG. 4, on both the ends of each supporting plate 81, 81 are set up-right the right and left pairs of supporting rods respectively as shown in FIG. 1, FIG. 3. Moreover, on each supporting rod 82, 82 is fixed the longitudinal slender receiving plates 83, 83 respectively to be parallel to said receiving plate 79 and also in the same level with the receiving plate 79.

In FIG. 1 and FIG. 5, 84, 84 are the right and left pairs of longitudinal L-shaped guide rails arranged parallel extending from the rear upper portion of the machine case 55 over to the interior of the front portion of the machine case 55. These guide rails 84, 84 are to support both the side edges of the blank board 29 supplied from the space between the rollers 48, 51 as shown in FIG. 5. The guide rails 84, 84 are secured on the pair of the right and left horizontal members 85, 85 fixed within the machine case 55. That is, as shown in FIG. 5, in the transversely oblong holes 86 formed in the pieces projected outward from both the ends of each guide rails 84, 84 are fitted loosely each pair of the bolts 87, 87 set up-right on each horizontal member 85, 85, and the guide rails 84, 84 are to be clamped with the nuts 88, 88 screwed on those bolts 87, 87. Consequently, the distance between the right and left guide rails 84, 84 may be adjusted freely by loosening the nuts 88.

On the middle portion of the front horizontal member 85 are set up-right a pair of the right and left bolts 89, 89 as shown in FIG. 5, the fixing plate 90 is attached on the horizontal member 85 with the nuts 92, 92 screwed on the bolts 89, 89 by fitting loosely each bolt 89, 89 in the pairs of the transversely oblong holes 91, 91 formed at both the sides of the front portion of the fixing plate 90. Accordingly, this fixing plate 90 may be also moved longitudinally by loosening the nuts 92, 92.

On the fixing plate 90 are secured a pair of the right and left supporting pieces 93, 93, the operating piece 95 hung from the shaft 94 mounted rotatably these supporting pieces 93, 93 is moved pushedly by the front

edge of the blank board 29 advanced along the guide rails 84, in front of this operating piece 95 is fixed on the fixing plate 90 the limit switch (LS-1) operated by the operating piece 95.

And, on the guide rails 84, 84 are fixed the stoppers 96, 96 receiving the pieces at the ends of both the side walls of the blank board 29. Namely, the stoppers 96, 96 are fixed with the nuts 99 screwed on the bolts 97 by fitting loosely the bolts 97 provided projectedly to the stoppers 96, 96 in the longitudinal oblong holes 98 formed in each guide rail 84, 84.

Consequently, the positions of the stoppers 96, 96 may be adjusted when the nuts are loosened and the positions of these stoppers are those where the front portions of both the sides of the blank board are stopped with the stoppers 96, 96 when the central front portion of the blank board moves pushingly said operating piece 95 and operates the limit switch (LS-1).

100, 100 in FIG. 1 are horizontal rotatable shafts arranged longitudinally within the machine case 55. Each of these horizontal shafts 100, 100 is provided with the male screw threads 101, 101 of reverse direction near both the ends thereof respectively as shown in FIG. 6, and moreover, around the sprockets 103, 103 secured near the end of each horizontal shafts 100, 100 is wound an endless chain 104, the end of the rear horizontal shaft 100 may be attached with the handle 105 when required, and each horizontal shafts 100, 100 may be rotated in a direction simultaneously by turning the handle 105.

106, 106 in FIG. 6 are a pair of the right and left supporting members. The female screws provided in the end members 107, 107 secured to both the ends of these members 106, 106 are screwed on each male screw of the horizontal shafts 100, 100 respectively as that the members 106, 106 on both the sides may be neared or parted as parallel by turning each of the horizontal shafts 100, 100.

Above each supporting member 106, 106 are fixed the bearings 109, 109, in each bearing 109, 109 is mounted rotatably the front portion of each shaft 110, 110 arranged parallel above each member 106, 106.

The horizontal shaft 111 is disposed to be located above the front portion of each shaft 110, 110 and both the ends of this shaft are mounted rotatably on the side walls 57, 57 as shown in FIG. 6, and the handle 112 may be secured on one end of this horizontal shaft 111. The bevel gears mounted to be rotatable but not movable axially on the frame 113, 113 fixed to the front end of said supporting members 106, 106 are meshed with the bevel gears 115, 115 fixed on the front ends of said shafts 110, 110.

The bevel gears 114, 114 are fitted slidably on said horizontal shaft 111 and the key 117 provided in the bore of each bevel gear 114 is fitted slidably in the long key way formed on the horizontal shaft 111 so that the bevel gear 114 may be rotated with the shaft 111 independently of the position thereof.

On both the ends of each shaft 110, 110 are formed male screw threads 118, 118 of reverse direction as shown in FIG. 6, these male screws 118, 118 are screwed in the female screws 120, 120 provided on the fixing frames 119, 119 secured slidably on each supporting member 106, 106 by a pair respectively, so that the fixing frame 119, 119 on each supporting member 106, 106 may be neared or parted simultaneously when each shaft 110 is rotated simultaneously.

In the center of the inner side of each of said supporting members 106 is disposed the bending device 121 located at the middle portion of both the sides of the blank board 29. The device 121 as shown in FIG. 7, has a pair of the upper and lower driving shafts 123, 124 mounted rotatably on the fixing plate 122 provided projectedly inside the supporting member 106, the rocking arms 125, 126 secured on the shafts 123, 124 respectively, and the bending piece 131 pivoted to the connecting piece 128 pivoted to the outer end of the rocking arm 126 and to the outer end of the arm 125 with the shaft 129, 130 respectively.

And, on the shafts 123, 124 are secured the gears 132, 133 respectively, the rack gear 134 meshing with these gears 132, 133 is connected to the piston rod 136 projected above the cylinder 135 fixed to the lower portion of the fixing plate 122, the back of the rack gear 134 is supported with a pair of the upper and lower guide rollers 137, 137, and these rollers 137, 137 are secured with shaft to the supporting plate 138 fixed to the fixing plate 122 not to interrupt the movement of the arm 126.

And, also, on the fixing plate 155 secured to the inside of the fixing frame 119, 119 on each of said supporting members 106, 106 is provided the bending device 139 for both the ends of the blank board 29 respectively. This device is of the same construction with said bending device 121 as shown in FIG. 8, and has the rocking arms 142, 143 secured to the upper and lower driving shafts 140, 141 mounted rotatably on the fixing plate 155 and the bending piece 148 pivoted to the rocking arm 142 and also pivoted with the shafts 146, 147 to the end of the connecting piece 145 pivoted to the end of the rocking arm 143 with the shaft 144. On the shafts 140, 141 are mounted the gear 149, 150 respectively, and the rack gear 153 connected to the upper end of the piston rod 152 projected from the cylinder 151 fixed to the fixing plate 153 is meshed with the gears 149, 150, and also the back of the rack gear 153 is supported with the guide rollers 154. These rollers 154 are pivoted to the supporting plate 156 fixed to the fixing plate 155 just like the case of the guide rollers 137 in said bending device 121.

And, on the piston rod 152 of either of said bending devices 139 is fixed the limit switch operating piece 157, and the limit switches (LS-4), (LS-5) operated with this operating piece 157 are secured in a suitable position.

On each fixing frame 119 mounted on each of said supporting member are provided the bending devices of the front and rear portions of the blank board 29 respectively. These bending device 159 are similar to the other bending devices 121, 139, and have the bending piece 160. With this bending device 159, as shown in FIG. 4, a pair of the upper and lower driving shafts 161, 162 are mounted rotatably in the left side (assume the left of FIG. 4 as the front portion) fixing frame 119 of the front portion and the right side frame 119 of the rear portion respectively. Each of said shafts 161, 162 is fitted rotatably in the frame 163 fixed inside of each fixing frame 119. And, these shafts 161, 162 are mounted to be rotatable but not movable axially with respect to the left side fixing frame 119 of the front portion and the right side fixing frame 119 of the rear portion in FIG. 4, but not reach to the right side fixing frame 119 of the front portion and the left side fixing frame 119 of the rear portion, and are fitted to be mov-

able axially and rotatably with respect to the frame 163 fixed inside each fixing frame in the right side of the front portion and the left side of the rear portion.

And, to the fixing plate 164 provided to the frame 163 on the side fixed with the driving shafts 161, 162 is secured the cylinder 165 as shown in FIGS. 9 and 10, and the rack gear 167 connected to the upper end of the piston rod 166 projected from the upper end of this cylinder 165 is meshed with the gears 168, 169 secured on each shaft 161, 162, the back of this rack gear 167 is supported with the pair of the upper and lower guide rollers 170, 170 mounted with shaft on the fixing plate 164.

On the outside of each of said frames 163 is fixed the supporting plate 172 by the suitable supporting rods 171 and in this supporting plate 172 are fitted loosely the driving shafts 161, 162. Between this supporting plate 172 and the frame 163, each driving shaft 161, 162 is fitted loosely in the bores 175, 176 in the base portion of the rocking arms 173, 174. In each bore 175, 176 is secured each key 177, 178 respectively, and the long key ways 179, 180 in which these keys are fittable slidably are formed on each of the driving shafts 161, 162 so that the rotation of the shafts 161, 162 may be transmitted to the arms 173, 174 even if the rocking arms are moved with respect to the shafts 161, 162. To the outer end of the arm 174 is pivoted the connecting piece 181 with the shaft 182, and the back of said bending piece 160 is pivoted to the outer end of the arm 173 and the outer end of the connecting piece 181 with the shafts 183, 184. And also, on either of the piston rods 166 is provided the operating piece 185, the limit switch (LS-6) operated with this operating piece 185 is secured to the fixing plate 164.

At the ends of the supporting arms 186, 186 fixed to the center of the inside of each of said supporting members 106, 106 are fixed the guide members 187, 187. These guide members 187, 187 comprise the upward upper edge projected to the inside of the right and left guide rails 84, 84 the slant surface inside thereof and the vertical part of the lower portion as shown in FIG. 3, and when the blank board 29 rested on the rails 84, 84 is pushed downward, they serve to bend both the side walls of the blank board 29 upward. And, on each of said frames 163 is set up-right the vertical guide rod 188 of square rod shape, inside thereof, that is, on the sides of the right and left guide rods 188, 188 facing each other are fixed the guide members 189 respectively. At the upper end of the guide rods 188 are formed the slant surfaces 190 for bending the pieces at the ends of the end walls provided in the front and rear of the blank board 29 as shown in FIG. 1, each of the guide members 189 are bent outward at the upper ends thereof to bend the front and rear end walls of the blank board upward as shown in FIG. 1.

In FIG. 1, FIG. 3 and FIG. 4, 191 is the plural endless belts (four in the drawing) arranged from the rear to the front in the lower portion of the machine case 55. 192 is a horizontal shaft fixed thereon with the plural grooved pulleys 193 for receiving the returning rear portion of the belts 191 and mounted rotatably between the walls of both the sides of the machine case 55. 194 is a horizontal shaft mounted rotatably in the machine frame 200 formed at the front portion within the machine case 55, on the shafts are mounted the plural grooved pulleys 195 for receiving the returning front portion of each of said belts. And, at the front and

rear of the lower portion of both the side walls 57 of the machine case 55 are mounted rotatably the horizontal shafts 196, 196 respectively, on each of these horizontal shafts 196, 196 are mounted the grooved pulleys 197, 197 for receiving the returning portion of said belts 191 respectively.

And, in the rear of said horizontal shaft 194, similarly, the rotatable horizontal shaft 198 is mounted on the machine frame 200, and on this horizontal shaft 198 are fixed the plural grooved pulleys 199 supporting the insides of the carrier sides of said belts 191.

Then, the carrier sides of said belts 191 supported with the grooved pulleys 193, 195, 199 are made to be horizontal, and are to carry out carton case after bent on the carrier side of each of these belts 191 in horizontally. And, each of said receiving plates 79, 83, 83 is moved up-and-down between the carrier sides of each of the belts.

At both the sides of the upper portion of said machine frame 200 are provided a pair of the right and left guide frames 201, the shaft 204 of the roller 203 is supported rotatably with the bearings 202 mounted movably up-and-down on both the guide frames 201, the bearings 202 may be located at a desired level by the threaded rod 205 mounted on the bearings 202.

206 is an operating plate secured rotatably at the end of the horizontal shaft 194 projected outward from one side of the machine frame 200, to this plate 206 are mounted rotatably with shaft the gear 208 meshing with the gear 207 secured to the end of the shaft 194 and the gear meshing with this gear 208, on the end of said horizontal shaft 204 is secured the gear 210 meshing disengageably with the gear 209. The operating plate 206 is to disengage the gears 209, 210 by turning the plate 206 downward with the lever 211 when the position of the roller 203 is to be adjusted, after adjustment of the position of the roller 203, the gears 209, 210 are meshed each other by lifting the lever 211 and the operating plate 206 is to be fixed with such as suitable clamping screw and the like.

223 in FIG. 1 is a motor, 224 is the reduction gear driven by the motor, the grooved pulley 195 is driven by winding the endless chain 227 around the sprocket secured to the output shaft of this reduction gear 224 and the sprocket at the end of said horizontal shaft 194. And, between the grooved pulleys 195, 199 is provided the limit switch (LS-7) for detecting the carton conveyed by the belt 191. Moreover, on the side of each of said grooved pulleys 195, 199 is attached a roller of the same diameter.

FIG. 11 is the wiring diagram, but the details thereof will be explained simultaneously with the explanation of the operation thereof.

Aforesaid blank board 29 is such as shown in FIG. 12, at both the sides of the bottom 212 thereof are provided a pair of the right and left side walls through the creases 217, similarly, at the front and rear sides of the bottom 212 are provided a pair of the front and rear end walls 214 through the creases 218. And, in the middle of the side walls 213 and the end walls 214 are formed the wide creases 219 and 220 respectively, at both the ends of the portions outside the creases 219 of the side walls 213 are provided the pieces 215 through the creases 221, at both the ends of the portions inside the creases 220 of the end walls 214 are provided the pieces 216 through the creases 222.

Hereinafter, the operation will be explained.

In the wiring diagram of FIG. 11, when the switch of the current source is thrown in, the pilot lamp will be lighted. Then, when the switch 230 of manual push button type for preparation of starting is pushed, the relay (EX) is operated, the A contacts (EX-1) (EX-2) (EX-3) are closed, and while the relay (EX) is self-held, the pilot lamp 231 is lighted. Next, when the switch 232 for the compressor and the switch 233 for the conveyor are thrown in, the magnetic switch 234 for the driving motor of the compressor for operating each cylinder and the magnetic switch 235 of the motor for driving the belts 191 are closed, thereby the compressor and the belts are started.

And, when the switch for the feed conveyor and the switch for the suction pump (both not shown) are thrown in, the magnetic switches (not shown) are closed, and the motors 35, 44 are started, thereby the belt 31 and the pump 43 start to turn.

And then, when the manual-automatic change-over switch 236 is thrown in automatic side, while the pilot lamp 237 indicating automatic running is lighted, the relay (RX) is operated, the A contact (RX-1) thereof is closed and the B contact (RX-2) is opened and the electric circuit is set in the state of automatic operation.

Now, when the push button of the starting switch of the circuit in FIG. 11 is pushed on keeping the manual operation switch 238 in cut state, the relay (R8) is operated, the A contacts (R8-1) (R8-2) thereof are closed, the relay (R8) is self-held, the solenoid valve 248 of the blank board feeding cylinder 37 is operated, and then the piston rod 38 is risen. When the piston rod 38 starts to ascend, the push force applied on the limit switch (LS-9) by the operating piece 47 is released and the switch (LS-9) is closed, the relay (R10) is operated, the A contacts (R10-1) (R10-2) thereof are closed, the solenoid valve 249 of the flexible hoses 42 are opened, the sucking operation of the suction disc 41 is started, and when the suction disc 41 risen is pressed against the lowermost blank board 29, the suction disc 41 is adhered to the lower surface of the blank board.

When the piston rod 38 is risen and the suction disc 41 is adhered to the lower surface of the blank board 29, the operating piece pushes the limit switch (LS-8), and when the limit switch (LS-8) is closed, thereupon, as the A contact (R102) is closed, the relay (R9) is operated, and as thereby the A contact (R9-1) is closed and the B contact (R9-2) is opened, the relay (R9) is self-held, and also as the relay (R8) is restored, the A contacts (R8-1) (R8-2) are opened, and the solenoid valve 248 is also restored and then the piston rod 38 is lowered. Meanwhile, as the relay (R10) is operating, the solenoid valve 249 remains in opened state, the sucking action of the suction disc 41 is continued, accordingly, along with descent of the piston rod 38, the blank board is lowered and adhered by the suction disc 41 and when the blank board 29 is rested on the belt 31, as the operating piece 47 pushes the limit switch (LS-9) to open, the relay (R10) is restored, and the A contacts (R10-1) (R10-2) are opened, the solenoid valve 249 is closed, and thereby, while the adhesion of the blank board by the suction disc 41 is released, the relay (R9) is also restored and returned back to the state before starting.

The blank board rested on the belt 31 and separated from the suction disc 41 is conveyed with the belt 31 and supplied on the rails 84, 84 from the space between

the rollers 48, 51. Simultaneously with that the pieces 215, 215 on both the sides of the front portion of the blank board 29 moved along the rails 84, 84 strikes against the stopper 96 as shown in FIG. 5, the end wall 214 of the front portion pushes the operating piece 95, and thereby the limit switch (LS-1) is closed. Therefore, as the relay (R1) is operated, the A contacts (R1-1) (R1-2) (R1-3) (R1-4) are closed, the solenoid valves 243, 244 for operating the upper cylinder 70 and the lower cylinder 77 are operated, the piston rod 71 is lowered and the piston rod 78 is risen. Therefore, the push plate 72 at the lower end of the piston rod 78 pushes down the bottom 212 of the blank board 29, and the receiving plate 79, 83 on the piston rod 78 are risen and support the descending bottom 212.

When the bottom 212 of the blank board is pushed down by the push plate 72, initially each piece 216 strikes against the upper end of the guide rod 188 and the blank board are bent rectangularly upward from the creases 222 as shown in FIG. 13. And, when the guide members 189 begin to bend the end walls 214 upward from the creases 218, a little later than this, as the guide members 187 start to bend the side walls 213 upward, when the side walls 213, 213 and the end walls 214, 214 are bent rectangularly completely, the pieces 216 are overlapped on the inner sides of the end portions of the side walls 213 as shown in FIG. 14. And, when the side walls 213, 213 are bent upward, the pieces 215 at both the ends thereof strike against the guide rods 188 and are bent rectangularly outward by the creases 221 as shown in FIG. 14.

When the push plate 72 reaches to the lowermost end, as the operating piece 76 provided on the guide rod 73 pushes the limit switch (LS-2), the relay (R2) is operated, the A contacts (R2-1) (R2-2) are closed and the B contact (R2-3) is opened, and thereby the current to the solenoid valve 243 is cut off, the solenoid valve 243 is restored, the piston rod 71 is risen thereby. When the piston rod 71 is risen slightly, the operating piece 75 pushes the limit switch (LS-3) to close it, then the relay (R3) is operated the A contacts (R3-1) (R3-2) (R3-3) are closed, while the relay (R3) is self-held, the solenoid valve 245, 246 for operating the cylinders 135, 151 for bending are operated, and as thereby each piston rod 136, 152 is risen and each gear 132, 133, 149, 150 is restored by each rack gear 134, 153 respectively, the bending pieces 131, 148 restored above in a vertical state as shown in FIG. 7 and FIG. 8, are turned round downward by 180°, thereupon, the upper halves of the side walls 213 are bent by 180° downward from the crease 219 as shown with a dot-and-dash line in FIG. 8. As the lower halves of both the ends of the inner sides of the side walls are supported with the pieces 216, the side walls 213 may be bent surely from the creases 219 and formed as shown in FIG. 15.

Moreover, during descending the push plate 72, the limit switch (LS-3) is pressed with the operating piece 75, but as the A contact (R2-2) is opened until the limit switch (LS-2) is pressed by the operating piece 76 and the relay (R2) is operated, the relay (R3) is not operated.

During bending operation as above described, when the prescribed rack gear 153 reaches to the upper dead point, the operating piece 157 closes the limit switch (LS-4). Therefore, the relay (R4) is operated, the A contacts (R4-1) (R4-2) are closed and while the relay

(R4) is self-held, the B contact (R4-3) is opened, the solenoid valve 246 is restored, the piston rod 152 of the cylinder 151 is lowered along with the rack gear 153, and each bending piece 148 pressing the inner sides of both the ends of the side walls 213 doubled back is restored. When the operating piece 157 pushes the limit switch (LS-5) by descent of the rack gear, the relay (R5) is operated, the A contacts (R5-1) (R5-2) are closed and while the relay (R5) is self-held, the solenoid valve 247 for operating the cylinder is operated, the piston rod 166 is risen along with the rack gear 167, the gears 168, 169 are rotated and thereby the driving shafts 161, 162 are rotated, and thus the rocking arms 173, 174 mounted on each driving shaft and the connecting piece 181 are rotated, each bending piece 160 is turned round by 180° as shown with a dot-and-dash line in FIG. 10, then thereby the upper halves of the end walls 214, 214 are bent inward from the creases 220, 220. Thereupon, as the lower halves of both the ends inside the end walls 214 are supported with the piece 215, the end walls 214 are to be bent surely from the creases 220 and the carton as shown in FIG. 16 is completed. And, 238, 256 are manual switches.

When the rack gear reaches to the upper dead point by the operation above described, the operating piece 185 pushes the limit switch (LS-6). Therefore, the relay (R6) is operated, the A contact (R6-1) is closed, and the B contacts (R6-3) (R6-4) (R6-5) are opened, the relay (R6) is self-held. Therefore, the relay (R-1), (R-2), (R-3), (R-4), (R-5) are restored, as the A contacts (R1-1) (R1-2) (R1-3), (R1-4) (R1-5) (R2-1) (R2-2) (R3-1) (R3-2) (R3-3) (R4-1) (R4-2) (R5-1) (R5-2) are opened and the B contacts (R2-3) (R4-3) are closed, the solenoid valves 245, 247 for said cylinders 135, 165 for bending are restored, the bending pieces 131, 160 are restored, and as the solenoid valve 244 for the lower cylinder 77 is also restored, the receiving plates 79, 83 supporting the bottom 212 of the blank board heretofore is lowered, moreover, the carton after completion is also lowered, while the receiving plates 79, 83 are lowered below the carrier side of the belt 191, the carton is rested on the belt 191 and moved, and when passing between the grooved pulley 195 and the roller 203, the upper and lower sides of the carton are pressed properly with the roller provided at the side portion of the grooved pulley 195 and the roller 203, (the gap between the roller of the same shape at the side of the grooved pulley 195 and the roller 203 thereabove are adjusted previously to compress slightly the distance between the upper and lower sides of the carton), thereby, the creases 219 and 220 of the side walls 213 and the end walls 214 of the carton are to be reformed correctly and the height of the carton is also reformed correctly.

And, when the carton enters between the grooved pulley 195 and the roller 203, the limit switch (LS-7) is pushed, the relay (R7) is operated, the A contact (R7-1) is closed and the B contact (R7-2) is opened, the relay (R6) is restored, the first process of carton manufacturing operation is completed.

As abovementioned, when the A contact (R7-1) is closed, the relay (R8) is operated without pushing the starting push button switch 250, carton manufacturing operation just like the first process may be started.

When fully automatic, the operation above described is repeated, the blank board 29 is bent automatically and completed as carton case.

And, where the manual-automatic change-over switch is switched to the manual side, the pilot lamp 241 indicating manual operation is lighted, as the relay is not operated, the A contact (RX-1) remains as opened, the B contact (RX-2) remains as closed, each portion may be operated freely by on-off operation of the manual switches 251, 252, 253, 254, 255, 256.

When feeding the blank board manually without using the blank board automatic feeding device, the blank board feeding device belonging to the machine case 11 in FIG. 1 is omitted and when the blank board is supplied manually on the rails 84, 84, the bending operation thereafter may be carried out automatically. In this case also, by switching the manual-automatic change-over switch 236 to the manual side, operation of each portion may be accomplished freely with the manual switches.

When carton case of different size, however, is to be manufactured, each portion may be accommodated to blank board of different dimensions by replacing the push plate 72, moving the frame 56 up-and-down by turning the handle 69, changing the distance between the guide rails 84, 84 and the position of the stopper 96 and the fixing plate 90 and also the distance between the supporting members 106, 106 and the fixing frames 119, 119 by turning the handles 105, 112, moving the lever 211 and the rollers 203 by moving the bearings 202.

The present invention is to obtain desirable carton case by feeding manually or automatically the blank board cut previously into a proper shape and provided with creases in important positions to be bent easily and then bending required portions automatically.

I claim:

1. An automatic carton fabricating apparatus for fabricating a carton from a blank having a bottom panel, opposed pairs of side wall panels joined to said bottom panel along fold lines and each of which has a panel extension thereon joined to the side wall panel along a fold line and the panel extensions each have an end flap on the ends thereof joined to the panel extension on a fold line, and opposed pairs of end wall panels joined to the bottom panel along fold lines and each of which has a panel extension thereon joined to the end wall panel along a fold line and an end flap on each end thereof joined to the end wall panel along a fold line, said apparatus comprising blank feeding means for feeding blanks one at a time, a receiving plate means positioned adjacent said blank feeding means for receiving blanks and supporting said blanks by the bottom panel, said receiving plate means being movable up and down relative to the level at which said feeding means feeds blanks, a pressing plate having the same shape as the bottom panel of the carton and positioned above said receiving plate means and movable toward and away from said receiving plate means to engage the upper surface of the blank in the area of the bottom panel after the blank has been received and stopped in a position on the receiving plate means, and moving said receiving plate means downwardly, end flap folding guide members adjacent the path of said receiving plate means and each having a folding edge and surface for engaging the end flaps on said end wall panels and folding them upwardly to an upright position as said receiving plate means moves down, end wall panel folding guide members adjacent the path of said receiving plate means and each having a folding edge and surface

below the level of the folding edge on said end flap folding guide members and engaging both end wall panels and the panel extensions and folding them upwardly, whereby the end flaps on the end wall panels previously bent upwardly extend horizontally at right angles to said side wall panels, side wall panel folding guide members adjacent the path of said receiving plate means and each having a folding edge and surface below the wall panel folding guide members for engaging the side wall panels and bending them upwardly as said receiving plate means moves down, said end flap folding guide members having a further folding edge and surface adjacent the path of the end flaps on the ends of the side wall panel extensions for folding said end flaps perpendicular to the side wall panel extensions as said extensions move past said end flap folding guide members to an upright position, two sets of panel extension folding means positioned below said folding guide members, one set for the end wall panel extensions and one set for the side wall panel extensions, and each set having an opposed pair of wall panel abutment for engaging the outside of the wall panels on which the panel extensions are attached and an opposed pair of panel extension folding devices for engaging the outside surface of the panel extensions and folding them 180° around the fold lines along which they are attached to the wall panels and against the inside surfaces of the wall panels, and a delivery device beneath said panel extension folding means for receiving a carton and conveying it out of said apparatus.

2. An apparatus as claimed in claim 1 in which said blank feeding means comprises a conveyor, means for intermittently driving said conveyor, a supply container above said conveyor for holding a supply of blanks in a horizontal position and from which the lowermost blank in the supply can be removed downwardly toward the conveyor, and suction means movable upwardly and downwardly between the supply container and said conveyor for engaging the lowermost blank in the supply by means of suction and lowering it to the conveyor.

3. An apparatus as claimed in claim 1 in which said

delivery device comprises a plurality of parallel delivery conveyor belts spaced from each other, and said receiving plate means comprises a plurality of projections movable upwardly through the spaces between said delivery conveyor belts, whereby when the projections move down past the delivery conveyor belts a carton thereon is engaged by the delivery conveyor belts and conveyed out of the apparatus.

4. An apparatus as claimed in claim 3 in which said delivery device further comprises a pressing roller spaced above the end of the delivery conveyor belts a distance equal to the desired height of the cartons for pressing the cartons to a uniform height.

5. An apparatus as claimed in claim 1 in which adjusting means is included in said apparatus on which said folding guide members are mounted and on which said sets of panel extension folding means are mounted for adjustment toward and away from said receiving plate means and said pressing plate to make it possible to accommodate blanks for different sizes of cartons.

6. An apparatus as claimed in claim 1 in which said panel extension folding devices each comprise a flat folding plate, a linkage connected to said plate movable from a first position in which the plate is against the wall panel extension and a second position which is at the end of a semicircular path from said first position in which said plate presses the wall panel extension is against the inside of the wall panel, and driving means connected to said linkage for reciprocally driving said linkage between said first position and said second position.

7. An apparatus as claimed in claim 6 in which said linkage comprises a base member, two curved links pivoted to said base member, one of said links being pivoted to said flat folding plate, and a further link pivotally connected between the other link and said flat folding plate, and said driving means comprises a pair of shafts on which said curved links are mounted, a gear on each shaft, a rack meshed with said gears, and a hydraulic piston-cylinder mechanism connected to said rack.

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