Oct. 1, 1963 R. C. TALBOT ETAL 3,105,418

CARTON GLUING AND FORMING MACHINE

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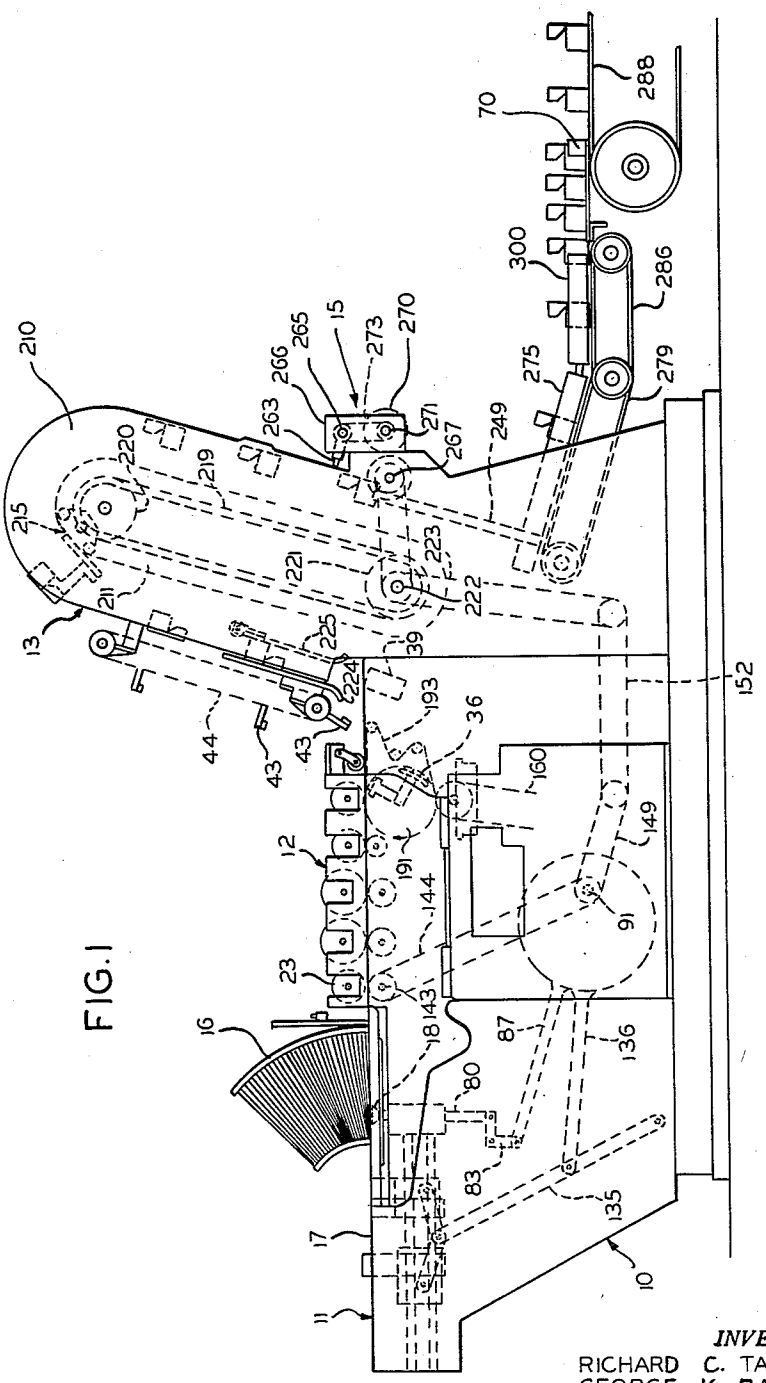


FIG. 1

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CARTON GLUING AND FORMING MACHINE

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FIG.3

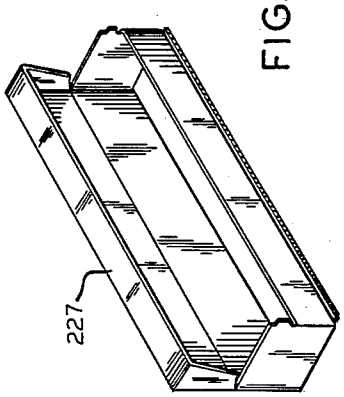


FIG.4

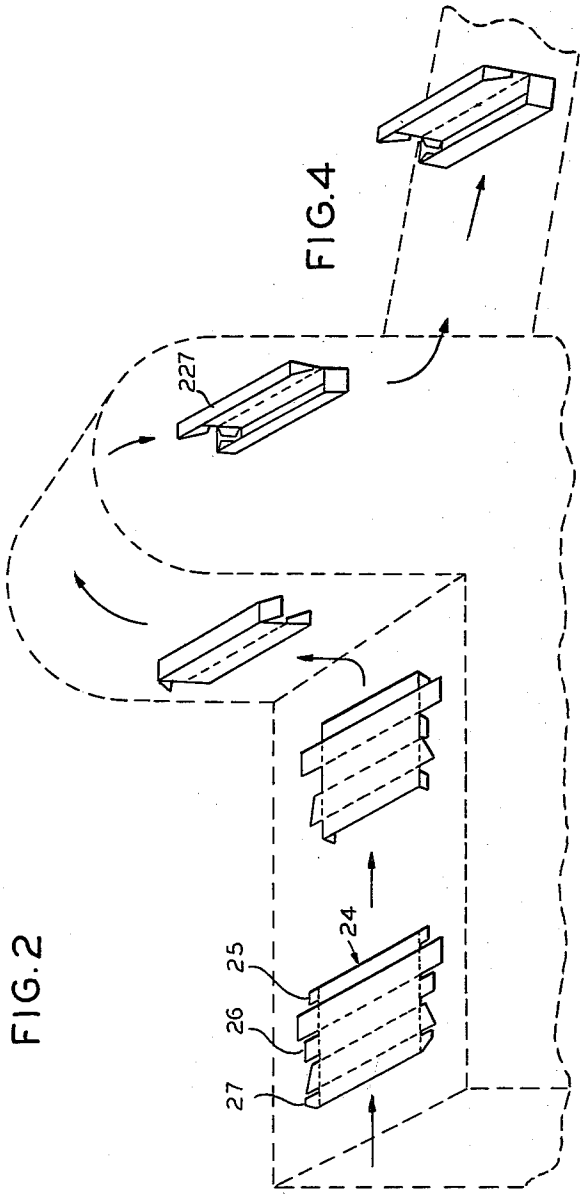
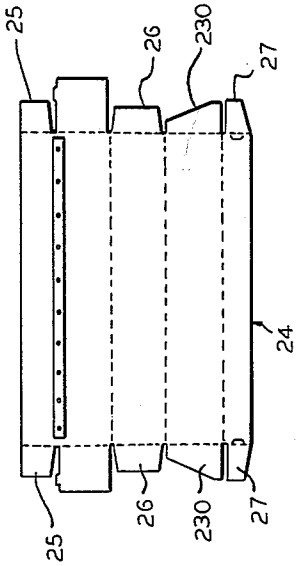


FIG.2



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CARTON GLUING AND FORMING MACHINE

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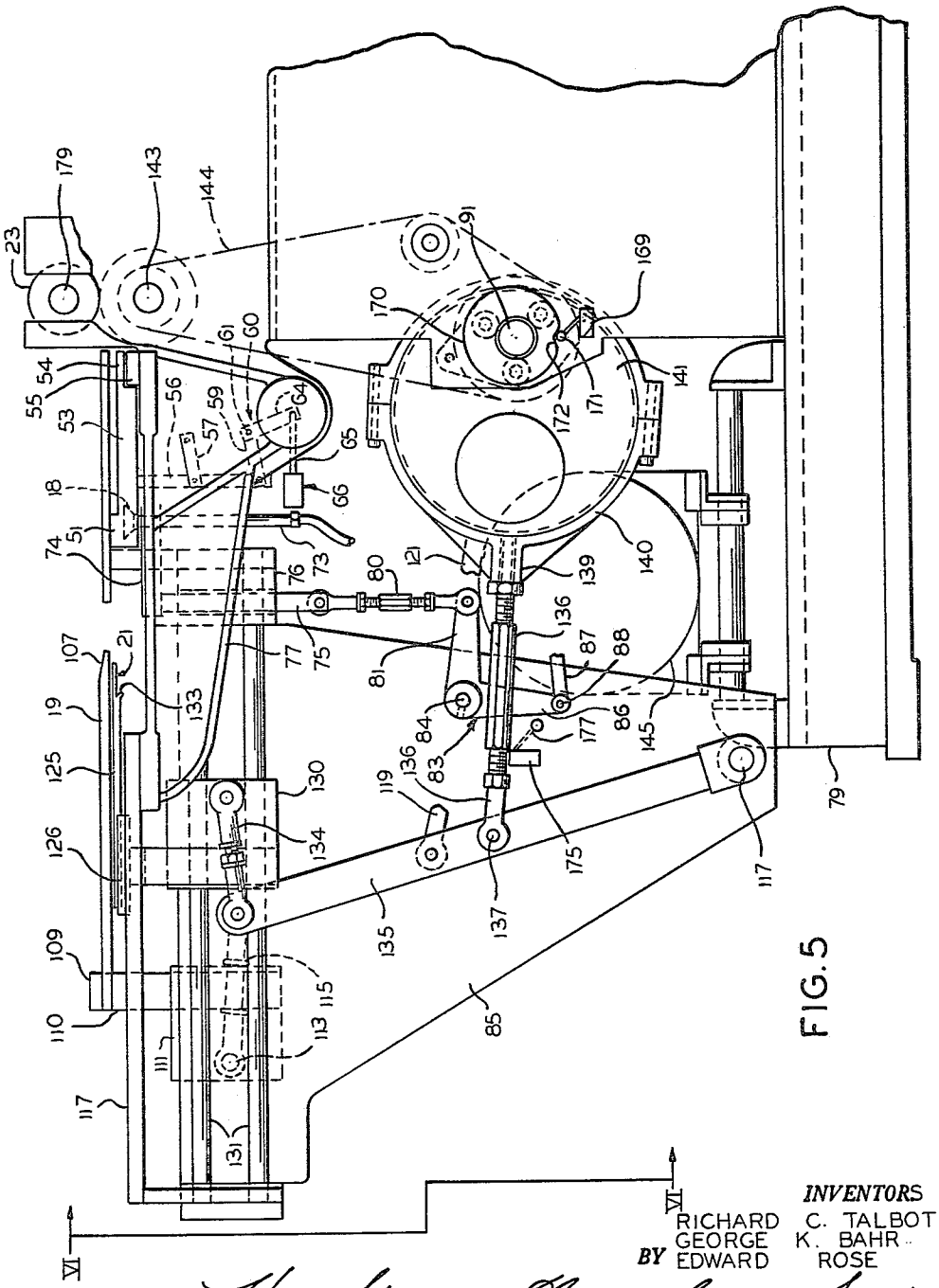


FIG. 5

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CARTON GLUING AND FORMING MACHINE

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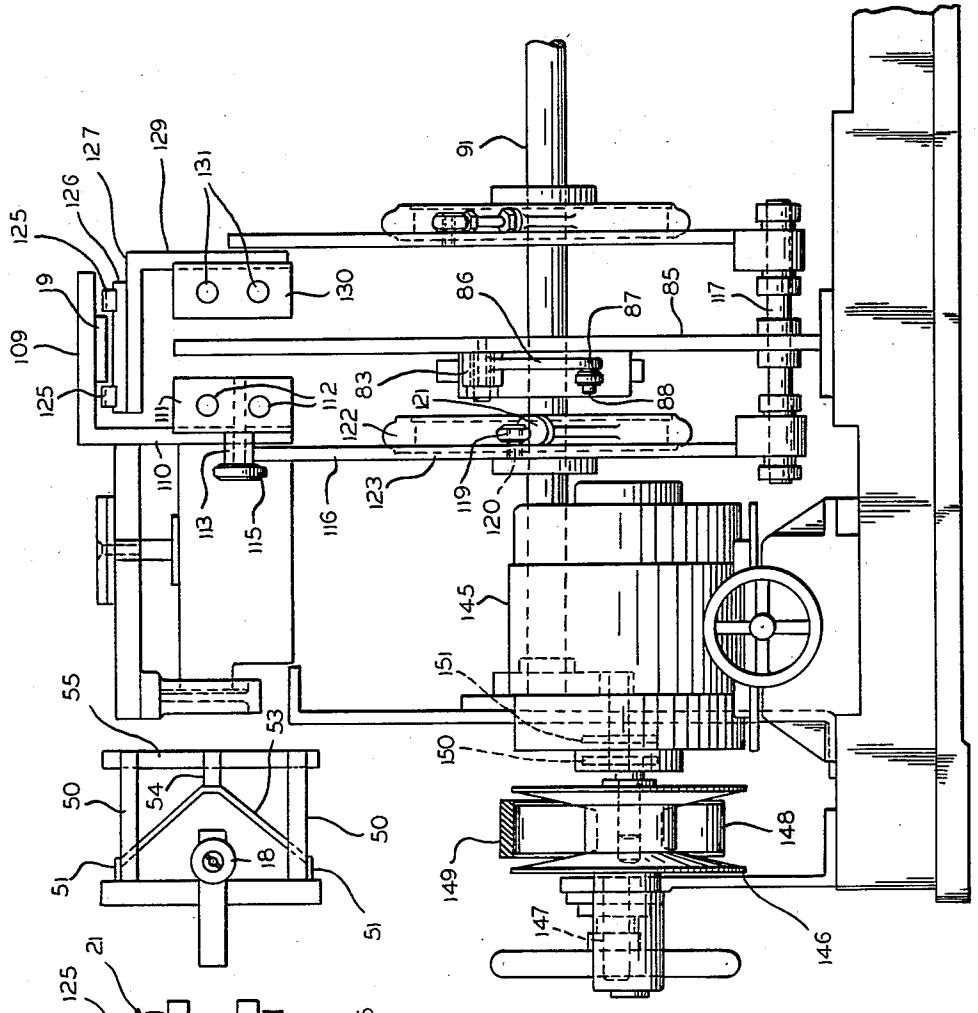


FIG. 6

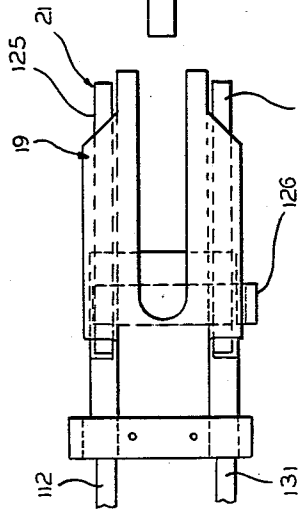


FIG. 7

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CARTON GLUING AND FORMING MACHINE

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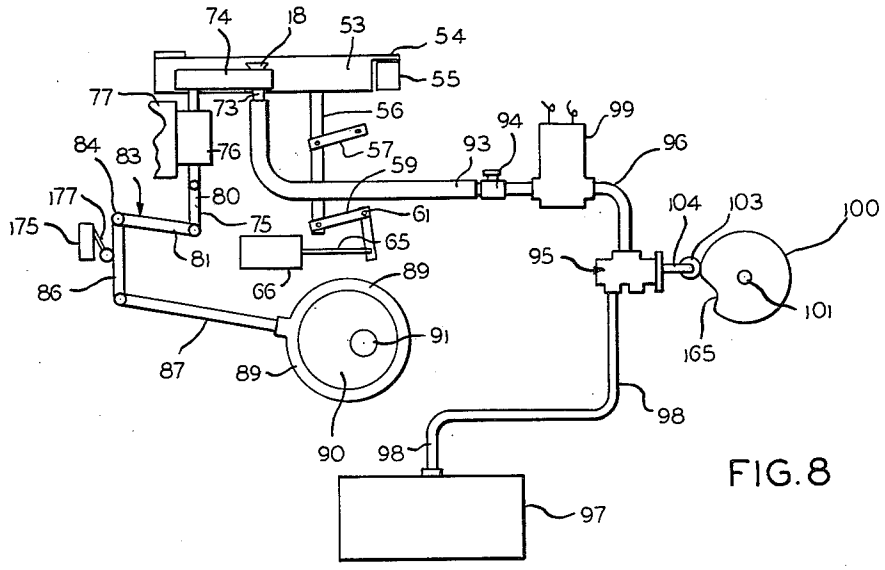


FIG.8

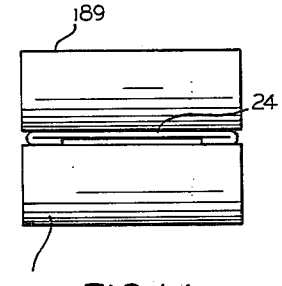


FIG.14

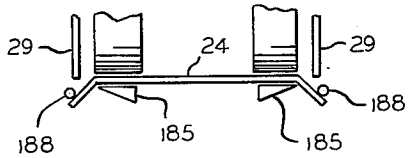


FIG.12

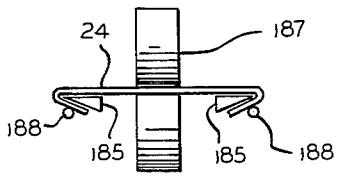


FIG.13

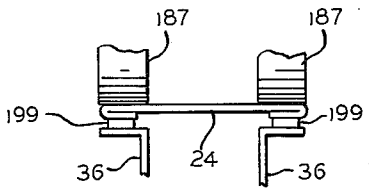


FIG.15

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CARTON GLUING AND FORMING MACHINE

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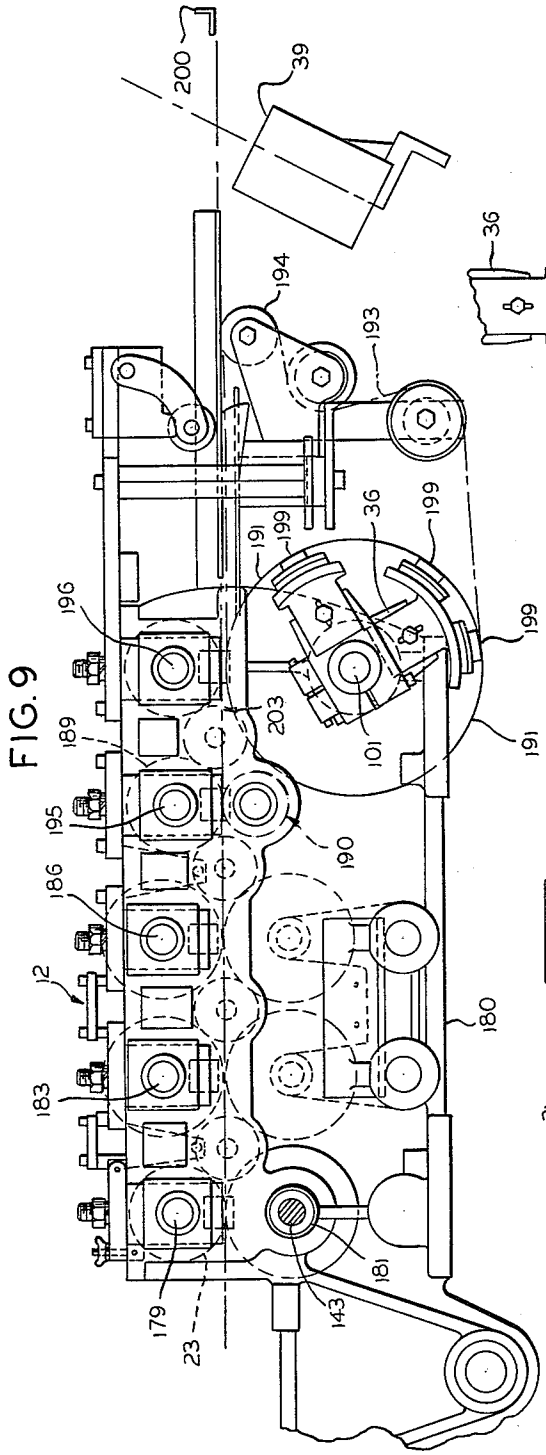


FIG. 9

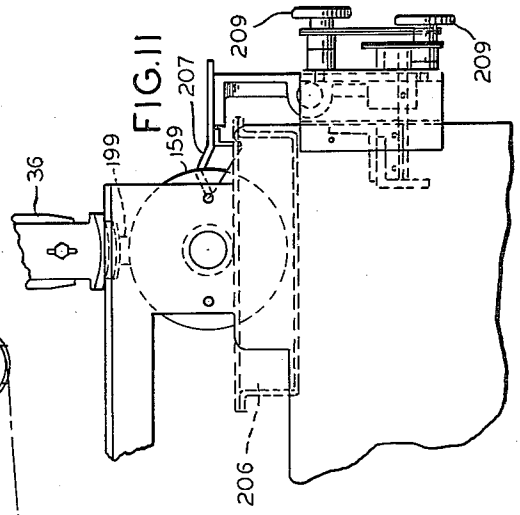


FIG. 11

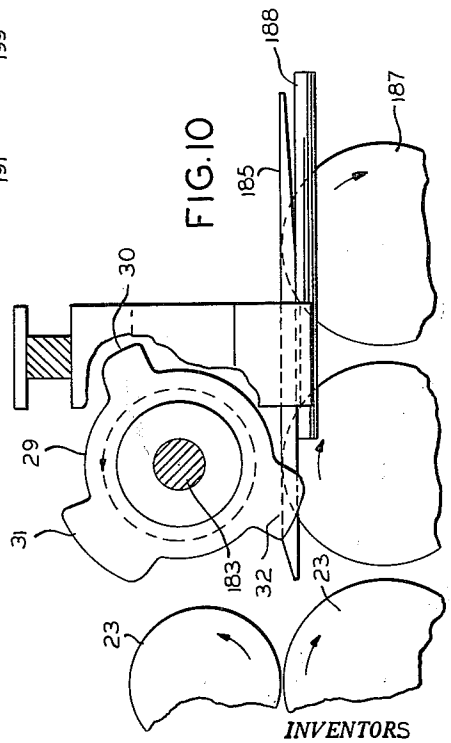


FIG. 10

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CARTON GLUING AND FORMING MACHINE

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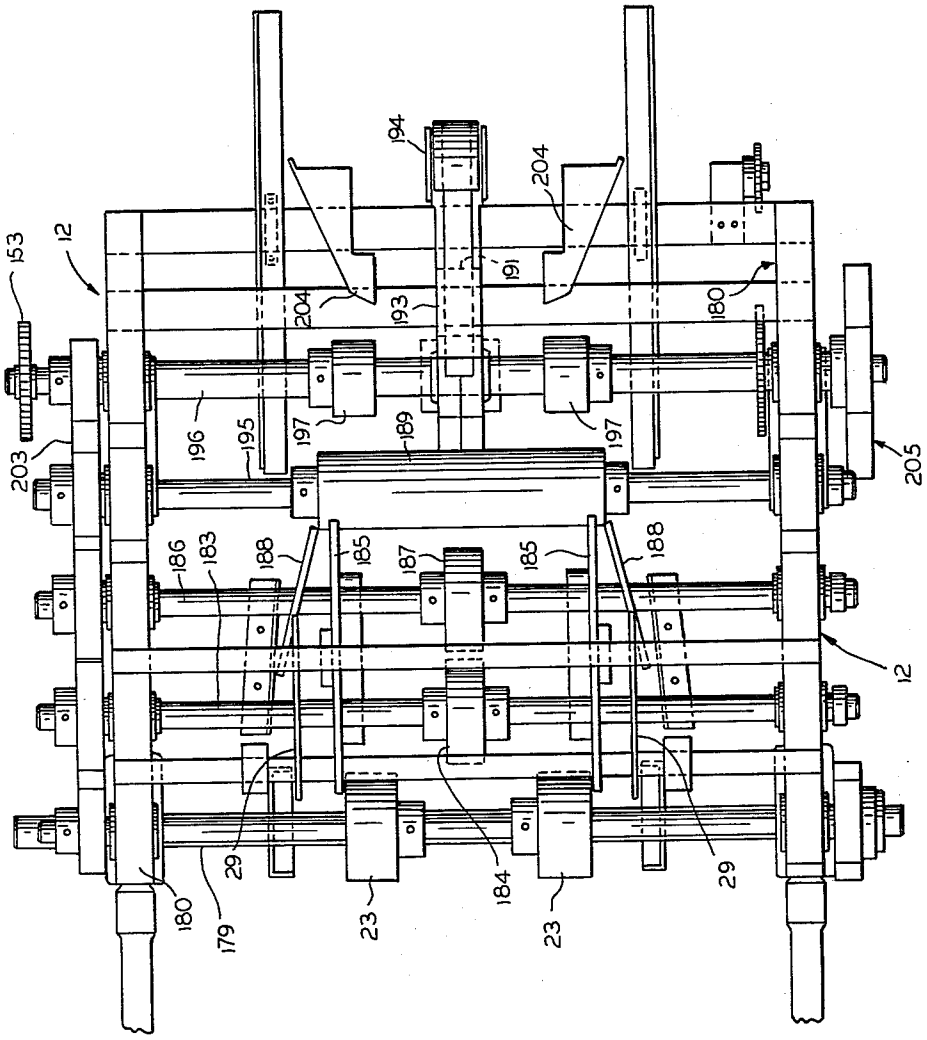


FIG. 16

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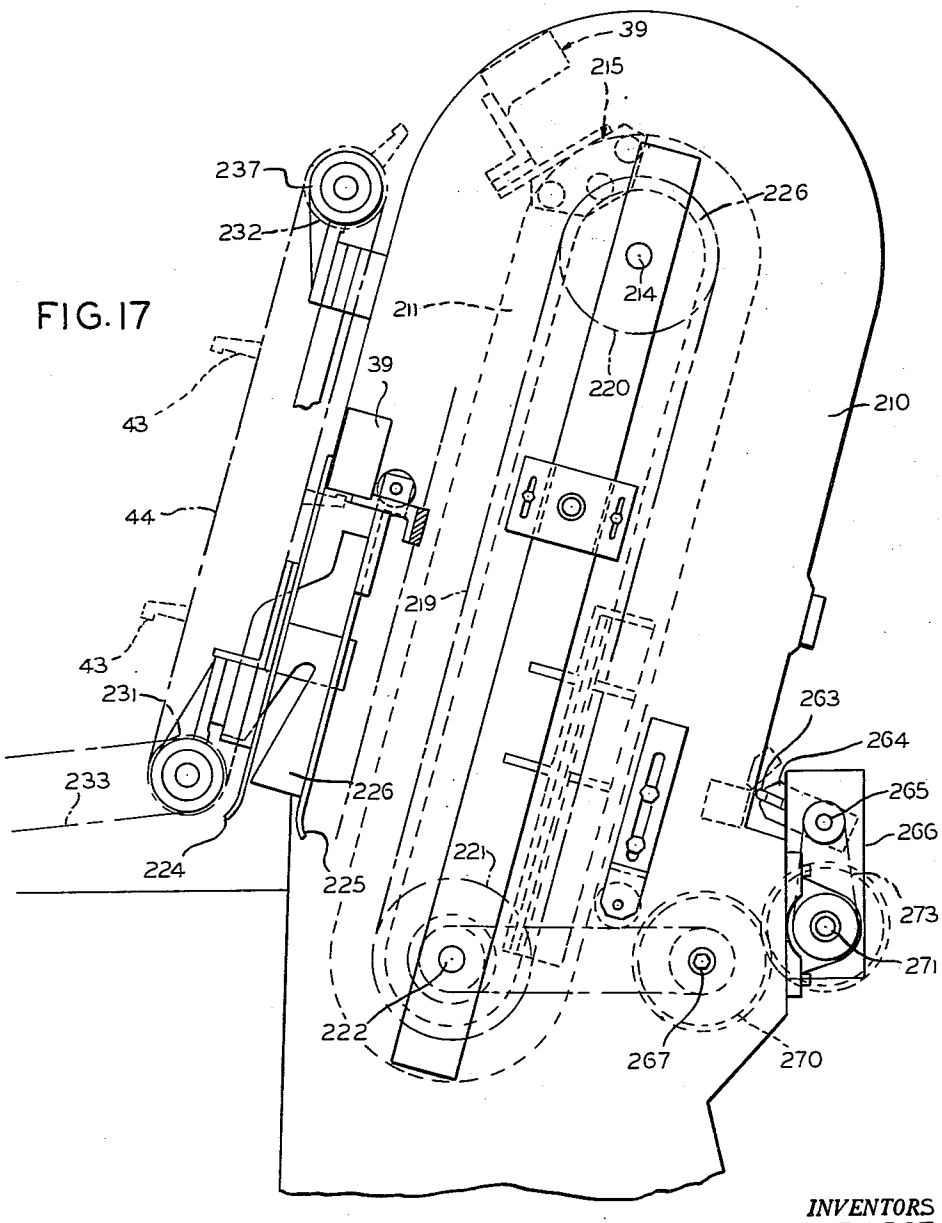
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CARTON GLUING AND FORMING MACHINE

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FIG. 17



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FIG. 18

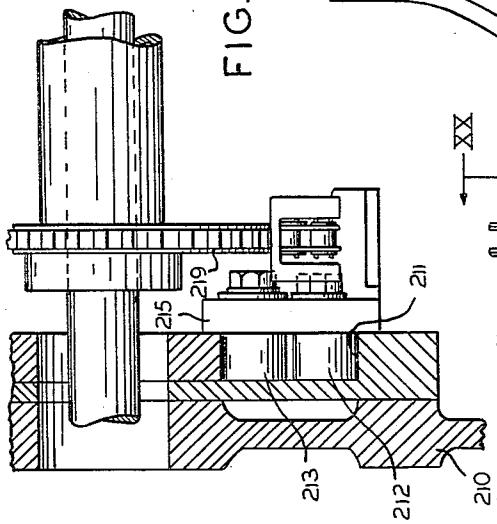


FIG. 19

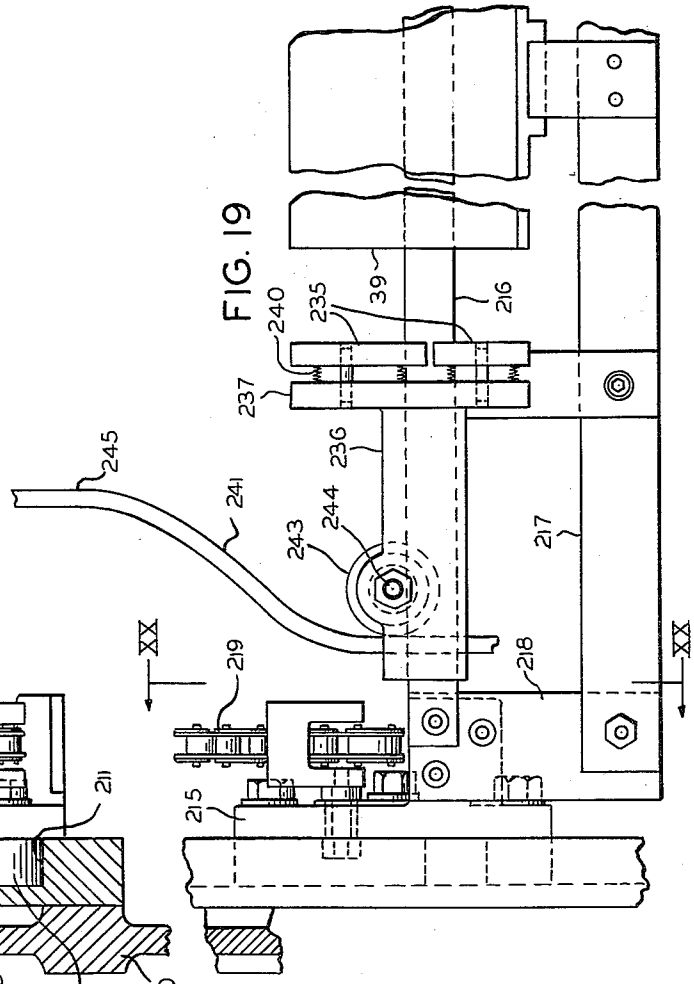
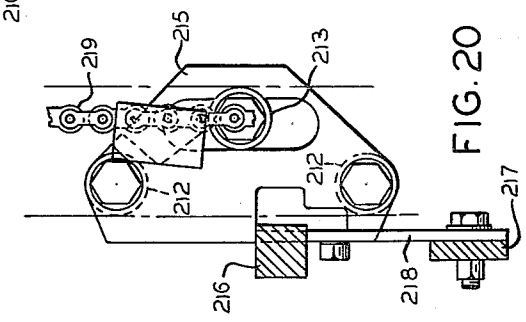


FIG. 20



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CARTON GLUING AND FORMING MACHINE

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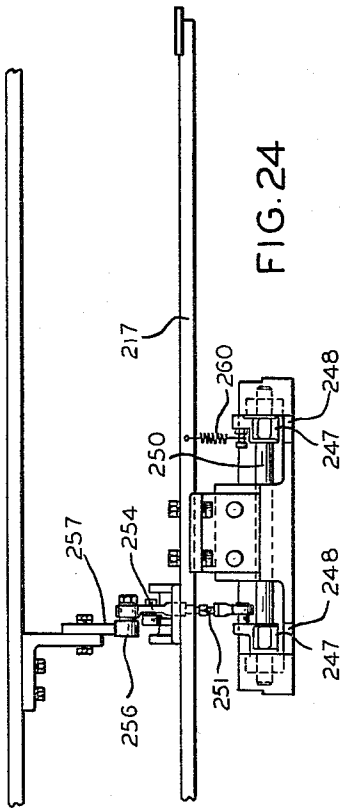


FIG. 24

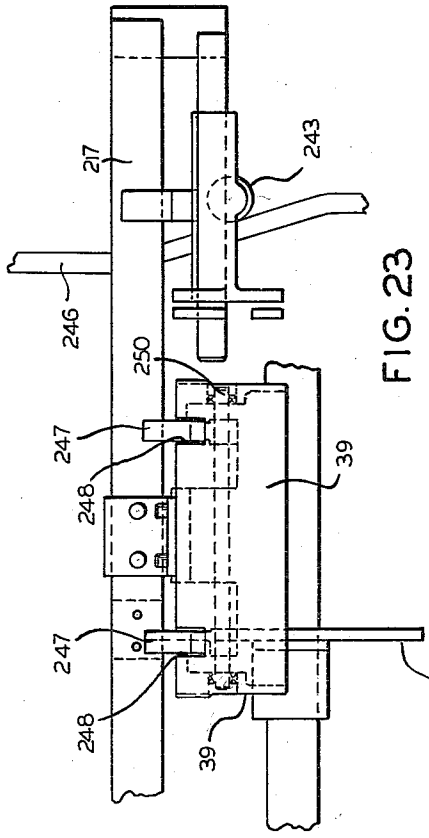


FIG. 23

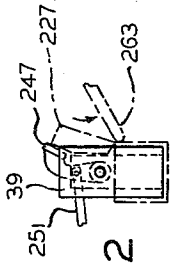


FIG. 22

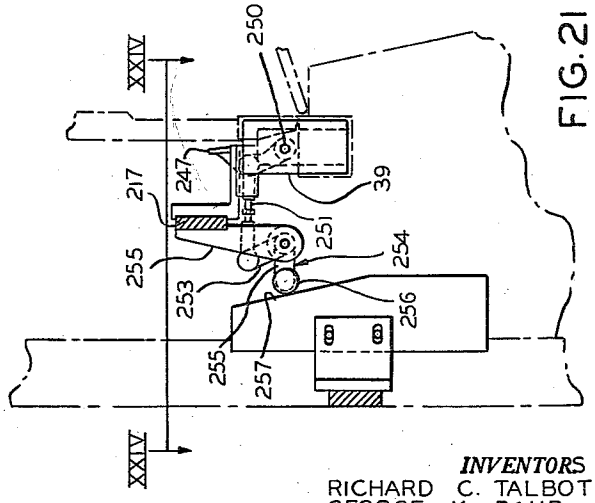


FIG. 21

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CARTON GLUING AND FORMING MACHINE

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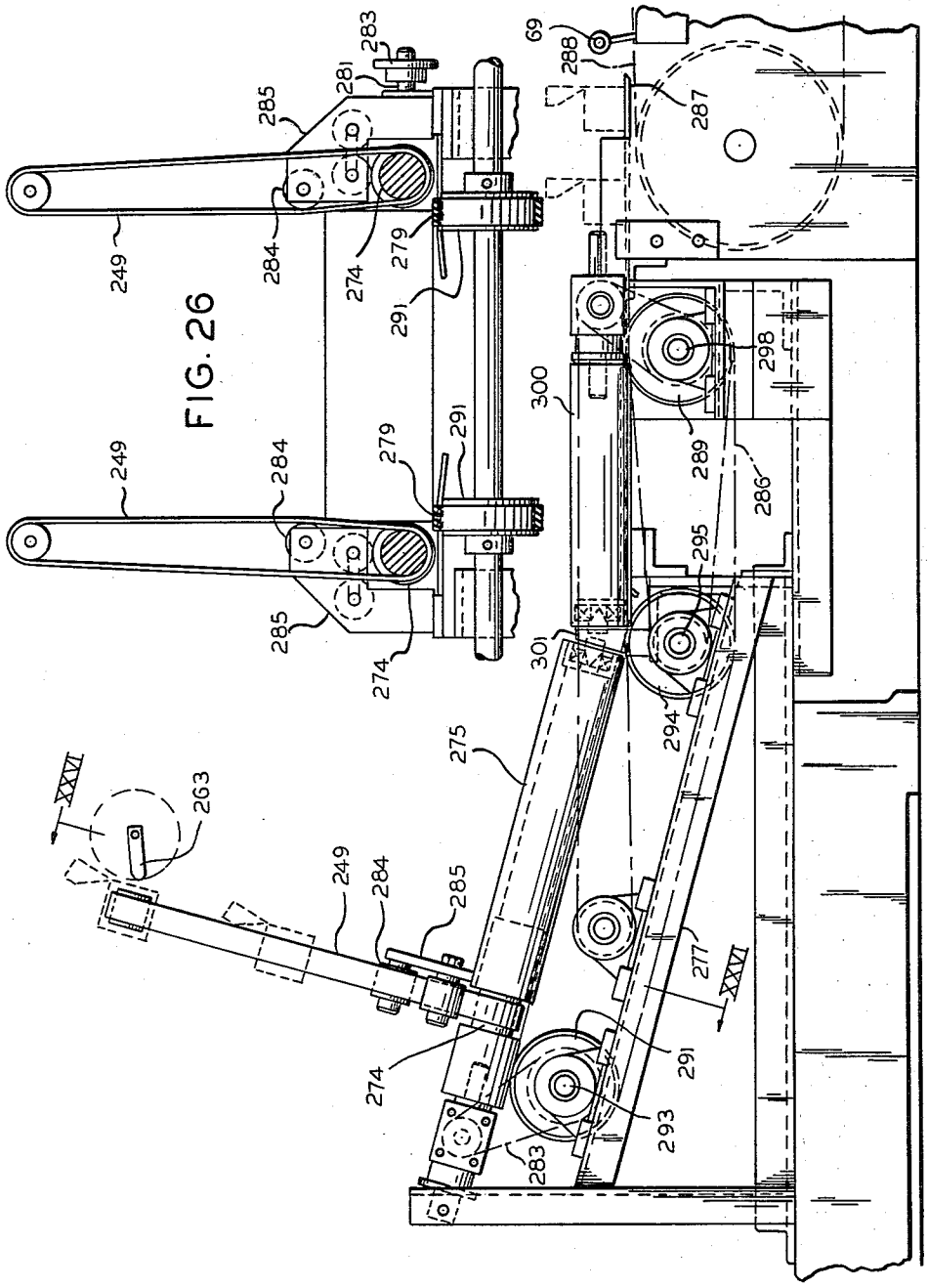


FIG. 26

FIG. 25

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CARTON GLUING AND FORMING MACHINE

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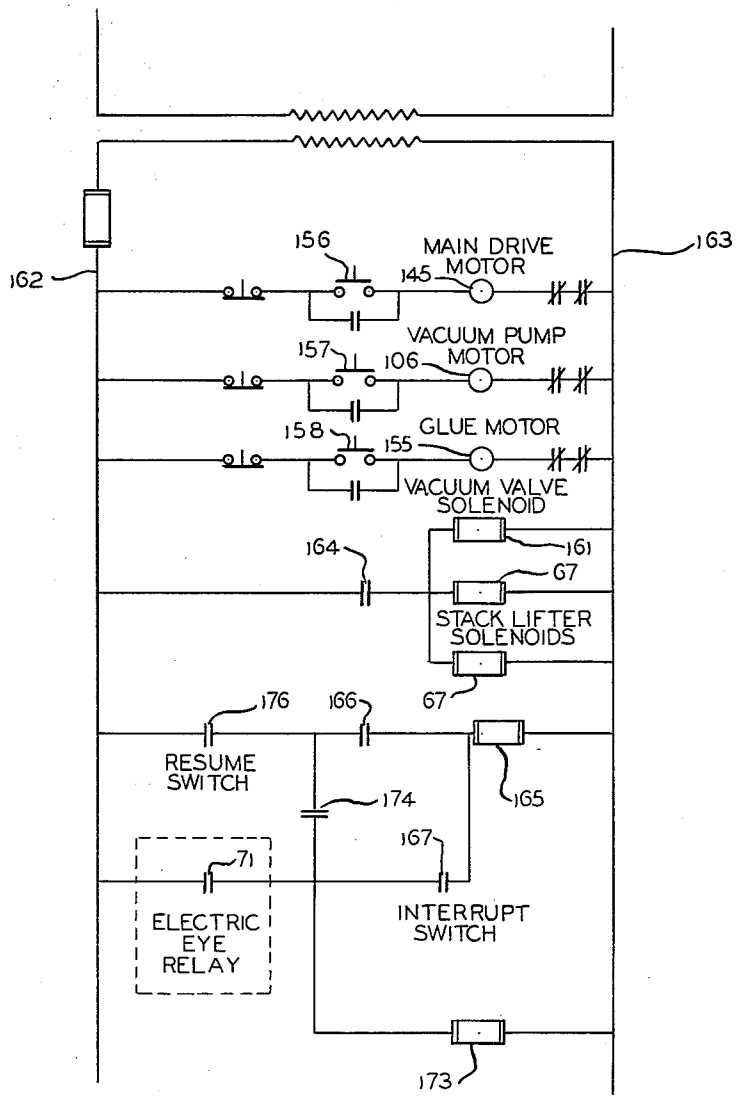


FIG. 27

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United States Patent Office 3,105,418 Patented Oct. 1, 1963

3,105,418

CARTON GLUING AND FORMING MACHINE

Richard C. Talbot, Joliet, George K. Bahr, Morton Grove, and Edward Rose, Skokie, Ill., assignors to Peters Machinery Company, Chicago, Ill., a corporation of Illinois

Filed Apr. 3, 1961, Ser. No. 100,266
3 Claims. (Cl. 93—44)

This invention relates to improvements in carton gluing and forming machines and more particularly relates to an improved form of automatic carton gluing and forming machine and control therefor.

A principal object of the invention is to provide a novel and improved form of carton gluing and forming machine arranged with a view toward simplicity and reliability in construction and operation.

Still another object of the invention is to provide an improved form of hooded carton forming and gluing machine in which the cartons are formed about a mandrel and in which an improved means on the mandrel is provided to remove the carton hoods from the mandrel for stripping from the machine.

A still further object of the invention is to improve upon the means for removing completed hooded cartons from their mandrels by providing mechanism on the mandrels for kicking the carton hoods from the mandrels and by carrying the cartons away from the mandrels by traveling strippers engaging the ends of the cartons.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a view in side elevation of a carton forming and gluing machine constructed in accordance with the invention;

FIGURE 2 is a plan view of one form of carton blank for a hooded carton that may be glued and formed on the machine of the invention;

FIGURE 3 is a perspective view of a completed carton;

FIGURE 4 is a diagrammatic view diagrammatically illustrating the stages of gluing and forming a carton by the apparatus of the invention;

FIGURE 5 is a fragmentary view in side elevation of the feeding end of the machine with certain parts broken away and certain other parts removed in order to show certain details of the feeding mechanism of the invention for advancing carton blanks from a stack of blanks for folding and gluing;

FIGURE 6 is a front end view of the machine shown in FIGURE 1, looking toward the carton blank feeder with certain parts broken away and certain other parts removed;

FIGURE 7 is a partial fragmentary top plan view of the carton separating and feeding mechanism shown in FIGURES 5 and 6;

FIGURE 8 is a diagrammatic view illustrating the automatic control for supplying vacuum to the vacuum cup for depressing the lower carton blank of a stack of carton blanks together with the means for elevating a stack of carton blanks above the support table therefor upon the accumulation of an excess number of cartons at the discharge end of the machine;

FIGURE 9 is a fragmentary view in side elevation of an intermediate portion of the machine illustrating the carton blank feeding rollers and applicator for applying glue to the folded flaps of the cartons;

FIGURE 10 is a fragmentary view in side elevation illustrating the bending roller for bending down the flaps of the carton blanks and showing the folding plows for folding the flaps upwardly against the undersides of the carton blanks for gluing;

FIGURE 11 is a fragmentary view in side elevation showing the glue roller applying glue to an applicator pad and generally illustrating the scraper for scraping excess glue from the glue roller;

FIGURES 12, 13, 14 and 15 are diagrammatic views illustrating the manner in which the flaps of the carton blanks are folded under and glued;

FIGURE 16 is a fragmentary plan view of the gluing station and illustrating the means for folding the flaps outwardly for forming after the glue applying operation;

FIGURE 17 is a fragmentary view in side elevation showing the forming station for forming the blanks into cartons;

FIGURE 18 is a partial fragmentary horizontal sectional view taken through the forming station and illustrating the guide and drive means for the carton forming and carrying mandrels and the connection from the drive chain to the mandrel on one side of the station;

FIGURE 19 is a fragmentary front end view of one half of the forming station illustrating the support for the forming mandrel and the means for holding the formed and glued flaps to set the glue thereon;

FIGURE 20 is a fragmentary sectional view taken substantially along line XX—XX of FIGURE 19;

FIGURE 21 is a fragmentary rear end view of one half of the forming station at the carton stripping side of the station with certain parts removed and certain other parts shown in vertical section in order to illustrate the stripper for stripping completed cartons from their mandrels;

FIGURE 22 is a diagrammatic view illustrating the operation of stripping a carton from its mandrel;

FIGURE 23 is an end view of the carton mandrel and carrier therefor showing the pressure pads released from the ends of the carton prior to stripping from the carton mandrel;

FIGURE 24 is a fragmentary plan view of the carton mandrel and its carrier looking substantially along line XXIV—XXIV of FIGURE 21;

FIGURE 25 is an enlarged view in side elevation with certain parts broken away and certain other parts removed and showing the stripping station for stripping formed cartons from their mandrels;

FIGURE 26 is a fragmentary sectional view taken substantially along line XXVI—XXVI of FIGURE 25; and

FIGURE 27 is a schematic wiring diagram illustrating the control circuit for the carton gluing and forming machine of FIGURE 1.

In the embodiment of the invention illustrated in the drawings, we have shown a carton gluing and forming machine 10 generally including a feeding station 11, a carton blank folding and gluing station 12, a carton forming station 13 and a carton stripping station and conveying station 15.

In the operation of gluing and forming cartons, a stack of carton blanks is placed in an arcuate guide hopper 16 extending upwardly from the top of a table 17 at the feeding station 11. The lowermost carton is then depressed by operation of a vertically reciprocable vacuum cup 18, a separator 19 is moved along the table in the space between the top of the depressed carton and the next adjacent carton of the stack of cartons and a feeder 21 advances the lowermost depressed carton along the table 17 between a pair of feed rolls 23 at the advance end of the flap bending and feeding station 12.

The carton blanks are indicated by reference character 24 in FIGURE 2 and are shown as being precut blanks having a series of flaps projecting from opposite sides

thereof and traveling in the direction of the arrows shown in FIGURES 2 and 4. As the carton blank is advanced by the feed rolls 23 alternate flaps 25, 26 and 27 are bent downwardly by rotary flap bending plows 29 having three sectors 30, 31 and 32 projecting therefrom, corresponding to the spacing and width of the respective flaps as they pass by said bending plows, as shown in FIGURES 10 and 13. The flaps are then folded under by folding plows 188 as shown in FIGURES 10, 14 and 16, and glue is applied to the outsides or bottoms of the flaps folded upwardly against the blank 24 by glue applicators 36. The flaps are then opened by plows 204 and are transferred to a mandrel 39 by a central conveyor belt 193 transferring the carton blank, with glue applied to the inwardly bent flaps 25, 26 and 27, to the forming mandrel 39. The blank is formed about the advance side and ends of the mandrel by stationary guides 224 and 225 extending along the path of travel of the mandrel 39 and side folding plows 226 mounted in the forming section 13 and extending along opposite sides of the path of travel of the blank. The trailing end portion of the blank is then folded along the trailing end portion of the mandrel to form a hood, by fingers 43 on endless chains 44. The fingers 43 change their directions of travel closely adjacent the line of travel of the blank as it is being transferred to the forming mandrel 39 and press the trailing end portion of the blank into engagement with the trailing surface of the mandrel 39. The folded flaps are then pressed together into engagement with opposite ends of the mandrel to set the glue by pressure pads 235 (FIGURE 19), pressing the glued flaps into engagement with each other and forming the carton to the form shown in FIGURES 3 and 4.

The formed carton travels with the traveling mandrel about the forming station to the trailing end thereof where it is kicked off by hood opener levers 247 and a creaser or kicker bar 263, and is stripped from the mandrel by parallel spaced generally vertically extending stripper belts 249 from which the completed carton is deposited onto a conveyor 288 carrying the carton for packing.

The general carton making operation having been generally described, the detailed structure of the carton gluing and forming apparatus will now be described.

Feeding Station

The carton blank feeding station as shown in FIGURES 1, 5, 6, 7 and 8 includes the separator 19 guided for movement in the space between a carton depressed by vacuum and downward movement of the vacuum cup 18 to separate the lowermost carton from the stack of cartons, and the feeder 21 engaging the edge of the separated carton blank and advancing the carton blank between the rotating feed or pinch rolls 23.

The arcuate guides or hopper 16 extending upwardly of the table 17 are in the form of angles slidably engaging the corners of the carton blanks. The space between the angles is open to accommodate movement of the vacuum cup 18 vertically into engagement with the bottom of the lowermost carton of the stack of cartons, to pull the lowermost carton downwardly by vacuum upon downward movement of said vacuum cup and to thereby accommodate the separator 19 to move into the space between the top of the lowermost carton and the bottom of the next adjacent carton, to separate the lowermost carton for feeding. The stack of cartons is supported along its opposite edges on parallel spaced rails 50 beneath which extend opposite end portions 51 of a stack lifter 53. The stack lifter 53 is generally V-shaped in plan with the opposite end portions 51 extending vertically along the outer sides of the rails 50. A stop lug 54 extends forwardly of the peak of said stack lifter into engagement with a transverse rail 55, serving to limit downward movement of the stack lifter 53.

The stack lifter 53 has parallel legs 56 depending from opposite sides thereof. The legs 56 are guided intermediate their ends by pivoted links 57, pivoted to said legs at one of their ends and pivoted to the machine frame at their opposite ends. The legs 56 are connected at their lower ends to lever arms 59 of bellcranks 60. The bellcranks 60 are pivoted intermediate their ends on pivot pins 61 extending transversely of the frame for the machine and suitably mounted therein and have depending lever arms 64 having armatures 65 of solenoids 66 pivotally connected thereto. Each solenoid 66 includes a solenoid coil 67 energized under the control of a source of light 69 (FIGURE 25), projecting a light beam onto a photoelectric cell 70 (FIGURE 1) at the stripping and conveying station 15 of the machine. The source of light 69 projects a light beam across the conveying station and effects the closing of contacts 71 (FIGURE 27) of the photoelectric cell relay when the light beam is broken for a predetermined time interval. Closing of the contacts 71 will effect energization of the solenoid coils 67 and effect lifting movement of the stack lifter 53 and side rails 50, to lift the stack of carton blanks and retain the stack of carton blanks out of operative association with the separator 19 and feeder 21, when sufficient cartons are stacked up at the stripping and conveying station of the machine to break the light beam for a substantial period of time. The photoelectric cell relay is a time delay relay to prevent closing of the contacts 71 as individual cartons break the beam of light.

The vacuum cup 18 is mounted on the upper end of a pipe 73. The pipe 73 extends through and is mounted on a bar 74 extending longitudinally of the machine toward the advance or feed end of the machine. A shaft 75 supports the bar 74 and is slidably guided in a guide member 76 extending across and suitably connected to side frame members 77 suitably mounted on and spaced above a base 79 for the machine. The shaft 75 has a link 80 pivotally connected to and depending from its lower end and pivotally connected to a lever arm 81 of a bellcrank 83. The bellcrank 83 is pivotally connected intermediate its ends to a transverse pivot shaft 84 mounted in and projecting horizontally from a plate 85 extending upwardly of the base 79. The bellcrank 83 has a depending lever arm 86 having a link 87 pivotally connected thereto on a pivot pin 88. The link 87 in turn is connected to an eccentric strap 89 extending about an eccentric 90 mounted on a transverse drive shaft 91 extending across the frame for the machine and suitably journalled therein. Rotation of the shaft 91 will thus rock the bellcrank 83 about the axis of the transverse shaft 84 and move the vacuum cup 18 upwardly into engagement with a lowermost carton blank of a stack of carton blanks and then move the vacuum cup 18 downwardly to depress the blank as vacuum is supplied to said vacuum cup, to accommodate the separator 19 to separate the lowermost blank from the stack of blanks.

The pipe 73 is connected with a source of vacuum, such as a vacuum pump 97 through a flexible tube 93 extending from the lower end of the pipe 73 and connected with a filter 94 having connection with a solenoid operated normally open valve 99 in series with a cam operated three way valve 95 connected in the supply side of a pipe 96. The cam operated three way valve 95 serves to vent a source of vacuum shown as being a vacuum pump 97 to atmosphere, or to connect a vacuum line 98 to the shut off valve 94 to connect said shut off valve 94 and the pipe 73, and vacuum cup 18 to the source of vacuum.

The cam operated valve 95 is operated by a cam 100 on a transverse shaft 101 rotating one revolution for each carton feeding, flap folding and gluing cycle. The shaft 101 also carries the glue applicator 36 and rotatably drives said glue applicator. The cam 100 engages a follower 103 on the end of a stem 104 for the three way valve 95. At the end of a feeding cycle the follower 103 engages a low spot or depression in the cam 100 and the valve 95 is vented to atmosphere. As the eccentric 90 actuates the

bellcrank 83 to raise the vacuum cup 18, the valve 95 connects said vacuum cup with the vacuum pump 97 and maintains vacuum in said vacuum cup during a complete raising and lowering of said cup to engage the vacuum cup with the bottom of a carton blank and depress the carton blank by downward movement of said vacuum cup to accommodate the separator 19 to separate the lowermost carton from the stack of cartons thereabove.

The solenoid operated valve 99 may be of a well known form and is operated to shut off the supply of vacuum to the three way valve 95 upon energization of the solenoids 66, effecting the lifting of the stack of carton blanks out of operative range with respect to the vacuum cup 18, upon breaking of the light beam projected from the source of light 69, by an accumulation of cartons at the stripping and conveying station of the machine.

The vacuum pump 97 may be of any well known form continuously driven from the motor 106 (FIGURE 27). The vacuum pump and motor, therefore, need not herein be shown or described further.

The separator 19 has spaced beveled advance end portions 107 passing (along opposite sides of the vacuum cup 18) into the space between the bottom of the stack of carton blanks and a lowermost blank depressed by the vacuum cup 18, and is riveted or otherwise secured to a transverse support bar 109 having a vertical leg 110 depending to one side of said separator. The depending leg 110 extends downwardly along one side of an actuator block 111, slidably mounted on two vertically spaced longitudinally extending guide bars 112. The actuator block 111 has a shaft 113 extending outwardly therefrom, on which is pivotally mounted a link 115 extending along and beneath the table 17 toward the discharge end of the feeder and pivotally connected to the upper end of a lever arm 116 (FIGURE 6). The lever arm 116 is pivotally mounted on a transverse shaft 117 at its lower end, mounted on and extending from opposite sides of the plate 85 extending upwardly of the base 79. The lever arm 116 has a link 119 pivotally connected thereto intermediate its ends on a pivot pin 120. The link 119 may be an adjustable link of a turnbuckle type and its end opposite the pivot pin 120 is threaded in a boss 121 of an eccentric strap 122. The eccentric strap 122 extends about an eccentric 123 keyed or otherwise secured to the eccentric drive shaft 91. One revolution of the eccentric 123 and eccentric drive shaft 91 will thus move the separator 19 from the position shown in FIGURE 5 for the full length of its stroke in the space between two cartons separated by the vacuum cup 18 to accommodate the feeder to feed the carton blank in the nip between the feed rolls 23 and will then move said separator back to the position shown in FIGURE 5. The eccentric shaft 91 and the glue applicator shaft 101 thus rotate one revolution during each carton blank feeding cycle.

The feeder 21 is shown in FIGURES 6 and 7 as comprising two parallel spaced bars 125 extending beneath and along opposite sides of the separator 19 and mounted on and extending in advance of a transverse support bar 126. The transverse support bar 126 is mounted on the horizontal leg of an angle bracket 127. The angle bracket 127 has a depending vertical leg 129 extending along the outer side of an actuator block 130 and suitably secured thereto. The actuator block 130 in turn is slidably supported on two vertically spaced parallel rods 131 extending parallel to the rods 112. The bars or fingers 125 have recessed advance undersurfaces terminating in inwardly beveled bottom shoulders 133 engageable with the separated edge of the carton black for feeding the carton blank into the nip between the rolls 23 upon advance of the feeder 21 toward said rolls.

The actuator block 130 is actuated by a link 134 transversely pivoted thereto and pivotally connected to the upper end of a lever 135 pivotally mounted on a transverse shaft 117. The lever 135 has a link 136 pivotally connected thereto intermediate its ends on a transverse pivot pin 137. The link 136 is in the general form of a turnbuckle and is threaded within a boss 139 extending radially of an eccentric strap 140. The eccentric strap 140 extends about an eccentric 141 keyed or otherwise secured to the transverse shaft 91 for rotation therewith. The transverse shaft 91 is shown in FIGURE 5 as being driven from a drive shaft 143 for the lower feed rolls 23 through a chain and sprocket drive 144.

Referring now to FIGURES 5, 8 and 27, and the automatic control for the vacuum cup 18 and stack lifter 53 for lifting the stack of carton blanks to an inoperative position and stopping feeding thereof upon the accumulation of cartons on the conveyor 288, a main drive motor 145 serves as the drive motor for the feeding station 11, the carton flap folding and gluing station 12, the forming station 13 and the stripping and conveying station 15. The drive connections to the various mechanisms in these stations may be through a variable speed pulley 146 driven by the motor shaft, and driving a belt 149 on a flat drive pulley 148, keyed or otherwise secured to a transverse shaft 147. The transverse shaft 147 is shown in FIGURE 6 as having two drive sprockets 150 and 151 thereon. The drive sprocket 150 serves to drive the former through a chain and sprocket drive indicated generally by reference character 152. The drive sprocket 151 serves to drive the rolls in the feeding station, the glue applicator and the eccentric shaft 91 through a chain and sprocket drive (not shown), and suitable geared and chain and sprocket drive connections (not shown) driven therefrom. The various drive connections from the motor 145 to the operative parts of the machine need not herein be shown or described in detail since they may be of conventional forms and are no part of the present invention.

The main drive motor 145, the vacuum pump drive motor 106 and a glue roll drive motor 155 are energized under the control of individual starters 156, 157 and 158 respectively, and continuously rotate during operation of the machine. The glue roll drive motor 155 drives a glue roll 159 through a chain and sprocket drive 160.

The solenoid valve 99 is operated by energization of a solenoid coil 161, connected across main line conductors 162 and 163, through contacts 164 of a contactor having an operating coil 165. The solenoid coil 161 for the valve 99 and the solenoid coils 67 for the stack lifter are also energized upon energization of the coil 165 and closing of the contacts 164.

The contactor or relay coil 165 also closes contacts 166 upon closing of the contacts 164. The coil 165 is energized to close the contacts 164 and 166 under the control of the contacts 71 of the photoelectric control relay and contacts 167 of a cam operated interrupt switch 169 (FIGURE 5). The cam operated interrupt switch 169 is operated by a cam 170 on the shaft 91 and closes when a follower 171 for operating said switch falls into a depression 172 on said cam, when the separator 19, feeder 21 and vacuum cup 18 are in the positions shown in FIGURE 5. The coil 165 may then be energized through the contacts 71 of the photoelectric cell relay and the contacts 167 of the interrupt switch, prior to the starting of a carton blank feeding operation. Energization of the coil 165 will effect closing of the contacts 164 and 166, This will energize the solenoid coils 161 and 67 and effect closing of the solenoid operated vacuum control valve 99 and raising of the stack lifter 53 to raise the stack of carton blanks out of operative association with the separator 19 and feeder 21, it being understood that under such conditions the motor 145 is operating and the separator 19 and feeder 21 reciprocate back and forth, while the vacuum cup 18 reciprocably moves up and down. The vacuum cup 18, however, is disconnected from the vacuum pump 97 under these conditions.

As the coil 165 is energized, a contactor or relay coil 173 will be energized through the contacts 71 of the photoelectric cell switch. This will close contacts 174

and provide a holding circuit for the coil 165 as the contacts of the interrupt switch open, as the follower 172 rides along the high spot of the cam 170.

A micro-switch 175 having contacts 176 in series with the contacts 166 and the coil 165 is provided to de-energize the coil 165 and thereby effect the deenergization of the solenoid coils 161 and 67, when the vacuum cup 18 is in its lowermost position shown in FIGURE 5. The micro-switch 175 is operated by a switch arm 177 engaged by the depending arm of the bellcrank 83 and opening the circuit through the contacts 176 when the depending arm of the bellcrank 83 is in the position shown in FIGURE 5.

The contacts 176 of the micro-switch 175 thus serve as holding contacts to hold the contactor coil 165 energized until the separator 19, the feeder 21 and vacuum cup 18 are at the return ends of their cycles of operation and to open the circuit to the coil 165 when said separator, feeder and vacuum cup are at the return ends of their cycles of operation. The contacts 176 of the micro-switch 175 thus condition the feeder to resume operation when the accumulation of excess cartons has been corrected.

Thus, the stack lifter 53 is held from operation to lift the stack of carton blanks until the vacuum cup 18, separator 19 and feeder 21 are in their return or retracted positions, while the contacts 176 of the resume micro-switch 175 prevent deenergization of the solenoid coils 161 and 67 and lowering of the stack of carton blanks to effect resumption of feeding until the separator 19 and feeder 21 are in their retracted positions shown in FIGURE 5, even though the contacts 71 of the electric eye relay may be broken prior to the end of a cycle.

Carton Flap Folding and Gluing Station

The carton flap folding and gluing station 12 includes the upper and lower feed rolls 23 spaced apart to engage the carton blank inwardly of the flaps thereof. The upper of said rolls 23 is mounted on a transverse shaft 179 suitably journalled in side frame members 180 and projecting outwardly from said side frame members. As shown in FIGURES 9 and 16, five parallel shafts are journalled in the side frame members 180 and carry forming and conveying rolls cooperating with rolls spaced therebeneath to advance the carton blank for bending and gluing and forming to its final form in the forming station 13.

The first shaft is the shaft 179 and carries the upper pinch rolls 23 cooperating with lower pinch rolls on a transverse shaft 143, the nips between the pinch or feeding rolls 23 defining the line of travel of the carton blank. The second shaft 183 has a centrally disposed feed roll 184 keyed or otherwise secured thereto and engaging a corresponding lower feed roll for feeding the carton blank along support rails 185 spaced inwardly of the flaps 25, 26 and 27. The shaft 183 also has the rotary flap bending plows 29 mounted thereon and rotatably driven thereby. A third shaft 186 has a centrally disposed feed roll 187 keyed or otherwise secured thereto and engaging a corresponding lower feed roll for progressing the carton blanks along the rails 185 and effecting the folding under of the flaps 25, 26 and 27 by folding plows 188 converging inwardly from the outsides of the rotary plows 29 to the nip between the upper roll 189 and a cooperating lower roll 190. The rolls 189 and 190 bend the flaps inwardly along the bottom of the carton blank for gluing by the glue applicators 36 as the carton blank passes over a lower center roll 191 and a belt 193 trained about the lower roll 191 and extending in advance thereof and trained about an idler roll 194 in advance of the side frame members 180.

The roll 189 is mounted on a fourth transverse shaft 195 journalled in the side frame members 180. A fifth transverse shaft 196 is in vertical alignment with the axis of rotation of the roll 191 and has spaced back up rolls 197 keyed or otherwise secured thereto backing up the carton blank as glue is applied to the inwardly folded flaps 25, 26 and 27 thereof, by glue applicator pads 199 on the applicator 36 spaced to successively engage the respective flaps 25, 26 and 27 and apply glue thereto as the carton is advanced into engagement with a stop 200 at the folding station 13 to be picked up by a traveling mandrel 39. The shaft 196 is driven by a chain and sprocket drive 153 driven from the sprocket 151. The shafts 195, 183, 186 and 179 are geared together and are driven from the shaft 196 in the same direction as the shaft 196 by a gear train 203.

A pair of spaced opening plows 204 is spaced in advance of the back up rolls 197 in alignment with the inner margins thereof to fold the flaps 25, 26 and 27 out of engagement with the bottom of the carton blank generally at right angles to the carton blank as they pass to the stop 200 to be picked up by the mandrel 39.

The roll 191 carrying the belt 193 and the glue applicators 36 spaced beneath the back up rolls 197 are carried on the transverse shaft 101 which also has the cam 100 mounted thereon, and are driven by said transverse shaft for one revolution for each carton blank gluing operation. The shaft 101 and the glue applicators and roll 191 are driven from the shaft 196 through a reduction gear train 205. The rotating glue pads 199 of each glue applicator 36 engage the spaced glue rollers 159 extending within a glue trough 206 and rotatably driven from the glue roll drive motor 155 through the chain and sprocket drive 160. An individual scraper 207 is provided for each glue roller 159 to scrape excess glue therefrom. The spacing between the scrapers 207 and the glue rollers 159 may be adjusted by individual adjustment knobs 209 in a manner well known to those skilled in the art so not herein shown or described in detail.

It may be seen from the foregoing that as the carton blank enters the nips between the feed rolls 23, it is advanced to the central feed rolls 184 where the folding sectors 30, 31 and 32 successively engage the flaps 25, 26 and 27 and fold the flaps downwardly to be engaged by the plows 188 folding the flaps inwardly toward the underside of the carton blank. The roll 189 and its cooperating lower roll 190 then bend the flaps 25, 26 and 27 along the underside of the carton blank and retain the flaps thereto to be successively glued by engagement by the glue pads 199 of the glue applicators 36 where the advance of the carton blank is continued and the flaps are folded outwardly by the folding plows 204 as the carton blank is conveyed to the stop 200 to be picked up by a forming mandrel 39 to be formed in the forming station 13 as will now be described.

Forming Station

The forming station 13 includes a pair of parallel spaced side frame members 210 having guide tracks 211 extending upwardly along the inner sides thereof and generally conforming to the margins thereof. Each guide track 211 is engaged by spaced outer rollers 212 and an inner roller 213 of a carrier 215. The carriers 215 are connected together by a transverse slide bar 216 and a mandrel cross bar 217 spaced in trailing relation with respect to the carrier by connector bars 218 and carrying the mandrel 39 along the guide tracks 211. Each carrier 215 is suitably connected to laterally spaced orbitally traveling endless chains 219 turning about idler sprockets 220 on a transverse shaft 214 at the upper ends of the paths of travel of said chains, and about drive sprockets 221 at the lower ends of paths of travel of said chains. The drive sprockets 221 are mounted on a transverse shaft 222 journalled in the side frame members 210 and driven from the chain and sprocket drive 152 through a chain and sprocket drive 223.

The mandrel 39 travels about the lower sprockets 221 into the path of a carton blank as the carton blank comes into engagement with the stop 200. The mandrel then

engages the underside of the carton blank and carries the carton blank upwardly between guides 224 and 225 and side folding plows 226, which fold the carton blank over the mandrel 39 and close the ends of the blank.

During continued upward travel of the mandrel with the carton partially formed thereon, the hood closing fingers 43 on the laterally spaced endless chains 44, come into engagement with the trailing end portion of the carton blank and press the trailing end portion of the carton blank upwardly along the trailing end portion of the mandrel 39 and form the trailing end portion of the carton blank into a hood 227. During continued upward movement of a carton blank, the side folding plows 226 come into engagement with flaps 230 of the carton blank and fold the flaps 230 into engagement with the glued flaps 27, to form the hood 227.

As shown in FIGURES 1 and 11, the endless chains 44 extend vertically along the forward faces of the side frame members 210 and turn about lower drive sprockets 231 and upper idler sprockets 232. The lower drive sprocket 231 is driven from the glue applicator drive shaft through a chain and sprocket drive 233, which also serves to drive the transverse shaft 101 and the cam 100. The hood closing fingers 43 follow the mandrel 39 and the carton carried thereon and change in direction of travel away from the carton blank about the upper idler sprockets 232.

The glued and unglued flaps of the carton are pressed into engagement with each other until the glue sets, by pressure pads 235 slidably mounted on the slide bar 216 and extending therefrom into alignment with opposite ends of the mandrel 39. As shown in FIGURE 19, a carrier 236 is slidably mounted on each slide bar 216 on each side of the associated mandrel 39. The carrier 236 has a flat plate 237 facing the mandrel 39 and having the pressure pads 235 slidably guided thereon. Compression springs 240 are interposed between the plate 237 and the pressure pads 235 to accommodate the pressure pads to yieldably press against the glued flaps of the carton and to hold the glued flaps into engagement with each other until the glue sets.

The pressure pads 235 are engaged with the glued flaps of the carton by laterally spaced stationary cams 241 adjustably mounted between the side frame members 210 on the shafts 214 and 222 in a suitable manner, and no part of the present invention so not herein shown or described further. The cams 241 are engaged by follower rollers 243 rotatably mounted on the carriers 236 on pivot pins 244. The cam tracks 241 converge into rectilinear holding faces 245 extending along the path of travel of the mandrel about the side frame members 210 to positions adjacent the stripping station 15.

Release cam tracks 246 are shown in FIGURE 23 adjacent the stripping station 15 for releasing the pressure pads 235 from the folded ends of the carton prior to stripping of the carton from its mandrel. The release cam tracks 246 are spaced inwardly of the follower rollers 243 and converge as the follower rollers 243 move therealong to release the pressure pads 235 from the glued and folded flaps. The cam tracks 246 may be adjustably mounted on the shafts 222 and 214 for adjustable movement toward and from each other with the cam tracks 241 to enable the apparatus to be adjusted for various widths of cartons in any suitable manner.

Carton Stripping and Conveying Station

Referring now to the carton stripping and conveying station as shown in FIGURES 1, 17 and 21 to 26 inclusive, the mandrel 39 carries hood opener levers 247 movable along upwardly opening slots 248 extending across the mandrel and engaging the inner edge portion of the hood of a carton as the pressure pads 235 are released therefrom to push the hood from the mandrel and accommodate a creaser bar 263 to loosen the carton to be carried away by parallel spaced vertically extending downwardly traveling stripper belts 249 engaging the ends of the carton and stripping the carton from its mandrel.

As shown in FIGURES 21 and 24 the hood opening levers 247 are mounted on a transverse rock shaft 250, rockingly mounted on the mandrel 39. One hood opening lever 247 has a link 251 pivotally connected thereto and extending therefrom and having connection at its end opposite the lever 247 with a lever arm 253 of a bellcrank 254. The bellcrank 254 is rockingly mounted in a bracket 255 secured to the mandrel support bar 217 and depending therefrom when the mandrel 39 is traveling toward the ground. The bellcrank 254 has a lever arm 255 extending inwardly therefrom, having a follower roller 256 on the end thereof, engageable with a stationary cam 257, carried between the side frame members 210, as the mandrel 39 travels downwardly along said side frame members. The other hood opener lever 247 is shown in FIGURE 24 as having a tension spring 260 connected thereto at one end and to the cross bar 217 at its opposite end. The tension spring 260 biases the follower roller 256 into position to engage the face of the cam 257.

As the follower roller 256 moves along the face of the cam 257 in a direction, which in FIGURE 21 is shown as being toward the lower end of the cam, the bellcrank 254 will pivotally move in a clockwise direction and bring the hood opener levers 247 into engagement with the edge of the hood of the carton and push the hood of the carton from the mandrel, as shown in FIGURE 22.

During the operation of removing the hood of the carton from the mandrel, a creaser member 263 comes into engagement with the rear face of the carton at the junction of the hood with the box-like portion of the carton to assure the opening of the hood, and removal of the hood from the mandrel about the connection of the hood to the box-like portion of the carton and preventing buckling of the carton during the hood opening operation. The creaser member 263 also serves to loosen or kick the carton to drop from the traveling mandrel between the stripping belts 249, to be carried away by said stripper belts.

As shown in FIGURES 1 and 17, the creaser member 263 is mounted on and extends from a rotating arm 264 mounted on a shaft 265 rotatably journalled in a frame structure 266, mounted on the side frame members 210 adjacent the rear lower end portions thereof and projecting rearwardly therefrom. The shaft 265 is driven from the shaft 222 by a chain and sprocket drive 267, a gear train 270, a chain and sprocket drive 273 connecting a gear driven shaft 271 with the shaft 265, for driving said shaft.

The shaft 265 is shown in FIGURE 17 as being driven in a counterclockwise direction and brings the creaser member 263 into engagement with the back of the carton at the junction between hood and box-like portion of the carton, as the carton moves downwardly to be stripped from the mandrel 39, and besides insuring uniform bending of the hood and preventing buckling of the back of the carton as the hood is opened or removed from the mandrel, the creaser member 263 also kicks the carton from its mandrel to be stripped therefrom by the stripper belts 249.

The stripper belts 249 are trained about and downwardly from idler rollers 273 rotatable about downwardly inclined generally longitudinal axes, and disposed just beneath the creaser member 263, to and about reduced diameter pulley portions 274 of rollers 275 extending generally longitudinally of the machine in planes perpendicular to the planes of travel of the creaser belts 249. The inner runs of the stripper belts 249 form downward continuations of the path of travel of the ends of the mandrels 39 and are maintained in parallel relation with respect to each other by idlers 284 spaced outwardly of the pulley portions 274.

The rollers 275 are suitably journalled at their ends in

a frame structure **277** and extend along the outer sides of spaced conveyor belts **279** conveying the stripped cartons for discharge beyond the rear end of the machine. The rollers **275** are rotatably driven to rotate downwardly toward the conveyor belts **279** to retain the stripped cartons thereto and are driven through a chain and sprocket drive **283** driving an angle drive indicated generally by reference character **281**.

The idlers **284** are journalled in brackets **285** extending upwardly of the frame structure **277**, and accommodate the inner runs of the stripper belts **249** to diverge as they approach the reduced diameter pulley portions **274** of the rollers **275**, to free the cartons to drop onto the conveyor belts **279** where they are carried to longitudinally extending conveyor belts **286**. The upper runs of the conveyor belts **286** extend generally horizontally and are positioned inwardly of the conveyor belts **279** and extend along the inner sides of retainer rollers **300**, forming horizontal continuations of the rollers **275** and rotatably driven from the rollers **275** by flexible couplings **301**.

The conveyor belts **279** are trained about idler sheaves **291** on a transverse shaft **294** at the upper ends of their paths of travel and about drive rollers or sheaves **294** at the lower ends of their paths of travel. The sheaves **294** are mounted on transverse drive shafts **295** also having the sheaves (not shown) for conveyor belts **286** mounted thereon and driven thereby. The conveyor belts **286** have generally horizontal runs and are trained about sheaves **289** on their forward ends mounted on a transverse shaft **298**, while the conveyor belts **286** are spaced inwardly of the conveyor belts **297** and in effect form continuations thereof. The drives to the stripper belts **249**, belts **279** and **286**, and to the rollers **275** and **300**, may be of any well known form so need not herein be shown or described except to point out that the stripper belts **249** may be driven at a slightly greater speed than the speed of travel of the mandrels **39**, as they travel downwardly along the guides **211** to the stripping and conveying station **15**.

While we have herein shown and described one form in which our invention may be embodied, it may be readily understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof as defined by the claims appended hereto.

We claim as our invention:

1. In a carton forming apparatus, at least one mandrel, guide means guiding said mandrel for movement along an orbital path, drive means driving said mandrel along said orbital path, said mandrel traveling upwardly along a carton forming run and downwardly along a carton stripping run, a pair of parallel spaced stripping belts extending along opposite ends of said mandrel, and forming downward continuations of the stripping run thereof, means for driving said stripping belts in the direction of travel of said mandrel, said mandrel having at least one lever pivotally mounted thereon engageable with a formed carton and removing the top portion of the formed carton from the top portion of said mandrel, a stationary cam extending along the stripping run of said mandrel, a follower member operatively connected with said lever and movable along said cam to operate said lever to remove the top portion of a carton from said mandrel, and a rotatably driven creaser member engaging the opposite side of the carton from said lever intermediate the ends thereof and defining a line of hinged movement of the top portion of the carton as it is removed from said mandrel by said lever, said creaser member rotating in the direction of travel of said mandrel and carton and also kicking said carton from said mandrel to be carried away by said stripping belts.

2. In a carton forming apparatus, a frame, a mandrel, flexible drive means guided for movement along said frame and driving said mandrel in an orbital path upwardly along said frame in a carton forming run and downwardly along said frame in a carton stripping run, said mandrel being formed to support a carton in folded over relation over the top thereof, means for stripping a formed carton from said mandrel comprising lever means pivotally mounted on said mandrel and movable to push the folded over portion of a carton from said mandrel, means operated by relative movement between said mandrel and said frame for operating said lever means, and a creaser mounted on said frame on the opposite side of said mandrel and from said lever means and rotatable in the direction of travel of said mandrel and engageable with the back of the carton and defining a line of hinged movement of the top portion of the carton when removed from said mandrel by said lever means, and means driving creaser member in the direction of travel of said mandrel along the stripping run thereof and kicking the carton from said mandrel.

3. In a carton forming apparatus, a frame, a mandrel, flexible drive means for said mandrel guided for movement along said frame in an orbital path upwardly along said frame in a carton forming run and downwardly along said frame in a stripping run, said mandrel being so formed as to support a carton in folded over relation over the top thereof, means for stripping a formed carton from said mandrel comprising cam means on said frame extending along the stripping run of said mandrel, lever means pivotally mounted on said mandrel and actuated by said cam to push the folded over top portion of a carton from said mandrel, a creaser member rotatably mounted on said frame for movement into engagement with the outer side of the carton intermediate the ends thereof and defining a line of hinged movement of the top part of the carton as it is removed from said mandrel and stripping the carton from said mandrel, and parallel spaced generally vertically extending stripping belts extending along opposite ends of said mandrel and forming continuations of the stripping run of said mandrel and engaging opposite ends of the formed carton as stripped from said mandrel and conveying the formed carton downwardly away from said mandrel.

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