

July 31, 1962

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3,046,935

GLUING CONTROL MEANS

Filed May 24, 1957

4 Sheets-Sheet 1

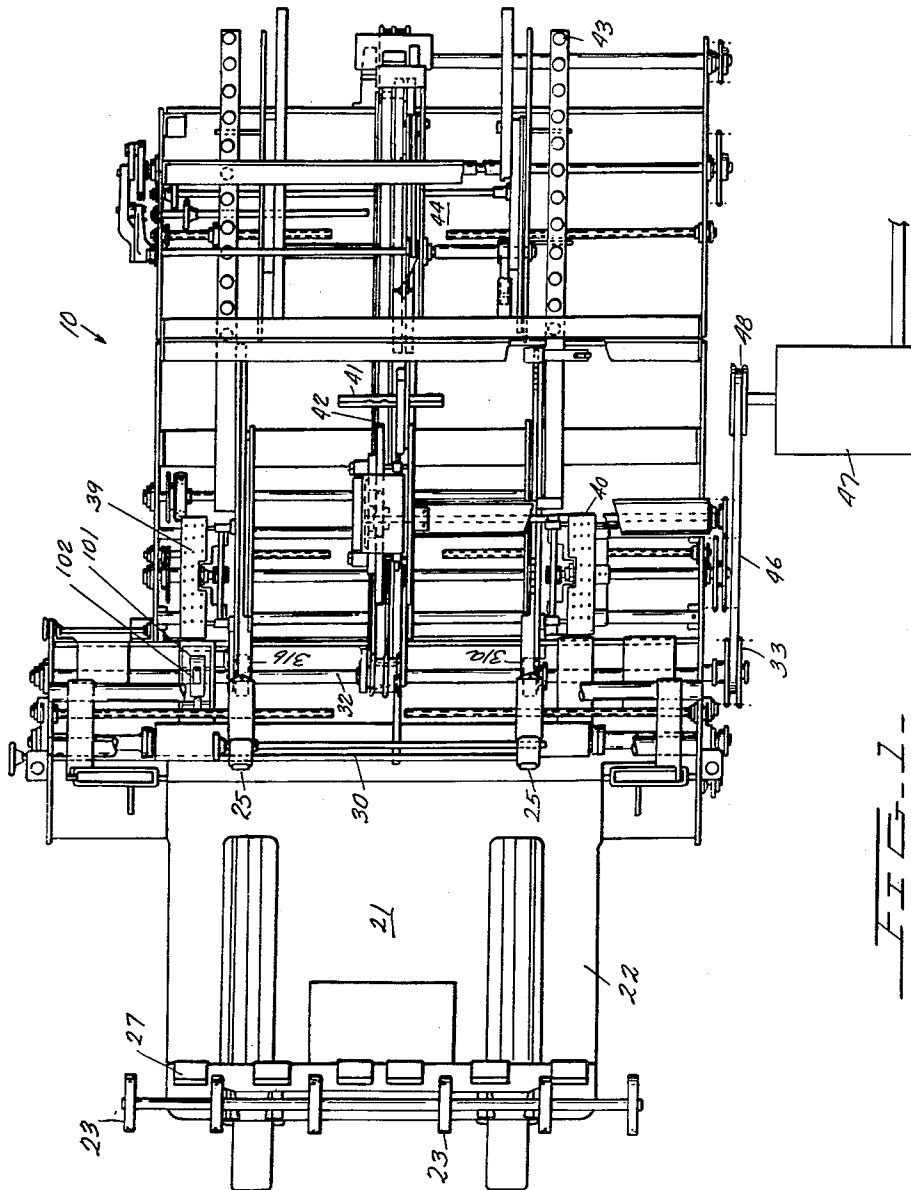


FIG. 1

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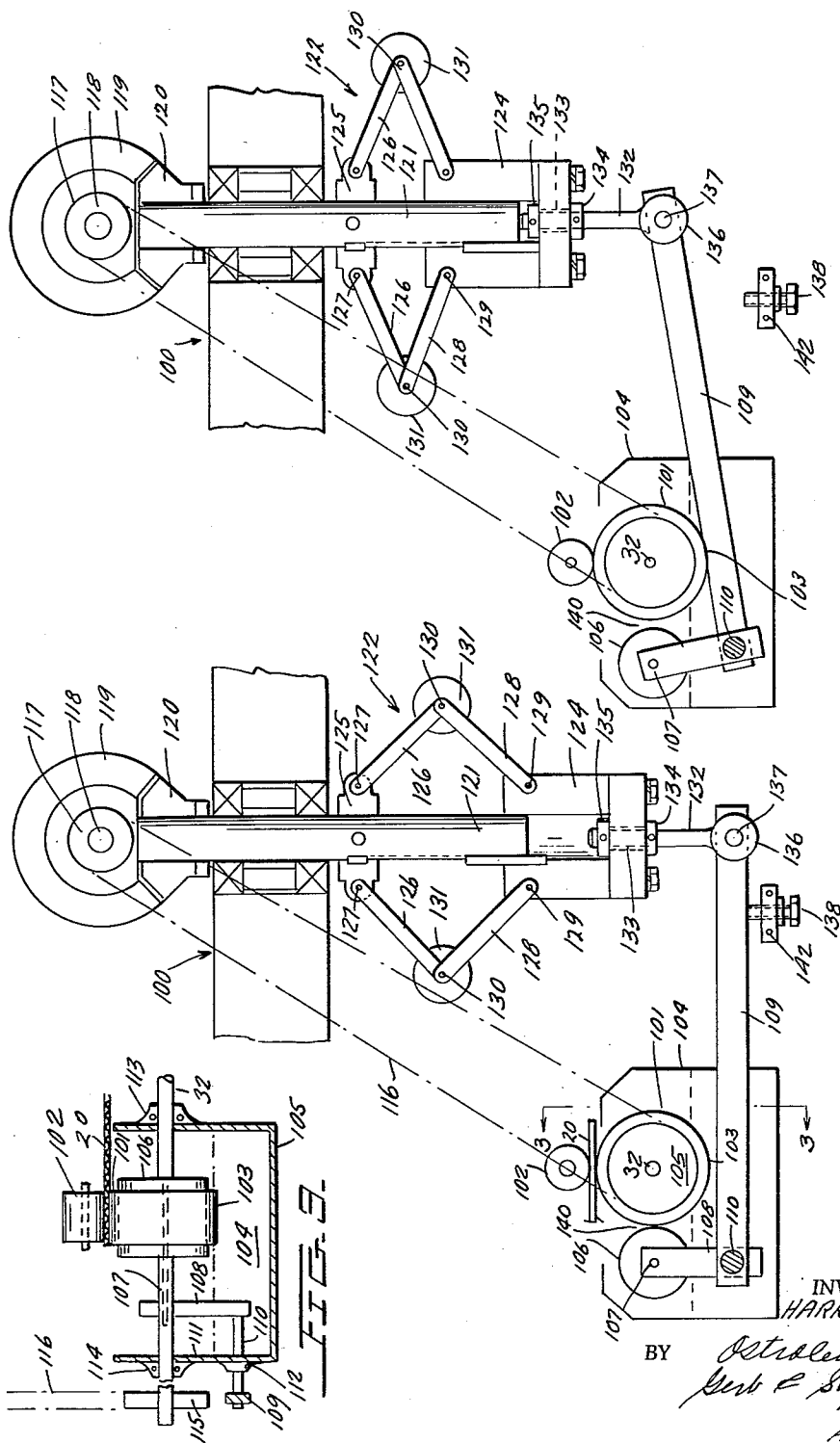
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4 Sheets-Sheet 2



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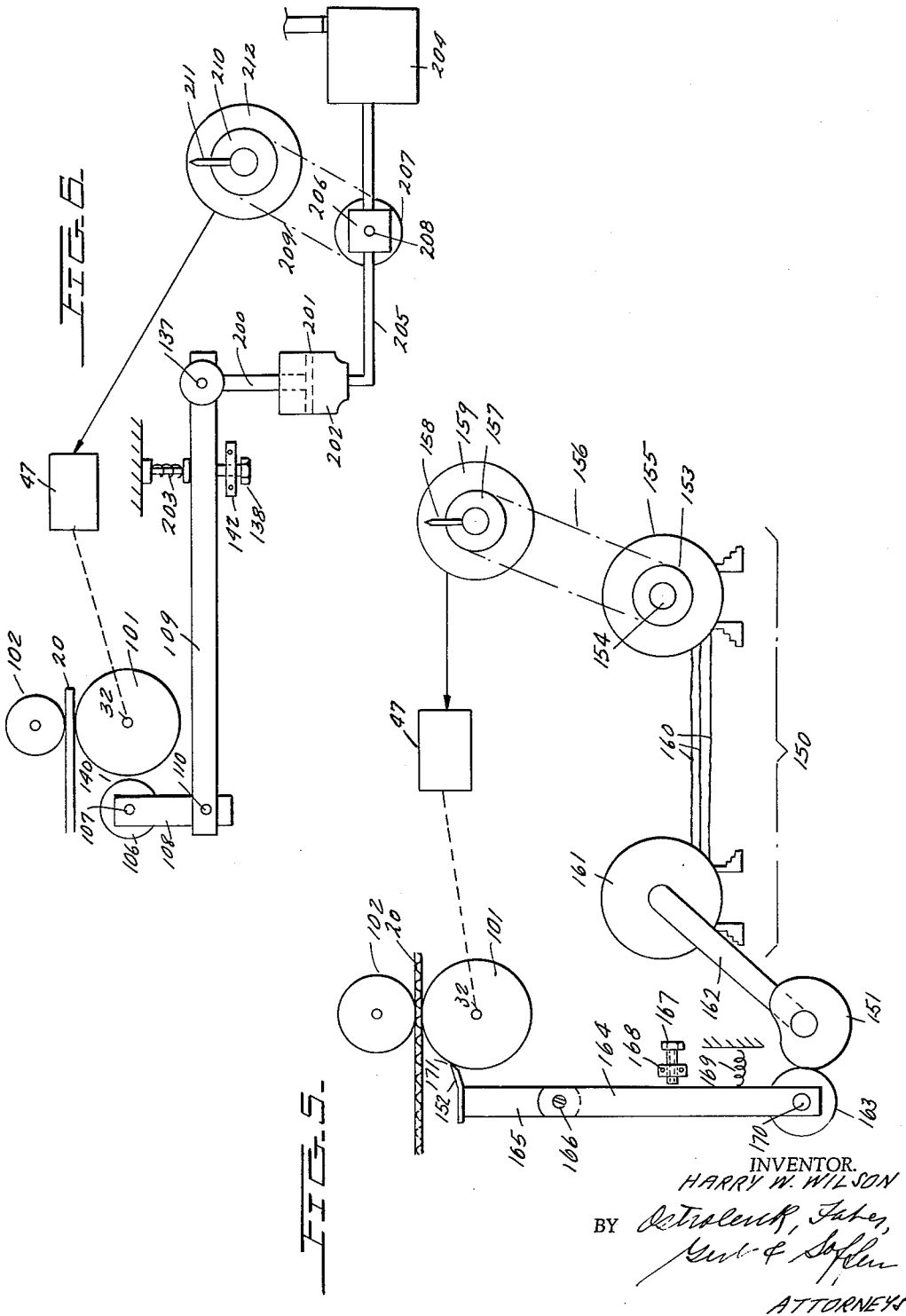
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

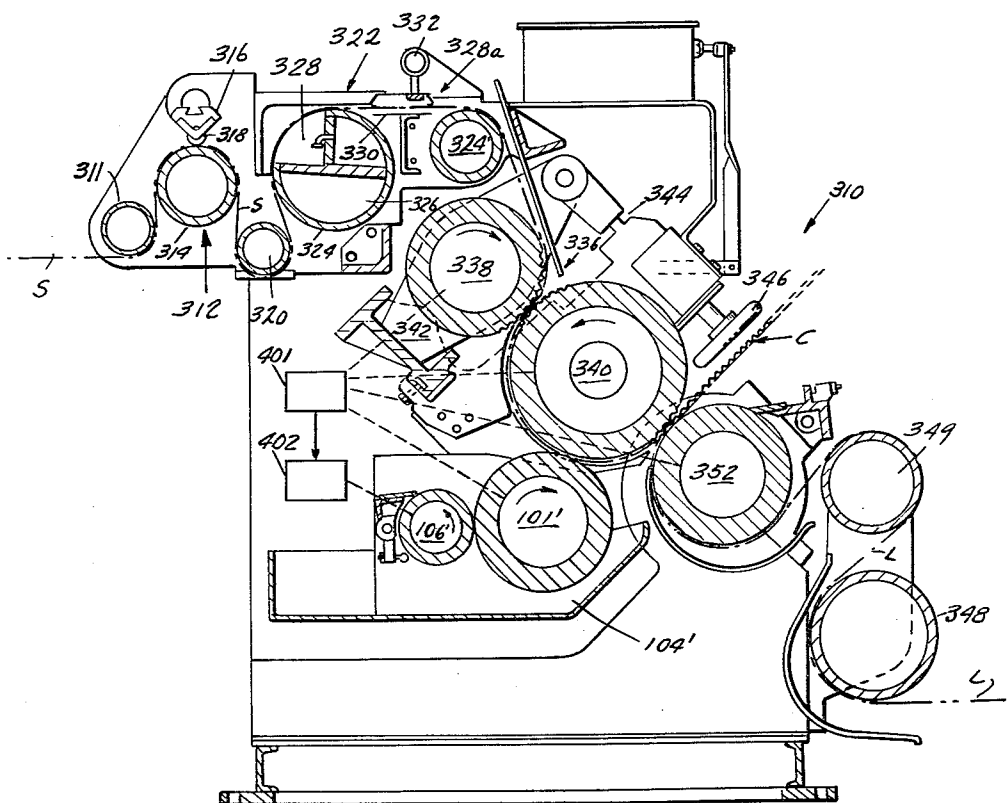


FIG. 7.

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GLUING CONTROL MEANS

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11 Claims. (Cl. 118-7)

This application relates to the glue applying section of automatic corrugating machines and paper box machinery and more particularly to means for automatically controlling the relative positions of the gluing and doctor rolls so that the proper amount of glue is applied to the corrugated sheet and paper box for varying speeds of the automatic machinery.

In the manufacture of paper or cardboard boxes, subsequent to the preliminary operations of cutting, scoring, creasing and folding the box blanks, it is necessary to glue predetermined parts of the blanks together to complete the box or carton. For example, in forming an open ended, generally rectangular sleeve like box, an elongated blank is initially formed with three transverse spaced fold lines subdividing the blank into four sections. One end adjacent section of the blank is formed with an integral flap or the like which, when the blank is folded into the sleeve like configuration, is secured to a marginal portion of the other end adjacent section. When folded and glued, the transverse fold lines define three of the meeting edges for the walls of the box, while the fourth meeting edge is provided at the marginal edges of the blank joined together by the flap.

Difficulty has been encountered in applying glue or adhesive to the flap or in the alternative to limited areas of the blank proper within the outline of the flap when in the folded formation. In either eventuality, there is a risk of transferring or smearing of the adhesive to portions of the blank proper which are to remain free from the adhesive. This results in a much lower yield of properly processed blanks, and additionally, the uncontrolled spreading of the adhesive material often causes fouling of the automatic mechanisms of the processing equipment.

This difficulty is caused in large measure by the unequal glue application given to blanks traveling through the automatic machinery at different rates of speed. That is, the speed of the automatic machinery may be intentionally varied to adjust for the rate at which the folded and glued blanks are being accepted by other machines, such as stacking, which perform subsequent operations on the blanks. When the automatic machinery is functioning at slow speed a given portion of the gluing roll, whose speed of rotation is geared to the speed of the automatic machinery, is immersed in the glue solution for a longer time and, therefore, accumulates a greater amount of glue than under high speed operation. The undesirable condition is compounded since the gluing roll also remains in contact with the blank for a longer time thereby permitting the transfer of an excessive amount of glue to the blank causing glue to spread beyond the intended limited areas to produce a probable reject.

Similar problems are encountered in single facer and double backer corrugating machines as the liner is being applied to the corrugated sheet. That is, if an excessive amount of glue is applied the combination of corrugated sheet and liner will be ejected from the machine before the glue has set. This permits relative movement between the corrugated sheet and liner and the production of a imperfect sheet. Should the glue film be too thin the bond between the corrugated sheet and liner will be weak also resulting in an imperfect sheet.

The instant invention solves the problems heretofore

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recited by removing more glue from the gluing roll, before it contacts the box blank or corrugated sheet during low speed operation than during high speed operation. This is accomplished by varying the position of the doctor roll relative to the gluing roll as a function of the speed of operation of the automatic machinery. As the automatic machinery operates at more reduced speeds the doctor roll moves closer to the gluing roll thereby spreading the adhesive to form a thin film on the gluing roll. Conversely, as the automatic machinery is operated at higher speeds the doctor roll moves further from the gluing roll thereby permitting a larger percentage of the adhesive to remain and spreading a thicker film of glue on the periphery of the gluing roll.

The gluing roll is positively rotated through a driving connection which is in some manner connected to the automatic machinery driving means so that the gluing roller speed increases and decreases directly with the speed of the blank being fed through the machinery. The gluing roll communicates with a glue solution contained in a glue pan, either by being partially submerged in the glue or else by means of transfer rolls interposed between the gluing roll and the glue solution. Positioned adjacent to the gluing roll and spaced therefrom is a doctor means which distributes the glue uniformly over the surface of the gluing roll to form a thin film thereon and at the same time removes excess glue.

The doctor means preferably comprises a doctor roll which may be mounted for rotation on the short arm of a crank. The doctor roll may be positively driven or be freely mounted depending on the specific glue being used. For some applications the doctor roll may be replaced by a doctor blade whose edge is spaced from the surface of the gluing roll.

In a first embodiment of this invention the long arm of the crank is secured to a speed sensing means which operates on a centrifugal principle. As the speed of the automatic machinery increases the shaft of the sensing means rotates at a faster rate moving a block, to which the long arm is connected in a direction such that the doctor means is spaced further from the surface of the gluing roller than under slow speed operation.

In a second embodiment of this invention an air or hydraulic means is used to control the crank position. The hydraulic means includes a piston, to which the crank is secured, and a cylinder connected to an air or hydraulic supply through a pressure regulator. The pressure regulator is operatively connected to the speed control operating handle of the automatic machinery so that for high speed operation the cylinder pressure will be increased and the doctor means will be moved further from the gluing roll than under low speed operation.

A third embodiment of this invention employs a synchro system and cam arrangement as the translation means which varies the spacing between the doctor and gluing rollers as a direct function of the speed of the automatic machinery.

Accordingly, a primary object of this invention is to provide a gluing device wherein the thickness of the adhesive film on the gluing roll is varied in direct proportion to the speed of rotation of the gluing roll.

Another object is to provide a gluing device wherein the position of the doctor means is relative to the gluing roll and is controlled by means of a synchro and a cam arrangement.

Still another object is to provide a gluing device wherein the position of the doctor means relative to the gluing roll is controlled by means of a centrifugal device.

A further object is to provide a gluing device wherein the position of the doctor means relative to the gluing roll is controlled by means of a pressure sensitive means.

A still further object is to provide an automatic box

gluing and folding machine wherein the thickness of the glue film on the blanks is controlled for varying speeds of the automatic folding machine.

Yet another object is to provide a gluing device which will assure a controlled thickness of transferred adhesive film which remains constant for all operational speeds or which varies as a direct function of the operational speed.

Another object is to provide a corrugating machine wherein the film thickness of the adhesive applied to the crowns of the corrugated sheet is controlled for varying speeds of the corrugating machine.

These, as well as other objects of this invention will become apparent after reading the following description of the accompanying drawings in which:

FIGURE 1 is a plan view of an automatic folding machine wherein the novel gluing device of this invention is incorporated.

FIGURE 2 is a side elevation of an embodiment of this invention utilizing a centrifugal device to translate the folding machine speed into motion of the doctor roll. In FIGURE 2 the folding machine is operating at an extremely slow speed.

FIGURE 3 is a section through line 3—3 of FIGURE 2 looking in the direction of the arrows 3—3.

FIGURE 4 is a view similar to FIGURE 2 with the folding machine now operating at a high speed.

FIGURE 5 is a side elevation of a second embodiment of this invention utilizing a servo system and a cam arrangement to control the position of the doctor means.

FIGURE 6 is a side elevation of a third embodiment of this invention utilizing a pressure actuated piston to control the position of the doctor means.

FIGURE 7 is a side elevation of a corrugating machine wherein any of the embodiments of my invention may be incorporated to control the adhesive film thickness applied to the corrugated sheet.

The automatic folding machine illustrated in FIGURE 1 is included as an example of the environment in which the gluing device 100 of this invention may be operated. It is to be understood that the gluing device 100 may be used with many types of automatic folding machines well known in the paper and cardboard box art as well as other automatic machinery which requires the placement of an adhesive film on a defined surface area.

A stack of blanks 20 is placed on the bed 22 of the stacking section 21 of the automatic folding machine 10 between the rear gauges 23 and front gauges 25. The bottom blank in the stack is fed towards the right by the feed slats 27 through a space (not shown) below the front gauges 25 and is pushed between upper feed roller 30 and a lower feed roller (not shown) which engage the blank 20 and move it forward to another set of upper feed rollers 31a, 31b and a lower feed roll which is carried on shaft 32.

Driving power is supplied to shaft 32 from variable speed drive unit 47 by chain 46 which mates with sprocket wheel 33 mounted on one end of shaft 32 and sprocket wheel 48 mounted on drive unit 47. Gluing roll 101 is mounted near the other end of shaft 32. A pressure roll 102 is positioned in the path of blank 20 to force the box flap against gluing roll 101.

The blank 20 continues its forward motion until it hits a stop (not shown) at which time the creases or scores on which the fold is to take place are in register with folding bars 39, 40. Folding bars 39, 40 are actuated to fold the blanks so that the panels overlap slightly. This means that one folding bar acts out of phase with the other.

After folding, the blank 20 is conveyed forward by slat 41, which is driven by chain 42, until the folded blank is grasped by a stripper (not shown). The stripper carries the folded blank through the rollers 43 of the straightening section 44 and then to a subsequent machine such as a stacking device.

The operation of folding machine 10 is completely described in copending application Serial No. 509,329, filed May 18, 1955, now U.S. Patent No. 2,898,819, and assigned to the assignee of the instant invention.

Referring more particularly to FIGURES 2 through 4, the periphery 103 of gluing roll 101 is partially submerged in glue bath 104 confined in pan 105. Doctor roll 106 is rotatably mounted inside of pan 105 on pin 107 at one end of the short arm 108 of a crank which includes a long arm 109 positioned outside of pan 105. Short arm 108 and long arm 109 are keyed to crank shaft 110 which passes through the side 111 of pan 105 and is journaled in sealed bearing 112.

Drive shaft 32 passes through pan 105 and is journaled in sealed bearings 113, 114. Sprocket wheel 115 is mounted on drive shaft 32 outside of pan 105 and is connected by means of chain 116 to sprocket wheel 117 on horizontal shaft 118 which has a bevel gear 119 mounted thereon. Bevel gear 119 mates with and drives bevel gear 120 which in turn rotates vertical shaft 121 having centrifugal unit 122 keyed thereto.

Centrifugal unit 122 comprises blocks 124, 125 keyed to vertical shaft 121 for rotation therewith. Block 124 is free to float axially along shaft 121 while block 125 is in fixed axial relationship with respect to shaft 121. Blocks 124, 125 are operatively connected by means of a plurality of scissor linkages each comprising a first link 126 pivotally secured to block 125 at 127 and a second link 128 pivotally secured to block 124 at 129. The links 126, 128 are pivotally connected at pin 130 which also carries weighted member 131.

End 133 of shaft 132 is secured to block 124 by retainers 134, 135 to move vertically with block 124 and at the same time not be rotated thereby. End 136 of shaft 132 is flattened and pivotally secured to an end of long arm 109 at pin 137.

Adjusting screw 138 is threaded through frame member 142 and abuts long arm 109 to set the at rest, or minimum, thickness of space 140 between the gluing roll 101 and doctor roll 106 as seen in FIGURE 2.

Drive shaft 32 is connected to the main drive 47 for the automatic folding machine 10 so that the speed of rotation of shaft 32 is directly related to the speed of the machine 10. Therefore, the speed of gluing roll 101 increases and decreases with the speed of machine 10. The operative connection between shaft 32 and vertical shaft 121 also relates to the speed of shaft 121 directly to the speed of the machine 10.

As the speed of shaft 121 increases weighted members 131 are forced outward due to centrifugal force thereby causing links 126, 128 to be drawn together in scissors fashion. Since block 125 is fixed, block 124 will be drawn upward carrying shaft 132 with it. Shaft 132 will in turn raise the free end of long arm 109 rotating shaft 110 counterclockwise with respect to FIGURE 2 thereby moving the free end of short arm 108 to the left (as in FIGURE 4) to increase the width of space 140 between the doctor 106 and gluing rollers 101 which will increase the thickness of the adhesive film available for transfer to blank 20.

A second embodiment of this invention utilizes a servo system 150 and cam 151 to control the position of doctor blade 152 relative to gluing roll 101. Sprocket wheel 153, secured to shaft 154 of servo motor 155, is driven by chain 156 which is in turn driven by sprocket wheel 157 keyed to the control handle 158 of the rheostat 159 which controls the speed of the main drive motor or variable speed drive unit 47 of the automatic folding machine 10.

The angular position of shaft 154 is transmitted to servo follower 161 through leads 160 so that shaft 162 will assume a position corresponding to the position of shaft 154. This in turn will position an appropriately shaped cam 15. Roller 163 is secured to long arm 164 at pin 170 and is urged into engagement with cam 151 by tension spring 169 secured to long arm 164.

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Long arm 164 is joined at shaft 166 with short arm 165 to form a lever or crank. Doctor blade 152 is mounted on the free end of short crank arm 165 so that movement of the follower roller 163 to the right at high speed operation will move doctor blade 152 to the left to increase the thickness of the space 171 between the doctor blade 152 and gluing roller 101. Adjusting screw 167 threaded through frame member 168 sets the minimum thickness of space 171.

A third embodiment of this invention, illustrated in FIGURE 6, is identical to that illustrated in FIGURES 2 through 4 from the long arm 109 to the doctor roll 106. Hence, the same numbers have been used to identify identical components.

Link 200 is secured between pin 137 and piston 201 which is disposed in cylinder 202 and closely fitted thereto. The position of piston 201 is regulated by the fluid pressure present in cylinder 202 which overcomes the biasing force of compression spring 203 acting on long arm 109.

The fluid for cylinder 202 is supplied through line 205 from reservoir 204 which is fed by a compressor (not shown). A pressure regulator 206 is fitted in line 205 to control the fluid pressure in cylinder 202. Sprocket wheel 207 is keyed to regulator shaft 208. The angular position of shaft 208 controls the pressure setting of pressure regulator 206. Chain 209 connects sprocket wheel 207 to sprocket wheel 210 which is keyed to control handle 211 of rheostat 212 which controls the speed of drive unit 47 hence the speed of automatic folding machine 10.

Thus, when the control handle 211 is moved to change the speed of operation of folding machine 10, the motion will be transmitted to change the setting of pressure regulator 206. This will change the pressure in cylinder 202 thereby changing the position of piston 201 which causes a corresponding change in position of crank 108, 109 thereby changing the thickness of space 140 which will result in a changing thickness of the adhesive film on the periphery of gluing roll 101.

Thus, a controlled adhesive film thickness on predetermined areas is assured even under varying operational speeds of the automatic machinery which includes the novel gluing device of the instant invention. This is accomplished by providing a spacing means operatively connected between the doctor means and gluing roll which will automatically vary the spacing between the doctor means and gluing roll as a direct function of the speed of the automatic machinery.

It is readily apparent that by a judicious selection of components the thickness of the adhesive film transferred from the gluing roll 101 to the box blank 20 may be kept at a constant despite varying speeds of operation of the automatic folding machine 10. However, for some applications relative sizes of the components may be chosen to provide a thicker film at slow speeds than at fast speeds. Even in the latter applications this invention will assure a controlled film thickness with the spacing between the doctor means and gluing roll varying as a direct function of the operational speed of the automatic machine.

Referring particularly to FIGURE 7, machine 310 is for the manufacture of single faced corrugated paper board C which may be the final product or may be delivered to a further machine for applying a second face. The sheet S to be corrugated is passed under a tensioning roller 311 and into a straw or sheet trimming assembly 312 including a trimmer roll 314 and a trimming head 316 having a cutting roller 318. Thereupon the sheet S is passed under and around an idler roller 320 to a sheet moistener assembly 322. The sheet moistener assembly embodies a steaming roll 324 including a steam chest 326 having a segmental cutout 328 over which the sheet S passes. The steam chest 326 is supplied with steam at a proper temperature whereby as the sheet S passes over the steam roll 324 it is preheated and prepared for the corrugating operation. After passing over

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the steam roll 324, the sheet S is fed through a guideway 328a including a plate 330 and a shield 332 whereupon the sheet is passed over a suitable feed roller 324' positioned above the corrugating unit generally designated by numeral 336.

The corrugating unit 336 includes a pair of intermeshing corrugating rollers 338, 340 each of which has its external peripheral surface provided with flutes which when in engagement along a line of intermeshing, impart corrugations to the sheet S passing therethrough. The corrugating roller 338 is mounted on suitable stationary bearings and is preferably supported for adjustment toward and away from the corrugating roller 340 and for example by means of a pivoted supporting bracket 342 and an adjusting coupling 344 operated from a hand wheel 346 accessible exteriorly of the machine. Suitable provision may likewise be made for adjusting the corrugating rollers 338, 340 axially relative to each other. In many applications the axial adjustment of the rollers may be essential to assure that the corrugating rollers have their respective axes in perfect parallelism and with the teeth in exact intermesh to thereby avoid cutting or crushing of the sheet S during high speed operation.

The facing sheet or liner L is fed toward the corrugating roller 340 for assembly with the corrugated sheet S by suitable pre-heat rollers 348, 349 arranged one above the other. The liner L passes over these rollers prior to being extended about the liner applying or pressure roller 352 arranged in cooperating relation with the corrugating roller 340 along a line of tangency substantially coplanar with the line of intermesh and the respective axes of the rollers 338, 340, 352.

Below the corrugating roller 340 and along the feed path prior to the liner applying roller 352 is a silicate or adhesive transfer or gluing roller 101', fed with adhesive from pan 104', with provision being made for the application of a uniform adhesive coating by means of doctoring roller 106'. The gluing roller applies the adhesive to the crowns of the corrugated sheet as it passes from the line of intermesh between the corrugated rollers 338, 340 and the line of tangency of the corrugating roller 340 and the liner applying roller 352.

Gluing roller 101', corrugating rollers 338, 340, liner applying roller 352 and the other feed rollers of automatic corrugating machine 310 are synchronously driven from a single variable speed drive (not shown) by means of appropriate gearing and chains.

Gluing roller 101' and doctoring roller 106' are both elongated to the width of corrugated sheet S. The thickness of the adhesive coating is determined by the spacing between the gluing roller 101' and doctoring roller 106', which are mounted and operatively connected through spacing control means 402 and 401 in a manner substantially the same as that of gluing roller 101 and doctor roller 106 of the embodiments of FIGURES 2 through 6. In this manner the adhesive coating on gluing roller 101' is controlled as a function of the speed of corrugating machine 310 to apply a controlled film of adhesive to the crowns of corrugated sheet S thereby assuring corrugated board of high strength and uniform quality.

As is apparent to those skilled in the art, the described arrangement is capable of corrugating the sheet S and adhesively securing to one face of the corrugated sheet a liner L, the resultant product being accessible beyond the corrugating rollers 340 and the liner applying roller 352 for further processing as and for example by providing a liner on the corrugated face opposite the liner L, or for cutting into appropriate lengths.

It should also be apparent to those skilled in the art that the doctor means 106 and 152 need not be pivoted about points 110 and 166 respectively, in order to vary the spacing between the gluing roll 101 and the doctor means 106, 152. Instead doctor means 106, 152 could readily be mounted so as to move in a linear path rather than the arcuate paths illustrated.

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In the foregoing, this invention has been described only in connection with preferred embodiments thereof. Many variations and modifications of the principles of this invention within the scope of the description herein are obvious. Accordingly, it is preferred to be bound not by the specific disclosure herein, but only by the appended claims.

I claim:

1. A gluing device comprising a rotatably mounted gluing roll, doctor means and spacing means; said doctor means being positioned in a closely spaced relationship with respect to said gluing roll; said spacing means being operatively connected to both said gluing roll and said doctor means; said spacing means constructed to vary the spacing between said doctor means and said gluing roll as a function of the rotational speed of said gluing roll.

2. The gluing device as set forth in claim 1 in which the doctor means comprises a roll having a rotational axis parallel to the axis of rotation of said gluing roll.

3. The gluing device as set forth in claim 1 in which the doctor means comprises a blade having an edge parallel to the peripheral surface of said gluing roll.

4. The gluing device as set forth in claim 1 also including adjustable stop means operatively connected to the doctor means to establish the minimum spacing between the doctor means and the gluing roll.

5. A gluing device comprising a rotatably mounted gluing roll, a doctor means and a spacing means; said doctor means being positioned in a closely spaced relationship with respect to said gluing roll; said spacing means including a crank and a pressure responsive means operatively connected to a first end of said crank; said doctor means being mounted on a second end of said crank; said pressure responsive means being constructed and operatively connected to said gluing roll whereby the spacing between said gluing roll through said crank and said doctor means will vary as a direct function of the rotational speed of said gluing roll.

6. A gluing device comprising a rotatably mounted gluing roll; a doctor means and a spacing means; said doctor means being positioned in a closely spaced relationship with respect to said gluing roll; said spacing means including a crank means and a centrifugal means operatively connected to said crank means; said doctor means also being operatively connected to said crank means; said centrifugal means being constructed and operatively connected to said gluing roll through said crank means whereby the spacing between said gluing roll and said doctor means will vary as a function of the rotational speed of said gluing roll.

7. A gluing device comprising a rotatably mounted gluing roll, a doctor means and a spacing means; said doctor means being positioned in a closely spaced relationship with respect to said gluing rolls; said spacing means including a crank and a servo means operatively connected to a first end of said crank; said servo means having an input and an output; said doctor means being mounted on a second end of said crank; means operatively connecting said servo means to said gluing roll in a manner whereby said servo means input is indicative of said gluing roll speed and said servo means output is effective to position said crank and thereby vary the spacing between said gluing roll and said doctor means as a direct function of the rotational speed of said gluing roll.

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8. The gluing device as set forth in claim 7 also including a cam operatively connected at the output of said servo means to be positioned thereby and a follower wheel secured to the first end of the crank; biasing means urging said follower wheel toward said cam whereby said crank assumes a position dictated by the position of said cam.

9. A gluing device comprising a rotatably mounted gluing roll, a doctor means, and a spacing means; said doctor means being pivotally mounted on an axis parallel to the axis of rotation of said gluing roll; said doctor means being positioned in closely spaced relationship to said gluing roll; said spacing means being operatively connected to both said gluing roll and said doctor means; said spacing means being constructed to vary the spacing between said doctor means and said gluing roll as a direct function of the rotational speed of said gluing roll.

10. An automatic gluing machine for transforming flat box blanks into folded boxes; said machine including a blank conveyor means, a variable speed drive and a gluing device; said gluing device comprising a gluing roll, a doctor means, and a spacing means; said gluing roll being rotatably mounted in the path of said box blanks; said doctor means being pivotally mounted on an axis parallel to the axis of rotation of said gluing roll; said doctor means being positioned in closely spaced relationship to said gluing roll; said blank conveyor means and said gluing roll being operatively connected to said variable speed drive so that the rotational speed of said gluing roll varies directly with the rate of speed at which said blanks are being fed through said machine; said spacing means being operatively connected to both said variable speed drive and said doctor means; said spacing means being constructed to vary the spacing between said gluing roll and said doctor means as a direct function of the rotational speed of said gluing roll.

11. In an automatic machine for applying at least one liner sheet to a corrugated sheet; said machine including a variable speed drive and a gluing device; said gluing device comprising a gluing roll, a doctor means and a spacing means; said gluing means being rotatably mounted in the path of the corrugated sheet so as to contact the crowns thereof; said doctor means being pivotally mounted on an axis parallel to the axis of rotation of said gluing roll; said doctor means being positioned in closely spaced relationship to said gluing roll; said gluing roll being operatively connected to said variable speed drive so that the rotational speed of said gluing roll varies directly with the rate of speed at which said sheets are passing through said automatic machine; said spacing means being operatively connected to both said variable speed drive and said doctor means; said spacing means being constructed to vary the spacing between said gluing roll and said doctor means as a direct function of the rotational speed of said gluing roll.

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