May 2, 1961 A. F. SHIELDS 2,982,189

POWER DRIVEN ADJUSTING MEANS FOR SLOTTING, SCORING, CREASING AND SLITTING MACHINE

Filed Sept. 6, 1957 5 Sheets-Sheet 1

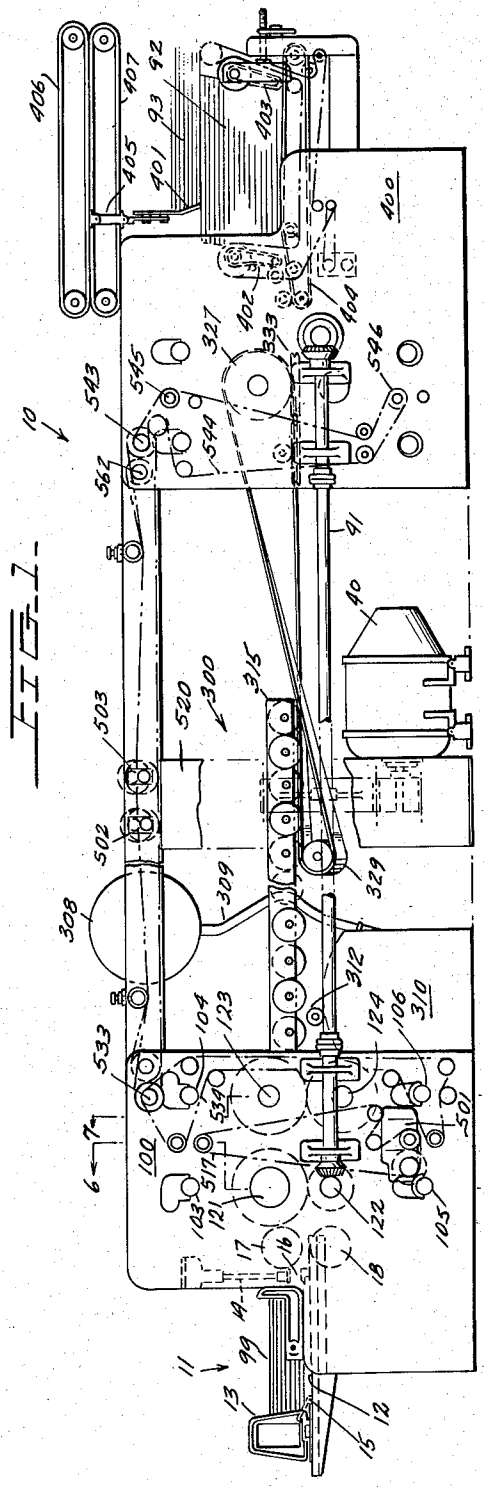

FIG. 1

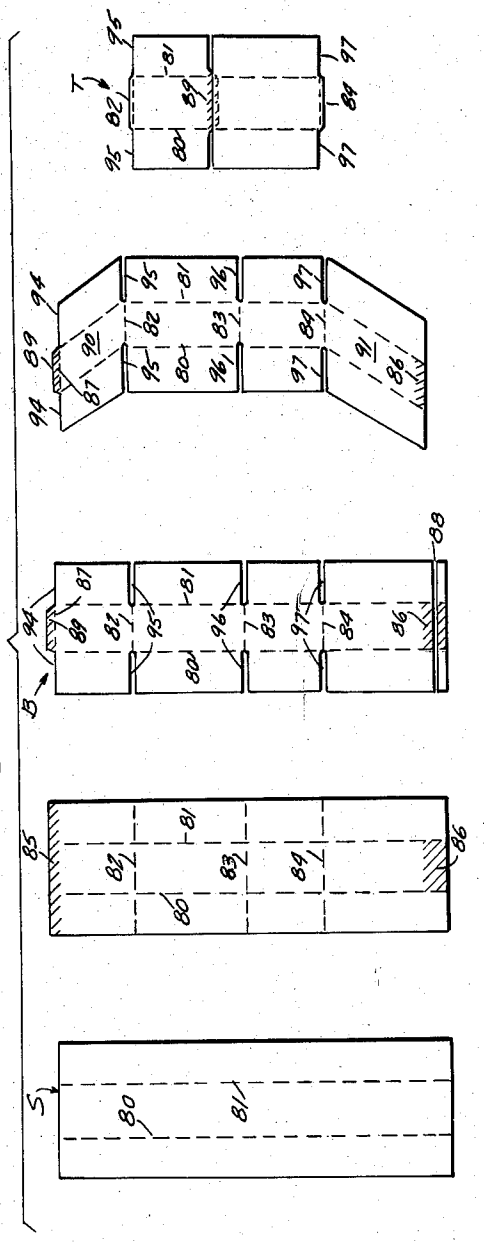

FIG. 2

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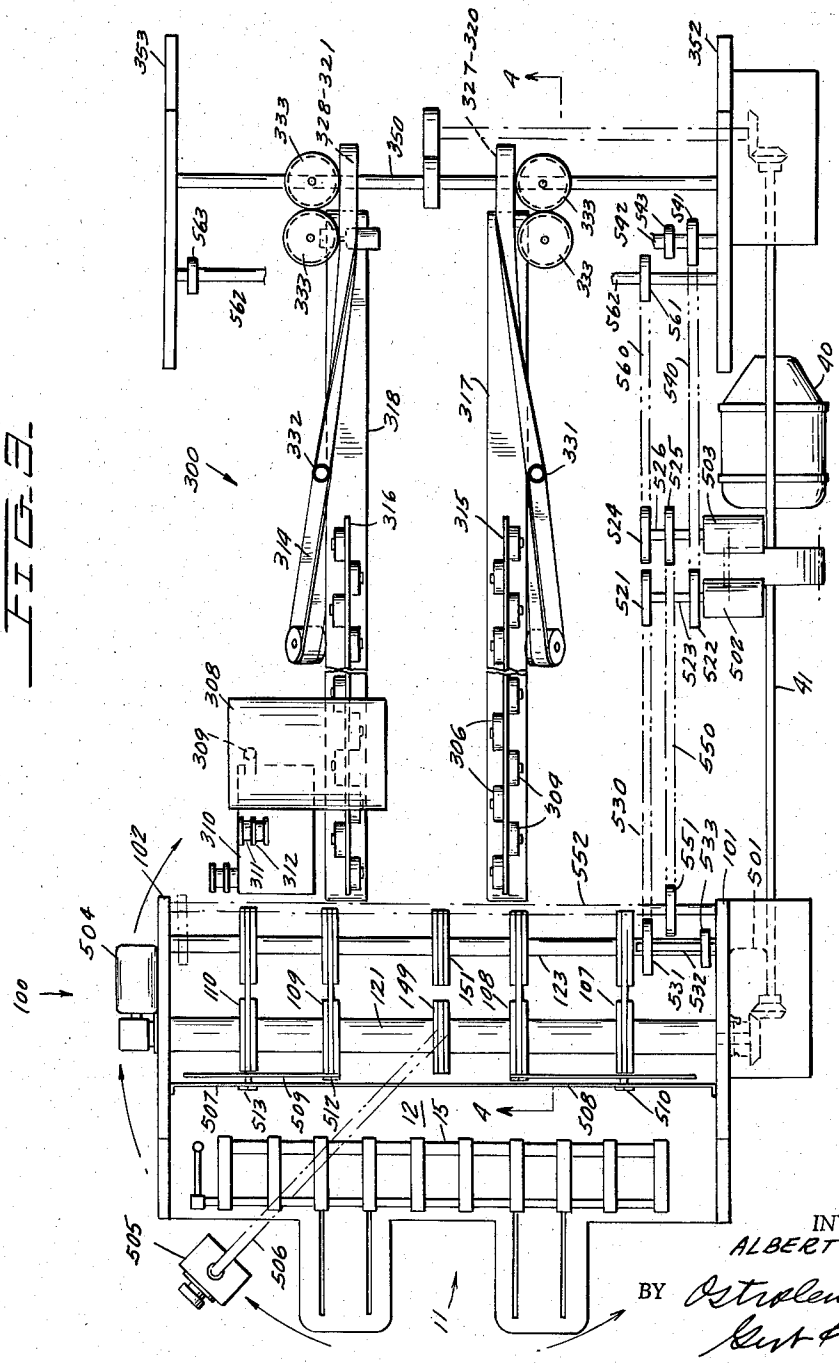
FIG. 3.



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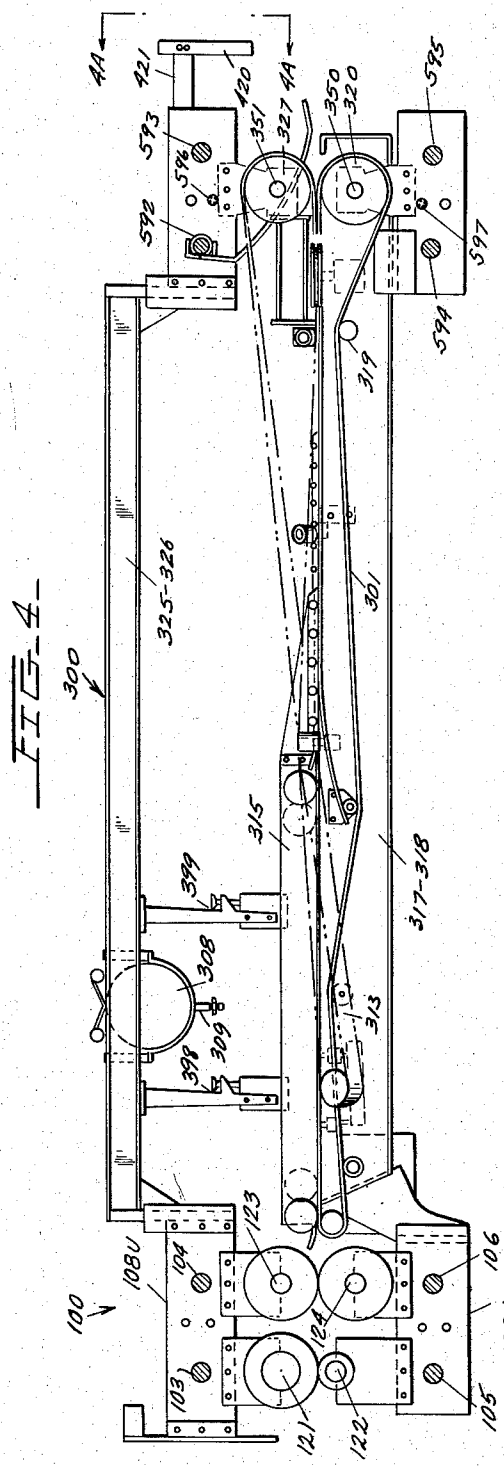

FIG. 4

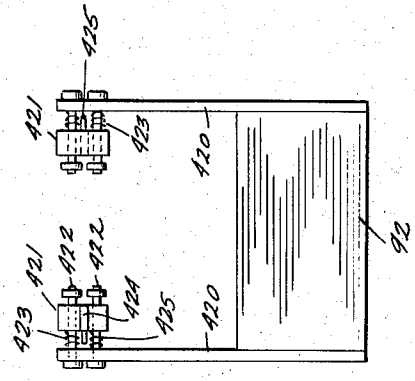

FIG. 4A

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FIG. 5.

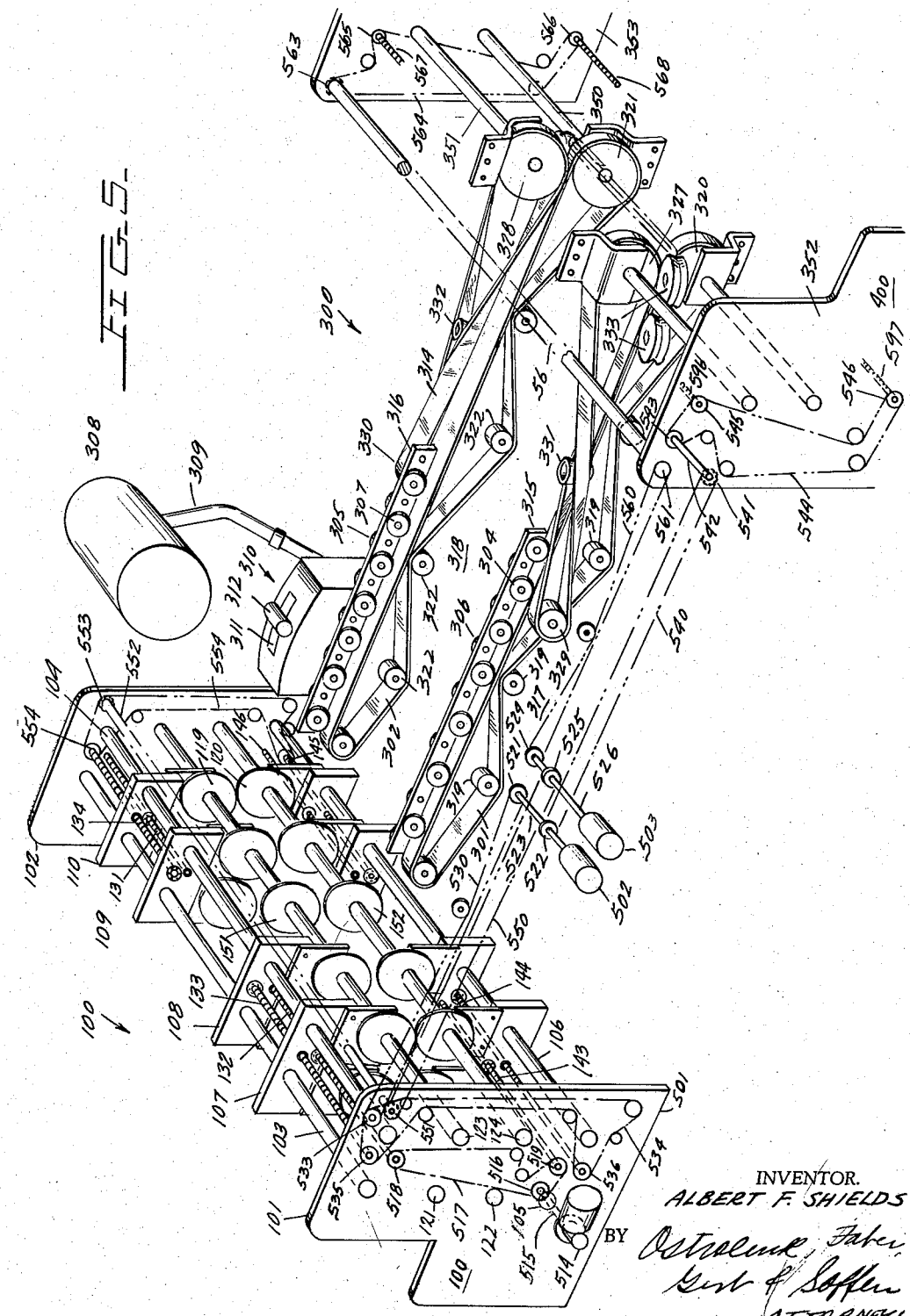

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FIG. 7.

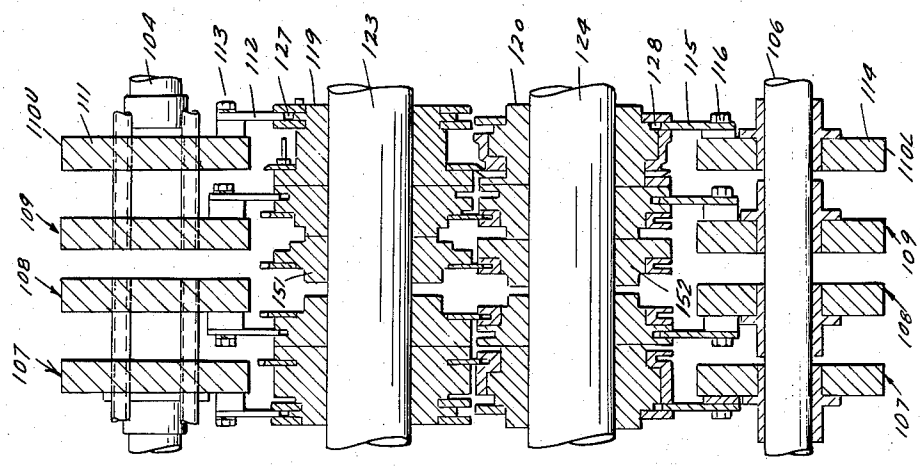
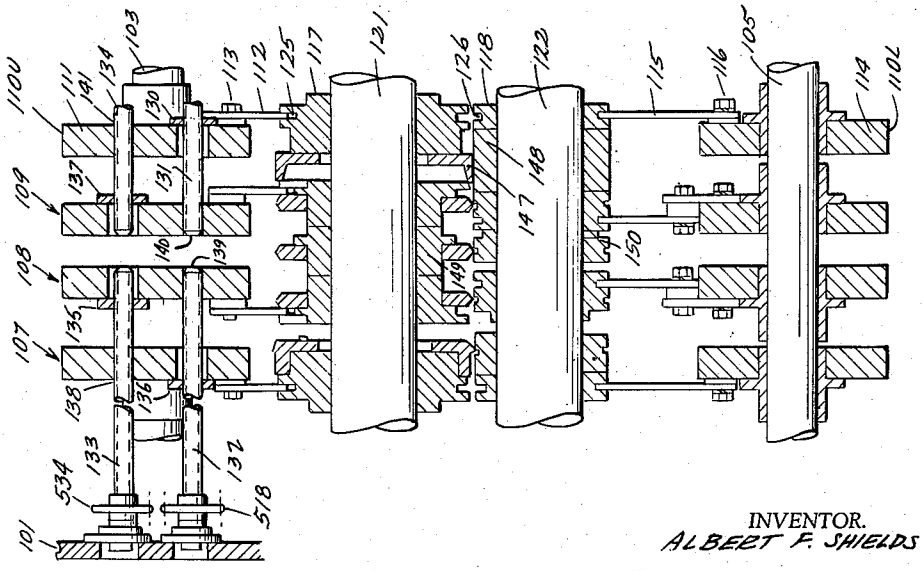


FIG. 6.



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United States Patent Office 2,982,189 Patented May 2, 1961

2,982,189

POWER DRIVEN ADJUSTING MEANS FOR SLOTTING, SCORING, CREASING AND SLITTING MACHINE

Albert F. Shields, Forest Hills, N.Y., assignor to S & S Corrugated Paper Machinery Co., Inc., Brooklyn, N.Y., a corporation of New York

Filed Sept. 6, 1957, Ser. No. 682,443

5 Claims. (Cl. 93—49)

This invention relates generally to automatic machinery which is adapted to receive corrugated blanks having score lines parallel to the leading edges thereof, and issue forth stacks containing a predetermined number of folded tubular boxes. More particularly, this invention relates to motor driven means whereby the machinery may readily be laterally adjusted to operate on blanks of various sizes.

Heretofore, a considerable problem has arisen in combining automatic machinery which included a blank cutting section, wherein blanks were slit, scored, slotted and crushed, with an automatic box folding section. A long period of time was required for setup even when a blank cutting section was operated separately since an individual hand adjustment was required to move each head laterally with respect to the feed path. The hand adjustments could only be accomplished with great inconvenience by an operator who was required to crawl between the closely spaced members of the machine and, after having assumed an awkward position, impart a precise amount of movement to a heavy cutting head. When the feedout end of a blank cutting section is connected to the feed-in end of a folding section, the hand adjustment of the cutting heads become an almost impossible task. Further, in the combined machine the setup or changeover adjustments of the folding section are rendered more difficult than they were when the folding machine is operated individually.

The present invention provides motor operated means whereby four carriers, each having at least one set of cutting heads of a blank cutting section rotatably mounted thereon, may each be individualy adjusted. Simultaneous with the adjustments of two of the carriers, an automatic gluing and folding section, fed by the cutting section, is also automatically adjusted as are the safety side gauges of the stacking section fed by the gluing and folding section.

Positioned between the center carriers are at least one set of longitudinally aligned cutting heads which are secured against lateral movement. The four carriers and sets of heads mounted thereto may be individually adjusted laterally while the operator stands in a convenient position where he can directly view the position of the cutting heads or else view these heads remotely by referring to a conveniently located scale having individual pointers for each carrier associated therewith. When the cutting heads have been properly positioned laterally the operator is assured that the folding and stacking sections are also in the correct lateral positions since their adjustments automatically accompany those of the cutting heads. The circumferential adjustment, when required, of the relatively lightweight knife segments are the only hand adjustments necessary.

For speed of operation as well as reliability, I prefer to use a folding section having folding belts. Since a folding section of this type extends for a considerable longitudinal distance, in order to apply the panel folds gradually, it is desirable to provide positive adjusting means at both ends to assure parallelism between the

longitudinal frame members. To this end I provide a pair of sprocket wheels mounted on a common shaft which is positioned approximately midway between the ends of the folding sections. A first chain, connected to one sprocket wheel, extends toward one end of the folding section while a second chain, connected to the other sprocket wheel, extends toward the other end of the folding section. In this manner both ends of the folding section are moved exactly the same distance. The split chain arrangement, in large measure, eliminates chain sag which is characteristic of long chains and thereby prevents a tooth on the sprocket wheels from jumping a chain link.

Thus, a primary object of the instant invention is the provision of motor driven means for the lateral adjustment of the slitting, scoring, slotting, and crushing heads of a blank cutting section thereby appreciably reducing setup time.

Another object is to provide automatic corrugated box machinery including coordinated cutting, folding and stacking sections wherein the lateral adjustments of all three sections take place simultaneously.

Still another object is to provide automatic box machinery adapted to receive unslotted blanks and issue stacks containing a predetermined number of folded tubular boxes with the blank moving through the cutting and folding sections in a continuous motion.

A further object is to provide a cutting section in which the cutting heads thereof are secured to laterally adjustable carriers with each carrier being movable by means of a motor driven lead screw in engagement with a nut secured to the carrier.

A still further object is to provide a split chain for the coordinated lateral adjustment of both ends of the folding section.

These as well as other objects of the instant invention shall become readily apparent after reading the following description of the accompanying drawings in which:

Figure 1 is a side elevation of the automatic corrugated box machinery of the instant invention.

Figure 2 is a plan view illustrating the condition of the entering sheet as various operations are performed thereon until the blank emerges as a folded tubular box.

Figure 3 is a plan view of the feeding, cutting, and gluing, folding sections of the automatic machinery of Figure 1.

Figure 4 is a section taken through line 4—4 of Figure 3 looking in the direction of the arrows 4—4.

Figure 4A is a section taken through line 4A—4A of Figure 4 and looking in the direction of the arrows 4A—4A.

Figure 5 is a perspective view of the cutting and gluing, folding sections of the automatic machinery of Figure 1.

Figure 6 is a section taken through line 6—6 of Figure 1 looking in the direction of the arrows 6—6.

Figure 7 is a section taken through line 7—7 of Figure 1 looking in the direction of the arrows 7—7.

Referring to the figures and more particularly to Figures 1 and 2, my automatic box machine 10 comprises a feed-in section 11 adapted to feed individual sheets S of cardboard or corrugated board, merely having transverse score lines 80, 81 thereon, from stack 99 into cutting section 100. A first group of laterally aligned cutting heads of cutting section 100 simultaneonsly applied longitudinal score lines 82—84 and crushes areas 85, 86 of sheet S. Thereafter, a second group of laterally aligned cutting heads of cutting section 100 slots sheet S at 94—97 and trims at 88 to form box blank B.

Box blank B passes from cutting section 100 to gluing, folding section 300 where glue is applied to crushed flap

89 and panels 90, 91 are folded over with crushed area 86 overlying glued flap 89 thereby forming a folded tubular box T. Folded tubular box T then enters stacking section 400 to become the bottom box T of stack 92 from which pusher 401 removes stack 93 containing a predetermined number of folded tubular boxes T.

Feed-in section 11 comprises a bed 12 whereon stack 99 of sheets S is placed between the rear 13 and front 14 gauges. The bottom blank in the stack fed towards the right by reciprocating feed slats 15 through space 16 below the front gauge 14. Space 16 is so adjusted that it is just high enough to permit one of the sheets S to pass through while holding back the remainder of stack 99. The construction and operation of feed-in section 11 is more fully described in United States Patent No. 2,583,713 assigned to the assignee of the instant invention.

Sheet S is pushed by feed slats 15 through opening 16 between the upper and lower feed rollers 17 and 18, respectively. Feed rollers 17, 18 engage sheet S and drive it forward into cutting section 100 where sheet S is transformed into box blank B.

Cutting secion 100 comprises stationary frame members 101, 102 between which the cutting heads are positioned. Reference to a cutting head throughout this specification is intended to designate a head which performs any one of the operations necessary to transform sheet S into box blank B. That is, a cutting head may perform one or more of the following operations, score, trim, slit, slot and crush.

Support rods 103–106 extend transversely across the feed path of sheet S and are secured at the ends thereof to frame members 101, 102. Carriers 107–110 are slidably mounted on support rods 103–106. Each carrier comprises an upper and a lower part with the upper part being supported (see Fig. 4) by rods 103. 104 and the lower part being supported by rods 105, 106.

Each of the carriers 107–110 is in operative engagement with two sets of cutting heads. The operative connection between carrier 110 and its associated sets of cutting heads will now be described, it being understood that carriers 107–108 are operatively connected to their associated cutting heads in the same manner.

Upper part 110U of carrier 110 comprises a thick plate 111 and a thin plate 112 secured thereto by fasteners 113 while lower part 110L of carrier 110 comprises a thick plate 114 and a thin plate 115 secured thereto by fasteners 116. Cutting heads 117, 118 keyed to drive shafts 121, 122 respectively, form a rear set of cutting heads while cutting heads 119, 120 keyed to drive shafts 123, 124; respectively, form a front set of cutting heads.

Each cutting head 117–120 includes a circumferential guide groove 125–128, respectively, cut therein. Mated with guide grooves 125, 127 is the lower edge of thin plate 112 which has appropriate arcuate cutouts for this purpose. Similarly the upper end of thin plate 112 is mated with guide grooves 126, 128. It should now be apparent that lateral movement of the upper and lower parts of carrier 110 will cause cutting heads 117–120 to move laterally in unison therewith. Similarly the lateral movement of carriers 107–109 will cause their associated cutting heads to move laterally in unison therewith.

Lateral movement of upper carrier 110U (see Fig. 6) is achieved by rotation of lead screw 131 which mates with threaded member 130 secured to thick plate 111. Similarly the lateral movements of the upper parts of carriers 107–109 is achieved by means of lead screws 132–134 which mate with threaded members 135–137, respectively. Clearance holes 138–141, are provided in the upper parts of carriers 107–110, respectively, to prevent interference with lead screws 132–134, 131 respectively. It is apparent that the operative engagement between carrier 170U–110U and their associated cutting heads while making possible their lateral adjustment as a unit will not interfere with the rotation of the cutting heads as drive shafts 121–124 are rotated.

Lateral movement of the lower parts (see Fig. 5) of carrier 107–110 and their associated cutting heads is achieved by means of lead screws 143–146, respectively, mating with appropriately threaded members secured to the respective carriers 107–110. The lateral adjustment of the upper and lower parts of each carrier occurs simultaneously and to the same degree in a manner to be hereinafter described. This assures proper alignment between the cutting blades, quite often segmental blades, and their mating member for each set of cutting heads.

Cutting head 117 includes crushing blade 147 which coacts with anvil 148, included with cutting head 118, to crush sheet S at 85. Score lines 84 and 82 are applied by the rear set of cutting heads associated with carriers 108 and 109, respectively, and area 86 is crushed by the rear set of cutting heads associated with carrier 107. Score line 83 is applied by cutting heads 149, 150 which are keyed to drive shafts 121, 122, respectively, for rotation thereby. Cutting heads 149, 150 may also be secured to drive shafts 121, 122 in a suitable manner to prevent axial movement therebetween.

Slots 95, 97 are applied by the front set of heads associated with carriers 109, 108, respectively, while the front set of cutting heads associated with carrier 107 trims sheet S at 88. Cutting heads 119 and 120 include blade segments to form slots 94 and score line 87. Cutting heads 151, 152 are secured to drive shafts 123, 124, respectively, in a manner which prevents relative movement therebetween. Heads 151, 152 apply slots 96 to sheet S.

Referring particularly to Fig. 3, box blank B is ejected from cutting section 100 and engaged by moving conveyor belts 301, 302 beneath sets of rollers 304–307. Glue stored in drum 308 is fed through tube 309 to glue applying means 310 where gluing roller 311 applies glue to flap 89 as it is backed up by roller 312. Thereafter, blank B is engaged by moving folding belts 313, 314 which gradually fold blank B along score lines 97 and 95, respectively, until crushed area 86 is in contact with glued flap 89. Roller sets 304 and 305 assist folding belts 313, 314 as they initially engage blank B, to produce the folds along score lines 97 and 95.

Roller sets 304, 306 are mounted to member 315 which depends from upper longitudinal frame member 325 by means of adjustable extensions 398, 399. Upper frame member 325 is in turn secured at one end to upper carrier 108U thereby moving laterally therewith. Similarly roller sets 305, 307 are mounted to member 316 which depends from longitudinal frame member 326 which in turn is secured at one end to upper carrier 109U to move laterally in unison therewith. Adjustable struts (not shown), similar to extensions 398, 399, secure member 316 to upper longitudinal frame member 326. Lower longitudinal frame members 317, 318 are secured to lower carriers 108L, 109L, respectively, to move laterally in unison therewith.

Idler rolls 319, to guide conveyor belt 301, as well as drive roll 320, are mounted on frame member 317. Similarly, idler rolls 322, which guide belt 302, as well as roll 321, from driving belt 302 are mounted on frame 318. Drive rolls 320, 321 are also keyed to drive shaft 350 for rotation therewith, but are movable axially with respect thereto. Stationary frame members 352, 353 support drive shaft 350 at the ends thereof.

Referring particularly to Fig. 3, folding belts 313, 314 are driven by rollers 327, 328 respectively, which are mounted on upper frame members 325, 326 respectively. Each folding belt is twisted so that the surfaces thereof that contact driving rollers 327, 328 do not contact idler rolls 329, 330, respectively, which are mounted to lower frame members 317, 318, respectively. Folding belts 313, 314 also follow a path defined by conical idlers 331, 332, respectively, which are mounted to lower frame members 317, 318. Drive rolls 327, 328 are keyed to drive shaft

351 for rotation therewith, but are movable axially with respect thereto. Stationary frame members 352, 353 support drive shaft 351 at the ends thereof. Straightening rolls 333, secured to lower frame members 317, 318, serve to bring the fold lines into parallelism so that a perfect box will be formed from the folded tubular box T.

The folded tubular box T is passed from gluing, folding section section 300 to stacking section 400 where folded box T is received by conveyor 404 and passed between vertically moving belts 402, 403 which convey folded box T upward to the underside of stack 92. Pusher 401, secured to assembly 405 traveling on overhead chains 406, 407 periodically removes a stack 93 having a predetermined number of folded tubular boxes T, from the top of stack 92 and passes stack 93 to a conveyor for bundling. Stacking section 400 is described in detail in my copending application Serial No. 645,801, filed March 13, 1957 (S–112) and assigned to the assignee of the instant invention.

Safety side gauges 420 (Figures 4 and 4A) extend downwardly on each side of stack 92, from horizontal members 421 secured to each of the upper longitudinal frame members 325, 326. Fasteners 422, loosely secure side gauges 420 to horizontal members 421. Partially compressed coil springs 423 surround fasteners 422 and are interposed between side gauges 420 and horizontal members 421.

Normally closed switch 424, having plunger 425, is mounted on each horizontal member 421. When side gauge 420 is deflected from its normally vertical position by the tipping of stack 92 caused by a jamming of stacking section 400, plunger 425 is engaged by side gauge 420 and depressed thereby to open switch 424. The contacts (not shown) of switch 424 are in the main power lines feeding variable speed drive motor 40. Interruption of power thereto will cause the automatic machinery 10 to come to a halt.

Drive motor 40 is operatively connected to main drive shaft 41 which extends from one set of stationary frame members 101, 102 to the other set 352, 353. Through appropriate gearing and chain connections, well known in the art, driving power necessary to convey blanks B through automatic machinery 10 is supplied to the various sections thereof 11, 100, 300, 400 so that the blanks B move therethrough with a continuous movement.

Having hereinbefore described the operation of the cutting 110, gluing, folding 300 and stacking 400 sections of machine 10 as these sections transform sheet S into stacks 93 of tubular folded blanks T, the lateral adjustments of these sections shall now be described.

Referring particularly to Fig. 3, each carrier 107–110 is power driven for lateral adjustment of their associated cutting heads by means of individual motors 501–504, respectively, which are selectively controllable from control panel 505. Control panel 505 is mounted on the end of swivel pendant 506 to readily permit the operator to directly view the cutting heads as they are being adjusted or else view a remote position indicating means. The indicating means comprises a fixed scale 507 and two movable scales 508, 509. Scale 507 is secured to stationary frame members 101, 102 while scales 508, 509 are secured to upper carriers 108, 109, respectively, and move laterally in unison therewith. Pointers 510–513 extend from carriers 107–110 and are positioned in front of the scale faces to indicate the positions of the cutting heads associated with the respective carriers.

Referring particularly to Fig. 5, motor 501 is operatively connected through gear box 514 to stub shaft 515 journalled in stationary frame member 101. Sprocket wheel 516 is mounted on stub shaft 515 and drives chain 517. Chain 517 drives sprocket wheels 518, 519 which are secured to lead screws 132, 143, respectively. Since lead screws 132, 143 have the same pitch and the sprocket wheels 518, 519 mounted thereto have the same number of teeth, both the upper and lower parts of carrier 107 will move the same lateral distance as motor 501 is operated.

In a similar manner, motor 504 is operatively connected to a stub shaft and driving sprocket wheel (not shown) supported by stationary frame member 102. This sprocket drives a chain (not shown) which is in operative engagement with sprocket wheels mounted on lead screws 131 and 146 to impart the identical degree of rotation to each screw 131, 146. This will cause both the upper and lower parts of carrier 110 to move the same lateral distance and carry with them their associated cutting heads. Glue applying means 310 is secured to lower carrier 110L, in any suitable manner, so that gluing roller 311 will automatically be in position to engage flap 89.

Referring particularly to Fig. 1, motors 502, 503 are mounted in an elevated position atop tower 520. Sprocket wheels 521 and 522 are both keyed to motor shaft 523 while sprocket wheels 524 and 525 are both keyed to motor shaft 526.

Chain 530 is driven by sprocket wheel 521 and in turn drives sprocket wheel 531 which is keyed to shaft 532 secured to stationary support member 101. Sprocket wheel 533 is also keyed to shaft 532 and drives chain 534. Chain 534 is in engagement with sprocket wheels 535, 536 which are keyed to lead screws 133, 144, respectively. It is now apparent that rotation of motor 502 will cause rotation of lead screws 133, 144 which in turn will bring about equal lateral movements of the upper and lower parts of carrier 108. Since the left ends (with respect to Figure 3) of longitudinal frame members 317 and 325 are secured to carrier 108 the left ends of frame members 317, 325 will automatically receive the proper lateral adjustment.

However (Figs. 3 and 4), longitudinal frame members 317, 325 are very long so that lateral movement of one end thereof will not necessarily be accompanied by an equal lateral movement of the other end. Therefore, chain 540 extends to the right and is driven by sprocket wheel 522. Chain 540 in turn engages and drives sprocket wheel 541 which is keyed to stub shaft 542 mounted on stationary frame member 352. Sprocket wheel 543 is also keyed to shaft 542 and drives chain 544 which in turn drives sprocket wheels 545, 546 (Fig. 1). Sprocket wheels 545, 546 are keyed to lead screws 596, 597 that are in driving engagement with upper 325 and lower 317 longitudinal frame members, respectively. Shafts 392–395, supported at their ends by stationary members 352, 353, support and journal the movement of the right ends of longitudinal frame members 325, 317.

In this manner (Figs. 3 and 4) equal lateral movements of upper 325 and lower 317 longitudinal frame members, as well as equal lateral movements of both ends thereof, is assured. Since one of the safety side gauges 420 is carried by upper longitudinal frame member 325, gauge 420 will be adjusted automatically as carrier 108 is moved laterally.

Similarly sprocket wheel 525 drives chain 550 which engages sprocket wheel 551 keyed to shaft 552 near one end thereof. The ends of shaft 552 are journalled in stationary frame members 101, 102 while sprocket wheel 553 is keyed to shaft 552 near the other end thereof. Chain 554 is driven by sprocket wheel 553 and in turn drives sprocket wheels 554, 555 which are keyed to lead screws 134, 145, respectively. Rotation of motor 503 causes movement of chain 550 which in turn causes rotation of shaft 552, movement of chain 554, rotation of sprocket wheels 554, 555, rotation of lead screws 134, 145 and finally equal lateral movements of the upper and lower parts of carrier 109 and its associated cutting heads.

Since upper and lower longitudinal frame members 326, 318, respectively, are secured to carrier 109 they too will be laterally adjusted at one of their ends. The other ends of longitudinal frame members 326, 318 are posi-

tively moved by means of chain **560** which is driven by sprocket wheel **524**. Chain **560** (Fig. 5) drives sprocket wheel **561** which is keyed to shaft **562** whose ends are journalled in stationary support members **352**, **353**.

Sprocket wheel **563** is also keyed to shaft **562** and drives chain **564** which in turn drives sprockets **565**, **566** keyed to lead screws **567**, **568**, respectively. Lead screws **567**, **568** are operatively engaged (not shown) with upper **326** and lower **318** longitudinal frame members, respectively, for lateral adjustment of the right ends thereof journalled on shafts **592–595**. A safety side gauge **420** (Fig. 4A), being secured to upper longitudinal frame member **326**, will automatically be laterally adjusted as carrier **109** is laterally adjusted.

Thus, I have provided an automatic machine **10** for transforming sheets S into folded tubular boxes T and delivering the boxes in stacks **93**, of a predetermined number. The machine includes cutting **100**, gluing, folding **300**, and stacking **400** sections as well as power driven means for the lateral adjustment of the machine with all sections thereof being automatically adjusted simultaneously.

In the foregoing, the 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 appending claims.

I claim:

1. In an automatic machine for cutting and/or scoring box blanks, a plurality of co-axial, spaced, cutting and/or creasing disks, respective shifting means for shifting said disks axially to effect predetermined spacing therebetween, respective motor means for actuating said shifting means to effect said shifting, and a control device for individually controlling said motor means, said control device being mounted for guided movement relative said disks so that an operator may move said device to various positions in order to conveniently observe spacing adjustments thereof.

2. In an automatic machine as set forth in claim 1, said control device being pivotally mounted to swing in a plane parallel to the axis of said disks.

3. An automatic machine for cutting and scoring box blanks comprising a pair of spaced parallel shafts arranged one above the other and a plurality of disks carried in axially spaced array on said shafts, wherein the disks of one shaft are aligned with respective disks of the other shaft to effect pairs of coacting disks for predetermined cutting and/or scoring operations; support means for supporting said shafts in rotative positions; individual upper and lower carrier elements for shiftably effecting lateral predetermined spacing between respective disks of each shaft, said carrier elements having tongues, said disks having grooved hubs into which said tongues protrude whereby shifting of said carrier elements effects shifting of respective disks, said carrier elements being disposed in vertical pairs, one of each pair of said elements being arranged above a respective disk on said upper shaft and the other of said each pair of carrier elements being arranged below the respective co-acting disk on said lower shaft, upper and lower support rods supporting upper and lower carrier elements, and means for effecting lateral shifting of said carrier elements comprising members engaging respective carrier elements, whereupon actuation of said members effects shifting of respective carrier elements to effect shifting of respective cutting disks; a plurality of respective motor means mechanically coupled for actuating "simultaneously" respective members, whereby each pair of co-acting disks on said shafts is simultaneously shifted, means for controlling said motors, means comprising a control panel disposed outwardly of said machine, pivotal support means carrying said control panel, said control panel being arcuately movable from one end to the other of said shafts and having an arcuate traverse of at least 180°.

4. An integrated automatic machine including a first section for cutting and/or scoring box blanks and a second section for receiving and folding blanks issuing from said first section; said first section comprising a plurality of co-axial, spaced, cutting and/or creasing disks, respective shifting means for actuating said shifting means to effect said shifting; said second section including first and second longitudinally extending frame sections mounted for movement toward and away from each other; a pair of chains associated with each of said frame sections; a sprocket individual to each of said chains; said sprockets arranged in pairs with each pair of sprockets mounted to a common shaft operatively positioned at an intermediate point between the ends of said frame sections; one of the chains of each pair extending toward one end of its associated frame section and the other chain of each pair extending toward the other end of its associated frame section; a control device for individually controlling said motor means, said control device being mounted for guided movement relative to said disks so that an operator may move said device to various positions in order to conveniently observe spacing adjustments thereof; each of said pairs of sprockets being driven by respective ones of said motor means whereby spacing adjustments of said frame sections occur simultaneously with spacing adjustments of a first and a second of said disks.

5. The automatic machine as set forth in claim 4 also including a third section for receiving and stacking blanks issuing from the second section; said third section including side gauges connected to the frame sections for movement therewith as spacing adjustments are made thereto.

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