United States Patent [19]

Flaum

[11] **3,913,464**

[45] **Oct. 21, 1975**

[54] **POSITIONING MEANS FOR HOLD-DOWN**

[75] Inventor: **Stephen S. Flaum**, New York, N.Y.

[73] Assignee: **S&S Corrugated Paper Machinery Co., Inc.**, Brooklyn, N.Y.

[22] Filed: **Nov. 22, 1974**

[21] Appl. No.: **526,394**

[52] **U.S. Cl.** ..... **93/36.3;** 93/49 R; 93/93 R

[51] **Int. Cl.²** **B31B 3/74;** B31B 1/98

[58] **Field of Search** ..... 93/49 R, 52 R, 36 R, 93 R, 93/94 PS, 93 DP, 36.3; 83/499, 501, 502, 504; 214/6 H, 6 S, 6 F; 53/387

[56] **References Cited**

UNITED STATES PATENTS

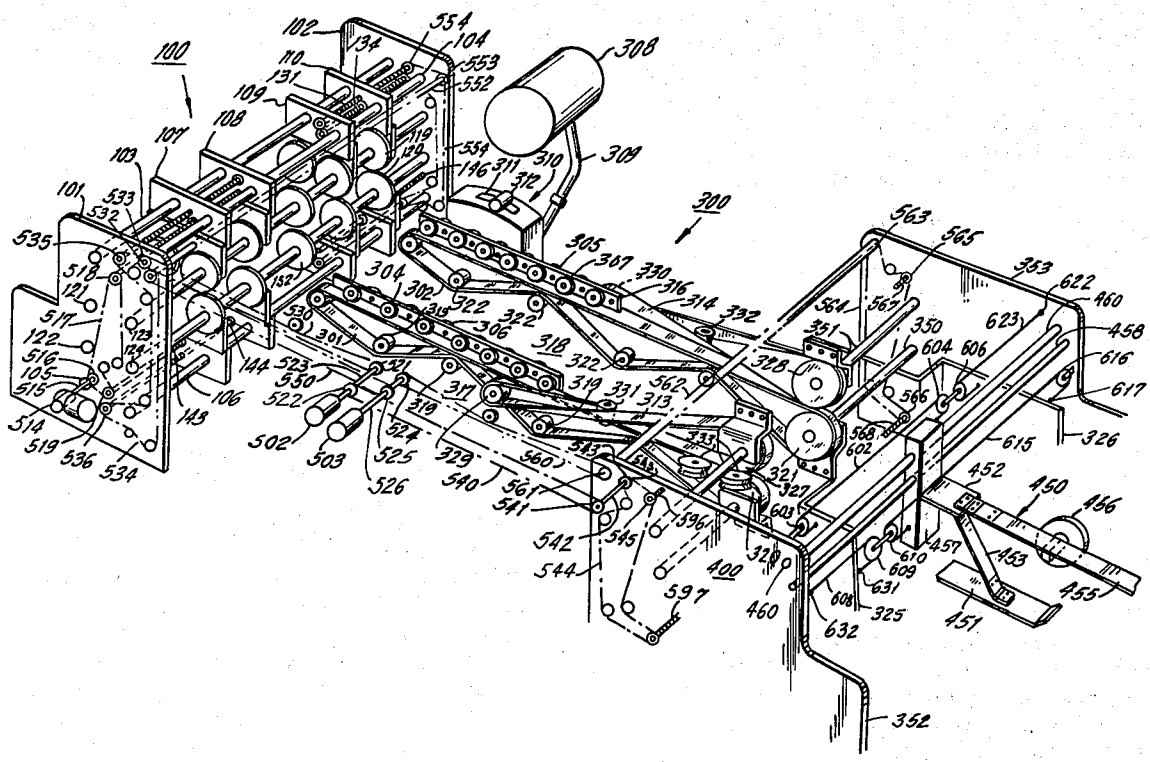
2,440,158	4/1948	Sly	83/504 X
3,601,265	8/1971	Shields	271/198 X
3,618,479	11/1971	Shields	93/36.3
3,648,605	3/1972	Hottendorf	93/49 R X

Primary Examiner—Roy Lake
Assistant Examiner—James F. Coan
Attorney, Agent, or Firm—Ostrolenk, Faber, Gerb & Soffen

[57] **ABSTRACT**

Apparatus for producing a folded tubular box from a box blank is provided with power driven means for adjusting the folding elements to operate on different size box panels. As the tubular boxes are produced, they are underfed into a stack and periodically a pile of boxes at the top of the stack is removed. While the boxes are in the stack, a hold-down means provides a downward force on the glue joint region connecting the inwardly folded panels of the box. A cable system interconnects the hold-down means with the power driven means for adjusting the folding sections so that as the apparatus is adjusted for different size boxes, the hold-down means is automatically positioned to apply a downward pressure at the joint region.

8 Claims, 4 Drawing Figures



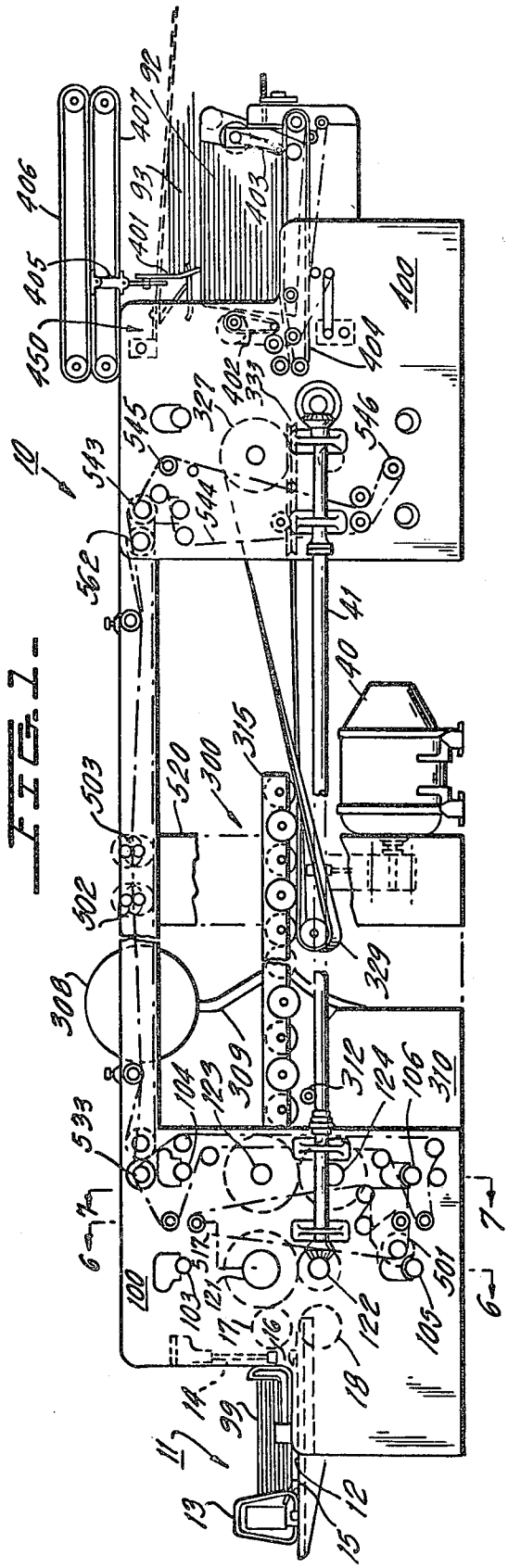


FIG. 1

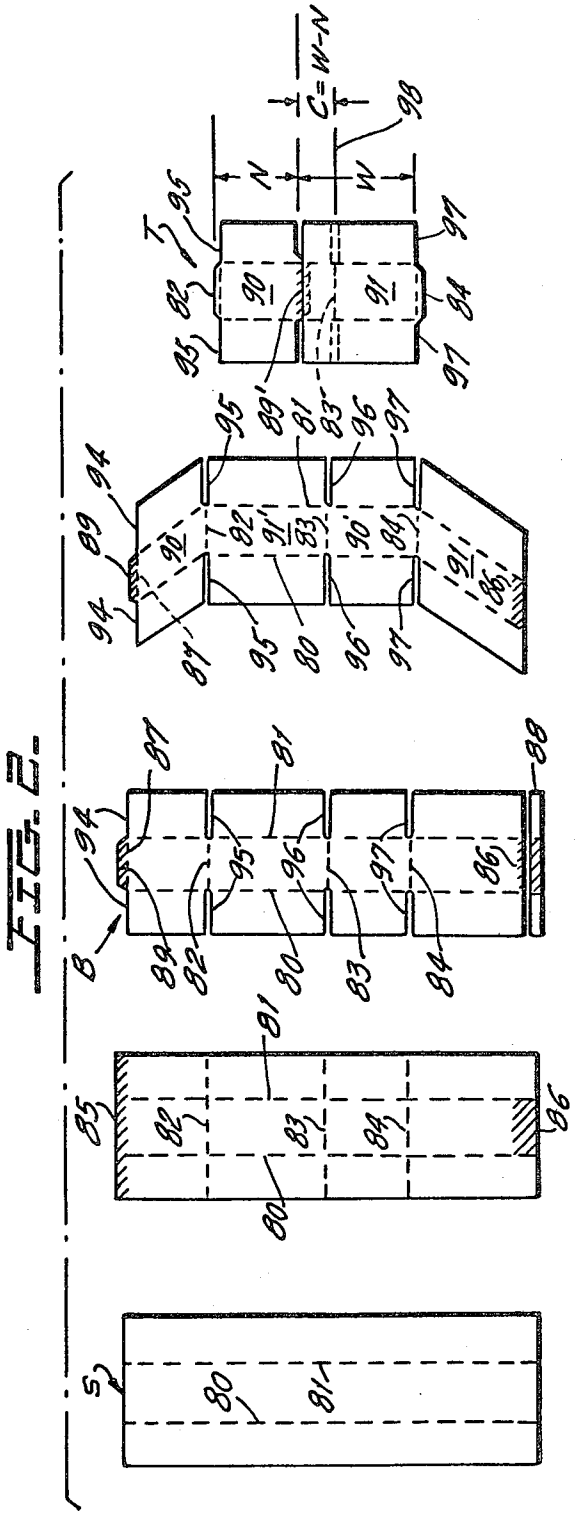


FIG. 2

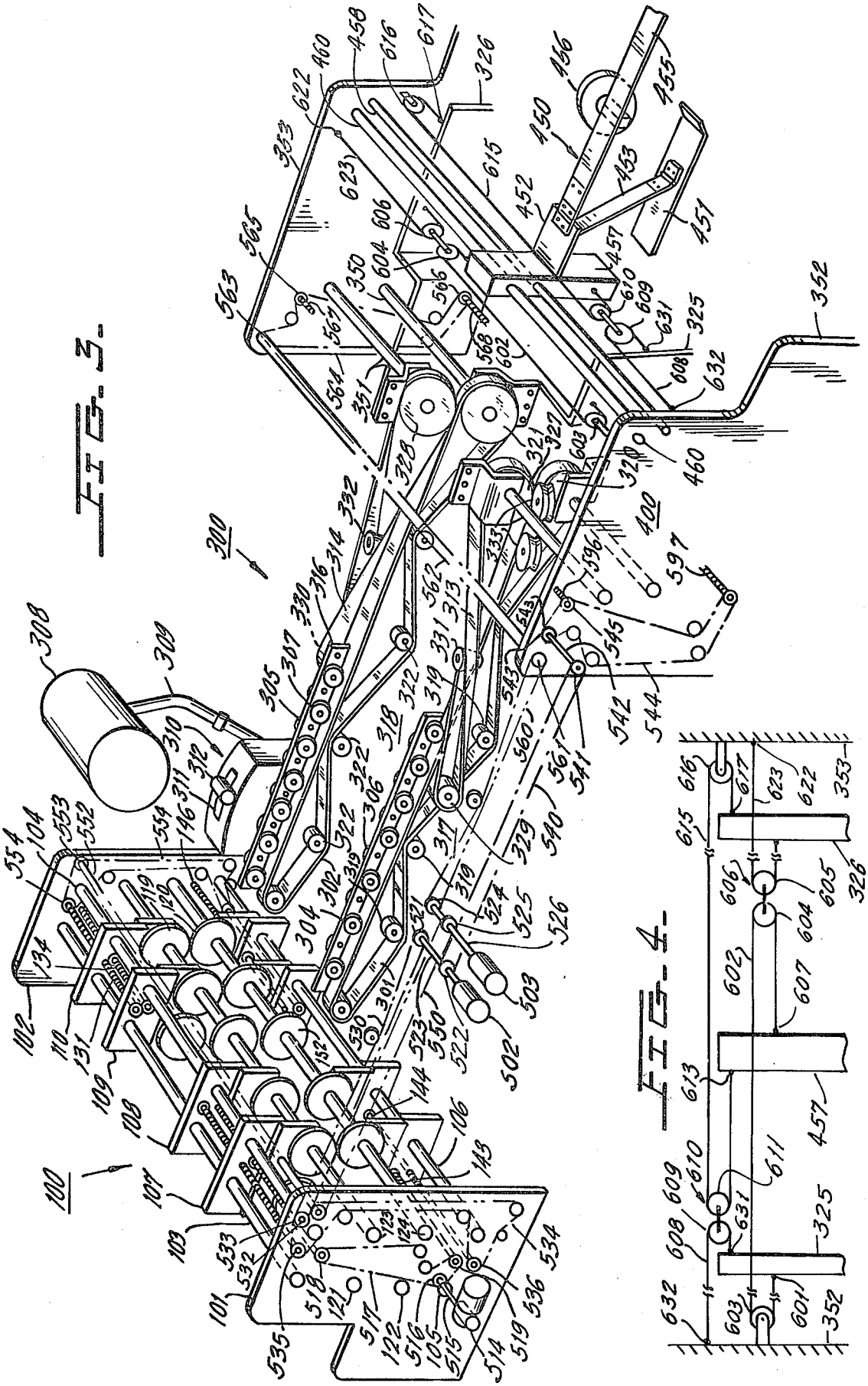


FIG. 3.

FIG. 4.

POSITIONING MEANS FOR HOLD-DOWN

This invention relates to box making apparatus in general, and in particular relates to economical means for automatically positioning a hold-down means over the joint region of a folded tubular box as the apparatus is adjusted for different size boxes.

In the A. F. Shields U.S. Pat. No. 2,982,189 issued May 2, 1961, for a Power Driven Adjusting Means For Slotting, Scoring, Creasing, and Slitting Machine, there is disclosed box making apparatus which transforms box blanks into folded tubular boxes and delivers these boxes in piles containing a predetermined number of boxes. The transformation from box blank to folded tubular box requires that outboard panels of the blank be inwardly folded to positions where the outboard or free edges of the blank are positioned at a joint region where they are connected by taping or by direct gluing.

In order to be able to produce different size boxes the panel folding sections are laterally adjustable by power driven means. In the stacking and delivery section, there is a holddown means which must be maintained in position to apply a downward force against the box at the joint region thereof. Since the folded panels are usually of different widths the position of the joint region changes for different size boxes. Thus, positioning of the folding sections requires repositioning of the hold-down means.

When the operator is adjusting the folding sections, he is located at a position very remote from the hold-down means which is located in the stacking and delivery section. At this time the operator's view of the hold-down means is usually obscured and/or the operator's concentration on adjusting the folding sections causes him to temporarily forget the existence of the hold-down means. Due to the foregoing circumstances, it often happens that the power driven movable frame, carrying a folding section, engages and thereby damages the hold-down means. Even when the hold-down means is not damaged, the operator must go to the opposite end of the apparatus and reposition the hold-down means.

To eliminate this problem and effort, the prior art as exemplified by the A. F. Shields U.S. Pat. No. 3,618,479 for an Automatic Positioner For Hold-Down Means utilizes a differential gearing unit which provides driving mechanical connections between the hold-down means and the folding sections so that as the folding sections are adjusted the position of the hold-down means is automatically adjusted in a manner such that it will not be damaged by the moving frame sections and the hold-down means remains in the proper position to exert downward forces at the joints of the folded tubular boxes. Unfortunately, the differential gearing and related elements are relatively expensive. Thus, as will hereinafter be seen, the instant invention utilizes a relatively inexpensive cable system to replace the differential gearing system of the aforesaid U.S. Pat. No. 3,618,479 for automatically positioning the hold-down means.

Accordingly, a primary object of the instant invention is to provide novel means for automatically positioning the hold-down means of a stacking and delivery section at the feed-out end of box making apparatus.

Another object is to provide novel and relatively inexpensive means interconnecting the hold-down means with the folding sections so that the position of the hold-down means is automatically adjusted as the positions of the folding sections are adjusted.

Still another object is to provide a cable system which drivingly interconnects power adjusted folding sections to automatically power adjust the hold-down means.

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

FIG. 1 is a side elevation of box making apparatus constructed in accordance with teachings of the instant invention.

FIG. 2 is a plan view illustrating the changes in the condition of the entering blank as various operations are performed thereon until such blank emerges as a folded tubular box.

FIG. 3 is a perspective of the cutting section, gluing section, folding section, and stacking and delivery sections of the automatic apparatus.

FIG. 4 is a front elevation of the cable system for automatically positioning the hold-down means.

Now referring to the figures, automatic box making machine **10** comprises 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** simultaneously applies longitudinal score lines **82–84** and crushes areas **85, 86** of sheet S. The term "longitudinal" refers to the direction of blank movement through machine **10.** 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. For details of the heads in cutting section **100** and the head adjusting means, reference is made to the aforesaid U.S. Pat. No. 2,982,189.

Box blank B passes from cutting section **100** to gluing folding section **300** where glue is applied to crushed lap **89** and panels **90, 91** are folded over with crushed area **86** overlying glued lap **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 pile **93** containing a predetermined number of folded tubular boxes T. In stacking section **400,** hold-down means **450** thereof applies a downward force on the top of stack **92** at the joint region where lap **89** overlies panel **91.** For details of hold-down means **450,** reference is made to the A. F. Shields U.S. Pat. No. 3,601,265 for a Blank Stacking, Straightening, and Delivery Means.

Feed-in section **11** comprises bed **12,** whereon stack **99** of sheets S is placed between the rear **13** and front **14** gauges. The bottom blank in stack **99** is fed towards the right, by reciprocating feed slat **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.** As sheet S passes through opening **16,** sheet S passes between upper and lower feed rollers **17** and **18,** respectively, which engage sheet S and drive it forward into cutting section **100** where sheet S is transformed into box blank B.

Cutting section **100** comprises stationary frame members **101, 102** between which the cutting heads are positioned. Reference to a cutting head in 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 score, trim, slit, slot and/or crush.

Support rods **103–106** extend transversely across the feed path of sheet S and are secured at the ends thereof to frame stationary 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 by rods **103,** 104 and the lower part being supported by rods **105,** 106. Two sets of cutting heads keyed to drive shafts **121–124** are connected to each of the carriers **107–110** so as to be laterally adjusted therewith.

Movement of the upper parts of carriers **107–109** is achieved by rotating lead screws **132–134** which mate with threaded members (not shown) secured to carriers **107–109.** Similarly, lateral movement of the lower parts 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 to assure proper alignment between the cutting blades, quite often segmental blades, and their mating member for each set of cutting heads.

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 outboard panels **90, 91** of 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 an upper longitudinal frame member (not shown) secured at one end of the upper part of carrier **108,** thereby moving laterally therewith. Similarly roller sets **305, 307** are mounted to another longitudinal frame member (not shown) which in turn is secured at one end of the upper part of carrier **109** 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 the lower parts of carriers **108, 109,** 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** for driving belts **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.

Folding belts **313, 314** are twisted and extend between driving rolls **327, 328** and idler rolls **329, 330,** 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 rollers **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 **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 pile **93,** having a predetermined number of folded tubular boxes T, from the top of stack **92** and passes pile **93** to a conveyor for bundling.

Stack **92** is subjected to a downward force by hold-down means **450,** which applies such force at the joint region where flap **89** of panel **90** is glued to crushed section **86** of panel **91.** Briefly, hold-down means **450** includes lower section **451** pivotally connected to support plate **452** by arm **453.** The upper section includes elongated metal slat **455,** hinged at its rear end to support **452** and carrying roller **456** at a location forward of support plate **452.** The latter is fixedly secured to the lower surface of support block **457,** which is slidably mounted on stabilizing rods **458, 460** that extend between stationary frame members **352** and **353.**

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. Each carrier **107-110** is power driven for lateral adjustment of its associated cutting heads, by means of an individual motor selectively controllable from a control panel located in the region of cutting section **100.** For purposes of explaining the instant invention, the adjustment of movable frame members **107, 110** need not, and will not, be described.

Motors **502, 503** for adjusting movable frame members **108, 109** are mounted in an elevated position on top of 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 a sprocket wheel (not shown) 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.** The longitudinal frame members secured at their left ends to carrier **108** will automatically receive the proper lateral adjustment at their left ends.

However, these longitudinal frame members 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 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 and lower longitudinal frame members 325, 317 extending from carrier 108. Shafts 392–395, supported at their ends by stationary members 352, 353, support and journal the movement of the right ends of these longitudinal frame members. In this manner equal lateral movements of these upper and lower longitudinal frame members, as well as equal lateral movements of both ends thereof, is assured.

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 135, 145, respectively. Rotation of motor 503 causes movement of chain 550 which in turn causes rotation of shaft 552, movement of chains 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 carrier parts 109 carry another set of upper and lower longitudinal frame members 326, 318, they too will be laterally adjusted at one of their ends. The other ends of these longitudinal frame members are positively moved by means of chain 560 which is driven by sprocket wheel 524. Chain 560 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.

Ends 601, 607 of drive cable 602 are anchored, respectively, to upper movable frame 325 and support block 457 of hold-down means 450. Cable 602 passes around guide pulley 603, anchored to stationary frame 352, and also around section 604 of movable pulley or guide means 606. Guide cable 608 passes around one pulley section 609 of movable guide means 610 and is anchored at opposite ends 631, 632 thereof to stationary frame 352 and movable frame 325, respectively. Ends 613, 617 of drive cable 615 are anchored, respectively, to support block 457 and upper movable carrier 326. Cable 615 passes around the other section 611 of movable guide 610 and around pulley 616, anchored to stationary frame 353. Ends 621, 622 of guide cable 623 are anchored, respectively, to movable frame 326 and stationary frame 353 after passing around one pulley section 605 of movable guide means 606.

As will hereinafter be seen, the rotation of folding belt adjusting shafts 542, 562 is effective to automatically operatively position hold-down means 450 so that it always exerts a downward force in the joint region where glued lap 89 engages panel 91. That is, panels 91 and 91′ are of equal widths and panels 90 and 90′ are of equal widths. The width of narrow panel 90 is indicated as being equal to N in the righthandmost illustration of FIG. 2, while the width of wide panel 91 is illustrated as being equal to W. Joint region 89′ is illustrated as being spaced by a distance C from fixed longitudinally extending reference line 98 on which score line 83 always lies. Thus, the distance C equals the difference between the width of panels 90 and 91.

The position of folding belt 313 with respect to reference line 98 is dictated by the position of score line 84, which in turn is dictated by the width N of narrower panel 90′. Similarly, the position of the other folding belt 314 is dictated by the position of score line 82, which in turn is controlled by the width W of the larger panel 91′.

Rotation of shaft 542 to adjust the position of folding belt 313 causes transverse movement of upper movable frame 325. If this movement is to the right with respect to FIG. 4, it will be transmitted directly through drive cable 602 to move support block 457 the same distance to the right. As movable frame 325 moves to the right, moving support block 457 to the right, end 613 of drive cable 604 is permitted to move to the right in that movable guide 611 also moves to the right in that end 631 of guide cable 601 also moves to the right. If movement of movable frame 325 is to the left with respect to FIG. 4, end 631 of guide cable 608 moves to the left, carrying movable guide 611 to the left. This causes end 613 of cable 615 to move to the left, carrying block 457 to the left. Cable 602 moves clockwise so that slack does not develop in any of the cables in the system. Similar operations occur when upper movable frame 326 is adjusted transversely through the rotation of shaft 562.

Although there have been described preferred embodiments of this novel invention, many variations and modifications will now be apparent to those skilled in the art. Therefore, this invention is to be limited not by the specific disclosure herein but only by the appending claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. In box making apparatus the combination comprising a first section for transforming box blanks into folded tubular boxes and a second section for forming boxes received from said first section into a stack and periodically removing piles of boxes from the stack; said first section including conveyor means for moving blanks and folded tubular boxes along a feed path extending parallel to a reference line; said first section also including first and second folding portions on opposite sides of said reference line for inwardly folding respective first and second outboard panels of box blanks along first and second score lines thereof to positions where the outboard edges of said blank are in juxtaposition at a joint area; said first and second score lines being parallel to said reference line and being spaced therefrom by first and second distances, respectively; said second section including a hold-down means for applying downward pressure to the stack at the joint region; first and second adjusting means for positioning the respective first and second folding portions transversely in relation to said reference line in accordance with the respective first and second distances; and a cable system connecting both of said folding portions to said hold-down means to move the latter transverse to said reference line to automatically maintain said hold-down means at said joint area as said joint region shifts with changes in said first and second distances.

2. The combination as set forth in claim 1, in which the joint area is spaced from said reference line by a third distance equal to said first distance minus said second distance.

3. The combination as set forth in claim 2, in which the first distance is larger than said second distance and the joint region is between said reference line and said first score line.

4. The combination as set forth in claim 1 in which the cable system includes a first drive cable anchored to said hold-down means and said first folding portion, a first fixed guide for said first drive cable secured to a first stationary area outboard of said first folding portion, a first movable guide for said first drive cable, a second drive cable anchored to said hold-down means and said second folding portion, a second fixed guide for said second drive cable secured to a second stationary area outboard of said second folding portion, a second movable guide for said second drive cable, a first guide cable supporting said first movable guide and anchored to said second folding portion and said second stationary area, and a second guide cable supporting said second movable guide and anchored to said first folding portion and said first stationary area.

5. The combination as set forth in claim 4 in which the first folding portion is disposed between the hold-down means and the first stationary area, said second folding portion being disposed between the hold-down means and the second stationary area.

6. The combination as set forth in claim 5 in which the first movable guide is positioned between the hold-down means and the first folding portion, said second movable guide being positioned between the hold-down means and the second folding portion.

7. The combination as set forth in claim 6, in which the joint area is spaced from said reference line by a third distance equal to said first distance minus said second distance.

8. The combination as set forth in claim 7, in which the first distance is larger than said second distance and the joint region is between said reference line and said first score line.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,913,464 Dated October 21, 1975

Inventor(s) Stephen S. Flaum

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In column 8, line 10 - replace "first" by --second--.

In column 8, line 12 - replace "second" by --first--.

Signed and Sealed this

First Day of March 1977

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks