

[54] FOLDER FOR LARGE BOX BLANKS

2,957,395 10/1960 Meyer..... 93/49 R

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[51] Int. Cl. **B31b 3/26**

[58] Field of Search 93/40, 41, 49, 84,
93/39, 44

[56] **References Cited**

UNITED STATES PATENTS

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[57] **ABSTRACT**

Apparatus for picking up a large size box blank from a stack, feeding it into a folding mechanism which folds one end of the blank along a pre-scored line, and then transferring such partially folded blank to a section where one man can fold the other end of the blank along a pre-scored line and feed the folded blank into a conventional piece of equipment, such as a stitcher or taper, to secure together the end of the blank and form a tube.

8 Claims, 12 Drawing Figures

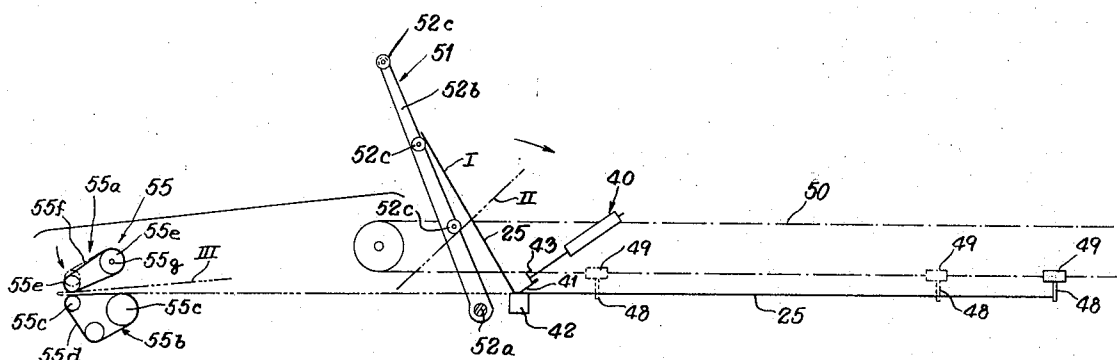


Fig. 1.

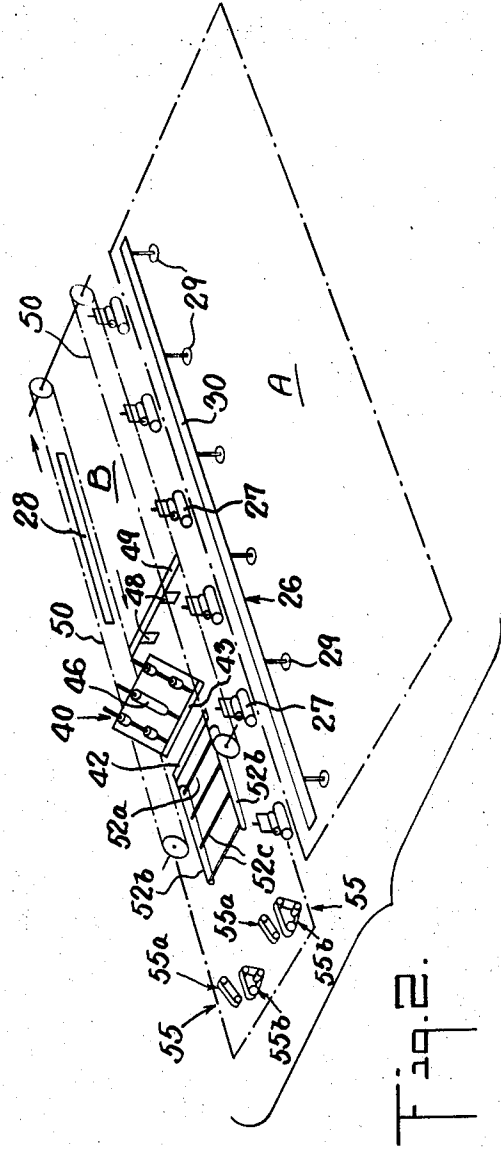
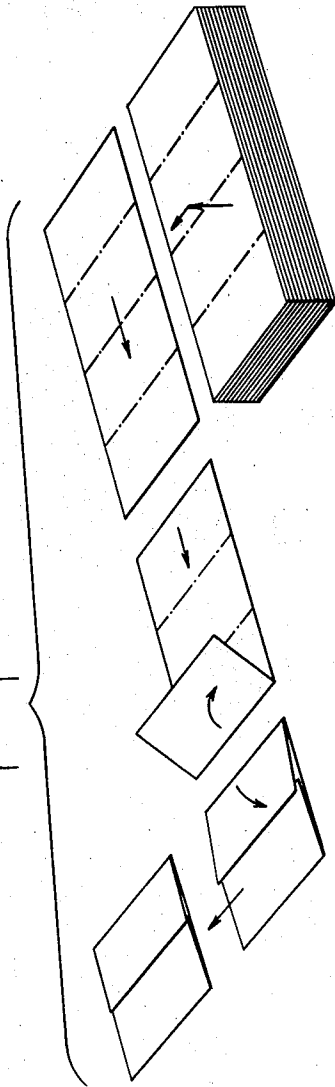
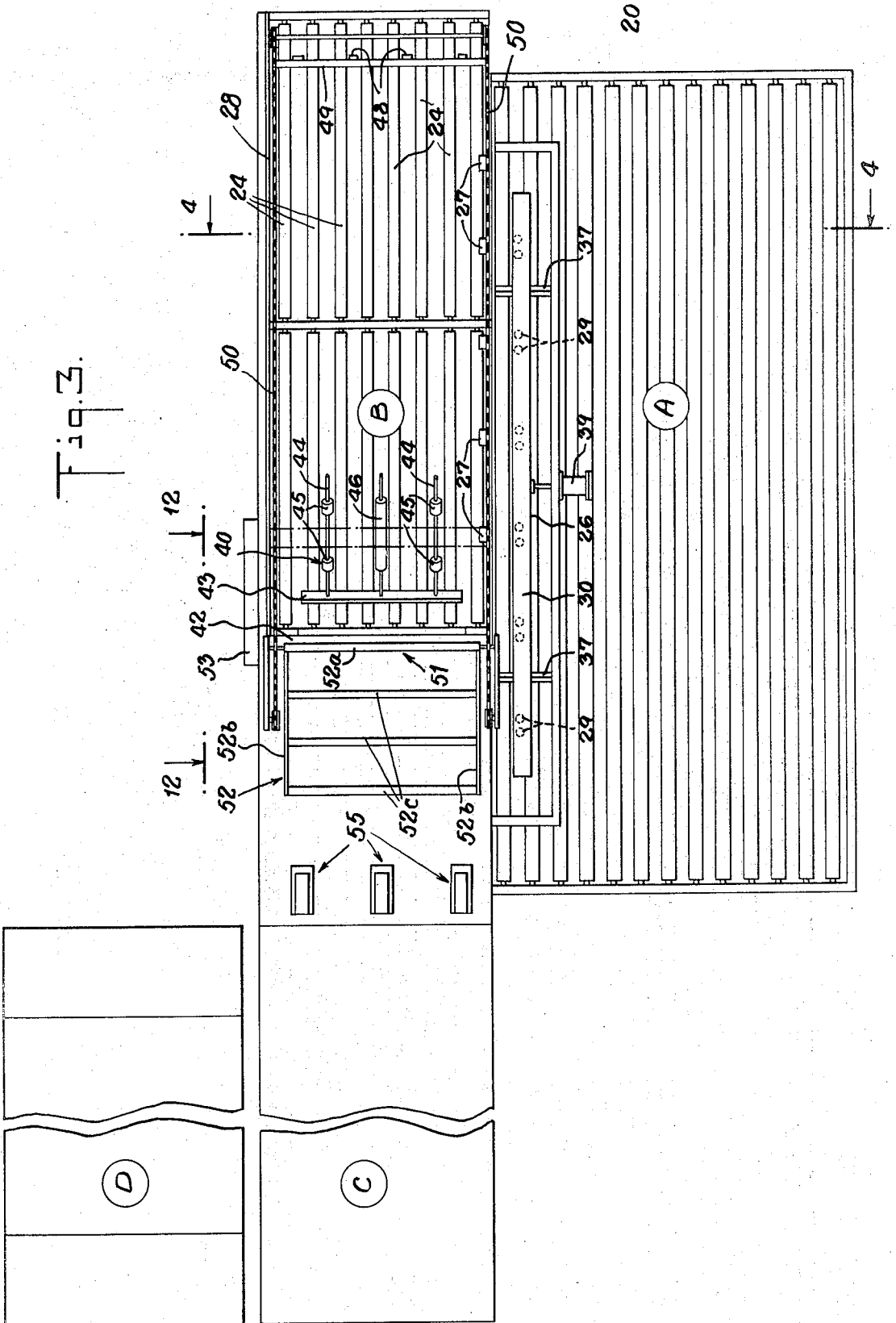
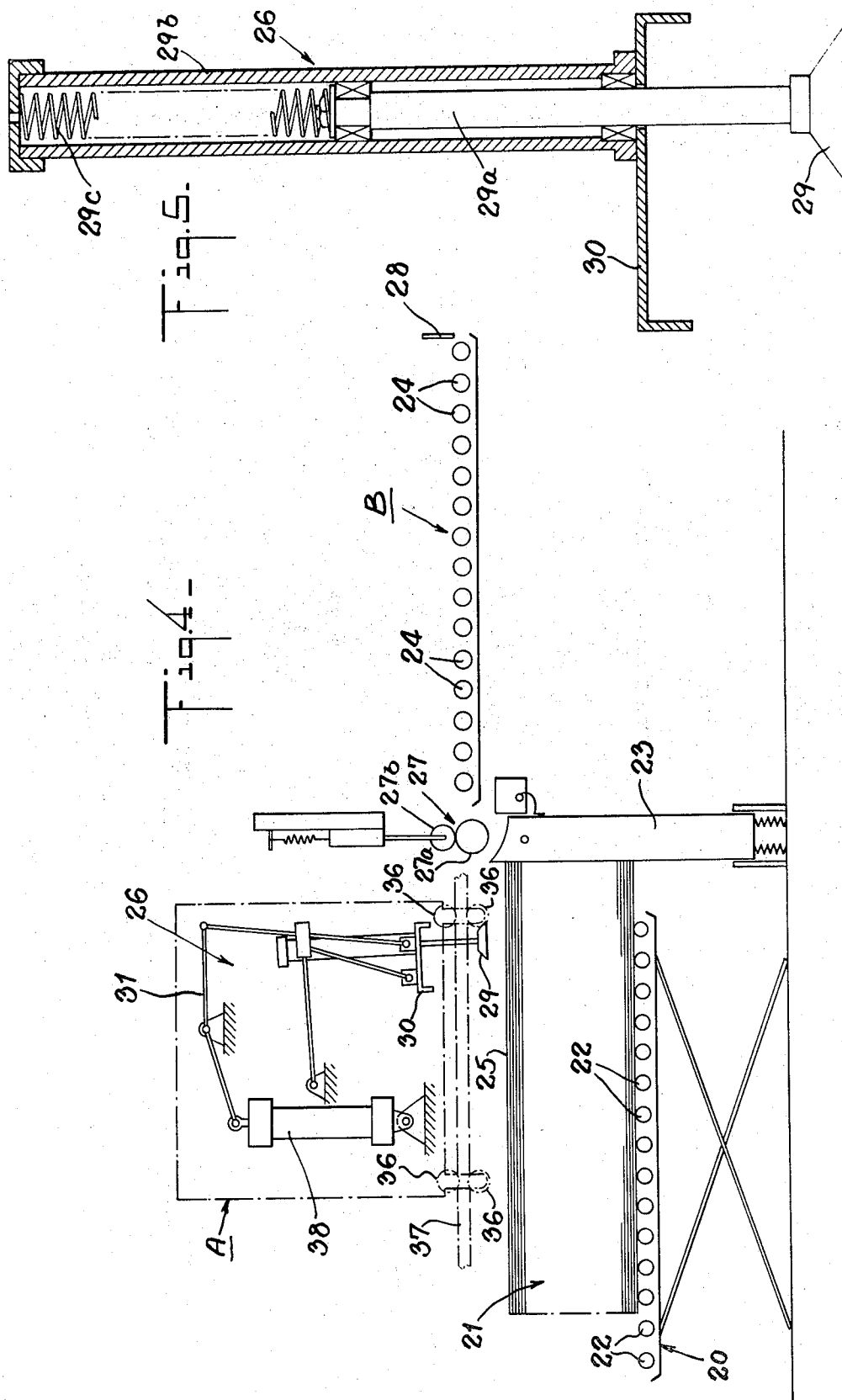
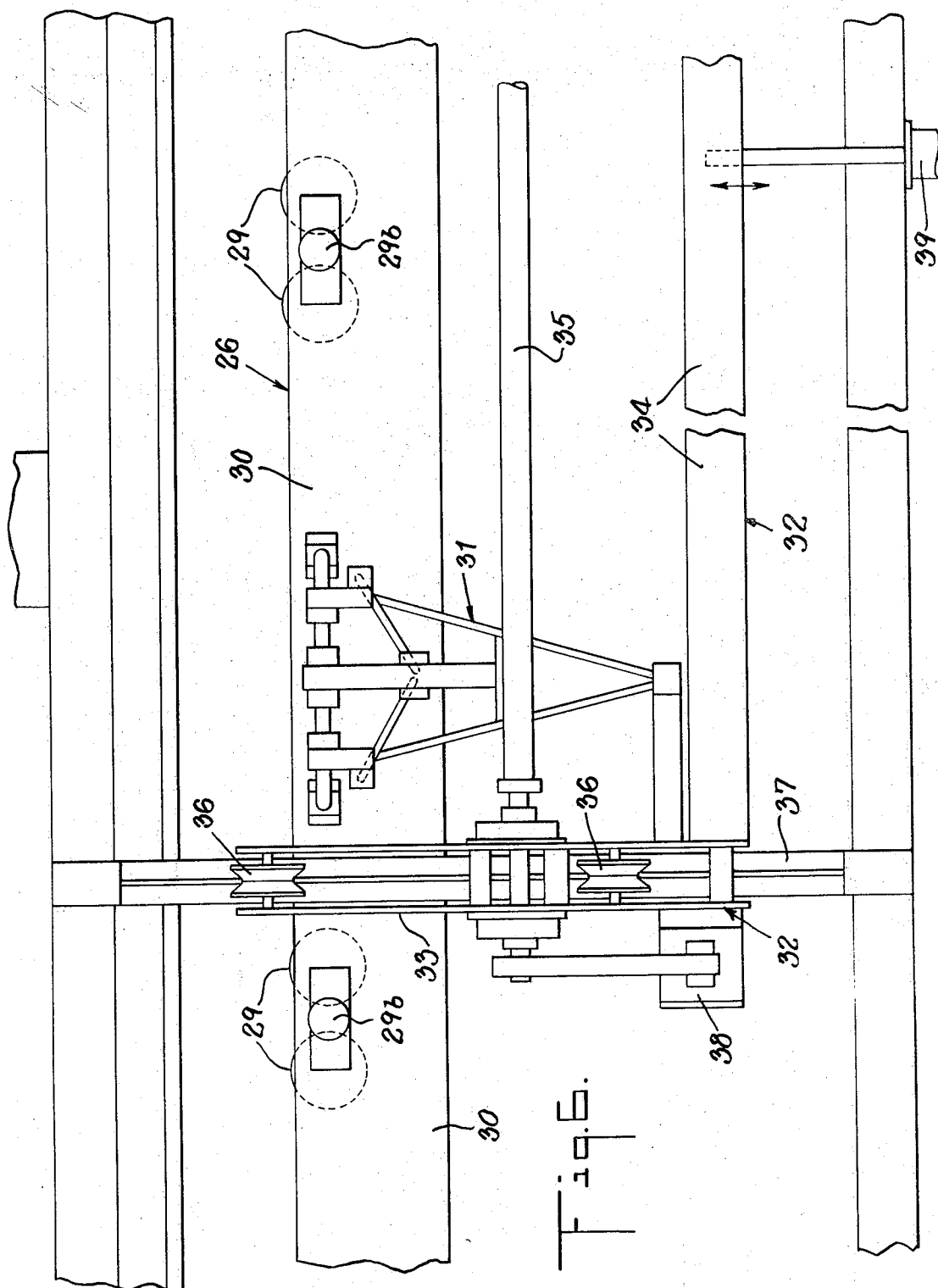


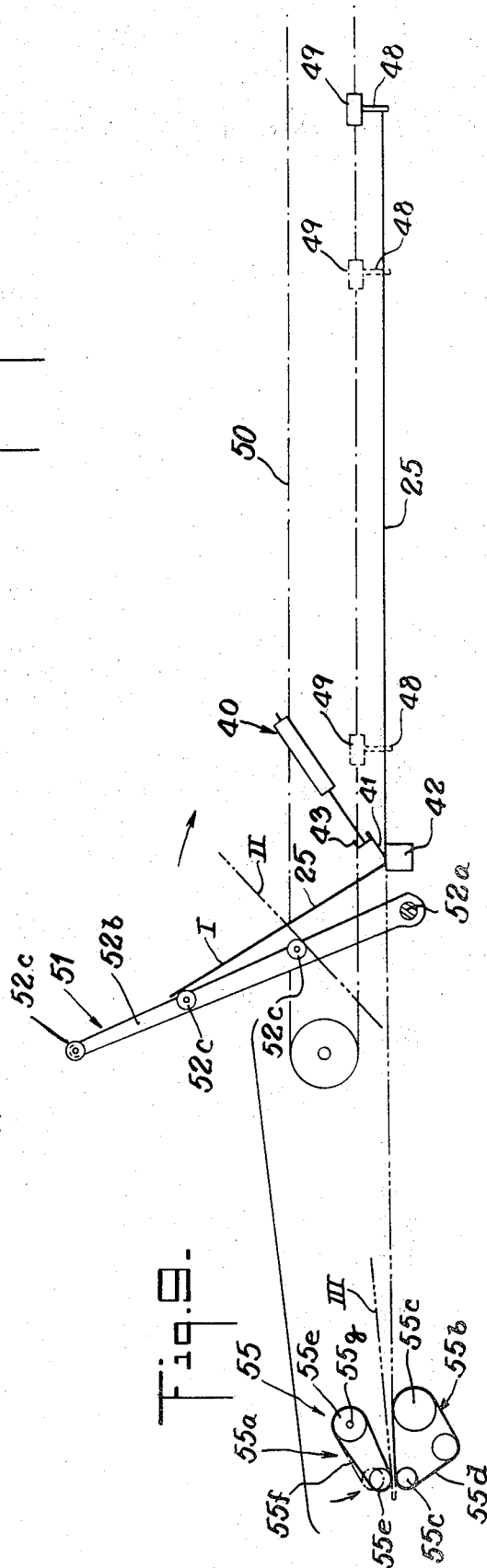
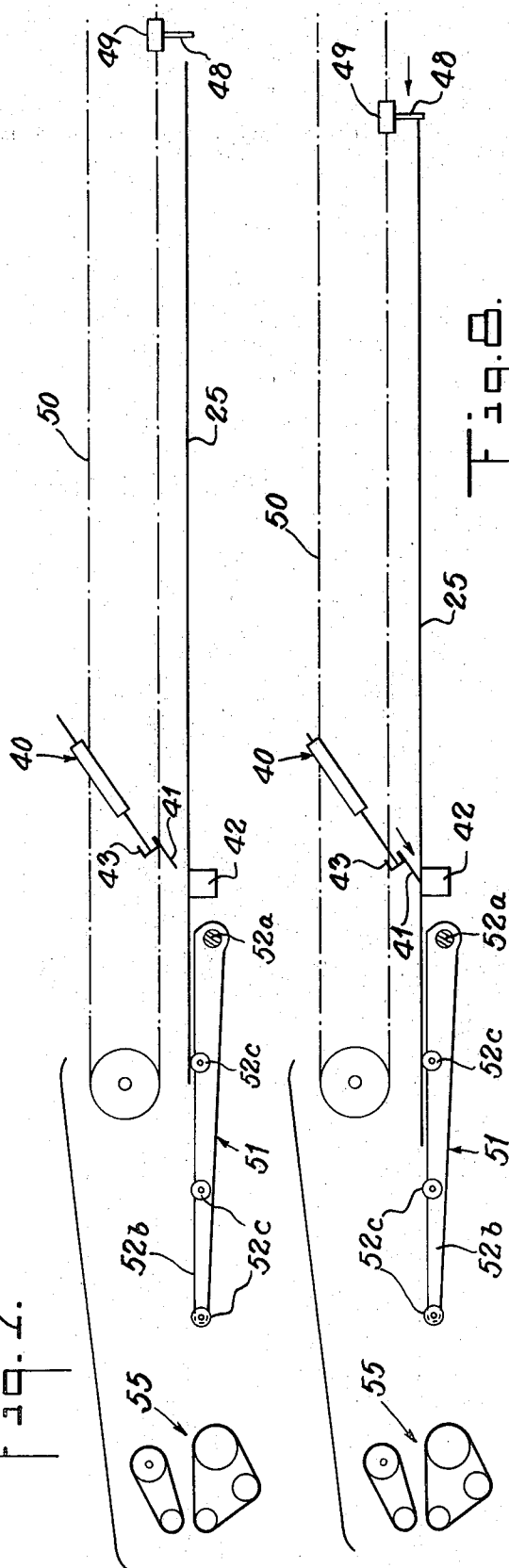
Fig. 3.







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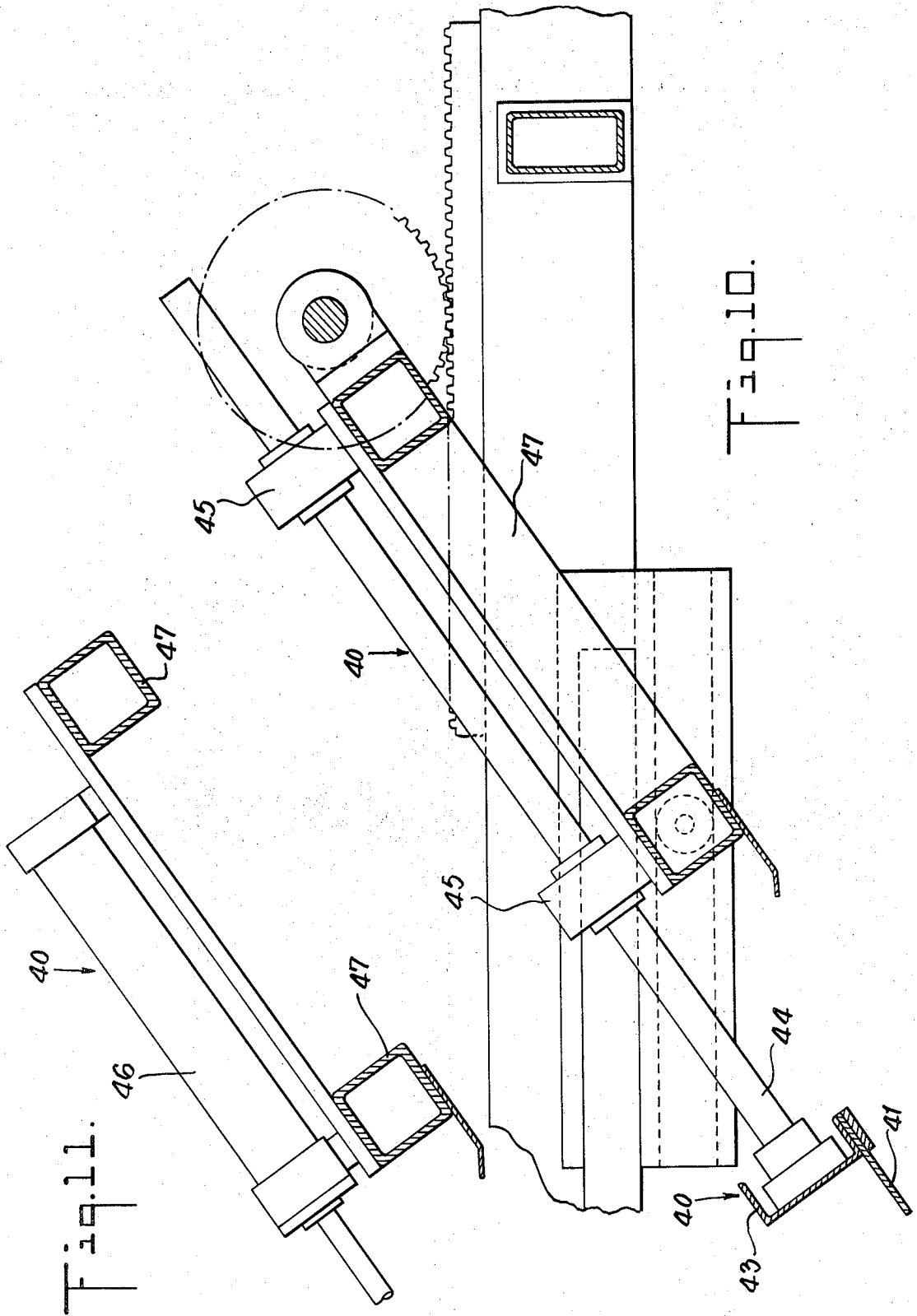
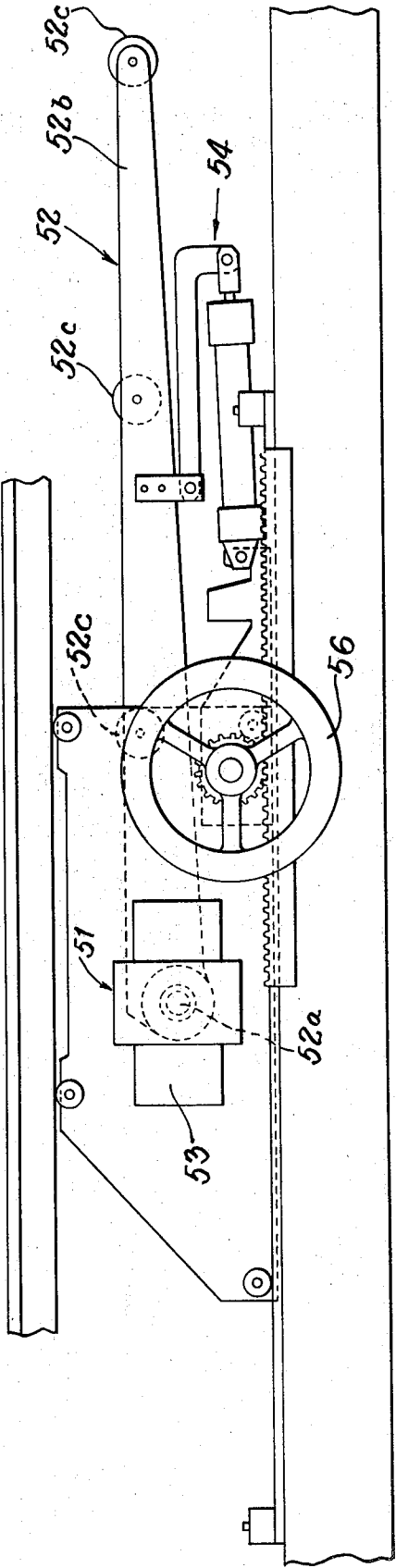


Fig. 12.



FOLDER FOR LARGE BOX BLANKS

BACKGROUND OF THE INVENTION

Prior to the present invention the folding of large box blanks was dependent on the capabilities of one man to handle the blank, fold the ends of the blank along pre-scored lines into a tube, and feed the folded tube into a conventional machine for securing together the ends of the blank and completing the tube. For large blanks it was necessary to use two men to perform this operation. The machine of the present invention is designed to eliminate one of the two men and permit the aforesaid operation to be carried out by one man with no difficulty.

SUMMARY OF THE INVENTION

It is an object of the invention to provide apparatus which will permit one man to handle a large box blank, fold the ends of the blank along pre-scored lines into a tube, and feed the folded blank into a conventional machine for securing together such ends and completing the tube.

It is a further object to provide apparatus which will pick up a large size box blank from a stack, feed the blank into a folding mechanism which folds one end of the blank along a pre-scored line, and then transfer such partially folded blank to a section where one man can fold the other end of the blank along a pre-scored line and feed the folded blank into a conventional piece of equipment to secure together the ends of the blank and form a tube.

It is a further object to provide apparatus which is simple and economical to manufacture, is efficient for its intended purpose, and can be operated by one man with no difficulty.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages will become apparent from the following description which is to be taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective plan view showing the operations performed on the box blank as it moves through the machine of the present invention;

FIG. 2 is a perspective plan view showing the portion of the machine in which a blank is fed from a stack and one end is folded;

FIG. 3 is a top plan view of the machine;

FIG. 4 is an enlarged cross-sectional view along the line 4-4 of FIG. 3;

FIG. 5 is a side elevation in section of the vacuum cup assembly;

FIG. 6 is a top plan view of the suction cup assembly and the mechanism for moving the blank into the folding section;

FIGS. 7, 8 and 9 are side elevations of the score bar assembly, the folding assembly and the nip assembly in different positions as one end of the blank is folded;

FIGS. 10 and 11 are side elevations of the score bar assembly; and

FIG. 12 is an enlarged cross-sectional view along the line 12-12 of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings there is shown in FIG. 1 the operations performed on a box blank as it moves from

the stack of blanks until the two ends are folded over ready to feed into a stitcher or taper. A single blank is fed from a stack, the one end of the blank is folded along a pre-scored line by the machine of the present invention, and then the other end of this blank is folded along a prescored line by hand to complete the folding into a tube. As is well known, blanks folded into tubes are shipped to customers in this form and the customer will set up the tube, fold the bottom flaps or apply a bottom, fill the box, and then close and seal the filled box.

As shown in FIG. 3 the machine consists of four basic sections labeled A, B, C and D. Section A holds a stack of finished blanks. In Section B the top blank of the stack of Section A is picked up, fully advanced into Section B where one end is folded, and then fed into Section C. In Section C the machine operator folds the other end by hand, squares the folded blank, and advances the blank into Section D where the two ends are secured together to form a tube. Section D is a conventional piece of equipment, such as a stitcher or taper, for making a completed tube.

Section A is a roller top lift table 20 for supporting a stack of blanks 21. The rollers 22 facilitate rolling a stack of blanks onto the table into feed position against stops 23 (FIG. 4). The table is controlled such that the top of the stack is maintained at a constant elevation as blanks are fed from the stack. This elevation is slightly below the elevation of the rollers 24 of Section B so that the blanks can be picked off the stack of Section A and easily fed into Section B (FIG. 4).

In Section B the top blank 25 of the stack 21 is picked up by a suction cup assembly 26 and moved into a series of nip rolls 27 which feed the blank onto forwarding rollers 24 which are driven and carry it against stops 28. The suction cup assembly 26 (FIGS. 4, 5 and 6) consists of a number of vacuum cups 29 mounted on a bar 30 which runs across the machine to cover the full width of the blank 25. The bar 30 is supported at spaced points on linkages 31 which are designed to give the vacuum cups straight up-and-down motion during pickup of the blank. Each linkage 31 is affixed to carriage 32 (FIG. 6) consisting of wheel assemblies 33, connecting-bar 34 and actuating rod 35. Each wheel assembly consists of upper and lower V-shaped rollers 36 which ride on the top and bottom of V-rails 37. The suction cup assembly 26 (FIG. 4) is actuated by air cylinder 38 which imparts an up and down motion and by air cylinder 39 (FIG. 3) which imparts a forward and backward motion. When the air cylinder 38 is actuated the vacuum cups 29 move downwardly through the linkages 31 to pick up the blank. The vacuum cups 29 (FIG. 5) are mounted on rods 29a which move in a tube 29b, and are spring loaded by springs 29c. This assures that the cups will make contact with the blank even though the blank may be warped or uneven across its width. The vacuum cup tubes 29b are affixed to the bar 30 (FIGS. 4, 5 and 6). When the air cylinder 39 is actuated the blank 25 held by the vacuum cups 29 is moved into nip rolls 27 at which point the vacuum cups 29 are released from the blank. The blank is then carried by nip rolls 27 to the forwarding rollers 24 and then against the stops 28 as heretofore described. The bottom nip rolls 27a are driven continuously and are fixed in position. The top nip rolls 27b are individually mounted and spring loaded to bear on driver rolls 27a. This assures a positive drive of the blank for any thick-

ness. When the blank hits the stops 28 the forwarding rollers 24 are stopped.

When the blank comes to rest against the stops 28, score bar assembly 40 (FIGS. 7 and 8) is actuated bringing flexible nose pieces 41 against the blank which is supported directly below by an anvil 42. The score bar assembly 40 (FIGS. 10 and 11) consists of a channel bar 43 which runs across the width of Section B and holds a number of flexible nose pieces 41. Secured to the channel bar 43 are two spaced apart guide rods 44, which slide in bearings 45, and an air cylinder 46, which serves to move the bar 43 up and down. The rods 44 are rigidly guided to assure that they will move in unison and parallel. The score bar assembly 40 is mounted on a score bar carriage 47 to be described hereinafter.

After the nose pieces 41 have contacted the blank 25, pushers 48 move the blank from the position shown in FIG. 7 to a folding position shown in FIG. 8. In this position the score line of the blank must be located adjacent to, but beyond the flexible nose pieces. The pushers 48 are mounted on a bar 49 which runs across the width of Section B and is supported at each end on a carriage secured to a conveyor chain 50. This chain moves backward and forward to move the blank as described.

When the pushers 48 have advanced the blank to the folding position shown in FIG. 8, a folding assembly 51 is actuated which starts the folding of one end of the blank. The folding assembly consists of a folding arm 52 (FIG. 12), and means for driving such arm. The folding arm consists of a shaft 52a, side arms 52b and cross members 52c. The side arms are rigidly mounted to the shaft 52a so that rotation of the shaft 52a causes the side arms 52b and attached cross members 52c to go from a horizontal position as shown in FIG. 8 to an upright position as shown in FIG. 9. The means for driving the folding arm as shown consists of a pneumatic rotary actuator 53 (FIG. 12) and a pneumatic motion control device 54 for controlling the accelerations and decelerations at the end of the folding arm stroke. The driving of the folding arm could be accomplished in other conventional ways.

Referring to FIG. 9 it will be seen that the blank in the first position I has one end folded upwardly and resting against the cross members 52c of the folding arm which is shown in its top position. When the folding arm reaches such position the pushers 48 advance the partially folded blank through the folding arm, forcing the partially folded panel against the lower cross member 52c into the position II. As the pusher continues, the blank is advanced to position III with the blank extending into an outfeed nip assembly 55. At this stage the blank comes to rest in the nip assembly 55 and the pushers 48 stop and return to their initial position shown in FIG. 7. As shown in FIG. 9 by the dotted showing of elements 48 and 49, pushers 48 stop before reaching anvil 42. The geometry of the machine and the set-up adjustments preclude any movement beyond anvil 42. In the event of a malfunction or improper set-up, a limit switch is provided to stop the motion of the pushers 48 and bar 49 before reaching anvil 42. It will be understood that the positions I, II and III are merely for illustration and that the blank moves continuously from position I to position II.

The blanks are held at rest in the outfeed nips 55 until a signal either automatically or manually actuates

such nips to advance the blank into Section C. As the blank exits from Section B, the folding arm returns to its initial position shown in FIG. 7 preparatory to receipt of another blank as previously described. The motion of the folding arm 52 is described above. As shown in FIG. 7, the arm 52 is in its initial position (horizontal) and does not start to return until the outfeed nips 55 start to advance the blank from Section B to Section C. When moving the blank from Section B to Section C, the pushers 48 only serve to advance the blank into the outfeed nip assembly 55 which, when signalled, advances the blank the rest of the distance.

The outfeed nip assembly 55 (FIG. 9) consists of upper belt conveyors 55a, lower belt conveyors 55b and a means for opening and closing the nip by pivoting the upper belt conveyors 55a. Each lower belt conveyor is fixed in position and includes a series of pulleys 55c over which a belt 55d runs. Each upper belt conveyor 55a also consists of pulleys 55e and a belt 55f. The conveyor belts 55d and 55f are drive on signal as stated above. Each upper conveyor 55a is pivoted about the shaft 55g of the drive pulleys 55e and is opened and closed by conventional means, for example by air or pneumatic cylinders.

The machine can be adjusted to accept a wide range of blank sizes merely by changing the start position of pushers 48, and the operating position of folder 51 and score bar 40 mechanisms. The folder and score bar mechanisms are tied together by a bar so that they can be adjusted simultaneously by turning a hand wheel 56 (FIG. 12).

Although the drawings show a blank with four panels which is folded in the center to form a tube, it will be understood that the machine can also be used for folding a blank with additional even numbered panels, such as six or eight, which can be folded on or off the center score line to form a tube which will be set up into a hexagonal, octagonal, or multisided carton.

The use and purpose of the apparatus of the present invention should be apparent from the foregoing description. Thus, the aforementioned objects and advantages are most effectively attained. Although the preferred embodiment of the invention has been disclosed and described herein, it should be understood that this invention is in no sense limited thereby and its scope is to be determined by that of the appended claims.

I claim

1. Apparatus for folding a box blank which has horizontal and vertical edges and has been pre-scored with a plurality of vertical score lines parallel to the vertical edges to permit folding the opposite ends of the blank along a first and second score line and bringing the vertical edges together to form a tube comprising:

a score bar assembly having a nose piece, an anvil and means to move such nose piece against one surface of the blank;

a folding assembly;

said assemblies being positioned adjacent to each other and said nose piece and anvil being spaced to receive the blank therebetween;

means for feeding the blank between the nose piece and the anvil;

means to position such blank to bring the said first score line adjacent to and ahead of the said nose piece and behind the folding assembly;

said folding assembly having side arms spaced outside the horizontal edges of the blank, at least one

cross member running between the said arms, and means to rotate the said arms and cross member upwardly and bring the cross member against the opposite surface of the leading end of the blank whereby the blank will be partially folded along the said first score line;

means for advancing the partially folded blank under the raised cross member, whereby the leading end of the blank is further folded, and into pressing means to complete the folding of the leading end of the blank backward against the said one surface of the blank; and

means for advancing the folded blank out of the pressing means to permit folding of the opposite end of the blank to bring the vertical edges together and joining such edges to form a tube.

2. The apparatus of claim 1 wherein the score bar assembly has a plurality of nose pieces.

3. The apparatus of claim 1 wherein the folding assembly has a plurality of cross members running between the side arms.

4. The apparatus of claim 1 wherein the pressing means comprises upper and lower belts between which the partially folded blank is fed.

5. The apparatus of claim 4 wherein the pressing means is a nip assembly comprising a first plurality of belts, a second plurality of belts which engage the first belts, and means for pivoting one plurality of belts to open and close the nip to accommodate folded blanks of different thickness between the first and second plurality of belts.

6. The apparatus of claim 1 wherein a blank is picked up from a stack of blanks by a plurality of suction cups and moved into a plurality of nip rolls which feed the blank into position between the nose piece and the anvil.

7. The apparatus of claim 1 wherein the blank is fed into the score bar assembly and the folding assembly with a horizontal edge of the blank leading and the score lines parallel to the cross member of the folding

assembly.

8. Apparatus for folding a box blank which has horizontal and vertical edges and has been pre-scored with a plurality of vertical score lines parallel to the vertical edges to permit folding the opposite ends of the blank along a first and second score line and bringing the vertical edges together to form a tube comprising:

a score bar assembly having an anvil and a movable nose piece adapted to be moved against the blank positioned on the anvil;

a folding assembly;

said assemblies being positioned adjacent to each other and said nose piece and anvil being spaced to receive the blank therebetween;

means for feeding the blank between the nose piece and the anvil with the said first score line positioned ahead of the said nose piece and behind the folding assembly;

the said score bar assembly having means to move the said nose piece against one surface of the blank adjacent the said first score line of the blank;

said folding assembly having side arms spaced outside the horizontal edges of the blank, at least one cross member running between the said arms, and means to rotate the said arms and cross member upwardly and bring the cross member against the opposite surface of the leading end of the blank whereby the blank will be partially folded along the said first score line;

means for advancing the partially folded blank under the raised cross member whereby the leading end of the blank is further folded, and into pressing means to complete the folding of the leading end of the blank backward against the said one surface of the blank; and

means for advancing the folded blank out of the pressing means to permit folding of the opposite end of the blank to bring the vertical edges together and joining such edges to form a tube.

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