Sept. 20, 1971 A. F. SHIELDS 3,605,576

FOLDER-TAPER

Filed June 13, 1969 5 Sheets-Sheet 1

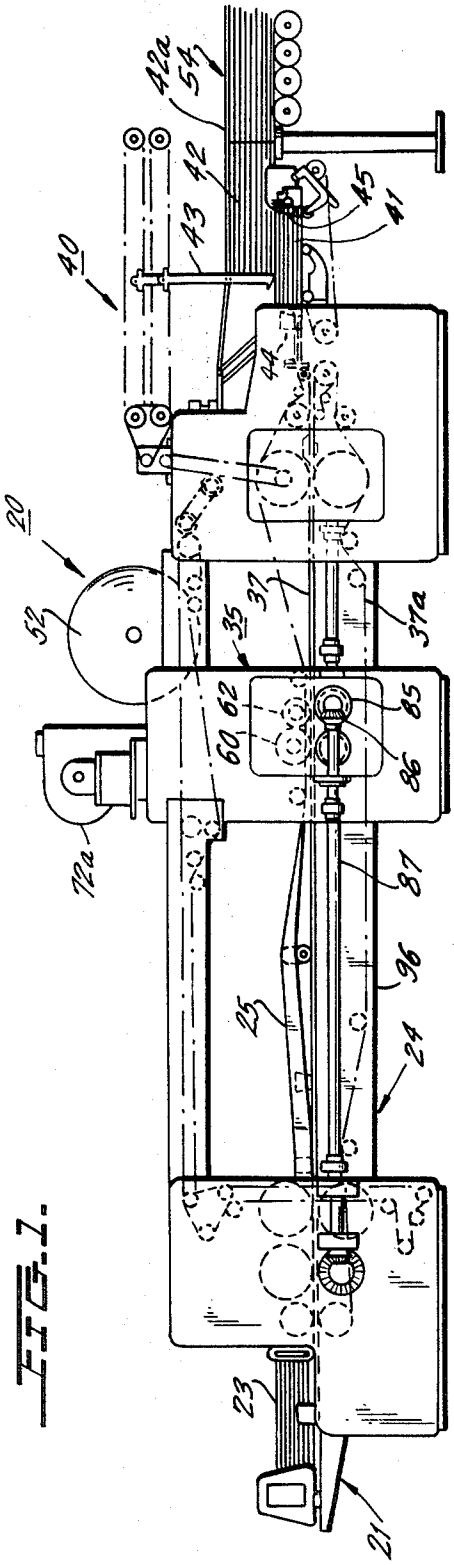


FIG. 1.

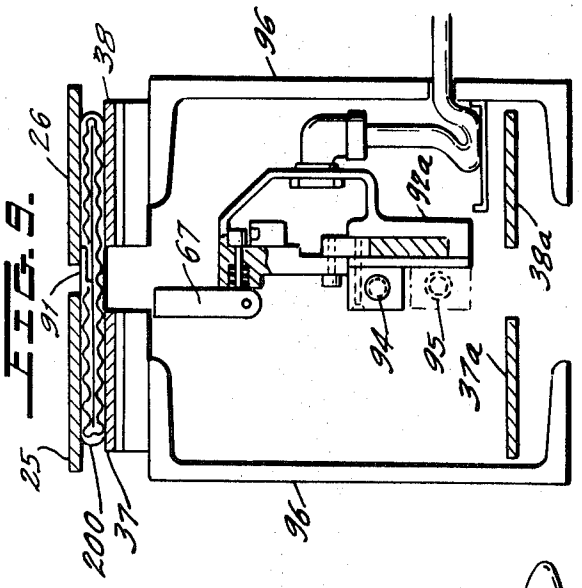


FIG. 5.

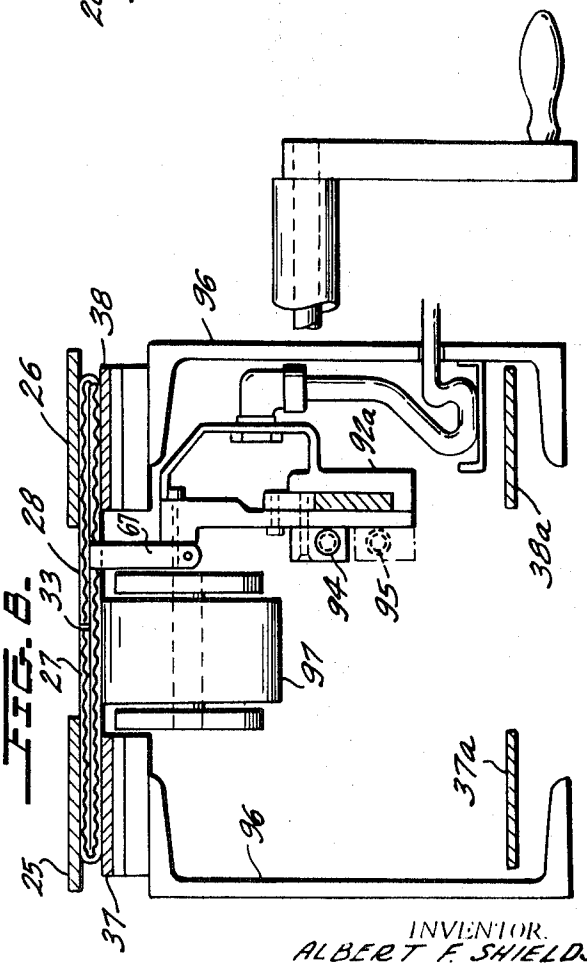


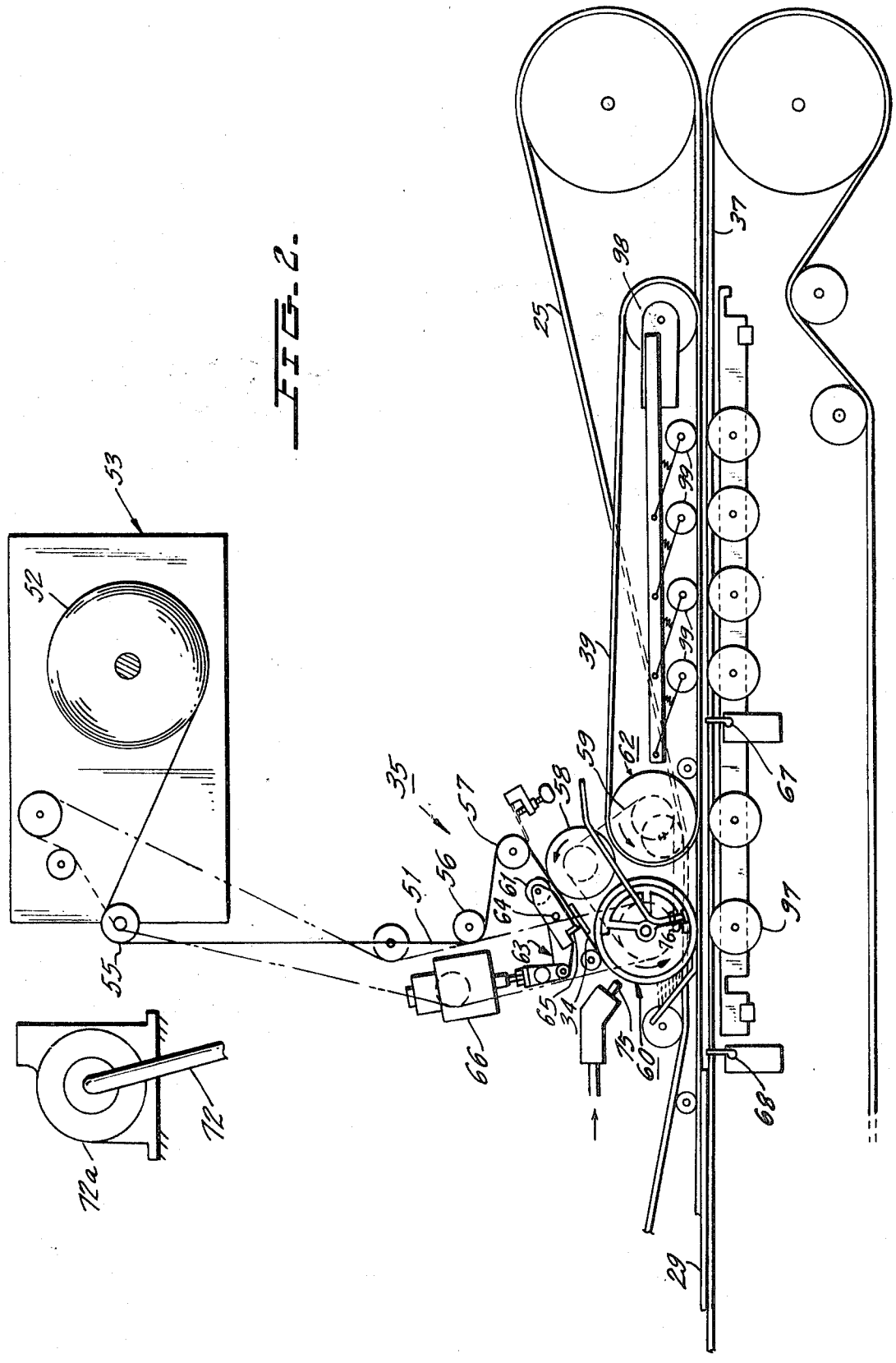
FIG. 8.

INVENTOR.
ALBERT F. SHIELDS

BY

OSTROLENK, FABER, GERB & SOFFEN
ATTORNEYS

FIG. 2.


53
52
55
72a
72
51
56
35
57
58
59
62
61
64
63
66
65
34
75
60
68
67
97
98
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39
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Sept. 20, 1971 A. F. SHIELDS 3,605,576

FOLDER-TAPER

Filed June 13, 1969 5 Sheets-Sheet 3

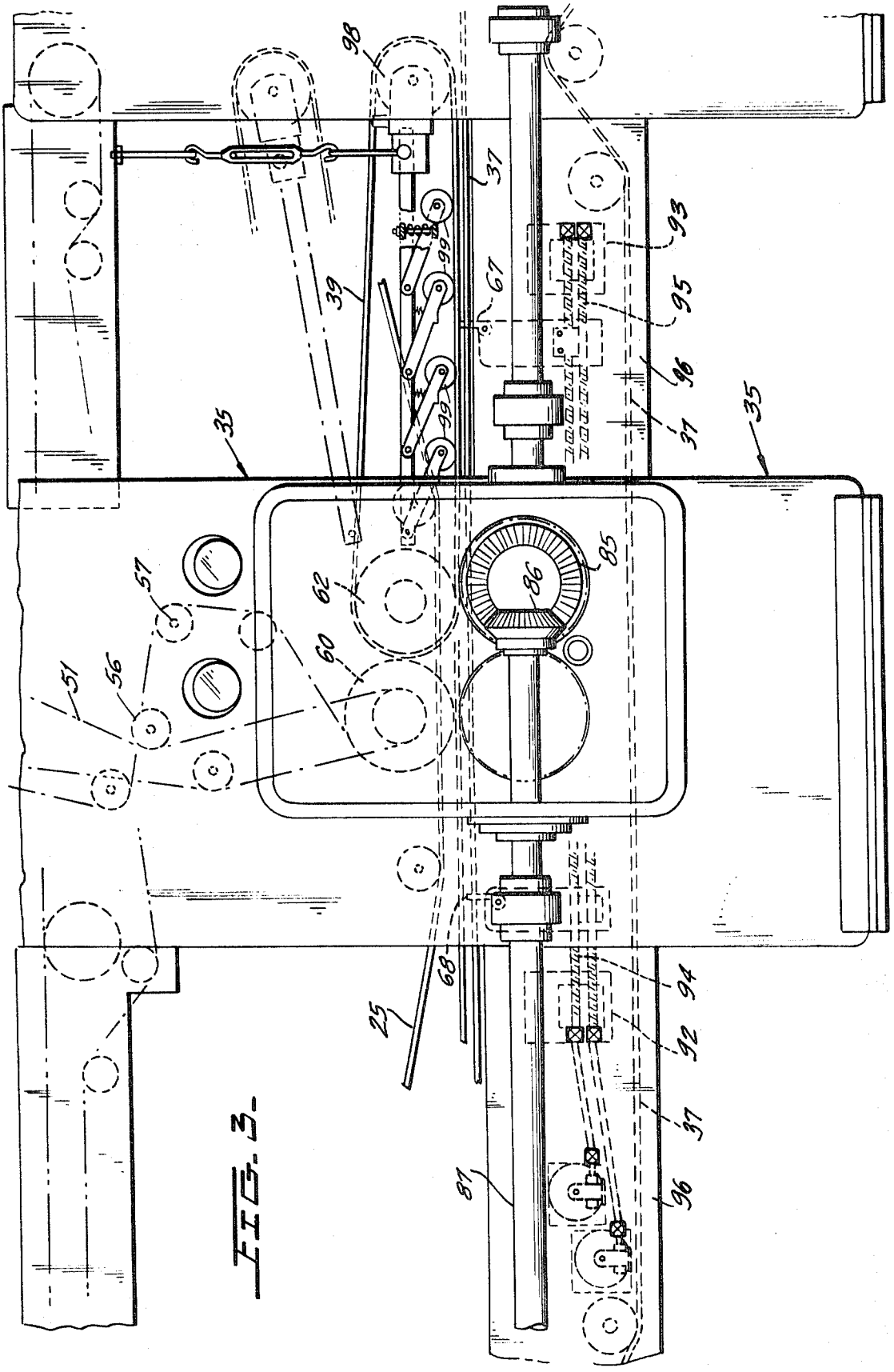


FIG. 3.

Sept. 20, 1971 A. F. SHIELDS 3,605,576

FOLDER-TAPER

Filed June 13, 1969 5 Sheets-Sheet 4

FIG. 5.

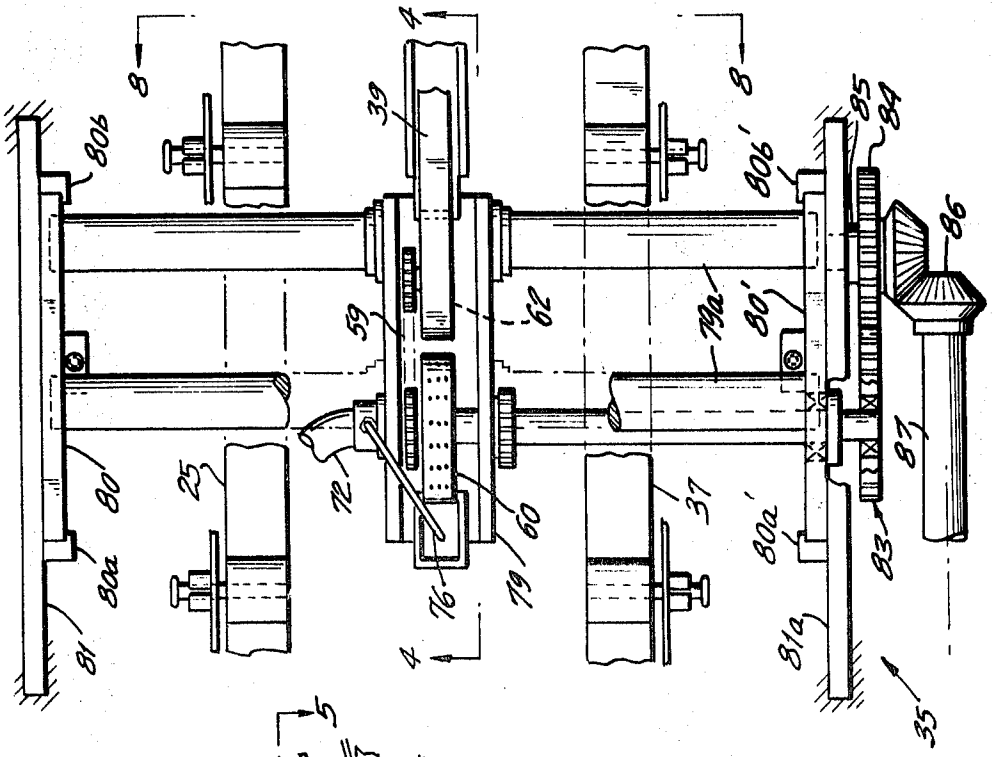
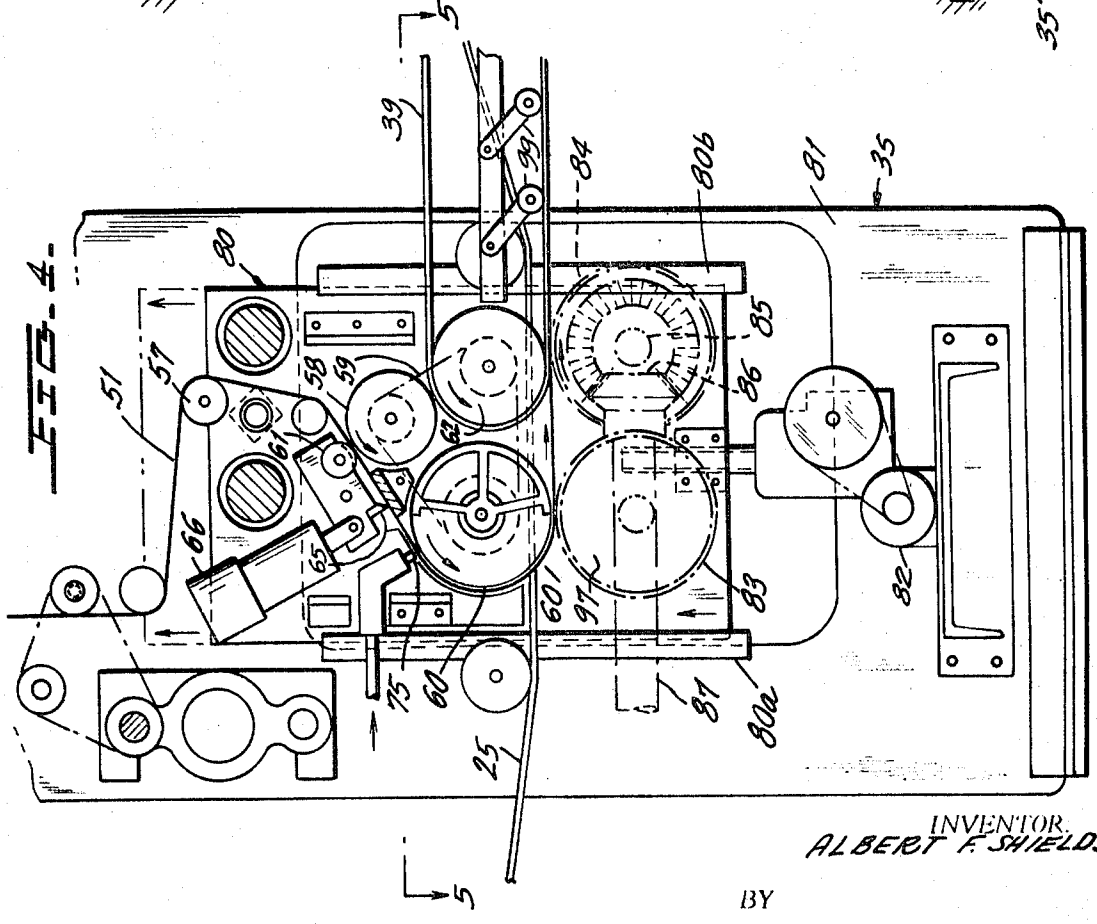


FIG. 4.



INVENTOR.
ALBERT F. SHIELDS

BY

OSTROLENK, FABER, GERB & SOFFEN

ATTORNEYS

Sept. 20, 1971 A. F. SHIELDS 3,605,576

FOLDER-TAPER

Filed June 13, 1969 5 Sheets-Sheet 5

FIG. 12.

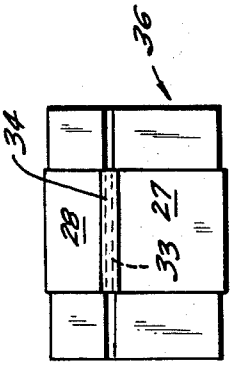


FIG. 6.

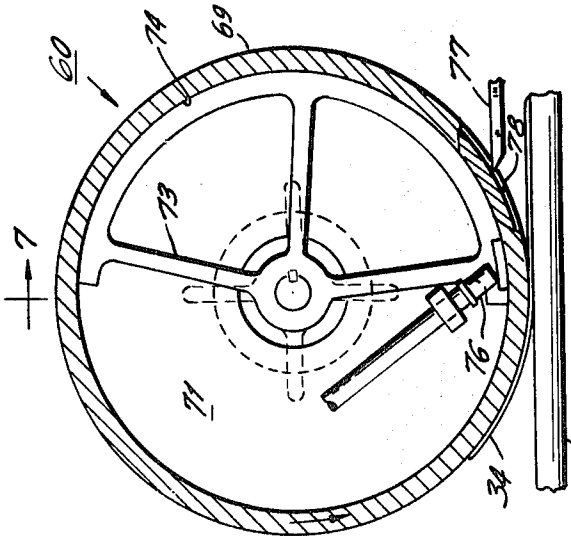


FIG. 11.

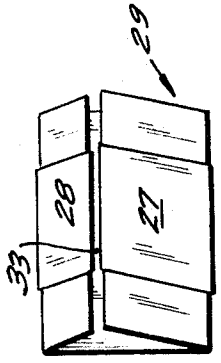


FIG. 10.

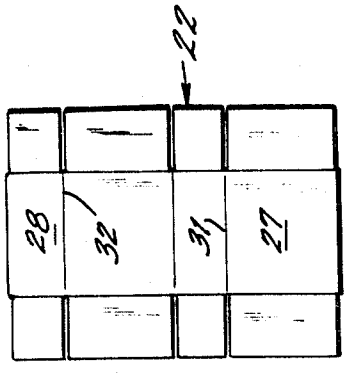
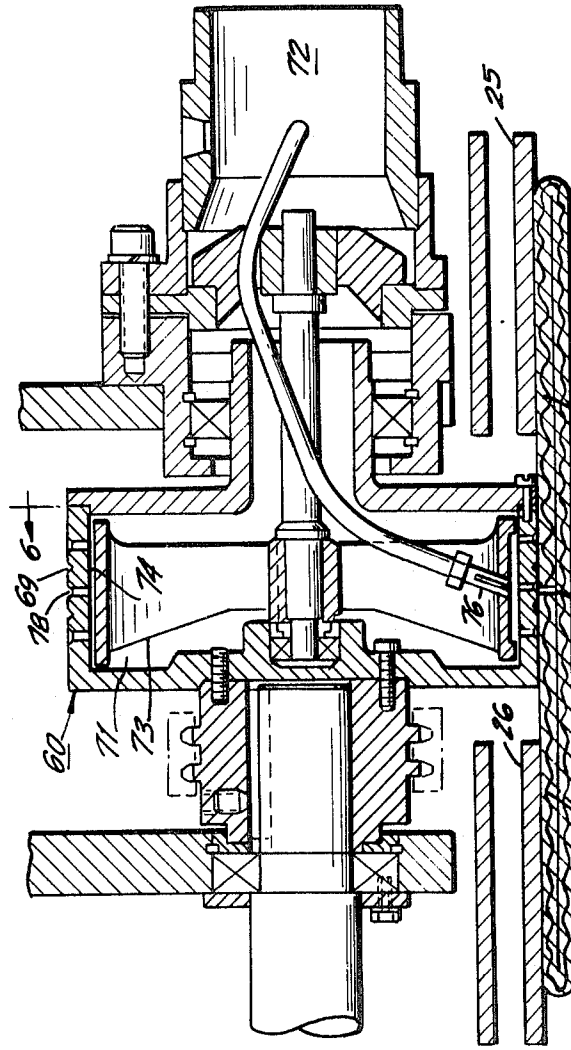


FIG. 7.



United States Patent Office 3,605,576 Patented Sept. 20, 1971

3,605,576

FOLDER-TAPER

Albert F. Shields, Forest Hills, N.Y., assignor to S & S Corrugated Paper Machinery Co., Inc., Brooklyn, N.Y.

Filed June 13, 1969, Ser. No. 832,976
Int. Cl. B31b 1/72
U.S. Cl. 93—41 6 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for producing corrugated boxes is provided with continuous folding belts which convey a flat box blank forward and simultaneously, but gradually, fold the outer panels of the blank inward. After the outer panels are completely folded and while the folded blank is still being moved forward by the folding belts, tape is applied to the folded blank to produce a folded tubular box. Immediately after application of the tape, the folded tubular box is delivered to a squaring section, where a series of slaps or blows are directed against the trailing edge of the folded tubular box, with such slapping being done at a time before the glue on the tape has an opportunity to set to a condition where straightening will be impeded.

This invention relates to high speed box folding and taping apparatus and more particularly to apparatus of this type in which tape is applied after the box panels are completely folded and while the box is in motion.

For the most part high speed folding machines for producing folded tubular corrugated boxes utilize either a glued lap or a glued tape to form the joint between the free ends of the folded over panels. In the prior art, the production of taped boxes was at a much slower rate than the production of boxes having glued laps. However, taped joint boxes are more desirable under certain conditions, since in folded tubular form they do not have the added or third-ply thickness resulting from the glue lap and so will form even stacks. Further, the absence of a glue lap allows for the packaging of objects which would otherwise interfere with an internal glued lap.

Prior art apparatus for automatically folding and taping has been relatively slow when of the type that squared box panels prior to application of the tape and it was difficult to maintain squareness during and after application of the tape. In apparatus that squared the panels after application of the tape, the tape was applied to one panel before folding of the panels, making it difficult to keep the tape straight on the finished box. Substantial setting of the tape adhesive took place before folding of the panels, so that the tape did not adhere equally to both folded-over panels, and in many cases the adhesive had set to such an extent that squaring became difficult.

Apparatus constituting the instant invention overcomes the deficiencies of prior art folder-tapers by utilizing continuous folding belts that extend through a taping section located immediately behind a squaring section. After the belts have completely folded over the outer box panels, tape is applied to form the joint between the folded over panels, and so little time elapses between application of the tape and the squaring operation that the latter is not interfered with.

Accordingly, a primary object of the instant invention is to provide novel improved high speed apparatus for automatically folding and taping a box blank to produce a folded tubular box.

Another object is to provide apparatus of this type in which tape is applied after the outer blank panels are completely folded inward, and at a time immediately preceding squaring.

Still another object is to provide apparatus of this type in which folding belts extend through the taping section to hold the blank with completely folded over outer panels during the taping operation.

A further object is to provide apparatus of this type in which the taping head may be withdrawn to an inactive position and the apparatus thereafter operated to produce folded tubular boxes having glued laps to join the folded over panels.

These 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 automatic apparatus, constructed in accordance with teachings of the instant invention, for producing stacks of folded tubular taped boxes from flat box blanks.

FIG. 2 is a fragmentary side elevation of that portion of the apparatus of FIG. 1 in the region of the taper head, with frame members of the apparatus being removed to more clearly reveal the operating elements.

FIG. 3 is a fragmentary side elevation of the apparatus of FIG. 1 in the region of the taping head.

FIG. 4 is a cross-section taken through line 4—4 of FIG. 5, looking in the direction of arrows 4—4, and showing a portion of the apparatus of FIG. 1 in the region of the taping head.

FIG. 5 is a cross-section taken through line 5—5 of FIG. 4, looking in the direction of arrows 5—5.

FIG. 6 is a cross-section taken through line 6—6, looking in the direction of arrows 6—6 showing an enlargement of the tape applying wheel.

FIG. 7 is a cross-section taken through line 7—7 of FIG. 6, looking in the direction of arrows 7—7.

FIG. 8 is a fragmentary transverse cross-section of the apparatus of FIG. 1, showing the target switch supporting rod when the taping head is in operation.

FIG. 9 is a view similar to FIG. 8, with the taping head deactivated and the apparatus set for the handling of very narrow boxes having glue laps.

FIG. 10 is a plan view of a box blank.

FIG. 11 is a plan view of the box blank of FIG. 10, with the outer panels thereof folded over almost to their final folded positions.

FIG. 12 is a plan view of the box blank of FIG. 11, with its outer panels fully folded over and a closure tape strip applied.

Now referring to the figures. Automatic box making apparatus **20** of FIG. 1 includes sheet feeding mechanism **21** which feeds box blanks **22** (FIG. 10) one at a time from the bottom of a stack **23** of such blanks. Such blanks **22** move to the right with respect to FIG. 1 into folding section **24** where a pair of folding belts **25, 26** (FIG. 8) engage the outer panels **27, 28**, respectively, of blank **22** and fold such panels **27, 28** inward along score lines **31, 32**, respectively, extending parallel to the direction of travel for blanks **22**, to produce folded tubular box **29** (FIG. 11) having an open joint **33** formed between the adjacent edges of panels **27, 28**. Thereafter joint **33** is closed by tape strip **34** applied at taping section **35** to produce taped folded tubular box **36** (FIG. 12). All during the transformation of box blank **22** to a folded tubular box **36**, blank **22** in its various modified stages is positively held and conveyed by folding belts **25, 26** in cooperation with lower conveyor belts **37, 38**, respectively.

Elements **37***a*, **38***a* (FIG. 9) are the lower or return flights of the respective lower feed belts **37, 38**.

Immediately after application of tape **34**, box **36** is conveyed by belts **25, 26, 37** and **38** below a short tape holding belt **39** (FIG. 2), which applies downward pressure directly on tape **34**. This serves to give the glue or adhesive on tape **34** an initial "tack" on box panels **27, 28**

but does not permit such adhesive to fully set. The front end of taping belt **39** is supported by roller **98** and the rear is supported by roller **62**. A plurality of pressure rollers **99** on individual pivoted arms apply a downward force to the lower flight of belt **39**. Belts **25**, **26**, **37** and **38** then deliver boxes **36** to stacking, straightening and delivery section **40**, where boxes **36** are formed into underfed stack **41**, the top portion **42** of which is periodically engaged by delivery pushers **43** and removed in a forward direction. While boxes **36** are near the bottom of stack **41**, reciprocated transverse bar **44** applies a series of "slaps" or blows to the trailing edges of boxes **36**, with reaction forces resulting from front barrier **45** acting on the leading edges of boxes **36** to straighten folded over panels **27**, **28** before the adhesive on tape **34** has set. A series of boxes in pile **42** are held in compression by hold down bar **42***a*. By the time pushers **43** have fully removed pile **42** from under hold down bar **42***a*, the adhesive on tapes **34** of boxes **36** in pile **42** has set and no further movement of panels **27**, **28** is possible.

Since sheet feeder **21**, folder **24**, and stacker straightener **40** are constructed in accordance with teachings of the prior art, detailed descriptions thereof are not found in the specification. Instead, for details concerning the constructions of sections **21**, **24** and **40**, reference is made to my U.S. Pats. Nos. 2,982,189, issued May 2, 1961; 3,279,788, issued Oct. 18, 1966, and 3,409,148, issued Nov. 5, 1968.

Particular reference is now made to FIGS. 2–7 for an explanation of taping section **35**. In FIG. 2 tape strips **34** are cut from tape ribbon **51** which is drawn from supply roll **52** located in tape prefeeder **53** of conventional construction. From supply reel **52**, tape **51** is guided by idler rolls **55**, **56**, **57** and applicator roll **60**. In the region between idler **57** and applicator **60**, tape **51** passes over drive roll **58** and beneath depresser roll **61** aligned opposite roll **58**. Roll **58** is driven in unison with applicator roll **60** by chain **59**, which also provides the drive for roll **62** driving taping belt **39** and positioned at the rear end thereof. Depresser roll **61** is also driven at tape speed by a chain means (not shown).

Depresser roll **61** is part of assembly **63**, which is pivotally mounted to pin **64** and includes tape cutting knife **65**. Solenoid **66**, when energized, pivots assembly **63** counterclockwise for the cutting of tape **51** by a knife **65** and simultaneous lifting of depresser roll **61** from tape **51** so that the latter ceases to be driven by roller **58**. When solenoid **66** is deenergized, return springs (not shown) associated therewith move assembly **63** clockwise, thereby lifting knife **65** from its cutting position to permit the leading edge of tape to move past knife **65**. Simultaneously, depresser roll **61** moves tape **51** against driven roller **58**. Energization of solenoid **66** commences when rear microswitch **68** is operated by the leading edge of folded box **29** and solenoid **66** is deenergized when front microswitch **67** is engaged by the leading edge of folder blank **29**. As is well known to the art, the longitudinal positions of target switches **67**, **68** are independently adjustable to insure that the length of tape strip **34** and placement thereof are both precise.

As seen more particularly in FIG. 7, applicator roll **60** is a hollow member, having a perforated peripheral edge **69**. Interior chamber **71** of roll **60** is connected through conduit **72** to a suction pump **72***a* shown in FIG. 2, so that a suction force is present to draw tape **51** against periphery **69**. Stationary member **73** disposed within chamber **71** is provided with an arcuate wall closely fitted over a portion of the perforated interior surface **74** so that suction is present only at a selected portion of peripheral surface **69**.

In the region where tape strip **34** is picked up by applicator roll **60**, moisture is applied through nozzle **75** to the glued surface of tape strip **34**. The moistened tape strip **34** is carried counterclockwise by applicator roll **60** and meets blank **29** with folded panel traveling forward, or in the direction indicated by arrow A in FIG. 6. At the point where applicator **60** deposits strip **34** on folded blank **29**, peripheral suction is not present. However, in order to insure that residual suction does not hold strip **34** to applicator **60**, compressed air is applied through nozzle **76** to drive tape strip **34** away from peripheral edge **69** of applicator roll **60**. In the event that compressed air from nozzle **76** is not effective to do its intended job, pointed finger **77** extending into peripheral groove **78** mechanically strips tape strip **34** from applicator roll **60**.

The portion of tape applicator **35** described to this point is mounted to support plate **79** which is supported on bars **79***a* so it can be positioned laterally in order to locate the tape band **51** directly over the point when the box panels are joined. Carrier bars **79***a* are, in turn, mounted in carrier plate **80** which is movably mounted to stationary frame **81**. That is, through the operation of motor **82** (FIG. 4) support plate **80** may be raised and lowered being guided in channels **80***a*, **80***b*. It is noted that even though only one support plate **80** is referred to, there are actually two movable support plates **80**, **80** mounted at opposite sides of apparatus **20**.

With plate **80** in its lowered position of FIG. 4, the taping elements are in active positions for supplying and applying tape strips **34**. When support plate **80** is moved upward a distance of approximately six inches, the taping elements are inactive in that gear **83**, which is mounted to support plate **80** and provides the drive for chain **59**, is disengaged from gear **84** mounted to shaft **85** on stationary frame **81**. Bevel gears **86**, driven from line shaft **87**, drive gear **84**. With the taping elements raised to their inoperative positions, apparatus **20** may be adjusted, as in FIG. 9, to produce very narrow boxes having glue laps **91** (FIG. 9). Simultaneously, with the upward movement of support plate **80**, blocks **92**, **93** supporting bar **92***a* and associated lead screws **94**, **95** for adjusting the respective target switches **68**, **67** move down so that target switches **67**, **68** are below the feed path of folded blanks for producing glued boxes **200**. This is seen in FIG. 9, which shows longitudinal frame members **96** adjusted inwardly to positions for handling the narrowest box **200** that can be produced by apparatus **20**. In order to move longitudinal frame members **96** to their positions of FIG. 9, it is necessary to remove support roller **97**, which is normally positioned below tape applicator roll **60**. Roller **97** may be lowered so that it is contained completely within the channels **96** which can remain in the machine without hindering the running of the smallest size gear lap boxes.

Thus, it is seen that the instant invention provides a novel folder-taper, in which tape is applied to the folded box immediately before such box enters the squaring section, and precise control is maintained over the boxes in the taping section by the same belts that perform the folding operation. When the apparatus is used for producing boxes with glue laps, the taping elements are moved to completely inactive positions and are not subject to wear during this type of operation.

Although there have been described preferred embodiments of this novel invention, many variations and modifications will now be apparent to those skiled 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. Box making apparatus including feeding means for feeding box blanks forward one at a time from a stack of such blanks; first means for transporting blanks received from said feeding means forward along a feed path and simultaneously folding outboard panels of such blanks inward along score lines extending in the direction of said feed path to positions overlying panels adjacent thereto; second means for applying closure means to connect such outboard panels together at their edges remote from the

score lines; said first means including a first and a second longitudinally extending continuous moving conveying and folding belt in engagement with blanks received by said first means; said belts remaining engaged with and retaining control of blanks with inwardly folded panels and moving such blanks forward while said second means applies closure means thereto forming them into folded tubular boxes; said belts move box blanks with closure means applied thereto forward of said second means; and third means positioned forward of said second means to receive folded tubular boxes produced by said first and second means, and straighten panels of such folded tubular boxes by applying front to back pressure thereto.

2. Apparatus as set forth in claim **1** in which the third means also forms folded tubular boxes produced by the first and second means, into an underfed stack.

3. Box making apparatus including feeding means for feeding box blanks forward one at a time from a stack of such blanks; first means for transporting blanks received from said feeding means forward along a feed path and simultaneously folding outboard panels of such blanks inward along score lines extending in the direction of said feed path to positions overlying panels adjacent thereto; second means for applying closure means to connect such outboard panels together at their edges remote from the score lines; said first means including a first and a second longitudinally extending continuous moving conveying and folding belt in engagement with blanks received by said first means; said belts remaining engaged with and retaining control of blanks with inwardly folded panels and moving such blanks forward while said second means

applies closure means thereto forming them into folded tubular boxes; a device for feeding and applying selected lengths of adhesive bearing tape to box blanks having inwardly folded panels while adhesive on said tape is moist; and a third means for stacking and straightening box blanks after said second means has applied tapes thereto, and pressure applying means acting to hold the tape to folded tubular boxes while the latter are being straightened and stacked by said third means.

4. Apparatus as set forth in claim **3**, in which pressure acting to hold the tape to folded tubular boxes is maintained until the adhesive on the tape has set sufficiently to exert a holding force preventing straightened box panels from returning to their unstraightened positions.

5. Apparatus as set forth in claim **3**, in which said device for feeding and applying selected lengths of tape includes a suction roll for delivering such selected lengths of tape to connect adjacent free edges of inwardly folded box blank panels.

6. Apparatus as set forth in claim **5**, in which there is a means for applying fluid pressure to counteract suction at said roll for positively driving said lengths of tape into contact with the inwardly folded box blank panels.

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