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72 Inventor: **Moll, Richard Joseph**

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**Warminster, Bucks
Pennsylvania (US)**

71 Applicant: **Moll, Richard Joseph**

74 Representative: **Everitt, Christopher James
Wilders et al
F.J. CLEVELAND & COMPANY
40/43 Chancery Lane
London WC2A 1JO (GB)**

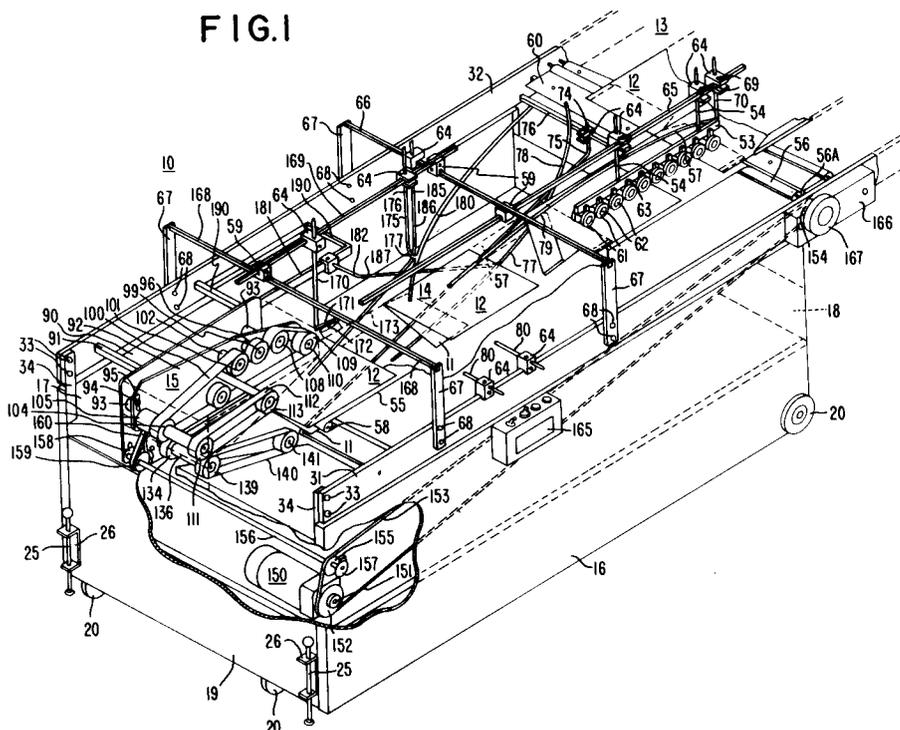
**Warminster, Bucks
Pennsylvania (US)**

54 **Folding machine for paper and the like.**

57 A folding machine which performs a final plow type fold on documents, such as sheets of paper and the like, which sheets may have had a pocket fold applied thereto, and which folds a cover flap of

the document up or down onto the main panel, as required compresses the documents, and delivers the folded documents for use.

FIG.1



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BACKGROUND OF THE INVENTION

Field of the Invention

A folding machine of the portable type, which performs a final up or down plow type fold on documents such as sheets of paper and the like, which are held in register, folded, compressed, and delivered in folded condition.

DESCRIPTION OF THE PRIOR ART

In the printing trade it is often desirable to provide a finished product that has one or more pockets thereon which can be used to hold other items. To form a pocket a sheet of paper is scored up from and parallel to the bottom to form a flap. A glue line is applied to one or more edges of the flap, which is folded up along the score line to contact the main sheet of paper and form a pocket. In some instances, it is desirable to provide a cover over the pocket, in which instance the sheet is scored lengthwise to form a cover flap, which also may be provided with a pocket, and which cover flap is then folded over and onto the main sheet.

Various apparatus have been proposed to fold a cover flap up and then over onto a main sheet, and various apparatus have been proposed to fold a cover flap down, and then up to cover a main sheet. Depending on the paper stock, the finish, and other considerations, it may be necessary to fold the cover flap up or to fold the cover flap down, which until the present invention required different apparatus to fold up, or to fold down. No single apparatus is available, which can fold the cover flap up or down as desired. Examples of prior art apparatus are illustrated in the U.S. Patents Nos. 715,620 to Staude; 846,123 to Mehle; 1,620,444 to Davidson; 1,923,121 to Simmons; 3,572,221 to Baum; 3,797,371 to Randle; 3,807,289 to Labombarde; 4,586,917 to Robinson; and 4,747,817 to Newsome.

With some types of paper stock it is very difficult to obtain an accurate fold, with the cover flap aligned with the main sheet and obtain an acceptable finished product.

As the folded or almost folded sheets leave the folding sections of various prior art apparatus, they are grabbed by mechanism in the delivery or alignment section, and subjected to high acceleration forces.

The grabbing or nipping action does not always exert uniform and perfectly straight forces on the leading edge of the sheet being accelerated. Indeed, there is a tendency for some of the individual flaps to be cocked or skewed from a desired position in which their leading edges are at right angles to the flow path. In the event of flaps cock-

ing or skewing as the sheets leave the folding section, the subsequent grabbing action produces unsymmetrical flap orientation, and an unacceptable finished product. This problem is overcome, in the present invention.

None of the prior art apparatus discloses a folding machine which can fold a flap up, or fold a flap down, as required, and particularly where a pocket has already been formed on one or more parts of the sheet being processed.

SUMMARY OF THE INVENTION

This invention relates to a plow type folding machine for paper and the like, which receives a sheet of paper which may have one or more pockets, and has been scored lengthwise to form a cover flap, registers the sheet, and performs a plow type fold to fold the flap down or up to cover the pocket, compresses and then delivers the folded sheet for further processing.

The principal object of the invention is to provide a plow type folding machine, which registers a sheet of paper, which has been scored lengthwise, and folds a flap up or down along the score line, onto a main sheet, and in aligned relation.

A further object of the invention is to provide a folding machine of the character aforesaid, which is fast and accurate in its operation.

A further object of the invention is to provide a folding machine of the character aforesaid, which can be easily set up to provide an up fold, or a down fold of a flap onto the sheet of paper.

A further object of the invention is to provide a folding machine of the character aforesaid, which is simple to construct and maintain.

A further object of the invention is to provide a folding machine of the character aforesaid, which can fold a large variety of types, and configurations of sheets of paper and the like.

Other objects and advantageous features of the invention will be apparent from the description and claims.

DESCRIPTION OF THE DRAWINGS

The nature and characteristic features of the invention will be more readily understood from the following description taken in connection with the accompanying drawings forming part hereof in which:

Fig. 1 is a view in perspective, and partially broken away, of a plow type folding machine in accordance with the invention, set up to fold a cover flap initially downwardly;

Fig. 2 is a view similar to Fig. 1, from the opposite perspective, and with a pocket folding machine feeding sheets of paper to the plow

type folding machine;

Fig. 3 is a view similar to Fig. 2, but of the plow type folding machine alone;

Fig. 4 is a view similar to Fig. 2, showing the plow type folding machine set up to fold a cover flap initially upwardly;

Fig. 5 is a view similar to Fig. 3, showing the plow type folding machine set up to fold a cover flap upwardly;

Fig. 6 is a view in perspective, and enlarged, of a portion of the plow type folding machine;

Fig. 7 is a view similar to Fig. 6, showing another portion of the plow type folding machine;

Fig. 8A is a fragmentary elevational view, showing a document in position prior to folding a cover flap in an initially downward direction;

Fig. 8B is a view similar to Fig. 8A, with the document in partially folded condition;

Fig. 8C is a view similar to Fig. 8B, with the document in final folded condition;

Fig. 9A is a view similar to Fig. 8A, showing a document prior to folding a cover flap in an initially upward direction;

Fig. 9B is a view similar to Fig. 9A, with the document in partially folded condition, and,

Fig. 9C is a view similar to Fig. 9B, showing the document in final folded condition.

It should, of course, be understood that the description and drawings herein are illustrative merely and that various modifications and changes can be made in the structure disclosed without departing from the spirit of the invention.

Like numerals refer to like parts throughout the several views.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawing and Figs. 1-3, 6, 7, 8A, 8B and 8C which illustrates the apparatus set for downward cover flap folding, and to Figs. 4 and 5 which illustrates the apparatus set for cover flap upward folding. A folding machine 10 is therein illustrated, which is set up for folding of cover flaps 11 of documents 12, such as sheets of paper and the like, which have been longitudinally prescored. The machine 10 includes a document receiving section 13, a folding section 14 and a delivery section 15. The folding machine 10, which is of a general rectangular configuration, has side plates 16 and 17, which are connected together by end plates 18 and 19. The side plates 16 and 17 have rollers 20 thereon at the receiving end, and at the delivery end rollers 20 are attached (not shown) to end plate 19 so that the machine is portable and can be rolled to desired locations. Vertically adjustable stops 25 are provided, carried

in brackets 26 on end plate 19, so that machine 10 can be locked when it is in position.

In Fig. 2, a pocket folding machine 27 of well known type is shown, in phantom, and which delivers documents 12, which have had one or more pocket flaps 29 formed thereon, which have been glued and folded to form pockets (not shown) prior to delivery to machine 10. The documents 12 have also had a lengthwise score line 30 applied thereto, in well known manner, while in machine 27, to provide a main panel 12A and a cover flap 11.

The folding machine 10 has a pair of top rails 31 and 32, above side plates 16 and 17, secured by bolts 33 to vertical brackets 34, which extend upwardly from side plates 16 and 17. The top rails 31 and 32 extend to the right as seen in Fig. 2, and to the pocket folding machine 27. The top rails 31 and 32 are connected together by a plate 35, which has a flat document transfer plate 36 secured thereto by screws 37. The top rails 31 and 32 form the document receiving section 13, with a longitudinally extending plate 38 therebetween and to end plate 18. A transverse idler roller 40 is provided, carried in bearings (not shown) in top rails 31 and 32. A plurality of endless document transport belts 41 are provided carried by roller 40, on top of plate 38, which extend to a driven roller 42, which is carried in bearings (not shown) on top rails 31 and 32. The belts 41 transport documents 12 from the receiving section 13 to the folding section 14.

Shafts 44 are provided, connected to top rails 31 and 32, with vertically extending brackets 45, which have arms 46 engaged therewith and which are connected to a document register member 47.

The arms 46 are slotted and have thumb screws 48 engaged with the brackets 45, and thumb screws 48 engaged with the document register member 47.

The brackets 45 have a document side stop and guide plate 49 spanning and connected thereto, which in conjunction with member 47 registers and guides documents 12 as they are transported by the belts 41 to the folding section 14.

The member 47 is preferably of wear resistant plastic, such as Delrin, and has a plurality of captive balls 50 to engage documents 12, and assist in their horizontal transportation.

A second document transfer plate 51 is provided, secured to end plate 18 by screws 52, and which transfers documents 12 from belts 41 to the folding section 14. The folding section 14 has an endless belt 55 to receive documents 12 and is engaged with a driven roller 56, which has a shaft 56A, which is carried in bearings (not shown) on top rails 31 and 32, and which belt 55 extends over a bed plate 57 onto a driven roller 58. The bed plate 57 extends under and between the endless loop of belt 55, and has an extension plate 60,

adjacent to plate 51, which extends to side plate 17, and forwardly a fraction of the length of the bed plate 57.

A plurality of guide rollers 61 are provided, in pairs, resting on belt 55, and are rotatably carried on shafts 62 in brackets 53A of plate 53. Shafts 54 are provided connected to plate 53, and engaged with U-shaped clamps 64, which are carried on a longitudinally extending square shaft 65, engaged with a mounting block 59 carried on a transversely extending square shaft 66, that is engaged with posts 67, which are secured to top rails 31 and 32 by bolts 68. The clamps 64 are movable on square shaft 65, and block 59 is movable on shaft 66, and they may be fixed in position by adjustment screws 69, carried therein.

A guide rod 70 is provided, engaged in a clamp 64 on shaft 65, with a straight member 71, and a diverging curved guide portion 72, which extends along and on top of bed plate 57.

A downward guide rod 75 is provided, which has a straight portion 74 engaged in a clamp 64, which is carried on a square shaft 76, which is fastened to and extends transversely from top guide rail 32.

The rod 75 has a contact portion 77 which extends therefrom and under bed plate 57 to guide a cover flap from a document 12 to be described. The shaft 76 has an extended curved contact portion 78, connected thereto by portion 79, and which extends along and under bed plate 57, which also guides the cover flaps 11 of documents 12, to be described. As shown in Fig. 2, a pair of clamps 64 are engaged with top rail 31, with square shafts 80 therein and connected to a document guide member 81, which is of rectangular configuration, and has rollers 85 which rest on belt 55, and with a smooth top surface 86 to guide documents 12, to be described.

The delivery section 15, which receives partially folded documents 12 from the folding section 14 includes an upper mounting plate 90, which is connected to side plate 17 by shafts 91, and has an upper drive plate 92 mounted thereto by bosses 93, and bolts 94 engaged in slots 95 in plate 92.

The plate 92 has a drive shaft 96 in bearing 97, thereon, with a sprocket gear 98 which is driven by a chain (not shown).

The shaft 96 has a roller 99 thereon, which has an endless belt 100 engaged therewith, and engaged with an idler roller 101 on shaft 102, which is mounted to plate 92, by a bolt (not shown) in slot 103. The belt 100 is engaged with an idler roller 104 preferably of steel, on shaft 105 mounted to plate 92, a roller 106, preferably of steel, on a shaft 107 on plate 92, and an idler roller 109 on shaft 110, mounted to plate 92, and an idler roller 107 on shaft 116. The shaft 105 has another steel roller

111 thereon, which has an endless belt 112 engaged therewith, and with an idler roller 113 on shaft 114, which is mounted to plate 92 by a bolt (not shown) carried in slot 115 of plate 92.

5 The belt 112 between rollers 111 and 113 diverges upwardly from the horizontal as represented by belt 55.

10 A lower mounting plate 120 is provided, which is connected to side plate 17 by shafts 121, and has a lower drive plate 122 mounted thereto by bosses 93, and bolts 94 engaged in slots 123 in plate 122.

15 The plate 122 has a drive shaft 124, in bearing 125, which is in plate 122, with sprocket gear 126 thereon, which is driven by a chain (not shown).

20 The shaft 124 has a roller 127 thereon, which has an endless belt 128 engaged therewith, engaged with an idler roller 129 on shaft 131, which is mounted to plate 121, by a bolt (not shown) in slot 130. The belt 128 is also engaged with an idler roller 132 on shaft 133 mounted to plate 122, a roller 134, preferably of steel, on a shaft 135, in bearing 136 on plate 122, an idler roller 137 on shaft 138, mounted to plate 122, and an idler roller 143, in shaft 144 on plate 122.

25 The shaft 135 has another steel roller 139 thereon, which has an endless belt 140 engaged therewith, and with an idler roller 141 on shaft 142, which is mounted to plate 122 by a bolt (not shown) carried in slot (not shown) of plate 122.

30 The belt 140 between rollers 139 and 141 diverges downwardly from the horizontal as represented by belt 55.

35 A driving motor 150 is provided, which is mounted (not shown) to the end plate 18, with an output shaft 151 that has a pulley 152 thereon, with an endless belt 153 engaged therewith, and with a pulley 154 on shaft 56A to drive roller 56. The belt 153 is also engaged with a pulley 155 on transverse shaft 156, which is mounted in bearing 157 in side plate 16, and in bearing 158 in side plate 17. A pulley 159 is mounted to shaft 156 with an endless belt 160 engaged therewith, and with a pulley (not shown) which drives the belts 100, 112, 128 and 140.

45 The motor 150 is connected to a control box 165 by wires (not shown) which box has well known structure therein to provide the motor 165 with a variable speed capability.

50 A hand wheel assembly 166 is provided, mounted to top rail 31, and engaged with shaft 56A for rotation as required. The hand wheel assembly 166 is of the safety clutch type, which requires the operator to pull the hand wheel 167 outwardly against a spring (not shown) to engage the hand wheel 167 for rotation of shaft 56A.

55 The top rails 31 and 32 have another pair of brackets 67 secured thereto by bolts 68 with a

transverse square shaft 168 therein, which has a mounting block 59 engaged therewith and with a square shaft 169 extending longitudinally of machine 10 and engaged with a block 59, which is carried on and engaged with shaft 66.

A rod 170 is provided, which has a roller 171 connected thereto by a shaft 172, and is mounted to shaft 159 by clamp 64. The roller 171 bears on the edge 173 of bed plate 57, to force the score lines 30 of documents 12 against the edge 173 as they travel on the belt 55 and along plate 57, to be described.

The shaft 169 has another clamp 64 engaged therewith and with an up fold contact and guide rod 175 engaged therein. The rod 175 has a straight portion 176, with another straight portion 177 at an angle thereto, connected to a curved contact rod 180, which can extend under transfer plate 51 and bed plate 57 for upward folding of document flap 11 to be described.

The shaft 66 has another clamp 64 engaged therewith, with a document contact and guide rod 185 engaged therewith, which has a straight portion 186, and a straight portion 187 connected thereto, which extends over top of belt 55 and adjacent the end of the folding section 14, to contact documents 12 as they are transported on belt 55 to the delivery section 15.

The side plate 17 has two square shafts 190 extending perpendicularly therefrom, with a square shaft 191 connecting them and extending longitudinally of the machine 10. A clamp 64 is carried on shaft 191, with a guide and contact rod 192 engaged therewith, which extends under the plate 55 for contact and guidance with cover flaps 11 when flaps 11 of documents 12 are to be folded downwardly.

A guard 193 is provided, in the delivery section 15, of U-shape, open at the ends, and fastened to upper mounting plate 90 by bolts (not shown) in well known manner.

As seen in Fig. 2, a transport or feeding table 195 is provided, shown in phantom, and which receives folded documents 12 from delivery section 15 for further processing as required.

The mode of operation will now be pointed out.

When it is desired to fold the cover flaps 11 of documents 12 initially downwardly, the rod 170 is adjusted so as not to interfere with the downward rotation of cover flaps 11, as they come off plates 51 and 60, and rods 70, 75 are adjusted to appropriate positions to contact and guide flaps 11.

The motor 150 is actuated to drive roller 58 and belt 55. Documents 12 are fed onto belts 41 from pocket fold machine 27 against guide plate 49, and under member 47, where the documents 12 are registered. The belts 41 deliver the documents 12 to transfer plate 51 and onto belt 55, and

extension plate 60. As the documents 12 move onto and off plate 51, their main panels 12A are engaged by guide roller 61, and as the cover flaps 11 are no longer supported by the plate 60, they fall downwardly until they contact rods 70, 77, with the score lines 30 against the edge 173 of bed plate 57. As the belt 55 moves the documents 12 along, the flaps 11 are rotated downwardly by rods 70, 77, and are then upwardly and contacted by rod 172 until the flaps are under plate 57. The documents 12 are also contacted by rollers 85, and by roller 171 on score lines 30, forcing the documents 12 against edge 173 of plate 57 and urging the flaps 11 upwardly while the rest of the document is carried along on belt 55. The documents 12 are moved off belt 55, and into the delivery section 15 where they contact belt 160, and then belt 140 which carries them between the rollers 111 and 139, which compresses the main panel 12 and flaps 11 of documents 12, and delivers them onto a feeder table, such as table 195 for use as desired.

When it is desired to fold cover flaps 11 initially upwardly, guide and contact rod 170 is moved under extension plate 60 so that flaps 11 will be supported as the documents move off plate 60, and along belt 55. The cover flaps engage rod 180, which rotates flaps 11 upwardly and between rods 180 and rod 185 onto belt 55, under roller 171, onto surface 86, onto panel 12A, and the documents 12 are moved off the belt 55 to delivery section 15, where they are engaged by belts 140 and 160, and further compressed between rollers 111 and 139.

Due to the divergent angles between the belts 140 and 160 at the entrance to the delivery section 15 from belt 55, the documents 12 are not immediately gripped, and are not compressed between rollers 111 and 139 until they are substantially off the belt 55, which results in substantially folding the entire length of the documents 12 along the crease lines 30, while registered and under pressure from rollers 171 and 85. The cover flaps 11 are therefore maintained in alignment until the documents 12 contact the belts 140 and 160 at the location of the rollers 111 and 139, which further compresses the documents 12, and maintains the alignment of flaps 11 as the documents 12 pass therethrough and are delivered for further processing as desired.

It will thus be seen that apparatus has been provided with which the objects of the invention are achieved.

Claims

1. A folding machine for performing a plow type fold on documents such as sheets of paper

and the like, where the documents have a longitudinal score line, which divides them into a main panel, and a cover flap which comprises

a receiving section, 5

a folding section,

a delivery section,

said receiving section includes means to receive and register said documents,

said folding section includes a bed plate, 10

an endless driven belt on said plate to receive and transport documents to be folded,

guide rollers to contact said main panels and to initially retain them on said belt,

adjustable guide rod means to engage 15
said cover flaps as the documents are being transported, to selectively cause said cover flaps to be rotated up, or down, about said score lines, until they are substantially parallel to said main panels, 20

pressure means to engage said documents along said score line and force them onto said bed plate,

said delivery section having at least one pair of opposed driven rollers, and at least one pair of idler rollers spaced therefrom, 25

said pairs of driven rollers are in close proximity to each other, and said pairs of idler rollers are spaced apart and located above and below said bed plate, 30

endless belts on and connecting said pairs of driven and idler rollers to receive said documents from said folding section, and carry them to and between said opposed driven belts on said rollers compressing said documents. 35

2. A folding machine as defined in Claim 1 in which:

said folding section includes an extension plate which supports said cover flap until it is in said folding section, and until the document leaves said extension plate, and 40

said guide rod means for flap rotation includes contact portions above said flaps to engage said cover flaps and urge them downwardly and then upwardly about the said score lines as documents are transported on said bed plate belt until the cover flap is parallel to said main panel and said document leaves the folding section. 50

3. A folding machine as defined in Claim 2 in which: said guide rod means for flap rotation includes contact portions below said cover flaps to support said cover flaps as they enter said folding section from said extension plate, and to urge the flaps upwardly, and then down-

wardly about said score lines as they are transported on said bed plate belt until the flaps are parallel to said main panels and the documents leave the folding section.

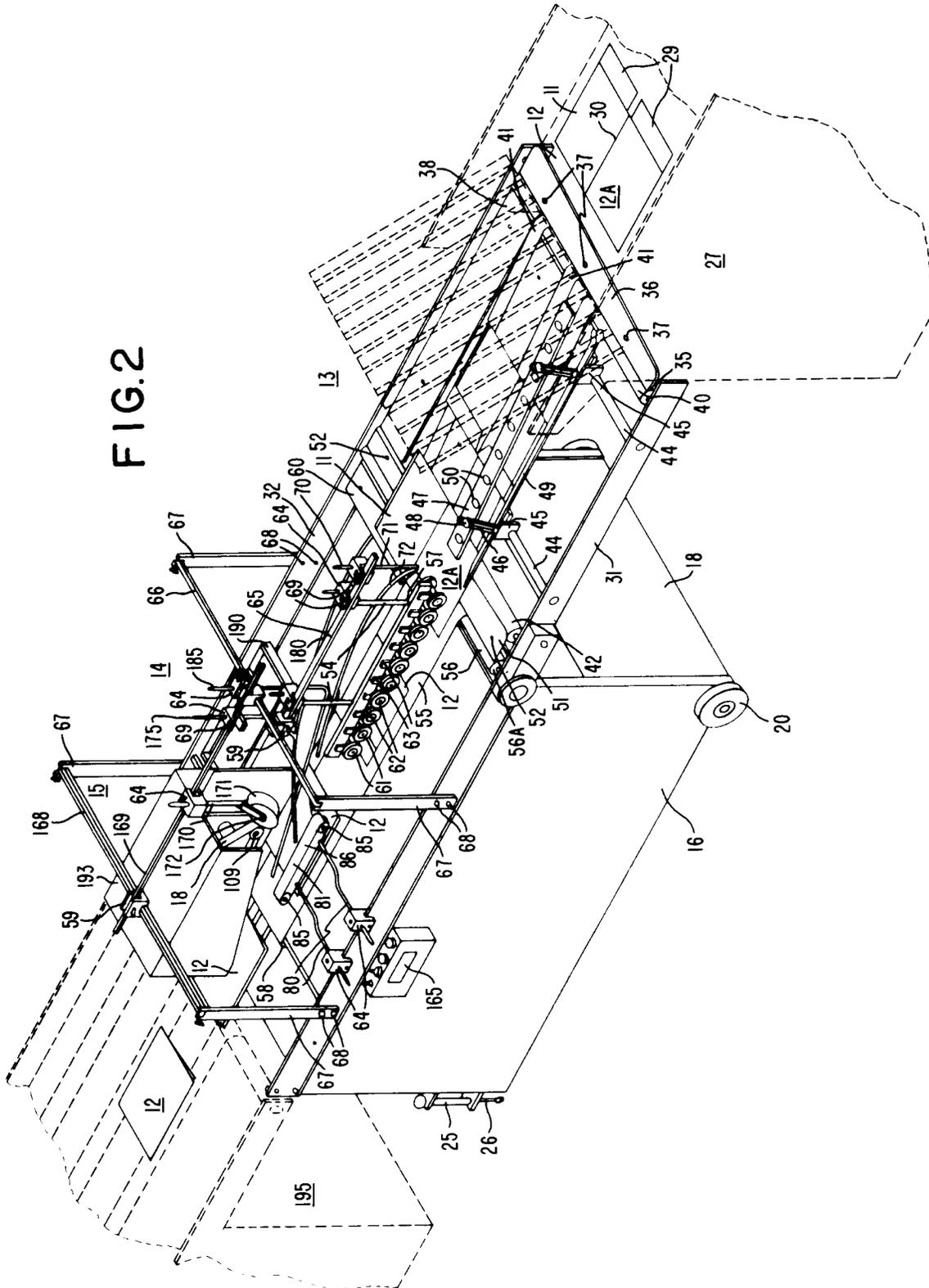
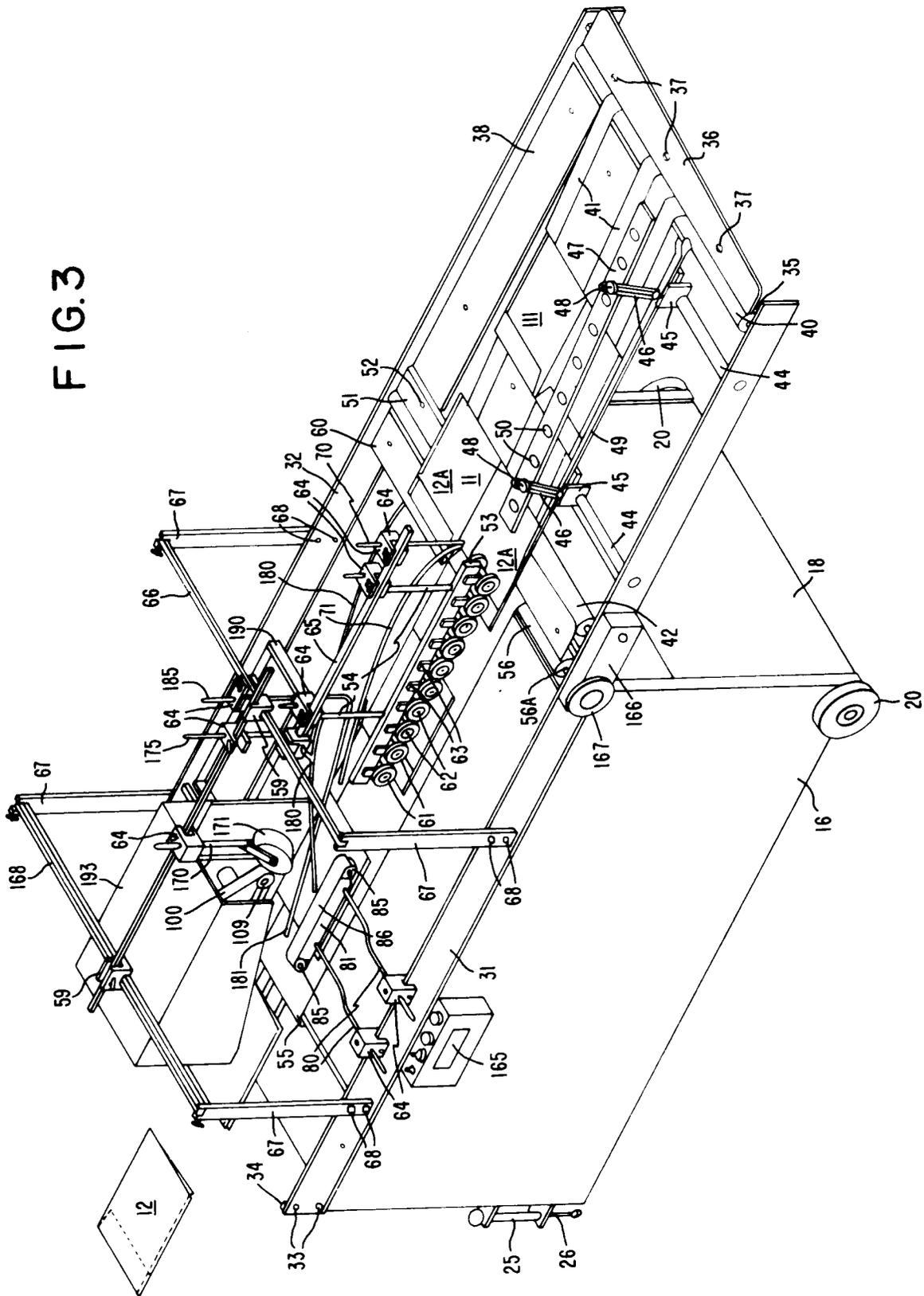


FIG.3



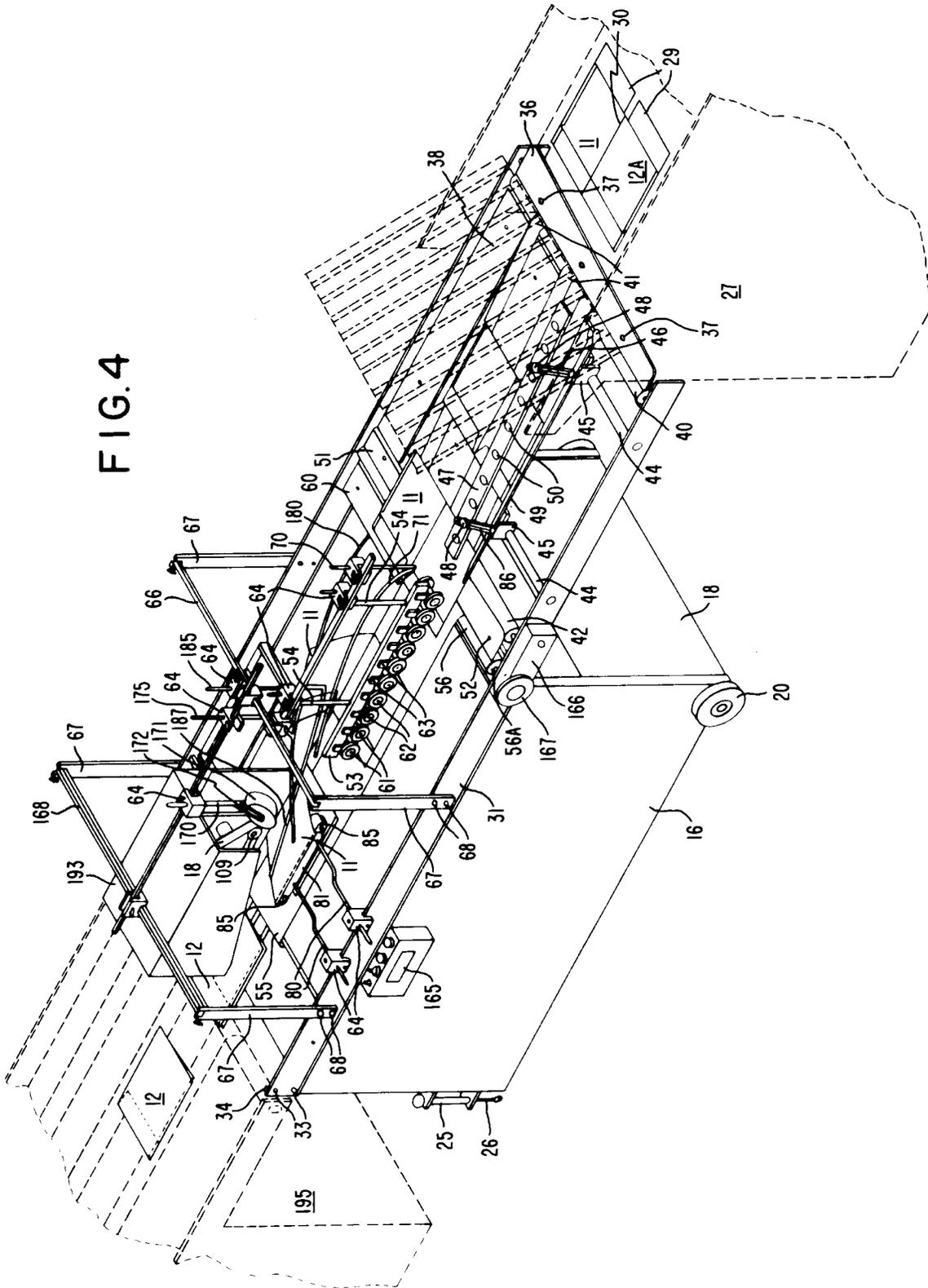
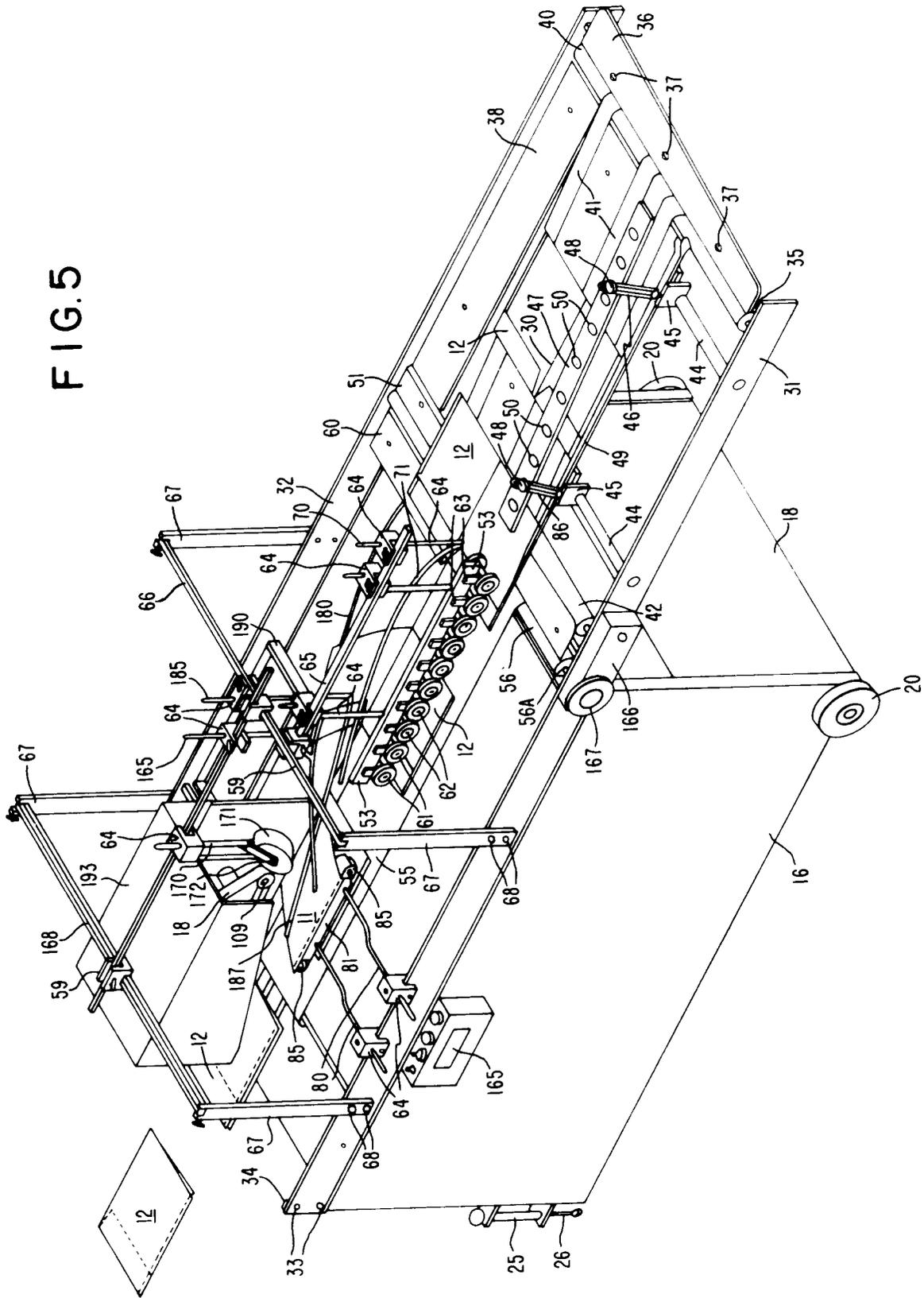


FIG. 5



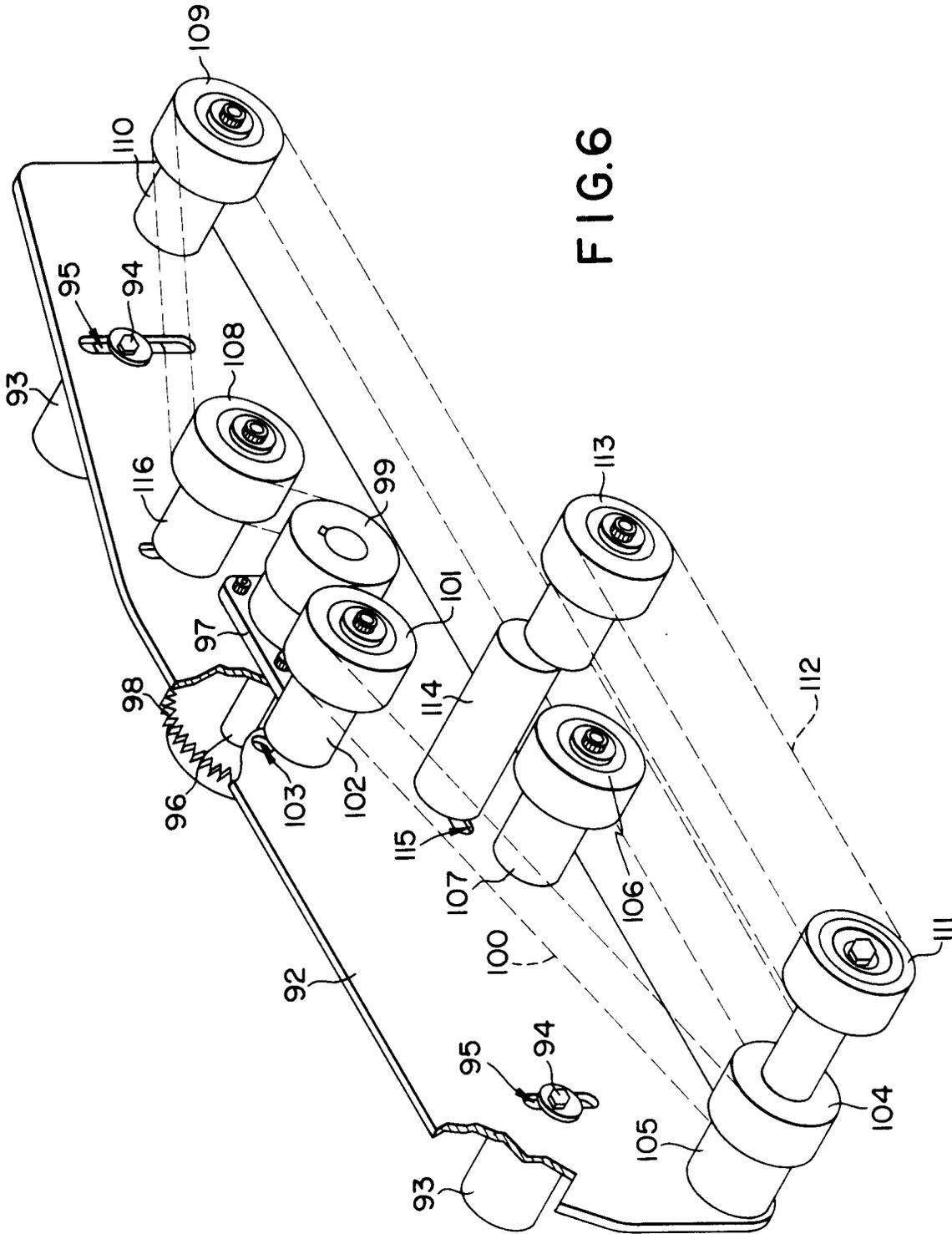


FIG. 6

FIG.8A

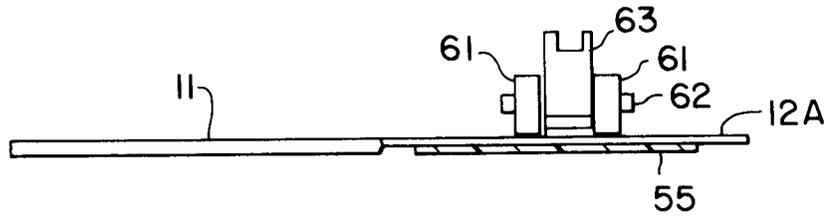


FIG.8B

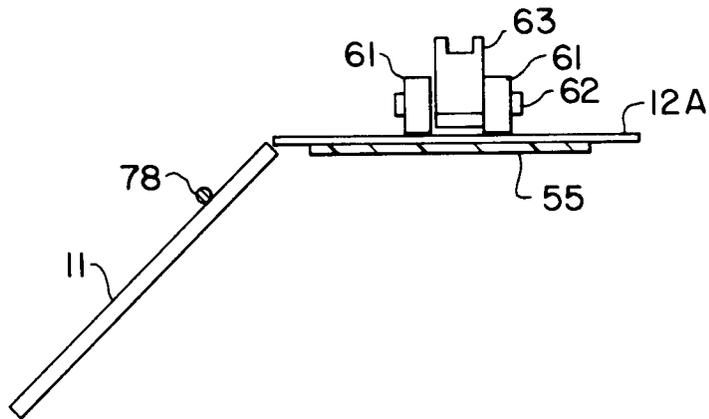


FIG.8C

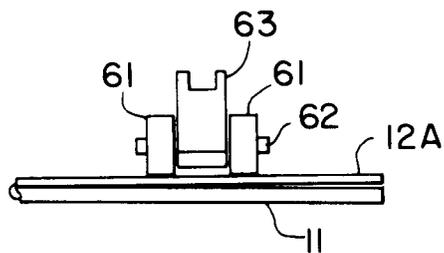


FIG. 9A

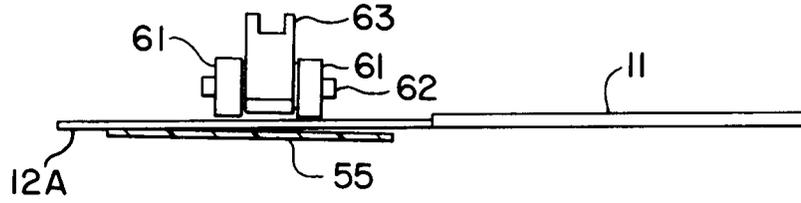


FIG. 9B

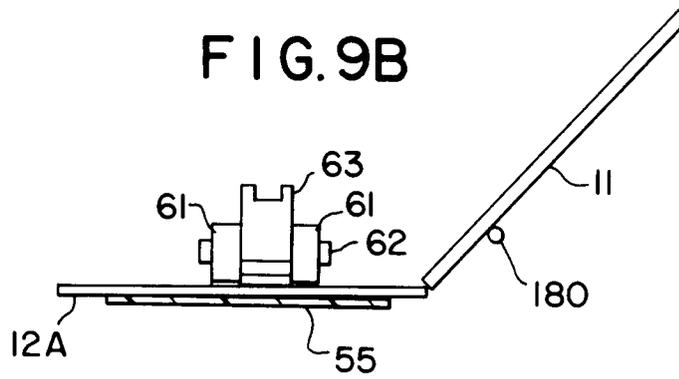
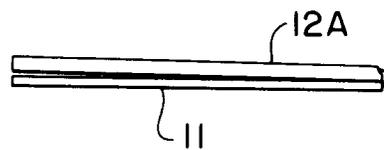


FIG. 9C





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-4 764 240 (SIMEONE J.M.) * column 10, line 3232 - line 58 * * column 20, line 15 - column 22, line 52; figures 1B,3,14 * ---	1	B42C7/00 B65H45/22
A	EP-A-0 030 097 (MISUBISHI JUKOGYO K.K.) * page 1, line 5 - page 2, line 19; figures 1A-1E * * page 6 - page 7, line 7; figure 7 * ---	1	
A	EP-A-0 182 713 (IMPRIMERIE CLAUDE CHAMBRE) * abstract; figures * ---	1	
A	US-A-3 656 741 (MACKE T.F.) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B42C B65H
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	17 February 1994	Thibaut, E	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			