

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 0 703 497 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

27.03.1996 Bulletin 1996/13

(51) Int Cl.⁶: **G03D 15/04**

(21) Application number: **95420253.7**

(22) Date of filing: **14.09.1995**

(84) Designated Contracting States:
DE FR GB

(30) Priority: **22.09.1994 US 310917**

(71) Applicant: **EASTMAN KODAK COMPANY**
Rochester, New York 14650-2201 (US)

(72) Inventors:

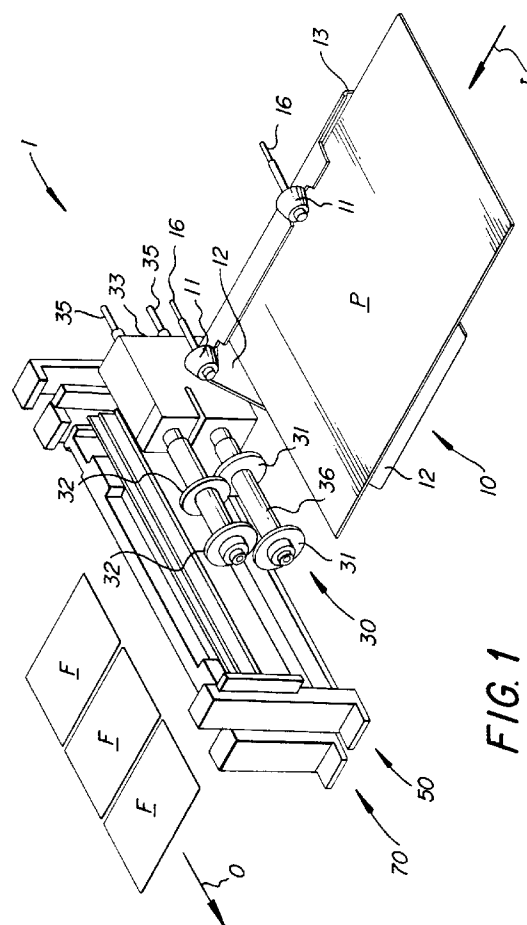
- **Phillips, Bradley Allen, c/o Eastman Kodak Co.**
Rochester, New York 14650-2201 (US)

- **Wellman, Jeffrey Allen, c/o Eastman Kodak Co.**
Rochester, New York 14650-2201 (US)
- **Caprio, Craig Andrew, c/o Eastman Kodak Co.**
Rochester, New York 14650-2201 (US)

(74) Representative: **Buff, Michel**
Kodak-Pathé
Département des Brevets et Licences CRT
Centre de Recherches et de Technologie
Zone Industrielle
F-71102 Chalon sur Saône Cédex (FR)

(54) **Apparatus for separating a multi-image, parent sheet into discrete, single-image, finished sheets**

(57) Apparatus (1) for separating a multi-image parent sheet (P) into a plurality of precise-dimension finished sheets (F) has a linear sheet edge guide (13) extending along a sheet feed path and sheet slitting (30) and strip cross-cut knives located respectively at precise transverse and orthogonal positions vis a vis the edge guide (13). Overridable feed rollers located upstream of the sheet slitting knives feed a parent sheet into accurate positions with a lateral edge against the edge guide (13), and a metering drive downstream of the slitting knives (31,32) overrides the feed rollers to accurately meter the strips to a position for cross-cutting.



EP 0 703 497 A1

Description

The present invention relates to the finishing of multi-image parent sheets to provide a plurality of single image finished sheets and more specifically to apparatus for precisely slitting and cutting such parent sheets to produce finished sheets of highly accurate dimension.

In photofinishing, images have heretofore been produced (for example photographically printed) in rows and columns, in an x-y pattern, on a multi-image parent sheet that has length and width to accommodate more than one image in each direction. The typical school photograph portfolio comprising a number of reproductions of the same magnification image on a sheet is one example.

US-A-4, 506,824 discloses another photofinishing system wherein multiple images are printed on, and cut from, a single web. The '824 patent describes a series of programmable die and punch assemblies to selectively separate the multiple images. Other systems such as described in US-A-4,943,270, use guillotine-type knife assemblies to separate sequential images on multi-image strips of photographic medium.

All of the above systems work acceptably in certain applications, particularly in those of low volume and where white borders exist between the images to be divided. However, it is desirable to increase productivity in such photofinishing operations and in that regard it would be desirable to have faster ways to separate the individual images of such multi-image sheets.

The problem is compounded in applications where borderless prints are involved. That is, optical systems can accurately project a plurality of different images in precise register, without borders, on adjacent x-y locations of a multi-image sheet; and the arrangement of such image arrays often present a dark edge of one image adjacent a light edge of the contiguous image. The need to separate such images precisely is very important, for an error is highly apparent to the customer.

Thus, one significant purpose of the present invention is to provide improved apparatus for precisely dividing multi-image sheets into a plurality of accurately bordered, single-image sheets. One advantage of the present invention is the increased rates of production which it can attain. Another advantage of the invention is its ability to produce borderless prints without edge artifacts incident to imprecise print separations.

In one aspect the present invention constitutes apparatus for separating a multi-image parent sheet into a plurality of precise-dimension finished sheets and comprises: (i) means defining a sheet feed path, including sheet edge guide means extending along a lateral side of the sheet path; (ii) means, including a plurality of over-ridable feed rollers, for feeding a parent sheet along an upstream feed path region and into precise edge alignment with the edge guide means; (iii) means for slitting a parent sheet into strips along lines parallel to the sheet feed direction, including a plurality of knife means locat-

ed downstream of said feeding means and in precise lateral spacings vis a vis said edge guide means; (iv) metering means located along said feed path downstream from said slitting means, for firmly gripping and precisely advancing slit strips fed thereto; (v) means controlling strip advance by said metering means to precisely position strips at a predetermined sever location, downstream therefrom and (vi) cross-cut knife means for severing strips at said sever location, in a direction precisely orthogonal to said sheet guide means.

The subsequent description of preferred embodiments of the invention refers to the accompanying drawings wherein:

Fig. 1 is a perspective view of one preferred sheet finisher embodiment in accord with the present invention, schematically illustrating parent sheet input and finished sheet output;

Fig. 2 is a top view of the Fig. 1 apparatus;

Fig. 3 is a side view of the Fig. 1 apparatus;

Fig. 4 is a front view, partially in cross section, of the slitter assembly of the Fig. 1 apparatus;

Fig. 5 is a front view of the metering assembly of the Fig. 1 apparatus; and

Fig. 6 is a front view of the cross-cut knife assembly of the Fig. 1 apparatus.

Fig. 7 is a perspective view similar to Fig. 1, but showing the sheet finisher apparatus without input sheets and showing a conveyor assembly for cooperating with the finisher apparatus.

Referring to Fig. 1, the sheet finisher apparatus 1, comprises, in general, a sheet feeding assembly 10, a sheet slitter assembly 30, a strip metering assembly 50 and a strip cross-cut assembly 70. A conveyor assembly 80 (Fig. 7) is provided to feed finished sheets F away from the output of finisher apparatus 1 in a direction O, perpendicular to the input feed path direction I, of the multi-image parent sheet P. Similarly, an input apparatus (not shown) conveys sheets P into the nip of the first upstream feed roller 11 of feeder assembly 10. Such input and output conveyor systems can take various forms known in the art and do not constitute a part of the present invention.

Referring now to Figures 2 and 3, as well as Fig. 1, the feeder assembly 10 provides means for feeding multi-image parent sheets along a feed path, defined by a guide plate 12, and into a precise alignment on that path, with a lateral edge of each sheet abutting against a linear edge guide 13. More particularly, the rollers 11 have a conical, edge drive configuration and are formed of compressible foam. The roller drive is effected by motor 14,

which drives timing belt 15, coupled to the roller shafts 16. The edge guide 13 is accurately aligned vis a vis the desired sheet feed direction, and the slitter assembly 30, metering assembly 50 and cross-cut knife assembly 70 are all precisely located vis a vis the edge guide 13. The shape and mounting of the feed rollers 11 force the sheet P to move with its adjacent edge snugly abutting against the guide 13, as it is feed forward into the slitter assembly 30. The structures and functions of such conical edge drive rollers are known in the art, see, for example, U S Patent No. 3,929,327. In accord with one aspect of the present invention, it is important that the feed rollers 11 be constructed and mounted to be overridable, and slip over the parent sheet surface, when the sheet metering movements are under control of the metering assembly as described subsequently. Referring now to Fig. 4, as well as the above noted Figures, the slitter assembly 30 is located along the feed path in a position to receive sheets P from the feeder assembly 10 and provides means for slitting a received sheet into strips along slit lines precisely parallel to the edge guide 13 and at predetermined transverse positions across the path, so as to provide precise widths for finished sheets F. More particularly the slitter means comprises a pair of rotary knife sets, each set having an upper knife 31 and a lower knife 32. The knife sets are driven by slitter motor 33, via a drive train including gears 34 and cantilevered shafts 35. The upper and lower knives preferably have a 90 degree rake angle (square edge), which provides a shear cut. The upper knives preferably are mounted with a .002" deflection preload against the lower knives. The knife positions along shafts 35 are defined by precision ground spacer 36, and a lock nut 38 clamps the knife sets and spacer together. As shown in Fig. 4, it is highly preferred, in accord with the invention, that the upper knives 32 both be inboard, toward the center of the feed path, of their respective lower knives. This blade relation and preload pressure effect balanced cutting forces which minimize sheet-steered non-alignments.

The precise width strips moving out of the knives of assembly 30 next enter the metering assembly 50, which receives the strips and provides for precise downstream advance of the strips to a predetermined position for cross-cutting to provide precise finished sheet lengths. The assembly 50, further illustrated in Fig. 5, comprises a hard, frictional surface, metering roller 51, which is precision ground and mounted on shaft 53, and a compliant pressure roller 52, also with a precision ground surface, for example, of 60 durometer polyurethane. The metering roller 51 is driven by a DC motor 54 controlled with feedback from rotary encoder system 55, having, for example, an effective resolution of 10,160 counts per revolution. The pressure roller 52 is supported on its shaft 56 by arms 57, which are slidable vertically in the apparatus mainframe and urged into contact with the metering roller 51 by springs 58, to have, for example, an 8 lbs. nip pressure.

Sensor 60 is positioned at the output side of the me-

tering rollers 51 as shown in Fig. 2 and provides means for detecting the path position of the lead edge of the strips. The sensor can comprise an infrared LED source mounted above the edge of the feed path and a cooperative detector mounted below the path. These elements are positioned so the lead edge of a sheet passing along the sheet guide will interrupt the source light and signal the edge presence.

The function of sensor 60 is to cooperate with metering assembly 50 to stop the lead ends of the slit strips, at a "zero position", or to jog the strips forward or backward to a predetermined position that is a precisely known distance along the feed path direction from the desired strip cutting position (that is, the position that will yield the precise length for finished sheets F). Once the strips are positioned at the correct "zero position", the metering roller is advanced a predetermined number of increments, under control of the encoder system 55, and the finisher apparatus microprocessor control (not shown), to locate the strip ends at the desired cross-cutting position, described above. During these stopping and precise advance sequences, the feed of the entire parent sheet P is controlled by the metering assembly. Thus when a parent sheet P passes into the nip of rollers 51, 52, the compliant sheet feed rollers 11 are overridden by the more firm grasp of the metering assembly nip. It is highly preferred, that the cutting nip of knife sets 31, 32 have a velocity equal to, or faster than, the metering roller's peripheral velocity so that a drag force is not created on the strips advance to their cutting position.

The cutting assembly 70, further illustrated in Fig. 6, comprises cooperating cross-cut knives 71, 72, which extend across the feed path, precisely perpendicular to the direction of feed (defined by edge guide 13) and in precise longitudinal alignment with cutting position to which strips are advanced by the metering assembly 50, as just described above. The lower knife 71 is stationary and the upper knife 72 is movable, and preloaded against the lower knife 71, to provide a progressive cutting action. That is, the shear angle of the upper knife and the relief angle of the upper knife and the relief angles in both upper and lower knives are selected to achieve progressive point contacts transversely across the cutting position. To effect the cutting operation the upper knife is lowered by crank assembly 73 (see Fig. 3), which is driven by motor 78 and operates eccentric crank arm 74, in turn coupled to an upper knife drive pin 76 by link 75. After a cutting actuation the upper blade 72 is returned to its open position by springs 76, to allow the next set of strips to be advanced.

Referring to Fig. 7, the finisher apparatus 1 can be seen in cooperation with an output conveyor and finished sheet collator 80. Thus, after sheets are slit precisely by assembly 50 and cut to precise lengths by assembly 70, the sequential arrays of tandem sheets are feed by transfer roller 81, operating over a sheet support plate not shown, into the nips of rollers 83 of the conveyor/collator assembly 80. The rollers feed the sheets into an ordered

condition and into a collator bin, where an operator can easily remove and insert print stacks to customer envelopes.

It will be appreciated that other constructions can be utilized in accomplishing the details of the cross-cut and rotary cutter assemblies and in accomplishing metering of strips to the correct cross-cut position.

The invention has been described with reference to preferred embodiments thereof, but it will be understood that modifications can be effected with the spirit and scope of the invention.

Claims

1. Apparatus for separating a multi-image sheet into a plurality of discrete, precisely-edged, finished sheets, the apparatus comprising:

a. means for feeding a multi-image sheet along a feed path and into precise transverse alignment on the path;

b. slitter means, located along the path, downstream from the feeding means, for slitting a sheet fed thereto, into a plurality of adjacent strips having precisely located edges;

c. metering means, located downstream of the slitter means, for receiving and precisely controlling the advance of the adjacent strips fed from the slitter means;

d. sensor means for accurately detecting the advance position of the adjacent strips;

e. control means for operating the metering means to advance the adjacent strips a precise distance from the sensor means; and

f. cutter means for cutting the strips along an orthogonal to the slit edges, after the precise advance.

2. The invention defined in claim 1 further including a linear edge guide and wherein: (i) the feeding means feeds an edge of the sheet into abutted alignment against the edge guide and (ii) the slitter means is located in predetermined transverse position vis a vis the edge guide.

3. The invention defined in claim 2 wherein the feeding means comprises a plurality of frusto-conical rollers spaced along the feed path upstream of the slitter means.

4. The invention defined in claim 2 wherein the slitter means comprises a pair of rotary knife sets and

means for rotating the sets.

5. The invention defined in claim 4 wherein the upper knives of the sets are deflectable and mounted with a deflective preload against the bottom knives of the sets.

6. The invention defined in claim 1 wherein the metering means comprises: (i) a relatively harder, frictional-surfaced metering roller, (ii) an opposing, relatively compliant pinch roller and (iii) incrementally positionable motor means for rotating the metering roller.

7. The invention defined in claim 6 wherein the feeding means comprise feed rollers that are overridable by the operation of the metering rollers in their forward, stopped and reverse modes of rotation.

8. The invention defined in claim 7 wherein sensor means comprises a sheet edge detector located on the downstream side of the metering means, and the control means comprises a rotary encoder coupled to the metering rollers and counter means coupled to the encoder output for effecting desired advancement of sheets past the sensor means.

9. The invention defined in claim 8 wherein the cutter means comprises opposing cross-cut knife blades constructed and located to effect progressive point contact precisely along a line orthogonal to the edge guide.

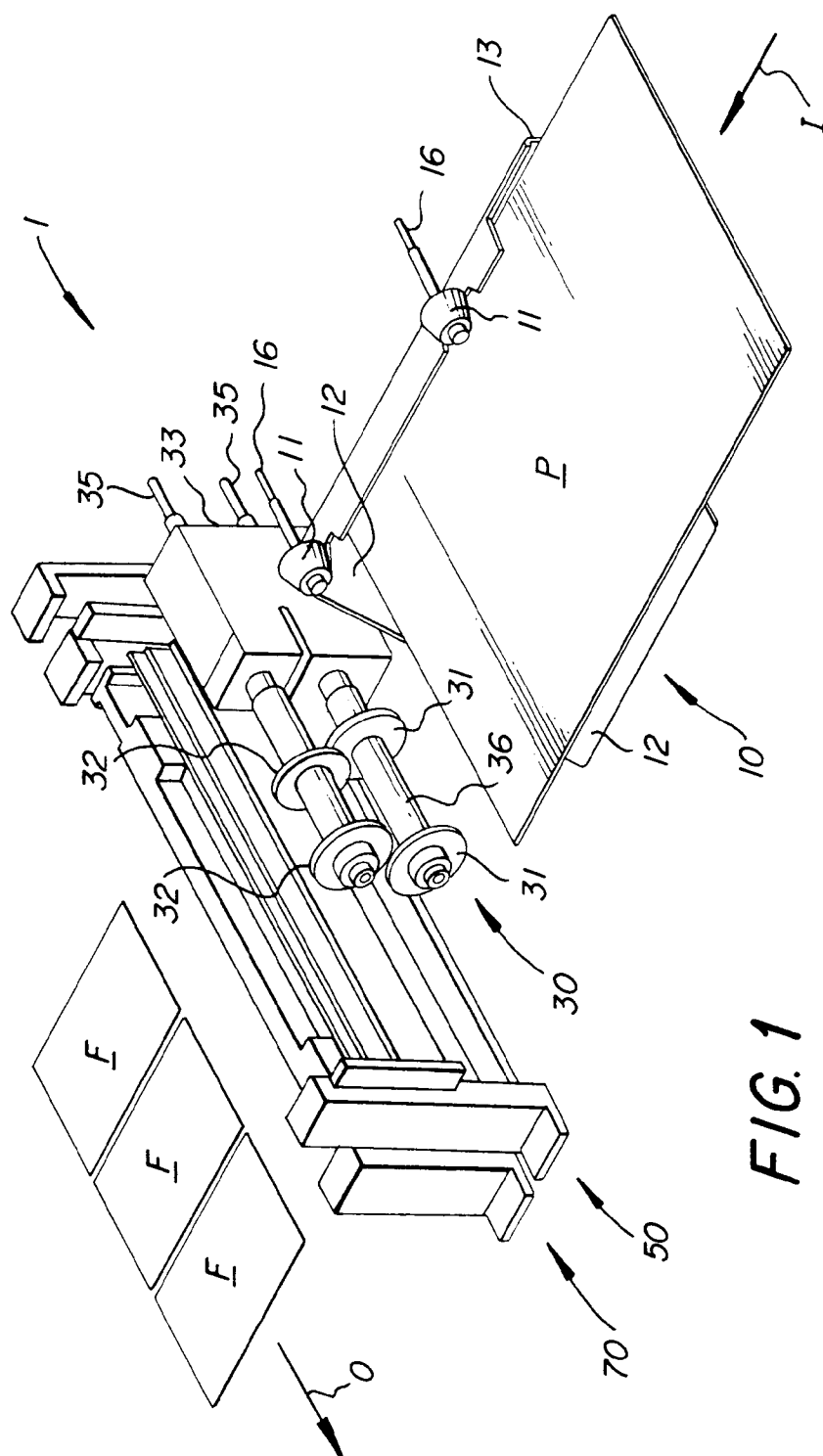
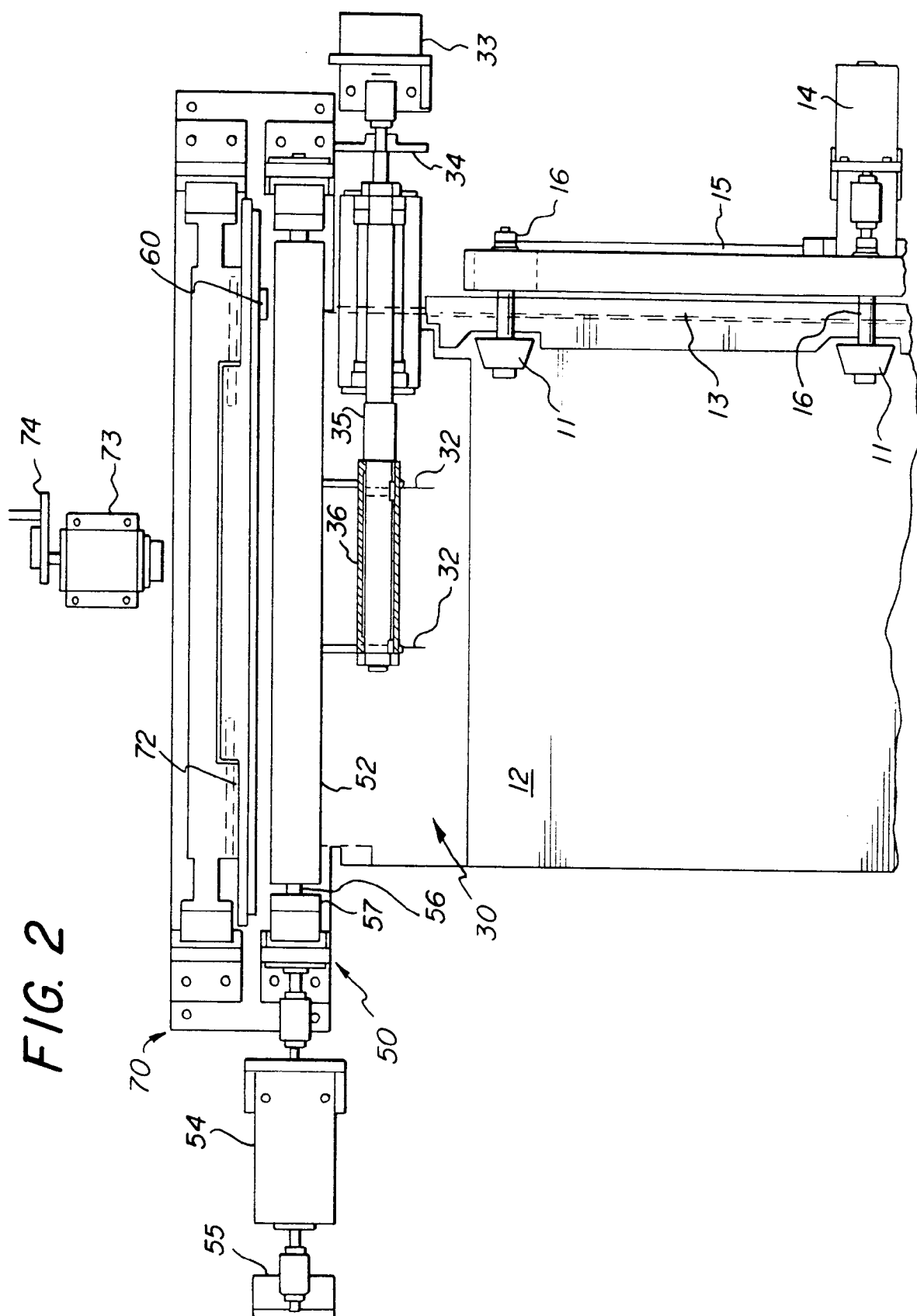


FIG. 2



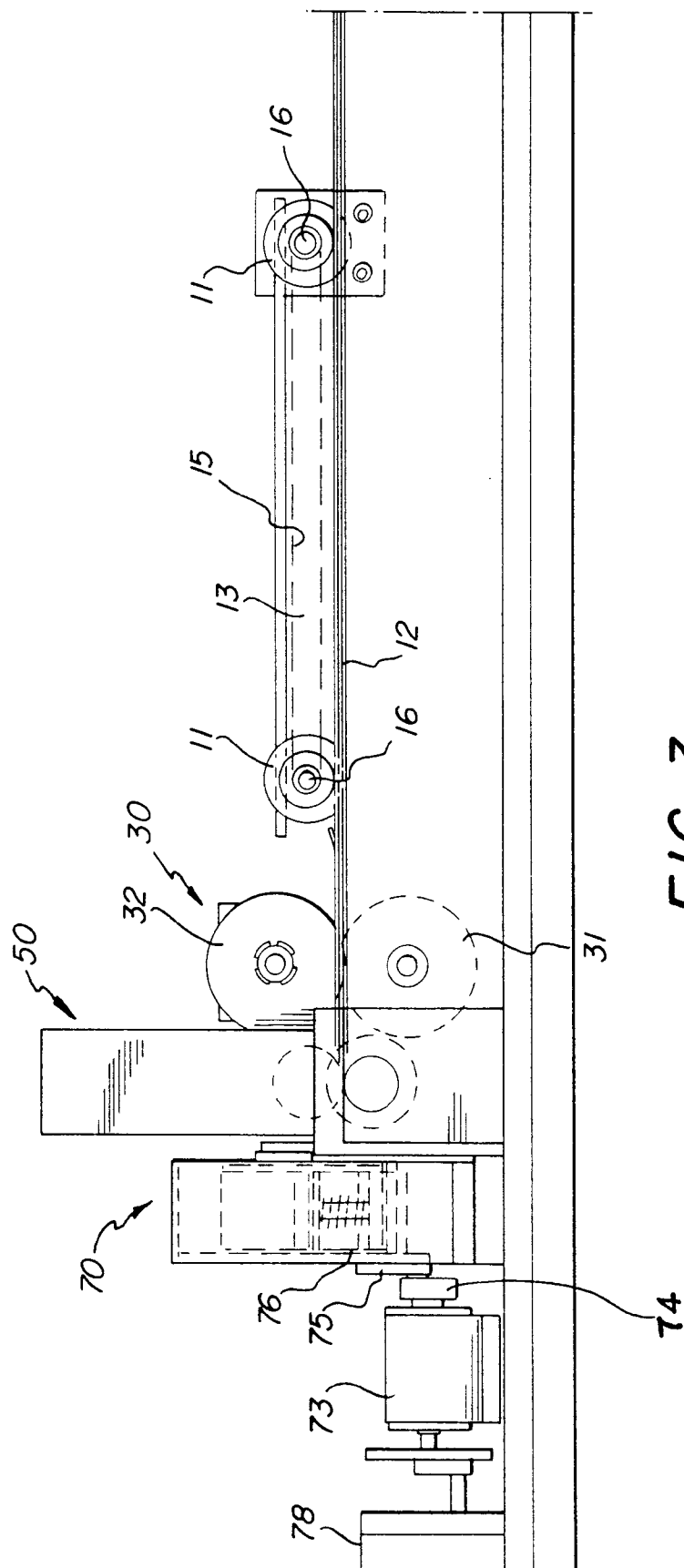


FIG. 3

FIG. 4

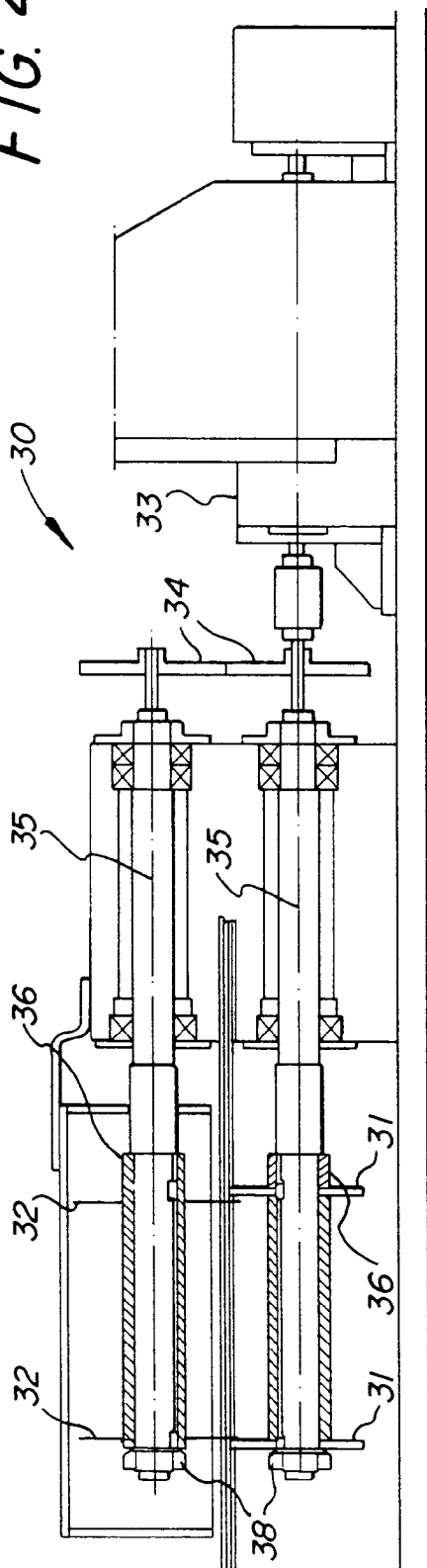
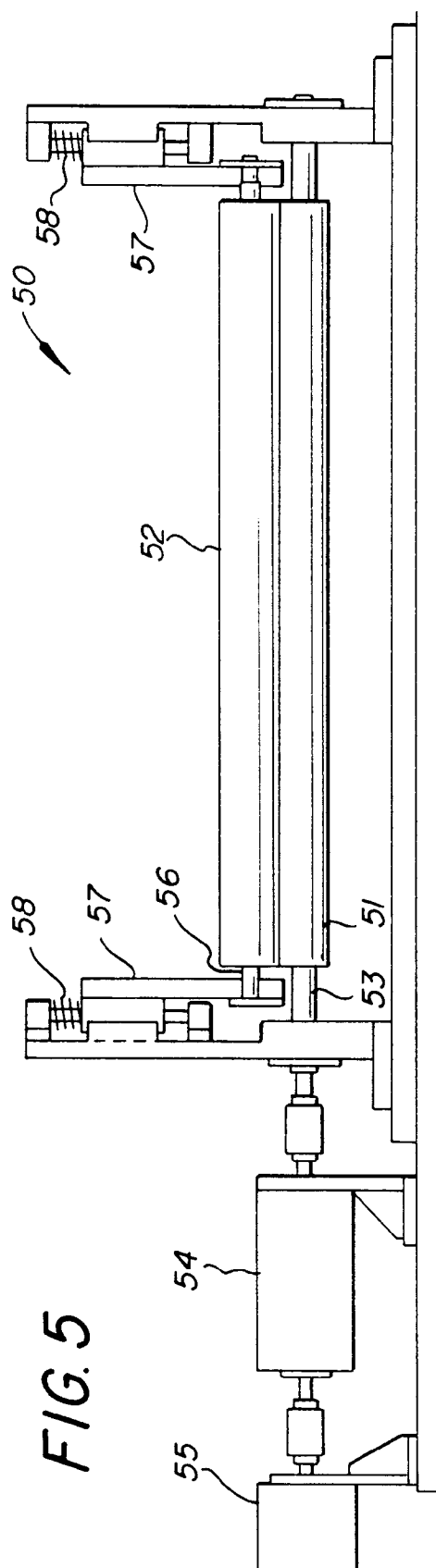


FIG. 5



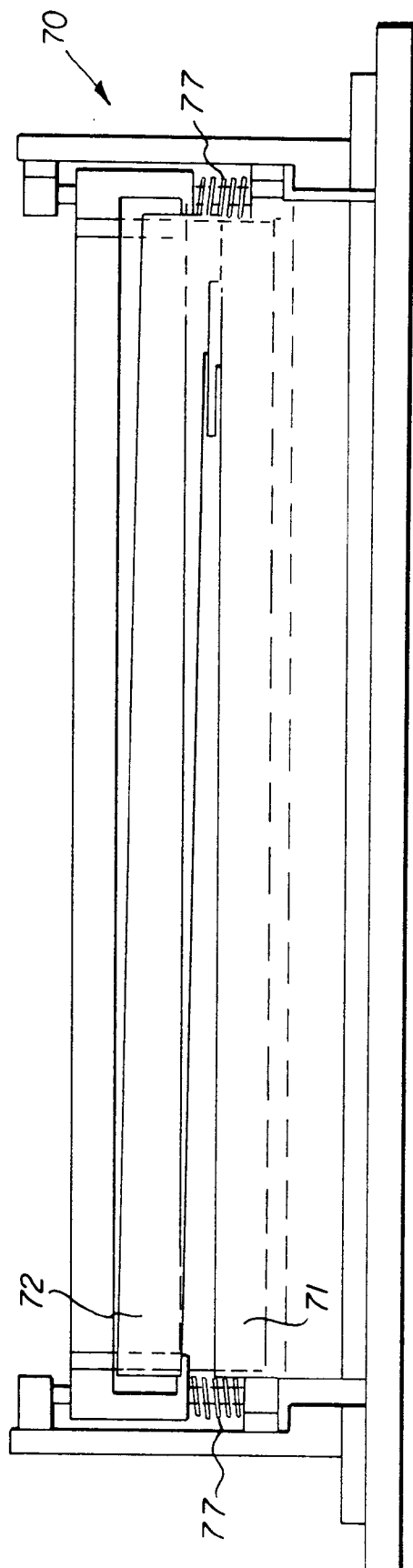
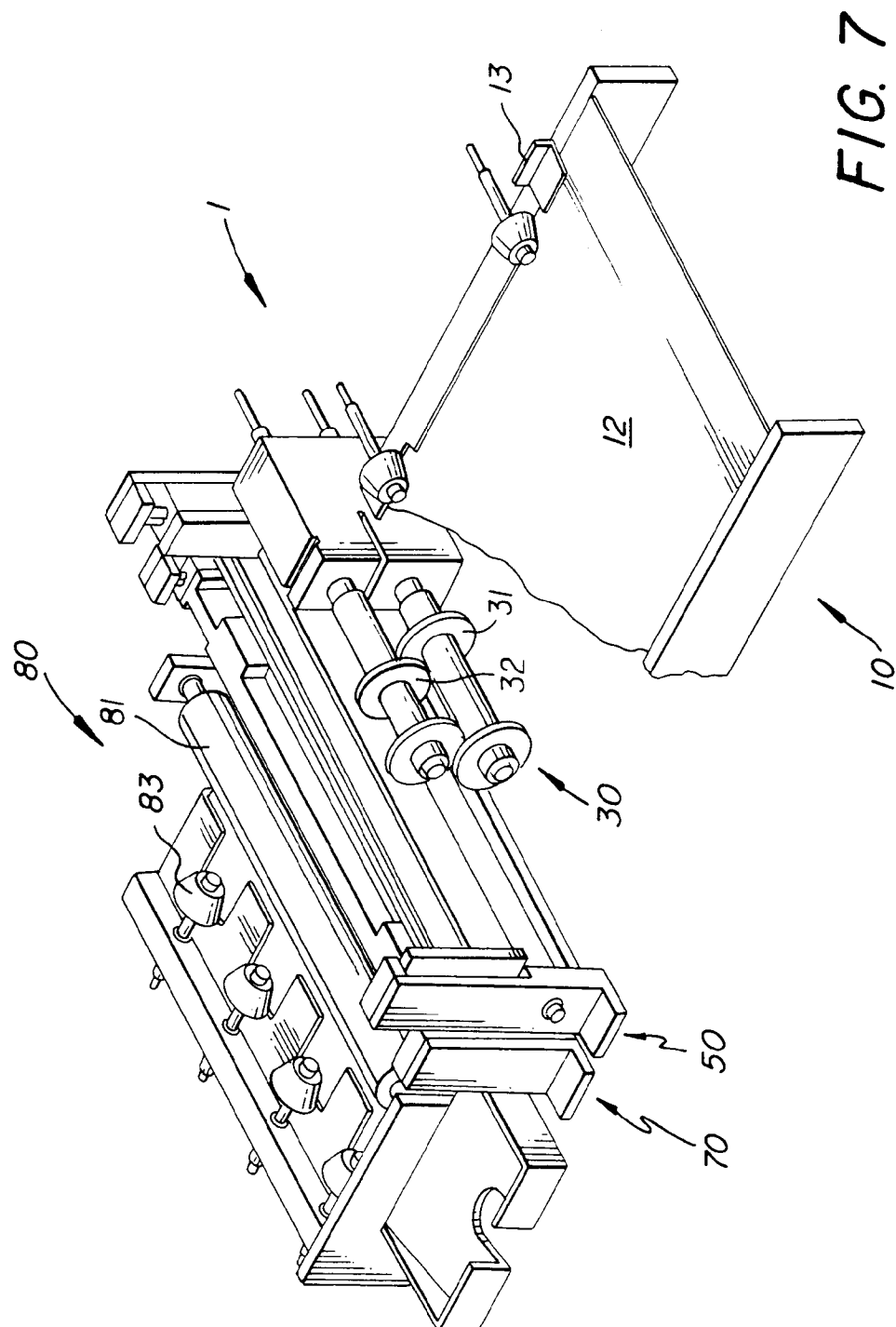


FIG. 6





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 42 0253

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)
D,A	US-A-4 506 824 (BARTZ) * abstract; figure 2 * ---	1	G03D15/04
D,A	EP-A-0 259 263 (GRETAG) * claim 1; figure 1 * ---	1,6	
D,A	US-A-3 929 327 (OLSON) * abstract; figure 1 * ---	1-3	
A	US-A-3 640 161 (KUHN) * claim 1; figure 1 * ---	1	
A	US-A-3 599 521 (LEE) * abstract; figure 1 * ---	1,8	
A	US-A-3 494 232 (LINDAU) * claim 1; figure 1 * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) G03D B26D B65H
Place of search THE HAGUE		Date of completion of the search 11 January 1996	Examiner Romeo, V
CATEGORY OF CITED DOCUMENTS 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 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			

EPO FORM 1503 01.82 (P04C01)