

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 592 716 A1

(12)

EUROPEAN PATENT APPLICATION(21) Application number: **92117653.3**(51) Int. Cl.⁵: **B65H 45/14**(22) Date of filing: **15.10.92**(43) Date of publication of application:
20.04.94 Bulletin 94/16(84) Designated Contracting States:
BE CH DE FR IT LI LU NL SE(71) Applicant: **ADVANCED SCIENTIFIC CORPORATION**
No. 26, Industry East 9th Rd.,
Science-Based Industrial Park
Hsin-Chu(TW)(72) Inventor: **Chang, Joseph, No. 26, Industry East 9th Rd.**
Science-Based Industrial Park
Hsin-Chu, Taiwan, R.O.C.(TW)(74) Representative: **von Puttkamer, Nikolaus,**
Dipl.-Ing. Patentanwalt
Thalkirchner Strasse 76
D-80337 München (DE)(54) **Automatic folding machine.**

(57) An automatic paper-and-folding machine, which is compact in size and can be conveniently adjusted to accept paper sheets of varying sizes, such as A4 or letter sized papers, and fold them into paper plies before they can be placed into envelopes for mailing. The sheet of paper to be folded is first fed from the paper-feeding unit into a first paper-guiding plate (21) in the paper-folding unit to make a first fold through the cooperative action of a first set of rollers (25,26). Then, the once-folded paper sheet is moved into a second paper-guiding plate (28) to make a second fold through the cooperative action of a second set of rollers (26,27). Thereafter the twice-folded paper sheet is guided out of the paper-folding machine with the aid of a paper-guiding roller (30) and an accurate paper-guiding plate (39), and finally the folded sheet is collected in a receiving rack mounted in front of the paper-folding unit.

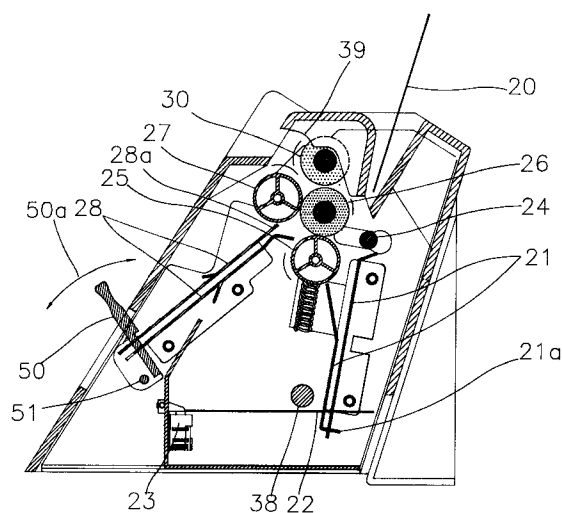


FIG. 7

EP 0 592 716 A1

This invention relates to a personal desktop paper-folding machine. More particularly, the present invention relates to a compact-sized desktop paper-folding machine which contains a feeding unit for receiving paper sheets to be folded, and a folding unit for automatically folding the paper sheets into neatly folded letter stacks ready for mailing.

In order to keep in touch with customers and to disseminate information thereto, modern corporations frequently have to send out hundreds of letters which are printed using office copy machines or personal computer printers. With the recent proliferation of high speed laser printers, the amount of letters that are being sent out has increased very significantly. Folding of such large amounts of letters into a neat form before mailing is a monotonous and time-consuming job. It is a very wasteful use of office manpower, and can often cause cutting and/or grazing damages to office workers.

Currently, there are commercially available many types of automatic paper-folding machines for folding newspapers and advertising flyers. Some of these paper-folding machines can fold tens of thousands of sheets per hour. Most of these machines are very large in size and are mainly designed for use by commercial printing shops; they are very poorly suited for office use. More recently desktop paper-folding machines, which are relatively smaller in size compared to the commercial folding machines and are designed primarily for office use, have been developed, most notably by German and Japanese manufacturers.

The smallest of these desktop folding machines is Model BFM 212 manufactured by Mathias Bauerle GmbH in Germany; it weighs about 5.5kg, and has a dimension of 32cm x 26cm x 12cm. The next smallest size paper-folding machine is Model Superfax PF-70a made by Fuji in Japan; it weighs about 10.5kg and has a dimension of 35.5cm x 16cm x 29cm in dimensions. These machines, while are much smaller than the conventional units, they are, however, still considered too bulky for office use. Office managers still have to make a tough decision regarding whether to buy a paper-folding machine to save man-power, or not to buy a paper-folding machine to save office space.

The primary object of the present invention is to provide an automatic paper feeding-and-folding machine that is very compact in size and light in weight; it has a physical dimension similar to that of a telephone set and can be conveniently placed on the desktop in any office. The automatic paper feeding-and-folding machine disclosed in this invention is further provided with an external knob to allow it to be adjusted to varying sizes of input papers to be folded, including, for example, the A4-size or letter-sized papers. In a preferred embodi-

ment of this invention, the input papers, which can be in either A4 or letter size, are folded into and collected as a stack of three-plys before they are placed into envelopes to be mailed out. The paper feeding-and-folding machine disclosed in the present invention can reduce the manpower cost, save office space, and prevent on-the-job injuries.

The primary feature of the present invention is characterized by a novel zigzag and heave-from-the-middle path that the fed paper travels inside the paper-folding machine. During the first step in a preferred embodiment of the paper folding machine, a sheet of paper is fed from a paper-feeding unit into a relatively vertical first paper-guiding plate in the paper-folding unit. After the paper reaches at or near the bottom of the first paper-guiding plate, it turns on a micro-switch which actuates a plurality of rollers. These rollers cooperatively heave the paper, at about one third of the length from the top of the sheet, from the first paper-guiding plate and press it between the rollers to make the first fold. The folded portion of the paper is then pulled, also by the cooperative action of the rollers, into a second paper-guiding plate.

After the leading edge of the folded portion of the paper reaches at or near the far end of the second paperguiding plate, the paper is again heaved up, at about one third of the paper length from the unfolded end, by the pulling action of another set of rollers and is pressed between two of these rollers to form the second fold. The fed paper sheet, after having been folded twice to form a twice-folded paper ply (or a three-ply paper stack), is then rolled out of the paper-folding machine with the guide of a paper-guiding roller and an accurate paper-guiding plate. Finally the folded sheet exits the paper folding machine and falls into a receiving rack placed in front of the paper folding machine.

Another feature of the present invention is that the length of the paper-guiding plate in the paper folding machine can be conveniently adjusted from an external knob. In the preferred embodiment as disclosed in this invention, the user simply has to move an adjusting knob to a desired position, in accordance with the size of the paper to be folded, and the machine will take care of the rest of the steps.

Therefore, the primary feature of this invention is that it combines compactness, light-weight, ease of operation, and flexibility in a personal desktop machine that will reduce the manpower required in order to fold office letters before mailing and prevent potential office injuries. An embodiment of this invention is described by way of example with reference to the drawings, in which:

FIG. 1 is a perspective and fragmental view of a preferred embodiment of the automatic paper

feeding-and-folding machine disclosed in the present invention.

FIG. 2 is a first sectional view taken along line A-A in FIG. 1 when the switch handle is in OFF position.

FIG. 3 is a second sectional view taken along line A-A in FIG. 1 when the switch handle is in ON position.

FIG. 4 is a perspective and inner view of the paper-folding unit as viewed from the right front side thereof.

FIG. 5 illustrates a length-adjusting assembly of paper-folding machine of the present invention.

FIG. 6 is a sectional view taken along line B-B in FIG. 5.

FIG. 7 is a sectional view taken along line C-C in FIG. 1.

FIG. 8 illustrates a front view of the inner structure of the right side of the paper-folding machine according to the present invention.

FIG. 9 is a perspective view of the rear-lift side of the paper-folding machine according to the present invention.

FIG. 10 illustrates the cooperative actions of the rollers when the paper-folding machine of the present is making the first fold of the paper.

FIG. 11 illustrates the cooperative actions of the rollers when the paper-folding machine of present invention is making the second fold of the paper.

Referring now to FIG. 1, which shows a paper-feeding unit 60 mounted on the top of a paper-folding unit 10 as disclosed in the present invention. A power cable 16 is provided to connect the paper-feeding unit 60 to the paper-folding unit 10 and receive power therefrom via a pair of power sockets, not shown. Two positioning pegs 61 at the bottom of the paper-feeding unit 60 are adapted to be plugged into two corresponding positioning holes 15 on the top of the paper-folding unit 10 so as to lock the two units together into an integral unit.

FIG. 5 illustrates a length adjusting assembly of the paper-folding unit. The length adjusting assembly includes a supporting shaft 51, a paper-holding plate 52 and a spring 53. The supporting shaft 51 extends through both sides of the paper-folding unit and is retained in place with two E-shaped retaining rings 54 and 54a, respectively. The paper-holding plate 52 has a tongue-shaped plate 55, the right side of which has a semi-circular flange 56 to be fitted in one of the two positioning holes 29a and 29b in a side flange 29 on the paper-guiding plate 28. In actual applications, the adjusting rod 50 of the tongue-shaped plate 55 mounted in the center of the paper-holding plate 52 can be moved slightly leftward thereby allowing the compressing spring 53 to urge the semi-circular flange

56 of the tongue-shaped plate 55 to be disengaged from the positioning hole 29a and engaged with another positioning hole 29b, or vice versa. This causes the position of the paper-holding plate 52 to be changed; therefore, the paper-folding machine of the present invention is adjusted to suit the length of the sheet to be folded.

The internal working of the paper-folding process of a preferred embodiment of this invention is illustrated as follows. Before folding a sheet of paper, the length of the sheet of paper must first be determined. The adjusting rod 50 as shown in FIG. 1 is then moved to a desired position, for example an A4 or letter-sized position. Then the switch handle 62 of the paper-feeding unit 60 is set at "OFF" position (as shown in FIG. 2). This turns off the first micro-switch 64 connected to a motor 63 and, pushes the shaft 65 back, causes the two rubber rollers 67 to be separated from two paper-guiding plates 68 fixed on shaft 65. The two rubber rollers 67 was pushed toward the two paper-guiding plate 68 by the compression spring 66 when the switch handle 62 was set at "ON" position shaft 65. Then, a given number of sheets of paper are placed in the space between the paper-guiding plate 68 and the rubber rollers 67. After the sheets of paper are placed into the feeding unit, the switch handle 62 is then set to the "ON" position (as shown in FIG. 3). This turns the micro-switch 64 start motor 63 as shown in FIG. 1. The motor 63 will drive a gear 69 to rotate which in turn causes two rubber rollers 67 on a shaft 70 to rotate. The rubber rollers 67 will feed one sheet of paper 20, by means of friction, into the paper inlet 11 in the paper-folding unit 10. After the sheet of paper 20 enters the paper inlet 11 as shown in FIG. 1, the sheet 20 will move downward, as shown in FIG. 7, until the lower end thereof is stopped by a lower flange 21a attached to a paper-guiding plate 21. When the sheet 20 is moved downward, a pivoting arm 22 fixedly mounted on a micro-switch 23 will be pressed down, as a result of the weight of the sheet 20, causing the micro-switch 23 to be turned on. When this happens, motor 31, as shown in FIG. 4, is started which sets in motion a belt pulley 32 and a belt 33, which then causes a belt pulley 34 to actuate a compound gear 34a. The compound gear 34a then drives a gear 35 mounted on a rubber roller 26. A compound gear 35a (as shown in FIG. 8) of the gear 35 is coupled to gears 36 and 37 on the aluminum alloy rollers 25 and 27 respectively; then, the three big rollers 25, 26 and 27 are all rolling in directions as shown with arrows in FIG. 10.

When the three big rollers 25, 26 and 27 are rolling, the rubber roller 26, as shown in FIG. 7, is also rolling which causes gear 41 mounted thereon to couple with a cam gear 42 and gear 43. At the

same time, gear shaft 44a fixed on the gear 44 and the two rubber rollers 30 on gear shaft 44a will also rotate as a result of the coupling effect of gear 43. When the cam gear 42 begins rotating, its apex 42a will change position, i.e., it will no longer push against a roller 45a mounted on rocking arm 45. This causes the two rocking arms 45 and 46 to pivot about the fixed shaft 38 by means of a spring 47. As a result of such pivoting action, the small roller 24 and the sheet paper 20 are pushed toward the rubber roller 26 in the direction as indicated by arrow 47a. At the same time, the third micro-switch 48a fixedly mounted behind the rocking arm 45 and connected to a motor 63 of the paper-feeding unit 60 will turn off the motor 63 because it is no longer being pressed by the rocking arm 45. This stops the paper feeding operation.

The steps by which the paper-folding machine makes its first fold are illustrated in FIG.10. In FIG. 10, it is shown that the paper sheet 20 is being pulled and squeezed by the small roller 24, toward the rubber roller 26 and the aluminum alloy roller 25. When the rubber roller 26 and the aluminum alloy roller 25 are rolling, the sheet 20 will move in the direction as shown by the arrow 20a because of the frictional force exerted by the rubber roller 26 and the smaller roller 24 on the sheet of paper 20. The portion of the sheet between the lower edge of the first paper-guiding plate 21 and the lower edge of the rubber roller 26 will be folded to form the first fold, when it passes through the tight space between rollers 26 and 25. Thereafter, the sheet 20 will change its moving direction as a result of the obstruction of the upper edge 28a of the second paper-guiding plate 28, i.e., it will enter the second paper-guiding plate 28 as indicated by arrow 20b, until the front edge of the folded portion of the sheet is stopped by the paper-holding plate 52 which is fixedly attached to a shaft 51. Plate 52 is allow to pivot about shaft 51 as indicated by arrow 50a (as shown in FIG. 7).

The steps by which the paper-folding machine makes its second fold are illustrated in FIG. 11. In FIG. 11, since the front edge of the sheet is stopped while the rubber roller and the aluminum alloy roller 27 are still rolling, the portion of the sheet 20 between the rollers 26 and 27 will be pulled in a direction as indicated by arrow 30a, and be pressed through the tight space therebetween to form the second fold. After the second fold is made, the sheet continues moving in the direction shown by the arrow 20c. Finally it will be brought in contact with a rubber paper-guiding roller 30. Thereafter, the sheet 20 will move in the direction shown by arrow 20d, and will be pulled out of the paper-folding unit via the paper outlet 12 as shown in FIG. 1, as a result of the rotation of the paper-guiding roller 30 and the guide of arcuate paper-

guiding plate 39. Finally the folded paper plied will fall into a receiving rack 14.

The cam gear 42 has been designed to have a predetermined number of teeth by which the cam gear 42 will take a longer time to complete a rotation cycle than the time required for the paper-folding machine to fold one sheet of paper. With this design, the cam gear 42 will not have completed one rotation cycle when the sheet of paper 20 is being pulled out of the paper outlet 12, as shown in FIG. 1. When the cam gear completes its rotation cycle, the apex 42a of the cam gear will again push the rocking arms 45 and 46 to their respective original positions. When this occurs, the three micro-switches 48, 48a and 49 behind the rocking arms 45 and 46 will be turned either on or off, depending on their respective functions. When the second micro-switch 48 is turned off, the paper-folding unit 10 and the motor 31 will be stopped. The fourth micro-switch 49 is used to control the counter 13 to register the completion of folding one sheet of paper. When the third micro-switch 48a is turned on, it actuates the paper-feeding unit 63 and the motor 63 to begin feeding a new sheet into the paper-folding unit 10 and start the folding cycle.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded as the subject matter of the invention.

An automatic paper-and-folding machine, which is compact in size and can be conveniently adjusted to accept paper sheets of varying sizes, such as A4 or letter sized papers, and fold them into paper plies before they can be placed into envelopes for mailing. The sheet of paper to be folded is first fed from the paper-feeding unit into a first paper-guiding plate in the paper-folding unit to make a first fold through the cooperative action of a first set of rollers. Then, the once-folded paper sheet is moved into a second paper-guiding plate to make a second fold through the cooperative action of a second set of rollers. Thereafter the twice-folded paper sheet is guided out of the paper-folding machine with the aid of a paper-guiding roller and an accurate paper-guiding plate, and finally the folded sheet is collected in a receiving rack mounted in front of the paper-folding unit.

Claims

1. An automatic paper-folding machine comprising:
 - (a) a feeding port for receiving paper to be folded;

- (b) a first paper-guiding plate and paper feeding means for moving said paper from said feeding port into said first paper-guiding plate, said first paper-guiding plate having a bottom flange for stopping the movement of said paper therein; 5
- (c) first set of rollers for making a first fold of said paper and moving the folded portion of said paper into a second paper-guiding plate, said second paper-guiding plate having a stop plate for stopping the movement of the once-folded paper; and 10
- (d) second set of rollers for making a second fold of said paper and moving the twice-folded paper from said second paper-guiding plate after said paper is stopped by said stop plate in said second paper-guiding plate. 15
2. The automatic paper-folding machine of claim 1 which further comprises a paper-guiding roller and an arcuate third paper-guiding plate for guiding said paper after being folded out of said paper folding machine and into a receiving rack in front of said paper-folding machine. 20 25
3. The automatic paper-folding machine of claim 1 which further comprises a cam gear and a plurality of micro-switches, said micro-switches being adapted to turn on and off by the rotation of said cam gear, and said cam gear being so designed that the amount time it requires to make a full rotation is longer than the amount of time required by said machines to fold one sheet of paper. 30 35
4. The automatic paper-folding machine of claim 1 further comprises a length adjusting assembly for adjusting said paper-folding machine to accept varying sizes of papers to be folded. 40
5. The automatic paper-folding machine of claim 4 wherein said length adjusting assembly comprising: 45
- (a) a paper holding plate having an elongated bottom member and two short vertical members each being disposed at one end of said bottom member, and each of said vertical members having a round first hole therethrough; 50
- (b) a supporting shaft which is mounted through both of said first round holes in said vertical members of said paper holding plate and is retained by two second round holes on said paper-folding machine; 55
- (c) a first side flange fixedly mounted on said second paper-guiding plate, said first side flange having at least two positioning holes; and
- (d) a tongue-shaped plate mounted at the center of said paper-holding plate, said tongue-shaped plate having a second side flange engageable with any one of said plurality of positioning holes in said first side flange, whereby pivoting of said tongue-shaped plate about said supporting shaft moves said paper holding plate up or down and allows said second side flange to be engaged with any one of said plurality of positioning holes in said first side flange in accordance with the size of the paper sheet to be folded.
6. The automatic paper-folding machine of claim 5 wherein said supporting shaft is retained into said second round holes with a pair of compressing springs and E-shaped retaining rings.
7. The automatic paper-folding machine of claim 1 further which comprises a pivoting arm disposed near the bottom end of said first paper-guiding plate, a micro-switch, and a motor, whereby when said pivoting arm is pressed by the weight of a sheet of paper, said pivoting arm turns on said micro-switch to actuate said motor, said motor then sets said first set of rollers into motion.
8. The automatic paper-folding machine of claim 1 wherein said first set of rollers comprises a small movable roller adapted to push said paper toward the rest of the first set of rollers thereby causing said paper to heave and thereby said first fold.

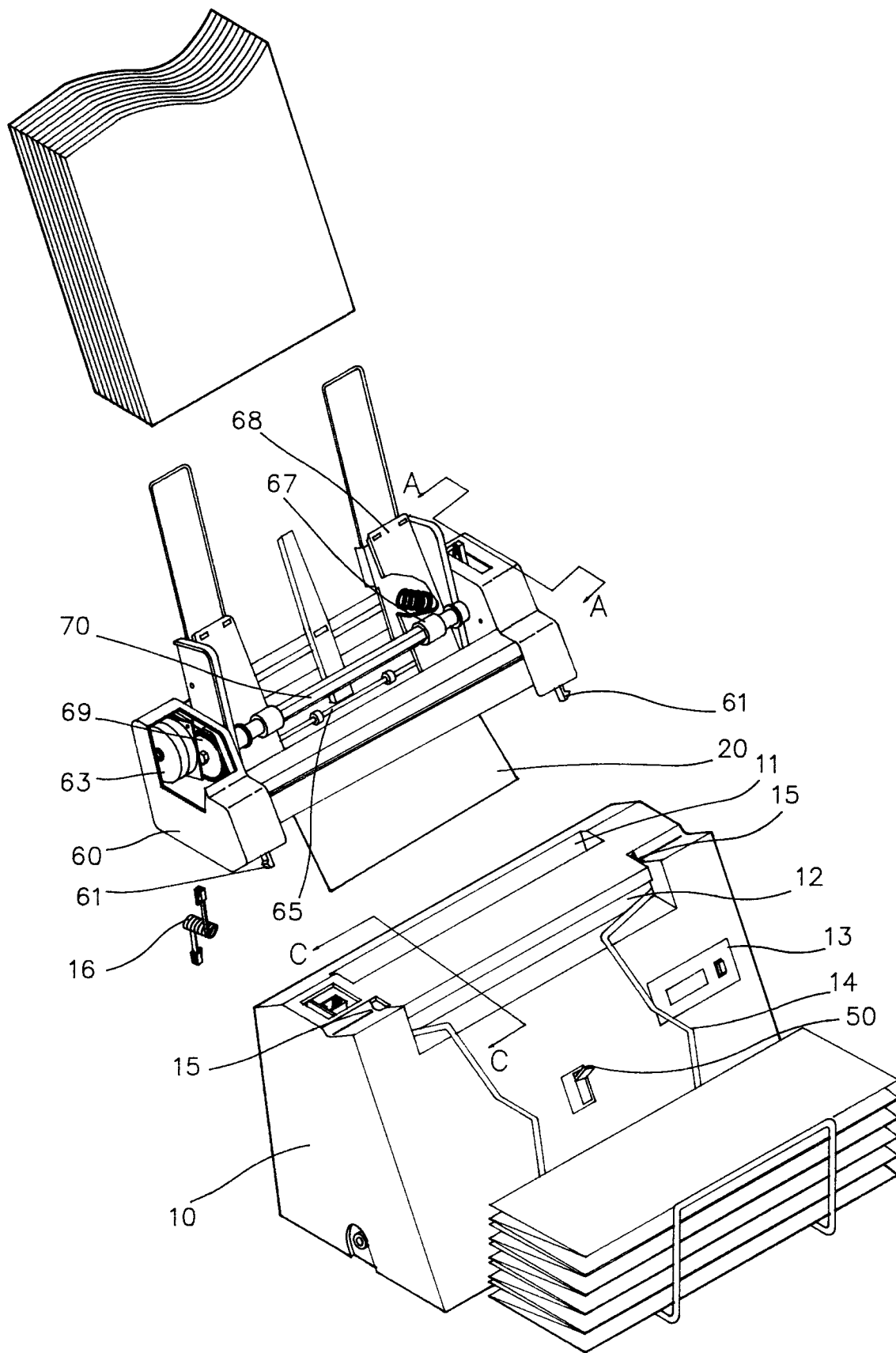
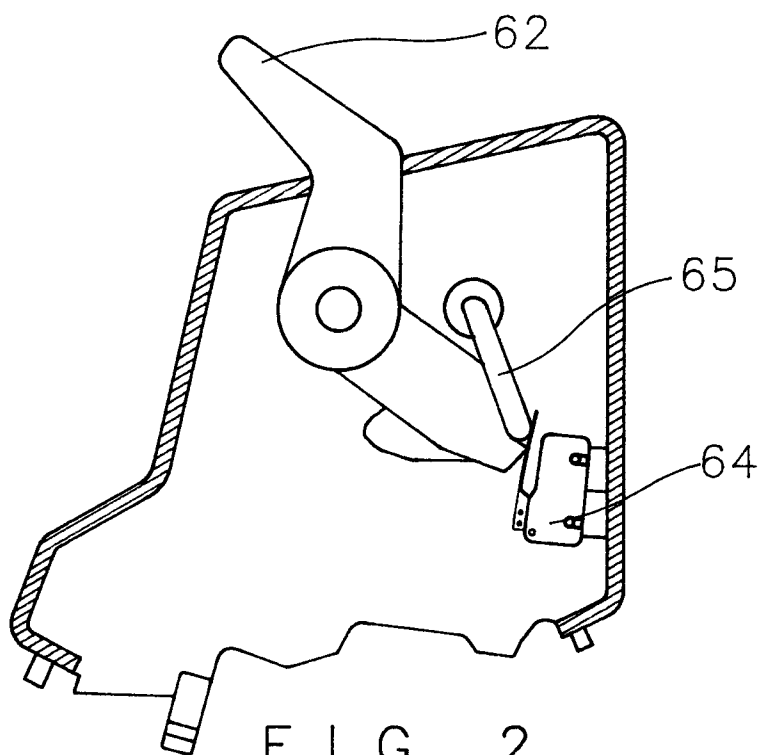
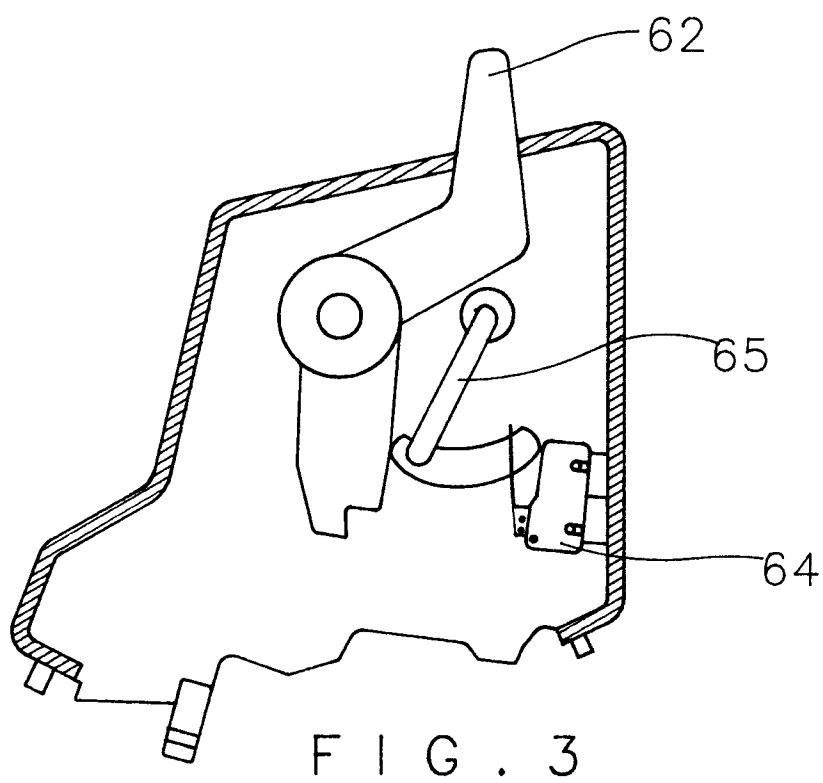


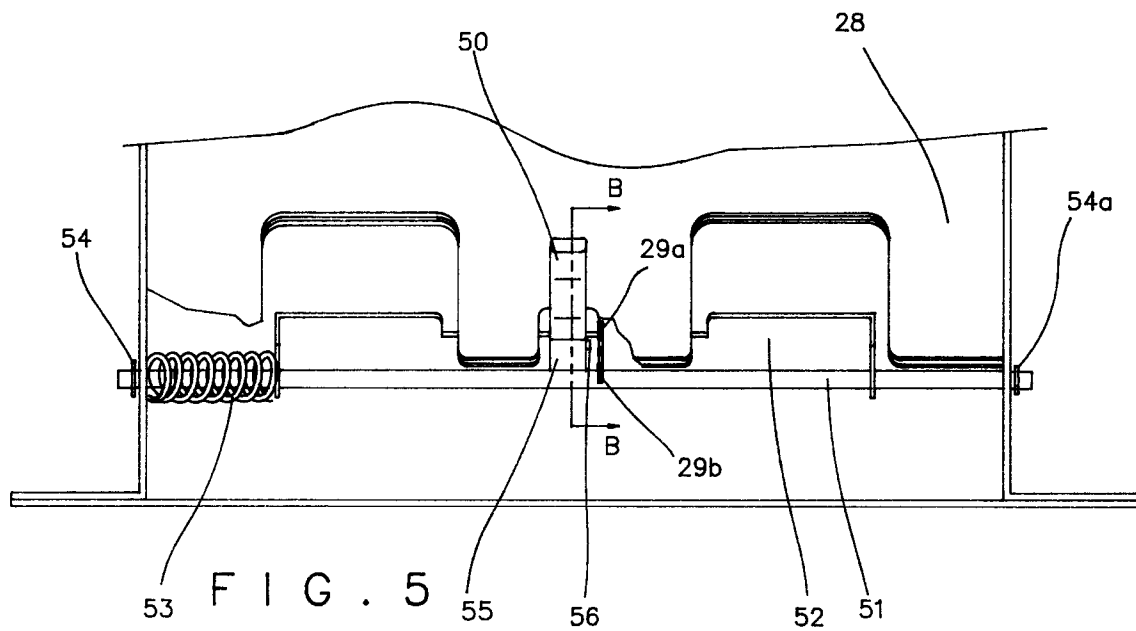
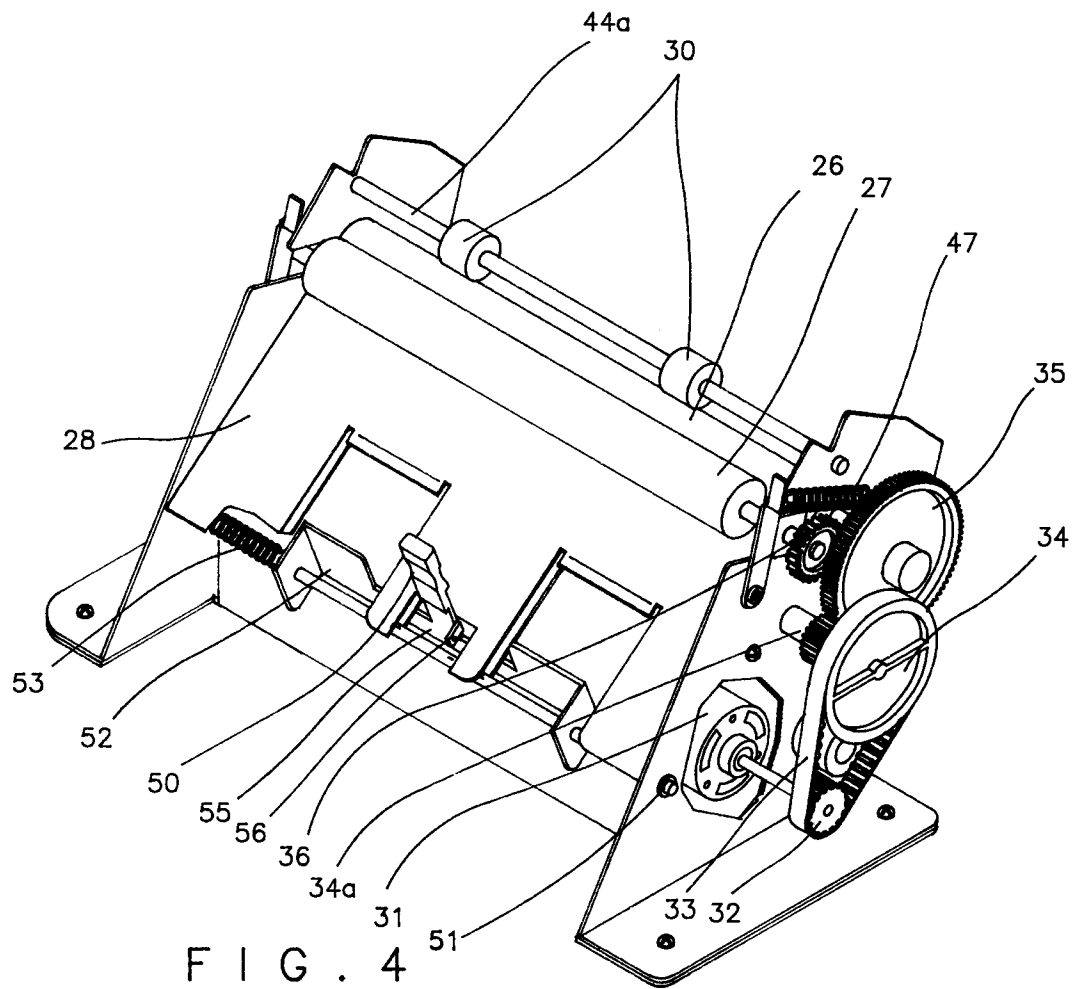
FIG. 1

OFF ← → ON



OFF ← → ON





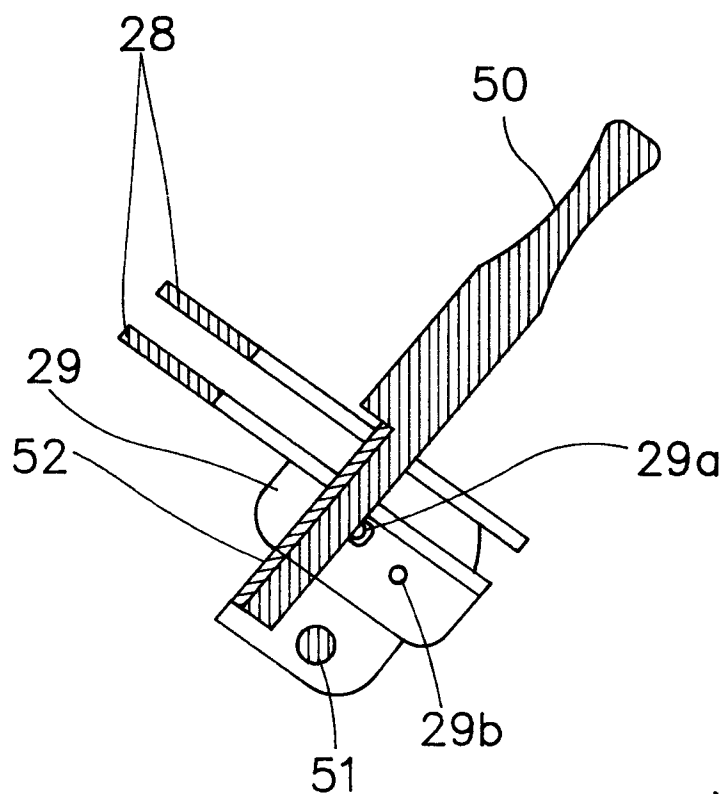


FIG. 6

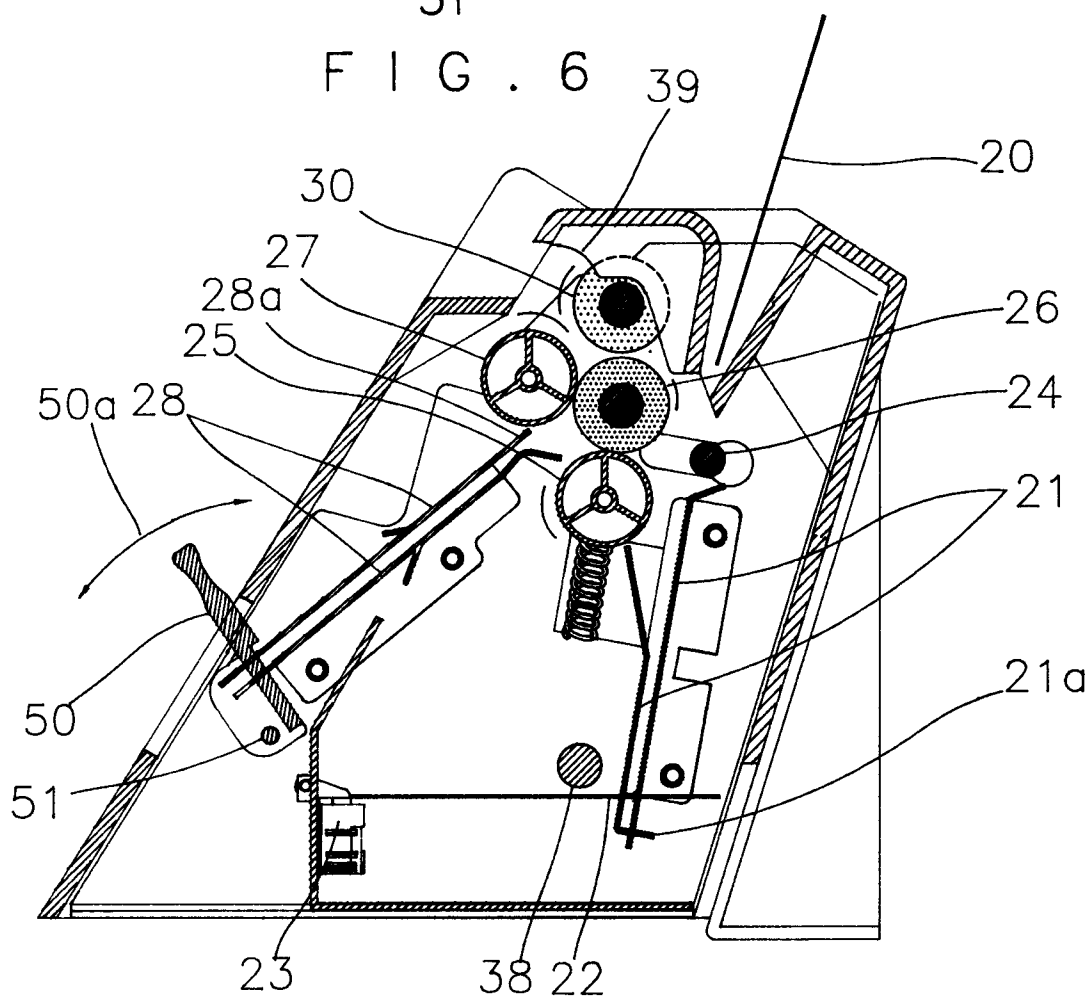


FIG. 7

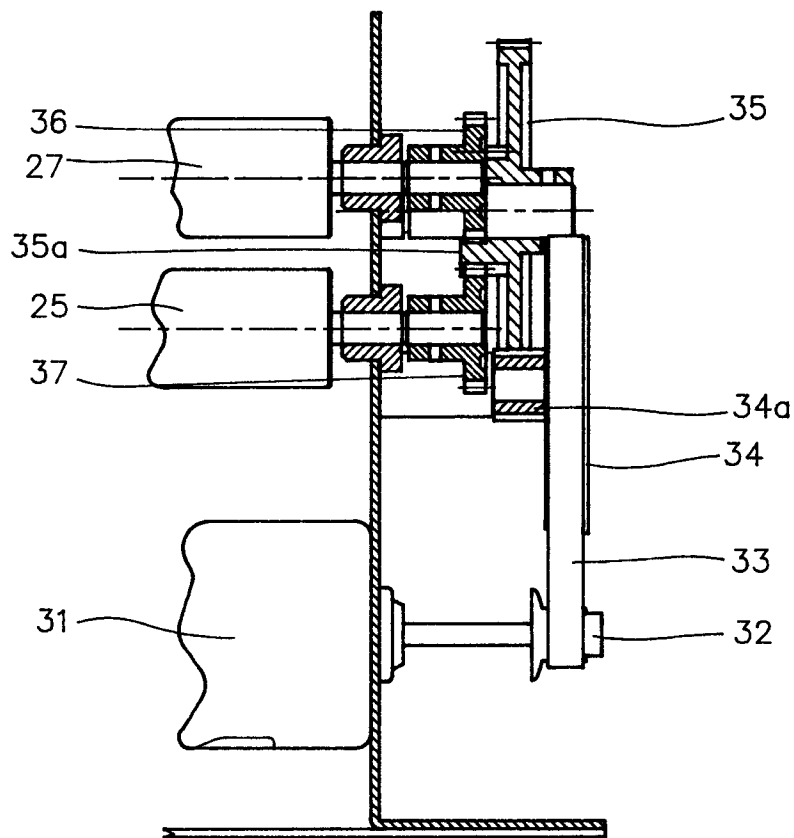


FIG. 8

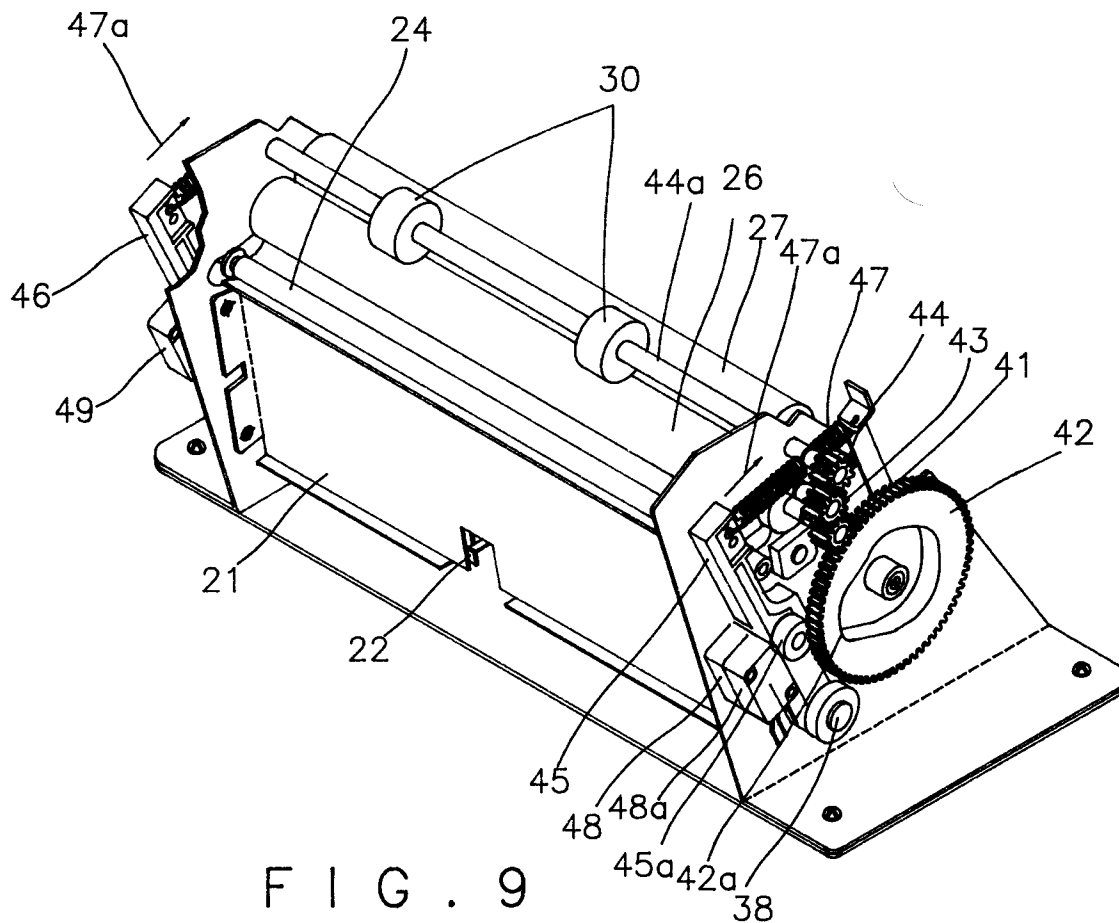
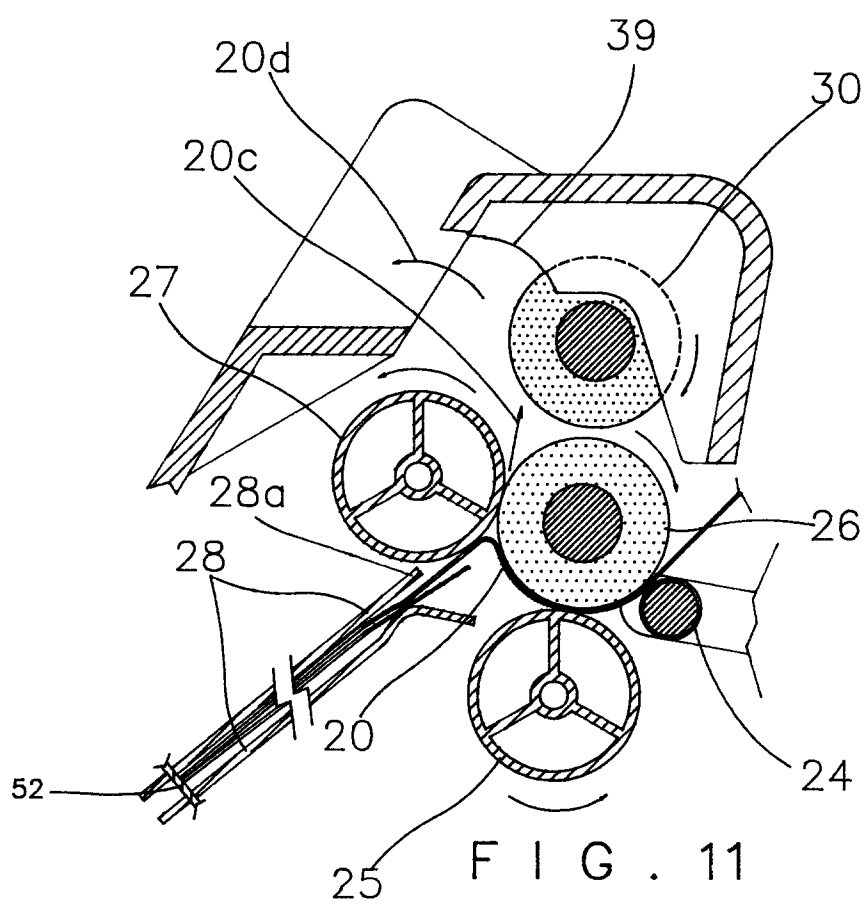
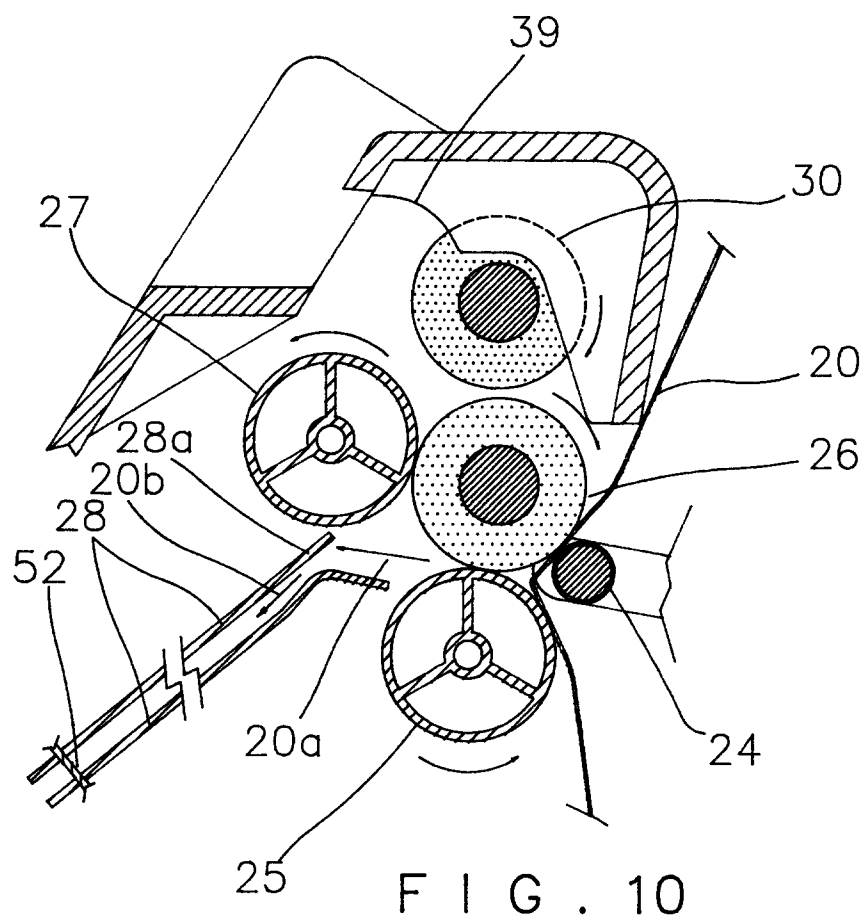


FIG. 9





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 11 7653

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.5)
X	FR-A-2 584 690 (DUPLO SEIZO) * the whole document *	1,3,4,8	B65H45/14
Y	---	2-5,7	
Y	FR-A-1 097 037 (KINGSBURY) * paragraph 4; figures 5-8 *	2	
Y	---	3,7	
Y	US-A-5 114 395 (MARTIN YALE INDUSTRIES) * column 2, line 20 - column 3, line 30; figures 1-3 *	4,5	
Y	---		
A	GB-A-248 383 (GEORG SPIESS) * the whole document *		
A	---		
A	US-A-5 147 275 (HUNT HOLDINGS) ---		
A	GB-A-1 066 398 (TIMSONS LIMITED) -----		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 APRIL 1993	Examiner LONCKE J.W.
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	