(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 539 156 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **92309570.7**

(22) Date of filing : **20.10.92**

(51) Int. Cl.^{5} : **B41J 13/00**

(30) Priority : **21.10.91 JP 299614/91**

(43) Date of publication of application :
28.04.93 Bulletin 93/17

(84) Designated Contracting States :
AT BE CH DE DK ES FR GB GR IE IT LI LU NL PT SE

(71) Applicant : **CANON KABUSHIKI KAISHA**
30-2, 3-chome, Shimomaruko, Ohta-ku
Tokyo (JP)

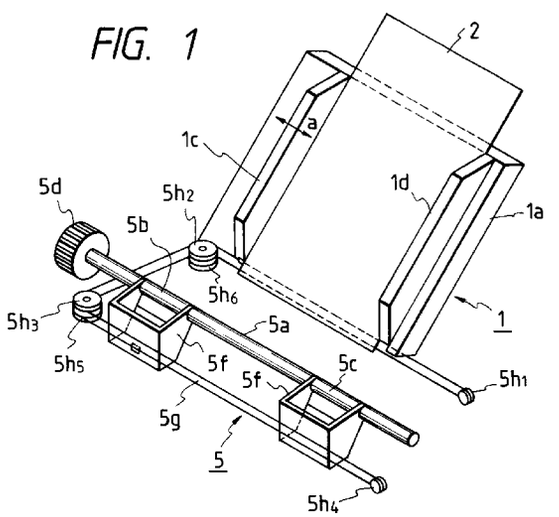
(72) Inventor : **Tetsuhiro, Nitta, c/o Canon Kabushiki Kaishi**
30-2, 3-chome, Shimomaruko
Ohta-ku, Tokyo (JP)

(74) Representative : **Beresford, Keith Denis Lewis et al**
BERESFORD & Co. 2-5 Warwick Court High Holborn
London WC1R 5DJ (GB)

(54) Sheet feeding mechanism for a recording apparatus.

(57) There are provided for a sheet feeding device and a recording apparatus using such a sheet feeding device according to the preserit invention, a feed mechanism for feeding a sheet material ; a guide mechanism for guiding the end portions of the foregoing sheet material, which is shiftable in the width direction of the sheet material ; and a discharge mechanism for discharging the foregoing sheet material being fed, which is capable of changing its positions in accordance with the shift of the foregoing guide mechanism ; hence making it possible to prevent any possible smudges to be caused by rollers, spurs, or the like when the recorded sheet is being discharged. In this way, image recording can be performed without degrading the recording quality.

FIG. 1



EP 0 539 156 A2

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a feeding mechanism for a sheet material and a recording apparatus using such a mechanism.

Related Background Art

A printer, a copying machine, a facsimile apparatus, and other recording apparatuses are of such a structure that its recording head is driven in accordance with recording information to record images on a recording sheet such as a paper or plastic sheet.

For the recording apparatus mentioned above, the recording sheet is being fed automatically by a sheet feeding device besides its manual set for insertion. In general, the sheet feeding device is provided with a feed driving unit for feeding a recording sheet by rotating the feed roller, and an discharge tray unit for stacking the recorded sheets which have been discharged. The arrangement is made for this device so that by utilizing the driving force for the carrier system of the recording apparatus, the foregoing feed driving unit is driven to feed the foregoing recording sheets one by one separately.

However, since the sheet feeding device carries the recording sheet to be discharged while depressing the recording surface of the recording sheet with an discharge roller or a spur directly, there may be some cases where the traces of the roller or other marks remain on the recorded portion. Also, in a case of an ink jet recording apparatus or the like where ink liquid is ejected for recording, the roller depresses the inked surface to cause the occurrence of smudges.

SUMMARY OF THE INVENTION

It is an object of the present invention to solve the foregoing problems of the conventional art and provide a sheet feeding device capable of preventing the smudges caused by a roller, a spur, or the like when a recorded sheet is discharged, and a recording apparatus using such a sheet feeding device.

It is another object of the present invention to provide a sheet feeding device in which discharging means is arranged to depress the vicinity of the end portions of a sheet in its width direction at all times, and the discharging means is capable of carrying the recording sheet by gripping the portions other than the recording area thereof when this device is used for a recording apparatus.

It is still another object of the present invention to provide a sheet feeding device including a feeding mechanism for feeding a sheet material; a guiding mechanism movable in the width direction of the foregoing sheet material to guide the end portions of the sheet material; and an discharging mechanism capable of changing its position in accordance with the shifting of the foregoing guiding mechanism to discharge the foregoing sheet material which has been fed.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view illustrating a sheet feeding device according to an embodiment of the present invention.

Fig. 2 is a view schematically illustrating a recording apparatus using the sheet feeding device.

Fig. 3 is a view for explaining the positional relations between a recording sheet and a discharge roller.

Fig. 4 is a view illustrating an embodiment wherein a guide member and a roller holding member are integrally structured.

Fig. 5 is a view illustrating an embodiment wherein a recording sheet is discharged by means of a discharging free roller and a plate which are in contact under pressure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, with reference to Fig. 1 to Fig. 3, the description will be made of an embodiment of the present invention applicable to an ink jet recording apparatus. In this respect, Fig. 1 is a perspective view illustrating a sheet feeding device. Fig. 2 is a view schematically illustrating the structure of an ink jet recording apparatus using the foregoing sheet feeding device. Fig. 3 is a view for explaining the positional relations between a recording sheet and a discharge roller.

This apparatus is of such a structure that a recording sheet 2 is fed by feeding means 1 in the direction indicated by an arrow shown in Fig. 2, at the same time being carried with a pair of feeding rollers 3a and 3b for a given recording performed by recording means 4, and then the recording sheet 2 is discharged by discharging means 5.

The structure of the foregoing feeding means 1 is that when recording sheets 2 are stacked on a feed tray 1a for setting, a recording sheet 2 placed on top thereof is depressed by a feeding roller 1b by means of a spring (not shown). Also, on the feed tray 1a, guide members 1c and 1d are arranged as shown in Fig. 1 to guide both ends of the recording sheet 2 in its width direction. One of the guide members 1c is arranged slidably in the width direction of the recording sheet 2 (direction indicated by an arrow a in Fig. 1). Further, at the lower ends of the guide members 1c and 1d, separation nails 1e are mounted, respectively.

Therefore, when the recording sheets 2 are set

on the feed tray 1a and the feeding roller 1b is rotatively driven by means of a motor (not shown), a recording sheet 2 on the uppermost layer is separated by the separation nails 1e for feeding.

The foregoing recording sheet 2 thus fed is being guided to a paper pan (not shown). Then, it is carried to be U-turned in the direction indicated by arrows in Fig. 2 to arrive at the recording position of the recording means 4.

The recording means 4 is to record ink images on the recording sheet 2 which has been conveyed. The recording means for this device is structured integrally with a line-type recording head 4a and an ink tank 4b and is arranged to use an ink jet recording method such as ejecting ink from the foregoing recording head 4a for recording. In other words, this recording head 4a is provided with minute liquid discharging ports (orifices), liquid passages, energy activating portions arranged on part of the liquid passages, and energy generating means to generate energy for the formation of liquid droplets to affect liquid in the foregoing activating portions.

For energy generating means for generating such energy as this, there are among others a recording method using electrothermal transducers such as piezoelectric elements, a recording method using energy generating means wherein heat generation is effectuated by irradiation of laser or other electromagnetic waves so as to eject liquid droplets by the application of the foregoing exothermic activation, or a recording method using energy generating means wherein liquid is heated by means of electrothermal transducers such as exothermic elements having exothermic resistive members so as to cause the liquid to be ejected.

Of these methods, the recording head used for the ink jet recording method wherein liquid is ejected by the utilization of thermal energy is capable of allowing its liquid discharging ports (orifices) for ejecting recording liquid droplets for the formation of discharging droplets to be arranged in a high density. Particularly, among such recording heads, the recording head using electrothermal transducers as energy generating means can be built compactly with ease, and for such a recording head, it is possible to utilize sufficiently the advantages of the IC technologies and micro-machining techniques which have demonstrated significant improvement in the advancement and reliability of the technologies in the semiconductor field of recent years; hence advantageously enabling a highly precise assembly for such a head with ease at a lower manufacturing cost.

This recording means 4 selectively ejects ink images onto a recording sheet 2 for recording by energizing the foregoing electrothermal transducers in accordance with image signals in synchronism with the conveyance of the foregoing recording sheet 2.

The recording sheet 2 on which given recording has been made by the foregoing recording means 4 is discharged by discharging means 5. This discharging means 5 is structured, as shown in Fig. 1 and Fig. 2, with a discharge driving roller 5a, and two discharging free rollers 5b and 5c to be in contact with the foregoing driving roller 5a under pressure by means of spring and others (not shown). Then, by driving a motor (not shown) which is connected to a transmission gear 5d mounted at the shaft end of the foregoing driving roller 5a, the driving roller 5a and free rollers 5b and 5c are caused to grip the recorded recording sheet 2 to be discharged onto the discharge tray 5e.

In this respect, the peripheral velocity of the foregoing discharge driving roller 5a is defined to be slightly slower than that of the feed driving roller 3a so that tension is given to a recording sheet 2 in conveyance. Also, the feeding speed of the recording sheet 2 is arranged to follow the rotational speed of the feed driving roller 3a by the transmission of driving force to the foregoing transmission gear 5d through a sliding clutch.

Further, the structure is arranged so that one of the foregoing discharging free rollers 5b is mounted slidably in the width direction of a recording sheet and when the foregoing guide member 1c slides, the discharging free roller 5b also slides accordingly.

In other words, to a roller supporting member 5f which supports the discharging free roller 5b rotatively, a wire (belt or the like) 5g is connected. While this wire 5g is tensioned between pulleys 5h1, 5h2, 5h3, 5h4, 5h5, and 5h6, it is connected to the guide member 1c. Therefore, if the guide member 1c is caused to slide to match the width of a recording sheet 2, the discharging free roller 5b is also allowed to slide in the same direction for the same amount.

Here, the description will be made of the gripping position for a recording sheet 2 by means of the foregoing driving roller 5a and free rollers 5b and 5c. As shown in Fig. 3, given the projecting amount of the discharging free rollers 5b and 5c from the guiding surface of the guide members 1c and 1d as L while the length of the marginal spaces 2a at the left and right end sides outside the recording area (slashed portion in Fig. 3) of the recording sheet 2 as M, they are defined to be $L < M$.

Therefore, the left and right end sides of the recording sheet 2 in conveyance are guided by the guide members 1c and 1d so as to be fed without any slanting. Then, after a given recording is performed by recording means 4, the discharging free rollers 5b and 5c which are in contact with the recording surface serve to discharge the recording sheet 2 by gripping the marginal portions 2a at all times.

As a result, irrespective of the sizes of a recording sheet 2, rollers and others are not in contact with the recording area where ink has not been fixed as yet; thus making it possible to obtain recorded images in high quality by preventing any creation of smudges

due to re-transfer of ink and others.

In the foregoing embodiment, an example is shown in which the guide member Ic and the discharging free roller 5b are connected by the wire 5g in order to interlock the slide of the roller with the movement of the guide member.

Hereinafter, another embodiment according to the present invention will be described. A structure shown in Fig. 4 is such that a slidable guide member 1c and a discharging free roller 5b are integrally connected to a roller supporting member 5f so that the guide member 1c and the discharging free roller 5b are allowed to slide integrally.

In this way, it becomes possible to avoid using the wire and pulleys as in the case of the foregoing embodiment and reduce the number of parts for the device. As a result, the assembling processes can be simplified and the manufacturing cost can be reduced as well.

Also, in the foregoing embodiment described in conjunction with Figs. 1 to 3, the discharging free rollers 5b and 5c are arranged in contact with the recording side of a recording sheet 2, but it may be possible to arrange the structure so that driving force is transmitted to the foregoing rollers 5b and 5c while making the roller 5a to be freely rotatable.

Further, when the driving force is transmitted to the rollers 5b and 5c as described above, it may be possible to arrange the structure so that in place of the roller 5a, a plate 5i as shown in Fig. 5 is in contact with the rollers 5b and 5c under pressure. In this case, it is possible to discharge a recording sheet 2 smoothly by using a material having a small friction coefficient μ, such as POM, for the surface of the plate 5i. Then, at one side end of the plate 5i (on the upstream side of the sheet conveying direction), a slope 5i1 is formed to provide a wide frontage for the sheet 2 to grip the recording sheet 2 smoothly.

Further, in the foregoing embodiment described in conjunction with Fig. 1 to Fig. 3, an example is shown in which one of the guide members 1c is structured to be slidable while the other one of the guide members 1d is fixed. However, it may be possible to structure both of guide members 1c and 1d slidably. Then, the structure is arranged so that each of the discharging free rollers 5b and 5c slides in accordance with the sliding of the guide members 1c and 1d, respectively.

Furthermore, if a recording sheet 2 used for the recording apparatus is only one kind, the guide members 1c and 1d and the discharging free rollers 5band 5c are not necessarily structured to be slidable.

Also, in the foregoing embodiment described in conjunction with Fig. 1 and Fig. 3, an ink jet recording method is employed as its recording means. It is more preferable to structure the recording means in such a manner that the electrothermal transducers are energized in accordance with recording signals and then with the thermal energy which becomes applicable by means of the foregoing electrothermal transducers, film boiling occurring in ink is utilized for the development of bubbles in ink and contraction thereof to cause ink droplets to be ejected from the discharging ports for recording.

Regarding the typical structure and operational principle of such a method, it is preferable to adopt those which can be implemented using the fundamental principle disclosed in the specifications of U.S. Patent Nos. 4,723,129 and 4,740,796. This method is applicable to a so-called on-demand type recording system and a continuous type recording system. Particularly, however, it is suitable for the on-demand type because the principle is such that at least one driving signal, which provides a rapid temperature rise beyond a departure from nucleation boiling point in response to recording information, is applied to an electrothermal transducer disposed on a liquid (ink) reining sheet or liquid passage whereby to cause the electrothermal transducer to generate thermal energy to produce film boiling on the thermoactive portion of the recording head; thus effectively leading to the resultant formation of a bubble in the recording liquid one to one for each of the driving signals. By the development and contraction of the bubble, the liquid is ejected through a discharging port to produce at least one droplet. The driving signal is preferably in the form of a pulse because the development and contraction of the bubble can be exerted instantaneously, and therefore, the liquid is ejected with quick response.

The driving signal in the form of the pulse is preferably such as disclosed in the specifications of U.S. Patent Nos. 4,463,359 and 4,345,262.

In addition, the temperature increasing rate of the thermoactive surface is preferably such as disclosed in the specification of U.S. Patent No. 4,313,124 for an excellent recording in a better condition.

The structure of the recording head may be as shown in each of the above-mentioned specifications wherein the structure is arranged to combine the discharging ports, liquid passages, and the electrothermal transducers as disclosed in the above-mentioned patents (linear type liquid passage or right angle liquid passage). Besides, the structure such as disclosed in the specifications of U.S. Patent Nos. 4,558,333 and 4,459,600 wherein the thermal activation portions are arranged in a curbed area is also included in the present invention.

In addition, the present invention is applicable to the structure disclosed in Japanese Patent Application Laid-Open No. 59-123670 wherein a common slit is used as the discharging port for plural electrothermal transducers, and to the structure disclosed in Japanese Patent Application Laid-Open No. 59-138461 wherein an opening for absorbing pressure wave of the thermal energy is formed corresponding

to the ejecting portion. In other words, according to the present invention, it becomes possible to operate the assuredly irrespective of the modes of the recording head.

Further, as a recording method, it may be possible to employ the method wherein a recording head is mounted on a carriage and then ink is ejected for recording while the carriage is allowed to travel in the width direction of the recording sheet, that is, the so-called serial type recording structure besides the use of the foregoing full-line type recording head.

In addition, the present invention is applicable to a serial type recording head wherein the recording head is fixed on the main assembly, to a replaceable chip type recording head which is connected electrically with the main apparatus and can be supplied with the ink when it is mounted in the main assembly, or to a cartridge type recording head having an integral ink container.

Also, it is preferable to add the recording head recovery means and preliminarily auxiliary means which are provided as constituents of a recording apparatus according to the present invention. They will contribute to making the effects of the present invention more stable. To name them specifically, they are capping means for the recording head, cleaning means, compression or suction means, preliminary heating means such as electrothermal transducers or heating elements other than such transducing type or the combination of those types of elements, and the preliminary ejection mode besides the regular ejection for recording.

As regards the kind and number of the recording heads mountable on the carriage, it may be a single head corresponding to a single color ink, or may be plural heads corresponding to a plurality of ink materials having different recording color or density. The present invention is effectively applicable to an apparatus having at least one of a monochromatic mode mainly with black, a multi-color mode with different color ink materials and/or a full-color mode using the mixture of the colors, which may be an integrally formed recording unit or a combination of plural recording heads.

Now, in the embodiments according to the present invention set forth above, while the ink has been described as liquid, it may be an ink material which is solidified below the room temperature but liquefied at the room temperature. Since the ink is controlled within the temperature not lower than 30°C and not higher than 70°C to stabilize its viscosity for the provision of the stabilized ejection in general, the ink may be such that it can be liquefied when the applicable recording signals are given.

In addition, while preventing the temperature rise due to the thermal energy by the positive use of such energy as an energy consumed for changing states of the ink from solid to liquid, or using the ink which will be solidified when left intact for the purpose of preventing ink evaporation, it may be possible to apply to the present invention the use of an ink having a nature of being liquefied only by the application of thermal energy such as an ink capable of being ejected as ink liquid by enabling itself to be liquefied anyway when the thermal energy is given in accordance with recording signals, an ink which will have already begun solidifying itself by the time it reaches a recording medium.

For an ink such as this, it may be possible to retain the ink as a liquid or solid material in through holes or recesses formed in a porous sheet as disclosed in Japanese Patent Application Laid-Open No. 54-56847 or Japanese Patent Application Laid-Open No. 60-71260 in order to exercise a mode whereby to enable the ink to face the electrothermal transducers in such a state.

For the present invention, the most effective method for each of the above-mentioned ink materials is the one which can implement the film boiling method described as above.

Furthermore, as modes of the foregoing ink jet recording apparatus, a copying apparatus combined with a reader and the like or a facsimile apparatus having transmission and reception functions or the like may be employed in addition to those used as an image output terminal of an information processing apparatus such as a computer.

In this respect, while the description has been made of an ink jet recording method as the foregoing recording means, the present invention is not confined to the ink jet recording method, but it is applicable to the thermal transfer recording method or thermal sensitive recording method or further to recording methods other than an impact recording method such as a wire-dot recording method. Also the present invention is not necessarily limited to a serial recording method but it can be used for the so-called line recording method.

As described earlier, according to the present invention, discharging means is structured to be in contact with the portions of a recording sheet other than its recording area. Therefore, the given images recorded by recording means are not smudged when passing through the foregoing discharging means. Hence, it is possible to obtain recorded images in high quality.

Also, according to the present invention, it is possible to obtain recorded images in high. quality irrespective of sheet sizes with the interlocked shifting of the foregoing discharging means with that of the guide members to guide the end portions of the recording sheet.

Claims

1. A sheet material feeding device, including the following:
   a feed mechanism for feeding a sheet material;
   a guide mechanism for guiding the end portions of said sheet material to be fed, said guide mechanism being shiftable in the width direction of said sheet material; and
   a discharge mechanism for discharging said sheet material being fed, said discharge mechanism being capable of changing its positions in accordance with the shift of said guide mechanism.

2. A sheet material feeding device according to Claim 1, wherein
   said discharge mechanism is mounted on said guide mechanism to be shifted integrally with said guide mechanism.

3. A sheet material feeding device according to Claim 1, wherein
   said discharge mechanism grips the vicinity of both end portions of said sheet material.

4. A recording apparatus, comprising the following:
   a mounting portion for mounting a recording mechanism for performing recording on a recording medium;
   a feed mechanism for feeding said recording medium to a recording position;
   a guide mechanism for guiding the end portions of said recording medium to be fed, said guide mechanism being shiftable in the width direction of said recording medium; and
   a discharge mechanism for discharging from the recording position said recording medium being fed, said discharge mechanism being capable of changing its positions in accordance with the shift of said guide mechanism.

5. A recording apparatus according to Claim 4, wherein
   said discharge mechanism is mounted on said guide mechanism to be shifted integrally with said guide mechanism.

6. A recording apparatus according to Claim 4, wherein
   said discharge mechanism grips the vicinity of both end portions of said sheet material.

7. A recording apparatus according to Claim 4, wherein
   said recording mechanism is an ink jet recording head for ejecting ink for recording in accordance with recording signals.

8. A recording apparatus according to Claim 7, wherein
   said recording mechanism has a plurality of discharging ports for ejecting ink over the entire width of the recording area of said recording medium.

9. A recording apparatus according to Claim 4, wherein
   said recording mechanism performs recording with ink to be ejected by utilizing film boiling generated in ink due to the thermal energy generated by electrothermal transducers when said electrothermal transducers are energized in accordance with recording signals.

10. A recording apparatus according to Claim 4, wherein
    said recording mechanism contains ink to be used for recording.

11. An ink jet recording apparatus for performing recording by ejecting ink onto a recording medium, comprising the following:
    a mounting portion for mounting an ink jet recording head for performing recording on a recording medium;
    a feed mechanism for feeding said recording medium to a recording position;
    a guide mechanism for guiding the end portions of said recording medium to be fed, said guide mechanism being shiftable in the width direction of said recording medium; and
    a discharge mechanism for discharging from the recording position said recording medium being fed, said discharge mechanism being capable of changing its positions in accordance with the shift of said guide mechansim.

12. An ink jet recording apparatus according to Claim 11, wherein
    said discharge mechanism grips the vicinity of both end portions of said sheet material.

13. An ink jet recording apparatus according to Claim 11, wherein
    said recording mechanism is an ink jet recording head for ejecting ink for recording in accordance with recording signals.

14. An ink jet recording apparatus according to Claim 11, wherein
    said ink jet recording head has a plurality of discharging ports for ejecting ink over the entire width of the recording area of said recording medium.

15. An ink jet recording apparatus according to Claim 11, wherein

said ink jet recording head performs recording with ink to be ejected by utilizing film boiling generated in ink due to the thermal energy generated by electrothermal transducers when said electrothermal transducers are energized in accordance with recording signals.

16. An ink jet recording head according to Claim 11, wherein

said ink jet recording head contains ink to be used for recording.

17. A sheet feeding device comprising a feed mechanism for feeding a sheet material; a sheet material guide mechanism adjustable laterally of the direction of feed; and a discharge mechanism for discharging the sheet material being fed, which mechanism effects positional adjustment in relation to the lateral shift of the guide mechanism.

18. A recording apparatus having a sheet feeding device which when moved laterally of the feeding path causes relative proportional shift of a sheet discharge mechanism.

FIG. 1

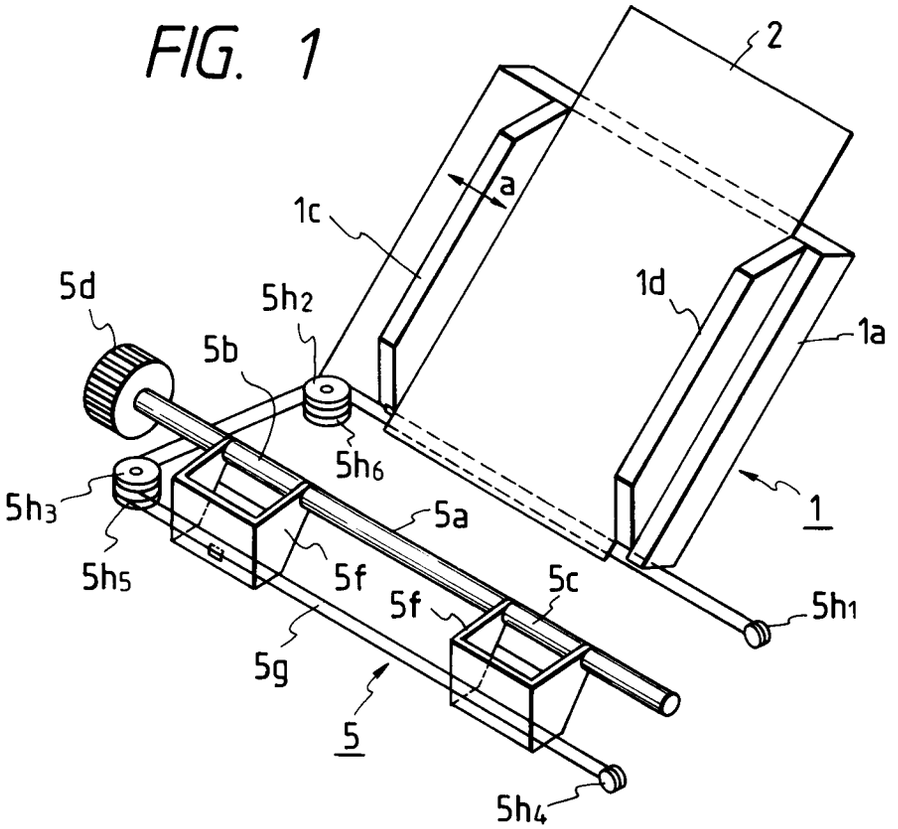

2
a
1c
1d
1a
5d
5h2
5b
5h6
5h3
5a
1
5h5
5f
5c
5f
5h1
5g
5
5h4

FIG. 2

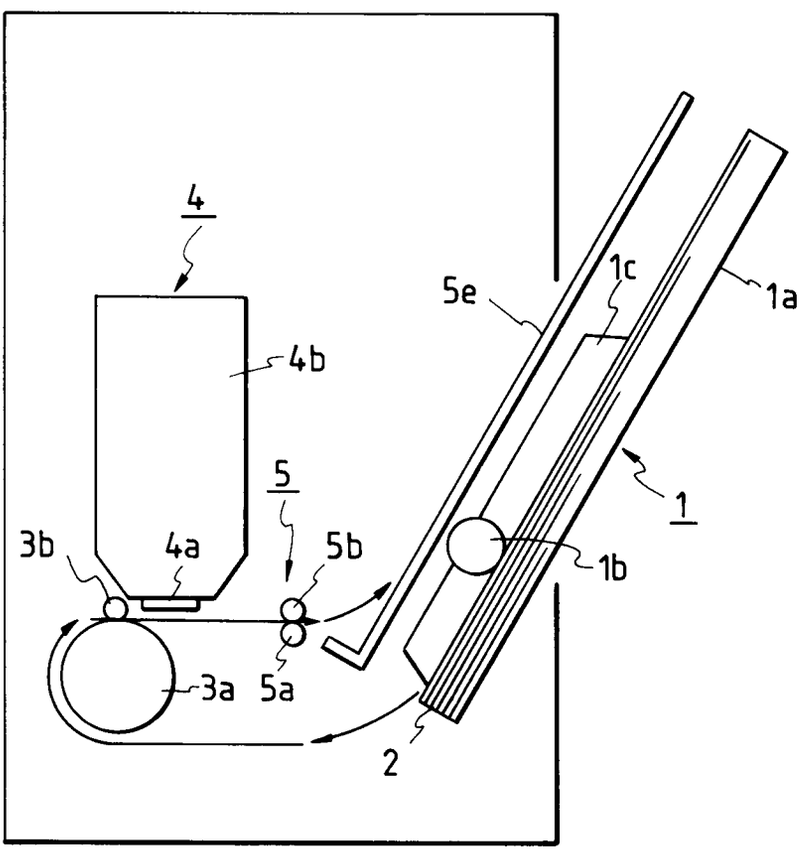

4
5e
1c
1a
4b
5
1
3b
4a
5b
1b
3a
5a
2

FIG. 3

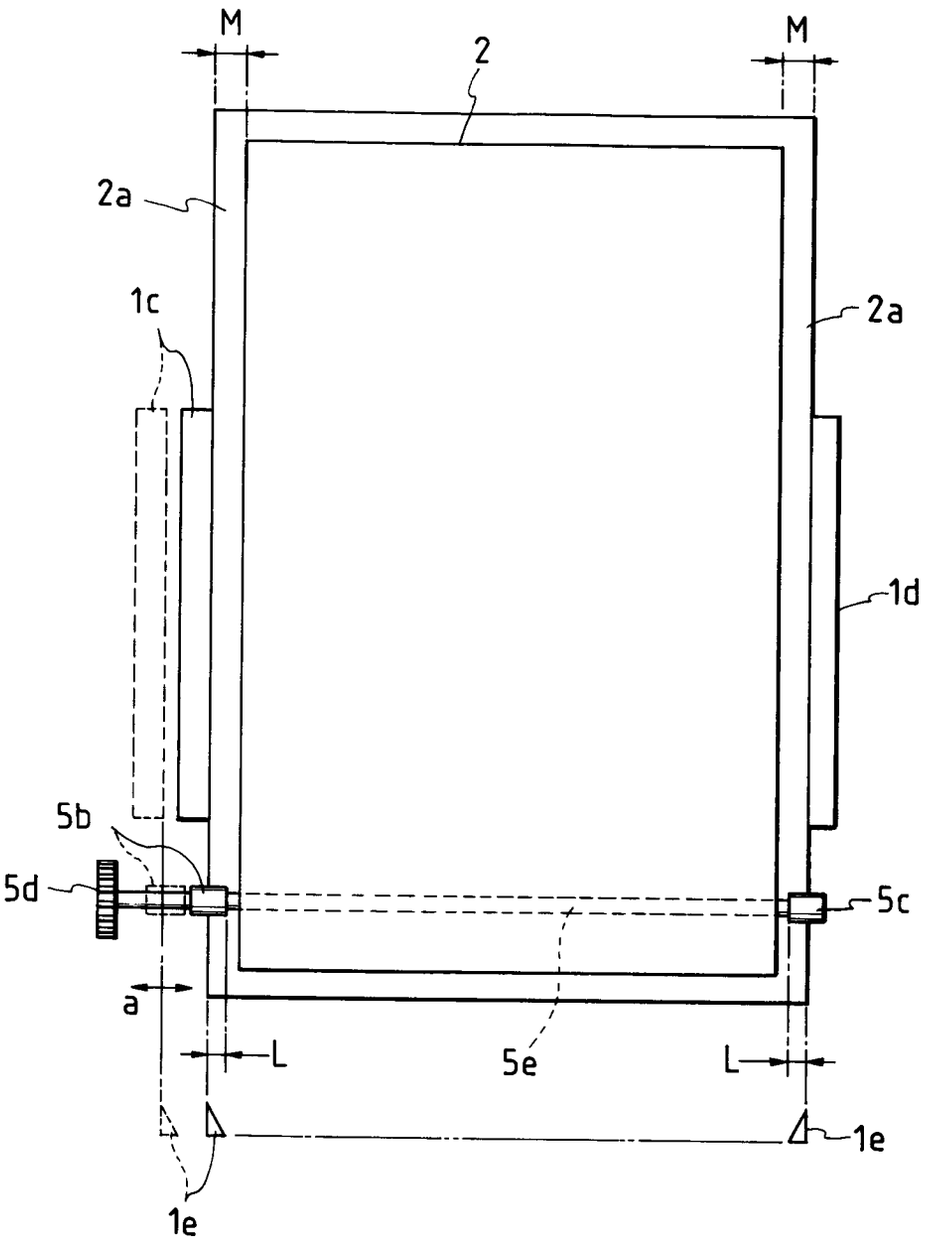


FIG. 4

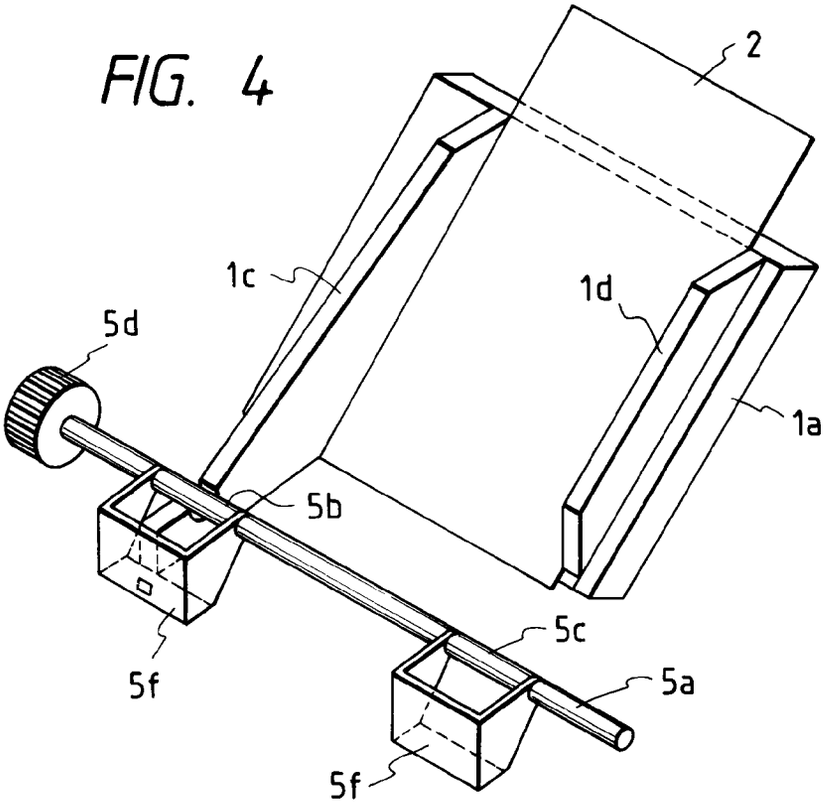


FIG. 5