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(54) **Printer medium drive clearance eliminator.**

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PATENT ABSTRACTS OF JAPAN vol. 9, no. 333 (M-443)(2056) 27 December 1985, JP-A-60 165276 (RICOH) 28 August 1985,

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Description

TECHNICAL FIELD

The present invention relates generally to computer printer medium drive mechanisms, and, more particularly, to drive mechanisms wherein the medium is required to curl around a roller as it feeds through the printer. The predominant current usage of the medium clearance eliminator of the present invention is as an aid to paper feeding and handling in thermal ink-jet printer medium drive mechanisms.

BACKGROUND ART

In any type of printer assembly, a mechanism is required to move print medium, usually either paper or a transparency, through the printer. The medium drive mechanism is required to advance medium smoothly and accurately and frequently both forward and backward through the printer. It usually must be capable of handling several types of medium, sometimes including both sheet medium and form feed medium, wherein the medium is supplied in a continuous length. The mechanism must not be prone to jamming, since it is intended that medium handling be entirely automatic and that it not require operator intervention. The mechanism must provide a proper medium exit angle appropriate to the type and design of printer to which it is adapted. The mechanism must further readily accept medium that is automatically fed into it, since this is frequently a part of the automated medium handling process within a printer. Because of the great variety of computer printer types and applications, a variety of different medium drive mechanisms have been developed for use in such printers. It is, sof course, the objective of each of these medium drive mechanism designs to achieve all of the above-mentioned desired properties. However, because of limitations of space and other factors, designers have frequently been compelled to favor some of these desired qualities over others.

One of the most common designs for printer medium drive mechanisms has the medium entering the mechanism between an opposed pair of rollers. The medium then curves around one roller and exits the drive mechanism in a direction essentially opposite the entering direction. Among the advantages of this arrangement are that the drive mechanism may be placed near the back of the printer, thereby reducing overall printer size. This type of drive mechanism has been found to work well, and has been in service for a considerable period of time. Nevertheless, this type mechanism is not without its problems. Among these are the fact that paper exiting the mechanism sometimes tends to skew, that is, to become improperly aligned with the print-head as its exits the drive mechanism.

A number of different methods have been tried to eliminate this problem. However, as anyone who uses this type of computer printer knows, this problem has certainly not been eliminated to date.

Another problem associated with this type of printer medium drive mechanism that it is not impervious to jamming. In fact, jamming is probably the most frequent complaint of users of printers incorporating this type of mechanism. No prior art mechanism to the inventors' knowledge has been developed which will prevent jamming and skewing in this othervise highly successful style of medium drive mechanism. All successful designs to date which have tended to reduce skewing and jamming have incorporated types of drive mechanisms which were not as suitable for desirable placement within a printer as is the drive mechanism style for which the present invention is adapted.

Patent Abstracts of Japan vol. 9, no. 333 (M-443) [2056], 27th December 1985 and JP-A-60165276 describes a paper guide mechanism designed to prevent poor quality printing and skewing of the print medium. The mechanism comprises a drive roller, a plurality of pinch rollers and a sub-auxiliary guide plate in the clearance between the drive roller and an auxiliary guide plate. The sub-auxiliary guide plate is made of a material low in rigidity and friction resistance, such as polyester film, and the base thereof is fastened to the auxiliary guide plate. In use, the end of the sub-auxiliary guide plate remote from the auxiliary guide plate is pressed against the drive roller and curves around part of the drive roller, thereby holding the print medium tightly against that part of the roller. This prevents deflection of the print medium due to clearance between the drive roller and the auxiliary guide plate.

The present invention relates to computer hardcopy output printers incorporating a conventional medium drive mechanism, and further incorporating the inventive mechanism so as to eliminate jamming and skewing problems associated with the conventional medium drive mechanism. The present invention is particularly adapted for use in thermal ink-jet printer assemblies.

The present invention provides a medium feed mechanism for a printer comprising a drive roller for propelling a print medium and at least one pinch roller for holding the print medium against the drive roller, and further comprising a clearance eliminator mechanism, including: a medium guide piece; a flexible clearance eliminator sheet mounted in tension on said medium guide piece, said clearance eliminator sheet conforming to a surface

of the drive roller over at least a portion of the circumference of said drive roller.

The clearance eliminator sheet can be made of any of a number of different materials. In the presently preferred embodiment of the invention, it has been found that a sheet of ultrahigh molecular weight (UHMW) polyethylene provides some particular advantages, as will be described herein.

Since clearance and drag within the mechanism are both reduced by use of the present invention, any tendency for medium to drag thereby causing one side of the medium to exit the mechanism before the other is eliminated. Furthermore, net drive force is increased by use of the inventive mechanism, thereby also helping to insure proper medium handling.

An advantage of the present invention is that jamming within a printer drive mechanism is reduced.

Another advantage of the present invention is that skewing of medium within a printer drive mechanism is reduced.

A further advantage of the present invention is that a conventional, proven and othervise desirable drive mechanism design may be employed while reducing tendencies of medium to jam or skew within the printer drive mechanism.

These and other objects and advantages of the present invention will become clear to those skilled in the art in view of the description of the best presently known mode of carrying out the invention and the industrial applicability of the preferred embodiment as described herein and as illustrated in the several Figures of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a printer assembly incorporating the clearance eliminator of the invention;

FIG. 2 is a side view of a printer assembly with conventional paper guide;

FIG. 3 is a side view of a portion of the printer assembly of FIG. 2, showing a medium jamming problem; and

FIG. 4 is a top view of a portion of the printer assembly of FIG. 2, showing a medium skewing problem.

BEST NODES FOR CARRYING OUT THE INVENTION

The best presently known mode for carrying out the invention is a thermal ink-jet printer incorporating conventional elements including a medium drive, or "feed" mechanism. The medium feed mechanism includes the inventive medium clearance eliminator as a means for eliminating clearances within the mechanism, which would othervise allow medium within the feed mechanism to buckle, and thus cause the undesirable properties of jamming and skewing of the medium.

The predominant expected usage of the inventive medium clearance eliminator is in ink-jet printers used in the data processing industry and in office and home computer printer installations.

A portion of the thermal ink-jet printer of the presently preferred embodiment of the present invention is illustrated in a side view in FIG. 1 and is designated therein by the general reference character **10**. In most of its substantial components, the printer **10** does not differ significantly from conventional thermal ink-jet printers. The physical structure is similar to that of prior art thermal ink-jet printers.

The conventional elements of the printer **10** include a pen **12** for depositing ink upon a print medium **14**, a platen **16** for holding the medium **14** relatively parallel to the pen **12** during printing, and an input guide **18** for guiding the medium **14** into contact with a drive roller **20**. A drive pinch roller **22** is contiguous to the drive roller **20** and parallel along its length. The medium **14** is drawn through the printer **10** by the drive roller **20** and is pushed past the pen **12** and the platen **16** where it is further directed by an exit roller **24** and an exit pinch roller **26**. The medium **14** is held against the drive roller **20** near the pen **12** by a drive plate **28**. The pen **12** is mounted on a pen traversing mechanism (not shown), allowing the pen **12** to traverse the medium **14** in a plane parallel to the medium **14** and perpendicular to a medium advance direction **30**.

Referring now to FIG. 2 wherein is illustrated a comparable printer assembly **10** including a conventional paper guide **32**, the drive plate **28** is affixed to the paper guide **32**, and the paper guide **32** is rigidly affixed relative to the printer assembly **10**. The medium **14** is shown buckling in a clearance area **34**. Jamming of the printer **10** can occur when medium **14** buckles sufficiently in clearance area **34** so as to double back as depicted in FIG. 3. FIG. 4, wherein a portion of printer assembly **10** is shown from a top view, shows the medium **14** exiting from the drive plate **28** in a skewed fashion as a result of the medium **14** having not advanced squarely through the clearance area **34**.

Referring now again to FIG. 1, the paper guide **34** is shown reshaped according to the present invention and pivotallv mounted relative to the printer assembly **10** at a pivot point **36.** A clearance eliminator sheet **38** is shown holding the medium **14** against the drive roller **20**. The clearance eliminator sheet **38** is made of a flexible ultrahigh molecular weight (UHMW) polyethylene so that it may conform somewhat to the shape of the

drive roller **20**. The clearance eliminator sheet **38** is rigidly mounted at a top mounting tab **40** and a bottom mounting tab **42** so as to allow for this flexibility. Bottom mounting tab **42** is slidingly mounted to the paper guide **32** and is tensioned by coil spring **43** so as to hold the clearance eliminator sheet **38** firmly against the drive roller **20**. The force holding the clearance eliminator sheet **38** against the drive roller **20** is provided by coil spring **43**, which is secured at one end by spring mounting pivot **46**.

In the presently preferred embodiment of the invention, the clearance eliminator sheet **38** is made of ultra-high molecular weight (UHMW) polyethylene sheet. While any of a number of relatively low friction materials might be used, UHMW polyethylene has been found to provide the best combination of low friction, flexibility, and wear resistance. UHMW polyethylene is well-known and commercially available. Advantageously, the thickness of UHMW polyethylene sheet, while not being particularly critical, is about 127 μm (0.005 inch).

In the presently preferred embodiment of the invention, the drive plate **28** is also surfaced with UHMW polyethylene in the area of contact with the medium **14**.

The paper guide **32** may be pivotally mounted as shown or rigidly affixed to the input guide **28** or an extension thereof. Another spring (not shown), or its equivalent, causes the paper guide **32** to rotate in the direction indicated by arrow **52**. The pivot point **36** is provided in the presently preferred embodiment of the present invention as a means for biasing the drive plate **28** against the drive roller **20**.

According to the present invention, the clearance area **34** (FIG. 2) is greatly reduced. The medium **14** does pass through two residual unsupported areas **54**. However, the medium **14** is sufficiently stiff to pass through these short residual unsupported areas **54** without buckling. Accordingly, the improvements of the present invention effectively eliminate jamming in the area of the drive roller **20** and the paper guide **32**. Furthermore, the medium cannot become skewed in this area, as elimination of the clearance area **34** prevents either side of the medium **14** from advancing ahead of the other.

Proper medium handling is further insured by use of the inventive mechanism by virtue of the fact that net drive force is increased by the clearance eliminator sheet **38** as disclosed herein. This net increase in drive force is a result of the fact that the clearance eliminator sheet **38** forces the print medium **14** against the drive roller **20**, thereby increasing the efficiency of drive force transfer between the drive roller **20** and the print medium **14**. Because the clearance eliminator sheet **38** is made of an extremely low friction material, any drag produced between the clearance eliminator sheet **38** and the print medium **14** is of a considerably lower vector quantity than is the addition forward drive force which is thereby transferred to the print medium **14**. Therefore, the net drive force is increased.

Various modifications may be made to the invention without altering its value or scope. For example, tension may be provided by means other than a coil spring **43**. Tension points and pivot points may also be altered as necessary to adapt the inventive clearance eliminator to various printer drive mechanisms. Another conceivable alteration would be to adapt the inventive clearance eliminator to printer types other than thermal ink-jet printers.

All of the above are only some of the examples of available embodiments of the present invention. Those skilled in the art will readily observe that numerous other modifications, alterations, and adaptations may be made without departing from the scope of the invention. Accordingly, the above disclosure is not intended as limiting, and the appended claims are to be interpreted as encompassing the entire scope of the invention.

The need for computer output printers has increased greatly over the past decade and is expected to continue to increase. Because of their many desirable qualities, ink-jet printers are expected to fill an increasing percentage of the demand for such printers. The type of medium drive mechanism for which the present invention is adapted has been proven to be one of the most desirable for ink-jet printers. It combines the attributes of readily accepting sheets of medium as they are fed into the drive mechanism, and allowing advancement of the medium in both a forvard and backward direction. It has, therefore, become a much used type of drive mechanism. By incorporating the medium clearance eliminator into a printer assembly along with the medium drive mechanism, a significant improvement in reliability and ease of operation has been realized. It is believed that the reduced tendency of medium to jam or skew within a printer as a result of the use of the inventive medium clearance eliminator will increase the desirability of ink-jet printers incorporating the present invention in the marketplace.

Ink-jet printers incorporating the present invention may be utilized in any application wherein conventional ink-jet printers or other conventional computer hardcopy output printers are currently used. Since computer printers utilizing the present invention may be readily constructed and do not require that an operator vary the manner in which such printers are used, it is expected that they will be acceptable in the industry as substitutes for

conventional printers. The increased reliability and improvement in medium feed qualities will make printers incorporating the present invention desirable substitutes and will enhance the applicability of the present invention.

For these and other reasons, it is expected that the utility and industrial applicability of the invention will be both significant in scope and long lasting in duration.

Claims

1. A medium feed mechanism for a printer comprising a drive roller (20) for propelling a print medium (14) and at least one pinch roller (22) for holding the print medium (14) against the drive roller (20), and further comprising a clearance eliminator mechanism, including:
   a medium guide piece (32);
   a flexible clearance eliminator sheet (38) mounted in tension on said medium guide piece, said clearance eliminator sheet (38) conforming to a surface of the drive roller (20) over at least a portion of the circumference of said drive roller (20).

2. A medium feed mechanism according to claim 1 wherein said clearance eliminator sheet (38) is made of ultrahigh molecular weight polyethylene.

3. A medium feed mechanism according to claim 1 or 2, wherein said tension on said clearance eliminator sheet (38) is provided by a coil spring (43).

4. A medium feed mechanism according to claim 1, 2 or 3, wherein the medium guide piece (32) is pivotally mounted on a pivot point (36).

Patentansprüche

1. Ein Mediumzuführungsmechanismus für einen Drucker, der eine Antriebswalze (20) zum Bewegen eines Druckmediums (14) und zumindest eine Klemmwalze (22) zum Halten des Druckmediums (14) gegen die Antriebswalze (20) umfaßt und der ferner einen Freiraumeliminatormechanismus umfaßt, der folgende Merkmale einschließt:
   ein Mediumführungsteil (32);
   ein biegsames Freiraumeliminatorblatt (38), das unter Spannung auf dem Mediumzuführungsteil befestigt ist, wobei das Freiraumeliminatorblatt (38) mit einer Oberfläche der Antriebswalze (20) über zumindest einen Abschnitt des Umfangs der Antriebswalze (20) zusammenpaßt.

2. Ein Mediumzuführungsmechanismus gemäß Anspruch 1, bei dem das Freiraumeliminatorblatt (38) aus einem Polyethylen mit ultrahohem Molekulargewicht hergestellt ist.

3. Ein Mediumzuführungsmechanismus gemäß Anspruch 1 oder 2, bei dem die Spannung auf das Freiraumeliminatorblatt (38) durch eine Schraubenfeder (43) bereitgestellt ist.

4. Ein Mediumzuführungsmechanismus gemäß Anspruch 1, 2 oder 3, bei dem das Mediumführungsteil (32) drehbar an einem Drehpunkt (36) befestigt ist.

Revendications

1. Mécanisme de chargement de support pour une imprimante comprenant un rouleau d'entraînement (20) pour propulser un support d'enregistrement (14) et au moins un rouleau presseur (22) pour maintenir le support d'enregistrement (14) contre le rouleau d'entraînement (20), et comprenant en outre un mécanisme éliminateur de jeu, comportant:
   une pièce guide de support (32);
   une feuille souple éliminateur de jeu (38) montée en tension sur ladite pièce guide de support, ladite feuille éliminateur de jeu (38) se conformant à la surface du rouleau d'entraînement (20) au moins sur une partie de la circonférence dudit rouleau d'entraînement (20).

2. Mécanisme de chargement de support selon la revendication 1, dans lequel ladite feuille éliminateur de jeu (38) est faite de polyéthylène de poids moléculaire très élevé.

3. Mécanisme de chargement de support selon la revendication 1 ou 2, dans lequel ladite tension sur ladite feuille éliminateur de jeu (38) est exercée par un ressort hélicoïdal (43).

4. Mécanisme de chargement de support selon la revendication 1, 2 ou 3, dans lequel la pièce guide de support (32) est montée pour tourner sur un point de pivotement (36).

Fig. 1.

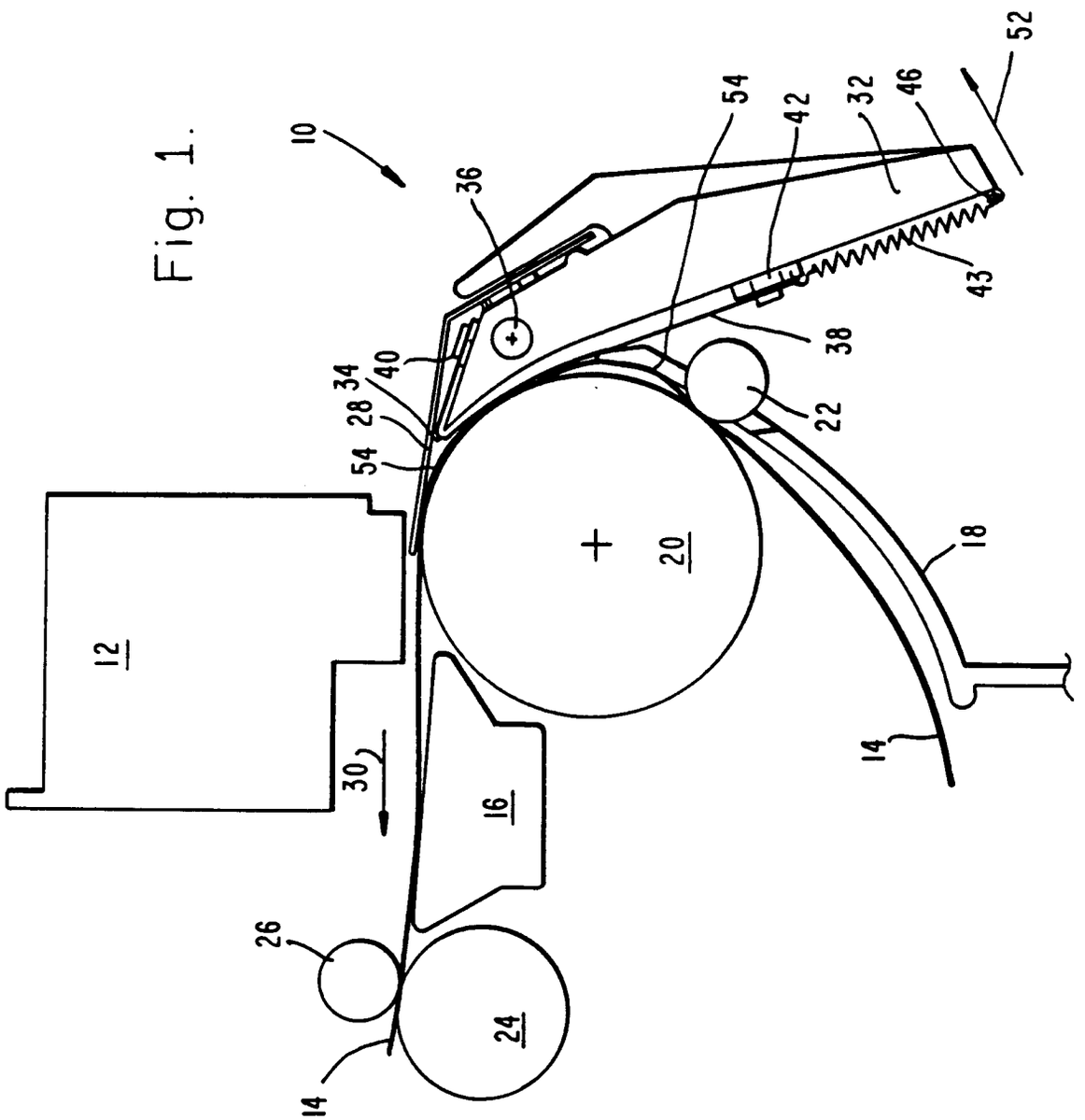


Fig. 2.

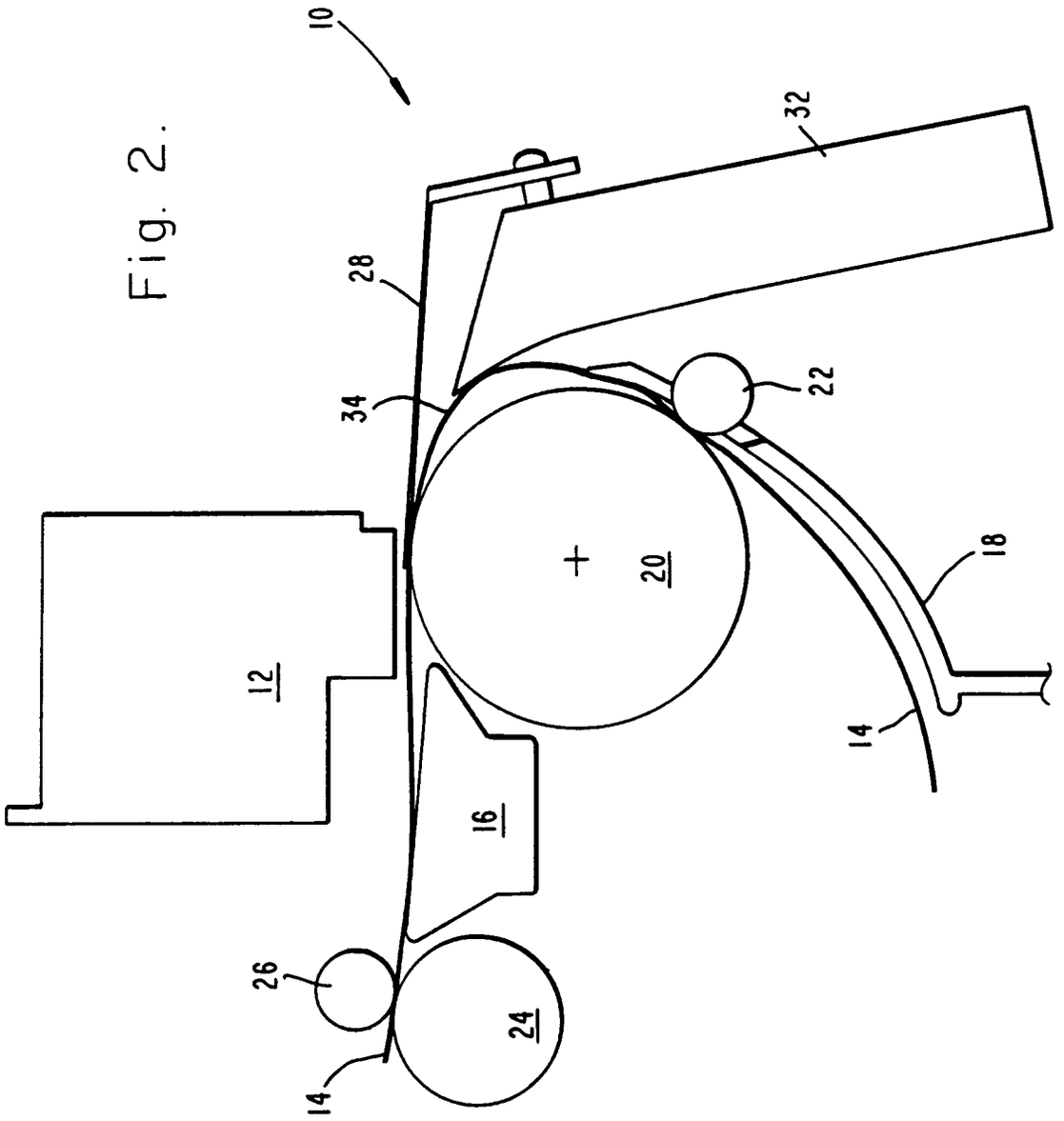
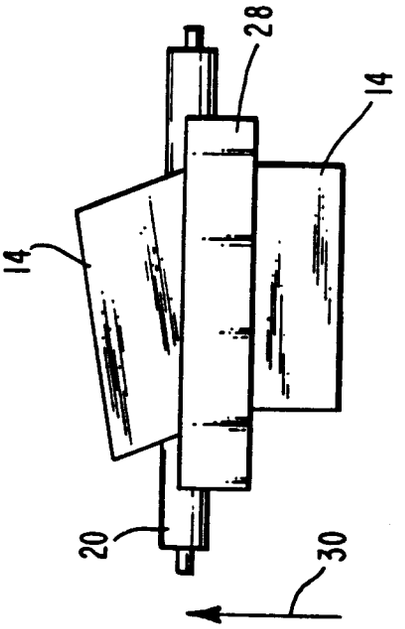


Fig. 4.



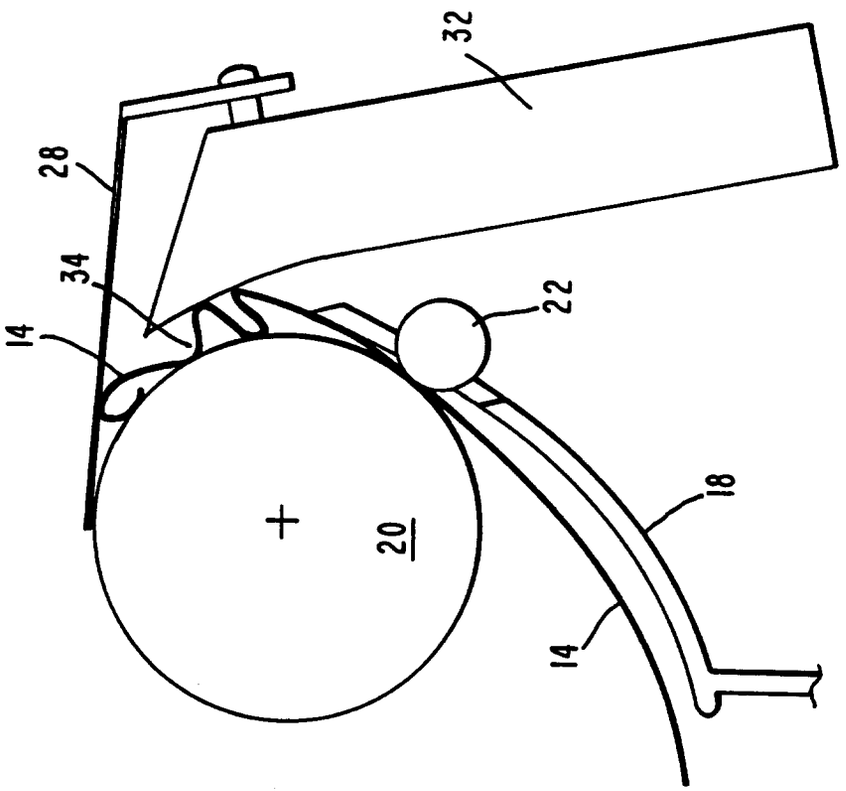


Fig. 3.