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(54) Printer medium drive clearance eliminator.

(57) A printer medium feed mechanism clearance eliminator is provided, including a paper guide (32) mounted to the printer, a clearance eliminator sheet (38), and tensioning means (43). The clearance eliminator plate (38 conforms to the curve of a medium drive roller (20), thereby eliminating clearance wherein the medium (14) might buckle and cause jamming or skewing within the printer (10).

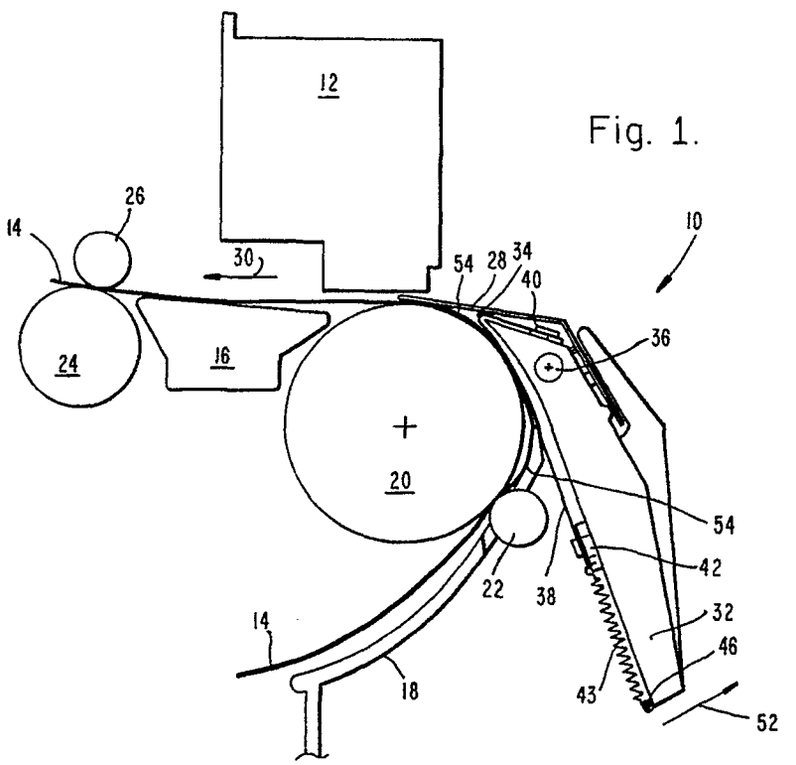

Fig. 1.

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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.

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 mechsanism style for which the present invention is adapted.

DISCLOSURE OF INVENTION

This 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 associates with the conventional medium drive mechanism.

The present invention is particularly adapted for use in thermal ink-jet printer assemblies. Briefly, the preferred embodiment of the present invention is a clearance eliminator which serves to hold medium against a drive roller as the medium curves around the roller. The inventive clearance eliminator thereby prevents buckling or skewing of paper within the drive mechanism itself which can result in jamming of the mechanism or skewing of the medium as it exits the mechanism.

In the preferred embodiment of the invention, a flexible clearance eliminator sheet is mounted on a paper guide. The clearance eliminator sheet is provide with a pivot point and a tension which causes the clearance eliminator sheet to maintain contact with a drive roller, thereby eliminating space wherein medium might buckle as it passed through the drive mechanism.

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 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. Further-

more, 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 ultra-high 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 mount-

ing 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, polyethylene has been found to provide the best combination of low friction, flexibility, and wear resistance. polyethylene is well-known and commercially available. Advantageously, the thickness of polyethylene sheet, while not being particularly critical, is about 0.005 inch.

In the presently preferred embodiment of the invention, the drive plate 28 is also surfaced with 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 forvard 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 spirit and 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. An apparatus for guiding a print medium through a printer feed mechanism, comprising:
a means for imparting motion to said print medium;
a clearance eliminator piece; and
means for holding said clearance eliminator piece against said means for imparting motion to said print medium.

2. The apparatus for guiding a print medium through a printer of claim 1, wherein:
said means for imparting motion to said print medium is a drive roller.

3. The apparatus for guiding a print medium through a printer of claim 2, wherein:
said clearance eliminator piece is flexible so as to conform to a surface of said drive roller, thereby maintaining conformity to said surface of said driver roller over at least a portion of the circumference of said drive roller.

4. The apparatus for guiding a print medium through a printer of claim 1, wherein:
said clearance eliminator is mounted on a medium guide piece, which is provided with a pivot point thereon and with means for applying tension to said medium guide piece around said pivot point.

5. 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 clearance eliminator sheet mounted on said medium guide piece; and
means for providing tension on said clearance eliminator sheet so as to hold said clearance eliminator sheet against the drive roller.

6. The medium feed mechanism of claim 5, wherein:
said clearance eliminator sheet is made of ultrahigh molecular weight polyethylene.

7. The medium feed mechanism of claim 5, wherein:
said means for providing tension on said clearance eliminator sheet is provided by a coil spring.

8. A device for eliminating unwanted clearance in a printer medium drive mechanism, comprising:
a medium guide piece;
a clearance eliminator sheet affixed to said medium guide piece; and
a means for tensioning said clearance eliminator sheet against a drive roller.

9. The device for eliminating unwanted clearance of claim 8, wherein:
said clearance eliminator sheet is made of an ultrahigh molecular weight polyethylene material.

10. The device for eliminating unwanted clearance of claim 8, further including:
a drive plate attached to said medium guide piece and pivoting therewith in respect to the drive roller for holding the medium against the drive roller at an exit point of said printer medium drive mechanism.

11. The device for eliminating unwanted clearance of claim 10, further including a surface on said drive plate comprising an ultrahigh molecular weight polyethylene material.

Fig. 1.

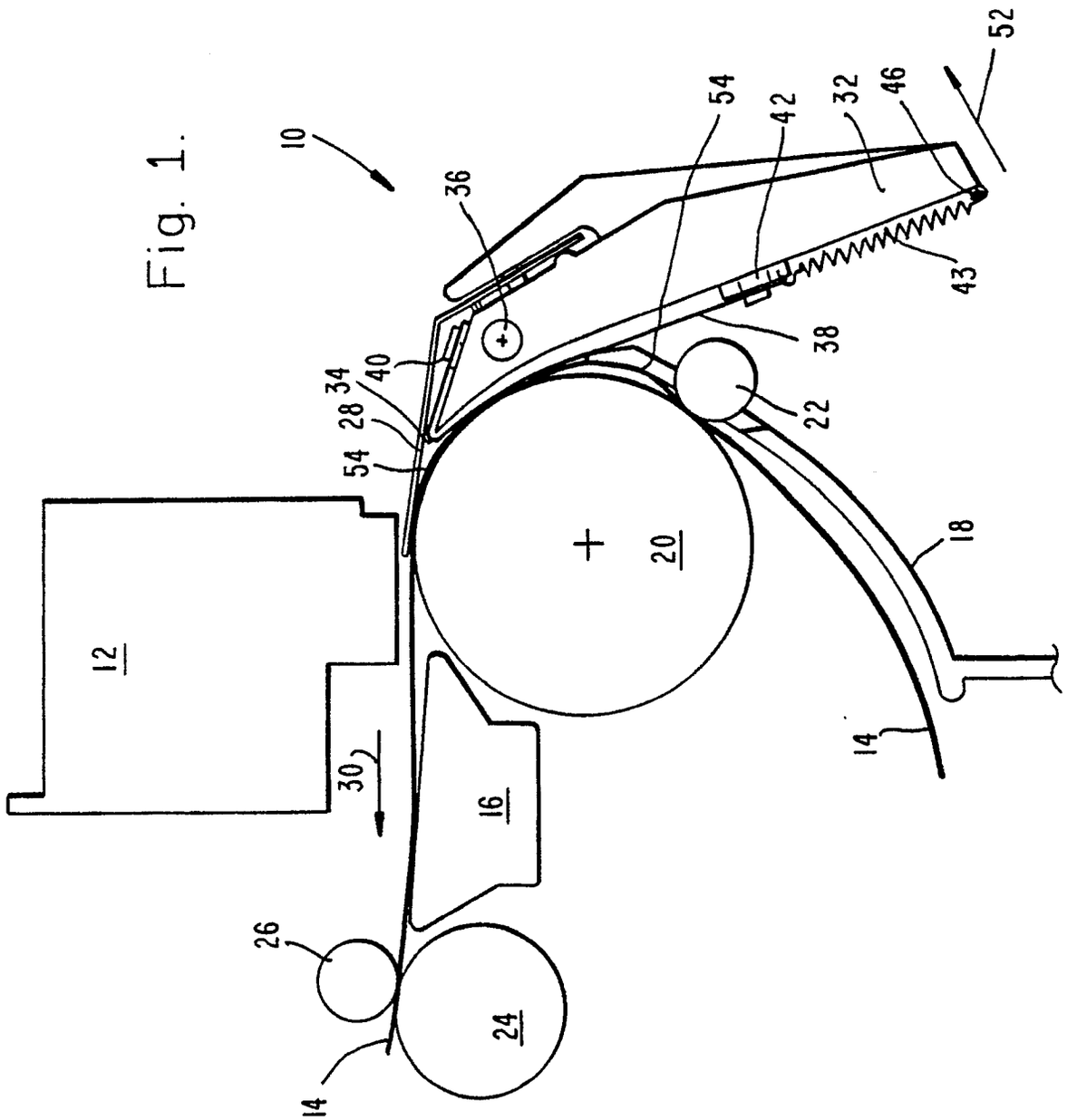


Fig. 2.

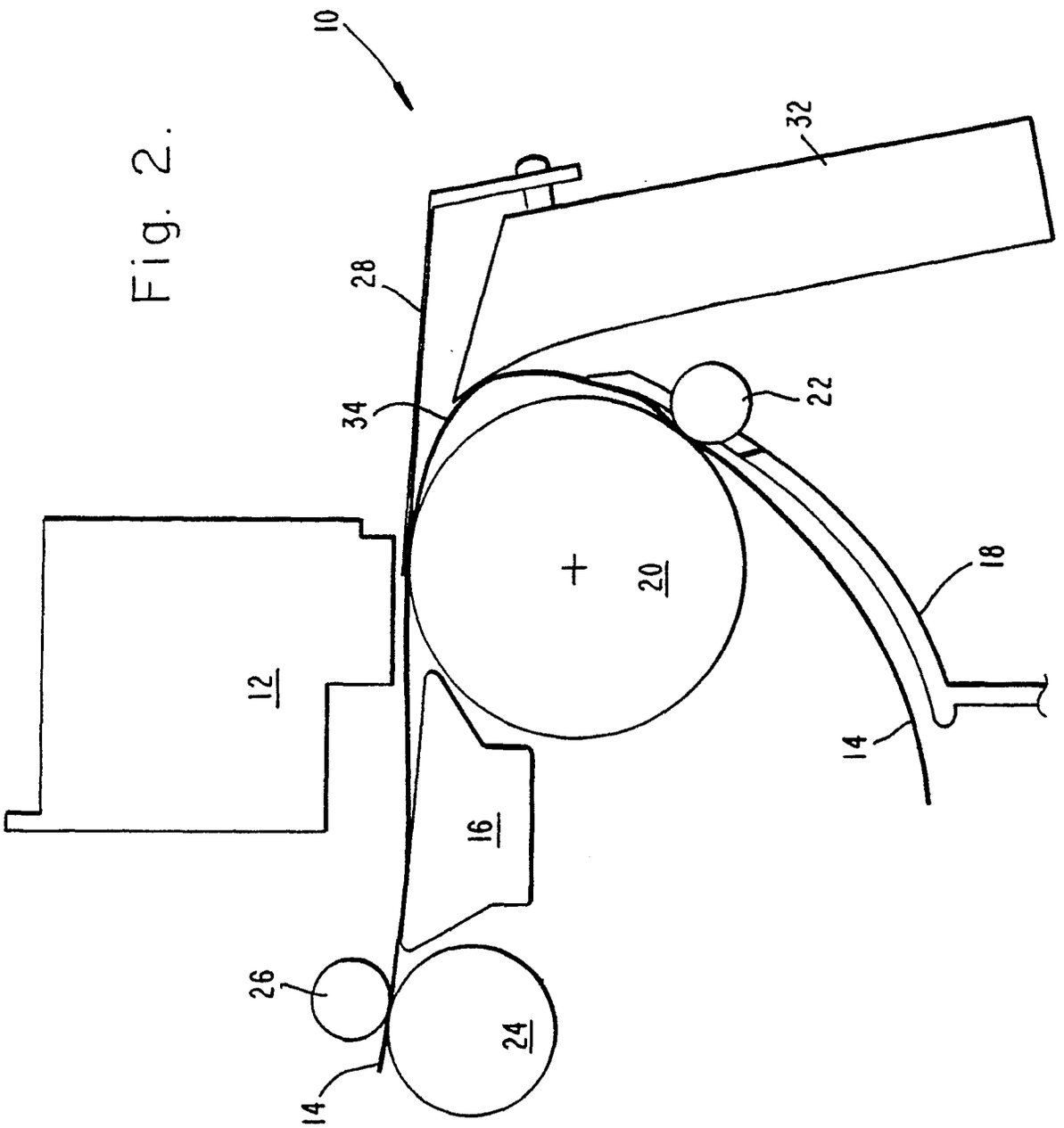
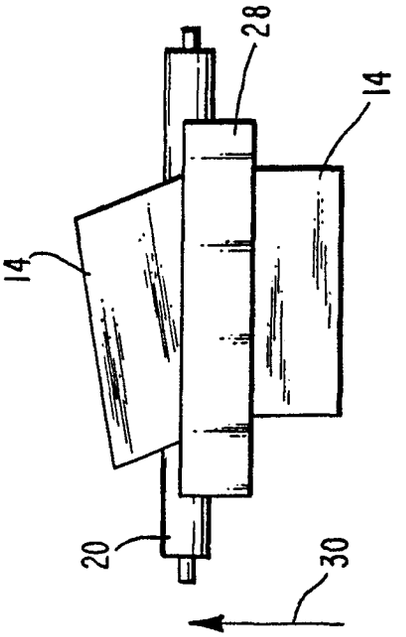


Fig. 4.



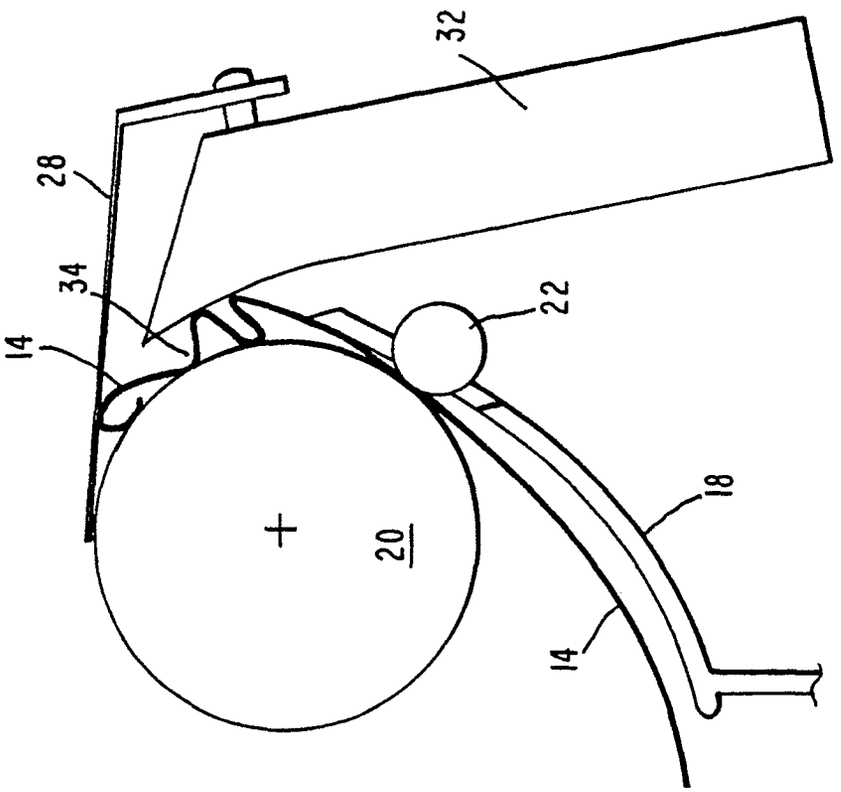


Fig. 3.