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EUROPEAN PATENT APPLICATION

21 Application number: 86115605.7

51 Int. Cl.⁴: **B41J 35/06**

22 Date of filing: 11.11.86

30 Priority: 11.12.85 US 807922

43 Date of publication of application:
16.06.87 Bulletin 87/25

84 Designated Contracting States:
DE FR GB IT

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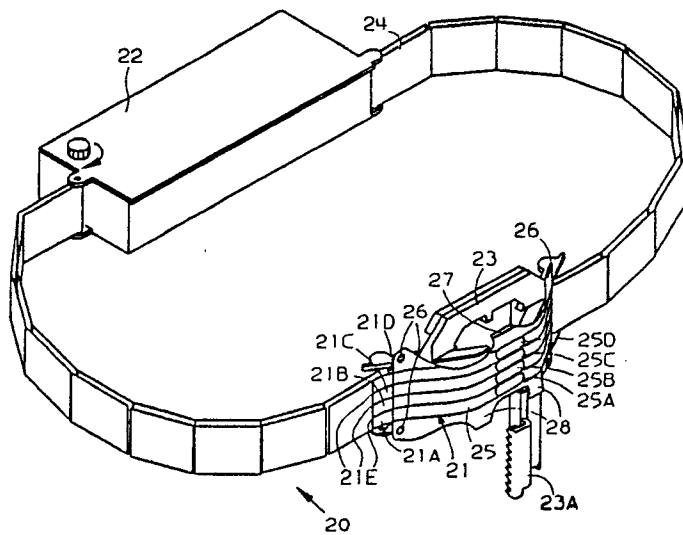
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54 **Printer ribbon assembly with integral ribbon shield and printer including such assembly.**

57 A printer ribbon assembly (20) having an integral, resilient ribbon shield (25) in pressure contact with the paper to deaden noise from the printing operation and to prevent smudging. Also disclosed is a method of preparing paper, which may have been folded or had corners bent from handling, for printing and feeding through a printer in which the ribbon shield is pressed against the paper while the print head carriage traverses across the paper to flatten the paper and urge it toward a nip of opposed paper feed rolls of a paper handling module associated with the printer.

FIG. 2



PRINTER RIBBON ASSEMBLY WITH INTEGRAL RIBBON SHIELD AND PRINTER INCLUDING SUCH ASSEMBLY

Cross Reference to Related Patents

The present invention is related to European patent application 85110396.0 relating to a ribbon guide assembly; this patent is sometimes referred to herein as the "Ribbon Guide Patent".

The present invention is also related to European patent application 85111906.5 relating to a ribbon positioning mechanism; this patent is referred to herein as the "Ribbon Positioning Patent".

The present invention is also related to a U.S. patent application 807,519 relating to a printer with removable and interchangeable paper feed modules, filed December 11, 1985; this patent will occasionally be referred to herein as the "Paper Module Patent".

Background of the Invention

Field of the Invention

The present invention relates to apparatus for printing information on paper. More particularly, the present invention relates to a ribbon shield apparatus for preventing unwanted contact between the ribbon and the paper (causing ink smudges on the paper) during relative movement of the ribbon and paper.

Background Art

Several types of impact printers are known today. Many include a fixed platen and a movable print head carriage including a plurality of spaced print wires which are selectively activated and driven into a ribbon and the paper as the head moves across the paper. Such printers are illustrated by U.S. Patents 3,592,311 and 3,897,865.

Printers create a substantial amount of noise during print wire activation and contact of the wires with the ribbon, paper and the platen. This noise increases as printers are driven at ever increasing printing rates, now approaching or exceeding 400 characters per second in some printers. This high speed requires more wire activations and platen contacts per unit of time. Current printers generate more noise as greater forces are employed to complete a firing sequence in a shorter period of time (in which the print head is in the proper printing location).

Another problem with printing at ever increasing speeds is that the ribbon is positioned close to the paper, making it more likely to come into unwanted contact with the paper, leaving smudges and other undesirable markings. In some printers, the print head and the paper are placed in close proximity (perhaps 0.4 millimeter separation) to permit short cycles required in high speed printing, but the ribbon is located between the print head and the paper. Further, the movement of the print head at increased speeds tends to make the ribbon more likely to come into contact with the paper.

One solution which addresses the noise problem as well as the ribbon contact with paper is to mount a ribbon shield to the print head carriage and place it in frictional engagement with the paper. An example of this solution is shown in U.S. Patent 4,410,291. While this reduces the noise created during printing and reduces the unwanted ribbon markings on the paper, the frictional engagement creates wear on the ribbon shield. The wear on the ribbon shield creates failure of the ribbon shield, necessitating periodic replacement. This replacement requirement dictates that an additional supply item (the ribbon shield) be manufactured and distributed so that the user can have his printer repaired as required. This also dictates that a mounting surface and removable mounting hardware be provided in the region of the print head and the ribbon, adding to the already crowded vicinity and possibly requiring greater distance between the print head and the paper. This patent teaches the use of a ribbon shield of approximately 1 millimeter in thickness, which is more than twice as large as the head-to-paper separation in current printers. The ribbon shield of this patent thus could not be used in current printers.

This patent also shares a disadvantage with other printers that the ribbon shield and the ribbon may be transversely movable with respect to each other. Relative movement of the ribbon with respect to the ribbon shield means that varying portions of the ribbon may be aligned with the print head and an aperture in the ribbon guide, at varying times. In the case of a multi-colour ribbon, this varying of alignment may mean that a wrong colour is printed or that printing partially in two different colours may occur. Both results are, of course, undesirable.

Documents on which printing is desired frequently do not have the stiffness and flatness necessary to feed the paper in the desired path. This is particularly true for, e.g., car rental agreements where the calculation of a customer's bill is desired

on the form which the customer has been carrying. This carried form may have been folded and its corners bent. In many printers, such a form could either not be handled well or would require manual preparation for printing.

A moving print head carriage has a tendency to snag on portions of paper inserted in a printer. This snagging potential is especially prevalent at edges of paper such as multiple part forms and at "outfolds" where continuous form paper joins together at joints which project out from the platen and into the path of the moving print head.

Cost of manufacturing, assembly and maintenance are considerations regarding all printers and printer ribbons. Many ribbon shield "solutions" proposed previously are expensive either to fabricate and assemble or to maintain. Accordingly, the resulting printer product is either too expensive or relatively uneconomical.

Some printer ribbon assemblies include a small, rather delicate ribbon guide in the vicinity of the print head to achieve a low mass ribbon guide assembly. However, the delicateness of the ribbon guide also allows it to bend, stretch and deform during ribbon installation. Any associated structure mounted to the ribbon guide must either have similar capabilities or will break.

Various examples of printer shields are known in the prior art. Examples of these include those shown in U.S. Patents 4,165,188; 4,285,604; 4,437,401; and 4,496,256 and in IBM Technical Disclosure Bulletin Vol. 16, No. 3, August 1973, p. 834; Vol. 26, No. 1, June 1983, p. 65 and p. 73.

Other limitations and disadvantages of the prior art systems will be apparent to those skilled in the art in view of the following description of the present invention.

Summary of the Present Invention

The present invention, as claimed, overcomes the disadvantages and limitations of the prior art printing systems by providing a ribbon shield which is integral with the ribbon cartridge and is mounted in frictional engagement with the paper when the ribbon is installed so that noise from the printing operation is reduced.

The integral mounting of the ribbon shield to the ribbon cartridge provides for its automatic replacement with each ribbon cartridge. In this way, any wear on the ribbon shield can be ignored, because the ribbon shield is replaced with each new ribbon. Accordingly, no separate ribbon shield needs to be inventoried, nor separately changed.

The association of the ribbon shield with the ribbon cartridge also means that the ribbon shield will always be matched to the ribbon. Otherwise, the possibility exists that a multi-colour ribbon shield would be installed on a printer which has a single-colour ribbon included therein. Such a mismatched ribbon shield could lead to transfer of ink of a different colour to a ribbon or an attempt to print through a ribbon guide in a region where no aperture exists. Also, the present mounting of the ribbon shield to the ribbon guide means that the apertures in the ribbon shield will be positioned in appropriate spatial relationship with the print head and the colour bands on the ribbon.

A further advantage of the present invention of an integral ribbon shield is that no special mounting between the ribbon shield and the print head carriage is necessary. This eliminates labour necessary to install such a ribbon shield during manufacture of the printer and also the labour of the service-person to adjust or replace the ribbon shield during use of the printer. It also means one fewer part which can fail and remove the printer from service.

This invention has the further advantage that low manufacturing cost of the ribbon shield can be achieved.

The present invention also has the advantageous effect that undesired smudges of the ribbon against the paper are greatly reduced, and possibly eliminated. The present ribbon shield also reduces the chance of ribbon snagging at the edges of the paper or at outfolds in continuous form paper by providing ramps which allow the print head assembly to move over such edges.

The present ribbon shield of an alternate design has the additional advantage that it can bend, stretch and deform as the ribbon and the ribbon guide are bent, stretched and deformed, without breaking or permanently deforming.

The frictional or pressure engagement of the ribbon shield against the paper allows a pass of the print head (without printing) to flatten a document which has been folded or bent. This pass of the print head across the width of the document serves to urge the document into a nip of opposed upper rollers carried on the paper modules of the Paper Module Patent, for example. In such a manner, the paper can be directed in a desired direction in an automatic operation of the printer, without requiring time and efforts of an attendant. Such automatic operation clearly reduces the difficulty and labour cost of the operation.

Other objects and advantages of the present invention will be apparent to those skilled in the art of designing printing apparatus and the ribbon assemblies useful therein, particularly in view of the

following detailed description of the preferred embodiments taken with the appended claims and the accompanying drawings.

Brief Description of the Drawings

FIG. 1 is a perspective view of a printer useful in the present invention.

FIG. 2 is a perspective view of a ribbon cartridge including a printer ribbon shield for the printer of FIG. 1.

FIG. 3 is a partial side view of the printer of FIG. 1, partially cut away along the line III-III in FIG. 1 with a ribbon cartridge of the type shown in FIG. 2 mounted therein.

FIG. 4 is an enlarged view of the ribbon guide and ribbon shield of the present invention, with the ribbon itself removed.

FIG. 5 is a perspective view of a ribbon shield of an alternate design to that shown in FIG. 2.

FIG. 6 is a partial side view of the alternate design ribbon shield of FIG. 5 mounted in the printer of FIG. 1. As such, this view is analogous to FIG. 3, but using a different ribbon and ribbon shield.

FIG. 7 is a partial cross-sectional view of a ribbon, ribbon guide and ribbon shield of the alternate embodiment ribbon of FIGS. 5 and 6, taken along the line VII-VII in FIG. 6.

Preferred Embodiments of the Invention

As shown in FIG. 1, a printer 10 includes an outer housing 15 which generally covers the inner working parts of the printer 10. An access cover 16 is hingedly connected at its upper rear portion to the outer housing 15. The hinged junction of the access cover 16 and the outer housing 15 provides a paper exit slot, broadly indicated by the reference numeral 17. At the juncture of the lower front of the access cover 16 and the housing 15, an inclined surface on the housing defines a paper entry slot 18. An operator control panel 19 is positioned adjacent the paper path between the paper entry slot 18 and the paper exit slot 17 and provides communication between the printer and the operator.

FIG. 2 shows a perspective view of a ribbon cartridge assembly 20 having a ribbon 21 which is guided from a ribbon box 22 to a ribbon guide 23 - (also referred to as a "nose piece" in the Ribbon Guide Patent) in a flexible leader or guide belt 24. The preferred form of a flexible leader or guide belt is shown in the Ribbon Guide Patent. The ribbon

21 is preferably a four colour ribbon in which longitudinal bands 21a, 21b, 21c, 21d of four different colours are each separated from the adjacent band by an ink barrier 21e.

A ribbon shield 25 is secured by rivets 26 to the ribbon guide 23 at each of its four corners. The ribbon shield 25 is made of a thin piece of plastic such as the plastic film sold under the trademark Mylar and is longer than the distance between the ends of the ribbon guide 23 at the ends so that the ribbon shield 25 bows outward from the ribbon guide 23. Since the ribbon shield 25 is made of clear plastic material in its preferred embodiment, the multi-colour bands of the ribbon 21 are seen through the ribbon shield 25 in this view. The ribbon guide includes a plurality of apertures 25a, 25b, 25c, 25d, each aligned with one of the colour bands of the ribbon and positioned in front of the print head (not shown in this view) when that colour is being printed.

A rack 23a portion of the ribbon guide 23 is shown as described in the Ribbon Positioning Patent to lift the ribbon 21, the ribbon guide 23 and the ribbon shield 25 to change colour of printing. The ribbon shield 25 includes an inwardly bent tab 27 (which extends toward the ribbon guide 23 and the print head and away from the paper at approximately a 45 degree angle) which allows the ribbon to be lifted for a change of colour without snagging even if printing is at the top of a page which has an outfold immediately above. In a similar manner, the bottom of the ribbon shield 25 is provided with two inwardly bent projections 28 which allow shifting of a ribbon even toward the bottom of a page which is immediately above an outfold. Again, the projections extend inwardly at about a 45 degree angle. While the upper projection is a single projection, the lower projections are a pair of projections, each spaced from the center line to allow the ribbon and ribbon shield to be inserted over the print head with a minimum thickness (the ribbon shield itself) in the lower center region which must pass between the print head and the platen.

The ribbon 21 shown and described in the foregoing embodiment is a multi-colour ribbon of the type used in a colour printer. However, the ribbon positioning and ribbon shield of the present invention are equally useful in a multi-band, single colour ribbon. In such a ribbon, all bands are of a single colour such as black, but it is desirable to use first one band, then sequentially move the ribbon to the next band until it is completely used.

FIG. 3 shows a cut-away partial side view of the printer 10 including the ribbon 21 and ribbon shield 25. A platen 30 is shown, with lower paper guide 31 and upper paper guide 32 shown directing paper 33 between the platen 30 and a print head carriage 34. The ribbon box 22 is mounted to

the frame of the printer (not shown). The carriage 34 moves along a support rod 35. The ribbon shield 25 includes the apertures 25a, 25b, 25c, 25d and the upper bent portion 27 and the lower bent portions 28.

FIG. 4 is a front view of the ribbon shield 25. The shield consists of a thin piece of flexible and resilient plastic film material such as is sold under the trademark Mylar. Apertures 25a, 25b, 25c, 25d are located medially along the width of the ribbon shield 25 and are arranged one above the other. Each aperture is positioned to be medial along the height of one ribbon section so that printing can be confined to a predetermined vertical region of the ribbon. The rivets 26 mount the ribbon shield 25 to the ribbon guide 23 through mounting holes located toward each of the four corners of the ribbon shield 25.

FIG. 5 is a perspective view of an alternate embodiment of the present invention, in which a ribbon shield 40 includes a central section 41 which is bowed outward and into a pressure contact with the paper and the platen when the ribbon shield is mounted to the ribbon guide (not shown in this FIG.). The central section 41 includes an aperture 42 through which printing may occur, which aperture is aligned with the print head and a selected region of the ribbon. This aperture 42 is preferably defined by generally parallel upper and lower edges and semi-circular ends connecting the upper and lower edges in a rounded arc which makes snagging of the ribbon unlikely. An upper projection 43 is bent inwardly at approximately a 45 degree angle to provide a ramp which prevents the upper outfolds from catching on the ribbon shield. A pair of lower projections 44, also extending inwardly toward the print head are located on the lower edge of the bottom of the central section 41, spaced from the center line of the ribbon shield to allow the ribbon guide to be installed over the print head despite its close proximity to the paper and platen.

Immediately adjacent to the central section 41 are indented sections 45, 46 which are spaced rearwardly of the central section. Remote ramps 47, 48 are spaced outwardly from the indented sections 45, 46, respectively, and project back outwardly from the indented sections. As will be apparent from the later description of FIG. 7, these indented sections 45, 46 allow a pair of retaining clips to pass forward of the indented sections 45, 46 while the retaining clips remain behind a plane passing from the outer edge of the center section 41 to the adjacent remote ramp, 47 or 48. In this manner, paper supported by the platen may pass smoothly over the ramps 47 or 48 and the central section 41 without catching in the clips which se-

cure the ribbon shield 40 in place, all as depicted in connection with FIG. 7. Apertures 49 in the indented sections 45, 46 reduce drag on the ribbon as the ribbon passes by the indented sections.

FIG. 6 illustrates a portion of the printer 10 with the ribbon and ribbon guide of the alternate embodiment of the present invention. In this view, the printer 10 includes a ribbon box 22 from which a ribbon 54 is threaded to a ribbon guide 55 and back to the ribbon box 22. The print head 34 is mounted to the guide rod 35. Lower paper guide 31 and upper paper guide 32 are shown directing paper 33 through a lower set of feed rolls 52 and an upper set of feed rolls 53, as might be done with document insertion device (DID) feed modules of the type described in the Paper Module Patent. The ribbon shield 40 and its upper and lower projections 43, 44 as well as the aperture 42 are depicted in this view.

FIG. 7 illustrates a cross-sectional view of the assembly of FIG. 6, cut along the line VII-VII looking in the direction of the arrow. The print head 34 is shown between ribbon guide portions 55. Clips 56 extend forward of the ribbon 54 and the ribbon shield in the region of the indented portions 45, 46. These clips extend upwardly, from their connection to the ribbon guide below the ribbon and the ribbon shield, and latch above the upper surface of the ribbon and the ribbon shield, captivating both. Aperture 42 is shown in the ribbon shield, through which printing may occur, as well as the apertures 49 in the indented portions. The ramps 47, 48 at the distal ends of the ribbon shield are also shown, as is the fact that the clips 56 are depressed below the surface of the ribbon shield central section 41 as it extends to the distal sections 47, 48. The paper 33 and the platen 30 are also shown in this view.

The ribbon shield of either embodiment is, as stated above, advantageously longer in length than the distance between the mounting points, causing it to bow outward and into the paper. When the print head is positioned adjacent to the paper in its operational position, this bowing puts the ribbon shield into an interference location, as its desired location would be to project perhaps 2 millimeters further. This interference causes the ribbon shield to press against the paper and reduce the noise created by the printing operation by one, two or more decibels, depending on the design.

The present invention (particularly the alternate embodiment using a single-colour ribbon and the paper module illustrated in FIGS. 5-7) has particular application to the use of the interchangeable paper modules disclosed in the referenced Paper Module Patent. In that Patent, for example, a cut-paper form such as a rental car agreement may be fed into the printing region after it has been carried

by the renter. In such a case, the form may have been folded, creased, or otherwise wrinkled or distorted. The present invention contemplates that such a paper may not be smooth and flat (even moisture can cause paper to wrinkle) and properly directed to feed from the printing station upward into the nip of the rolls of the upper paper handling apparatus. Accordingly, a longitudinal traverse of the paper by the print head, with the ribbon guide in pressure contact with the paper, will flatten the paper and guide it into the desired position in the nip between the rolls, allowing the paper to pass out through the upper rolls after printing. While this traverse pass of the print head is preferably across the entire page to "iron" or flatten the entire width of the document across its upper edge, some lesser traverse also has a similar advantageous effect of removing or reducing the effect of wrinkles or folds.

Of course, many modifications to the best mode described above can be effected without departing from the scope of the present invention. The ribbon shield, while disclosed in its preferred embodiment of plastic film material sold under the trademark Mylar, could be manufactured of other resilient, yet long lasting materials if desired. Further, some of the features of the present invention can be used to advantage without the corresponding use of other features. Accordingly, the description of the preferred embodiment should be viewed as merely illustrative of the principles of the present invention and not in limitation thereof. The scope of the present invention is described solely in the claims which follow.

Claims

1. A ribbon assembly (20) for a printer (10) including a moving print head (34) for printing on paper (33), the ribbon assembly comprising: means (23, 55) for supporting and guiding the ribbon (21, 54) to position a desired portion of the ribbon between the print head and the paper when said assembly is mounted in the printer, said ribbon supporting and guiding means being mountable on the print head and movable therewith; means (24) for transporting the ribbon (21, 54) from a ribbon supply (22) to the ribbon supporting and guiding means (23) and from that means to a ribbon take-up (22), said transporting means (24) being secured to the ribbon supporting and guiding means (23); and characterized by integrally comprising: a resilient ribbon shield (25, 40) mounted to the ribbon supporting and guiding means (23) and bowed outwardly toward the position of the paper - (33) to contact the paper and provide a pressure

contact against the paper (33) and the platen (30) when the ribbon is mounted to the printer (10), said ribbon shield including at least one aperture (25a-d, 42) to allow printing to occur therethrough but providing protection against other portions of the ribbon contacting the paper in unwanted regions and providing, through the pressure contact of the ribbon shield against the paper, sound dampening to reduce the noise from printing which travels from the printing region.

2. A ribbon assembly (20) as described in Claim 1 wherein the ribbon shield is a single piece of plastic material (25) secured (26) at each of its ends and medially provided with a plurality of apertures (25a-d) located one above another, each aperture located adjacent to and associated with a different band (21a-d) of a multi-band print ribbon - (21), and the means (23) for supporting and guiding the ribbon includes means (23a) for positioning any selected one of the bands and its associated aperture aligned with a print head (34) to print with the selected band through the associated aperture.

3. A ribbon assembly (20) as described in Claim 1 wherein the ribbon shield (40) includes inwardly bent portions (45, 46) on either side of its central section (41) which includes the aperture - (42) through which printing occurs, and the means (55) for supporting and guiding the ribbon (54) includes securing means (56) which captivate the ribbon shield, said inwardly bent portions allowing a portion of the securing means to pass in front of the inwardly bent portions but remain behind an extension of a surface defined by the central section (41) of the ribbon shield, whereby a possibility of snagging of the paper (33) on the securing means is reduced.

4. A ribbon assembly (20) as described in Claim 3 wherein the ribbon shield (40) includes ramps (47, 48) projecting distally from the inwardly bent portions (45, 46) and a plane passing between the ramps and the central portion (41) of the ribbon shield (40) passes forwardly of the securing means (56), whereby a reduced possibility of snagging of the paper on the securing means may be accomplished.

5. A ribbon assembly (20) as described in any preceding Claim wherein the ribbon shield (25) or the central section (41) thereof includes a generally flat body and upper and lower projections (27, 28, 43, 44) which are bent inwardly toward the side of the ribbon (21, 54) and away from the position of the paper to allow the ribbon shield to avoid outfolded paper when such paper is inserted into the printer.

6. A ribbon assembly as described in Claim 5 wherein both the upper and lower projections of the ribbon shield extend at an angle of approximately 45 degrees with respect to a plane extending from the ribbon shield.

7. A ribbon assembly as described in Claim 5 or 6 wherein the upper projection (27, 43) of the ribbon shield (25, 41) is a single projection located medially about a vertical center line of the ribbon shield and the lower projection includes two projections (28, 44) located to either side of the vertical center line of the ribbon shield to avoid the print head (34) when the ribbon assembly (20) is installed over the print head.

8. A method of flattening an upper edge of a document (33) to be printed in a printer (10) having a print head (34) which traverses across the document supported from behind by a platen (30), with a ribbon (21, 54) and a ribbon shield (25, 40) disposed between the print head and the document, characterized by the steps of:

inserting the document into the printer between the platen and the print head with the ribbon shield in pressure engagement with the document;

moving the print head and ribbon shield to traverse across at least a portion of the width of the document to thereby urge the document flat against the platen by virtue of the pressure of the ribbon shield on the document; and

then printing on the document.

9. A method of guiding an upper edge of a document (33) to be printed into feed rolls (53) of a printer having a print head (34) carrying a ribbon shield (25, 40) positioned to be in pressure contact with the paper when the print head traverses across the document, said document being supported by a platen (30), characterized by the steps of:

inserting the document into the printer between the platen and the print head with the ribbon shield in pressure engagement with the document;

moving the print head and ribbon shield across at least a portion of the width of the document to thereby flatten the document against the platen, and urge the top portion of the document into feed rolls (53) above the top edge of the document by virtue of the pressure of the ribbon shield on the document as it moves over the width of the document; and

then printing on the document.

10. A printer (10) comprising:

a platen (30) mounted to a printer frame for supporting paper (33) at a printing station;

a print head (34) movably mounted to said printer frame to traverse across the platen and controlled to print indicia on the paper in response to signals; and

a ribbon assembly (20) replacably mounted to the

print head and including a source of ribbon and a take-up of ribbon, a ribbon support (23, 55) mounted on opposite sides of the print head for positioning the ribbon between the print head and the paper on the platen, a guide (24) for transporting ribbon from the source to one side of the ribbon support and from the other side of the ribbon support to the take-up, and

characterized by a ribbon shield (25, 40) mounted to the opposite sides of the ribbon support (23, 55) and positioned between the ribbon (21, 54) and the paper (33) to prevent the ribbon from contacting the paper in undesired regions, said ribbon shield including an aperture (25a, 42) in the region of desired printing between the print head and the paper and being longer than the distance between its mounting points on the ribbon support so that the ribbon shield bows outwardly toward the paper a distance greater than the separation of the paper from the ribbon support, compressing the paper in pressure contact with the platen to muffle printing noise.

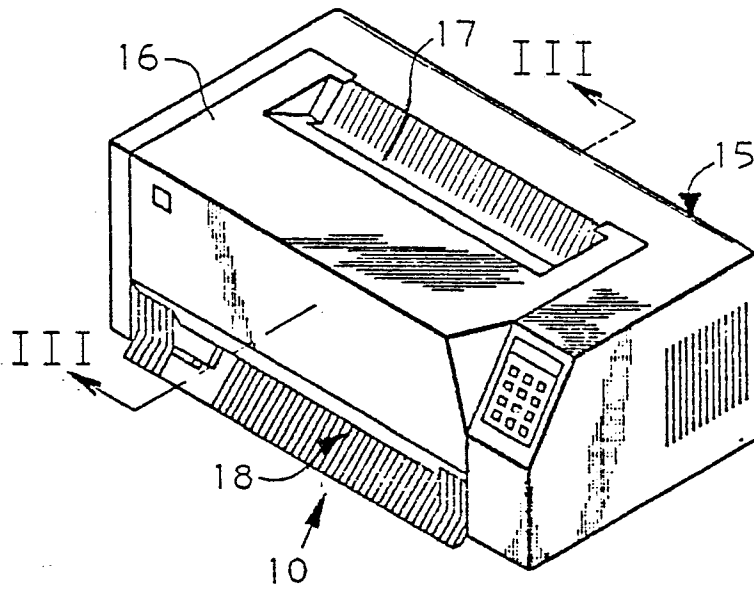
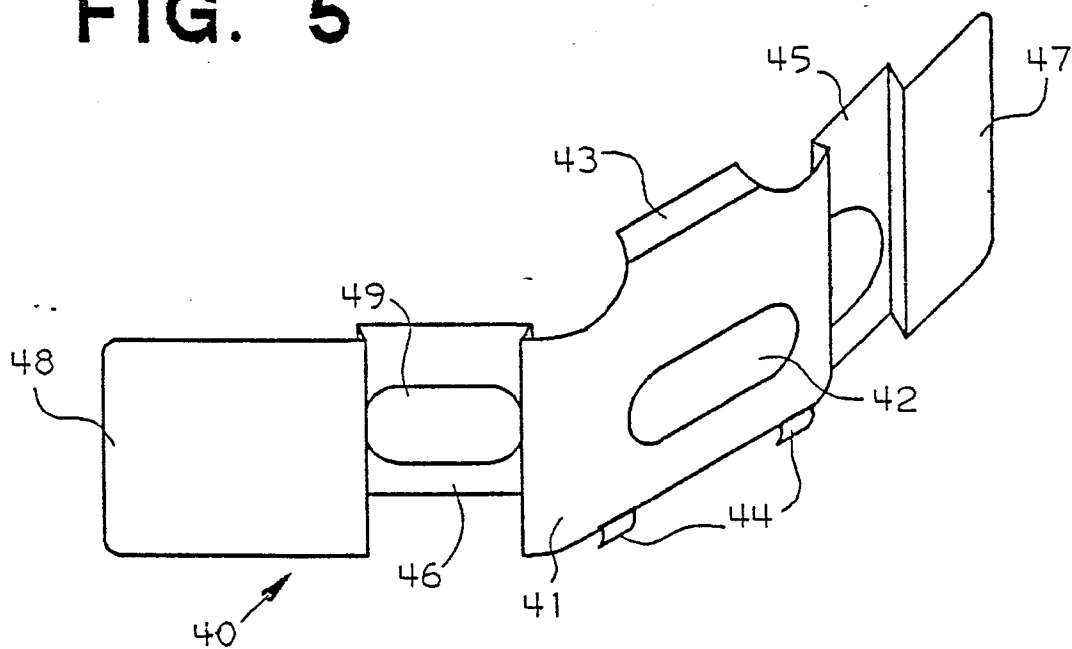
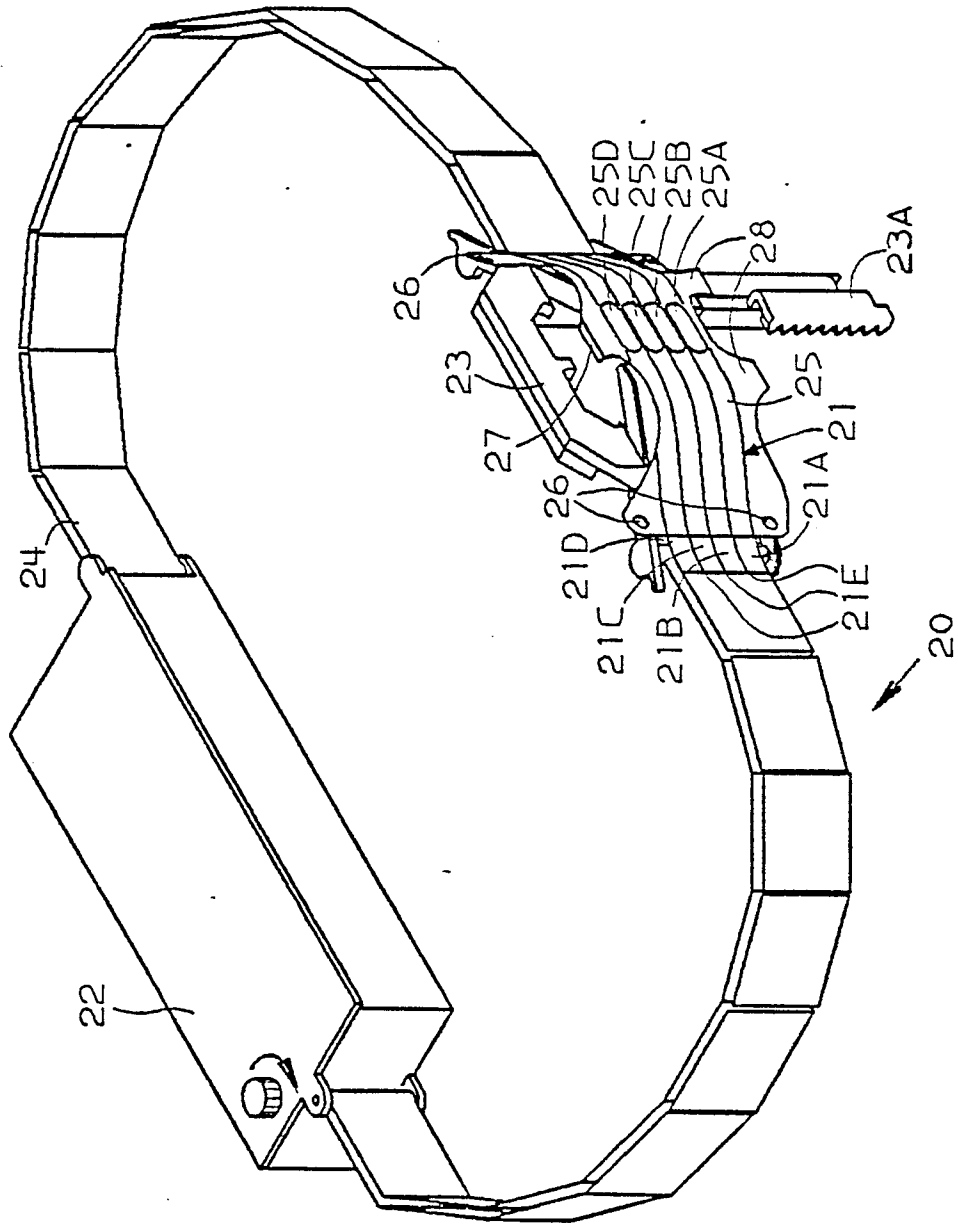
FIG. 1**FIG. 5**

FIG. 2



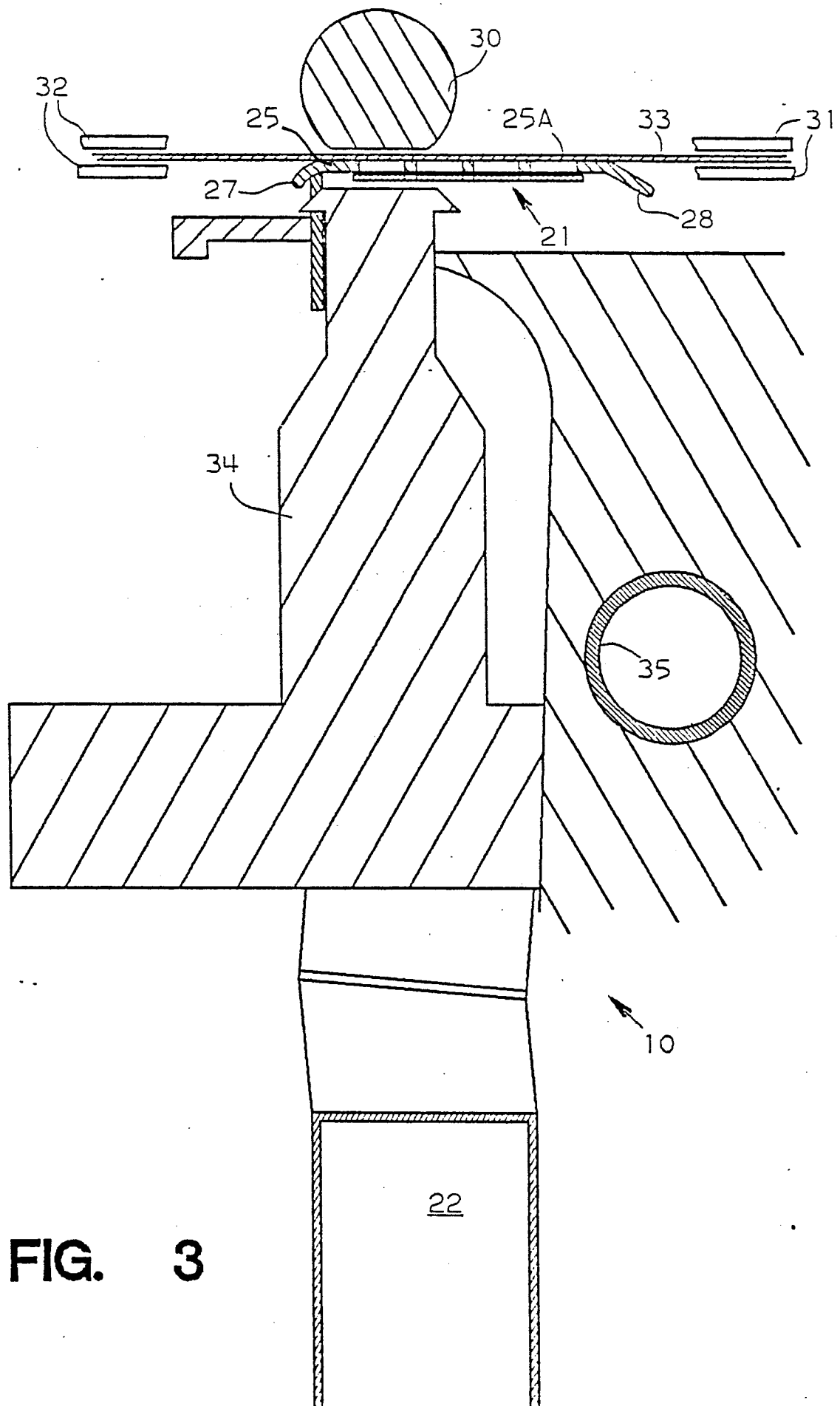


FIG. 3

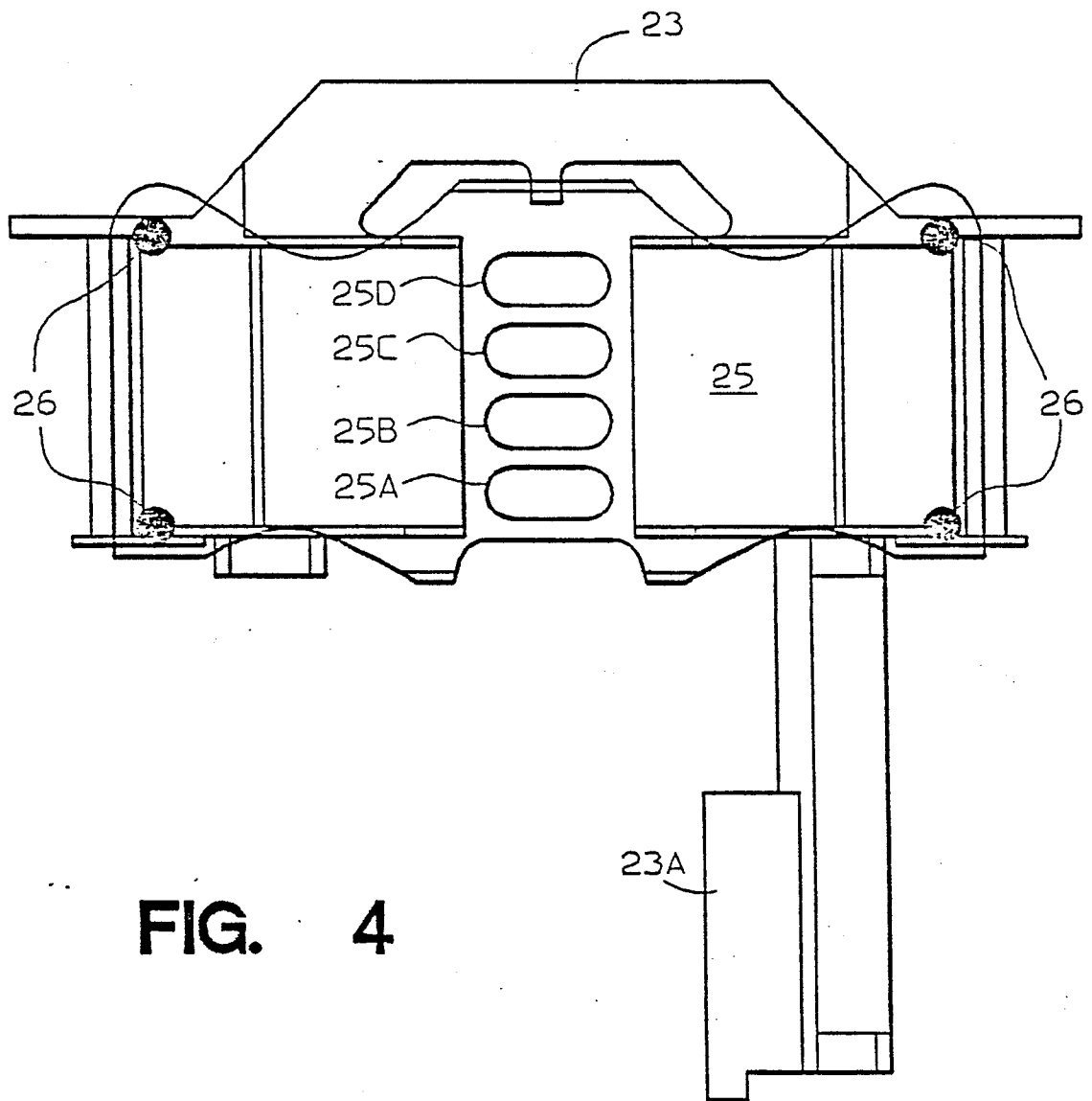
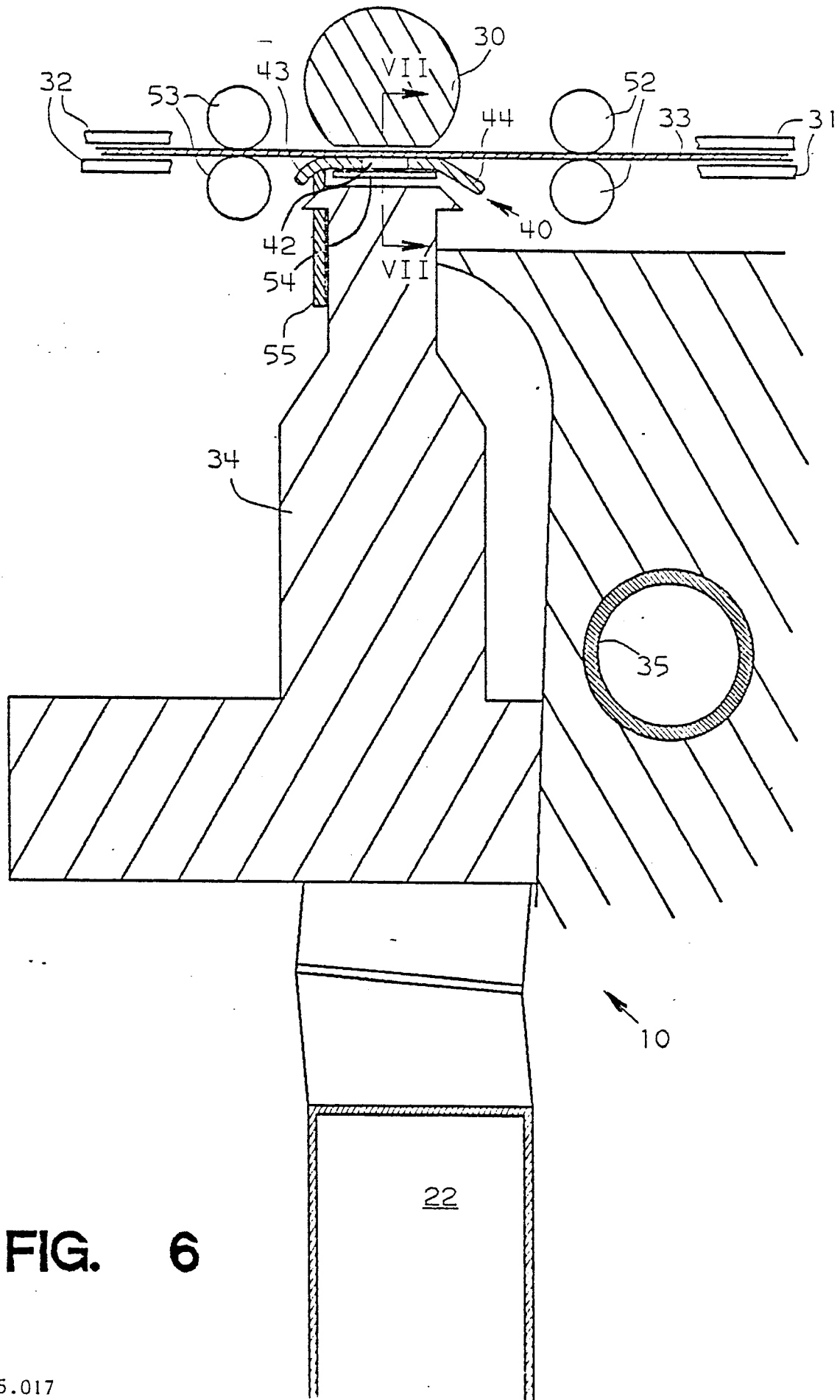


FIG. 4



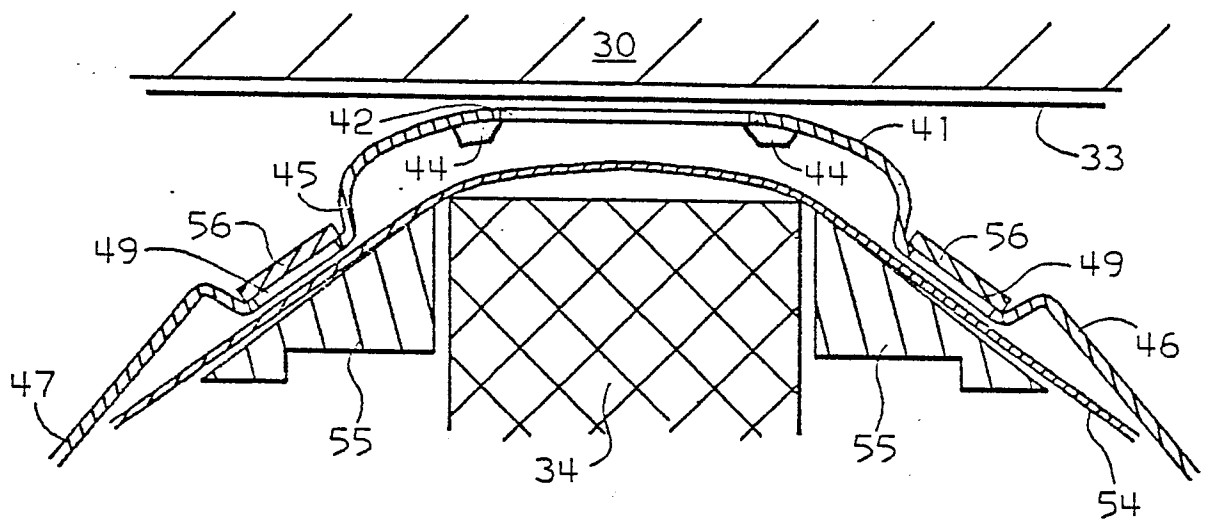


FIG. 7