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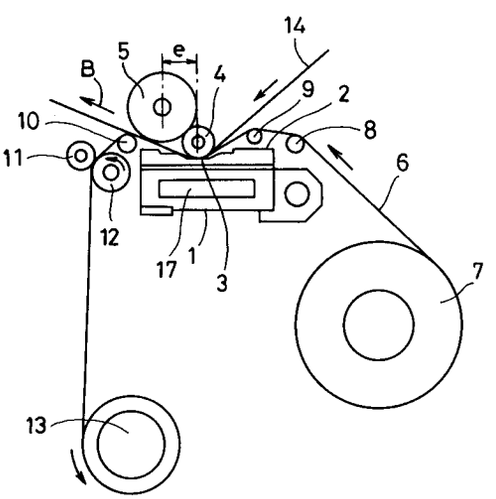
(54) Printing unit incorporating thermal head.

(57) A printing unit comprises an elongate base member (1), a thermal head (2) mounted on the base member and carrying a line (3) of heating dots, a platen roller (4) arranged to contact the heating dot line, and a backup roller (5) arranged farther from the thermal head than the platen roller but held parallel to the platen roller in contact therewith. Printing paper (14) is transferred between the thermal head and the platen roller for thermal printing by the line of heating dots. The backup roller is located ahead of the platen roller with respect to the paper transfer direction to prevent the platen roller from bending in the paper transfer direction.

Fig.1



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This invention relates to a printing unit incorporating a thermal head. More specifically, the present invention relates to a thermal head printing unit of the type which can be advantageously used for a relatively large-sized facsimile machine or printer.

For conveniently explaining the problems to be solved by the present invention, reference is now made to Figs. 7 and 8 showing a prior art thermal head printing unit. The illustrated printing unit comprises an elongate base member 21, a thermal head 22, a platen roller 24, and a backup roller 25. The base member 21, typically made of a solid metal bar, is fixed to the facsimile or printer body (not shown) and carries the thermal head 22 on its upper surface. On the upper surface of the thermal head 22, there is formed a line 23 of heating dots extending longitudinally of the base member 21. The platen roller 24 is located above the thermal head 22, and is countered by the backup roller 25.

In operation, an ink transfer tape 26 is unwound from a supply roller 27, fed along a pair of guide rollers 28, 29, then introduced between the platen roller 24 and the thermal head 22, where the thermal head 22 causes ink transfer from the tape 26 onto printing paper 34. The tape 26 is further pulled along a guide roller 30 by a pair of feed rollers 31, 32, and then wound up on a winding roller 33. The printing paper 34 is fed between the platen roller 24 and the ink transfer tape 26 by appropriate feeding means (not shown.)

According the arrangement of the prior art printing unit, the backup roller 25 is located right above the platen roller 24 in contact therewith. Thus, the backup roller 25 can effectively prevent the platen roller 24 from bending vertically upward away from the thermal head 22.

In reality, however, bending of the platen roller 24 is not limited to the vertical direction. Specifically, since the printing paper 34 and the ink transfer tape 26 are subjected to a tensile force during transfer, the tensile force also acts on the platen roller 24 in a generally horizontal direction. As a result, the platen roller 24 tends to bend in the paper feed direction, as indicated by broken lines in Fig. 8. This causes deterioration in the printing quality due to uneven pressing contact between the heating dot line 23 and the platen roller 24.

Further, when the platen roller 24 is pressed against the thermal head 22, it is inevitable that the base member 21 bends downwardly, as also indicated by broken lines in Fig. 8. Obviously, such downward bending of the base member 21 additionally deteriorates the printing quality.

It is apparent that the tendency of bending increases as the respective lengths of the the base member 21 and platen roller 24 increase. Thus, if the size of the printer or facsimile machine must be adapted to a large paper size, e.g. JIS-A1 (594mm) or JIS-A0 (841mm), the problem of bending becomes particularly serious.

A simple way to prevent or reduce horizontal bending of the platen roller 24 is to increase the diameter of the platen roller 24. However, such a solution results in unacceptable increase of weight and size.

Likewise, downward bending of the base member 21 may be prevented or reduced simply by increasing the thickness of the base member 21. However, this solution will, again, cause unacceptable increase of weight and size. Further, when the base member 21 is excesssively thick, heat dissipation from the base member 21 deteriorates to result in heat accumulation during actation of the heating dot line 23. Thus, the difference in heat expansion between the base member 21 and the thermal head 22 may cause thermal bending due to the known bimetal phenomenon, which adds to deterioration of the printing quality.

It is, therefore, a primary object of the present invention to provide a printing unit wherein a platen roller can be reliably prevented from bending in the paper feed direction without increasing the diameter of the platen roller itself.

Another object of the present invention is to provide a printing units which, in addition to achieving the primary object, is capable of preventing a base member from bending away from the platen roller without increasing the weight of the base member and deteriorating heat dissipation from the base member.

According to the present invention, there is provided a printing unit comprising: an elongate base member; a thermal head mounted on the base member and carrying a line of heating dots; a platen roller arranged to contact the heating dot line, printing paper being transferred between the thermal head and the platen roller; and a backup roller arranged farther from the thermal head than the platen roller but held parallel to the platen roller in contact therewith; characterized in that the backup roller is located ahead of the platen roller with respect to the paper transfer direction.

With the arrangement described above, the location of the backup roller is such that it supports the platen roller against bending in the paper transfer direction when the tension applied to the paper for feeding acts on the platen roller. Thus, the printing unit is prevented from a printing quality deterioration which may result from bending of the platen roller.

Preferably, the printing unit may further comprise an additional backup roller located behind the platen roller with respect to the paper transfer direction and held parallel to the platen roller in contact therewith. The additional backup roller co-

operates with the first mentioned roller to prevent the platen roller from bending away from the thermal head.

Further preferably, the base member is rendered hollow to have at least one longitudinal bore which is open at both ends of the base member. The base member thus configured is mechanically reinforced against bending, but the presence of the longitudinal bore reduces the weight of the base member and yet enables efficient heat dissipation by utlizing air passage. Advantageously, the longitudinal bore of the base member may be connected to a blower means for positive ventilation of the base member.

Other objects, features and advantages of the present invention will be fully understood from the following detailed description given with reference to the accompanying drawings, in which:

Fig. 1 is a schematic front view showing a printing unit according to an embodiment of the present invention;

Fig. 2 is a schematic front view showing a printing unit according to another embodiment of the present invention;

Fig. 3 is a perspective view showing a printing unit according to a further embodiment of the present invention;

Fig. 4 is a sectional view taken on lines IV-IV in Fig. 3;

Fig. 5 is a perspective view showing a substitute example of base member to be incorporated in the printing unit of Fig. 3;

Fig. 6 is a perspective view showing another substitute example of base member to be incorporated in the printing unit of Fig. 3;

Fig. 7 is a front view showing a prior art printing unit; and

Fig. 8 is a perspective view illustrating the problems encountered in the prior art printing unit of Fig. 7.

Referring now to Fig. 1 of the accompanying drawings, there is illustrated a printing unit which comprises a base member 1 and a thermal head 2. The base member 1 is typically made of a metal such as aluminum or aluminum alloy in a bar form, and fixed in place within a facsimile or printer body (not shown) by using suitable brackets (not shown in Fig. 1 but shown in Fig. 3 representing a different embodiment). Further, the base member 1 has an upper surface provided with a thermal head 2 which, in turn, has an upper surface formed with a line 3 of heating dots (see Fig. 3 for reference).

Above the thermal head 2, there is provided a platen roller 4 in contact with the heatig dot line 3. Further, above the platen roller 4 is arranged a metallic backup roller 5 which is held parallel to the platen roller 4 in contact therewith.

In operation, an ink transfer tape 6 is unwound from a supply roller 7, fed along a pair of guide rollers 8, 9, and then introduced between the platen roller 4 and the thermal head 2. Further, the ink transfer tape 6 is pulled along a guide roller 10 by a pair of feed rollers 11 , 12, and then wound up on a winding roller 13. On the other hand, an unillustrated feeding means causes printing paper 14 to be fed between the platen roller 4 and the ink transfer tape 6, as indicated by an arrow B. As a result, the thermal head 2 causes ink transfer from the ink transfer tape 6 onto the printing paper 14 for intended recordal of information.

One important feature of the present invention resides in that the axis of the backup roller 5 is displaced from that of the platen roller 4 by an appropriate amount e in the forward transfer direction of the ink transfer tape 6 and paper 14 while maintaining parallelism relative to the platen roller 4. Thus, the backup roller 5 is located above and ahead of the platen roller 4.

During the printing operation, the ink transfer tape 6 and the printing paper 14 are transferred in the arrow B direction under a tensile force applied thereto, as already described. Such a tensile force also acts on the platen roller 4, which results in that the platen roller 4 tends to bend in the paper feed direction.

However, according to the present invention, the platen roller 4 is supported by the backup roller 5 which is located above and ahead of the platen roller by the suitable amount e. This positional relation allows the backup roller 5 to reliably prevent the platen roller 4 from bending in the paper feed direction while also preventing the platen roller 4 from bending in the direction away from the base member 1 (upwardly in Fig. 1).

Further, in the embodiment of Fig. 1, the base member 1 is shown to be hollow with a longitudinal bore 17 extending therethrough. Thus, the base member 1 is prevented from bending away from the platen roller 4 (downwardly in Fig. 1) without increasing the weight of the base member 1 itself.

Fig. 2 shows another embodiment of the present invention wherein the platen roller 4 is supported by two backup rollers 5a, 5b which are held in parallel to each other and to the platen roller 4. One backup roller 5a (front backup roller) is arranged above and ahead of the platen roller 4, whereas the other backup roller 5b (rear backup roller) is arranged above and behind the platen roller 4.

According to the embodiment of Fig. 2, the front backup roller 5a prevents the platen roller 4 from bending in the paper feed direction.

Further, the front and rear backup rollers 5a, 5b cooperate with each other to press the platen roller 4 toward the thermal head 2, thereby preventing the platen roller 4 from bending in the direction

away from the base member 1 (upwardly in Fig. 2). Obviously, the upward bending prevention provided by the two backup rollers 5a, 5b is more reliable than that provided by a single backup roller.

Figs. 3 and 4 show a printing unit according to a further embodiment of the present invention. The printing unit of this embodiment incorporates a divisional-type thermal head 2' arranged on a base member 1 which, in turn, is fixed to a facsimile or printer body (not shown) by means of brackets 15 and bolts 16 (Fig. 4). Though not illustrated in Figs. 3 and 4, the printing unit further includes a platen roller and a backup roller in the same manner as shown in Fig. 1 or 2.

In the embodiment of Figs. 3 and 4, the divisional-type thermal head 2' comprises a plurality of unit thermal heads 2a' each having a unit width w and arranged in a longitudinal array to provide an overall printing length W corresponding, for example, to JIS A0 or JIS A1 size paper (JIS: Japanese Industrial Standard). The use of such a divisional-type thermal head is particularly preferred when the paper size is relatively large.

Again, in the embodiment of Figs. 3 and 4, the base member 1 is shown to have a longitudinal bore 17 which is open at both ends 1a, 1b of the base member. The base member thus configured may be made of aluminum or aluminum alloy by extrusion.

As already described in connection with the embodiment of Fig. 1 the hollow base member 1 is greatly reinforced against longitudinal bending without calling for a significant weight increase. In addition, since the longitudinal bore 17 is open at both ends 1a, 1b of the base member 1, the air within the bore 17 is heated upon actuation of the heating dot line 3 and displaced by external air through convection. As a result, heat dissipation from the base member 1 can be improved by the provision of the longitudinal bore 17.

Advantageously, the longitudinal bore 17 of the base member 1 may be connected to a blower 18 through a duct 19. In this case, the longitudinal bore 17 can be positively ventilated to additionally improve heat dissipation from the base member 1.

Figs. 5 and 6 respectively show two different base members 1' and 1'' which may replace the base member 1 shown in Figs. 3 and 4. Specifically, the base member 1' of Fig. 5 is made to have two divided longitudinal bores 17', whereas the base member 1'' of Fig. 6 is made to have four divided longitudinal bores 17''. In either case, the base member is rendered mechanically stronger than that of Figs. 3 and 4.

The present invention being thus described, it is obvious that the same may be varied in many other ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to those skilled in the art are intended to be included within the scope of the following claims.

Claims

1. A printing unit comprising: an elongate base member (1, 1', 1''); a thermal head (2, 2') mounted on the base member and carrying a line (3) of heating dots; a platen roller (4) arranged to contact the heating dot line, printing paper (14) being transferred between the thermal head and the platen roller; and a backup roller (5, 5a) arranged farther from the thermal head than the platen roller but held parallel to the platen roller in contact therewith; characterized in that

   the backup roller (5, 5a) is located ahead of the platen roller (4) with respect to the paper transfer direction.

2. The printing unit according to claim 1, further comprising an additional backup roller (5b) located behind the platen roller (4) with respect to the paper transfer direction, the additional backup roller being held parallel to the platen roller in contact therewith.

3. The printing unit according to claim 1 or 2, wherein the base member (1, 1', 1'') is rendered hollow to have at least one longitudinal bore (17, 17', 17'') which is open at both ends (1a, 1b) of the base member.

4. The printing device according to claim 3, wherein the longitudinal bore (17) of the base member (1) is connected to a blower means (18) for positive ventilation of the base member.

Fig. 1

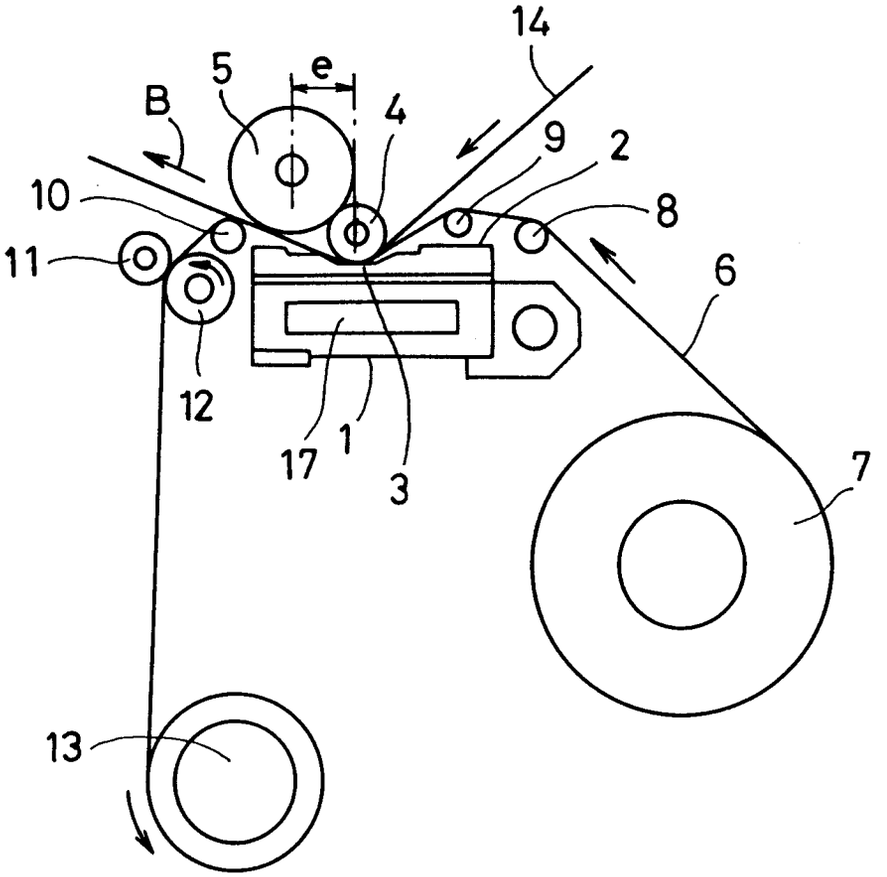

Fig. 2

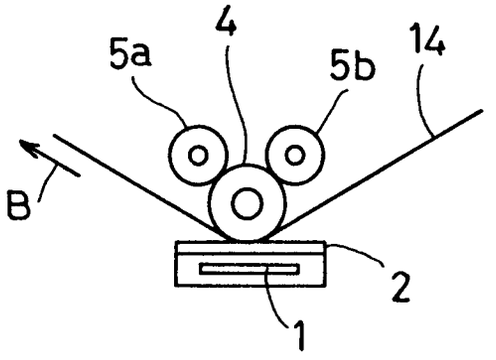

Fig. 3

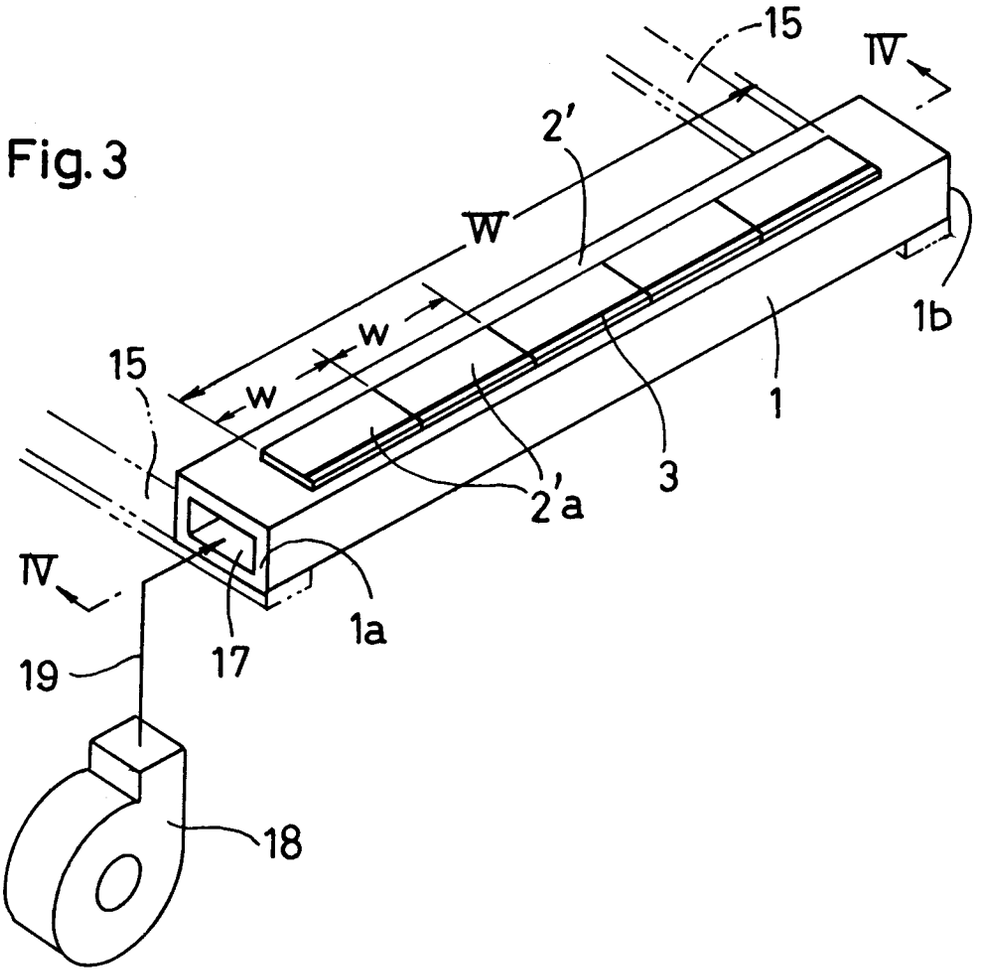

Fig. 4

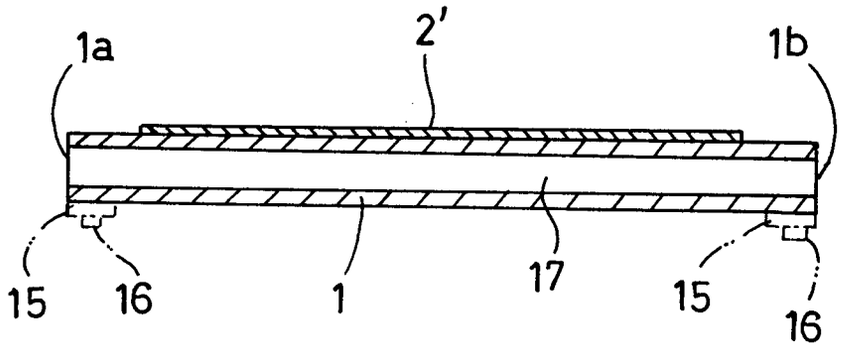

Fig.5

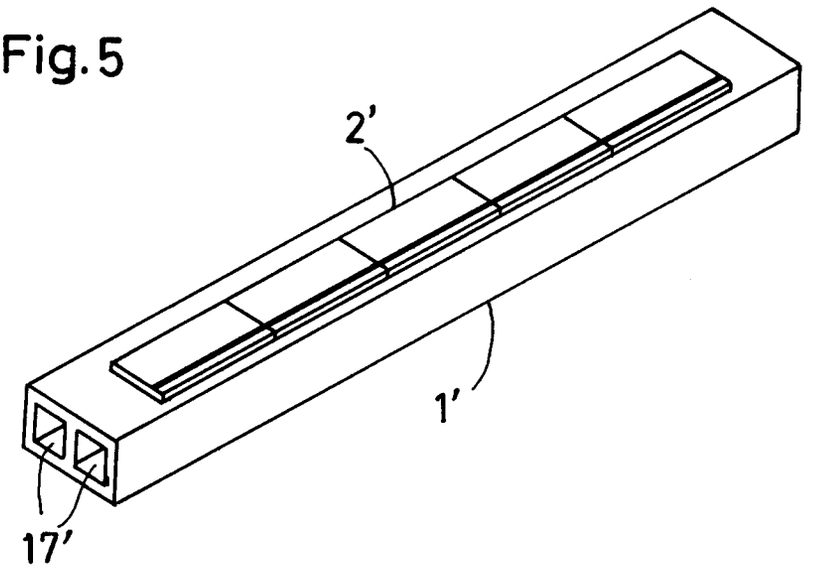

Fig.6

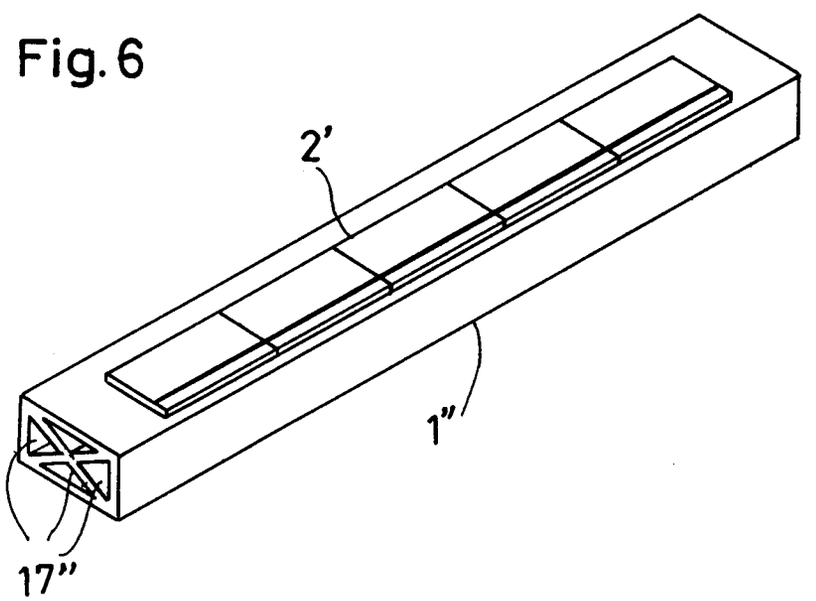

Fig. 7
(PRIOR ART)

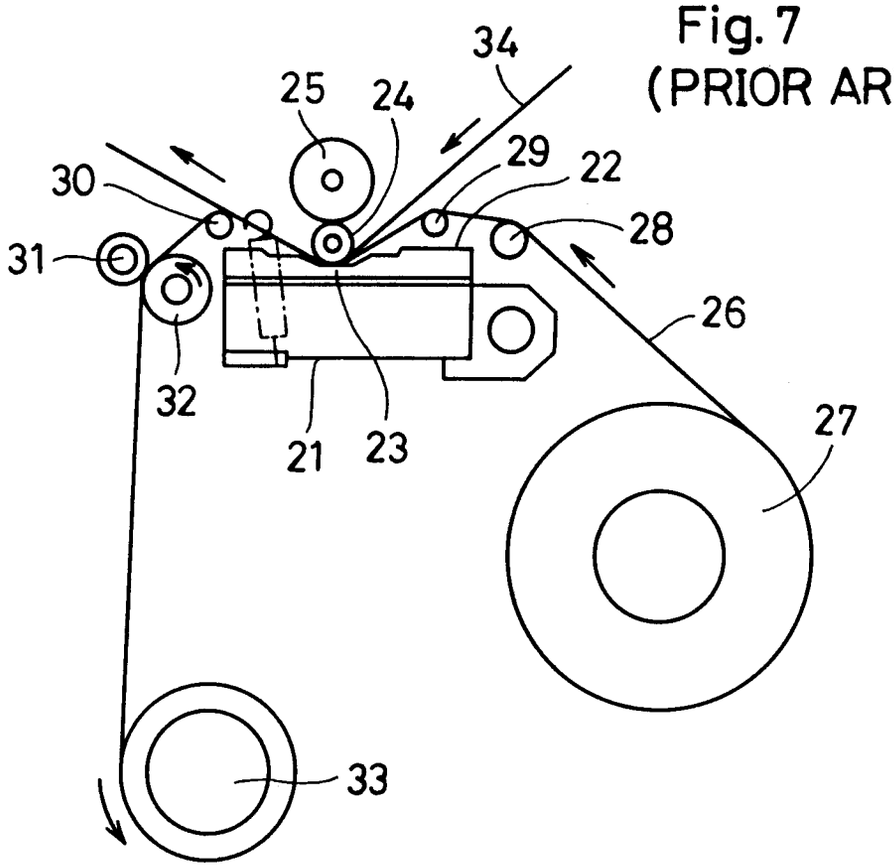

Fig. 8
(PRIOR ART)