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

(11) Publication number: **0 143 467**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **84114467.8**

(51) Int. Cl.⁴: **B 41 J 11/20**

(22) Date of filing: **29.11.84**

(30) Priority: **29.11.83 JP 225110/83**

(43) Date of publication of application: **05.06.85 Bulletin 85/23**

(84) Designated Contracting States: **DE FR GB**

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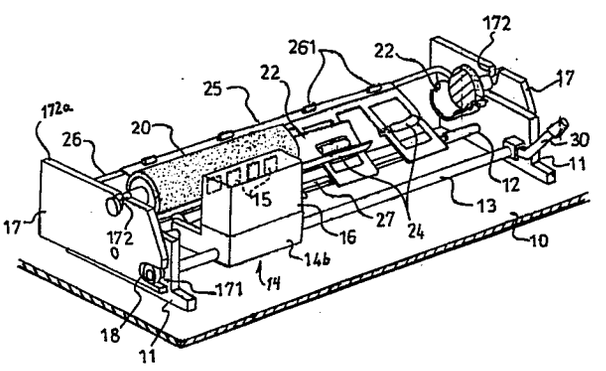
(54) Adjusting device for dimensionally adjusting a gap between a platen and a print head assembly and printer using the adjusting device.

(57) An adjusting device for an impact printer includes a printing mechanism (16) with printing heads (15) movably mounted on parallel guide shafts (12, 13). A pair of separated side frames (17) are pivotally coupled to one of the guide shafts (12) and are connected through a cam (18) to the other guide shaft (13) so that the side frames (17) are pivotal about the one guide shaft (12) in response to rotation of the other guide shaft (13). The platen (20), which is journally mounted to the side frames (17), thus moves towards or away from the printing heads (15) as the side frames (17) are pivoted thereby dimensionally adjusting the gap (d) between the platen (20) and the printing heads (15) to compensate for varying thicknesses of printing sheets on the platen (20), for example. The adjusting device is suited for use in a printer in which printing heads (15) are hammered to print upon a printing sheet fed along a cylindrical surface of a platen (20).



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ADJUSTING DEVICE FOR DIMENSIONALLY ADJUSTING A GAP BETWEEN A PLATEN AND A PRINT HEAD ASSEMBLY AND PRINTER USING THE ADJUSTING DEVICE

The present invention relates to an adjusting device for dimensionally adjusting a gap between a platen and a print head assembly according to the preamble of the main claim. The invention also relates to a printer using this adjusting device. The invention is in the field of an impact type printer in which the printing heads are selectively hammered to print upon a printing sheet set on a platen, and refers more particularly to an adjusting device in the impact type printer which dimensionally adjusts a gap defined between the platen and the printing heads.

In an impact type printer, it is essential to maintain a constant-dimension gap between a printing sheet and the printing head in order to ensure uniform printing quality. However, if the dimension of the gap between the platen and printing heads is incapable of being adjusted, the varying thicknesses of printing sheets which can be utilized will therefore artificially vary the dimension of the gap so that the optimum dimension needed for proper

print quality will be destroyed. This problem is particularly acute when a number of print sheets with carbon paper disposed therebetween is utilized. Accordingly, if the striking force of the printing head is constant, then the resultant prints become non-uniform in density as the dimension of the gap changes to deleteriously affect the printing quality.

In order to overcome this problem, conventional printing adjustment is typically accomplished by moving the printing heads relative to a fixed-position platen to change the gap between the printing sheet on the platen and the printing heads, for example, to compensate for the thickness of the printing sheet being used. However, this method is disadvantageous in that whenever the printing heads are moved, they must be fixedly secured at their new position. Accordingly the mechanism to accomplish such movement is necessarily intricate thereby increasing the manufacturing cost of the printer.

It is therefore an object of the present invention to provide an adjusting device for dimensionally adjusting a gap defined between a platen and a print head assembly which is simple in construction and low in manufacturing cost. This object is solved by the adjusting device as defined in the main claim. Further advantageous features of the adjusting device according to the invention are evident from the subclaims 2 and 3. The invention also provides for a printer which takes advantage of the adjusting device and which is disclosed in claim 4. Further advantageous features of this printer are evident from the subclaims 5 to 7.

According to the present invention, a printing adjusting device is provided in an impact type printer in which the dimension of the gap between the platen and the printing heads can be positively adjusted to compensate for the varying thicknesses of printing sheets, for example, and which is simple in construction and low in manufacturing cost.

The printing adjusting device of the present invention is particularly well suited for use in a printer in which printing heads are hammered to print upon a printing sheet fed along the cylindrical surface of a platen. The adjusting device generally includes first and second guide shafts supported on a pair of base frames in such a manner that the guide shafts are in parallel orientation with one another. A printing mechanism carrying printing heads is movably mounted on the guide shafts for reciprocal rectilinear movements therealong. A pair of side frames to journally mount the platen therebetween are coupled to the first guide shaft and are pivotal in a vertical plane about the axis established by the first guide shaft. The side frames are also coupled through cams to the second guide shaft. Thus, upon pivotal movement of the second guide shaft, the cams pivot the side frames about the first guide shaft. In such a manner, the platen, being mounted on the side frames, is displaced through an arc towards and away from the printing heads in dependence upon the direction of pivotal movement of the side frames.

Further aspects and advantages of the present invention will become more clear after careful consideration is given to the following detailed description thereof when read in conjunction with the accompanying drawings.

Reference will hereinafter be made to the accompanying drawings wherein like reference numerals throughout the various Figures denote like structural elements and wherein:

Fig. 1 is a perspective view showing essential components of an impact-type printer in which the printing adjustment device of the present invention is utilized;

Fig. 2 is an exploded perspective view of the printer shown in Fig. 1;

Fig. 3 is a side elevational view of the adjusting device of the present invention;

Fig. 4 is an enlarged perspective view showing the interaction between an eccentric cam and a side frame of the present invention; and

Fig. 5 is a side elevational view, similar to Fig. 3, but showing the operating movements of the present invention.

As shown in Figures 1 and 2, the present invention includes a pair of base frames 11 which are rigidly fixed on a base plate 10 in such a manner that base frames 11 are separated yet in parallel orientation with one another. Parallel adjusting and supporting shafts 12, 13 are provided so as to span the distance between the base frames 11. A recessed cut section 12b is defined in the cylindrical surface of the adjusting shaft 12 and extends for a predetermined dimension between the base plates 11 in the longitudinal direction of shaft 12.

A head carriage 14 is mounted for reciprocal movements along both of the adjusting shaft 12 and the supporting

shaft 13. More specifically, the supporting shaft 13 is inserted into hole 14a defined through the body 14b of the head carriage 14, while the adjusting shaft 12 is inserted through aligned holes 14c formed through a pair of supporting frames 141 which extend from the body 14b of the head carriage 14 towards support wall 26.(Only one frame 141 and its corresponding hole 14c are shown in Figures 1 and 2.) A printing mechanism 16 is fixedly provided on the head carriage 14 and includes a plurality of printing heads 15 arranged in side-by-side fashion in the direction of a printing line upon a printing sheet (e.g. parallel to the longitudinal direction of shafts 12, 13.)

A pair of side frames 17 are provided on the outer surfaces 17a of the base frames 11, respectively. Two end portions 12a of the adjusting shaft 12 protrude outwardly from the outer surfaces 11a of base frames 11 and are fixedly mated with a respective aperture 17a defined substantially at the middle portions of the side frames 17 as shown more clearly in Figure 2. The side frames 17 define cam grooves 171 which are sized and configured to accept a respective one of the rotatable eccentric cams 18 provided at both ends of the supporting shaft 13. Preferably, cam grooves 171 are defined by a pair of vertically separated planar surfaces 171a, 171b which permit free eccentric rotation of cams 18 therebetween and thus provide bearing surfaces against which the cams 18 bear. Therefore, as the supporting shaft 13 rotates, the side frames 17 pivot about an axis established by the adjusting shaft 12 through an angle corresponding to the amount of eccentricity (1) of the eccentic cams 18 due to the cams 18 eccentrically bearing against the surfaces 171a, 171b of cam grooves 171.

A platen 20 is journally supported between the side frames 17 by means of central shaft 21. More specifically, the

side frames 17 define receiving grooves 172 respectively formed in the upper edge portions 172a thereof. End portions 21a of the central shaft 21 longitudinally extend from both ends of the platen 20 and define an annular recess 21b registrable with receiving grooves 172 so as to be rotatably supported thereby. Thus, the platen 20 is positioned over the two shafts 12 and 13 by means of the side frames 17 in such a manner that the platen 20 confronts the printing heads 15. As the side frames 17 pivot about the axis established by the adjusting shaft 12 as described above, the platen 20 is responsively moved through a slight arc so as to be displaced towards or away from the printing heads 15 in dependence upon the direction of pivotal movement of the side frames 17 about shaft 12.

An arcuate paper guide 22 is fixedly held between the base frames 11 and is positioned in such a manner that a gap of predetermined dimension is defined between the platen 20 and the paper guide 22. A printing sheet is thus insertable into the gap and is arcuately guided along the platen 20 by the paper guide 22. A plurality of slots 23 are formed in the bottom of the paper guide 22 in such a manner that the slots 23 are aligned in the longitudinal direction of the paper guide 22 so as to accept respective ones of a plurality of pressure rollers 24. Thus, a portion of each roller 24 extends through its respective slot 23 so as to press a printing sheet against the platen 20.

The pressure rollers 24 are longitudinally arranged relative to platen 20 on a respective leaf spring member 25. Each pressure roller 24 has a central shaft 241 rotatably engaged with opposing recesses 251 formed in the leaf spring member 25. The leaf spring member is preferably a rectangular flat plate with the pressure rollers 24 extending across rectangular holes 251a formed in the

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leaf spring member 25.One side portion 25a of the leaf spring member 25 is coupled to the upper edge 26a of mounting wall26 on the base plate 10. The one side portion 25a of the leaf spring member 25 is preferably secured to the upper edge 26a of the mounting wall 26 by mating engagement between the supporting pieces 261 of wall 26 and mounting holes 252 formed in the one side portion 25a. The other side portion 25b of the leaf spring member 25 rests upon the recessed cut portion 12b of the adjusting shaft 12.

Therefore, as the adjusting shaft 12 rotates, the leaf spring member 25 is vertically displaced against its bias force through an angle corresponding to the step between the cylindrical surface of the shaft 12 and the recessed cut portion 12b. In such a manner, the recessed cut portion 12b and the cylindrical surface of the shaft 12 establishes a cam which displaces the pressure rollers 24 into and out of pressing engagement relative to the printing sheet on the platen 20 in response to rotation of the shaft 12 in opposite rotational directions, respectively.

The printing sheet is inserted from above between the platen 20 and the paper guide 22 and is held between the platen 20 and the pressure rollers 24 as previously described. As the platen20 rotates about its longitudinal axis established by central shaft 21, the printing sheet is respectively moved along the cylindrical surface of the platen 20, guided by the paper guide 22, so that it exits towards the left platen 20 as viewed in Fig. 3. The printing heads 15 of the printing mechanism 16 are then caused to confront printing hammers (not shown), such that the printing heads 15 are selectively hammered to print upon the printing sheet on the platen 20.

The guide shaft 13 is manually pivotal through a predetermined angle by manipulation of an adjusting lever 30. Thus, upon pivotal movement of shaft 13, the eccentric cams 18 are responsively pivoted about their eccentric axis (established by shaft 13) in the cam grooves 171, respectively, so that the side frames 17 are pivoted in a vertical plane through an arc as indicated by the arrow 100a in Figures 4 and 5. As the side frames 17 pivot, the platen 20 coupled to the side frames 17 is thus responsively moved towards or away from the printing heads 15 as indicated by the arrow 101 in Figure 5 to change the dimension of gap d defined between the platen 20 and the printing heads 15. Thus, the gap d defined between the platen 20 and printing heads 15 can be adjusted to an optimum dimension for uniform printing purposes so as to accomodate the particular thickness of the printing sheet being utilized, for example. Accordingly, the printing pressure of the printing heads 15 can be set to an optimum value in dependence upon the thickness of a printing sheet.

In addition to the line impact-type printer described above, the present invention is also applicable to a serial-type printer. Moreover, the present invention can also be advantageously utilized with a pin feed type printer or a tractor-feed type printer in addition to the friction-feed type printer described above. Guide shaft 13 could also be pivoted automatically through e.g. motor drive units rather than manually as described herein.

ADJUSTING DEVICE FOR DIMENSIONALLY ADJUSTING A GAP BETWEEN A PLATEN AND A PRINT HEAD ASSEMBLY AND PRINTER USING THE ADJUSTING DEVICE

Claims:

1. An adjusting device for dimensionally adjusting a gap (d) defined between a platen (20) and a print head assembly (16), said device comprising

- side frame means (17) for journally mounting said platen (20);
- pivotal supporting shaft means (13) for supporting said print head assembly (16) to permit for reciprocal rectilinear movements thereof longitudinally of said supporting shaft means (13) substantially parallel to said platen (20)
- adjusting shaft means for mounting said side frame means (17) for pivotal movement about an adjusting axis (12a) established by said adjusting shaft means and
- cam means (18) fixed to said supporting shaft means (13) for pivotal movement therewith and engageable with said side frame means (17), said cam means (18) for pivotally moving said side frame means (17) about said adjusting axis (12a) in response to pivotal movement of said supporting shaft means (13), said platen (20) thereby being carried by said side frame means (17) through an arc to displace said platen (20) relative to said print head assembly (16) whereby a gap (d) defined therebetween is dimensionally adjusted.

2. An adjusting device as in claim 1 wherein said cam means includes an eccentric cam (18).

3. An adjusting device as in claim 1 or 2, wherein said side frame means includes a pair of side frame members (17) interconnected by said adjusting shaft means (12 a) to laterally support said platen (20), at least one of said side frame members (17) including means defining a cam groove (171) sized and configured to accept said eccentric cam (18) therein, wherein said eccentric cam (18) bears against said cam groove to responsively pivotally move said pair of side frame members (17) upon rotation of said supporting shaft means (13).

4. In a printer of the type having a printing mechanism (16) carrying printing heads (15), first and second guide shafts (12,13) for mounting said printing mechanism (16) for reciprocal longitudinal movements, said first and second guide shafts (12,13) each mounted for pivotal movement about their respective longitudinal axes, a platen (20) in confronting relationship to said printing heads (15) to establish a gap (d) therebetween, and adjusting means to adjustably select a dimension of said gap (d), the improvement wherein said adjusting means comprises:

- a base member (10) including a pair of upright separated base frames (11);
- a pair of separated frames (17) adjacent to a respective one of said base frames (11), said side frames (17) being fixed to a respective end (12a) of said first shaft (12) so as to be privotal therewith, at least one of said side frames (17) including means (171) defining a bearing surface (171a, 171b);
- means (172) to journally mount said platen (20)

to said side frames (17) so that said platen (20) spans the distance between said side frames (17) substantially parallel to said first and second shafts (12,13); and

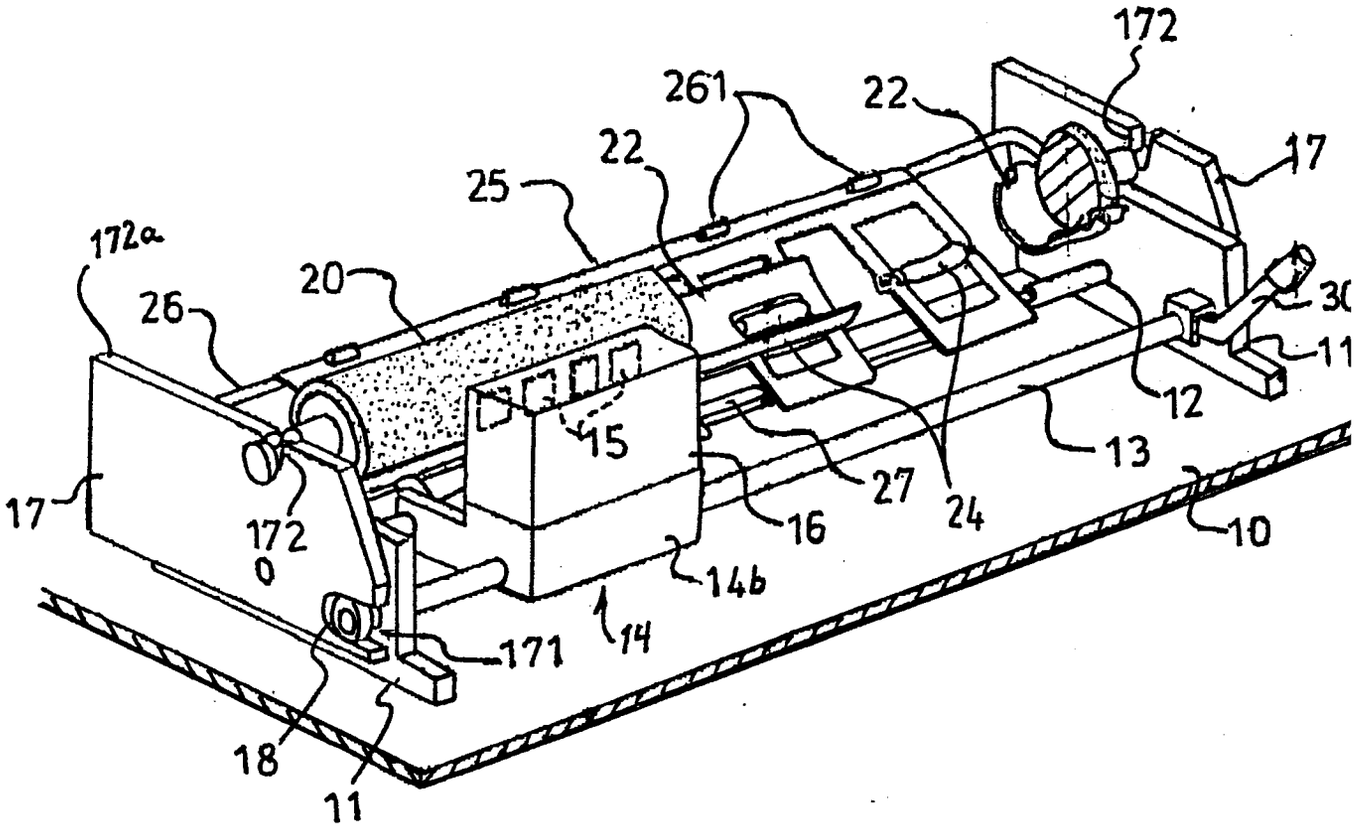
- cam means (18) fixed to said second shaft (13) so as to be pivotal therewith and operatively engageable with said bearing surface (171a, 171b) of said at least one side frame (17), said cam means (18) for bearing against said bearing surface (171a, 171b) upon rotation of said second shaft (13) to responsively cause said pair of side frames (17) to pivot about said first axis (12) to thereby displace said platen (20) relative to said printing heads (15) whereby said dimension of said gap (d) is adjusted.

5. Adjusting means as in claim 4, wherein said cam means (18) is a cam eccentrically mounted to said second shaft (13).

6. Adjusting means as in claim 4 or 5, wherein said means defining a bearing surface defines a pair of vertically separated, substantially planar bearing surfaces (171a, 171b) between which said cam means (18) is pivotal.

7. Adjusting means as in one of the claims 4 to 6, wherein said second shaft (13) includes lever means (30) for permitting manual pivotal manipulation of said second shaft (13)

FIG.1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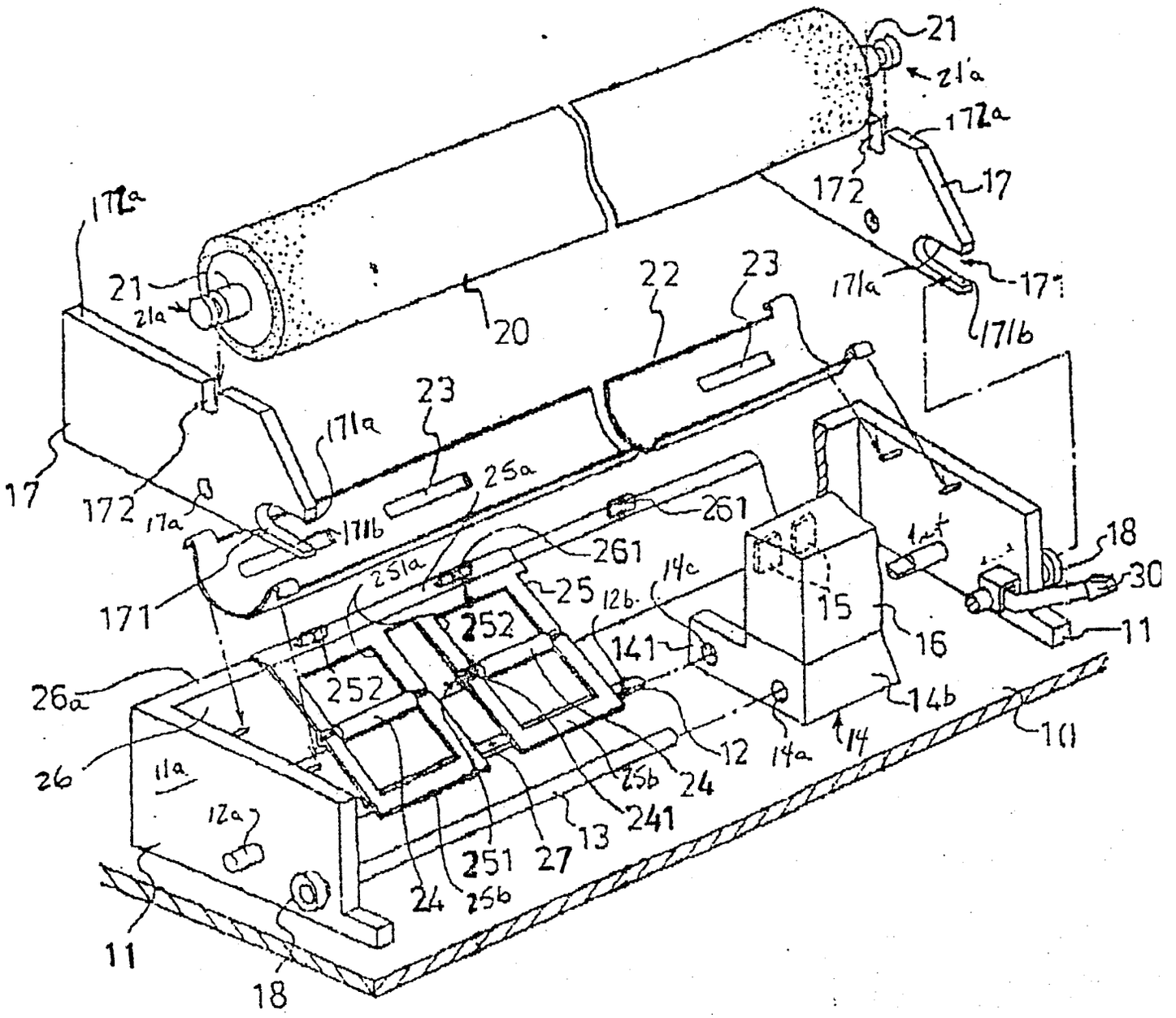
261
22
17
22
25
172a
20
26
30
11
12
15
13
27
24
17
172
0
16
10
14b
14
171
18
11

FIG. 2


21
21a
172a
172
17
171a
171
171b
20
22
23
25a
261
25
251a
252
12b
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15
16
18
30
11
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26
11a
12a
24
26b
241
13
27
251
101

 FIG. 3

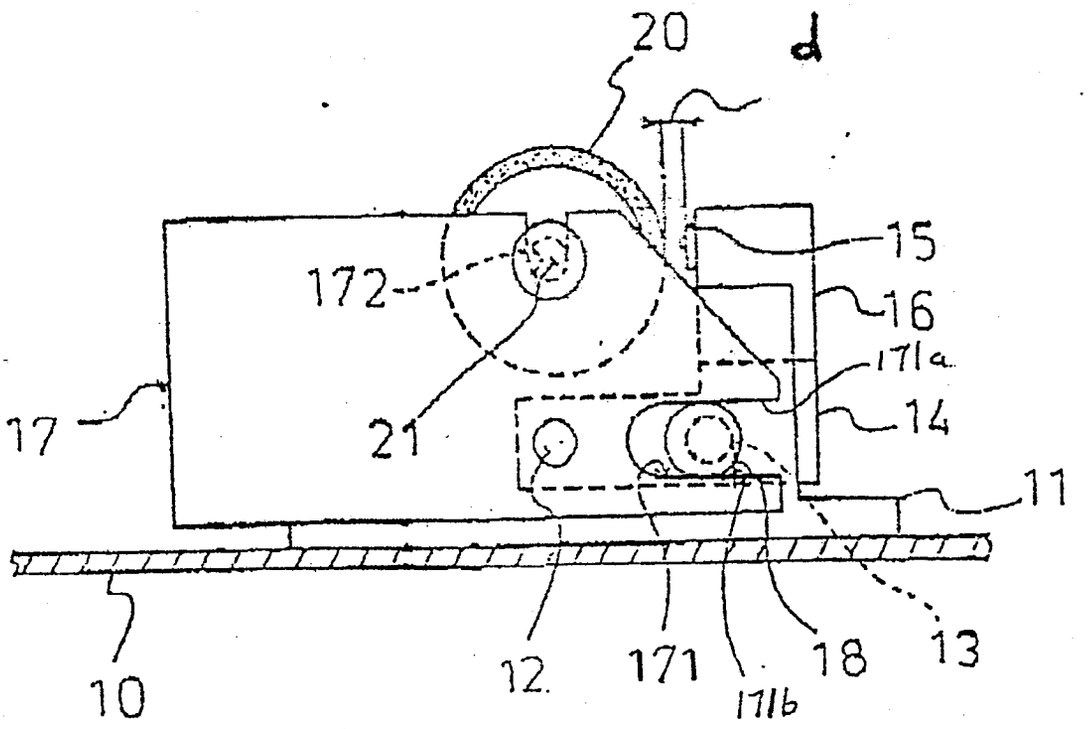

FIG. 4

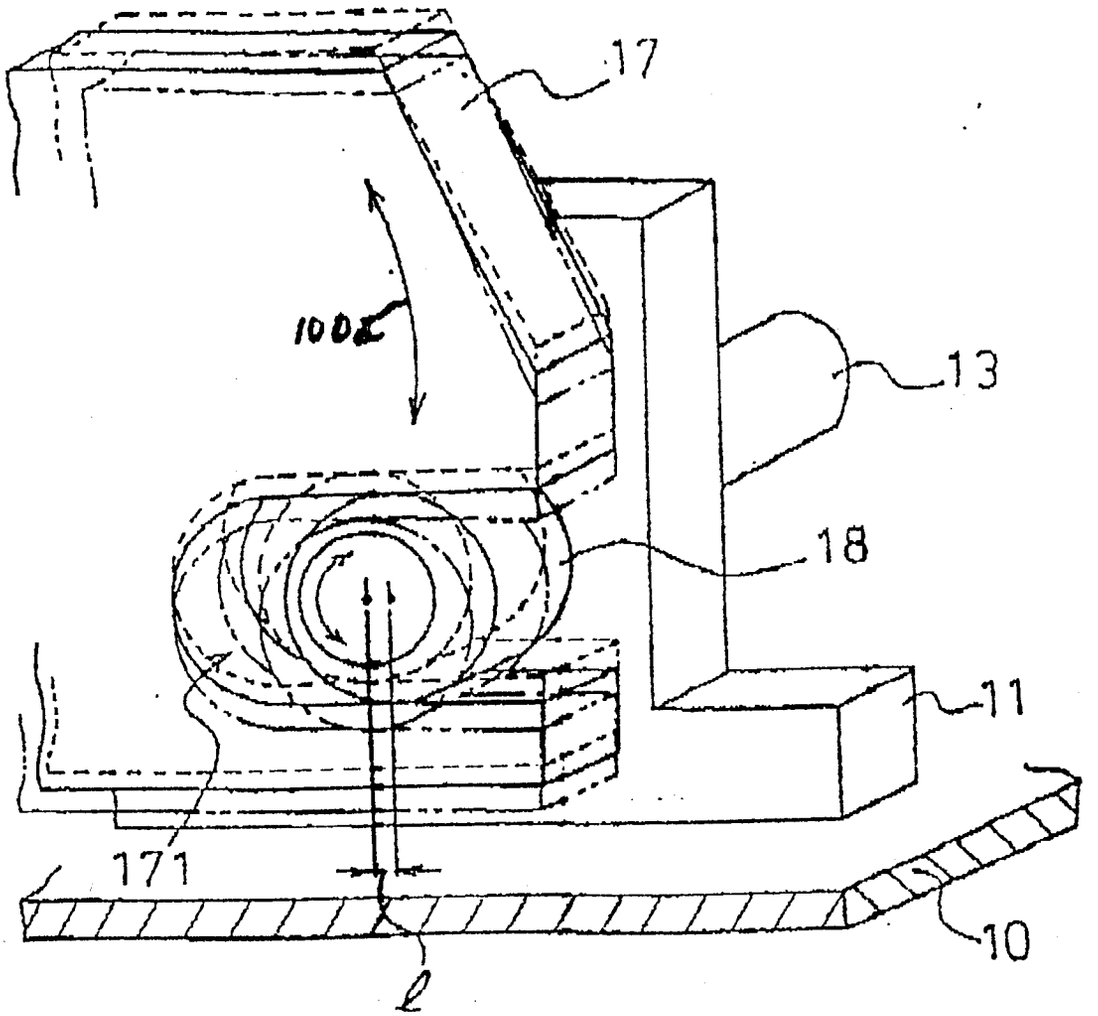

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FIG. 5