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(71) Applicant: **Wazana Brothers International, Inc.,
d/b/a
Micro Solutions Enterprises
Van Nuys, CA 91406 (US)**

(72) Inventors:
• **Perez, Jesus Gonzalez
Chatsworth, CA 91311 (US)**
• **Lenahan, Scott
Castaic, CA 91383 (US)**

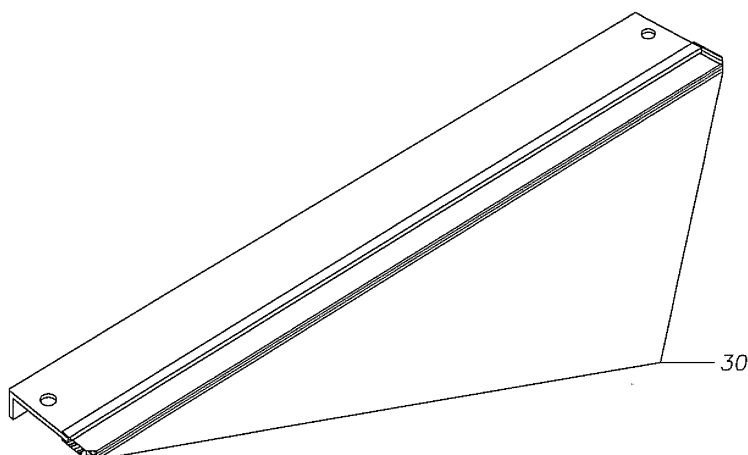
(74) Representative: **van Kooij, Adriaan et al
Arnold & Siedsma
Sweelickplein 1
2517 GK Den Haag (NL)**

(54) **Laser printer toner cartridge cleaning blade**

(57) Process and apparatus for reducing and/or eliminating chances of new or used cleaning blades installed in a laser printer toner cartridge, failing in operation due to high friction forces applied by the photo-sensitive

member (24), achieved by trimming the corners (30) of the polymeric section (20) of the blade and thus reducing the forces and pressure applied on the corners, or by fabricating new cleaning blades with angled or rounded corners.

FIG.2



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Description

FIELD OF INVENTION

[0001] The invention relates generally to the field of original laser printer toner cartridges and remanufactured laser toner cartridges.

BACKGROUND OF INVENTION

[0002] Laser printer technology including the associated toner cartridges is a fast growing, highly competitive industry that strives for continuous improvements related to the performance of cartridges and printers. Some examples of print characteristics that manufacturers are continuously trying to improve include print quality, print resolution, print speed, cost, and versatility of equipment, such as to enable printing, copying and photographing.

[0003] The present cleaning blade designs relate to the print speed characteristic, and are directed to laser toner printer and cartridge manufacturers' goal of constantly trying to increase the print speed. There are numerous parameters that limit the increase of print speed. Examples of those parameters include toner powder ability to flow, toner powder melting point, toner powder chargeability, cleaning blade performance and durability.

[0004] The conventional cartridge cleaning blade, also known as the wiper blade, is made of a metal bracket and a polymer strip. The function of the cleaning blade is to remove toner residue from the photosensitive member after a toner image has been transferred onto the paper, and, in order to prepare the photosensitive member for creation of another image. The process of cleaning the photosensitive member with the cleaning blade is usually done by the polymer strip, which is usually made of polyurethane and lies against the surface of the photosensitive member. During operation the polyurethane strip wipes the toner residue, like a squeegee, into the toner waste bin. The polymeric strip is typically connected to a metal bracket that is, in most cases, screwed to the waste bin. Continuous pressure is applied by the polymer strip of the cleaning blade to the photosensitive member in order to assure effective cleaning. Failure to effectively clean the surface of the photosensitive member results in print defects called "back grounding" and/or "double image". In those types of defects the image shown on a prior page appears faintly on the next page printed. Generally, higher or greater force of the blade on the surface of the photosensitive member results in better cleaning. However, the force applied on the photosensitive member, also known as the drum, by the polymeric strip of the cleaning blade can cause negative effects. For example, the force applied by the cleaning blade can wear the sensitive coating on the drum as well as on the polymeric layer of the blade sufficient to create light print quality.

[0005] Also, excessive force can cause the polymeric section or strip of the blade to turn to the other side of

the drum, thus causing complete failure of the toner cartridge, as explained with particular reference to Figure 5. This phenomenon is known as "flipping blade". Higher print speed results in higher friction force between the drum and the cleaning blade, and that in turn results in greater probability of flipping the cleaning blade. It is presently believed that the main parameters affecting the susceptibility of the cleaning blade to flipping are: (1) printing speed; (2) shape of the cleaning blade; (3) the polymeric material the cleaning blade is made of; (4) orientation of the cleaning blade with relation to the drum; (5) the type of drum coating; and, (6) the pressure that the cleaning blade applies to the drum.

[0006] A known method for preventing cleaning blades from flipping is lubricating the polymer strip. This method is effective in many applications, especially in original laser toner cartridges, because all components of the cartridge are designed by the manufacturer to prevent flipping. In the remanufacturing industry, replacement components are often used on the original design cartridge housing, and often times, the combination of different components, including the developing toner, can cause the cleaning blade to flip. Moreover, original equipment component cleaning blades, when used a second or third time or cycle in remanufacturing a cartridge, have a higher tendency to flip. It is believed that this tendency is due to degradation of the mechanical and physical properties of the cleaning blade. Moreover, it is believed that original cleaning blades have not been designed to perform with replacement toners or drums, and thus can be more susceptible flipping when subjected to a remanufacturing environment in which different tolerances in dimensions and different physical properties of materials are found.

[0007] Embodiments of a modified wiper blade and a modification process to alter the shape of the cleaning blade's polymeric section are described below. These embodiments function to significantly reduce, and in most cases eliminate the flipping cleaning blade phenomenon described above.

SUMMARY OF THE INVENTION

[0008] In accordance with the embodiments described herein the drawbacks and problems associated with flipping cleaning blades in high speed printing (over 20 pages per minute) and wide format printers are overcome. High forces applied to the cleaning blade parallel to the direction of rotation of the drum are believed to cause the polymeric section of the cleaning blade to turn under the drum and thus cause the cartridge to fail. It is believed that by creating the shape of the polymeric section of the cleaning blade in a new cleaning blade, or by modifying the shape of the polymeric section of an existing cleaning blade, during operation of the printer relatively less torque is applied to the corners of the polymeric section, thus significantly reducing or eliminating the chances of the drum "grabbing" the blade and turning it under itself.

Moreover, it is believed that the modification to the distal edges of the polymeric strip increases the stiffness of the edges of the polymeric section of the cleaning blade, so that such a modified cleaning blade has more stiffness than a cleaning blade with 90-degree corners at the leading edges of its polymeric strip, thus reducing the chances of blade flip.

[0009] These and other embodiments, features, aspects and advantages of the invention will become better understood with regard to the following description, appended claims and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The foregoing aspects and the attendant advantages of the present invention will become more readily appreciated by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

[0011] Figure 1 is a perspective view of a prior art cleaning blade without modification;

[0012] Figure 2 is a perspective view of the Figure 1 cleaning blade including two preferred modifications;

[0013] Figure 3 is a perspective view of the Figure 1 embodiment illustrating the orientation of the cleaning blade and the photosensitive member as assembled on the laser toner cartridge's waste bin;

[0014] Figure 4 is a perspective view of the Figure 1 embodiment illustrating the "flipping blade" phenomenon;

[0015] Figure 5 is a perspective view of a preferred embodiment of a modified cleaning blade of the type shown in Figure 1;

[0016] Figure 6a is a cross-sectional view of the Figure 1 cleaning blade before or prior to flipping;

[0017] Figure 6b is a cross-sectional view of the Figure 1 cleaning blade after the polymeric strip of the blade has been flipped;

[0018] Figure 7 is a perspective view of a preferred tool for use in modifying a conventional cleaning blade of the type shown in Figure 1;

[0019] Figure 8a is a top view illustrating preferred cleaning blade modifications; and,

[0020] Figure 8b is a top view illustrating alternate cleaning blade modifications.

[0021] Reference symbols or names are used in the Figures to indicate certain components, aspects or features shown therein. Reference symbols common to more than one Figure indicate like components, aspects or features shown therein.

DETAILED DESCRIPTION

[0022] With reference to the Figures preferred embodiments of the present designs and processes will be described. These designs and methods address the cleaning blade flipping phenomenon phenomena that has been a source of problems in the laser printer industry.

In its preferred embodiments the right and left leading edge corners of the cleaning blade polymeric strip are trimmed into a new, predetermined shape, which shape can take different forms. The shape or trimmed edge design can also be applied to new blades, thus fabricating a brand new blade with a more robust design that is resistant to flipping.

[0023] Figure 1 shows a prior art, commonly used cleaning blade typically found in a conventional laser toner cartridge. Metal bracket (16) is typically fastened to the cartridge waste bin (not illustrated) by two screws that pass through two holes (18, 18). Flexible, polymeric section or strip (20) of the blade is commonly attached to the metal bracket (16) by molding the polymer strip onto the bracket (22).

[0024] Figure 2 illustrates a preferred embodiment of the present modified cleaning blade. In one form of the modified blade, a commonly used cleaning blade is modified after at least one cycle of use. Shown in Figure 2 is a modified blade, that is, after the distal ends of the leading edge of the polymeric section or strip have been trimmed in accordance with the present process. The trimmed corners are shown at (30). While the trimmed edges at 30 are preferably provided on a previously used blade, the distal ends of a new blade may also be trimmed as shown in Figure 2.

[0025] Again referring to Figure 2, as well as Figure 3, it may be seen that the cleaning blade is formed of a metal bracket and a polymeric strip. The strip is fastened to the bracket. For reference purposes the blade typically is of an "L" shape, with the strip fastened along one edge of the longer leg of the "L". The longer leg of the "L" and the strip each has a width, a length and a thickness. With reference to Figure 3, the width of each is the dimension that extends along the axis of the roller. The length of each of the longer leg of the "L" bracket and of the strip extends in the Y direction as shown in Figure 3. Thus, the width of the bracket and the width of the strip extend in the X direction as shown in Figure 3, and would correspond to the width of a sheet of paper that is fed through the printer. The thickness of the longer leg of the "L" bracket and the thickness of the strip extend in the Z direction.

As is apparent from Figure 3, the width of the strip is greater than its length.

[0026] The polymer strip can be initially molded in the shape shown in Figure 2, or alternatively in another shape whereby the edges are trimmed from a straight, right-angled shape to some difference angle or to have rounded edges. Figure 2 shows one example, of several shapes into which the distal edges of the blade's polymeric strip can be trimmed or to molded.

[0027] Figure 3 is a drawing that illustrates the orientation of the prior art cleaning blade and the photosensitive member once assembled in the laser toner cartridge's waste bin. The polymeric section (20) presses against the drum surface (24). The drum (24) rotates in the direction of arrow (28). As drum (24) rotates, a force

(F) is applied in the direction of the Y axis to the distal edges or corners of the polymer strip (22) and to the leading edge of the polymer strip (26) as it touches the rotating drum (24).

[0028] Figure 4 illustrates the prior art phenomenon of flipping blade. As the drum (24) rotates in the direction of the arrow (28) it can, and often does grab one or both of the distal edges or corners of the polymer strip, shown at (22). The force (F) then bends the polymeric strip underneath itself. It is believed that the distal edges or corners (22) are more flexible than the polymer strip's leading edge (26), and thus these corners or distal edges bend first. Once one of the edges bends over, it then pulls the rest of the leading edge, shown along line (26), with it. Moreover, it is believed that the force (F) applied on the corner (s) (22) along the y-axis creates a high local pressure, that initiates the flip.

[0029] Figure 5 illustrates the orientation of the cleaning blade and the drum assembled in the cartridge's waste bin (not illustrated) after the corners or distal edges of the polymeric strip have been modified, as shown at (30). It is believed that the force (F) along the y-axis is then spread along the chamfer, or other shape (30) at these corners or distal edges, so that the pressure applied on the polymer strip is reduced in comparison to the applied pressure on the unmodified cleaning blade. In general, it is believed that chamfering or rounding the edge makes the area more rigid, thus reducing the chances of flipping.

[0030] Figures 6A and 6B are cross-sectional views of the blade flipping phenomenon. Figure 6a is a cross sectional view illustrating the flip phenomenon and shows the orientation of the cleaning blade (B), the polymeric section or strip (20), the drum (24) rotating in the direction of arrow (28) and edge (22). The leading edge of the polymeric strip is the edge that first contacts the drum as it rotates in the direction of arrow 28 shown in Figure 6A, and extends along the X axis for the entire width of the strip. This leading edge is vertically oriented along the Z axis, and is the edge shown at (22) in Figure 6A. Thus, in their preferred forms, the trimmed edges are at the distal ends of the polymeric strip and at the leading edge of the strip, as opposed to the trailing edge of the polymeric strip. Figure 6B is a cross sectional view that illustrates the flipped blade where the drum (24) has been turned in the direction of the arrow (28) and grabbed the edge (22) of the polymer section or strip (20) and pulled the strip 20 under itself.

[0031] Figure 7 is a perspective view that illustrates an apparatus (36) that is adapted to modify and trim the corners of the polymeric section or strip of a cleaning blade, such as cleaning blade (22), by pressing the handle (38) down in the direction of the arrow (44), thus forcing or making the cutting blades (42) come down along the slides or glides (43, 43) and to cut and trim the polymeric strip into the desired shape. Preferably, the cleaning blade affixed to the fixture (36) and aligned in a predetermined position with alignment pins (48, 48) in order

to achieve a consistent cut every time. As will be apparent to one of skill in this field, the trimming apparatus and trimming process can be automated.

[0032] Figures 8A and 8B illustrate different, preferred corner shapes into which the distal edges or corners of the polymeric strip of a cleaning blade made be cut or trimmed and function to prevent or reduce the chances of the blade flipping during operation of the printer. Figure 8A illustrates a preferred modified cleaning blade (50) that includes a metal bracket (52), a polymeric section or strip (54), and a modified chamfered or new molded corner shown at (56). While only one distal edge or corner (56) is shown, it is preferable that both distal edges of the strip be modified. The chamfered corner shape (56) is defined by an angle (A°) that extends between the distal, lateral edge of the polymeric section, shown at (58), and along the chamfer line (60) for a distance (L) between the edge (58) and to end point (62) that is at the leading edge of the polymeric section or strip (54) of the cleaning blade. While it is believed that any angle between 0 degrees and 90 degrees will permit the modified blade to work for its intended purpose. The angle (A°) preferably is in a range of about 10 to 80 degrees depending on the type of cartridge, components, media and/or toner used in the printing apparatus. The most preferred angle (A°) is about 45 degrees.

[0033] The maximum length of L is limited or dictated by the greatest width of the printed media permitted by any specific cartridge. Thus, the length L is chose so that the leading edge of the remaining strip has a width (as referred to above with reference to Figure 3) that is at least as great as the intended printable width on a sheet of paper to be printed by the particular printer under consideration. In the event that a length L, for a given cartridge design, extends or penetrates into the printed area or printable area for a given cartridge, then a print defect in the form of toner haze on or along the margins of the page will appear.

[0034] Figure 8B illustrates an alternate, preferred modified cleaning blade (64) having a metal bracket (66), a polymeric section or strip (68), and a distal edge or corner that has been modified with a cut, or a new cleaning blade (64) that has a new, molded round edge (70). The Figure 8B blade is one example of an alternate class of modified blades, i.e., blades in which the corners are rounded or curved, rather than straight. Although only one preferred, alternate distal edge is illustrated in Figure 8B, the preferred modified blade or new blade preferably has the rounded distal edges on both ends of the strip. The preferred round edge is defined by radius (R). The value of radius R depends on the clearance of the maximum size media printed with the specific cartridge model, the type of media printed, components used in the printing apparatus and the toner used. Thus, the value of R may vary. Also, complex curvatures, elliptical curvatures, offset centers for the radius and multiple chamfers or multiple, angled distal edges may also be used to modify previously used cleaning blades, or to manufac-

ture new blades in order to reduce or eliminate the blade flipping problem. Preferably the rounded edges, or straight edges if used, do not extend into the printable area under the cleaning blade.

[0035] The trimmed edges of the corners preferably are straight edges along the Z axis, i.e., at right angles to the top and bottom surfaces of the strip. These vertical edges may also be at angles other than 90-degrees from the top and bottom surfaces of the polymeric strip.

[0036] The force (F) described in Figure 3 that is applied on the cleaning blade by the photosensitive drum varies from one cartridge model to another. It is believed that in a prior art, 90 degree shaped corner, shown at (22) on Figure 1, a force F is applied on the corner sufficiently high to create a high pressure point that increases the chances of the blade flipping, whereas in the modified cleaning blade edge, shown at (30) in Figure 2, and at 58 and 70 in Figures 8A and 8B, respectively, the force (F) is distributed such that the local force is significantly reduced at each point. Moreover, it is believed that the angled cut, shown at (30) in Figure 2 reduces the force (F) normal to the blade because some of the force, inherently, is distributed parallel to the trim.

[0037] Although specific embodiments of the invention have been described, various modifications, alterations, alternative constructions, and equivalents are also encompassed within the scope of the invention.

[0038] The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense. It will, however, be evident that additions, subtractions, deletions and other modifications and changes may be made thereunto without departing from the broader spirit and scope of the invention as set forth in the claims.

Claims

1. A method for modifying a laser printer toner cartridge cleaning blade comprising:

providing a previously used laser printer toner cartridge cleaning blade formed of;
a metal bracket having a length, width and thickness; and,
a polymeric strip having a length, width and thickness; attached to said bracket; having four corners; two of said four corners attached to said metal bracket and two of said corners not attached to said metal bracket; and,
trimming said two corners not attached to said metal bracket to form two corners not having right-angles along the length of the metal bracket.

2. The method of claim 1 wherein said trimming includes trimming to remove a triangular portion of each of said two corners not having right-angles

along the length of the metal bracket.

3. The method of claim 1 wherein said trimming includes trimming to form rounded corners.

4. A laser printer including a toner cartridge comprising:

a printer, a toner cartridge housing, a photosensitive member positioned inside of said toner cartridge housing, and a cleaning blade positioned inside of said toner cartridge housing and adapted to wipe toner residue off of said photosensitive member during operation of said printer;

the cleaning blade including a bracket and a polymeric strip attached to each other; the polymeric strip including a leading edge adapted to contact said photosensitive member during operation of said printer and having a first corner located at a first distal end of said leading edge and a second corner located at a second distal end of said leading edge; and
said first corner is not a right-angle corner and said second corner is not a right-angle corner.

5. The laser printer of claim 4 wherein said first corner is formed by said leading edge and a first straight edge extending at a first acute angle from said leading edge and said second corner is formed by said leading edge and a second straight edge extending at a second acute angle from said leading edge.

6. The laser printer of claim 4 wherein said first corner is formed by said leading edge and a first straight edge extending at about a 45-degree angle from said leading edge and said second corner is formed by said leading edge and a second straight edge extending at about a 45-degree acute angle from said leading edge.

7. The laser printer of claim 4 wherein said first corner is formed by said leading edge and a first straight edge extending at an angle of about 10 to about 80 degrees from said leading edge and said second corner is formed by said leading edge and a second straight edge extending at an angle of about 10 to about 80 degrees from said leading edge.

8. The laser printer of claim 4 wherein said first corner is rounded and said second corner is rounded.

9. The laser printer of claim 4 wherein said first corner has a complex curve shape and said second corner has a complex curve shape.

10. The laser printer of claim 4 wherein said first corner is rounded with a variable radius curve and said second corner is rounded with a variable radius curve.

11. A laser printer including a remanufactured toner cartridge comprising:

a printer, a remanufactured toner cartridge housing, a photosensitive member positioned inside of said remanufactured toner cartridge housing, and a remanufactured cleaning blade positioned inside of said toner cartridge housing and adapted to wipe toner residue off of said photosensitive member during operation of said printer; 5
the remanufactured cleaning blade including a bracket and a polymeric strip attached to each other; the polymeric strip including a leading edge adapted to lie against said photosensitive member during operation of said printer and having a first corner located at a first distal end of said leading edge and a second corner located at a second distal end of said leading edge; 10
and 20
said first corner formed by said leading edge and a first straight edge extending at an angle of about 10 to about 80 degrees from said leading edge and said second corner formed by said leading edge and a second straight edge extending at an angle of about 10 to about 80 degrees from said leading edge. 25

12. The laser printer of claim 11 wherein said first corner is formed by said leading edge and a first straight edge extending at about a 45-degree angle from said leading edge and said second corner is formed by said leading edge and a second straight edge extending at about a 45-degree acute angle from said leading edge. 30
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50

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FIG. 1

PRIOR ART

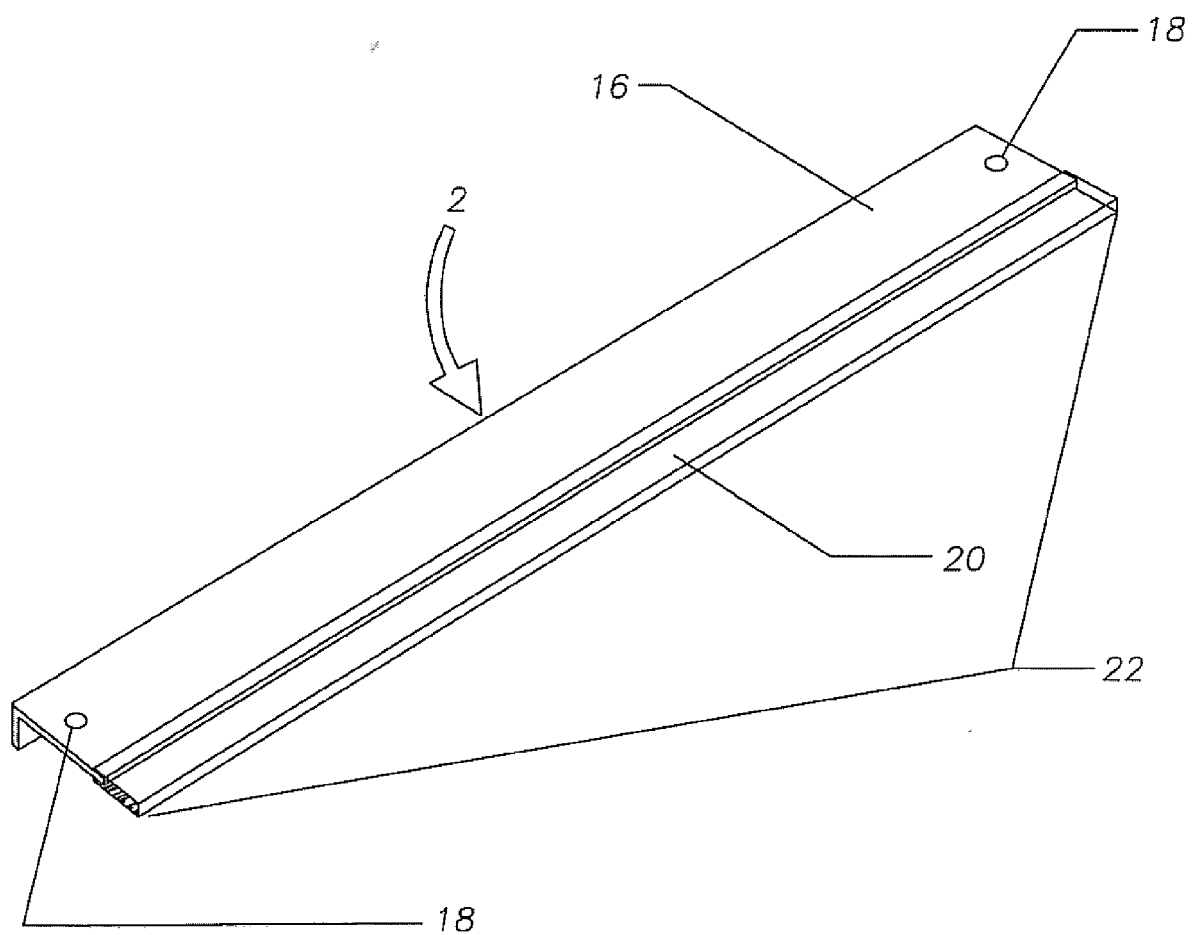


FIG.2

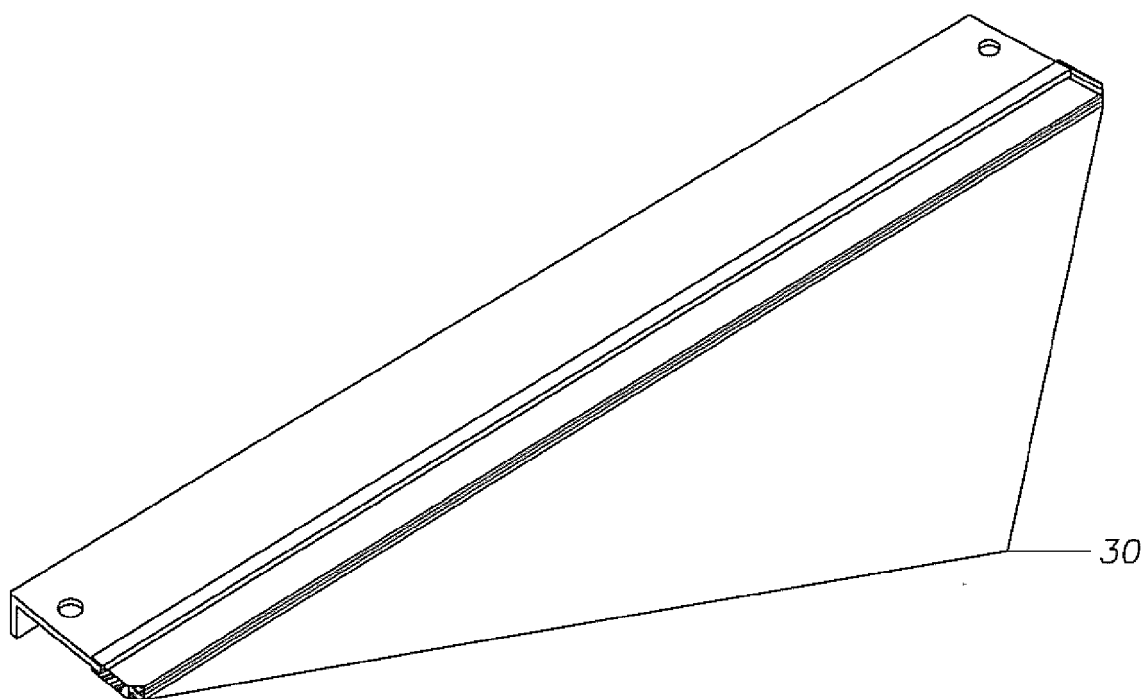


FIG.3

PRIOR ART

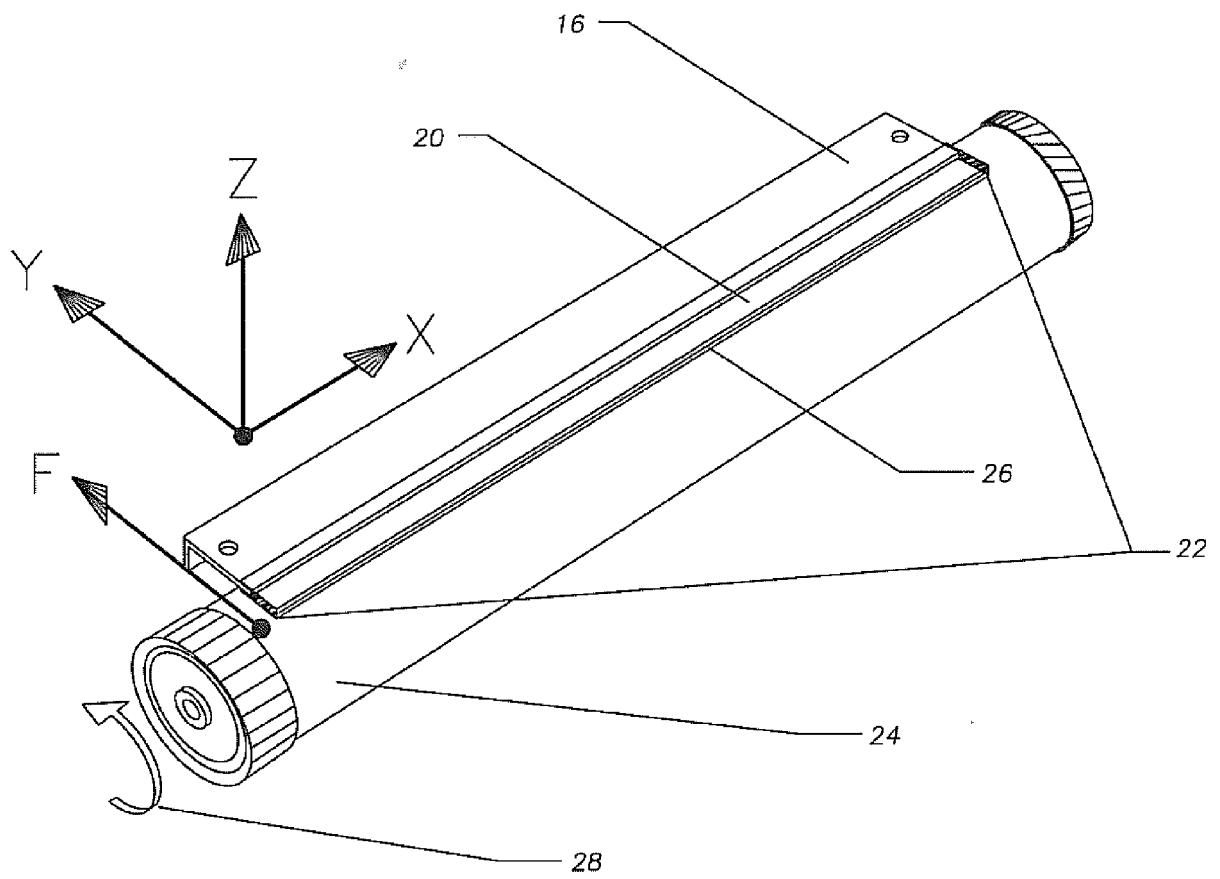


FIG.4

PRIOR ART

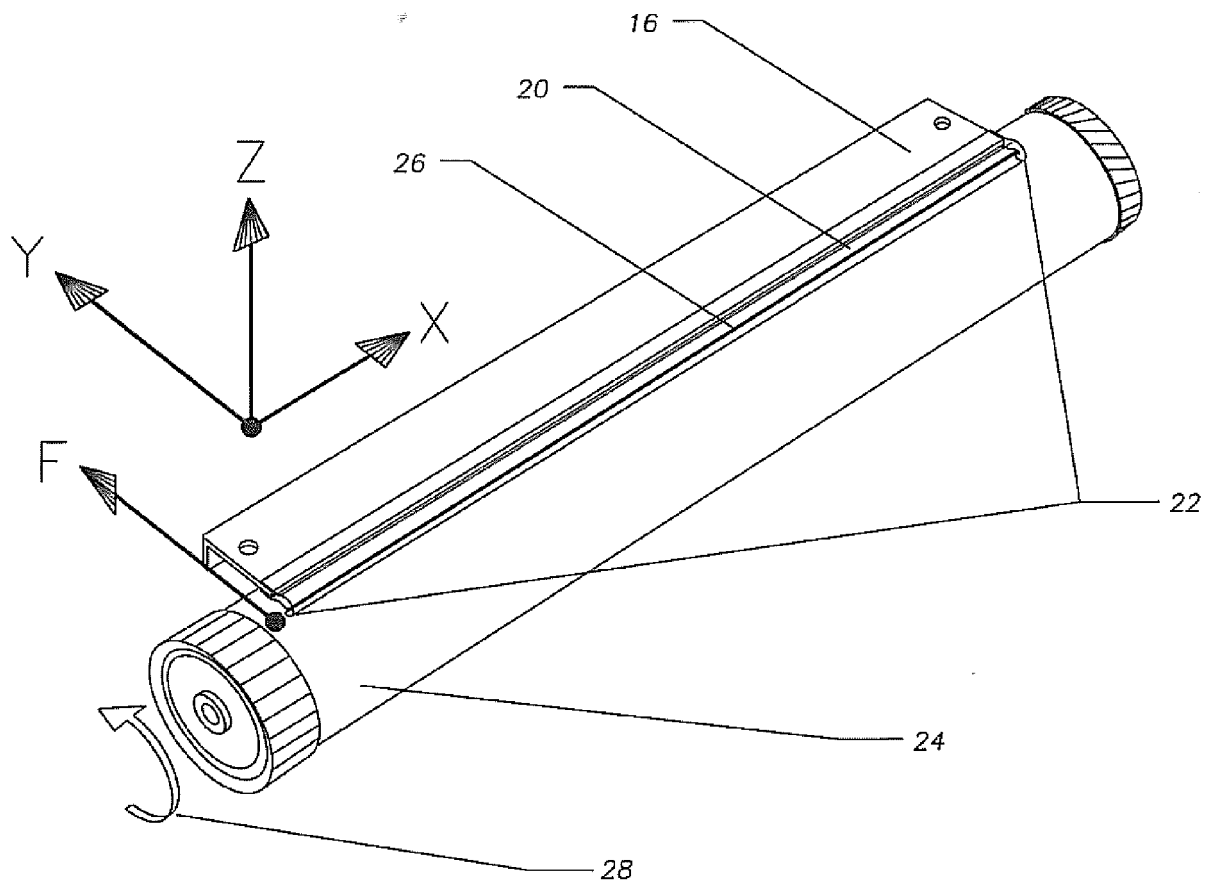


FIG.5

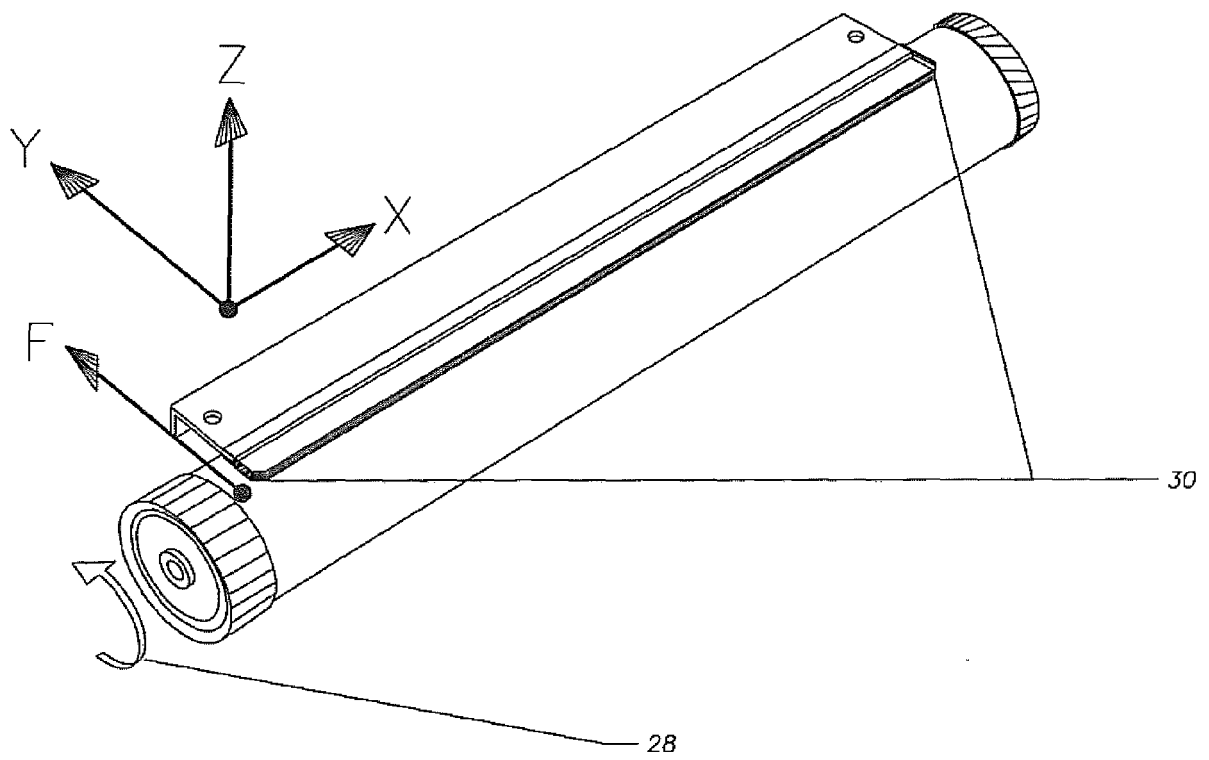


FIG. 6A

PRIOR ART

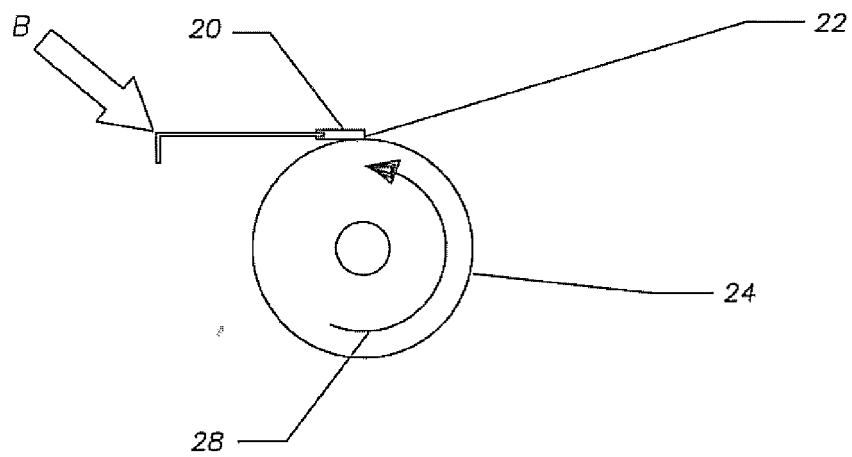


FIG. 6B

PRIOR ART

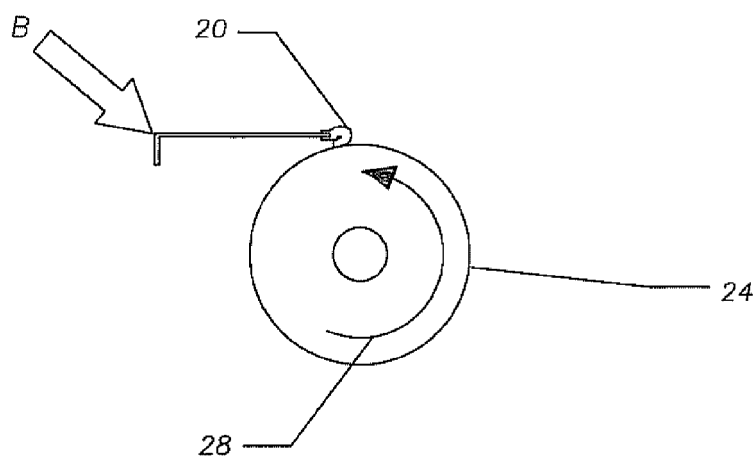


FIG.7

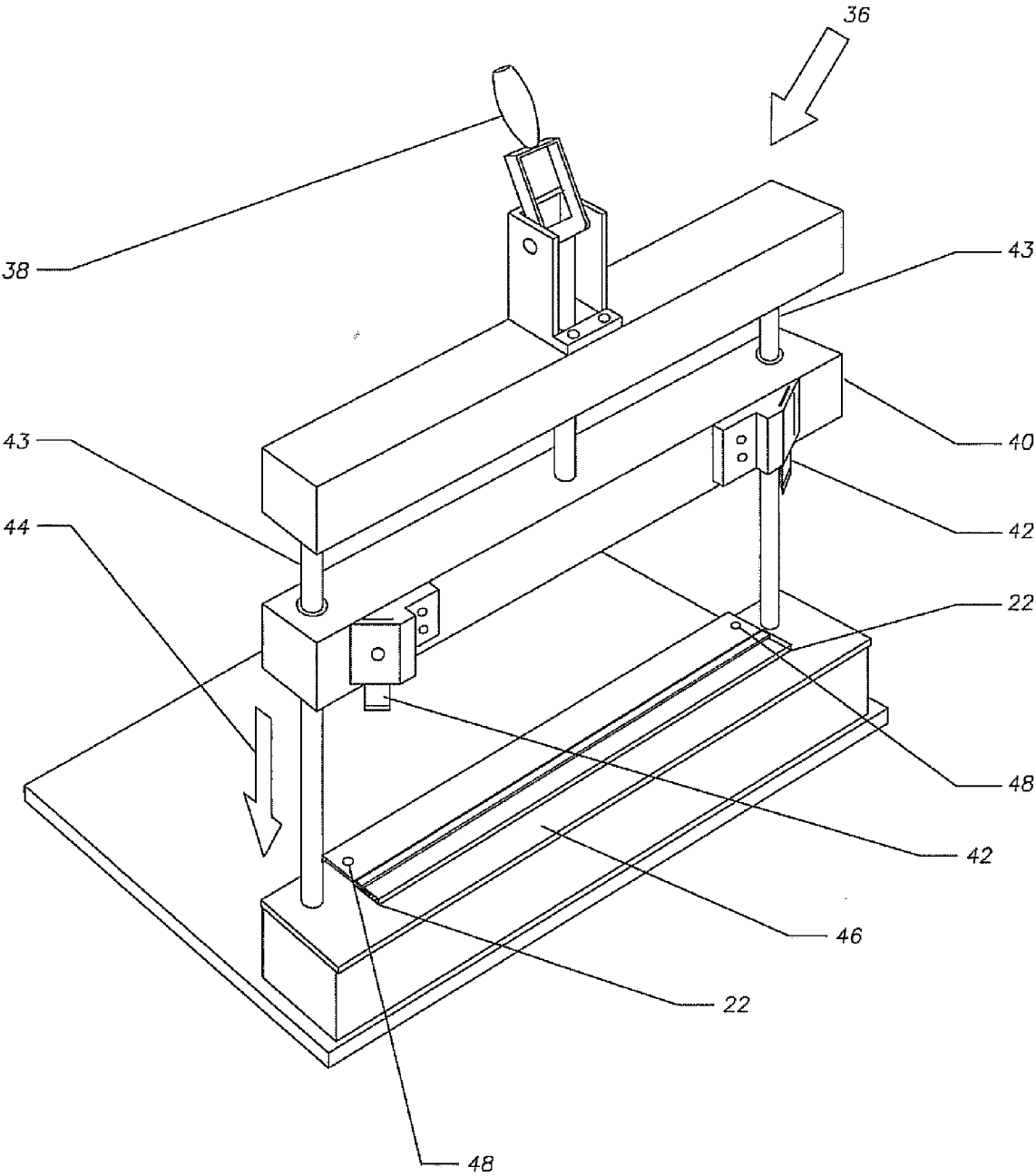


FIG. 8A

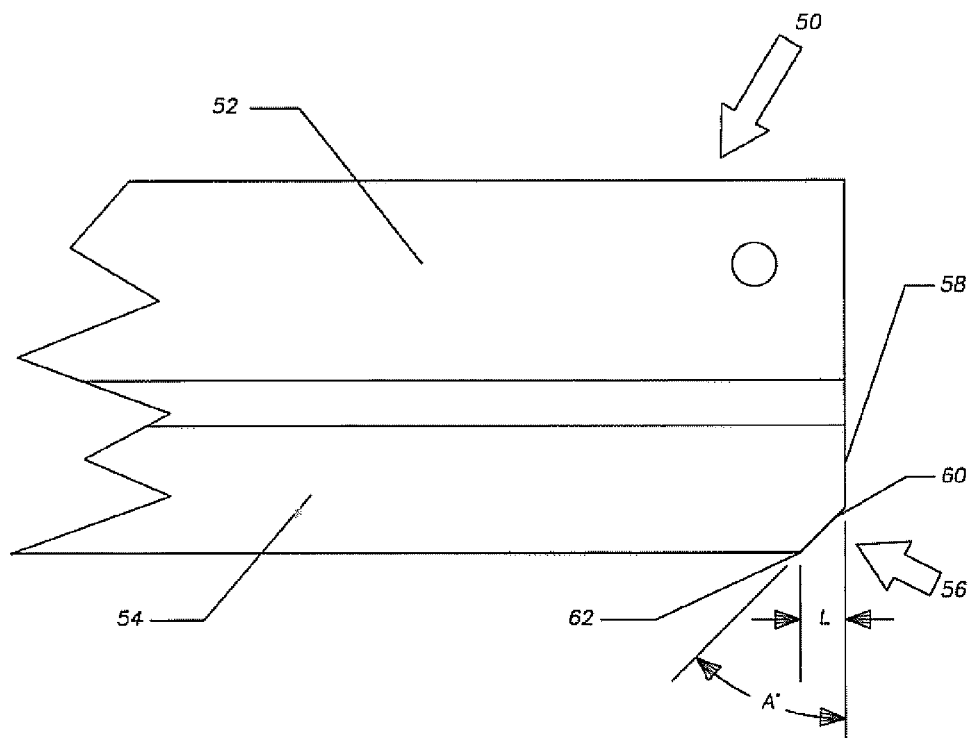
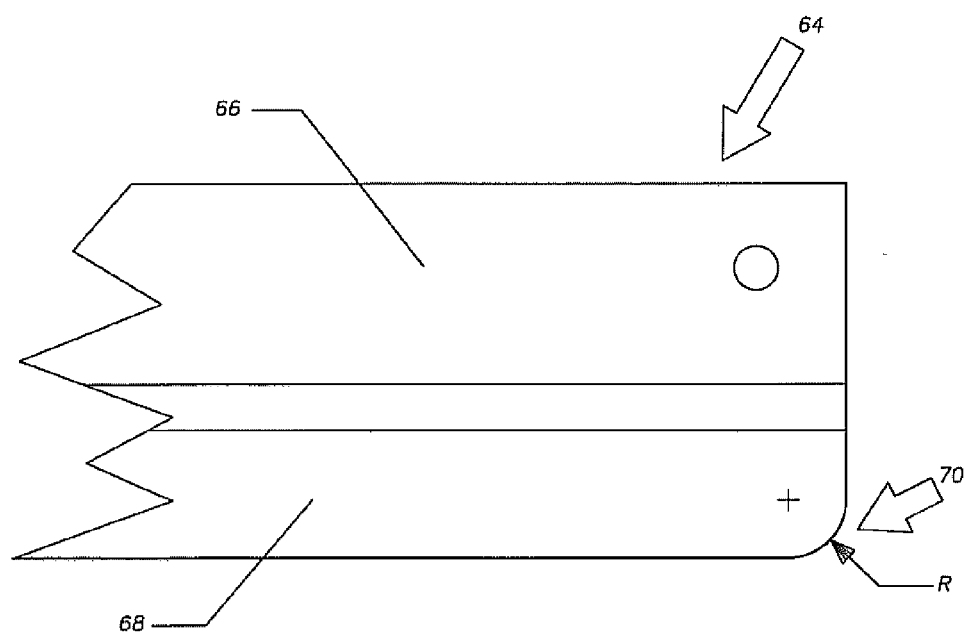


FIG. 8B





EUROPEAN SEARCH REPORT

Application Number
EP 09 15 5793

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 July 2009	Examiner Billmann, Frank
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