

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
7 February 2008 (07.02.2008)

PCT

(10) International Publication Number  
**WO 2008/014546 A1**

(51) International Patent Classification:  
**B26D 1/143** (2006.01) **B26D 1/15** (2006.01)

(21) International Application Number:  
PCT/AU2007/001065

(22) International Filing Date: 31 July 2007 (31.07.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
2006904172 2 August 2006 (02.08.2006) AU

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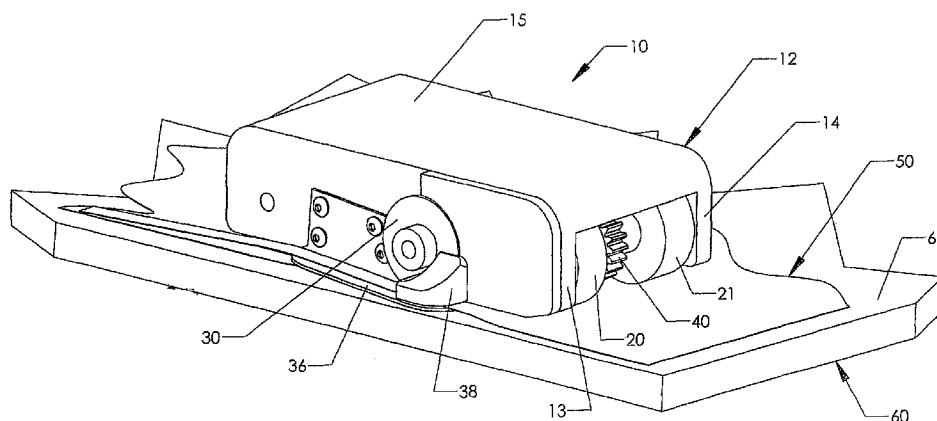
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**  
— with international search report

(54) Title: CUTTER DEVICE



(57) Abstract: A manually operable cutter device for cutting flexible sheet material, the cutter device comprising a cutter body which is movable over a work surface on which the flexible sheet being cut can rest. The device comprises a cutting blade assembly operatively mounted to the cutter body and including a rotatable cutter blade having a peripheral edge portion and a fixed cutter blade adapted to cooperate together to provide a cutting zone in which sheet material can be cut. The rotatable cutting blade is mounted for rotation about an axis which extends generally laterally with respect to a normal feed direction of the sheet material to the cutting zone and the direction of rotation of the peripheral edge portion through the cutting zone is in the normal feed direction. The tangential peripheral speed of the rotating cutter blade in the cutting zone is not less than the speed of the feed of sheet material to the cutting zone.



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## CUTTER DEVICE

### Introduction:

This invention relates generally to a cutter device suitable for cutting flexible sheet material such as for example paper, cardboard, fabric, plastics and the like.

### 5 Prior art:

Conventional scissors are tiring to use for extended periods and not ideal for producing smooth, straight cuts, and only produce clean edged tight radius cuts in one direction (to the left in the case of right-handed scissors). There is also some risk of cutting the user, and most scissors can be used as a weapon, resulting in their prohibition in some  
10 environments. Scissors may sometimes cut continuously in the hands of skilled users by simply pushing them forward with the blades fixed with respect to each other. This relies on static friction being overcome by starting with a conventional cutting action. However, speed of cut must also be high to keep the friction coefficient low, and the blades must be very sharp. Conventional track type trimmers are safe, quick and easy to use, but the cut  
15 length is limited to less than the machine length, and curves are not possible. The machines are bulky, expensive and heavy. Guillotines are capable of heavy cuts, but are heavy, require additional complexity to make them safe and are capable of straight cuts only. Conventional rotary and fixed knife blade cutters are excellent for cutting curves, but are inherently dangerous as the blade must be extremely sharp to cut by pressure alone. They  
20 also require a mat to be placed under the paper to prevent marking the surface underneath. It is the object of the present invention to provide an improved cutting device alleviates one or more of the aforementioned disadvantages.

### Summary of the Invention:

According to one aspect of the present invention there is provided a manually  
25 operable cutter device for cutting flexible sheet material, the cutter device comprising a cutter body which is movable over a work surface on which the flexible sheet being cut can rest, a cutting blade assembly operatively mounted to the cutter body and including a rotatable cutter blade having a peripheral edge portion and a fixed cutter blade adapted to

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cooperate together to provide a cutting zone in which sheet material can be cut, the rotatable cutting blade being mounted for rotation about an axis which extends generally laterally with respect to a normal feed direction of the sheet material to the cutting zone and the direction of rotation of the peripheral edge portion through the cutting zone is in  
5 the normal feed direction.

In one form the axis of rotation is generally at right angles with respect to the normal feed direction. In another form the axis of rotation is inclined with respect to the normal feed direction. Preferably the tangential peripheral speed of the rotating cutter blade in the cutting zone is greater than the speed of the feed of sheet material to the  
10 cutting zone.

The cutter device may include a drive for causing rotation of the rotatable cutter blade. In one form the drive includes a drive wheel which is operatively mounted to the cutter body and adapted to rotate as the cutter body travels over the work surface in a direction opposite to the feed direction. The drive wheel may be operatively coupled to the  
15 rotatable cutter blade via a transmission which causes the wheel and the rotatable cutter blade to rotate in the same direction as the cutter body travels over the work surface. The transmission may include a gear train.

The cutter device may further include a guide for the sheet material being fed to the cutting zone. The guide and a leading edge portion of the fixed cutter blade may  
20 provide for a slot for receiving the sheet material being fed to the cutting zone.

The cutter body may include a frame having support wheels operatively mounted thereto at least one of the ground engaging wheels providing for the drive wheel. Preferably at least one of said support wheels is disposed forwardly of the rotatable cutter blade with respect to the normal direction of travel of the device when cutting.

25 A guide track may be provided along which the cutter body can travel.

The frame may include a forward end and a rearward end and spaced apart side wall members extending between the forward and rearward end, the support wheels being at the forward end and rearward end and upon which the frame rests at least one of the wheels providing the drive wheel, the rotatable and fixed blades being operatively mounted  
30 to one of the side wall members on an outer side portion thereof and disposed between the forward and rearward support wheels. The drive wheel and rotatable cutter blade may be

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operatively connected at a pivot mount spaced from the drive wheel so that the axis of rotation of the cutter blade can be angularly inclined with respect to the axis of rotation of the drive wheel. The arrangement being such that the drive wheel positively drives the cutter blade.

5           In one embodiment two cutter blades may be provided each being operatively connected to a respective drive wheel and each having associated therewith a respective fixed cutter blade. The rotatable cutter blades may be operatively connected together by a mechanism arranged such that one drive wheel can rotate at a higher or lower speed relative to the other when the device is changing its direction of travel. The mechanism  
10 may for example be in the form of a differential gear train, a series of overrun clutches or the like.

The device may further include a lifter blade which can raise the sheet material off the work surface.

The invention can be easily made inherently safe so that the user is protected from  
15 the cutting edges, and there are no long blades to allow stabbing.

Except as otherwise described hereafter, cuts are preferably made with the sheet material flat on a table, with only one hand being required in most cases as the cutter wheels hold the material to be cut steady. The invention may be made in a compact pocket-sized form, or a variety of shapes for various purposes examples of which are  
20 described hereafter. A very low manufacturing cost is possible, comparable to basic scissors. There is no power required other than a small pushing force from the operator similar to that required to push a computer mouse. The blades are somewhat self-sharpening as they wear - similar to scissors. The cutting parts are small and can therefore be economically manufactured from wear resistant materials such as ceramics. The  
25 invention may be used for straight cuts or curved cuts of either direction, but some embodiments are more suitable to straight cuts and some to curves. Accurate straight cuts and curves of known radii are easily achieved.

The maximum length of freehand straight cuts is limited only by cutting table size. The maximum length of guided straight cuts is limited only by length of the guide  
30 track which may be an inexpensive extrusion.

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Preferred embodiments of the invention will hereinafter be described with reference to the accompanying drawings and in those drawings:

Figure 1 is a schematic isometric view of a cutter device according to one embodiment positioned on a table and shown cutting a flexible sheet material.

5        Figure 2 is a schematic underside view of a cutter device shown in figure 1.

Figure 3 is a similar view to that shown in Figure 1 but in use with a guide track.

Figure 4 is a detail of part of the device shown in Figure 3 with the guide removed to show the cutting parts.

10        Figure 5 is a schematic underside view of a second embodiment of the cutter device according to the invention.

Figure 6 is a side elevation of the embodiment shown in Figure 5 from the side of the cutting parts.

Figure 7 is a plan section A-A view of the embodiment shown in Figures 5 and 6, from above, at the axis of the drive wheel.

15        Figure 8 is a front elevation of the embodiment shown in Figures 5 to 7 illustrating the position of the section plane as illustrated in Figure 9.

Figure 9 is a plan section B-B view of the embodiment shown in Figures 5 to 8, from below, at the plane of the paper where it is cut.

20        Figure 10 is a schematic layout of some of the components of the device shown in Figures 5 to 9.

Figure 11 is a plan view of those components shown in Figure 10.

Figure 12 is a sectional view taken along the line D-D in Figure 11.

Figure 13 is a schematic isometric view of a third embodiment of cutter device of the invention.

25        Figure 14 is a plan view of the device shown in Figure 13.

Figure 15 is a sectional view taken along the line C-C in Figure 14.

Figure 16 is a detail of part of the device shown in Figure 15.

Figure 17 is a partially cutaway isometric view of the third embodiment.

Figure 18 is a partial sectional view of the third embodiment.

30        Figure 19 is a detail of part of the device shown in Figure 18.

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Figure 20 is a schematic view of some of the components of the device shown in Figures 13 to 19.

Figure 21 is a detail of part of the device shown in Figure 20.

## 5 Description of Preferred Embodiments:

Referring to figures 1 to 4 there is shown a cutter device generally indicated at 10 which is particularly suitable for making straight and large radius cuts in flexible materials such as for example paper. The device 10 includes a main body 12 configured to contain the internal parts and to be comfortably held in one hand. The main body 12 includes spaced apart side wall members 13 and 14 and top wall member 15. The device further comprises drive wheels 20 and 21 operatively connected to the main body 12 via one or more substantially horizontal axis bearings 23. The drive wheels 20 and 21 are adapted to roll on the flexible sheet 50 or the work surface 60 on which the material being cut is placed. The work surface 60 in the embodiment shown is in the form of a generally horizontal table 61. As shown in figure 2 stabilising wheels 24 and 25 are provided which ensure the cutter device remains planar with respect to the table 61 during use. One or more of the stabilising wheels may also perform as drive wheels, particularly in the straight cutting version of the device.

A rotatable cutter disc 30 is supported by one or more bearings so that its axis of rotation is parallel to, or within approximately  $15^\circ$  of being parallel to the drive wheel axis, with its lower edge close to but not touching the work table 61. Gears 40, 41 and 42 causes the drive wheel to rotate the cutter disc 30, in the same rotational direction as the drive wheel, with a peripheral speed of the cutter disc which is greater than or equal to that of the drive wheel. A fixed blade 36 is mounted to the main body 12 with a cutting edge 37 substantially horizontal or tilted down slightly in the forward direction as shown and positioned close to the cutting table and against the cutting edge of the cutter disc 30. As best seen in figure 3, guide 38 is provided which together with the body or the fixed blade forms a narrow entry slot 39 leading to the region where the cutter disc and fixed blade first meet. As shown in figure 3 a guide track 32 on which the cutter may run may be provided to assist in producing straighter cuts. The guide track 32 includes a channel or groove 33 in which drive wheel 20 for example can be positioned. An optional graduated

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visual guide, not shown, attached to the cutter anywhere ahead of or in the entry slot, close to the paper surface which may be used to align the cut with lines on the paper.

The operation of the device is hereinafter described. The cutter body 12 is presented to the edge of the material 50 being cut and the material lifted by hand if  
5 required or by a lifter such as for example flexible blade 254 as shown in figure 19 so that the fixed blade 36 passes under it. The cutter is then pushed further with a slight downward force to provide traction for the drive wheels. The gears 40, 41 and 42 drive the cutter disc 30 at a peripheral speed equal to or greater than the forward speed of the cutter body but in the opposite direction (the same rotational direction as the drive wheel). The  
10 cutting disc 30 thus slides backwards against the material 50, tending to draw the material into the cutting blades at the point of shear.

Preferably, the cutting edges of the cutter disc and the fixed blade are held in contact by a spring element (not shown). The spring element may be a separate item or built into the cutter disc or fixed blade in the form of structural flexibility. An external  
15 button or other means of separating the cutting parts may be provided to clear torn material caught between the cutting parts, if required.

The sheet material passes through the narrow entry slot 39 above the fixed blade 36 to prevent the paper buckling under compression. This compression force, combined with the traction force of the cutter disc drives the sheet material through the cutter. Figure  
20 4 illustrates the shearing action with the guide removed for clarity. The sheet material continues to be cut while the cutter is pushed forward and the drive wheel turns.

To improve the straightness of cut, a guide track 32 as shown in figure 3 may be placed on the sheet material and under the cutter so that the cutting blades run to one side of the track, over the sheet material, and the drive wheel and the following stabilizing  
25 wheel is guided by and runs in a groove 33 formed in the track. The cutter may be totally separate from the guide track as shown, or captive (not shown) so that it is free to move between the ends but may not be removed. It may also be semi-captive whereby a spring-loaded latch or sliding lock or other mechanical device preventing the cutter coming free from the track unless required by the user. Captive or semi-captive configurations make  
30 ideal replacements for expensive track type rotary trimmers.

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The device operates because the sum of the paper driving forces exceeds the sheet material stalling forces. The sheet material driving forces are the sum of the cutter disc traction force and the sheet material compression force. The sheet material stalling force is the sum of the fixed blade sliding friction (with respect to the sheet material) and the component of the shearing force parallel to the travel direction of the sheet material. Preferably, operation is achieved by maximising the driving and minimising the stalling forces as follows. Minimising the cutter disc slip velocity maximises the coefficient of friction (which is lower at higher sliding velocities in most cases - hence the need for antilock braking stems in motor vehicles). The cutter disc friction can be maximised through material selection of the substantially cylindrical surface next to the cutting edge. The drive wheel to sheet material friction can be maximised through material selection and placement of non-driving wheels and skid pads as far as possible from the point of application of the user's drive force. The sheet material entry slot gap is minimised, to reduce drag from sheet material buckling under compression. The static and dynamic coefficients of friction of the fixed blade material surface may be minimised as is the angle between the cutter disc and fixed blade at the region of shear, thereby minimising the component of the shearing force parallel to the sheet material travel direction. The friction coefficient of the lower surface of the sheet material with respect to the upper surface can be minimised by inverting the sheet material if necessary.

A cutter with two or more non-coaxial wheels on fixed axles will tend to cut in a straight line although elastomeric tyres will allow large radius to be cut if a turning torque about the vertical axis is applied while cutting. Tighter radii require that the may be steered easily by use of a steering wheel or other control device, or by turning the cutter directly if it has caster wheel or skid pad to support it. A steerable caster wheel may be provided to offer the user a choice of both types of control; that is, the caster wheel may be steered directly or the whole cutter turned while the caster wheel follows passively. In all cases any wheel coaxial with the drive wheel must be free-spinning, and supports away from the drive wheel axis must be slide pads or caster wheels to allow the cutter to turn easily. This is only part of the solution however.

During turning, the drive wheel must be in firm contact with the sheet material to achieve traction and the sheet material is constrained laterally by the cutting blades. The

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shearing region must therefore be directly under the drive wheel bearing axis so that the distance between the traction and shearing points can remain constant without distorting the sheet material. The first embodiment described above does not achieve this.

The cutting disc and fixed blade also constrain cutter steering. As with  
5 conventional scissors, the sheet material must pass the cutter surfaces after being sheared, and if these are straight the sheet material may only be turned in one direction without distortion of the side of the sheet material being retained - assuming the other side is scrap. For right-handed scissors for example, left turns produce an undistorted edge only to the left of the cut. It is impossible to produce undistorted left and right turn cuts on the same  
10 piece of sheet material with scissors; the effect is particularly noticeable with thick material such as cardboard. This effect is difficult to avoid with scissors as the shear region must move along the blades, which must therefore be straight to produce a straight cut by default. The shearing region of the proposed invention is very short however, which allows more directional flexibility.

15 The surface speed ratio between the drive wheel and cutter disc may be modified for versions able to cut curves due to the lateral distance between the drive wheel and cutter. As the cutter slides on the sheet material in the opposite direction to the direction of cut, the gearing compensates for the drive wheel running on a smaller radius if it closer to the radius centre than the cutter.

20 A second embodiment of cutter device is shown in figures 5 - 12. The cutter device generally indicated at 110 comprises a cutter body 112 which includes a cutter housing 113 and an arm 114 extending from the housing. As best seen in figure 7 the device further includes a drive wheel 120 and a cutter disc 130 operatively connected to the drive wheel 120 through a coupling assembly which includes a flexible coupling  
25 element 137 and axle 138. Axle 138 and drive wheel 120 have a hollow therein so that the cutter disc shaft 139 can extend therethrough. The arrangement is such that there is a positive drive between the drive wheel 120 and the rotatable cutter disc 130. The device further includes a handle 116 having a guide wheel 127 at its free end. A stabilising wheel 124 is provided at the free end of arm 114. The handle 116 is adapted to be tilted  
30 upwardly without tilting housing 113. A fixed cutter blade 131 is mounted to the housing adjacent the cutter disc 130.

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In this embodiment the cutter disc 130 has a larger diameter than the drive wheel 120 and is driven directly via an angled shaft 139 and flexible coupling 137 connected to the hollow drive wheel axle 138, as shown in figure 5. (In an alternative embodiment, the cutter disc is smaller than the drive wheel and driven via an internal gear attached to the drive wheel and a pinion on the cutter driveshaft.) In both cases the cutter disc peripheral speed is greater than that of the drive wheel and in the same rotational direction. The wheel to cutter surface speed ratio is increased beyond that required for straight cutting to compensate for the drive wheel peripheral speed being slower than the cut speed at the cut region when cutting a curve that places the drive wheel closer to the curve centre point than the cutter. This ratio limits the minimum cut radius: radii below this will stall the cutter. The cutter disc axis lies behind the drive wheel axis at the cutting surface and may be or angled to it as shown at Z in figure 7 (or parallel, if gear not shown). The point of shear is as close as possible to directly under the wheel axis so that the "shear point lead" X (figure 9) is as small as possible to minimise cut edge damage in tight radii.

The cutter disc 130 may have a convex conical, spherical or otherwise curved shearing face to present a substantially straight shearing region which is substantially parallel to the direction of travel and cut. This also reduces the radius presented to the cut sheet material, so that curves above this radius can be cut without distortion of the sheet material edge. Figure 9, a section through the plane of the paper shows the minimum cut radius Y possible while avoiding contact between the sheet material edge and the non-cutting parts of the cutter disc, as well as the body. The cutter disc 130 may have a raised section contacting the fixed blade 131 so that the disc edge is sharpened by moving contact. The fixed blade 131 may have a wear-resistant insert as the contact area is very much smaller than that of the disc. The guide wheel 127 can be engaged with the sheet material as required to produce a straight cut or constant radius curve and a castor wheel, not shown, may be added ahead of the drive wheel to hold the sheet material down while it becomes engaged at the start of the cut. The guide wheel 127 mount attached to the operating handle may be rotated about the vertical axis, with a calibrated scale (not shown) and locked for a constant cut radius or free and constantly steered. The operating handle is attached to the handle horizontal pivot allowing the user to lift the guide wheel without disturbing the cutting action.

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A further embodiment of the cutter device is shown in figures 13 - 21. This embodiment is particularly suited for cutting tight radius curves.

Referring to the drawings the cutter device 210 comprises a main body 212 which houses two cutter discs 230 and 232. Each disc 230 and 232 has a fixed blade 236 with cutting edges 237 and 238. The device further includes two drive wheels 220 and 222  
5 operatively connected to respective cutter discs 230 and 232.

The main body may be substantially symmetrical about the vertical plane perpendicular to the drive wheel axis. The two cutter discs 230 and 232 may be separable or manufactured as one piece, which straddle the fixed blade 236 so that two cuts are made  
10 simultaneously and a narrow strip of waste material 280 is usually generated. The resulting device is effectively two mirror image medium radius cutters, as described above, joined together. As with the other embodiments described, the cutter peripheral speed is greater than or equal to that of the drive wheel and in the same rotational direction. In this  
15 embodiment the two drive wheels are of a smaller diameter than the cutter discs, and drive the with no rotational speed increase over the average speed of the two wheels. A differential gearbox 240 allows one drive wheel to rotate at a higher speed and one at a lower speed than the discs during turning.

The differential gearbox 240 comprises two crown wheels 242 and 243, two planet gears 244 and 245 and a multi-part planet wheel cage 246 which is fixed to and  
20 mounted inside the cutter device. Each drive wheel drives a crown wheel via a drive shaft 247 and 248, each of which has a flexible coupling 251 and 252 at each end. The cutter discs therefore have a peripheral speed equal to the average peripheral speed of the drive wheels times the ratio of the cutter to wheel diameters, chosen to ensure the traction force on the paper is in the correct direction at all times, irrespective of the turn radius. This  
25 embodiment minimises the cutter disc to paper slip velocity under straight cutting conditions, increasing the desirable traction friction.

The cutter disc axis is preferably placed behind the drive wheel axis at the cutting surface and may be parallel or angled to it; preferably the latter so that the shearing region is as close as possible to directly under the wheel axis. Figures 13 - 19 show the two axes  
30 in the same plane for the sake of clarity. The cutter discs may have a convex conical, spherical or otherwise curved shearing faces to produce a substantially straight shearing

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region which is substantially parallel to the direction of travel and cut. However, this has little effect on the minimum radius that can be cut without distortion of the paper edge as only the central waste strip has its path impeded. The left and right cut parts of the paper are substantially unimpeded laterally by the cutter discs as they pass underneath. The fixed  
5 blade is made as thin as possible with a relief angle below the shear region so that the left and right cut parts are almost completely unimpeded while turning.

This embodiment has a sheet material lifter 254 which has a sharp leading edge and stays in contact with the work table 260 so as to slide under the paper and lift it onto the fixed blade. The lifter is removable, and located between the tines of the fixed blade in  
10 case of the need for replacement by the user. The tines in this embodiment are slightly flexible and preloaded together to provide the force needed to keep the cutting edges in contact at the point of shear.

Further preferred embodiments of the cutter (not shown in the figures) may be derived from any of the above embodiments for use with stiffer grades of sheet material.  
15 The cutter would be fixed in a convenient orientation to the user, the work table being effectively replaced by a small moveable table on which the sheet material is held by the user or by other mechanical means. In these embodiments the table and sheet material are held by the operator and drawn through the cutter. These embodiments provide the user a better ergonomic position for fine, close work, and position the cutting region in a constant  
20 orientation.

Further preferred embodiments of the cutter (not shown in the figures) may be derived from all of the above embodiments but with the moveable table being replaced by one or more rollers loaded by springs, or other means, against the drive and stabilising wheels, if any are present, separated by and locating the sheet material. In these  
25 embodiments the paper is held by the operator and drawn directly through the cutter.

In a further preferred embodiment of the cutter shown may be derived from any of the above embodiments for by eliminating transmission elements such as gears, belts and flexible couplings altogether. The cutter disc is mounted on the same shaft, or mechanical equivalent, as the driving wheel, which is of a smaller diameter to achieve the higher  
30 surface speed required, as described above. Other items shown in the figures are numbered as for the other embodiments, that is; the stabilising wheel, the table and the point of shear.

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To operate on a flat surface, the drive wheel axis is mounted tilted within the body so the cutter disc clears the table, but otherwise the cutter is similar to the embodiments described above. The direct drive particularly lends itself to a captive track mounted configuration. In such an embodiment the track thickness allows the drive wheel diameter to be less than that of the cutter disc while the drive wheel axis is substantially horizontal.

In a further preferred embodiment of the track mounted cutter (not shown in the figures) comprise a gear rack formed in the track which engage with a gear attached to the drive wheel to ensure wheel and therefore cutter rotation with reduced downward force required. The rack and pinion may be replaced by other positive drive means; a tensioned cord or belt attached at one end of the track, wrapping around the drive wheel or shaft, then continuing to an attachment at the other end of the track. for example.

Preferably in embodiments able to operate either with or without a track, the gear outer diameter is less than the wheel diameter to prevent contact with the table.

Features described above may be transferred freely between the above embodiments to produce numerous variations. For example, the handle described in the medium radius embodiment may be used in the tight radius embodiment, and the paper lifter would be useful in all embodiments.

Any number of the items shown as stabilizing wheels may be used as drive wheels by being connected the cutter disc via a suitable transmission.

The transmission may be by belt, traction between conical or cylindrical components, or, as described above, by gear, direct coaxial drive or flexible coupling.

Throughout this specification, unless the context requires otherwise, the word "comprise", and variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgement or any form of suggestion that that prior art forms part of the common knowledge in Australia.

Whilst the present invention has been hereinbefore described with reference to particular embodiments, it will be understood that numerous variations and modifications will be envisaged by persons skilled in the art. All such variations and modifications

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should be considered to fall within the scope of the invention as broadly hereinbefore described.

CLAIMS

1. A manually operable cutter device for cutting flexible sheet material, the cutter device comprising a cutter body which is movable over a work surface on which the flexible sheet being cut can rest, a cutting blade assembly operatively mounted to the cutter body and including a rotatable cutter blade having a peripheral edge portion and a fixed cutter blade adapted to cooperate together to provide a cutting zone in which sheet material can be cut, the rotatable cutting blade being mounted for rotation about an axis which extends generally laterally with respect to a normal feed direction of the sheet material to the cutting zone and the direction of rotation of the peripheral edge portion through the cutting zone is in the normal feed direction.
2. A cutter device according to claim 1 wherein the axis of rotation is generally at right angles with respect to the normal feed direction.
3. A cutter device according to claim 1 wherein the axis of rotation is inclined with respect to the normal feed direction.
4. A cutter device according to any preceding claim wherein the tangential peripheral speed of the rotating cutter blade in the cutting zone is not less than the speed of the feed of sheet material to the cutting zone.
5. A cutter device according to any preceding claim including a drive for causing rotation of the rotatable cutter blade.
6. A cutter device according to claim 5 wherein the drive includes a drive wheel which is operatively mounted to the cutter body and adapted to rotate as the cutter body travels over the work surface in a direction opposite to the feed direction.
7. A cutter device according to claim 6 wherein the drive wheel is operatively coupled to the rotatable cutter blade via a transmission which causes the wheel and the rotatable

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cutter blade to rotate in the same direction as the cutter body travels over the work surface.

8. A cutter device according to claim 7 wherein the transmission includes a gear train.

5 9. A cutter device according to any preceding claim further including a guide for the sheet material being fed to the cutting zone.

10 10. A cutter device according to claim 9 wherein the guide and a leading edge portion of the fixed cutter blade provides for a slot for receiving the sheet material being fed to the cutting zone.

11. A cutter device according to any preceding claim wherein the cutter body includes a frame having support wheels operatively mounted thereto at least one of the ground engaging wheels providing for the drive wheel.

15

12. A cutter device according to claim 11 wherein at least one of said support wheels is disposed forwardly of the rotatable cutter blade with respect to the normal direction of travel of the device when cutting.

20 13. A cutter device according to any preceding claim further includes a guide track along which the cutter body can travel.

14. A cutter device according to claims 10 or 11 wherein the frame includes a forward end and a rearward end and spaced apart side wall members extending between the forward and rearward end, the support wheels being at the forward end and rearward end and upon which the frame rests at least one of the wheels providing the drive wheel, the rotatable and fixed blades being operatively mounted to one of the side wall members on an outer side portion thereof and disposed between the forward and rearward support wheels.

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15. A cutter device according to claim 1 wherein the device comprises a drive wheel, said rotatable cutter blade being operatively connected to the drive wheel at a pivot mount spaced from the drive wheel so that the axis of rotation of the cutter blade can be angularly inclined with respect to the axis of rotation of the drive wheel.

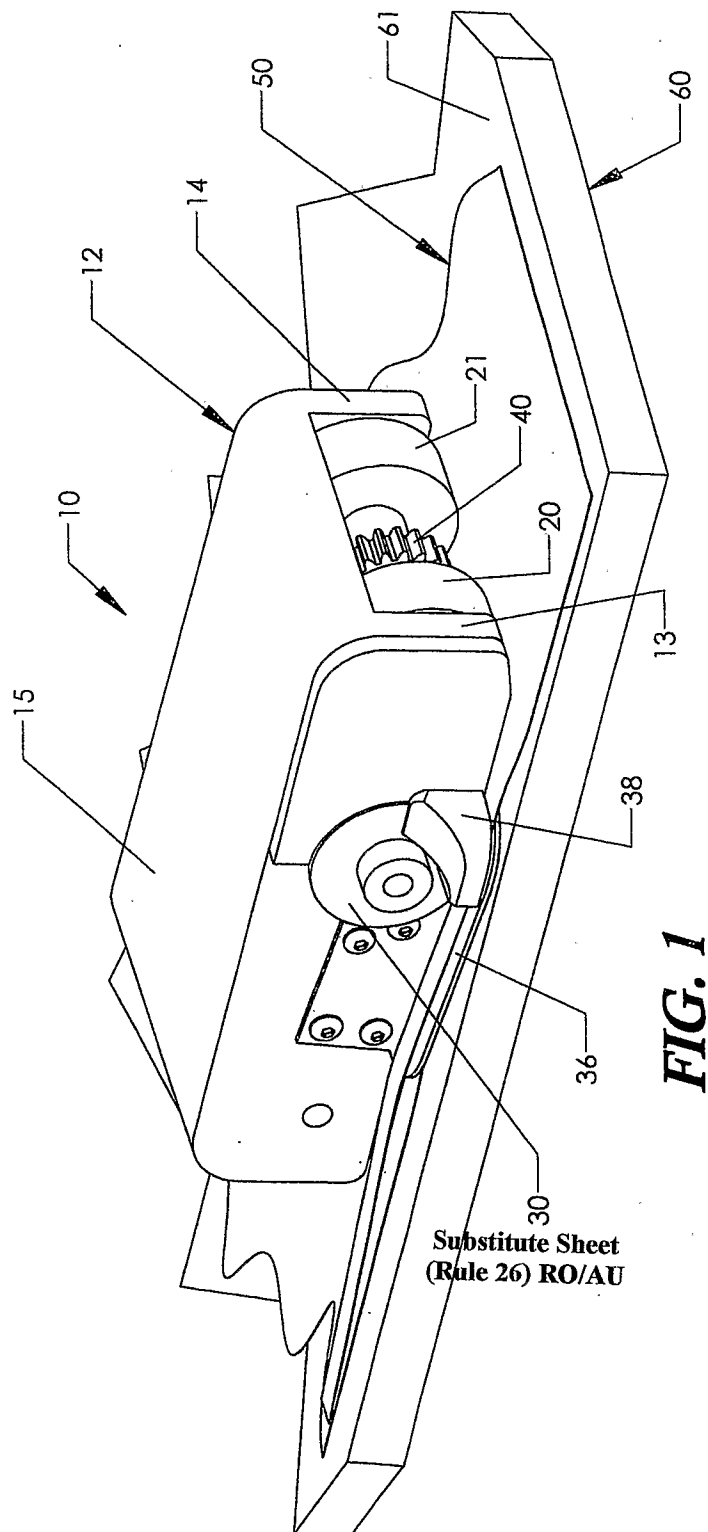
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16. A cutter device according to claim 15 wherein the cutter body comprises cutter housing and an arm extending from the housing, the pivot mount being operatively connected to the arm in spaced relation from the housing.

10 17. A cutter device according to claim 16 further including a handle mounted at one end to the housing and extending therefrom and a stabiliser wheel mounted to the handle in spaced relation to the housing.

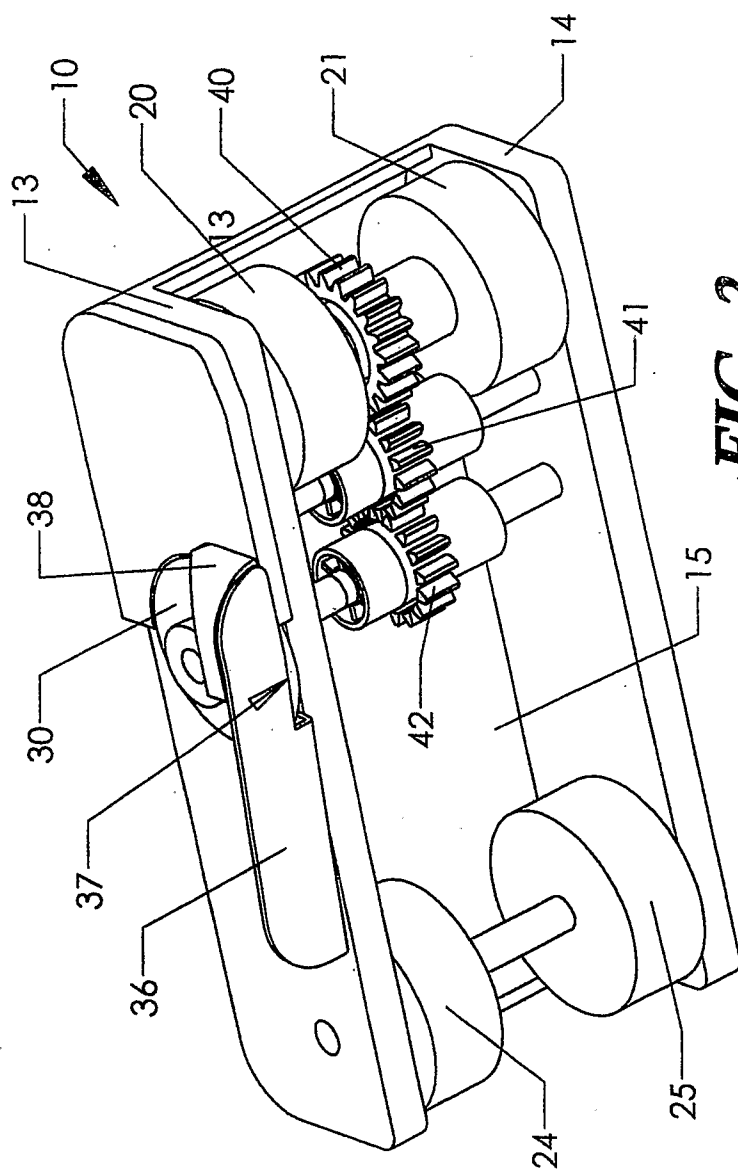
15 18. A cutter device according to claim 1 including two said cutter blades each being operatively connected to a respective drive wheel and each having associated therewith a respective said fixed cutter blade, said rotatable cutter blades being operatively connected together through a mechanism such that one drive wheel can rotate at a higher or lower speed relative to the other when the device is changing direction of travel.

20 19. A cutter device according to any preceding claim including a lifter blade which can raise the sheet material off the work surface.

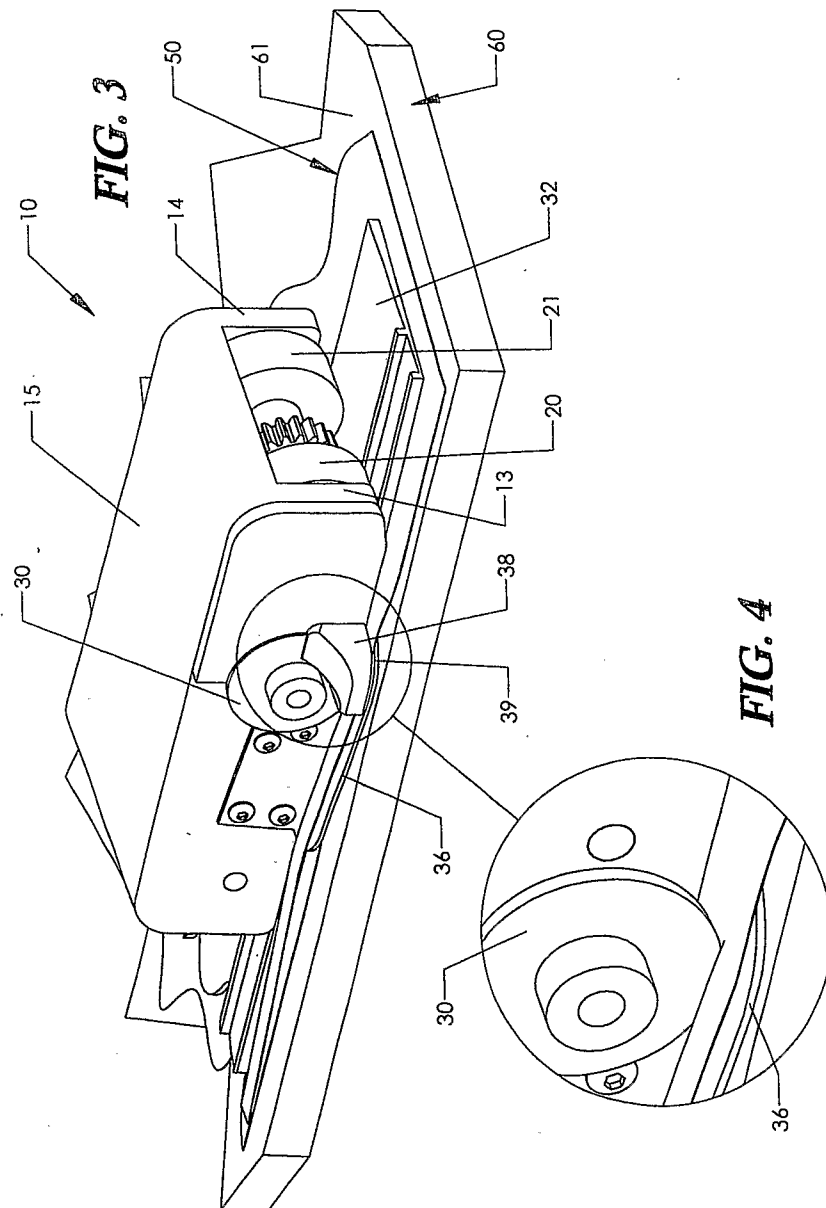


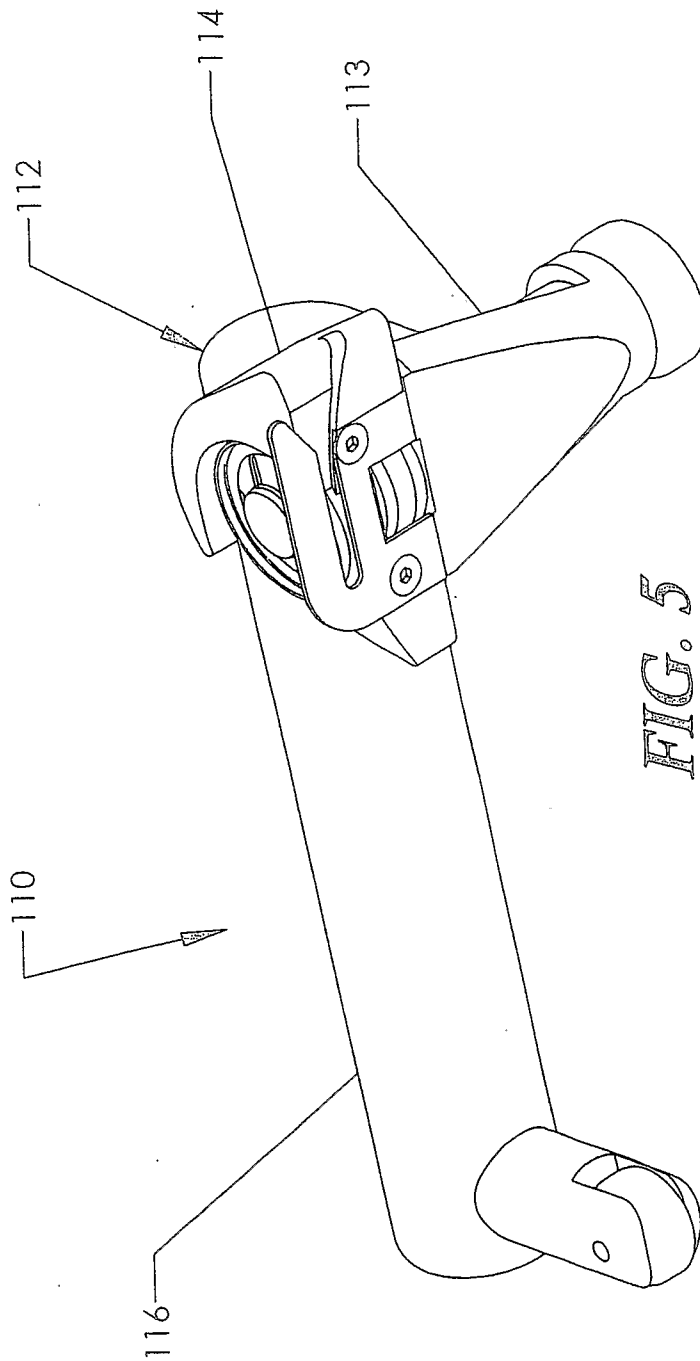
**FIG. 1**

Substitute Sheet  
(Rule 26) RO/AU



**FIG. 2**





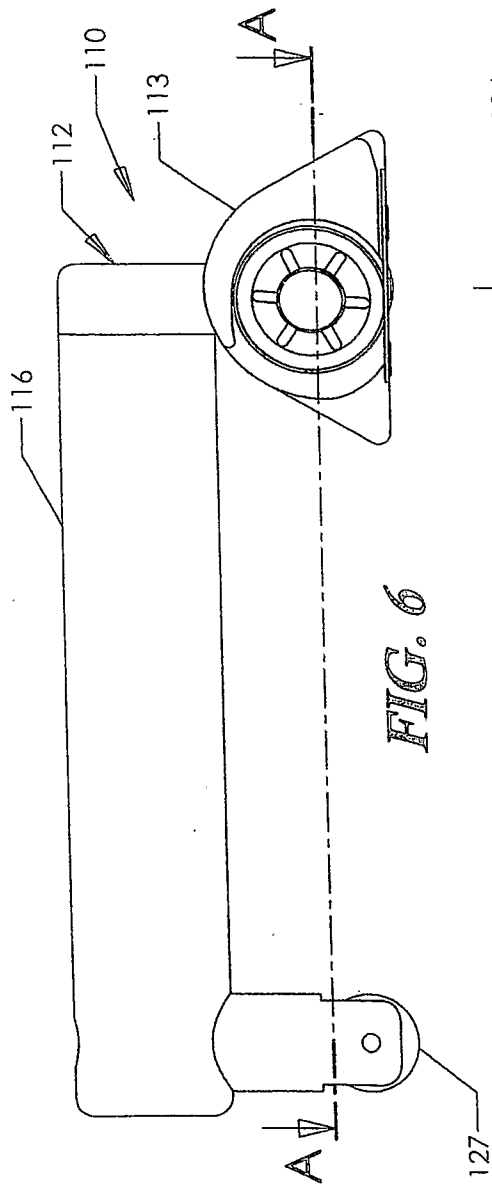


FIG. 6

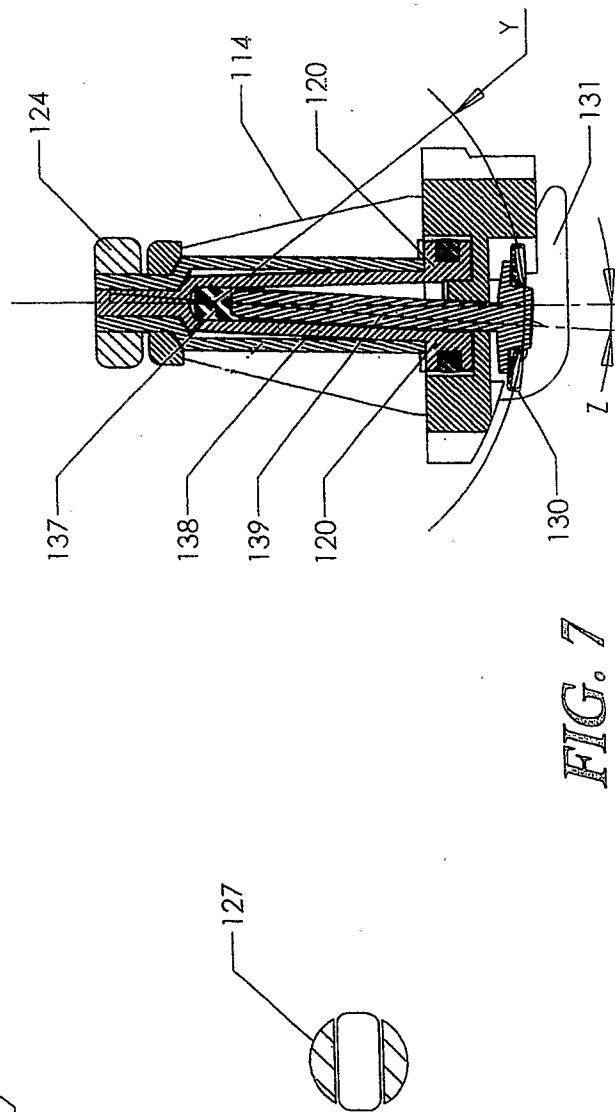
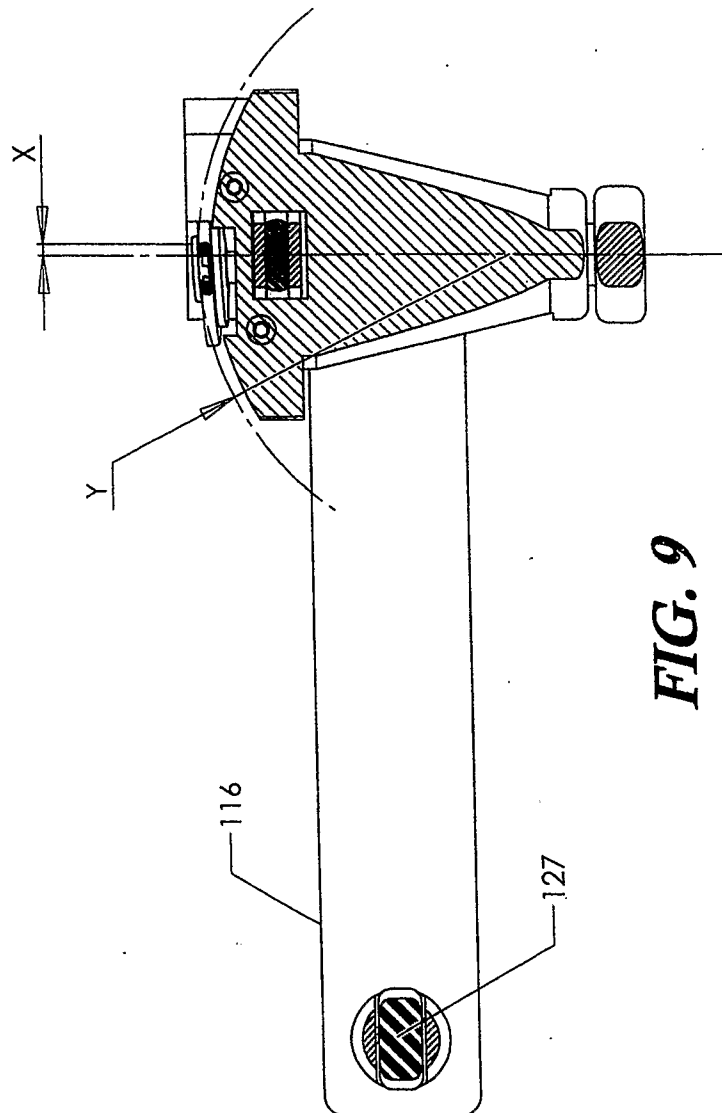
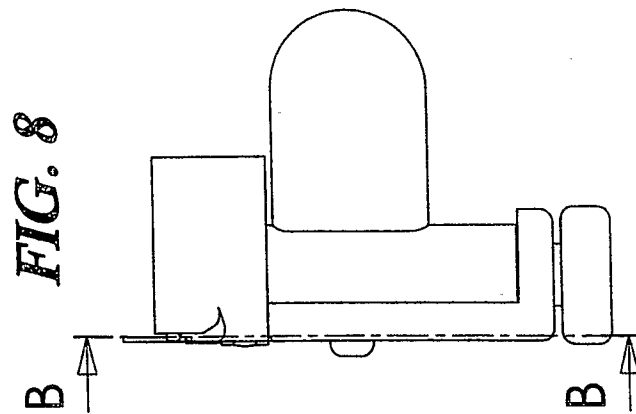
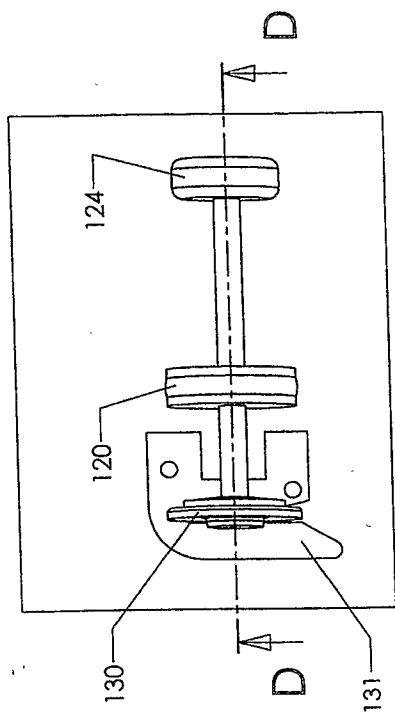
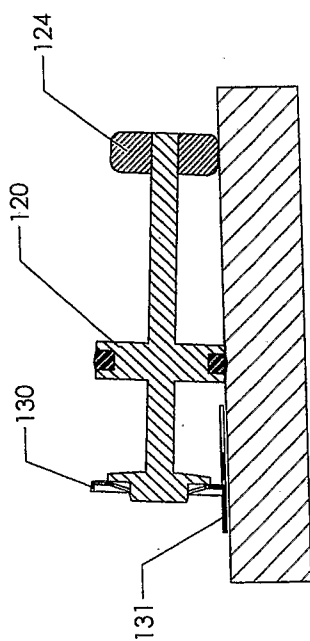


FIG. 7

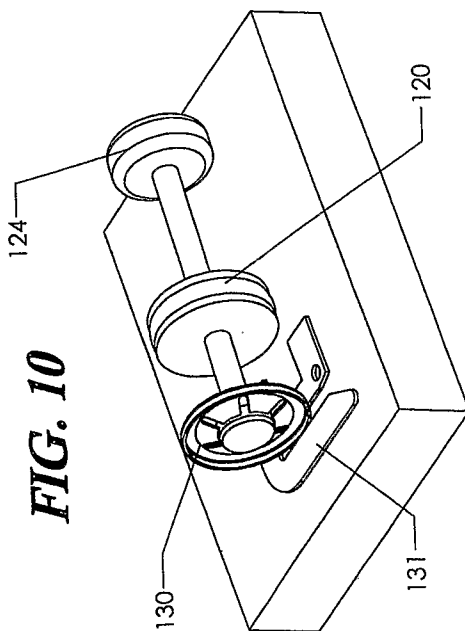




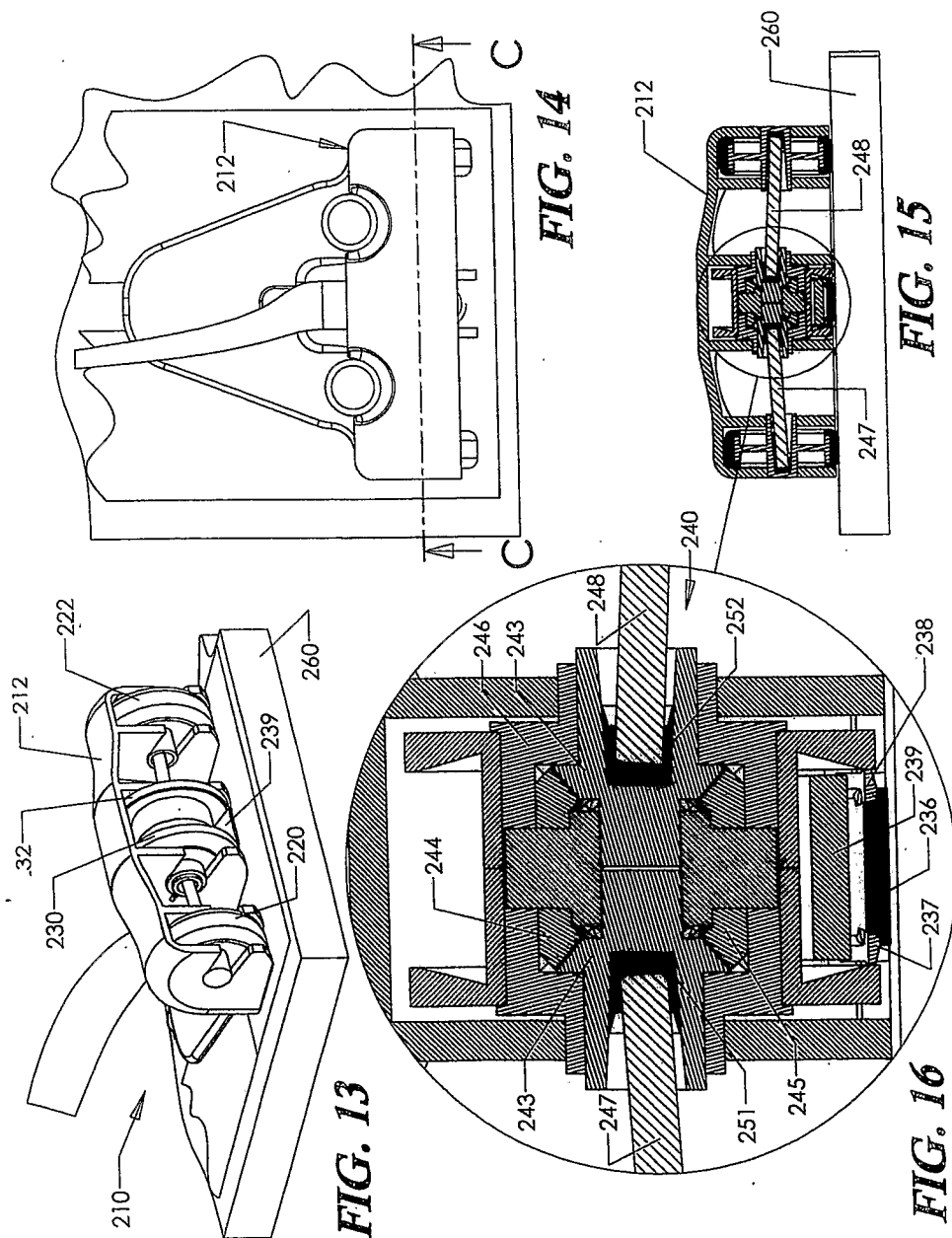
**FIG. 11**

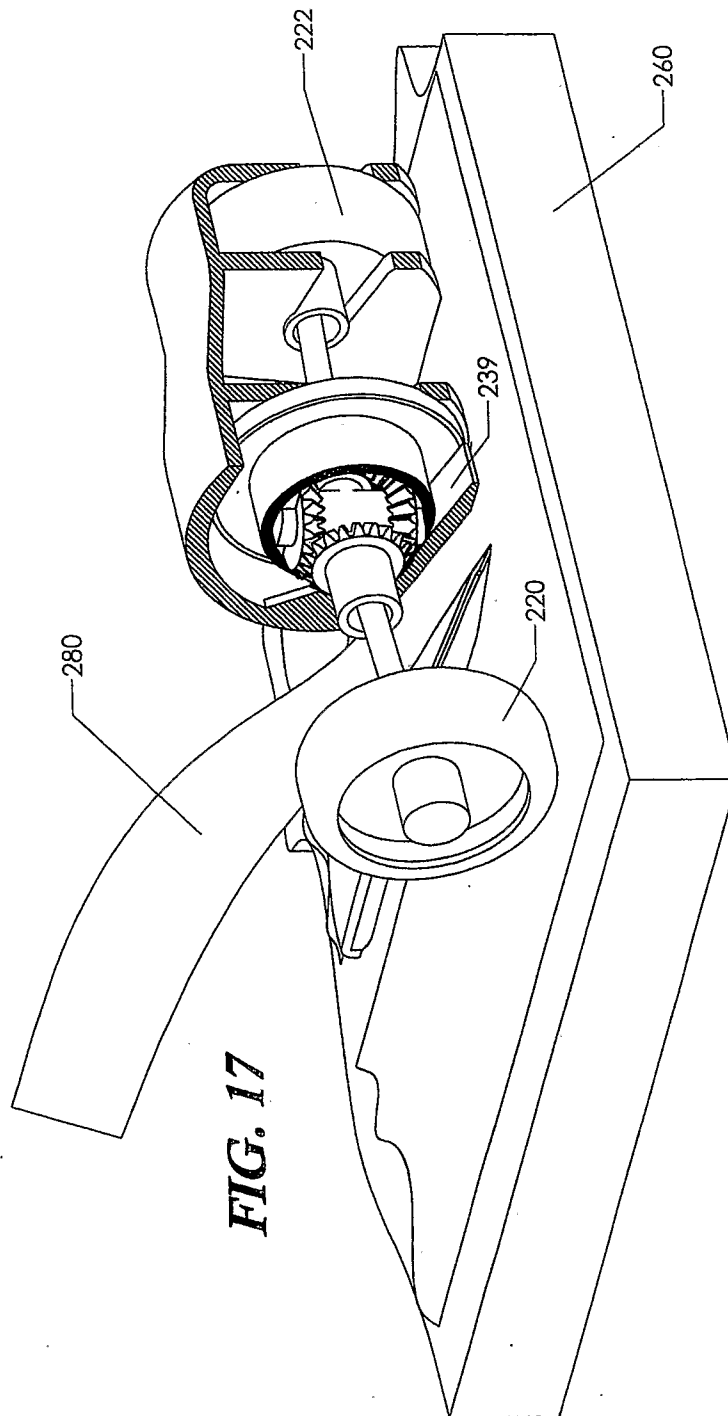


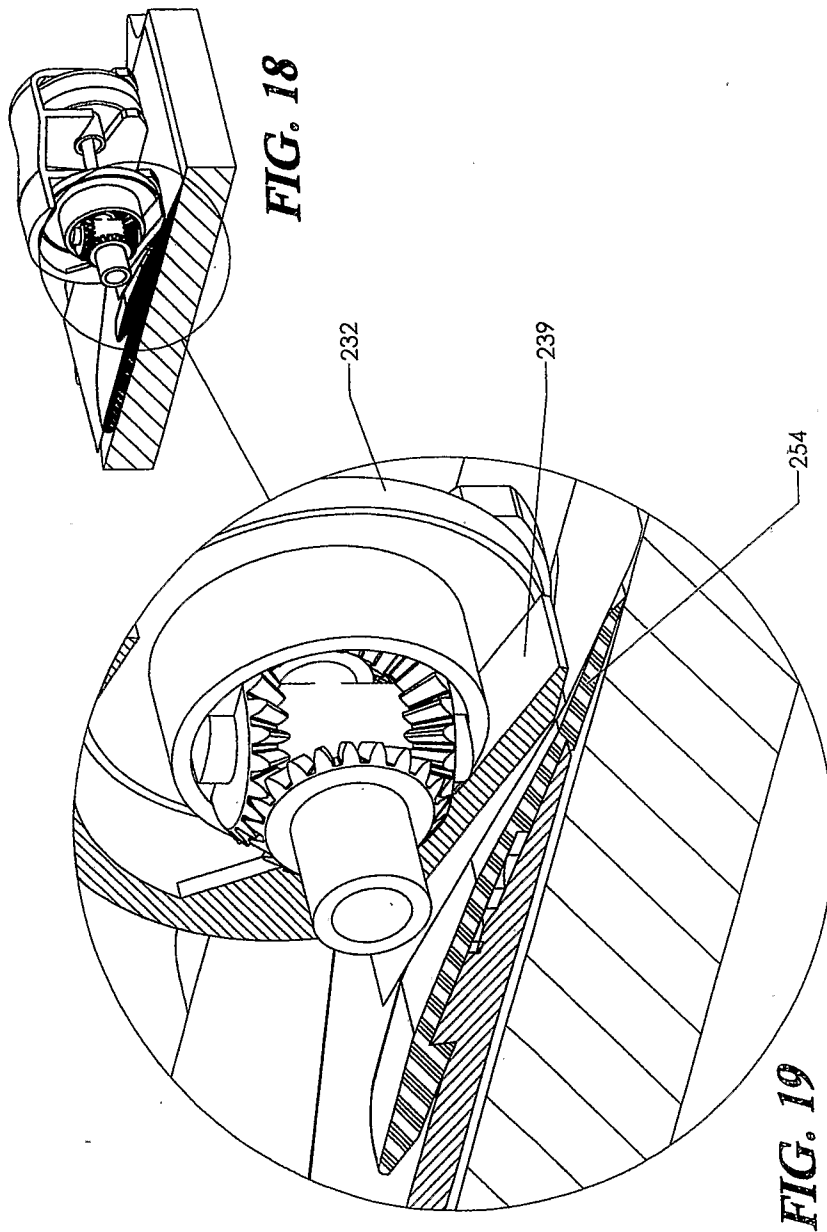
**FIG. 12**

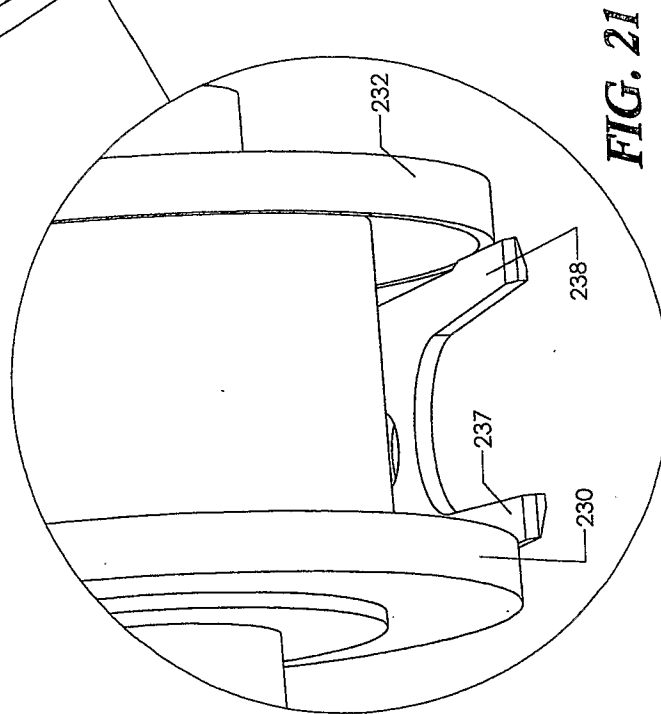
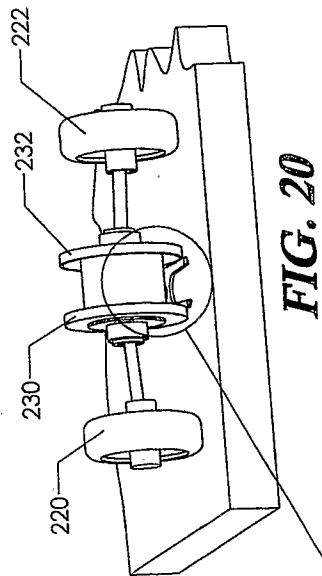


**FIG. 10**









# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/AU2007/001065

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>Int. Cl. <b>B26D 1/143</b> (2006.01) <b>B26D 1/15</b> (2006.01)<br>According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched<br>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)<br>DWPI - IPC B26D 001/143,001/15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Relevant to claim No.                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US3443314 A (LEOPOLD KARL et.al) 13 MAY 1969<br>See Abstract & Figs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US3189997 A (GEORGE W. MOUNT) 22 JUNE 1965<br>See Abstract & Figs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US5860217 A (ELAINE A. BRAUN) 19 JANUARY 1999<br>See Abstract & Figs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <table border="0"> <tr> <td>           * Special categories of cited documents:<br/>           "A" document defining the general state of the art which is not considered to be of particular relevance<br/>           "E" earlier application or patent but published on or after the international filing date<br/>           "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br/>           "O" document referring to an oral disclosure, use, exhibition or other means<br/>           "P" document published prior to the international filing date but later than the priority date claimed         </td> <td>           "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<br/>           "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone<br/>           "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art<br/>           "&amp;" document member of the same patent family         </td> </tr> </table> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                     | * Special categories of cited documents:<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier application or patent but published on or after the international filing date<br>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed | "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<br>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone<br>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art<br>"&" document member of the same patent family |
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| Date of the actual completion of the international search<br>01 November 2007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Date of mailing of the international search report <b>14 NOV 2007</b>                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Name and mailing address of the ISA/AU<br>AUSTRALIAN PATENT OFFICE<br>PO BOX 200, WODEN ACT 2606, AUSTRALIA<br>E-mail address: pct@ipaaustralia.gov.au<br>Facsimile No. (02) 6285 3929                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Authorized officer<br><b>BANDULA RAJAPAKSE</b><br>AUSTRALIAN PATENT OFFICE<br>(ISO 9001 Quality Certified Service)<br>Telephone No : (02) 6283 2120 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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Information on patent family members

International application No.

**PCT/AU2007/001065**

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| Patent Document Cited in<br>Search Report                                                                                 |         | Patent Family Member |         |
|---------------------------------------------------------------------------------------------------------------------------|---------|----------------------|---------|
| US                                                                                                                        | 3443314 | FR                   | 1518478 |
| US                                                                                                                        | 3189997 |                      |         |
| US                                                                                                                        | 5860217 | CA                   | 2252449 |
| Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. |         |                      |         |
| END OF ANNEX                                                                                                              |         |                      |         |