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European Patent Office
Office européen des brevets



(11) Publication number:

0 505 508 B1

(12)

EUROPEAN PATENT SPECIFICATION

(49) Date of publication of patent specification: **06.12.95** (51) Int. Cl.⁶: **B26D 7/08**, B26D 9/00

(21) Application number: **91906107.7**

(22) Date of filing: **07.03.91**

(86) International application number:
PCT/US91/01569

(87) International publication number:
WO 91/13733 (19.09.91 91/22)

(54) **SLITTING APPARATUS FOR CORRUGATED PAPERBOARD AND THE LIKE.**

(30) Priority: **08.03.90 US 490793**

(43) Date of publication of application:
30.09.92 Bulletin 92/40

(49) Publication of the grant of the patent:
06.12.95 Bulletin 95/49

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

(56) References cited:
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EP 0 505 508 B1

Description

Background of the Invention

The present invention relates to an apparatus for slitting a traveling corrugated paperboard sheet and, in particular, to a thin rotary blade slitting apparatus for substantially improving the quality of the slit.

Apparatus for longitudinally slitting a continuous traveling sheet or web of corrugated paperboard is well known in the art. Such apparatus is often combined with a mechanism for simultaneously providing longitudinal score lines to the advancing sheet, which score lines facilitate subsequent folding in the construction of boxes or the like. Thus, a combined "slitter-scorer" utilizes pairs of rotatable cutting tools and scoring tools disposed in the path of the advancing sheet, with one tool of each pair disposed on an opposite side of the sheet. Typically, multiple slitting tools are mounted coaxially and laterally spaced across the width of the sheet and, likewise, multiple scoring tools are also coaxially mounted and spaced across the sheet width.

In the prior art, each pair of upper and lower slitting tools is disposed with overlapping radial cutting edges between which the advancing paperboard sheet is moved to provide a continuous cut. Although the operation is commonly referred to as "slitting", the cutting tools in fact shear the moving sheet causing a relative vertical displacement of the cut edges from one another. As the thickness of the corrugated board being processed increases, the cuts tend to become more ragged, the edges tend to be crushed, and the cut quality tends to degrade significantly. Another problem commonly associated with rotary shear cutting of corrugated board is the generation of dust. Fine paper dust is a very serious problem which may result in clogged filters on air handling systems, hazardous air quality for workers, contamination of electronic and other equipment, and even explosion or fire hazards.

Other methods and apparatus for cutting corrugated paperboard have been developed to eliminate or alleviate some of the problems associated with rotary shear cutting. Thus, it is known to utilize high pressure water jets to cut paperboard. Water jets provide high quality cuts, but the equipment has an extremely high initial cost and requires costly maintenance.

U.S. Patent 4,627,214 shows a slitter-scorer apparatus of one prior art construction in which the board is sheared by passage between the overlapping edges of a pair of rotary cutting knives. Even when such cutting knives are properly adjusted and maintained in a sharpened condition, their use to

slit heavier double and triple wall board has been less than satisfactory.

German Patent DE-A-2225152, which has been taken for the delimitation of claim 1, shows an arrangement which utilizes a saw-edge two-part disposable blade used in conjunction with a soft-surfaced slotted support roller to achieve slitting. It may be expected however that a sawing action during slitting will generate dust and heat. Moreover a saw-edge blade cannot readily be sharpened.

There is a need, therefore, for an apparatus which will provide a clean, dust-free cut in a efficient and economical manner.

In accordance with the present invention, there is provided an apparatus for longitudinally slitting a moving sheet of corrugated paperboard, of the type having multiple paper layers secured together by an adhesive, comprising:-

an annular rotatable blade mounted so as to be on one side of said paperboard sheet in use with the peripheral cutting edge of said blade extending, in use, beyond the opposite side of said sheet;

a rotatable roller means mounted so as to be on said opposite side of said paperboard sheet in use and having a cylindrical outer surface positioned in use to make tangent contact with said opposite side of said sheet;

an annular circumferential slot in the outer surface of said roller means, said slot having a width greater than the width of the peripheral edge of said blade and positioned to receive said blade edge therein to form a nip;

means for moving the sheet into said nip formed by said blade and said roller means; and

means for rotating said blade to move the peripheral edge thereof in the direction of movement of said sheet;

said peripheral cutting edge of said blade being a smooth continuous edge defined by similar beveled edge faces on opposite sides of the blade;

said roller means being an idler roller means and presenting a solid cylindrical outer surface to said sheet;

said blade being driven to move the peripheral edge thereof at a speed greater than the speed of the sheet; and,

there being lubrication means for supplying lubricant to the peripheral edge of said blade.

In a preferred embodiment, an upper tool head is mounted over the sheet and is laterally translatable across the width of the sheet to position the tool head on the desired cut line. An annular cutting blade is rotatably attached to the tool head such that the peripheral cutting edge of the blade extends downwardly beyond the opposite side of the board sheet. A lower tool head or counterhead is mounted on the underside of the sheet and is

also laterally translatable across the width of the sheet on a line parallel to the line of lateral translation of the upper tool head. Roller means are rotatably attached to the counterhead and present a cylindrical outer surface which is positioned to make tangent contact with and support the underside of the sheet. The roller means are provided with an annular circumferential slot in the outer surface, which slot has a width slightly greater than the width of the blade and is positioned to receive the rotating blade edge therein. Thus, the overlapping blade and roller means form a nip into which the moving sheet is fed for sitting. Drive means are provided to rotate the slitting blade edge in the direction of movement of the sheet and at a speed greater than the speed of the moving sheet. The provision of a supply of a lubricant to the cutting edge of the blade prevents a build-up on the blade of starch from the glue used to hold the components of the corrugated board together.

Preferably, the supporting roller means is formed from a pair of coaxially mounted rollers which are axially spaced such that their adjacent interior faces define the annular circumferential slot for receipt of the sitting blade. The rotational axis of the rollers is preferably offset in the upstream direction, with respect to movement of the sheet, from the rotational axis of the blade. Also, the diameter of the rollers is less than the diameter of the slitting blade and the offset position of the rollers is established such that the line of tangent contact of the rollers with the underside of the sheet defines a line which is normal and tangent to the blade edge where it exits the lower surface of the sheet.

The adjacent interior faces of the supporting rollers defining the circumferential slot preferably diverge in a radially inward direction. Alternately, the adjacent interior faces of the rollers may be recessed to define open interior portions. In either embodiment, the rollers are relatively more open in a radially inward direction to provide space for the accumulation of paper scraps, dust and the like. Preferably, a stripper bar is attached to the roller-supporting counterhead and extends through the circumferential slot to present an edge defining an acute angle with respect to the plane of the sheet and to diverge therefrom in the downstream direction of sheet movement. The combined rotary movement of the blade and rollers tends to cause accumulating paper scrap and the like to move along the stripper bar and out of the slot between the rollers.

In the preferred embodiment, the lubricant applying means comprises a wick holder which is attached to the upper tool head and presents a pair of spaced generally parallel legs positioned to straddle the cutting edge of the blade. A wick is

mounted on the inside of the legs of the wick holder to maintain contact with the blade edge while the blade is rotating and metered amounts of a lubricant are supplied to the wick. The wick holder is pivotally attached to the tool head for movement between the operative lubricating position and an inoperative position spaced radially beyond the blade edge to facilitate blade changing.

The slitting apparatus of the preferred embodiment also includes means for sharpening the blade edge on the fly or while the blade is rotating. The sharpening means includes a bracket attached to the upper tool head, a rotary sharpening tool pivotally attached to the bracket for movement between an operative position in contact with the cutting edge of the blade and an inoperative position out of contact therewith, means for moving the tool between its operative and inoperative positions, and means for rotating the tool when it is in its operative position in contact with the blade.

The longitudinal slitting apparatus of the preferred embodiment is utilized on a slitting apparatus of the prior art type in which a plurality of slits are provided spaced across the width of a traveling sheet or web. Thus, an upper support structure is positioned to overlie the advancing sheet and has an upper guide means defining a linear path across the width of the sheet. A plurality of upper tool heads are mounted on the upper guide means such that each of the upper tool heads may be individually moved along the linear path across the sheet. A blade holder is rotatably attached to each upper tool head and positioned for rotation on a common axis. A drive shaft is positioned on the common axis of the blade holders to simultaneously drive the same and to support the tool holders and upper tool heads for movement along the upper guide means. A thin annular slitting blade is carried on each of the blade holders, each blade presenting a downwardly depending circular cutting edge which extends below the bottom face of the sheet, as previously described. A lower support structure is disposed under the sheet and includes lower guide means defining a lower linear path across the width of the sheet and parallel to the upper linear path. A plurality of lower tool heads are mounted on the lower guide means with each of said lower tool heads individually movable on the guide means along the lower linear path. Roller means are rotatably attached to each of the lower tool heads, in a manner previously described, with the outer surface of the roller positioned to make tangent contact with the underside of the sheet. An annular circumferential slot is provided in the outer surface of the roller means, the slot having a width sufficient to receive therein the portion of the blade edge extending below the sheet. Means are provided for advancing the sheet over the roller means

and into the blade cutting edges, for rotating the drive shaft to move the blade cutting edges at a speed greater than the speed of the moving sheet, and for applying a lubricant to the blade cutting edges.

Preferably, each upper tool head includes separate positioning means for moving the tool head along the upper guide means and for carrying therewith its corresponding lower tool head along the lower guide means. In its most simple embodiment, the lower tool head is carried by virtue of contact between the slitting blade and the roller means. To provide a greater bearing surface for carrying contact between the blade and the roller means, each of the roller means may be pivotally attached to a lower tool head on a pivot axis parallel to the axis of rotation of the roller means to increase the amount of the blade edge which is received in the circumferential slot in the roller means.

Rotation of the sitting blades at a speed substantially in excess of the speed of the moving paperboard sheet, e.g. two or more times faster, provides a clean razor slit which is virtually dust free, thereby substantially eliminating all of the dust-related problems of prior art rotary shear and saw cutting apparatus. On the fly blade lubrication and sharpening provide, respectively elimination of starch build-up on the blades and the ability to maintain sharp cutting edges for extended periods of operation without shutdown.

The drawings illustrate the best mode presently contemplated of carrying out the invention.

In the drawings:

FIG. 1 is a side elevation, partly in section of a rotary sitting apparatus in accordance with one example of the present invention;

FIG. 2 is an end elevation of the rotary slitting apparatus shown in FIG. 1;

FIG. 3 is a vertical section taken on line 3-3 of FIG. 2;

FIG. 4 is an end elevation of a roller assembly of an alternate embodiment;

FIG. 5 is a detailed view of a portion of FIG. 4;

FIG. 6 is a side elevation of an alternate embodiment of the roller bracket assembly; and

FIGS. 7 and 8 are detail views of the rotary blade sharpening apparatus.

The main supporting framework for the slitting apparatus includes an horizontal upper beam 10 and a parallel lower beam 11. The beams 10 and 11 extend across the width of the slitting apparatus and are somewhat longer than the maximum width of a continuous moving web or sheet 13 of corrugated paperboard or the like which moves between the beams and the attached components of the slitting apparatus to be hereinafter described. A plurality of upper tool heads 12 are attached to the

underside of the upper beam 10 for individual movement across the width of the sheet 13 on a pair of linear ways 14 attached to the beam 10. Each upper tool head 12 has a pair of linear bearing pads 15 attached to its upper edge, which bearing pads connect the tool head to the linear ways 14 for positioning movement to set the tool head in the position where a longitudinal slit in the sheet 13 is desired.

A rotary tool holder 16 is attached to each upper tool head 12. The tool holder 16 includes an inner hub 17 which forms the inner race of a rotary bearing 18. The outer race 20 of the rotary bearing 18 is secured in an annular boss 21 in the tool head 12. The inner hub 17 of the tool holder 16 has an axial through bore 22 having a non-circular cross section, such as the hexagonal shape shown. The through bores 22 of the tool holders 16 mounted on the plurality of tool heads 12 lie on a common axis. A drive shaft 23 having a hexagonal cross section is mounted to extend through the bores 22 in each plurality of coaxially mounted tool holders 16. The drive shaft 23 extends across the full width of the apparatus and is connected at one end to suitable drive means, whereby its driving rotation causes tool holders 16 to rotate in bearings 18 with respect to the tool heads 12. Also, the drive shaft 23 provides support for the commonly mounted tool holders 16 and tool heads 12 for movement along the linear ways 14. Each tool holder 16 includes an outer hub 24 to which a thin annular slitting blade 25 is demountably attached, as with a series of machine screws 26 disposed in a circular pattern. The blades 25 depend downwardly from their respective tool heads such that the circular cutting edge extends below the underside 27 of the corrugated paperboard sheet 13.

A plurality of lower tool heads 28 are supported for individual sliding movement along a pair of lower linear ways 30 which are, in turn, attached to the upper surface of the lower beam 11. Each lower tool head 28 is supported for movement along the linear ways 30 by a pair of bearing pads 31 similar to the pads 15 on the upper tool heads 12. A pair of identical rollers 32 are coaxially mounted on each lower tool head 28 for rotation on an axis parallel to the axis of the upper drive shaft 23. The rollers 32 are mounted with suitable bearings on a roller shaft 33 which is, in turn, supported in a roller mounting bracket 34. The roller mounting bracket comprises a pair of vertical side plates 35 interconnected at their lower edges by a cross piece 36. Each of the side plates includes an upwardly opening mounting slot 37 in its upper edge for receipt of the roller shaft 33. The roller mounting bracket 34 is adjustably attached to one face of the lower tool head 28 by a pair of locking screws 41. Vertical adjustment of the rollers 32 is

provided with a pair of diametrically opposite adjustment slots 39 in the side plate 35 adjacent the roller mounting bracket 34. In this manner, the vertical position of the rollers 32 may be varied at the time of machine set-up to obtain accurate vertical positioning. The roller mounting bracket is locked in position with the locking screws 41 extending through the slots 39 and into suitably tapped holes in the lower tool head 28.

The rollers 32 are maintained axially spaced on the roller shaft 33, as by the use of suitable shims, to define therebetween an annular circumferential slot 44 having a width slightly greater than the width of the blade 25. The roller mounting bracket 34 and attached rollers 32 are positioned to make tangent contact with the lower surface of the moving sheet 13 and to allow a portion of the downwardly depending edge of the blade 25 to be received in the circumferential slot 44 between the rollers. The blade 25 is rotated in a clockwise direction as viewed in Fig. 1 and the moving sheet 13 is directed over the rollers 32 and into the nip formed by the rollers and the blade in the direction of rotation thereof, i.e. from right to left as viewed in Fig. 1. The drive shaft 23 is driven at a speed sufficient to impart an edge speed to the blade 25 which is substantially greater than the linear speed of the sheet. For example, the edge speed of the blade may be as much as three times the speed of the sheet or greater. By utilizing a very thin blade, in the range for example of 0.89 mm (.035 inches), and maintaining the cutting edge thereof in a sharpened condition, the sheet 13 of corrugated paper-board or the like is provided with a virtually dust-free and extremely clean cut.

The rollers 32 are preferably substantially smaller in diameter than the blade 25. The rollers may have a diameter in the range of 12.7-17.8 cm (five to seven inches), whereas the maximum diameter of the blade may be as much as approximately 30.5 cm (twelve inches). The axis of the roller shaft 33 is offset horizontally in an upstream direction from the axis of the drive shaft 23 for the blade 25. Preferably, the rollers 32 are positioned so that the line of tangent contact between the rollers and the underside of the sheet 13 coincides with a line normal to the plane of the blade 25 and tangent to the blade edge. In this manner, the rollers provide adequate support for the sheet against the downward force of the rapidly rotating blade, resulting in the characteristic clean cut.

As is best shown in Fig. 2, the rollers 32 in one embodiment are machined or otherwise formed from metal with large open annular recesses 53 on either side of a central web 50. The central web 50 interconnects an outer cylindrical rim 51 and an inner hub 52, with the hub supported on bearings 54 for rotation on the roller shaft 33. The circum-

ferential slot 44 between adjacent rollers is defined by the axially adjacent interior faces 45 thereof. In the Fig. 2 embodiment of the rollers, the width of the slot 44 is defined by adjacent outer radial edge portions 46 of the cylindrical rims 51. The slot may have a nominal width of approximately 1.14 mm (.045 inch). It is important that the axially adjacent interior faces of the rollers 32 define open interior portions, such as are provided by the annular recesses 53. This allows paper scraps or accumulated dust and the like to move radially inwardly away from the slot 44 so as to prevent a build-up at the slot/blade interface and possible jamming which would adversely affect the quality of the slit. To further prevent such a build-up and jamming, the roller mounting bracket 34 also supports a stripper bar 42 within the slot 44. The stripper bar is attached at its ends beyond the outer surfaces of the rollers by a pair of mounting pins 43 extending between the side plates 35 of the mounting bracket. Thus, the stripper bar extends completely through the slot and has an upper edge disposed at an acute angle with respect to the plane of the sheet and diverges therefrom in the downstream direction. The stripper bar 42 tends to prevent a build-up of accumulated debris in the slot 44, and its inclined angle tends to allow loose material to be swept out of the slot. In addition, the central webs 50 of the rollers 32 may be provided with a number of circumferentially spaced openings 55 to allow accumulated debris to be periodically removed from the annular recesses 53.

The most severe wear on the rollers 32 occurs at the axially adjacent radial edge portions 46 defining the slot 44. Abrasive wear from even small amounts of board dust and starch from the board adhesive created during slitting causes an eventual rounding of the edge portions 46 and eventually a widening of the slot 44. Should the slot be worn to an excessive width, shims between the bearings 54 may be moved to the axial outer faces of the rollers and the slot 44 returned to its original preferred width. It should also be noted that the construction of the rollers 32 of the Fig. 2 embodiment is such that they are axially symmetrical and may, therefore, be reversed to present new radial edge portions 46.

In Fig. 4, there is shown an alternate embodiment of the rollers 32. In this embodiment, each roller 56 comprises a substantially solid roller body 57, preferably constructed of a tough plastic material such as Nylatron or ultrahigh molecular weight polyethylene. The axial interior faces 58 of the roller bodies 57 are constructed to diverge in a radially inward direction to define a slot 60 having its narrowest width at the outer surface of the rollers 56. This is also to allow loose paper material and the like to move away from the radial outer

edge of the slot near the interface with the moving blade 25 and into the more open interior. Otherwise, the mounting assembly and stripper bar utilized with the alternate rollers 56 is identical to the preferred embodiment utilizing rollers 32.

Conventional corrugated paperboard is typically fabricated with a starch-based glue which, in Prior art board slitting devices, has been found to result in a starch build-up on the cutting blades. In the apparatus of the present invention, starch build-up on the blade is even more critical because of its direct adverse effect on the normally extremely high slit quality. In particular, the high speed at which the slitting blades 25 of the present invention are operated generates more heat which results in a faster build-up of starch. Eventually, the starch build-up may become great enough to result in extremely ragged cuts and tearing or crushing of the cut edges such that the clean razor slit characteristic of the present invention is completely lost. To prevent a build-up of starch on the blade surfaces adjacent the cutting edges, a blade lubricator 61 provides a continuous thin coating of a light lubricant to the blade while the blade is in slitting operation. The blade lubricator 61 includes a generally U-shaped wick holder 62 pivotally attached at its closed end to the upper tool head 12 by a mounting bolt 63. The wick holder has a pair of spaced, generally parallel legs 64 operatively positioned to straddle the cutting edge of the blade 25. A piece of wick material is inserted in the wick holder and secured to the inside faces of the legs 64. With the wick holder disposed in its operative full line position shown in Fig. 1, the wick 65 is in continuous contact with the blade surfaces adjacent the cutting edge. Small metered amounts of a light liquid lubricant, such as a thin penetrating oil, are supplied to the wick holder and onto the wick 65 by a positive displacement injector 66 attached to the tool head 12 and receiving lubricant from a common source (not shown). Only very small amounts of lubricant are necessary to coat the blade edge with a thin layer that prevents starch from sticking to the blade, thereby precluding any starch build-up. For example, the positive displacement injector 66 may provide about 0.2 ml (0.2 cc) of lubricant to the wick on times pulses every eight seconds. Obviously, the amount of starch available to build-up on a blade is greatly dependent on the upstream gluing process and variations in the volume of lubricant supplied and the timing of the injection pulses may be suitably provided. To facilitate changing or repositioning of the blade 25, the lubricator 61 is pivotable about the mounting bolt 63 to an inoperative dashed line position shown in Fig. 1 in which the wick holder 62 and attached wick 65 are spaced radially beyond the blade edge.

Each of the slitting blades 25, as previously indicated, may have a thickness of approximately .035 inch and is preferably made of a high quality steel. The cutting edge 67 of the blade as shown in the sectional view of the blade in Fig. 7 is provided with a double bevel. The outer bevel at the cutting edge may have, for example, an included angle of 37°. In order to maintain the high quality slit, the blade must not only be kept free from the build-up of starch, but the cutting edge must be maintained in a razor sharp condition.

To maintain the necessary sharp cutting edge, the slitting apparatus includes a blade sharpener 68 adapted to sharpen one face of the outer blade edge bevel while the blade is rotating. The blade sharpener 68 is attached to an angled mounting bracket 70 mounted by its vertical leg 71 to the face of the upper tool head 12 such that the horizontal leg 72 extends over the upper edge of the blade 25. A rotary sharpening tool 73 is attached to the horizontal leg 72 of the mounting bracket and depends downwardly therefrom. The sharpening tool includes a circular sharpening head 74 having a flat outer abrasive face 75. The head is rotatably attached to a small air motor 76 attached to one end of a tool body 77 such that the abrasive face 75 is disposed at the same angle as the adjacent face of the blade edge bevel. The tool body 77 is pivotally attached at its end opposite the air motor to the underside of the horizontal leg 72 of the mounting bracket 70. Specifically, the end of the tool body 77 is provided with a cylindrical recess 78 providing the outer race for a ball bearing assembly 80, the inner race of which is attached to the end of a stub shaft 80 attached to and extending down from the mounting bracket 70. A torsion spring 82 surrounds the stub shaft 81 with its ends in engagement with the mounting bracket and the tool body 77 to bias the latter to an inoperative position in which the abrasive face 75 is out of engagement with the blade edge. A small single acting air cylinder 83 is attached to the mounting bracket 70 with the rod end 84 of the cylinder in contact with the surface of the tool body 77. When compressed air is supplied to the air cylinder inlet fitting 85 from an external source (not shown), the rod end 84 will be extended and the tool body and attached sharpening head 74 will be rotated about the stub shaft 81, against the bias of the torsion spring 82, until the abrasive face 75 makes light contact with the beveled edge of the blade 25. Air cylinder 83 operates at very low pressure such that the abrasive face 75 makes light surface contact with the blade edge. The air motor 76 which drives the rotary sharpening head 74 is also supplied with compressed air via a fitting 86 to drive the air motor whenever the tool body is rotated into operative sharpening position by ac-

tivation of the air cylinder 83. The air motor 76 preferably operates at relatively high speed, for example, about 5,000 rpm.

Under substantially continuous operating conditions, if the blades 25 are made of a high quality tool steel, it has been found that the blades need only be sharpened a few times per week. The sharpening tool 73 is operated so that the sharpening head 74 applies only a very light force of not more than about three pounds to the face of the bevel. Sharpening contact need be maintained for only a short period of time to remove approximately 0.025-0.050 mm (.001-.002 inch) of material from the blade edge. Periodically, the blade may be removed from the tool holder 16 and reversed so that the opposite face of the edge bevel may be sharpened to maintain an overall balance in the cutting edge of the blade. The sitting blades of the present invention are tolerant to a substantial reduction in overall blade diameter as a result of sharpening without adversely affecting the quality of the slit. Also, little adjustment, if any, of the blade position is necessary over its useful life.

As indicated previously, in a typical slitter apparatus, a plurality of upper tool heads 12 and slitting blades 25 are mounted on a common drive shaft 23 for individual movement and selective positioning along the linear ways 14 to provide a plurality of longitudinal slits in the advancing sheet 13 at any selected positions across the width of the sheet. To individually position each upper tool head 12, an electric servomotor 87 is mounted on each tool head and drives a pinion gear 88 positioned to engage a linear toothed rack 90 attached to the underside of the upper beam 10, in a manner well known in the art. It is also known to utilize a similar motor-driven rack and pinion assembly to position the lower tool heads 28. In accordance with the present invention, however, it has been found that both the upper and lower tool heads may be simultaneously moved and repositioned with a single upper servomotor 87 and its related gear 88 and rack 90 in a manner in which the overlapping portion of the cutting blade 25 within the slot 44 between the rollers 32 (or 56) bears on the axial inner face of the roller and carries the roller assembly and lower tool head 28 along with the moving upper head assembly. In some instances, however, it is recognized that the blade/roller overlap, the strength of the blade material, or the speed or thrust of the servomotor assembly may be such that the bearing force between the blade edge and the rollers may break or otherwise damage the blade. Thus, in Fig. 6, there is shown a modified assembly in which the entire roller mounting bracket 34 and attached rollers 32 may be pivoted upwardly so that a much larger portion of the blade edge is received within the slot 44 to enhance the

bearing contact surface therebetween and distribute the load imposed by repositioning over a greater portion of the blade edge. Repositioning of the upper and lower tool heads is, of course, undertaken between board runs and, therefore, at a time when there is no sheet present to interfere with the substantial upward movement of the rollers and roller mounting bracket assembly.

As previously indicated, the rollers 32 (or 56) support the advancing sheet at the point where the slitting blade passes through the sheet. Supplemental support of the sheet 13 is also preferably provided just upstream of the rollers and slitting knife by an appropriate sheet supporting surface 91, as shown in Fig. 1. The continuous sheet 13 or web is otherwise driven by appropriate means external of the slitting apparatus, as is also well known in the art. As is also known in the prior art, each of the plurality of upper tool heads 12 mounted on the common drive shaft 23 and linear ways 14 are simultaneously locked in their selected slitting positions with a common lockdown apparatus 92. In the embodiment shown, the lockdown apparatus comprises a long cylindrical cam extending across the full width of the apparatus and supported for rotation on its axis between a locking position with its cylindrical outer surface in locking engagement with a locking pad 94 on each tool head and an unlocked position in which an axial flat surface 95 on the cam 93 is positioned directly adjacent and spaced from the locking pad 94. In the latter position, the tool heads are unlocked for repositioning. Similarly, the plurality of lower tool heads 28 are also locked in operating position with an identical lockdown apparatus 92 including all components identical to those used for the upper locking mechanism.

Claims

1. An apparatus for longitudinally slitting a moving sheet (13) of corrugated paperboard, of the type having multiple paper layers secured together by an adhesive, comprising an annular rotatable blade (25) mounted so as to be on one side of said paperboard sheet (13) in use with the peripheral cutting edge (67) of said blade (25) extending, in use, beyond the opposite side of said sheet (13);
rotatable roller means (32; 56) mounted so as to be on said opposite side of said paperboard sheet (13) in use and having a cylindrical outer surface positioned in use to make tangent contact with said opposite side of said sheet (13);
an annular circumferential slot (44) in the outer surface of said roller means (32; 56), said slot (44) having a width greater than the width

of the peripheral edge (67) of said blade (25) and positioned to receive said blade edge (67) therein to form a nip;

means for moving the sheet (13) into said nip formed by said blade (25) and said roller means (32; 56); and

means for rotating said blade (25) to move the peripheral edge (67) thereof in the direction of movement of said sheet (13);

the apparatus being characterized in that;

said peripheral cutting edge (67) of said blade (25) is a smooth continuous edge defined by similar beveled edge faces on opposite sides of the blade;

said roller means (32; 56) is an idler roller means and presents a solid cylindrical outer surface to said sheet (13);

said blade (25) is driven to move the peripheral edge (67) thereof at a speed greater than the speed of the sheet (13); and,

lubrication means (61) is provided for supplying lubricant to the peripheral edge (67) of the blade (25) of the apparatus.

2. Apparatus as claimed in Claim 1, further comprising:

a tool head (12) mounted on one side of the sheet and translatable laterally across the width of the sheet on a line parallel thereto, the blade (25) being rotatably attached to the tool head (12); and

a counterhead (28) mounted on the opposite side of the sheet and translatable laterally across the width of the sheet on a line parallel to the line of translation of the tool head (12), the roller means (32; 56) being rotatably attached to the counterhead (28).

3. Apparatus as claimed in Claim 1, for slitting a continuous, travelling sheet of corrugated paperboard (13) to provide a plurality of parallel, spaced slits characterized by one or more further annular rotatable blades (25) mounted so as to be on one side of sheet (13) in use with the respective peripheral cutting edge (67) thereof extending, in use, beyond the opposite side of said sheet (13);

corresponding one or more further rotatable roller means (32; 56) mounted so as to be on said opposite side of said sheet (13) in use and having a cylindrical outer surface positioned in use to make tangent contact with said opposite side of said sheet (13);

an annular circumferential slot (44) in the outer surface of said further roller means (32; 56) having a width greater than the width of the peripheral edge (67) of the respective blade

(25) and positioned to receive said blade edge (67) therein to form a nip;

means for moving the sheet (13) into said nips formed by said blades (25) and said roller means (32; 56); and

means for rotating said blades (25) to move the peripheral edges (67) thereof in the direction of movement of said sheet (13);

the peripheral cutting edge (67) of the or each further blade (25) being a smooth continuous edge defined by similar beveled edge faces on opposite sides of the blade;

the or each further roller means (32; 56) being an idler roller means and presenting a solid cylindrical outer surface to said sheet (13);

the or each further blade (25) being driven at the speed of the first mentioned blade (25); and

the or each further blade (25) having lubrication means (61) for supplying lubricant to the peripheral edge (67) thereof.

4. An apparatus as claimed in Claim 3 for longitudinally slitting a continuous, travelling sheet of corrugated paperboard (13) of the type having multiple paper layers secured together by an adhesive, or the like, to provide a plurality of parallel spaced slits, said apparatus being characterized by:

an upper support structure (10) overlying the sheet in use and having upper guide means (14) defining an upper linear path across the width of the sheet (13);

a plurality of tool heads (12) mounted on said upper guide means (14), each of said tool heads being movable individually thereon along said upper linear path;

a tool holder (16) rotatably attached to each tool head (12) for rotation on a common axis parallel to said guide means (14) and each tool holder (16) carrying a respective blade (25);

a drive shaft (23) positioned on said common axis to simultaneously drive said tool holders (16) and to support said tool holders (16) and upper tool heads (12) for movement along said upper guide means (14);

a lower support structure (11) under the sheet (13) in use and having lower guide means (30) defining a lower linear path parallel to the upper linear path;

a plurality of counterheads (28) mounted on said lower guide means (30), each of said counterheads (28) movable individually thereon along said lower linear path and each counterhead (28) supporting a respective roller means (32; 56); and, means for rotating said

drive shaft (23) to rotate said blades (25).

5. An apparatus as claimed in any one of Claims 1 to 4, **characterized in that** the or each lubricant applying means (61) is operative during blade rotation. 5
6. An apparatus as claimed in Claim 5 when dependent upon Claim 2 or 4, **characterized in that** the or each lubricant applying means (61) comprises: 10
 - a respective wick holder (62) attached to the or each tool head (12) and having a pair of spaced generally parallel legs (64) operatively positioned to straddle the cutting edge (67) of the blade (25); 15
 - a wick (65) mounted on the inside of said legs (64) and in contact with the blade (25) adjacent its cutting edge (67); and,
 - means (66) for supplying metered amounts of a lubricant to said wick (65). 20
7. An apparatus as claimed in Claim 6, **characterized in that** the or each wick holder (62) is pivotally mounted to the respective tool head (12) for movement between its operative lubricating position and an inoperative blade changing position spaced radially beyond the blade edge (67). 25

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8. An apparatus as claimed in any one of Claims 1 to 7, **characterized by** means (68) for sharpening the cutting edge (67) of the or each blade (25) while said blade is rotating. 35

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9. An apparatus as claimed in Claim 8 when dependent upon Claim 2, 4, 6 or 7, **characterized in that** said sharpening means comprises: 40
 - a respective bracket (70) attached to the or each tool head (12);
 - a respective rotary sharpening tool (73) pivotally attached to the respective mounting bracket (70) for movement between the operative position in contact with the cutting edge region of the respective blade (25) and an inoperative position out of contact therewith; 45
 - means (82, 83) for moving said tool (73) between its operative and inoperative positions; and,
 - means (76) for rotating said tool (73) when in its operative position. 50
10. An apparatus as claimed in any one of the preceding claims, **characterized in that** the rotational axis of said roller means (32; 56) is offset in the upstream direction from the rotational axis of said blade (25). 55

11. An apparatus as claimed in any one of the preceding claims, **characterized in that** the diameter of said roller means (32; 56) is less than the diameter of said blade (25), and the line of tangent contact of said roller means (32; 56) with the sheet (13) in use coincides with a line normal and tangent to the blade edge (67).
12. An apparatus as claimed in any one of the preceding claims, **characterized in that** the or each roller means (32; 56) comprises a pair of coaxially mounted rollers (32; 56) having axially adjacent interior faces (45; 58) with outer radial edge portions spaced to define said annular circumferential slot (44).
13. An apparatus as claimed in Claim 12, **characterized in that** the adjacent interior faces (58) of said rollers (56) are divergent in a radially inward direction.
14. An apparatus as claimed in Claim 4, **characterized by** positioning means operatively interconnecting each tool head (12) and said upper support structure (10) for moving said tool head along said upper guide means (14) and for carrying therewith its corresponding counterhead (28) along said lower guide means (30).
15. An apparatus as claimed in Claim 14, **characterized by** means for pivotally attaching each of said roller means (32; 56) to its counterhead (28) on a pivot axis parallel to the axis of rotation of said roller means for varying the amount of the blade edges (67) received in the respective slot (44).

Patentansprüche

1. Vorrichtung zum Längsschneiden eines beweglichen Weilpappebogens (13), der mehrere durch einen Klebstoff miteinander verbundene Papierschichten aufweist, mit einem ringförmigen drehbaren Schneidmesser (25), das im Einsatz an einer Seite des Pappbogens (13) angeordnet ist, wobei sich die Umfangsschneidkante (67) des Schneidmessers (25) im Einsatz über die gegenüberliegende Seite des Bogens (13) hinaus erstreckt; einer Drehrolleneinrichtung (32; 56), die im Einsatz an der gegenüberliegenden Seite des Pappbogens (13) angeordnet ist und eine zylindrische Außenfläche aufweist, die im Einsatz in tangentialen Kontakt mit der gegenüberliegenden Seite des Bogens (13) steht; einem ringförmigen Umfangsschlitz (44) in der Außenfläche der Rolleneinrichtung (32; 56),

wobei der Schlitz (44) eine größere Breite als die Umfangsschneidkante (67) des Schneidmessers (25) aufweist und zur Aufnahme der Schneidkante (67) unter Bildung eines Spalts angeordnet ist;

Mitteln zur Bewegung des Bogens (13) in den durch das Schneidmesser (25) und die Rolleneinrichtung (32; 56) gebildeten Spalt; und Mitteln zur Drehung des Schneidmessers (25) zur Bewegung seiner Umfangskante (67) in der Bewegungsrichtung des Bogens (13);

dadurch gekennzeichnet, daß die Umfangsschneidkante (67) des Schneidmessers (25) eine gleichmäßige durchgehende Schneide ist, die durch gleichartig abgeschrägte Schneidflächen auf gegenüberliegenden Seiten des Schneidmessers begrenzt wird;

die Rolleneinrichtung (32; 56) eine Leitrolleneinrichtung ist und dem Bogen (13) eine feste zylindrische Außenfläche bietet;

das Schneidmesser (25) zur Bewegung seiner Umfangskante (67) mit einer größeren Geschwindigkeit als der Bogen (13) angetrieben wird; und

eine Schmiereinrichtung (61) zur Zufuhr eines Schmierstoffs an die Umfangskante (67) des Schneidmessers (25) der Vorrichtung vorgesehen ist.

2. Vorrichtung nach Anspruch 1, ferner mit:

einem an einer Seite des Bogens angeordneten und quer über die Breite des Bogens auf einer dazu parallelen Linie verschiebbaren Werkzeugkopf (12), an dem das Schneidmesser (25) drehbar angeordnet ist; und einem an der gegenüberliegenden Seite des Bogens angeordneten und quer über die Breite des Bogens auf einer Linie parallel zur Translationslinie des Werkzeugkopfs (12) verschiebbaren Gegenkopf (28), an dem die Rolleneinrichtung (32; 56) drehbar angeordnet ist.

3. Vorrichtung nach Anspruch 1 zum Schneiden eines durchgehenden, sich bewegenden Wellpappebogens (13) zur Erzeugung mehrerer paralleler, beabstandeter Schnitte, gekennzeichnet durch

ein oder mehrere weitere ringförmige drehbare Schneidmesser (25), die im Einsatz auf einer Seite des Bogens (13) angeordnet sind, wobei sich deren jeweilige Umfangsschneidkante (67) im Einsatz über die gegenüberliegende Seite des Bogens (13) hinaus erstreckt;

entsprechend eine oder mehrere weitere Drehrolleneinrichtungen (32; 56), die im Einsatz auf der gegenüberliegenden Seite des Bogens (13) angeordnet sind und eine im Einsatz im tangentialen Kontakt mit der gegenüberliegen-

den Seite des Bogens (13) stehende zylindrische Außenfläche aufweisen;

einen ringförmigen Umfangsschlitz (44) in der Außenfläche der weiteren Rolleneinrichtung (32; 56), wobei der Schlitz eine größere Breite als die Umfangskante (67) des Schneidmessers (25) aufweist und zur Aufnahme der Schneidkante (67) unter Bildung eines Spalts angeordnet ist;

Mittel zur Bewegung des Bogens (13) in den durch das Schneidmesser (25) und die Rolleneinrichtung (32; 56) gebildeten Spalt; und Mittel zur Drehung des Schneidmessers (25) zur Bewegung seiner Umfangskante (67) in Bewegungsrichtung des Bogens (13);

wobei die Umfangsschneidkante (67) des oder jedes weiteren Schneidmessers (25) eine gleichmäßige durchgehende Kante ist, die durch in ähnlicher Weise abgeschrägte Schneidflächen an gegenüberliegenden Seiten der Schneide begrenzt wird;

wobei die oder jede der weiteren Rolleneinrichtungen (32; 56) eine Leitrolleneinrichtung ist und dem Bogen (13) eine feste zylindrische Außenfläche bietet;

wobei das oder jedes weitere Schneidmesser (25) mit der Geschwindigkeit des zuerst genannten Messers (25) angetrieben wird; und wobei das oder jedes weitere Schneidmesser (25) eine Schmiereinrichtung (61) zur Zufuhr eines Schmierstoffs an seine Umfangskante (67) aufweist.

4. Vorrichtung nach Anspruch 3 zum Längsschneiden eines durchgehenden, bewegten Wellpappebogens (13), der mehrere durch einen Klebstoff miteinander verbundene Papierschichten aufweist, gekennzeichnet durch:

eine im Einsatz über dem Bogen liegenden oberen Trägerstruktur (10) mit einem oberen Führungsmittel (14), das einen oberen Linearweg über der Breite des Bogens (13) definiert; mehrere an dem oberen Führungsmittel (14) angeordnete Werkzeugköpfe (12), die jeweils unabhängig voneinander entlang dem oberen Linearweg beweglich sind;

einen an jedem Werkzeugkopf (12) drehbar angeordneten Werkzeughalter (16) zur Drehung auf einer gemeinsamen Achse parallel zu dem Führungsmittel (14), wobei jeder Werkzeughalter (16) ein entsprechendes Schneidmesser (25) trägt;

eine Antriebswelle (23), die auf der gemeinsamen Achse zum gleichzeitigen Antrieb der Werkzeughalter (16) und zur Halterung der Werkzeughalter (16) und der oberen Werkzeugköpfe (12) zur Bewegung entlang dem oberen Führungsmittel (14) angeordnet ist;

- eine im Einsatz unter dem Bogen (13) angeordnete untere Trägerstruktur (11) mit einem unteren Führungsmittel (30), das einen unteren Linearweg parallel zum oberen Linearweg definiert;
- mehrere Gegenköpfe (28), die auf dem unteren Führungsmittel (30) angeordnet sind, wobei jeder der Gegenköpfe (28) unabhängig voneinander entlang dem unteren Linearweg bewegbar ist, und wobei jeder Gegenkopf (28) eine entsprechende Rolleneinrichtung (32; 56) trägt; und
- Mittel für die Drehung der Antriebswelle (23) zum Drehen der Schneidmesser (25).
5. Vorrichtung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die oder jede Schmiereinrichtung (61) während der Drehung des Schneidmessers in Betrieb ist.
6. Vorrichtung nach Anspruch 5, soweit abhängig von Anspruch 2 oder 4, dadurch gekennzeichnet, daß die oder jede Schmiereinrichtung (61) umfaßt:
- einen entsprechenden Dochthalter (62), der an dem oder jedem der Werkzeugköpfe (12) befestigt ist und ein Paar beabstandeter, im allgemeinen paralleler Schenkel (64) aufweist, die in Betrieb zur Überbrückung der Schneidkante (67) des Schneidmessers (25) angeordnet sind;
- einen Docht (65), der an der Innenseite der Schenkel (64) angeordnet ist und in Kontakt mit dem Schneidmesser (25) angrenzend an seine Schneidkante (67) angeordnet ist; und
- Mittel (66) zur Zufuhr einer abgemessenen Menge eines Schmierstoffs zum Docht (65).
7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß der oder jeder Dochthalter (62) an dem entsprechenden Werkzeugkopf (12) zur Bewegung zwischen seiner funktionellen Schmierstellung und einer radial von der Schneidkante (67) beabstandeten, nicht betriebsbereiten Schneidmesserwechselstellung, gelenkig angeordnet ist.
8. Vorrichtung nach einem der Ansprüche 1 bis 7, gekennzeichnet durch Mittel (68) zum Schärfen der Schneidkante (67) des oder der Schneidmesser (25) während der Drehung des Schneidmessers.
9. Vorrichtung nach Anspruch 8, soweit abhängig von Anspruch 2, 4, 6 oder 7, dadurch gekennzeichnet, daß die Schärfmittel umfassen:
- eine entsprechende Stütze (70), die an dem oder jedem Werkzeugkopf (12) befestigt ist;
- ein entsprechendes drehbares Schleifwerkzeug (73), das an der entsprechenden Stütze (70) zur Bewegung zwischen der Betriebsstellung in Kontakt mit dem Schneidkantenbereich des entsprechenden Schneidmessers (25) und einer nicht betriebsbereiten Stellung außer Kontakt damit verschwenkbar ist;
- Mittel (82, 83) zur Bewegung des Werkzeugs (73) zwischen dessen betriebsbereiten und nicht betriebsbereiten Stellung; und
- Mittel (76) zur Drehung des Werkzeugs (73) in der Betriebsstellung.
10. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Drehachse der Rolleneinrichtung (32; 56) stromaufwärts versetzt ist von der Drehachse des Schneidmessers (25).
11. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Durchmesser der Rolleneinrichtung (32; 56) geringer als der Durchmesser des Schneidmessers (25) ist, und daß die Linie des Tangentialkontakts der Rolleneinrichtung (32; 56) mit dem Bogen (13) im Betrieb mit einer Linie senkrecht und tangential zu der Schneidkante (67) übereinstimmt.
12. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die oder jede Rolleneinrichtung (32; 56) zwei koaxial angeordnete Rollen (32; 56) umfaßt, die axial angrenzende Innenflächen (45; 58) mit äußeren Radialkanten aufweisen, die zur Bildung des ringförmigen Umfangsschlitzes (44) beabstandet sind.
13. Vorrichtung nach Anspruch 12, dadurch gekennzeichnet, daß die angrenzenden Innenflächen (58) der Rollen (56) radial nach innen divergieren.
14. Vorrichtung nach Anspruch 4, gekennzeichnet durch Positioniermittel, die jeden Werkzeugkopf (12) und die obere Trägerstruktur (10) funktionell verbinden, um den Werkzeugkopf entlang dem oberen Führungsmittel (14) zu bewegen, und um damit dessen entsprechenden Gegenkopf (28) entlang dem unteren Führungsmittel (30) zu führen.
15. Vorrichtung nach Anspruch 14, gekennzeichnet durch Mittel zur schwenkbaren Halterung jeder Rolleneinrichtung (32; 56) an deren Gegenkopf (28) auf einer Schwenkachse parallel zur Drehachse der Rolleneinrichtung zur Veränderung des Bereichs der in dem entsprechenden

Schlitz (44) aufgenommenen Schneidkante (67).

Revendications

1. Appareil de découpage longitudinal d'une feuille en déplacement (13), composée de carton ondulé, du type comportant des couches de papier multiples assemblées par un adhésif, comprenant une lame annulaire rotative (25) montée de sorte à se situer sur un côté de ladite feuille de carton (13) utilisée, l'arête coupante périphérique (67) de ladite lame (25) s'étendant en service au-delà du côté opposé de ladite feuille (13);
 - un moyen de rouleau rotatif (32; 56) monté de sorte à se situer sur ledit côté opposé de ladite feuille de carton (13) utilisée et ayant une surface externe cylindrique agencée en service de sorte à établir un contact tangentiel avec ledit côté opposé de ladite feuille (13);
 - une fente circonférentielle annulaire (44) dans la surface externe dudit moyen de rouleau (32; 56), ladite fente (44) ayant une largeur supérieure à la largeur de l'arête périphérique (67) de ladite lame (25) et positionnée de sorte à recevoir ladite arête de la lame (67) pour former un pincement;
 - un moyen pour déplacer la feuille (13) dans ledit pincement formé par ladite lame (25) et ledit moyen de rouleau (32; 56); et
 - un moyen pour tourner ladite lame (25) pour déplacer l'arête périphérique (67) correspondante dans la direction du déplacement de ladite feuille (13);
 l'appareil étant caractérisé en ce que;
 - ladite arête coupante périphérique (67) de ladite lame (25) est une arête continue lisse définie par des faces d'arête biseautées similaires sur les côtés opposés de la lame;
 - ledit moyen de rouleau (32; 56) est un moyen de rouleau tendeur et présente une surface externe cylindrique solide à ladite feuille (13);
 - ladite lame (25) est entraînée pour déplacer l'arête périphérique (67) correspondante à une vitesse supérieure à la vitesse de la feuille (13); et
 - un moyen de lubrification (61) sert à amener un lubrifiant à l'arête périphérique (67) de la lame (25) de l'appareil.
2. Appareil selon la revendication 1, comprenant en outre:
 - une tête porte-outil (12) montée sur un côté de la feuille et pouvant effectuer un mouvement de translation latéral à travers la largeur de la feuille sur une ligne parallèle à

celle-ci, la lame (25) étant fixée par rotation à la tête porte-outil (12); et

une contre-tête (28) montée sur le côté opposé de la feuille et pouvant effectuer un mouvement de translation latéral à travers la largeur de la feuille sur une ligne parallèle à la ligne du déplacement de la tête porte-outil (12), le moyen de rouleau (32; 56) étant fixé par rotation à la contre-tête (28).

3. Appareil selon la revendication 1, pour le découpage d'une feuille continue en déplacement, composée de carton ondulé (13), pour produire plusieurs découpages parallèles espacés, caractérisé par une ou plusieurs lames rotatives annulaires (25) montées de sorte à se situer sur un côté de la feuille (13) utilisée, l'arête coupante périphérique respective (67) s'étendant en service au-delà du côté opposé de ladite feuille (13);
 - par un ou plusieurs moyens de rouleau rotatifs correspondants supplémentaires (32; 56) montés de sorte à se situer sur ledit côté opposé de ladite feuille (13) utilisée et ayant une surface externe cylindrique agencée en service de sorte à établir un contact tangentiel avec ledit côté opposé de ladite feuille (13);
 - par une fente circonférentielle annulaire (44) dans la surface externe dudit moyen de rouleau supplémentaire (32; 56) ayant une largeur supérieure à la largeur de l'arête périphérique (67) de la lame respective (25) et agencée de sorte à recevoir l'arête de la lame (67) pour former un pincement;
 - par un moyen pour déplacer la feuille (13) dans lesdits pincements formés par lesdites lames (25) et ledit moyen de rouleau (32; 56); et
 - par un moyen pour tourner lesdites lames (25) pour déplacer les arêtes périphériques (67) correspondantes dans la direction du déplacement de ladite feuille (13);
 - l'arête coupante périphérique (67) de la lame ou de chaque lame supplémentaire (25) étant une arête continue lisse définie par des faces d'arête biseautées similaires sur les côtés opposés de la lame;
 - le moyen de rouleau ou chaque moyen de rouleau supplémentaire (32; 56) étant un moyen de rouleau tendeur et présentant une surface externe cylindrique solide à ladite feuille (13);
 - la lame ou chaque lame supplémentaire (25) étant entraînée à la vitesse de la première lame citée (25); et
 - la lame ou chaque lame supplémentaire (25) comportant un moyen de lubrification (61) pour amener un lubrifiant à l'arête périphérique

correspondante (67).

4. Appareil selon la revendication 3 pour le découpage longitudinal d'une feuille continue en déplacement, composée de carton ondulé (13), du type comportant des couches de papier multiples assemblées par un adhésif ou par un moyen similaire, pour produire plusieurs découpages parallèles espacés, ledit appareil étant caractérisé par:

une structure de support supérieure (10) superposée à la feuille utilisée et comportant un moyen de guidage supérieur (14) définissant une trajectoire linéaire supérieure à travers la largeur de la feuille (13);

plusieurs têtes porte-outil (12) montées sur ledit moyen de guidage supérieur (14), chacune desdites têtes porte-outil pouvant être déplacée individuellement le long de ladite trajectoire linéaire supérieure;

un porte-outil (16) fixé par rotation à chaque tête porte-outil (12) en vue d'une rotation sur un axe commun parallèle audit moyen de guidage (14), chaque porte-outil (16) supportant une lame respective (25);

un arbre de commande (23) positionné sur ledit axe commun pour entraîner simultanément lesdits porte-outils (16) et pour supporter lesdits porte-outils (16) et les têtes porte-outil supérieures (12) en vue d'un déplacement le long dudit moyen de guidage supérieur (14);

une structure de support inférieure (11) au-dessous de la feuille (13) utilisée et comportant un moyen de guidage inférieur (30) définissant une trajectoire linéaire inférieure parallèle à la trajectoire linéaire supérieure;

plusieurs contre-têtes (28) montées sur ledit moyen de guidage inférieur (30), chacune desdites contre-têtes (28) pouvant être déplacée individuellement le long de ladite trajectoire inférieure et chaque contre-tête (28) supportant un moyen de rouleau respectif (32; 56); et un moyen pour tourner ledit arbre de commande (23) pour faire tourner lesdites lames (25).

5. Appareil selon l'une quelconque des revendications 1 à 4, caractérisé en ce que le ou chaque moyen d'application de lubrifiant (61) peut être actionné pendant la rotation de la lame.

6. Appareil selon la revendication 5, dans la mesure où elle dépend des revendications 2 ou 4, caractérisé en ce que le ou chaque moyen d'application de lubrifiant (61) comprend:

un porte-mèche respectif (62) fixé à la ou à chaque tête porte-outil (12) et comportant une paire de branches espacées généralement

parallèles (64) positionnées en service de sorte à enjamber l'arête coupante (67) de la lame (25);

une mèche (65) montée sur l'intérieur desdites branches (64) et en contact avec la lame (25) près de son arête coupante (67); et

un moyen (66) pour amener des quantités dosées d'un lubrifiant à ladite mèche (65).

7. Appareil selon la revendication 6, caractérisé en ce que le ou chaque porte-mèche (62) est monté par pivotement sur la tête porte-outil respective (12) en vue d'un déplacement entre sa position de lubrification de service et une position d'arrêt et de remplacement de la lame, espacée radialement au-dessus de l'arête de la lame (67).

8. Appareil selon l'une quelconque des revendications 1 à 7, caractérisé par un moyen (68) pour affûter l'arête coupante (67) de la ou de chaque lame (25) au cours de la rotation de ladite lame.

9. Appareil selon la revendication 8, dans la mesure où elle dépend des revendications 2, 4, 6 ou 7, caractérisé en ce que ledit moyen d'affûtage comprend:

une console respective (70) fixée à la ou à chaque tête porte-outil (12);

un outil d'affûtage rotatif respectif (73) fixé par pivotement à la console de montage respective (70) en vue d'un déplacement entre la position de service, en contact avec la région de l'arête coupante de la lame respective (25), et une position d'arrêt, hors de contact avec celle-ci;

un moyen (82, 83) pour déplacer ledit outil (73) entre ses positions de service et d'arrêt; et

un moyen (76) pour faire tourner ledit outil (73) lorsqu'il se trouve dans sa position de service.

10. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que l'axe de rotation dudit moyen de rouleau (32; 56) est décalé dans la direction orientée en amont par rapport à l'axe de rotation de ladite lame (25).

11. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que le diamètre dudit moyen de rouleau (32; 56) est inférieur au diamètre de ladite lame (25), la ligne du contact tangentiel entre ledit moyen de rouleau (32; 56) et ladite feuille (13) utilisée coïncidant avec une ligne perpendiculaire et

tangentielle à l'arête de la lame (67).

12. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que le ou chaque moyen de rouleau (32; 56) comprend une paire de rouleaux montés coaxialement (32; 56), ayant chacun des faces internes axialement adjacentes (45; 58) avec des parties de bord externes radiales espacées pour définir ladite fente annulaire circonférentielle (44). 5 10
13. Appareil selon la revendication 12, caractérisé en ce que les faces internes adjacentes (58) desdits rouleaux (56) divergent dans une direction orientée radialement vers l'intérieur. 15
14. Appareil selon la revendication 4, caractérisé par un moyen de positionnement connectant en service chaque tête porte-outil (12) et ladite structure de support supérieure (10) pour déplacer ladite tête porte-outil le long dudit moyen de guidage supérieur (14) et pour déplacer ainsi sa contre-tête correspondante (28) le long dudit moyen de guidage inférieur (30). 20 25
15. Appareil selon la revendication 14, caractérisé par un moyen pour fixer par pivotement chacun desdits moyens de rouleau (32; 56) à sa contre-tête (28) sur un axe de pivotement parallèle à l'axe de rotation dudit moyen de rouleau pour changer la portion des arêtes de la lame (67) reçue dans la fente respective (44). 30

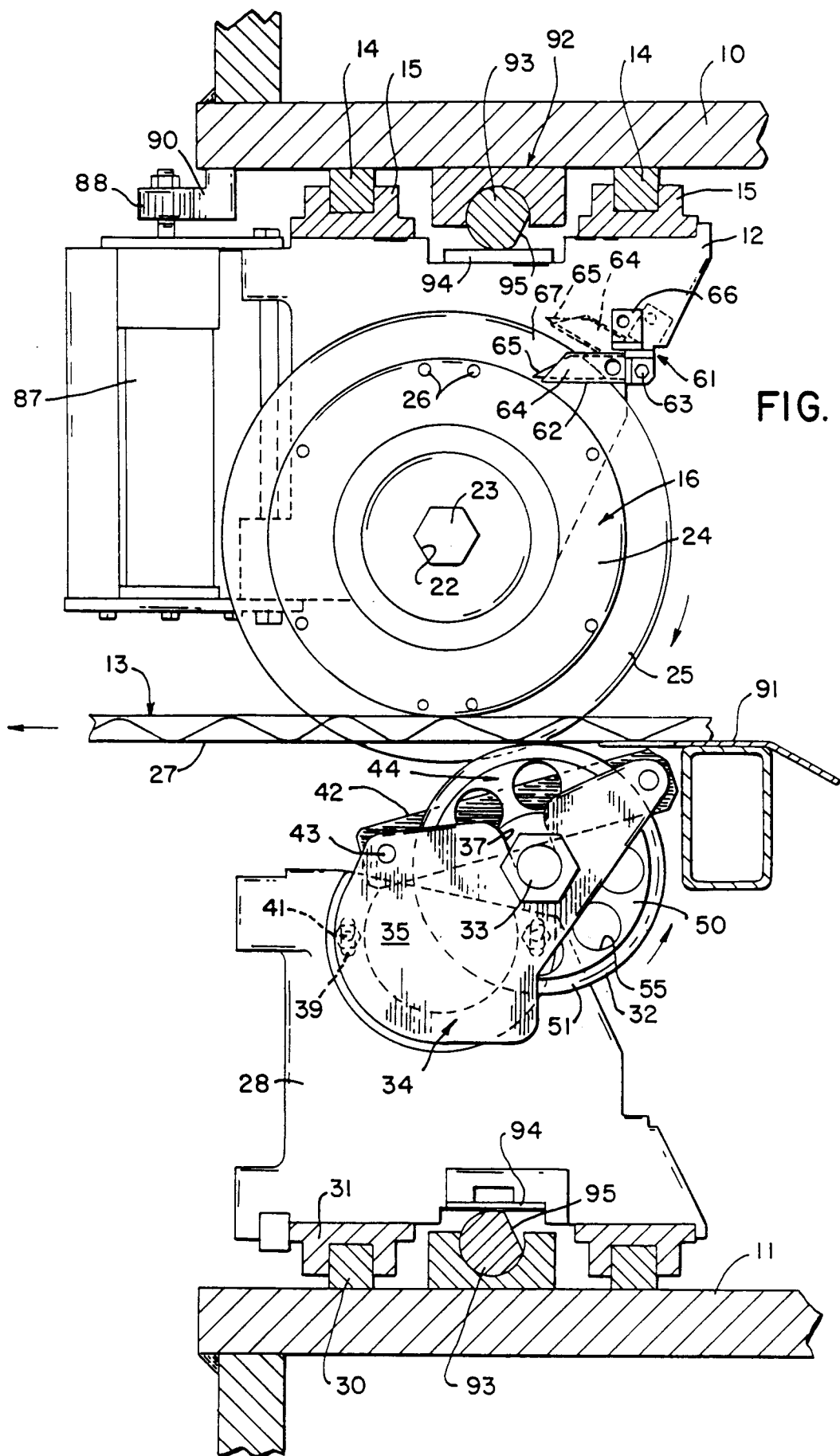
35

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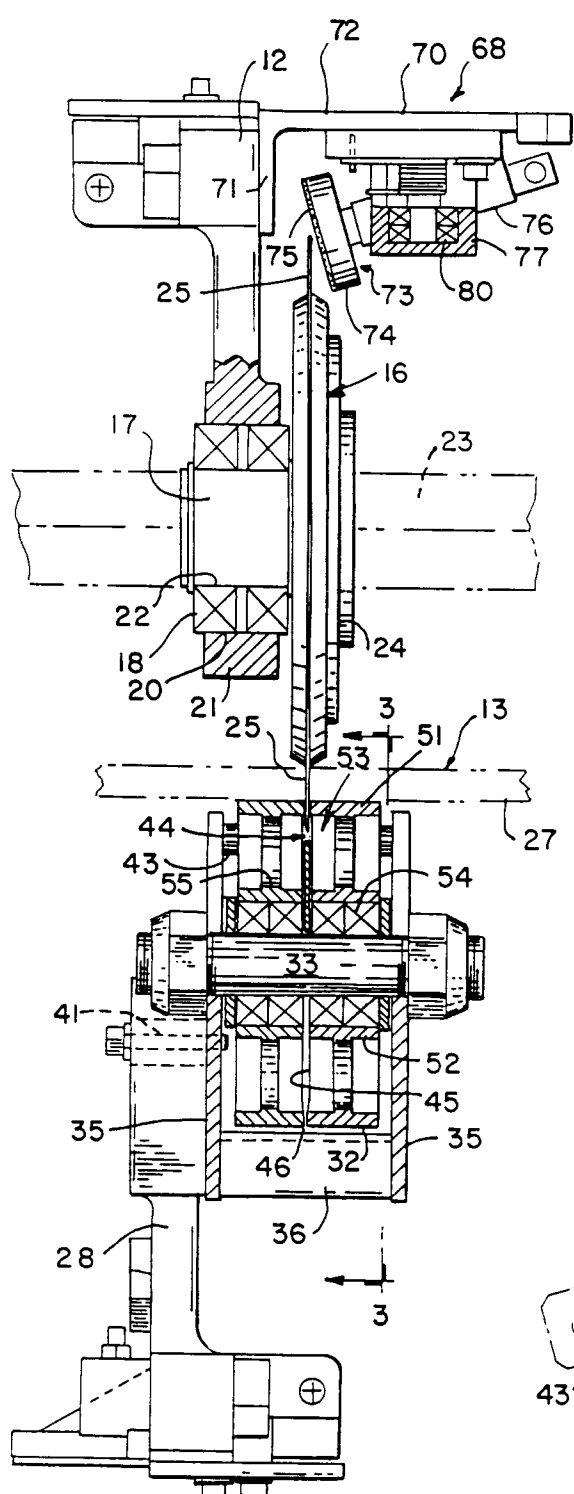


FIG. 2

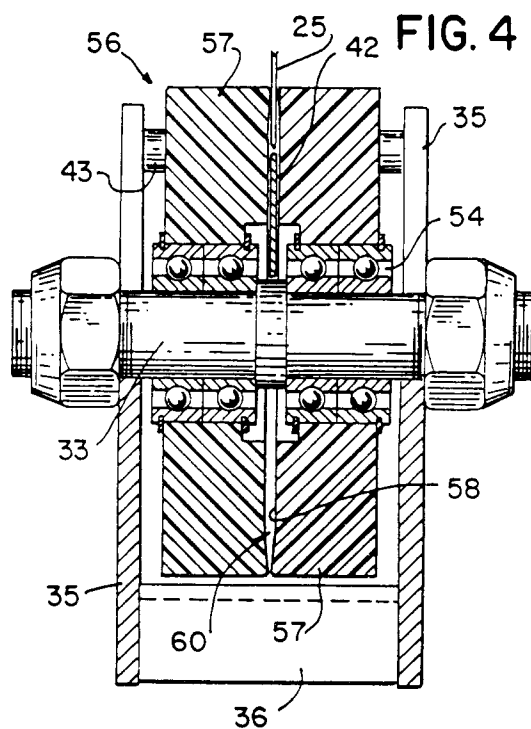


FIG. 4

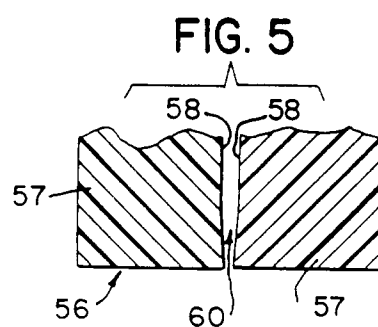


FIG. 5

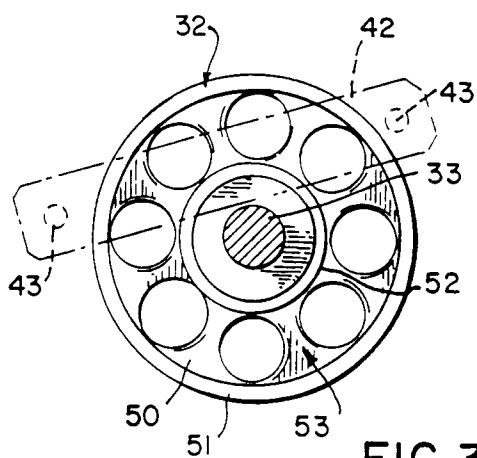


FIG. 3

