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

(11) EP 1 497 086 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
07.10.2009 Bulletin 2009/41

(21) Application number: **03718810.9**

(22) Date of filing: **16.04.2003**

(51) Int Cl.:
B26D 3/12 $^{(2006.01)}$ ***B26D 1/40*** $^{(2006.01)}$
B26D 7/26 $^{(2006.01)}$

(86) International application number:
PCT/FI2003/000308

(87) International publication number:
WO 2003/086720 (23.10.2003 Gazette 2003/43)

(54) SHEET CUTTER WITH INCLINED CUTTING EDGE

BLATTSCHNEIDVORRICHTUNG MIT GENEIGTER SCHNEIDKANTE

COUPEUR DE FEUILLE A BORD DE COUPE INCLINE

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT RO SE SI SK TR

(30) Priority: **18.04.2002 FI 20020747**

(43) Date of publication of application:
19.01.2005 Bulletin 2005/03

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(56) References cited:
EP-A2- 0 900 637
DE-C- 814 236
GB-A- 695 757
US-A- 3 203 292
US-A- 3 401 585
US-A- 4 014 234
US-A- 4 846 035

EP 1 497 086 B1

Description

[0001] The invention relates to a sheet cutter according to the preamble of claim 1 for cutting multilayer webs of paper and paperboard into sheets from a moving continuous web. Cutting is arranged to take place crosswise in regard to the machine-direction travel of the web.

[0002] Fabrication of paper and paperboard products needs two basic types of slitters/cutters at the paper mill. Slitters perform the slitting of the broad web of a machine roll into narrower webs, while sheet cutters severe from the end of the web pieces of predetermined dimensions, or sheets, to be stacked for transportation. Printing papers and other lightweight paper grades that can be rewound without impairing the quality of the product are simply slit at the slitter and then rewound into narrower rolls ready for shipping to customers. However, if a multilayer product is made by combining several webs of, e.g., paper and plastic, the thickness and stiffness of the product may increase so drastically as to prevent winding of the ready-laminated product into a roll without compromising the quality of the product. The finishing process or use of the product thus manufactured may also have such a character that the product is most appropriately delivered as cut sheets packaged on a pallet, for instance, in lieu of a roll even when the latter alternative could be possible without affecting the qualities of the product.

[0003] In order to permit this kind of lamination process resulting in a multilayer web to flexibly produce a product of maximally high degree of finishing and quality, the process is complemented with precise trimming of the ready-cut sheet as to its width and length. The sheets thus trimmed should be rectangular with a maximally planar and equal size. The cut edge must be precise, lint-free and neat at all edges of the sheet. The cutting of the sheets or their subsequent steps of transfer, stacking and packaging may neither leave degrading marks. Cutting into sheets also improves the value added of the product. Hence, the above-described kind of lamination process of a multilayer web needs for maximally high degree of finishing and quality to perform the trimming of sheet accurately to desired width and length.

[0004] Conventional sheet cutters are generally based on so-called scissor sheeters having a cutting knife adapted on both sides of the sheet. The opposed knives of the pair are individually controlled to move so that their mutual distance (also called the knife gap size) can be controlled to a suitable value for cutting - generally so narrow that the sheeter construction becomes complicated. The knife edges of a scissor sheeter must almost hit each other in order to prevent the material being cut from jamming between the knives. The actual crosswise cutting of the web takes place in these sheeters starting from one edge of the web and continuing therefrom as transversely as possible toward the other edge. As the web travels continuously forward through the entire sheeting action, a precondition for acceptable cutting quality is that the instantaneous cutting point between the pair of knives moves along with the web in the machine direction. At higher web speeds in particular, the time allowable for cutting the web remains very short resulting in problems such as needing, e.g., an excessively high force to severe the web. Since the cut sheets cannot be made very long due to the limited maximum dimensions of transportation packages, web speeds even as low as a few tens of meters per minute may invoke very quick cutting times. However, a manufacturing line of a multilayer material should desirably operate at a high speed to assure sufficient efficiency of production. Herein, the cutting cycle of the sheeter must be short in order to prevent the sheeter from forming a bottleneck in production. For thick webs, the cutting force must be high, whereby the sheeter must be dimensioned to bear these forces necessitating heavy structures in the moving parts of the sheeter. Obviously, such heavy machine parts performing fast reciprocating movements cause problems due to vibration, noise, wear and other like factors. In the case that a single sheeter is desired to be used for cutting sheets of different lengths, the problems are aggravated inasmuch as fast change of the cycle time is a must in order to prevent changes in the sheet length from causing an excessively long halt in production.

[0005] A simple scissor sheeter may be constructed such that one of the knives is a stationary bed knife in a position slightly angled from the cross direction of the web.

[0006] Then the movement of the cutting edge of the moving knife - conventionally mounted revolving on a rotary knife cylinder - during its travel at a suitable speed past the stationary knife in the cross-machine direction causes the web to be cut in a desired fashion. The function of this kind of a cutting arrangement is to set the crosswise cutting time equal to the time spent by the web during its travel in the machine direction over the distance between the points at which the revolving knife crosses the edges of the web. This distance is determined by the angle of the knives in regard to the web. However, the above arrangement has many shortcomings allowing this simple embodiment to be used only within a limited range of paper grades, typically for lightweight, flexible and yielding webs. Moreover, this cutting technique does not give a perfectly straight edge aligned exactly at right angles relative to the edge of the web.

[0007] Particularly in the case that the web to be cut is relatively thick and stiff, the problems of the simple sheeter construction - especially those related to its stationary bed knife - become uncontrollable at concurrent web speeds. In order to overcome such complications, a more complex scissor sheeter must be used having both knives adapted movable in the machine direction along with the web. In most constructions, this is arranged by having both knives mounted on a rotary cylinder revolving at a speed conforming to the cutting operation. In order to assure smooth progress of the cutting action from one edge of the web to the other, the knives must be mounted obliquely on the periphery of the cylinder with one end of the knife leading in regard to the other end of the knife in regard to the travel direction of the web. Resultingly, the edges of the knives must have a helical shape on the periphery of the cylinder. Proper control of the knife gap also requires synchronization of the rotary movement of the knife cylinders. With the additional constraints due to the run-time conditions of varying lengths of sheets, the construction and control of this kind of sheeter becomes complicated and, hence, subject to disturbance. Conventionally, frequency converter drive equipment is used for controlling the rotation of the knife cylinders and, in fact, this arrangement gives a relatively easily controllable sheeter. With the help of the helical shape of the knives and controllable rotational speed of the knife cylinders, the primary goal is to set the tangential velocity of the knives at the cutting instant equal to the web speed. If the web speed and the sheet length to be cut are incompatible such that the web does not travel the exact length of the sheet in the time of a full revolution of the knife cylinder, the rotational speed of the knife rolls must be either retarded or accelerated appropriately. These rapid accelerations or decelerations need a high instantaneous drive power capability and a complicated structure of high strength. As a result, this kind of sheeter becomes cost-inefficient: that is, expensive to acquire and costly to use.

[0008] It is an object of the present invention to provide a sheet cutter featuring a construction simpler than those of the prior art thus disposing with a complicated knife assembly and precise synchronization of knife cylinders.

[0009] The goal of the invention is attained by forming the cutting nip between a smooth-surfaced counter-roll and a knife mounted at an angle on a knife cylinder forming a nip with the counter-roll.

[0010] More specifically, the sheet cutter according to the invention is characterized by what is stated in the characterizing part of claim 1.

[0011] The invention offers significant benefits.

[0012] The sheet cutter according to the invention uses only one straight knife acting against a simple counter-roll. This arrangement makes the overall construction of the sheeter uncomplicated. As the knife is cost-efficient to fabricate and the counter-roll need not necessarily be provided with separate drive means for roll rotation, the cost of the construction is further lowered. Within given limits, the apparatus is relatively easy to adjust for different sheet lengths and the adjustment range can be changed by using counter-rolls of different diameters. Due to the simple structure of the knife, it can be easily complemented with adjustment means for setting the distance between the knife and the counter-roll. In spite of the uncomplicated construction of the sheet cutter, it gives very precise cutting tolerances when so desired. By virtue of its simple construction, the sheet cutter can be made rigid without any essential increase in its cost, whereby the vibration tendency of the sheeter is reduced and its durability increased. Due to the inexpensive knife and other components of the sheeter, too, the operating costs of the sheeter remain lower than in conventional sheeters of more complex construction.

[0013] In the following, the invention will be examined in greater detail with the help of exemplary embodiments by way of making reference to the appended drawings in which

FIG. 1 shows a diagrammatic view of a first embodiment of the invention;

FIG. 2 shows a cross section of the sheeter of FIG. 1;

FIG. 3 shows a detailed cross-sectional view of the sheeter according to the invention;

FIG. 4 shows a diagrammatic view of a second embodiment of the invention; and

FIG. 5 shows a diagrammatic view of a third embodiment of the invention.

[0014] As shown in the diagrams, the construction of the apparatus according to the invention has a two-column frame 1. The frame 1 is fixed on foundations made on the floor of the machine hall. Lowermost in frame 1 is adapted a counter-roll 3 rotating supported by a shaft 3 on frame 1. Above counter-roll 2, rotating supported by a shaft 2 on frame 1 is a knife cylinder 5 having a cutting knife 6 mounted in an oblique position thereon. The shaft 4 of the knife cylinder 5 is connected to the shaft of a drive motor 7, and the shafts 2, 4 of knife cylinder 5 and counter-roll 3, respectively, are connected to each other by meshing gear wheels 9 in order to synchronize their mutual rotary movements. Both ends of roll 3 and cylinder 5 are provided with cylindrical support discs 10 having diameters slightly larger than the diameter of roll 3 and cylinder 5, respectively. When the cutting nip is driven closed, the cylindrical support discs 10 rest against each other thus defining the gap between the counter-roll and the knife cylinder and, hence, the distance of the edge of knife 6 from the periphery of counter-roll 3 at the instant the knife 6 travels through the cutting nip. Between the frame 11 and the support bearings of the knife cylinder are adapted springed dampers 11 of adjustable stiffness for attenuation of vibrations in the knife cylinders. The dampers 11 may also be utilized for preloading the support bearings of the sheeter.

[0015] Knife 6 is mounted by a knife holder 13 in a groove 14 made on knife cylinder 5. The structure, mounting method and position of knife 6 in the cutting nip is discussed below. The description below gives a basic description on the construction of the knife cylinder and its counter-roll used in the sheet cutter according to the invention, with further details of the cutting knife geometry, mounting of the knife on the knife cylinder and adjustment of knife gap.

[0016] In terms of good cutting result, a primary interest is laid on a method of extending the cutting time thus alleviating the vibration, noise and other problems associated with a too short cutting time. In the sheet cutter according to the invention, this goal is achieved by virtue of equipping the knife cylinder 5 with a knife mounting plane 14 slightly inclined in regard to the axial direction, that is center line C_1 of the knife cylinder 5. In FIG. 3 the mounting plane 14 is shown displaced at distance E from center line C_1 in the cross-sectional view of the diagram taken at the center of the sheeter and the knife cylinder 5. The actual inclination angle is set by tilting the mounting plane by dimension 2e over the entire width of the knife cylinder 5. Hence, the mounting plane 14 is at one end of knife cylinder 5 displaced at a greater distance from the center line of the cylinder than at the other end of the cylinder. Advantageously, the mounting plane is inclined symmetrically. Denoting the structural width of the knife cylinder as 2b, the inclination angle of the mounting plane is arctan(e/b).

[0017] In regard to the function of the cutting knife and the sheeter, it is essential to know in which angle (γ_e) the mounting plane should be at the instant the knife reaches the critical point of cutting action. In most cases, the critical point of cutting occurs when the cutting edge of the knife is simultaneously at the center line of both the cylinder and the counter-roll. This situation is illustrated in FIG. 3. In most cases, it is advantageous to set the knife mounting plane 14 at about 45° angle in regard to the plane defined by the center lines C_1 and C_2 of the knife cylinder 5 and the counter-roll 3, respectively. As to the cutting action, it is further essential to consider how symmetrically or asymmetrically the tip angle α_k of the cutting edge 12 of knife 6 is divided between the incoming and outgoing sides of the web. The smaller the angle γ_e the steeper the leading bevel of knife 6 meets the web surface and, respectively, the trailing bevel of the knife is more aligned parallel to the web surface. Inasmuch as the quality of the neat cut edge is determined by the meeting angles of the leading bevel and the trailing bevel of the knife with the web, a too small leading bevel angle of the knife may cause tearing of the web instead of shearing of the web, the inclination angle γ_e is advantageously selected to be in the range of 30° to 60°. Then, the knife severs the web with a neat cutting groove, whereby also shaving remaining on the side of the counter-roll 3 is separated neatly.

[0018] In order to achieve maximal stiffness of the knife cylinder and other benefits, it would be advantageous to adapt the mounting plane 14 of the cutting knife 6 as close as possible to the periphery of knife cylinder 5. However, this design objective is contrary to such constraints as, e.g., the space requirement of the knife support plate 13 and the optimal location of the cutting action starting point. Hence, the space requirements of knife 6 and knife support assembly 13 dictate the minimum distance of the mounting plane from the periphery of knife cylinder 5 at the end point of the cutting action, while the web speed and rotational speeds of the knife cylinder and the counter-roll determine the inclination angle of mounting plane 14, i.e., how much the knife 6 and its mounting plane 14 must be moved toward the center line of knife cylinder 5. On the other hand, if distance E is made smaller, the amount of material to be removed from the periphery of knife cylinder 5 becomes larger, whereby the unbalance of the cylinder increases.

[0019] Yet, a proper choice of distance E gives an operating zone permitting the distance of the mounting plane to be varied without causing substantial problems in the operation of the sheeter. This zone has been found to be advantageously in the range of $0.25d_1 < E > 0.4d_1$.

[0020] Advantageously, the cutting knife 6 itself is a rectangular bar of constant thickness (s) and constant height (h) supported by the knife mounting plane 14 of the knife cylinder 5. The cutting knife 6 is mounted on the plane in an adjustable fashion using, e.g., two crosswise running rows 15, 16 of mounting bolts as illustrated in the diagram of this exemplary embodiment. Additionally, the knife is adapted adjustable and clampable in the direction of the mounting plane by adjustment screws 17 passing through the knife cylinder 5 thus allowing the adjustment and straightness alignment of the knife gap. The uncomplicated knife mounting system based on screws/bolts can be complemented with such a resilient mounting of the knife that allows a minor reciprocating movement of the knife along the knife mounting plane in order to attenuate vibrations occurring, e.g., along the length of the entire knife cylinder. The opposite side of the knife cylinder 5 in regard to the knife 6 is provided with a recess 18 having a balancing member mounted therein that serves to improve the balance of the knife cylinder against vibrations. Inasmuch as balancing can be implemented in plural ways, a person skilled in the art knows the appropriate means to find a suitable solution in each application.

[0021] The cutting edge 12 of the knife must have a suitable shape in order to permit the edge to perform its function appropriately throughout the entire cutting action from the very first contact of the knife to the final severing of the web. In regard to the neatness of cutting, the knife edge angle α_k is a critical variable that may be varied in the range of $\alpha_k = 40° - 120°$. For a plurality of applications, a 90° knife edge angle is advantageous by allowing the knife to have a rectangular cross section, whereby its fabrication is cost-advantageous. Differently from the knife of guillotine sheeter, the cutting knife of this sheeter is made symmetrical. Since this is compatible with the actual cutting process in many cases, economical reasons favor to have all the four edges of the knife sharpened. Namely, then the knife can be simply rotated for using each one of the cutting edges in time in the sheeter. In contrast, if the knife edge angle is made different from 90°, it is very difficult to fabricate a knife having four cutting edges.

[0022] To the function of the sheeter it is essential that minimum distance of the knife edge from the counter-roll, known as the knife gap s_k, stays constant during the progress of the cutting action over the cross-machine width of the web. In the sheet cutter according to the invention, this condition is satisfied in the following way: the ends of both the knife cylinder and counter-roll are equipped with a cylindrical support disc 10 that is accurately centered in regard to the periphery of the cylinder and the counter-roll, respectively, but has a slightly larger diameter. As a result, these cylindrical support discs 10 run in contact with each other thus determining, not only the interaxial distance a between the center lines of the knife cylinder and the counter-roll, but also the nip gap s_n between the knife cylinder and the counter-roll. When the distance of the cutting knife 6 from the counter-roll 3 is checked and adjusted having the peripheral surfaces of the cylindrical discs 10 driven resting against each other on both sides of the sheeter with a suitable preloading force, the knife gap s_k can be set to a desired value - generally to a constant value - over the entire web width in the cross direction of the sheeter.

[0023] As to the material to be sheeted, its thickness s_r, the knife gap s_k and the interperipheral distance s_n between the cylinder and the counter-roll, it is advisable to define the useful range of these parameters. The cutting process is carried out in such a fashion that the cutting knife penetrates partially through the thickness of the web, however, not severing the web entirely. The wedged edge of the knife 6 then pushes the still mating edges of the adjacent sheets apart from each other. To obtain successful sheetings, the cutting depth made by knife must be at least half the web thickness, i.e., the cutting depth which is equal to the gap between the knife edge and the counter-roll must be set to be in the range $0 < s_k > 50$ %, advantageously in the range $0 < s_k > 30$ %. In FIG. 3, d_1 denotes the roll diameter, D_1 the diameter of the cylindrical support disc 10 and D_2 the diameter of the circular envelope trajectory of the knife cutting edge 12 which is larger than the knife cylinder diameter but smaller than the counter-roll diameter. When the knife cutting edge is aligned perfectly straight, the diameter of the envelope circle swept by the cutting edge is constant over the entire length of the knife cutting edge. The difference between the diameter of the envelope circle swept by the knife cutting edge and the diameter d_2 of the counter-roll determines the web cutting depth that normally is adjusted constant over the entire length of the cut, but in certain cases might be contemplated to be adjusted slightly tapering in depth such that at the starting point of the cut is made deeper in order to aid the separation of the sheets. While the largest difference in the cutting depth between web edges obviously could be made as large as the gap between the knife cylinder 3 and the counter-roll 5, such a maximal adjustment cannot give a good cut. In the case that the knife is desired to be set in an inclined position, the cutting depth should be kept within the above-mentioned limits over the entire cutting length.

[0024] In the sheeter, the web to be cut is passed into the cutting nip with the help of, e.g., an underlying support guidance band or entirely unsupported. Web guidance may also be enhanced with vacuum suction applied through both the support guidance band and the envelope of the guide roll of the sheeter. Obviously, web guidance must be implemented in accordance with the properties of the web. A lightweight and fragile web naturally always needs the use of improved guidance techniques.

[0025] The sheets are cut from the web in an open nip formed between two roll-like elements 3, 5. Cylindrical support discs 10 rotating at both ends of the roll-like elements 3, 5 are the actual members determining the peripheral interroll distance, or the nip gap. One of the roll-like elements has adjustably mounted thereon a cutting knife 6 of a slab-like shape extending over in the cross-machine direction at least over such a width that is required in the sheeting operation. The knife 6, together with the peripheral interroll distance between the roll-like elements 3, 5, is adjustable such that the knife will not hit on the counter-roll 3 even in the cutting nip where the distance of the knife from the counter-roll 3 is smallest.

[0026] The actual sheeting takes place as follows. When the sheeter runs at a speed controlled compatible with the web speed, sheet length and other run-time parameters, the cutting knife 6 mounted on the sheeter topside knife cylinder 5 revolves toward the cutting nip, wherein its sharpened cutting edge 12 first meets the lateral edge of web 8, pushes the web down and presses the web against counter-roll 3 and eventually cuts web 8. Simultaneously, counter-roll 3 has elevated the web and pushed it from below toward cutting knife 6. The cutting edge 12 of knife 6 is shaped such that, during its penetration deeper into the web, it simultaneously both neatly cuts partially through the thickness of the web and tensions the web under the cutting area so that the uncut portion of the web thickness snaps precisely apart along the already partially cut sheeting line without the need for the knife to penetrate through the entire thickness of the web until hitting the outer surface of the counter-roll. The sheeting action does not take place simultaneously over the entire width of the web, but instead, the cutting edge 12 of the knife travels in synchronism with the outer surface of the counter-roll 3 in a kind of scissors-like movement.

[0027] To obtain accurate and vibration-free rotation of the roll-like elements 3, 5, vibrations of the top-side knife cylinder that would be detrimental to the cutting action are attenuated by having between the ends of the knife cylinder and the sheeter frame adapted an adjustable-stiffness, springed vibration damper 11 that also may be used for preloading the cylindrical support discs 10 mounted at the ends of the roll-like elements or, alternatively, directly preloading the shaft bearings of the roll-like elements 3, 5. While vibrations may occur due to unbalance of the roll-like elements if their balancing is not perfected carefully, a major cause of cyclic excitement of vibrations is related to the actual cutting action taking place at a constant frequency that generates vibrations. Hence, these vibrations must be eliminated by designing the sheeter frame construction and the entire apparatus if possible so that its eigenfrequency does not fall within the cutting action frequencies exciting vibrations.

[0028] The sheeter also includes precision-controlled drive means 7 capable of driving the sheeter on basis of information obtained from the preceding process such as its run speed and draw, further the predetermined length of the sheet to be cut and, for instance, the alignment tolerance requirements of a picture possibly printed on the web. A conventional drive means arrangement herein comprises, e.g., an electrically controllable/adjustable frequency converter, a compatible electric drive motor coupled to a mechanical drive, e.g., a reduction gear with an output shaft, or to a toothed-belt drive. Such different kinds of rotary drive means and their connection to a process control system are well known in the art and can be implemented in a plurality of different embodiments.

[0029] Although the sheet cutter may be run with only the knife cylinder 7 being driven, in many applications it is both advantageous and functional to have also the counter-roll 3 driven separately. In the exemplary embodiment of FIG. 1, a mechanical drive integral with the sheeter is used to provide this facility.

[0030] If the web is passed at right angles into the sheeter, the sheet will not be cut rectangular but instead with its ends cut oblique at an angle determined by the actual cutting angle of the knife. However, a rectangular cut can be obtained by rotating the entire sheeter askew in regard to the web travel direction at an angle substantially equal to the cutting angle β_k. This arrangement is schematically shown in FIGS. 3 and 4. In a particularly critical situation necessitating rapid and flexible run-time fine adjustment of the sheet true squareness, the angled position of the sheeter does not necessarily need to be readjusted. Instead, it is sufficient to angle the knife cylinder in its horizontal plane slightly from its parallel alignment with the center axis of the counter-roll as shown in FIG. 5. This may be readily accomplished with the help of, e.g., a screw mechanism adapted to displace the support bearing housing of the knife cylinder in the horizontal plane relative to the sheeter frame. Such small changes of the axial alignment do not alter the cutting geometry so much as to cause any side-effects.

[0031] As mentioned above, the web is normally cut to sheets of a precise length specified in a given customer order. However, this dimension must be changed from one sheeting lot to another. By virtue of varying the rotational speed of the sheet cutter according to the invention in a controlled fashion relative to the web speed, the cutter readily manages a given range of sheet lengths. When for some reason there is a need to cover a very wide range of different sheet lengths, the cutter construction can be provided with a facility of changing the knife cylinder. Then, the overall sheet length range to be handled by the sheeter can be covered by a suitable selection of the knife cylinder diameters. By having the knife cylinder located topmost in the frame, its elevation away from the frame and replacement by another kind of knife cylinder becomes a very fast operation. The change time may be further shortened by dismantling the support bearings together with the cylinder, whereby the new knife cylinder can be mounted in place as a complete assembly including the knife cylinder bearings, their housings and the cylindrical support discs. This arrangement permits rapid run-up of the sheeter after the knife cylinder replacement and also reduces the time required for the tedious sheeter assembly and adjustment operations.

[0032] While the counter-roll is conventionally made from steel, also other materials may be contemplated at least for the covering of the counter-roll surface that can be coated with a resilient polymeric material, wear-resistant ceramic coating compound or other suitable coating material. The cutting knife or at least the cutting edge 12 thereof is advantageously coated by any conventional coating material capable of increasing the wear resistance of the cutting knives. Obviously, a very wide selection of materials are available for making the entire knife. The position of the rolls can be varied from that described above so that the rolls may reside side-by-side to each other or in an inclined position, depending on the constraints of the space into which the sheet cutter is to be located. While also a knife cylinder with multiple knives could be contemplated, this kind of a structure becomes complex and leads to a complicated control of the sheet cutting length.

Claims

1. A sheet cutter comprising a frame (1), a counter-roll (3) mounted on the frame together with a knife cylinder (5) forming a nip therewith, at least one knife (6) mounted on the knife cylinder (5) and drive means (7) for rotating at least said knife cylinder, said knife (6) being mounted on said knife cylinder so as to align the cutting edge (12) of the knife in an inclined position relative to the center axis (C_1) of the knife cylinder (5), whereby the angle between the travel directions of the sheet cutter and the web being sheeted is set equal to the knife inclination angle on the knife cylinder, **characterized in that** the knife (6) is mounted on the knife cylinder (5) so that the knife (6) is at a distance (E) from the center axis (C_1) of the knife cylinder so that said distance is greater at one end of the knife cylinder than at the other end of the cylinder

2. The sheet cutter of claim 1, **characterized in that** the knife (6) is mounted on a mounting plane (14) formed on the knife cylinder (5) at a distance (E) from the center axis (C_1) of the knife cylinder so that said distance is greater at one end of the knife cylinder than at the other end of the cylinder.

3. The sheet cutter of claim 1, **characterized in that** the angle between a line drawn through the center axes (C_1, C_2) of the knife cylinder (5) and its counter-roll (3), respectively, and a normal to said mounting plane (14) is 30° to 60°.

4. The sheet cutter of any one of foregoing claims, **characterized in that** cutting edge angle (α_k) of the knife (6) is 40° to 120°.

5. The sheet cutter of any one foregoing claims, **characterized in that** at least one end of the knife cylinder (5) and one respective end of its counter-roll are provided with a cylindrical support discs (10) running in contact to each other thus determining the nip gap between the knife cylinder and its counter-roll.

6. The sheet cutter of claim 4, **characterized in that** the cutting edge angle (α_k) of the knife (6) is 90° and that the knife has a rectangular cross section with each one of the knife edges serving as a cutting edge.

7. The sheet cutter of any one of foregoing claims, **characterized in that** the difference dimension s_k between the periphery of the counter-roll (3) and the diameter of the circular envelope trajectory (D_2) of the cutting edge (12) of the knife is in the range $0 < s_k < 50$ %, advantageously in the range $0 < s_k < 30$ %.

8. The sheet cutter of any one of foregoing claims, **characterized in that** the knife cylinder (5) is aligned at an angle relative to its counter-roll (3).

Patentansprüche

1. Bogenschneider mit:

einem Rahmen (1);
einer zusammen mit einem Messerzylinder (5) am Rahmen montierten Gegenwalze (3), wobei zwischen dem Messerzylinder und der Gegenwalze ein Spalt ausgebildet ist;
mindestens einem auf dem Messerzylinder (5) montierten Messer (6); und
einer Antriebseinrichtung (7) zum Drehen mindestens des Messerzylinders, wobei das Messer (6) auf dem Messerzylinder derart montiert ist, dass die Schneidkante (12) des Messers bezüglich der Mittelachse (C_1) des Messerzylinders (5) schräg ausgerichtet ist, wobei der Winkel zwischen den Bewegungsrichtungen des Bogenschneiders und einem in Bogen zu schneidenden Bahnenmaterial dem Neigungswinkel des am Messerzylinder montierten Messers gleicht;
dadurch gekennzeichnet, dass das Messer (6) derart am Messerzylinder (5) montiert ist, dass das Messer (6) in einem Abstand (E) von der Mittelachse (C_1) des Messerzylinders angeordnet ist, wobei der Abstand an einem Ende des Messerzylinders größer ist als am anderen Ende des Messerzylinders.

2. Bogenschneider nach Anspruch 1, **dadurch gekennzeichnet, dass** das Messer (6) auf einer auf dem Messerzylinder (5) in einem Abstand (E) von der Mittelachse (C_1) des Messerzylinders ausgebildeten Montageebene (14) derart montiert ist, dass der Abstand an einem Ende des Messerzylinders größer ist als am anderen Ende des Messerzylinders.

3. Bogenschneider nach Anspruch 1, **dadurch gekennzeichnet, dass** der Winkel zwischen einer sich durch die Mittelachsen (C_1, C_2) des Messerzylinders (5) bzw. seiner Gegenwalze (3) erstreckenden Linie und einer Normalen zur Montageebene (14) 30° bis 60° beträgt.

4. Bogenschneider nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Schneidkantenwinkel (α_k) des Messers (6) 40° bis 120° beträgt.

5. Bogenschneider nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** an mindestens einem Ende des Messerzylinders (5) und einem entsprechenden Ende seiner Gegenwalze zylinderförmige Stütz- oder Haltescheiben (10) angeordnet sind, die in Kontakt miteinander laufen und dadurch die Spaltbreite zwischen dem Messerzylinder und seiner Gegenwalze bestimmen.

6. Bogenschneider nach Anspruch 4, **dadurch gekennzeichnet, dass** der Schneidkantenwinkel (α_k) des Messers (6) 90° beträgt, und das Messer einen rechteckigen Querschnitt hat, wobei jede der Messerkanten als eine Schneidkante dient.

7. Bogenschneider nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** das Differenzmaß s_k zwischen dem Umfang der Gegenwalze (3) und dem Durchmesser der kreisförmigen Hüllkurventrajektorie (D_2) der Schneidkante (12) des Messers im Bereich von $0 < s_k < 50\%$ und vorteilhaft im Bereich von $0 < s_k < 30\%$ liegt.

8. Bogenschneider nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Messerzylinder (5) bezüglich seiner Gegenwalze (3) unter einem Winkel ausgerichtet ist.

Revendications

1. Dispositif de coupe de feuille comprenant un châssis (1), un contre-rouleau (3) monté sur le châssis conjointement à un cylindre porte-couteau (5) formant une ligne de contact entre eux, au moins un couteau (6) monté sur le cylindre porte-couteau (5) et des moyens d'entraînement (7) pour faire tourner au moins ledit cylindre porte-couteau, ledit couteau (6) étant monté sur ledit cylindre porte-couteau afin d'aligner le bord de coupe (12) du couteau dans une position inclinée par rapport à l'axe central (C_1) du cylindre porte-couteau (5), moyennant quoi l'angle entre les directions de déplacement du dispositif de coupe de feuille et la toile qui est prévu pour l'impression de feuilles est égal à l'angle d'inclinaison de couteau sur le cylindre porte-couteau, **caractérisé en ce que** le couteau (6) est monté sur le cylindre porte-couteau (5) de sorte que le couteau (6) est à une certaine distance (E) de l'axe central (C_1) du cylindre porte-couteau de sorte que ladite distance est supérieure au niveau d'une extrémité du cylindre porte-couteau qu'au niveau de l'autre extrémité du cylindre.

2. Dispositif de coupe de feuille selon la revendication 1, **caractérisé en ce que** le couteau (6) est monté sur un plan de montage (14) formé sur le cylindre porte-couteau (5) à une distance (E) de l'axe central (C_1) du cylindre porte-couteau de sorte que ladite distance est supérieure au niveau d'une extrémité du cylindre porte-couteau qu'au niveau de l'autre extrémité du cylindre.

3. Dispositif de coupe de feuille selon la revendication 1, **caractérisé en ce que** l'angle entre une ligne tracée passant par les axes centraux (C_1, C_2) du cylindre porte-couteau (5) et son contre-rouleau (3) respectivement et une normale par rapport audit plan de montage (14) est de l'ordre de 30° à 60°.

4. Dispositif de coupe de feuille selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'angle de bord de coupe (α_k) du couteau (6) est de l'ordre de 40° à 120°.

5. Dispositif de coupe de feuille selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**au moins une extrémité du cylindre porte-couteau (5) et une extrémité respective de son contre-rouleau sont prévues avec des disques de support cylindriques (10) en contact entre eux, déterminant ainsi l'espace de ligne de contact entre le cylindre porte-couteau et son contre-rouleau.

6. Dispositif de coupe de feuille selon la revendication 4, **caractérisé en ce que** l'angle de bord de coupe (α_k) du couteau (6) est de 90° et **en ce que** le couteau a une section transversale rectangulaire avec chacun des bords de couteau qui sert de bord de coupe.

7. Dispositif de coupe de feuille selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la différence de dimension S_k entre la périphérie du contre-rouleau (3) et le diamètre du la trajectoire d'enveloppe circulaire (D_2) du bord de coupe (12) du couteau est de l'ordre de $0 < S_k < 50$ %, avantageusement de l'ordre de $0 < S_k < 30$ %.

8. Dispositif de coupe de feuille selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le cylindre porte-couteau (5) est aligné selon un angle par rapport à son contre-rouleau (3).

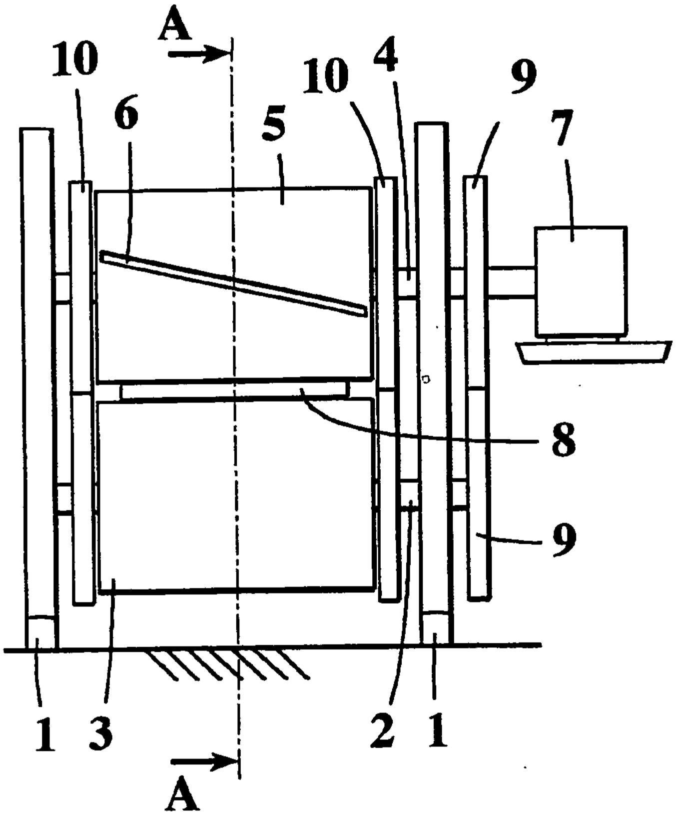

Fig. 1

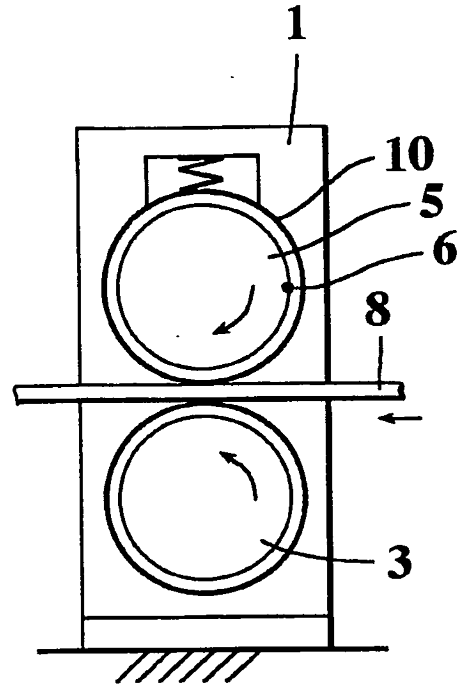

Fig. 2

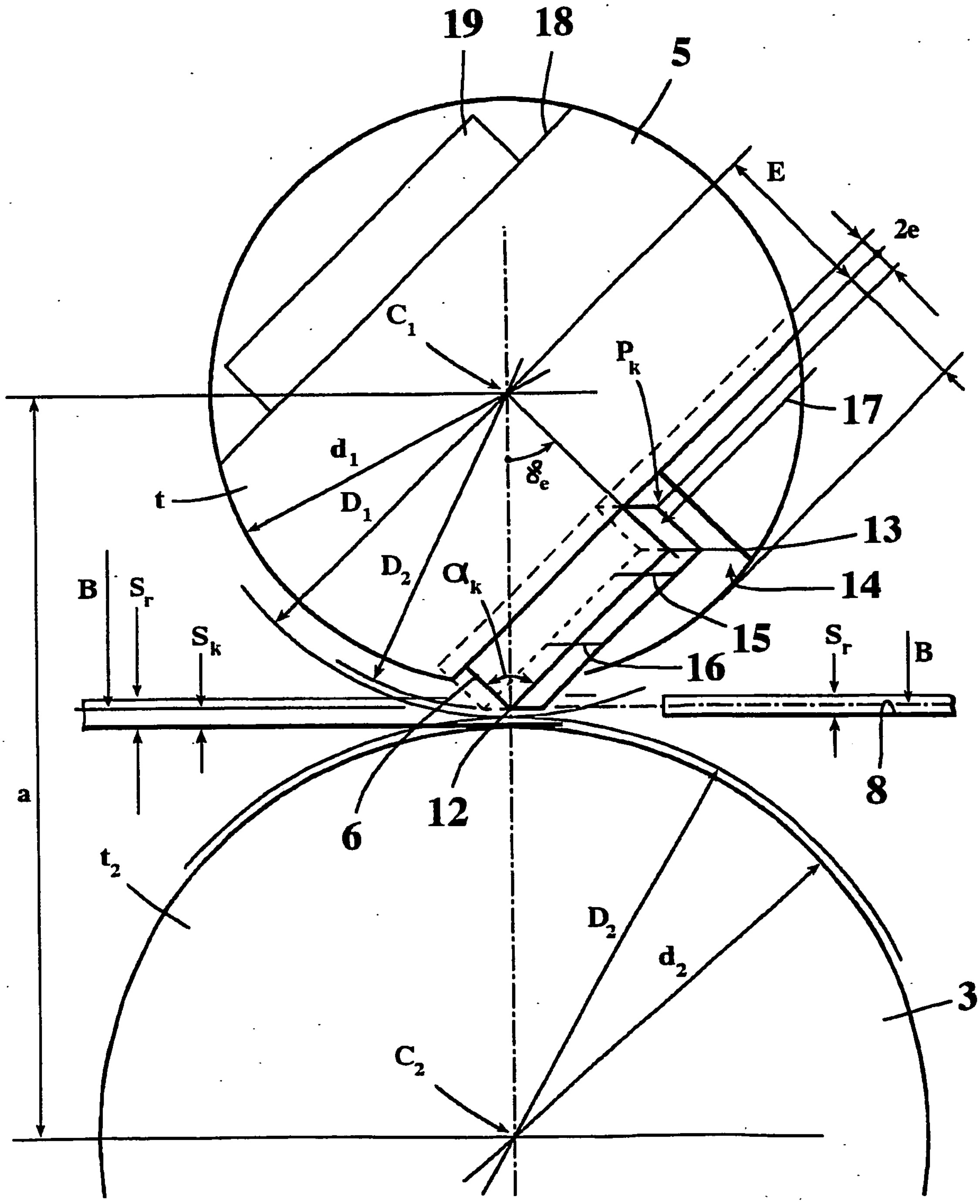
19
18
5
E
2e
C_1
P_k
17
d_1
δ_e
t
D_1
13
D_2
α_k
14
B
S_r
S_k
15
S_r
B
16
8
a
6
12
t_2
D_2
d_2
3
C_2

Fig. 3

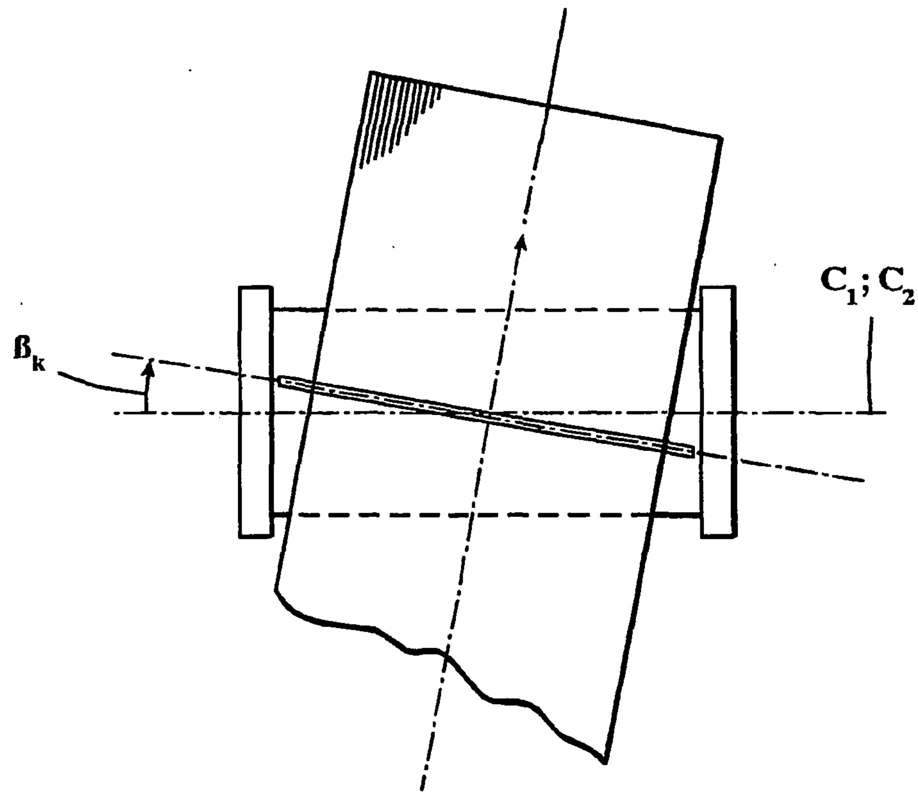

Fig. 4

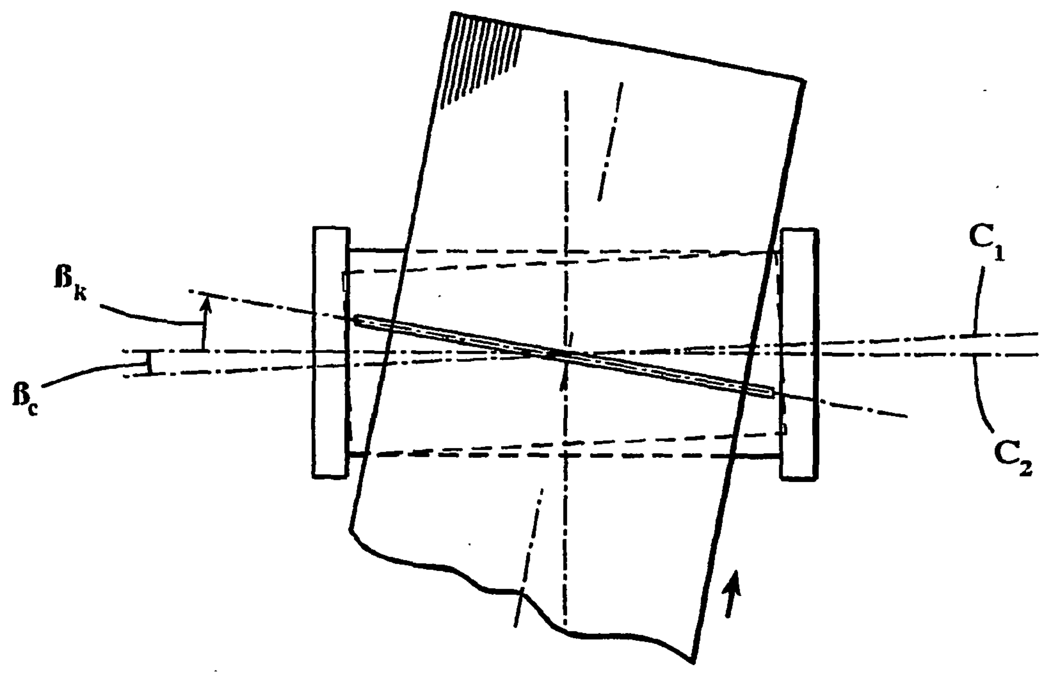

Fig. 5