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(54) Method of forming product rolls

(57) This invention describes a method of forming a web product roll, for example a tissue paper roll, by cutting individual product rolls from an elongated web log roll (101) that is coreless or has a weak core (112) without damaging or destroying the central opening of the roll. This is done by placing the elongated log roll (101) in a cutting location, between two end plates (102,105), at least one of which is connected to a controllable (108) source of pressurized gas, holding the elongated log roll (101) in the cutting location by means of the two end plates (102,105), the two end plates (102,105) together with the first end part of the web or the core (112) defining an interior space (111) of the elongated log roll (101), filling the interior space (111) with pressurized gas, and cutting the elongated log roll (101) into product rolls with a rotating knife blade (109), whereafter the product rolls are removed.

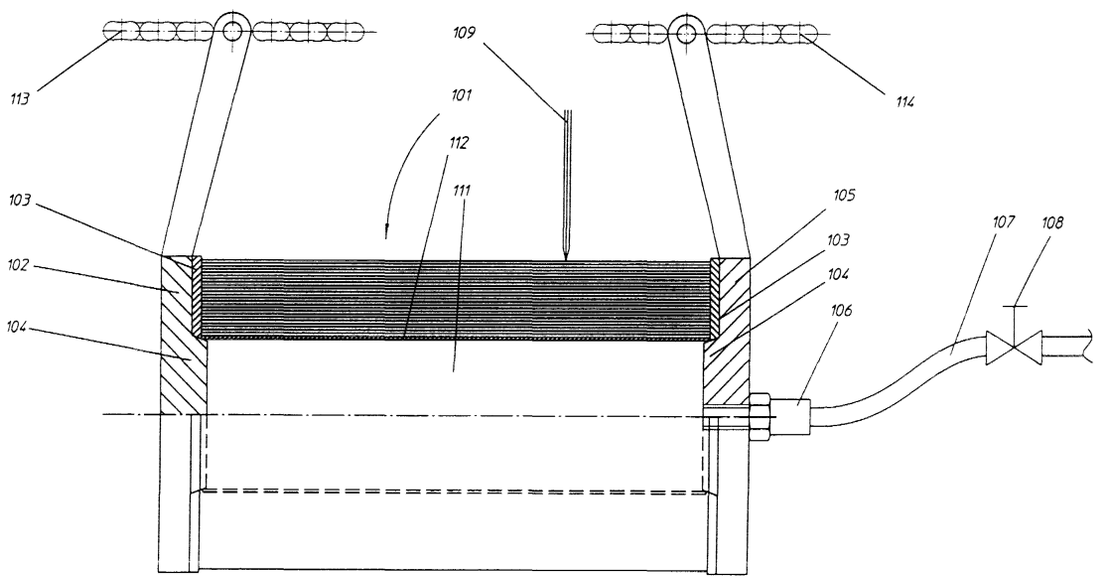

Fig 5

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Description

Technical field

[0001] This invention relates to a method of forming a web roll product, for example, a roll of tissue paper. More particularly, the method of the invention is concerned with the cutting of individual roll products from a web log roll that is coreless or has a weak core without damaging or destroying the central opening of the roll.

Background of the invention

[0002] In producing web roll products for consumer and industrial use there is a need for cutting the paper web produced on a paper machine, both in length to provide a web roll product of suitable length and in width to provide a web roll product of suitable width so as to fit into the dispensers that exist on the market.

[0003] Many ways of doing this are known in the prior art or are common knowledge. Rewinding a mother roll while slitting the web lengthwise and winding onto small-width cores, with the help of a revolving turret head roll change system, is common practise.

[0004] Another way is to produce elongated web log rolls of a suitable web length as an intermediate product, with the help of a revolving turret head roll change system or a surface winder system, and then to cut these elongated web log rolls into web product rolls of suitable width using a rotating knife blade.

[0005] Traditionally thick-walled cores have been used. These can be cut fairly easily and give good strength and dimensional stability to the web roll. The drawbacks are volume used by the core walls that cannot be used for additional web length, extra weight in transport, added cost and a waste problem.

[0006] More recently, thin-walled cores of different types have come into use. They alleviate the above-mentioned problems, but give rise to new ones, of strength and roll stability, as they are weaker than the thick-walled ones.

[0007] Also, coreless rolls have come onto the market. US. Pat. 4,487,378 discloses the forming of an elongated coreless log of web (such as tissue paper) on a mandrel having a polygonal cross section. The elongated log is pulled off the mandrel after forming. A rotating knife blade then cuts the web log into individual web rolls.

[0008] It is also possible to use cylindrical mandrels to make coreless web logs, e.g. according to EP-B1-0,710,212 where a small amount of water is used to enable the elongated web logs to be removed from the mandrel.

[0009] A problem arising when using rolls with thin or no cores is when the rotating knife blade reaches the center of the log roll, the core of a web log roll or the innermost web layers of a coreless web log roll will initially be deflected a slight distance into the open area in the log roll center, and when the rotating knife blade cuts through into the open area a distortion in the form of a beak will arise. This can give the roll product a bad appearance and also makes it difficult to be able to fit the roll product into a roll dispenser, or for a coreless roll product also makes it difficult to be able to withdraw the web from the center hole.

[0010] This distortion can also force the rotating knife blade out of its intended straight line, perpendicular to the length of the elongated log roll, making the cut oblique from the center and out to the other side. Thus the edge of the roll can be warped.

[0011] This latter effect is especially a problem when cutting away edge trim of typically a few centimeters, where the retaining forces from the larger part and from the trim part of the roll are uneven. The beak will then be lop-sided, with more material retained in the larger part, and this will always force the edge of the rotating knife blade outwards and the edge of the roll will be warped.

[0012] A patent aiming to address this problem for coreless paper rolls is US Pat 5,271,137 that discloses a method for forming a coreless paper roll product, where the cutting into roll segments is done with the mandrel having a polygonal cross-section still partly inside the elongated paper roll to be cut, so that the location of the cut is just outwards from the end of the mandrel. Thus the inner part of the paper roll, making up a pseudocore, retains its form during the cutting, and after the cutting can reshape according to the inner stresses.

[0013] There is however still a need for alternative solutions to these distortion problems.

[0014] Another problem that arises when using a rotating knife blade originates from the heat generated by the cutting action of the knife edge and the frictional force between the knife blade and the wound web. This will affect the knife blade by increasing mainly the edge area temperature while the rest of the knife blade is still at a lower temperature. The higher temperature at the edge will make the edge expand, which can only take place sidewise out of the plane of the knife blade, making the edge wobbly. This wobbliness will then augment the friction and generate still more heat. This will put extra stress and wear on the knife blade and also hinder the knife blade from making a cut that is as straight and clean as could otherwise be effected.

[0015] Earlier solutions have been aimed at cooling the blade by blowing air or at lowering the friction by spraying a mist of lubricating lotion on the part of the rotating knife blade that is outside the roll that is being cut.

[0016] There is however still a need for alternative solutions to this problem of uneven heating of the rotating knife blade.

Summary of the invention

[0017] A first aim of the invention is to form a product

roll with little or no damage to the core or first windings of the product roll when cutting individual product rolls from an elongated web roll.

[0018] This is solved by the method defined in claim 1, which prescribes a method of forming product rolls from a web comprising the steps of:

winding a web, starting from a first end part of the paper web, with or without a core, into an elongated log roll;
cutting the elongated log roll from the web after the elongated log roll having a predetermined outer diameter or web length has been formed by the web;
placing the elongated log roll in a cutting location;
supplying two end plates, at least one of which is connected to a controllable source of pressurized gas;
holding the elongated log roll in the cutting location by means of the two end plates, the two end plates together with the first end part of the web or the core defining an interior space of the elongated log roll with an inner diameter;
filling the interior space with pressurized gas during the cutting;
cutting the elongated log roll into product rolls with a rotating knife blade;
removing the product rolls.

[0019] A second aim of the invention is to alleviate the wobbling of the rotating knife blade caused by uneven heating of the knife blade when cutting individual product rolls from an elongated web roll.

[0020] This is also solved by the method defined in claim 1, and can be enhanced by the method of claim 8 where the pressurized gas is cooled.

[0021] The other dependent claims describe advantageous variants of the invention.

Brief description of the drawings

[0022] Fig 1 is an end view of a cored product roll according to prior art being cut without support from the interior space of the roll at the moment just before the knife blade breaks through into the interior space.

[0023] Fig 2 is an end view of a cored product roll according to prior art with a typical beak.

[0024] Fig 3 is a side view of a cored product roll according to prior art with a typical beak and also showing the oblique part of the edge.

[0025] Fig 4 is an end view of a coreless product roll according to prior art with a typical distortion from the beak effect.

[0026] Fig 5 is a schematic view of an elongated log roll being cut into product rolls according to the invention.

Detailed description of the invention

[0027] Prior art problems are illustrated in Figures 1 - 4.

[0028] In Figure 1 can be seen how a cored roll 1 is being cut without support from an interior space 2 of the roll 1 at the moment just before a rotating knife blade 5 breaks through into the interior space 2. The core 3 is under compression and the core 3 is showing a displacement 4 from the pressure of the rotating knife blade 5 at a contact point with the rotating knife blade 5 edge.

[0029] The result after the rotating knife blade 5 has broken through into the interior space 2 can be seen in Figure 2, where a beak 6 has been formed in the core of the finished product roll from the displacement 4.

[0030] Figure 3 shows a sidewise view of the roll from Figure 2 with a beak 6 and the resulting warping 7 of the edge of the roll 1.

[0031] When cutting a coreless roll 8, the innermost windings will normally collapse a little after the cutting, depending on the stresses introduced by the winding. If the cutting is done without support from the interior space 2 of the roll 1 the collapsing 9 will be asymmetric and more extensive as can be seen in Figure 4.

[0032] Referring to Figure 5, the method of the invention will now be described. A web is wound onto an elongated core 112 on a mandrel or directly onto an elongated mandrel either directly from the web production line or when rewinding from a mother roll.

[0033] The web can be a sheet made up from cellulosic or synthetic fibres, with some additives like fillers or chemicals that will be designed to render certain desired properties or functions to the web. Webs of this type are papers, tissues and nonwovens.
The web can also be a more or less homogenous web, where fillers or armouring fibres can be added. Webs of this type are films.
Also laminates, integrated structures of at least one base web and addition of at least one other web or any other type of surface-covering addition, can be webs that are well suited for treatment by the method of the invention.

[0034] The winding is normally done using a well known revolving roll change system where four reciprocally parallel equidistantly mandrels revolve around a common axle parallel with their longitudinal direction. The mandrels, each in sequence, pass four stations; adding a core (if the roll is to be cored), waiting/starting a new roll, finishing the roll, and roll take-off. In the waiting station the web is led partly around the waiting core on its way to be wound around the roll being finished. When the roll being finished has reached its predetermined size, the web is cut off between the waiting station and the finishing station, the trailing end is wound up and fixed onto the finished roll, and the first end part of the severed web is blown around the waiting core to start a new roll. The new roll will during filling continue to revolve until it reaches the finishing station.

[0035] Any other type of rewinding or surface rewinding with a mandrel can also be used. As each elongated roll reaches its predetermined diameter or web length, the web will be cut off, and the next first end part of web will be blown or led around the next core or mandrel to start a new elongated log roll 101.

[0036] When forming a coreless roll a pseudocore 112 is made up from the few first windings from the first end part of the web.

[0037] The elongated log roll 101 is then pulled from the mandrel and placed in a cutting location, resting in a tray bed. A first end plate 102, connected to a first transporting chain link 113, is used to hold the elongated log roll 101 during the cutting operation and by the action of the first transporting chain link 113 on the first end plate 102 the elongated log roll 101 is pushed stepwise to each new cutting location. This end plate 102, covering the back end of the elongated log roll 101, is furnished with a gasket 103 to make a gas-tight connection to the end of the elongated roll 101, and can also be equipped with a protruding knob 104 to fit into an interior space 111 of the elongated roll 101 to hold it securely.

[0038] For pushing the first end plate 102 and the elongated log roll 101 forward to each new cutting location can instead of the first transporting chain link 113 also be used a hydraulic cylinder, or a pusher arm driven by a stepping motor, or any other suitable pushing means. The gasket 103 can be manufactured from several materials, most preferred is rubber, or be of the grooved metal disk type. The height and form of the knob 104 can vary, but preferred is about 5 mm height with a slight conicity. The diameter of the knob 104 should fit into the interior space 111 of the elongated log roll 101 to be cut. It is also possible to use the method of the invention without any knob 104 at all.

[0039] The cutting of the elongated log roll 101 is made with a rotating knife blade 109. The rotating knife blade 109 can be either a rotating circular saw or a rotating band saw. A rotating circular knife or a rotating band knife with a preferably symmetrically sharpened edge can also be used. Most preferred is a circular rotating saw. The diameter of a circular saw or knife must exceed double the outer diameter of the elongated log roll 101 to be cut by at least about 100 mm since when using a circular saw or knife only the part of the blade from the edge thereof to the axle can be used for radial movement during the cutting.

[0040] The front end of the elongated log roll 101, normally the end where the cutting operating is commenced, is held during the cutting operation by a second end plate 105, similar to the first end plate 102 at the back end, with a gasket 103 to make a gas-tight connection to the end of the elongated roll 101, and can also be equipped with a protruding knob 104 to fit into the interior space 111 of the elongated log roll 101 to hold it securely.

[0041] The second end plate 105 is connected to a second transporting chain link 114, and by the action of the second transporting chain link 114 the elongated log roll 101 is retained in its stepwise movement caused by the first transporting chain 113 to each new cutting location.

[0042] The retaining pressure on the second end plate 105 and therewith also the elongated log roll 101 by the second transporting chain 114 can alternatively be exerted by a hydraulic cylinder, a braker arm driven by a stepping motor or any other suitable retaining force applying means.

[0043] The two end plates 102,105 can together exert a retaining pressure by the action of the first transporting chain 113 and the second transporting chain 114 to hold the elongated log roll 101 securely and to effect gas-tightening, with the aid of the gaskets 103 at the front and back ends of the elongated log roll 101.

[0044] The two end plates 102,105 together with the core or pseudocore 112 define an interior space 111 of the elongated log roll 101 with an inner diameter.

[0045] At least one of the end plates 102,105 is equipped with a threaded nipple 106 for connecting a source of compressed gas. Instead of the threaded nipple 106 can also be used a fast attachment device of the snap-on type or any other suitable connecting means.

[0046] To this threaded nipple 106 is connected a pressurized gas pipe, hose or tube 107 from a common factory/plant source. Most convenient is to use pressurized air, but other gases such as nitrogen or carbon dioxide can also be used. The gas should be dried so as not to bring any water droplets into the product rolls. The gas could be heated, especially when cutting coreless rolls where water can be used for getting better cohesion in the first end part of the web to make a few first windings of the web into a pseudocore and/or as a lubricant to make it easier to pull the elongated log roll 101 off the mandrel. Then the heated gas will assist in drying away this water. It could also be advantageous to use pressurized gas that is humidity controlled, with a certain amount of water to adjust humidity in the core or pseudocore 112 or render the cooling effect on the rotating knife blade 109 more effective.

[0047] The pressurized gas pipe 107 is furnished with gas controller 108 for regulating the gas flow to the elongated log roll 101. The gas controller 108 may include one or more of a flow rate controller, a pressure controller and an on-off controller. Thus the speed of the pressure build-up and the final pressure in the interior space 111 can be controlled to at all times during the cutting get a satisfactory pressure in the interior space 111 of the elongated log roll 101 to withstand the pressure from the rotating knife blade 109.

[0048] The elongated log roll 101 is held tightly between the end plates 102,105, pressurized gas is let into the interior space 111 to a predetermined internal gas pressure of 100 - 1200 kPa, preferably 200 - 800 kPa, and more preferably 200 - 600 kPa. Preferably the gas controller means 108 is kept open during the complete

cutting of one elongated log roll 101.

[0049] When the rotating knife blade 109 cuts into the elongated log roll 101, the pressing force from the rotating knife blade 109 on the core 112 (or a pseudocore made up from the few first windings from the first end part of the web if the roll is coreless) will be counteracted by the internal gas pressure, thus the core 112 will retain its proper form. As the blade 109 cuts through the core 112 some of the gas will escape between the rotating knife blade 109 and the wound web. Normally this loss is less than can be met by the gas flow rate controller of the gas controller means 108, so no pressure loss will result in the interior space 111.

[0050] The gas escaping between the rotating knife blade 109 and the wound web will flow along both sides of the rotating knife blade 109 and carry off some of the heat generated by the cutting action and friction between web or core and the rotating knife blade 109. The gas flow will also act as a lubricating medium between the web or core and the rotating knife blade 109. Thus the heat generated will be less.

[0051] The pressurized gas can even be cooled to be more effective in its cooling action on the rotating knife blade 109.

[0052] After the first cut is completed the pressure from the first transporting chain 113 together with the pressure from the second transporting chain 114 on the end plates 102,105 will force the freshly cut edges together, making the cut gas-tight. If any pressure loss in the interior space 111 has occurred, the gas pressure will now rise again to its predetermined value. The next cut is started and the process is repeated.

[0053] When all the cuts in one elongated log roll 101 are made, the pressurized gas is shut off with the gas controller means 108, the front end plate 105 retracted, and the product rolls are removed to free the tray bed for the next elongated log roll 101. The product rolls are then transferred to further processing and/or packaging.

[0054] The inner diameter of the elongated log roll 101 (and also the resulting roll product) is 10 - 100 mm, preferably 20 - 80 mm.

[0055] The outer diameter of the elongated log roll 101 (and also the resulting roll product) is 80 - 800 mm, preferably 90 - 500 mm.

[0056] One sequence of making the cutting operation is to after placing the elongated log roll 101 in the cutting location: 1) tighten the end plates 102,105; 2) fill the interior space 111 with gas; 3) cut off one product roll; 4) repeat steps 1 to 3; 5) stop the gas feed; 6) move away one end plate 102,105; 7) remove all the product rolls.

[0057] Another sequence of making the cutting operation is to after placing the elongated log roll 101 in the cutting location: 1) tighten the end plates 102,105; 2) fill the interior space with gas; 3) cut off one product roll; 4) stop the gas feed; 5) move one end plate 102,105; 6) remove the product roll; 7) repeat steps 1 to 6.

[0058] The invention can of course also be used directly on mother rolls without any intermediate production steps, when they are of a suitable size to fit directly cutting into product rolls.

Example

[0059] Tests were made in one of the tissue mills of SCA Hygiene Products in Sweden, the Lilla Edet mill. The paper used in the tests was a 1-ply normal tissue paper with the basis weight 25 g/m^2 sold under the trade name MiniTork.

[0060] The elongated log rolls used were about 2 m long, with an outer diameter of 120 mm and an inner diameter of 71 mm. These were cut into product rolls with a length of 240 mm. The rolls were coreless and had the first windings wetted to create a pseudocore.

[0061] The cutting was done using a standard rotating circular saw, of the type 'Big Blade', that can be bought from several suppliers.

[0062] Pressurized air from the normal plant supply was let into the elongated log roll from both end plates. A pressure controller was used to adjust the pressure of the interior space of the roll.

[0063] At an overpressure of 150 kPa a slight improvement of the product rolls was seen.

[0064] At an overpressure of 400 kPa a very marked improvement of the product rolls was seen.

[0065] The air consumption for cutting these rolls at 400 kPa was about 0,006 kg/sec.

[0066] The drying effect on the pseudocores was also noticeable.

Claims

1. Method of forming product rolls from a web comprising the steps of:

- winding a web, starting from a first end part of the web, with or without a core (112), into an elongated log roll (101);
- cutting the elongated log roll (101) from the web after the elongated log roll (101) having a predetermined outer diameter or web length has been formed by the web;
- placing the elongated log roll (101) in a cutting location;
- cutting the elongated log roll (101) into product rolls with a rotating knife blade (109);
- removing the product rolls,

characterized by

- providing two end plates (102,105), at least one of which is connected to a controllable (108) source of pressurized gas;
- holding the elongated log roll (101) in the cutting location by means of the two end plates (102,105), the two end plates (102,105) togeth-

er with the first end part of the web or the core (112) defining an interior space (111) of the elongated log roll (101) with an inner diameter;

- filling the interior space (111) with pressurized gas during the cutting.

2. Method of forming product rolls from a web according to claim 1 **characterized in**

that the pressure of the pressurized gas is 100 - 1200 kPa, preferably 200 - 800 kPa, and more preferably 200 - 600 kPa.

3. Method of forming product rolls from a web according to claim 1 or 2 **characterized in**

that the pressurized gas is dried, or humidity controlled.

4. Method of forming product rolls from a web according to any of the preceding claims **characterized in**

that the pressurized gas is heated.

5. Method of forming product rolls from a web according to any of the preceding claims **characterized in**

that the pressurized gas is cooled.

6. Method of forming product rolls from a web according to any of the preceding claims **characterized in**

that the rotating knife blade (109) is a rotating circular knife or a rotating band knife.

7. Method of forming product rolls from a web according to any of the preceding claims **characterized in**

that the inner diameter of the elongated log roll (101) is 10 - 100 mm, preferably 20 - 80 mm.

8. Method of forming product rolls from a web according to any of the preceding claims **characterized in**

that the outer diameter of the elongated log roll (101) is 80 - 800 mm, preferably 90 - 500 mm.

9. Method of forming product rolls from a web according to any of the preceding claims **characterized in**

that a sequence of 1) tightening the end plates (102,105); 2) filling the interior space (111) with gas; 3) cutting off one product roll; 4) repeating steps 1 to 3; 5) stopping the gas feed; 6) moving away one end plate (102,105); 7) removing all the product rolls,
is used after the elongated log roll (101) is placed in the cutting location.

10. Method of forming product rolls from a web according to any of the preceding claims **characterized in**

that a sequence of 1) tightening the end plates (102,105); 2) filling the interior space with gas; 3) cutting off one product roll; 4) stopping the gas feed; 5) moving one end plate (102,105); 6) removing the product roll; 7) repeating steps 1 to 6;
is used after the elongated log roll (101) is placed in the cutting location.

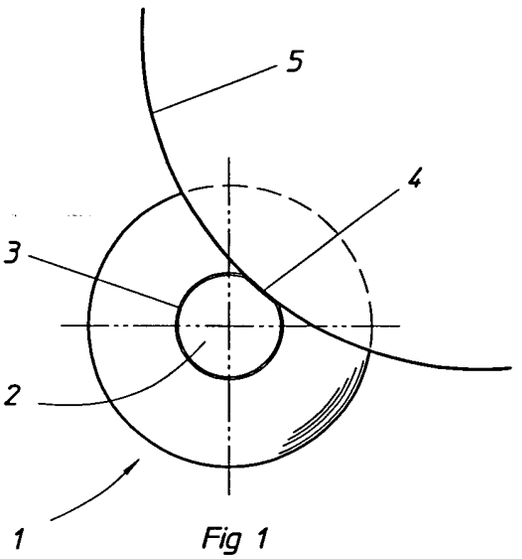

Fig 1

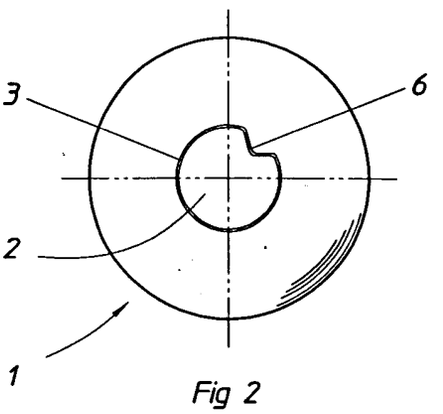

Fig 2

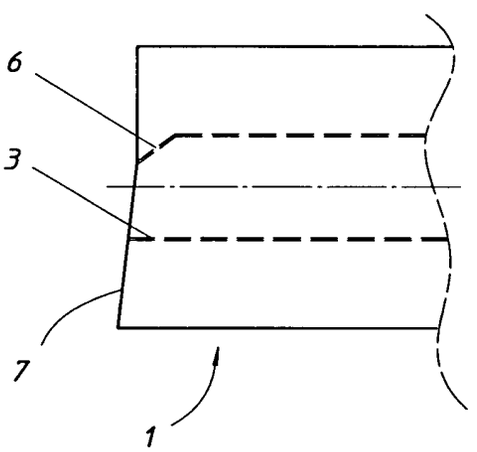

Fig 3

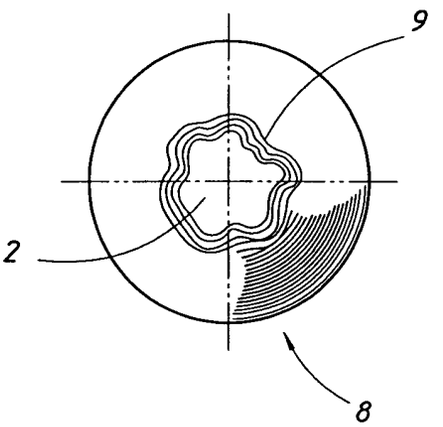

Fig 4

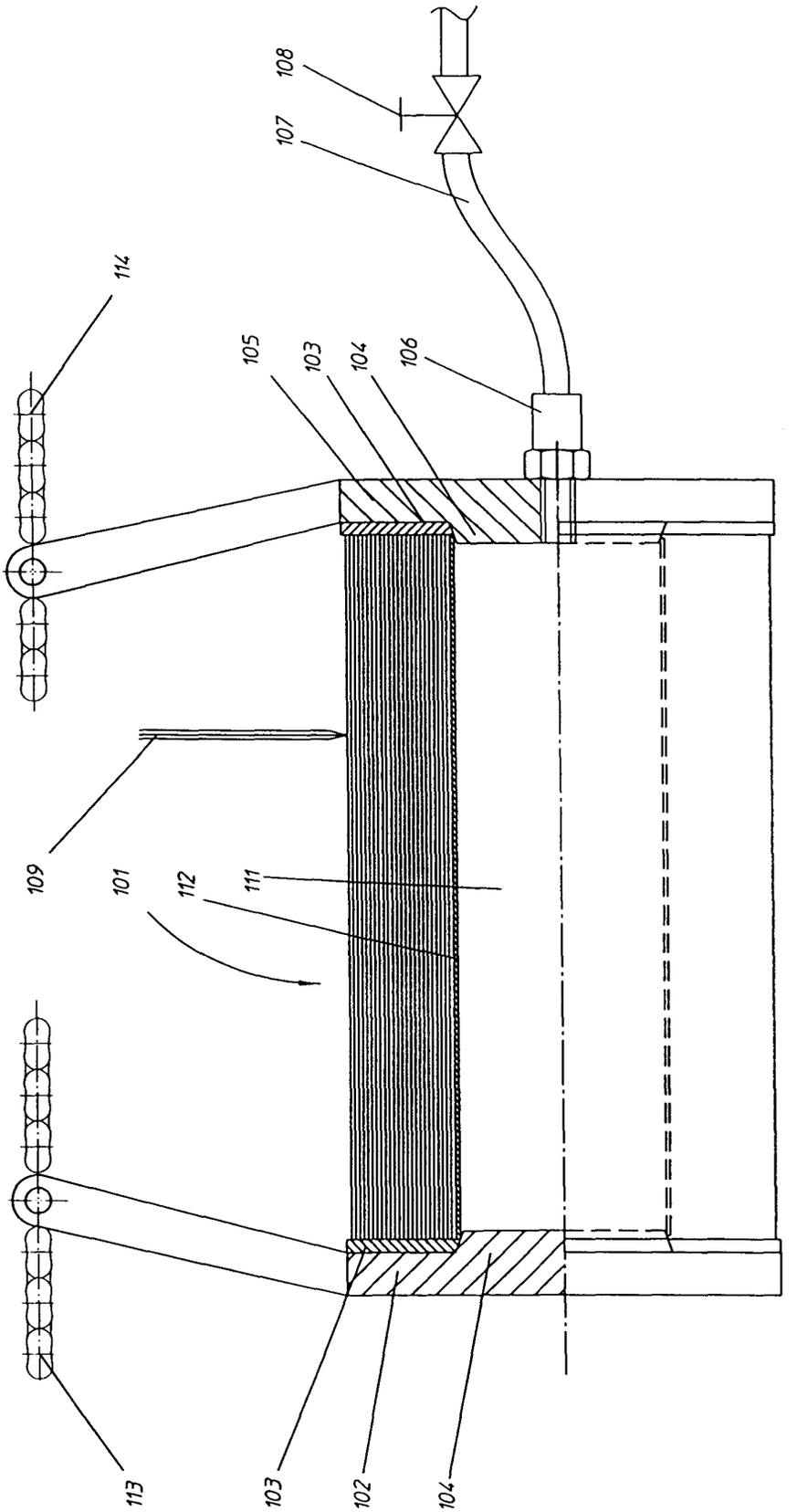

Fig 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 12 4891

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
D,A	US 5 271 137 A (SCHUTZ RUDOLPH W) 21 December 1993 (1993-12-21) * the whole document *	1	B26D3/16
A	US 5 453 070 A (MOODY JOHN R) 26 September 1995 (1995-09-26) * column 4, line 30 - line 48; figures *	1	
A	DE 17 78 323 A (DYNAMIT NOBEL AG) 9 September 1971 (1971-09-09) * claim 4; figures *	1	
A	US 4 487 378 A (KOBAYASHI MASASHI) 11 December 1984 (1984-12-11)		

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B26D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 July 2001	Haaken, W

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 12 4891

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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24-07-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5271137 A	21-12-1993	NONE	
US 5453070 A	26-09-1995	CA 2153644 A	13-01-1996
		EP 0692347 A	17-01-1996
		FI 953040 A	13-01-1996
		TR 960050 A	21-06-1996
DE 1778323 A	09-09-1971	NONE	
US 4487378 A	11-12-1984	JP 1423610 C	15-02-1988
		JP 58200719 A	22-11-1983
		JP 62034664 B	28-07-1987
		AU 565446 B	17-09-1987
		AU 2131883 A	23-05-1985
		BR 8207205 A	17-04-1984
		CA 1223567 A	30-06-1987
		CH 660293 A	15-04-1987
		DE 3241920 A	24-11-1983
		DK 497783 A	01-05-1985
		ES 280315 U	16-01-1985
		ES 527066 D	16-11-1984
		ES 8501343 A	16-02-1985
		FR 2554799 A	17-05-1985
		GB 2120206 A,B	30-11-1983
		IT 1175281 B	01-07-1987
		KR 8701478 B	13-08-1987
		MX 159414 A	25-05-1989
		NL 8204499 A,B,	16-12-1983
		SE 455367 B	11-07-1988
		SE 8306035 A	03-05-1985
		SU 1369670 A	23-01-1988

EPO FORM P0459

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