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

(11) **EP 2 085 504 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.08.2009 Bulletin 2009/32

(51) Int Cl.:
D01G 15/46 *(2006.01)* ***D04H 1/00*** *(2006.01)*

(21) Application number: **08002004.3**

(22) Date of filing: **04.02.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(71) Applicant: **ALBIS Spa**
20123 Milano (IT)

(72) Inventor: **Boscolo, Galliano**
Vigliano Biellese (IT)

(74) Representative: **Matkowska, Franck**
Matkowska & Associés
9 Rue Jacques Prévert
59650 Villeneuve d'Ascq (FR)

(54) **Suction apparatus for transferring a nonwoven web**

(57) The apparatus (3) is used for transferring a nonwoven web (W) between an upstream unit (1), such as for example a conveyor belt, and a downstream unit (2) , such as for example a thermal bonding unit. The apparatus comprises a rotating and air permeable cylinder (30), and air suction means (31) for creating a suction force through the cylinder in order to make a nonwowen web adhere against the surface of a first portion (P1) of the cylinder. The air suction means (31) further comprise a stationary internal channel (310) that is mounted inside the cylinder (30) and extends between the said first portion (P1) and a second portion (P2) of the cylinder, and a suction hood (311) that is mounted outside the cylinder (30) and in the vicinity of the said second portion (P2).

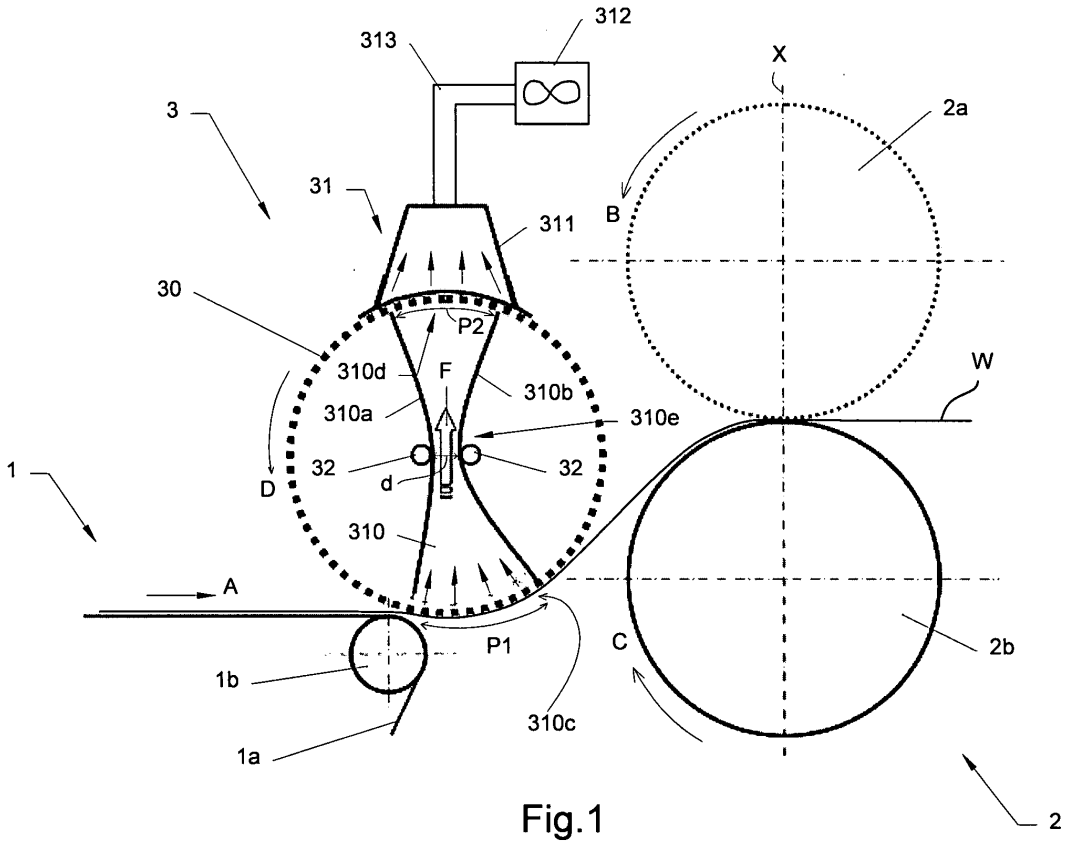

Fig.1

EP 2 085 504 A1

Description

Technical field

[0001] The invention relates to a suction apparatus for transferring a nonwoven web between an upstream device and a downstream device. The invention is particularly, but not exclusively, applicable for taking off and transferring a nonwoven web from a conveyor belt to a downstream unit, such as for example a bonding unit.

Prior art

Nonwoven web

[0002] As used therein, the wording "nonwoven web" refers to any fibres and/or filaments web manufactured in the nonwoven industry, independently of the method of manufacturing said web and of the fibres or filaments type. The web can be a monolayer web or a multilayer web made from several layers of fibres or filaments. In particular, the nonwoven web can be made of one or more layers selected form the group: carded nonwoven layer, spunbonded nonwoven layer, meltblown nonwoven layer, air-laid nonwoven layer. One layer of the web can be also an absorbent layer made from a fibre material generally referred as "pulp", and made of or containing fibres from natural sources such as woody and non-woody plants. Woody plants include, for example, deciduous and coniferous trees. Non-woody plants include, for example, cotton, flax, esparto grass, milkweed, straw, jute hemp, and bagasse. In case of a multilayer web, all the layers can be of the same type, or the nonwoven can be composite, that is to say made of several layers of different types such as for example a CMC nonwoven web (Carded layer / Meltblown layer / Carded layer), a SMS nonwoven web (Spunbonded layer / Meltblown layer / Spunbonded layer), a SPC nonwoven web (Spunbonded layer / Pulp layer / Carded layer), ...

[0003] A nonwoven web generally undergoes one or more consolidation steps such as for example by thermal bonding, hydroentangling, needle bonding, chemical bonding, ultrasonic bonding. As used therein the wording "nonwoven web" refers generally either to a non-consolidated web or to a consolidated web (i.e. after bonding).

Transfer of a nonwoven web

[0004] In the nonwoven industry, it is known to date to use a suction cylinder for transferring a nonwoven web between an upstream unit and a downstream unit.

[0005] In particular, in European patent application EP 0 733 729 a suction cylinder is used for taking off a nonwoven from an upstream conveyor belt and for transferring the nonwoven web to a downstream calendering unit. During its transfer, the nonwoven web adheres by suction against a lower portion of the suction cylinder.

[0006] More particularly, the suction cylinder described in this publication comprises a rotating and perforated cylinder and suction means. The suction means comprise a stationary internal suction chamber mounted inside the cylinder, and blowing means mounted outside the cylinder and used for sucking air from the internal chamber. The internal chamber is constituted by an air pipe or duct, extending on the whole length of the cylinder and having a longitudinal bottom slot, and two stationary partitions extending from each side of the said slot. The two partitions define an internal suction sector. The internal air pipe or duct is connected at one extremity or at both extremities to air blowing means. This type of construction for a suction cylinder is also disclosed in French patent application FR 1 500 746.

[0007] In operation, air is continuously sucked from the outside of the cylinder within the internal suction sector, and the nonwoven web adheres by suction against the outer surface of the perforated cylinder, in the zone delimited by the stationary suction sector.

[0008] In the suction apparatus described in European patent application EP 0 733 729 or French patent application FR 1 500 746, the use of an internal longitudinal air duct mounted inside the cylinder and connected at least at one extremity to blowing means involve several drawbacks.

[0009] It is difficult to obtain a homogenous air distribution on the whole length of the cylinder. In practise the suction force that is generated in the vicinity of the suction extremity of the duct is indeed higher than in the middle of the duct. It is thus difficult to generate a constant suction force along the whole length of the suction cylinder, especially when a long cylinder is used. This poor air distribution may detrimentally damage the structure of the nonwoven web or may detrimentally cause the formation of creases in the nonwoven web.

[0010] The volume of the internal duct is also limited by the geometry of the cylinder, which in turn prejudicially impairs the suction air flow, and thereby impairs the suction force applied on the nonwoven web.

[0011] These drawbacks render this type of suction apparatus suitable only for transferring nonwoven web of short width and/or for transferring nonwoven web at low speed. Such a suction apparatus is no efficient for transferring a nonwoven web of large width, especially a nonwoven web having a width of 5m ore more, and/or for transferring a nonwoven web at high speed, especially at speeds higher than 100 m/min.

Objective of the invention

[0012] One main objective of the invention is to provide a novel apparatus for transferring a nonwoven web between an upstream unit and a downstream unit and that overcomes the aforesaid drawbacks of the suction transfer apparatus of the prior art.

Summary of the invention

[0013] This objective is reached by the apparatus of claim 1. This apparatus for transferring of a nonwoven web comprises a rotating and air permeable cylinder and air suction means for creating a suction force through the cylinder in order to make a nonwowen web adhere against the surface of a first portion of the cylinder. The air suction means comprise a stationary internal channel that is mounted inside the cylinder and extends between the said first portion and a second portion of the cylinder, and a suction hood that is mounted outside the cylinder and in the vicinity of the said second portion.

Brief description of the drawing

[0014] Other characteristics and advantages of the invention will appear more clearly on reading the following description of a preferred embodiment of the invention, which description is given by way of nonlimiting example and is made with reference to the accompanying drawing in which the sole figure 1 is schematic representation of a transfer apparatus of the invention that is used for transferring a nonwoven web from an upstream conveyor belt to a calendering unit.

Detailed description

[0015] In reference to figure 1, a nonwoven web W is taken off from an upstream unit 1 and transferred to a downstream unit 2 by means of a transfer apparatus 3 of the invention.

[0016] In this particular example, the upstream unit 1 is a conveyor belt that is used for conveying the nonwoven web W, and that comprises an endless belt 1a tensioned between rotating rollers. Only the downstream roller 1b is illustrated on figure 1. In operation, this endless belt 1a is driven by said rollers in the direction indicated by arrow A. This conveyor belt 1 is for example positioned at the output of a carding machine (not shown on figure 1), the nonwoven web being in that case a non-consolidated web made of one or several carded fibre layers.

[0017] In the particular example of figure 1, the downstream unit is a thermal bonding unit 2, also called "calendering unit" and comprise two calendering cylinders 2a, 2b. Preferably, at least one of the cylinders is heated. More particularly, the upper cylinder 2a and the lower cylinder 2b are mounted along a same axis X which is substantially vertical, and rotate in opposite directions, indicated by arrows B and C. In operation the nonwoven web W is drawn and compressed between the two said calendering cylinders 2a, 2b. This nonwoven web is thus consolidated by mechanical compression and heat.

[0018] The invention is not limited to the use of a transfer apparatus 3 for transferring a nonwoven web between an upstream conveyor belt 1 and a downstream calendering unit 2, but can be more generally used for transferring a nonwoven web between any upstream unit 1 and any downstream unit 2, independently of the structure or function of theses units. This nonwoven web W is not necessarily a carded web, but can be any known monolayer or multilayer nonwoven web.

[0019] The transfer apparatus 3 comprises a rotating and air permeable cylinder 30, for example a perforated cylinder, and air suction means 31.

[0020] The cylinder 30 is positioned between the conveyor belt 1 and the calendering unit 2, in vicinity of the downstream roller 1b. In operation, the cylinder is rotated in the direction indicated by arrow D. In another variant, the cylinder 30 can be positioned closer to the cylinder 2b of the calendering unit 2, as disclosed in European patent application EP 0 733 729.

[0021] The air suction means 31 comprise a stationary air channel 310 positioned inside the cylinder 30 and a suction hood 311 mounted outside the cylinder 30.

[0022] The air channel 310 extends in the direction perpendicular to figure 1 along substantially the whole length of the cylinder 30, and extends in the plan of figure 1 between two opposite portions of the cylinder 30, namely a bottom portion P1 referred therein as first portion, and an upper portion P2 referred therein as second portion. The air channel 310 comprises two opposite air suction inlet 310c and air exhaust outlet 310d. Air suction inlet 310c defines a suction sector extending in front the aforesaid first portion P1 of the cylinder 30. Air exhaust outlet 310d is positioned opposite to the suction hood 311 and defines a discharge sector extending in front of the aforesaid second portion P2 of the cylinder 30.

[0023] In the particular example of figure 1, this air channel 310 is delimited by two partitions 310a and 310b mounted inside the cylinder 30. More particularly, the two partitions 310a, 310b are held inside the cylinder 30 by two rods 32 that extend longitudinally in the hollow cylinder 30. The transverse section of the air channel 310 formed by the two partitions 310a, 310b is preferably decreasing from the air suction inlet 310c towards a narrow section 310e (figure 1/ distance d) and is preferably increasing from this narrow section 310e towards the air exhaust outlet 310d. In the particular construction of figure 1, this narrow section 310e is obtained by using partition 310a, 310b that are constituted by two bended plates.

[0024] Preferably, but not necessarily, when the air channel 310 comprises a narrow section 310e, this narrow section 310e is positioned substantially at the centre of the cylinder 30 as shown on figure 1.

[0025] The invention is not limited to the used of rods 32 for fastening the partitions 310a, 310b inside the cylinder, but the partitions 310a, 310b may fastened inside the cylinder 30 by any fastening means known by one skilled in the art. The air channel 310 is not necessary formed by two partitions 310a, 310b but can be formed by any other structure. The transverse section or shape of the air channel 310 can also differ from the one shown on figure 1.

[0026] The suction hood 311 is mounted outside the cylinder 30, in vicinity of the second portion P2 of the cylinder 30, and covers the said second portion P2. The suction hood 311 extends preferably on substantially the whole length of the cylinder 30. This suction hood 311 is connected to the suction inlet of at least one fan 312 by means of at least one duct 313 that is preferably positioned at the centre of the hood 311, or by means of several ducts 313 that are preferably regularly distributed on the whole length of the hood (i.e. on the whole length of the cylinder 30).

[0027] In operation, when the fan 312 is running, air coming from the outside of the cylinder 30 is continuously sucked through the first portion P1 of the cylinder 30, penetrates inside the air channel 310 through the air suction inlet 310c, is canalized in the air channel 310 by partitions 310a, 310b, and is discharged in the suction hood 311 through the air exhaust outlet 310d and through the second portion P2 of the cylinder 30. The air flow inside the channel 310 is illustrated by arrow F on figure 1.

[0028] When a nonwoven web W is conveyed onto the conveyor belt 1, this nonwoven web W is taken off the belt and adheres against the first portion P1 of the cylinder 30 under the action of the suction force created through this portion P1, and is transferred thanks to the rotation of the cylinder 30 between the two calendering cylinders 2a, 2b, at a position downstream the suction portion P1.

[0029] Thanks to this implementation of the suction hood 311 combined with the internal air channel 310, the air flow through the whole surface of suction portion P1 of the cylinder can be better and easier controlled and adjusted. In particular, a homogeneous air distribution can be obtained through the first suction portion P1, which enables to obtain a substantially constant suction force on the whole surface of first suction portion P1. The nonwoven web W is thus correctly held on its whole width by this first portion P1 during its transfer to the downstream unit 2. Furthermore, the air velocity, and thus the suction force applied on the nonwoven web, can be easily adjusted to a sufficient level. Thanks to these advantages, the transfer apparatus 3 of the invention can be efficiently used for transferring a nonwoven web W of large width, for example a nonwoven web having a width of 5m ore more, and/or for transferring a nonwoven web at high speed, for example at speed higher than 100 m/min. Of course, the transfer apparatus 3 of the invention can be also advantageously used for transferring a nonwoven web W of width less than 5m, and/or for transferring a nonwoven web at speeds lower than 100 m/min.

[0030] Preferably, but not necessarily, the position of at least one partition, and more preferably of both partitions 310a, 310b, inside the cylinder 30 is adjustable, in order to adjust the dimension of the portions P1 and P2, and also the volume of the air channel 310. In the particular construction of figure 1, the adjustment of the positions of the partitions 310a, 310b enable also to adjust the dimension of the narrow section 310e. To this end, the fastening rods 32 are for example slidably movable inside the suction cylinder 30.

[0031] Preferably, but not necessarily, the position of the air channel 310 inside the cylinder is also adjustable, in order to adjust the positions of portions P1 and P2 on the periphery of the cylinder.

[0032] The suction hood 311 is preferably, but not necessarily, fixedly mounted above the suction cylinder 30, but its position may, in an alternative embodiment, be adjustable around the periphery of the cylinder 30.

Claims

1. An apparatus (3) for transferring of a nonwoven web (W), and comprising a rotating and air permeable cylinder (30), and air suction means (31) for creating a suction force through the cylinder in order to make a nonwowen web adhere against the surface of a first portion (P1) of the cylinder, **characterised in that** the air suction means (31) comprise a stationary internal channel (310) that is mounted inside the cylinder (30) and extends between the said first portion (P1) and a second portion (P2) of the cylinder, and a suction hood (311) that is mounted outside the cylinder (30) and in the vicinity of the said second portion (P2).

2. The apparatus of claim 1, **characterised in that** the air channel (310) comprises an air suction inlet (310c) and an air exhaust outlet (310d), and the transverse section of the air channel (310) is decreasing from the air suction inlet (310c) towards a narrow section (310e) and is increasing from this narrow section (310e) towards the air exhaust outlet (310d).

3. The apparatus of claim 2, **characterised in that** the narrow section (310e) of the air channel (310) is positioned substantially at the centre of the cylinder (30).

4. The apparatus of anyone of claims 1 to 3, **characterised in that** the air channel (30) is formed by two partitions (310a, 310b).

5. The apparatus of claim 4, **characterised in that** the two partitions (310a, 310b) comprise two bended plates.

6. The apparatus of claims 4 or 5, **characterised in that** the position of at least one partition (310a, 310b) inside the cylinder is adjustable, in order to adjust the dimension of first (P1) and second (P2) portions.

7. The apparatus of anyone of claims 1 to 6, **characterised in that** the volume of the air channel (310) is adjustable.

8. The apparatus of anyone of claims 1 to 7, **characterised in that** the position of the air channel (310) inside the cylinder is adjustable.

9. The apparatus of anyone of claims 1 to 8, **characterised in that** the air channel (310) comprises an air suction inlet (310c) and an air exhaust outlet (310d), and **in that** the air suction inlet (310c) is positioned in a lower portion of the suction cylinder, and the air exhaust outlet (310d) is positioned in an upper portion of the cylinder (30).

10. A system for handling and optionally treating a nonwoven web (W), **characterised in that** it comprises an upstream unit (1), a downstream unit (2), and a transfer apparatus (3) of anyone of claims 1 to 9, and **in that** the cylinder (30) of the transfer apparatus (3) is positioned between the two upstream (1) and downstream (2) units for transferring a nonwoven web from the upstream unit (1) to the downstream unit (2).

11. The system of claim 10, **characterised in that** the upstream unit (1) comprises a conveyor belt.

12. The system of claim 10 or 11, **characterised in that** the downstream unit (2) is a bonding unit (2) for consolidating a nonwoven web.

13. The system of claim 12, **characterised in that** the downstream unit (2) is a thermal bonding unit comprising two calendering cylinders (2a, 2b).

14. A use of an apparatus of anyone of claims 1 to 9 for transferring a nonwoven web (W) from an upstream unit (1) to a downstream unit (2).

15. The use of claim 14, **characterised in that** the upstream unit (1) comprises a conveyor belt.

16. The use of claim 14 or 15, **characterised in that** the downstream unit (2) is a bonding unit (2) for consolidating a nonwoven web.

17. The use of claim 16, **characterized in that** the downstream unit (2) is a thermal bonding unit comprising two calendering cylinders (2a, 2b).

18. A process for transferring a nonwoven web (W) from an upstream unit (1) to a downstream unit (2), **characterised in that** the nonwoven web (W) is taken from the upstream unit (1) and adheres against the first portion (P1) of the cylinder (30) of a transfer apparatus of anyone of claims 1 to 9, under the action of the suction force created through this portion (P1), and **in that** the cylinder (30) is rotated in order to transfer the nonwoven web to the downstream unit (2).

19. The process of claim 18, **characterised in that** the upstream unit (1) comprises a conveyor belt and the nonwoven web (W) is conveyed by the conveyor belt and is taken off the conveyor belt by the suction cylinder (30) of the transfer apparatus (3).

20. The process of claim 18, **characterised in that** the nonwoven web (W) is consolidated in the downstream unit (2).

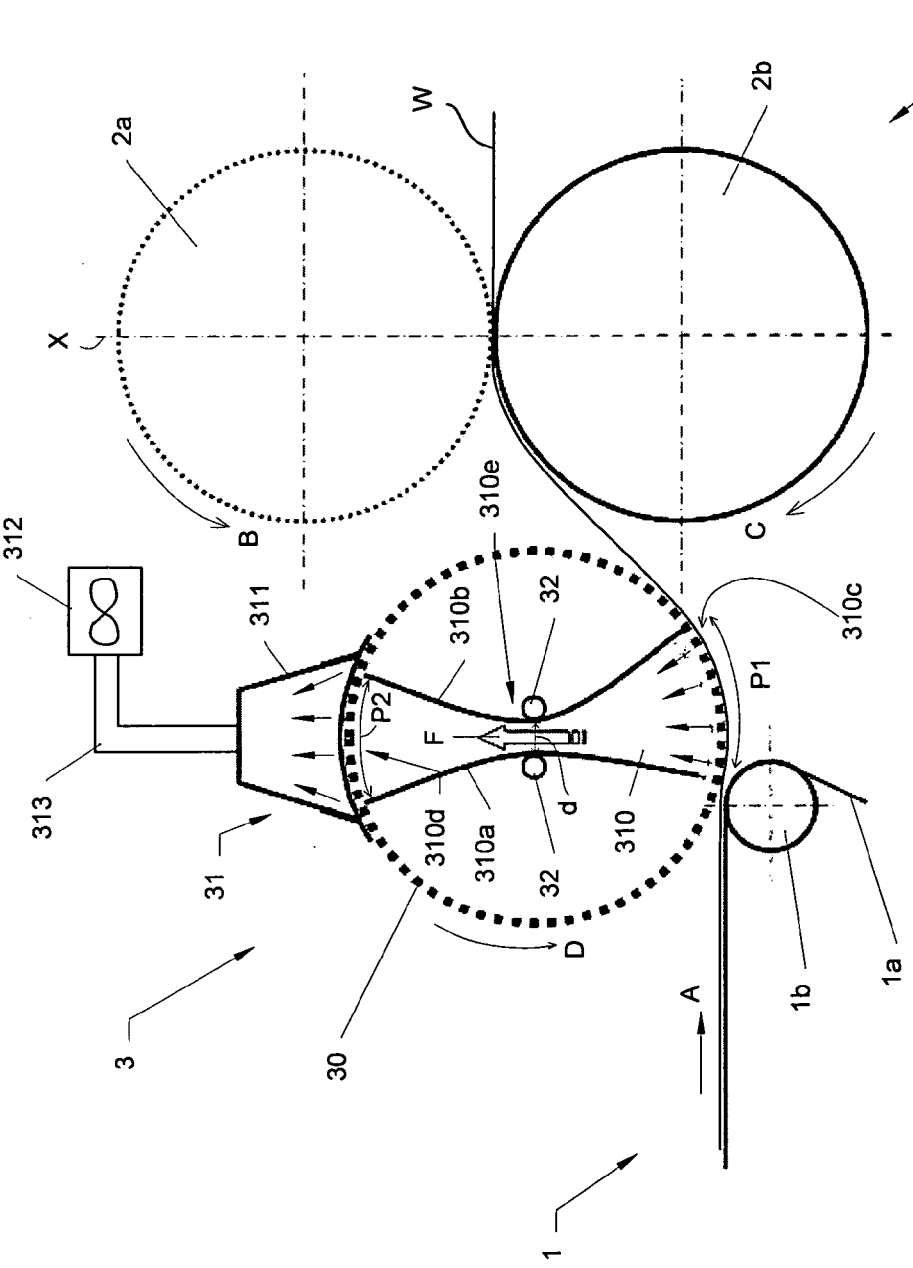
2
2a
2b
W
X
B
C
310e
312
311
310b
32
310c
P1
P2
F
313
31
310d
310a
d
310
32
D
A
3
30
1b
1a
1

Fig.1

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 08 00 2004

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 0 733 729 A (THIBEAU & CIE SA A [FR] THIBEAU [FR]) 25 September 1996 (1996-09-25) * column 2, line 51 - column 3, line 12; claim 1; figure 1 *	1-20	INV. D01G15/46 D04H1/00
A	GB 1 476 230 A (VOITH GMBH J M) 10 June 1977 (1977-06-10) * page 2, lines 53-57; claim 1 * * page 3, lines 29-34; figure 2 *	1,18	
A	GB 2 001 369 A (NOKIA OY AB; VALMET OY) 31 January 1979 (1979-01-31) * abstract; figure 2 *	1,18	
A	EP 0 899 370 A (SPINNBAU GMBH [DE]) 3 March 1999 (1999-03-03) * abstract; figure 1 *	1,14,18	
A	GB 973 086 A (FERDINAND REITERER; LOUIS WINDISCH; JEAN NIFENECKER) 21 October 1964 (1964-10-21) * page 3, lines 12-19; figures 5,6 *		TECHNICAL FIELDS SEARCHED (IPC) D01G D04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 January 2009	Dreyer, Claude

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 00 2004

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-01-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0733729 A	25-09-1996	AT 161591 T	15-01-1998
		DE 69600129 D1	05-02-1998
		DE 69600129 T2	04-06-1998
		DE 733729 T1	05-06-1997
		DK 733729 T3	19-01-1998
		FR 2732042 A1	27-09-1996
		JP 8260375 A	08-10-1996
		US 6050469 A	18-04-2000
GB 1476230 A	10-06-1977	AT 335279 B	10-03-1977
		DE 2364346 A1	10-07-1975
		FI 371074 A	23-06-1975
		JP 50094212 A	26-07-1975
		JP 54019486 B	16-07-1979
		SE 7416136 A	23-06-1975
		US 4033049 A	05-07-1977
GB 2001369 A	31-01-1979	BR 7804397 A	28-02-1979
		CA 1120260 A1	23-03-1982
		DE 2829341 A1	25-01-1979
		FI 54164 B	30-06-1978
		FR 2396829 A1	02-02-1979
		IT 1096912 B	26-08-1985
		JP 54018909 A	13-02-1979
		NO 782384 A	09-01-1979
		SE 420747 B	26-10-1981
		SE 7807600 A	09-01-1979
		SU 847935 A3	15-07-1981
		US 4194947 A	25-03-1980
EP 0899370 A	03-03-1999	DE 19737514 A1	04-03-1999
GB 973086 A	21-10-1964	CH 373992 A	15-12-1963
		FR 1255061 A	03-03-1961

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 0733729 A **[0005] [0008] [0020]**
- FR 1500746 **[0006] [0008]**