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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: METHOD AND APPARATUS FOR PLAITING PAPER

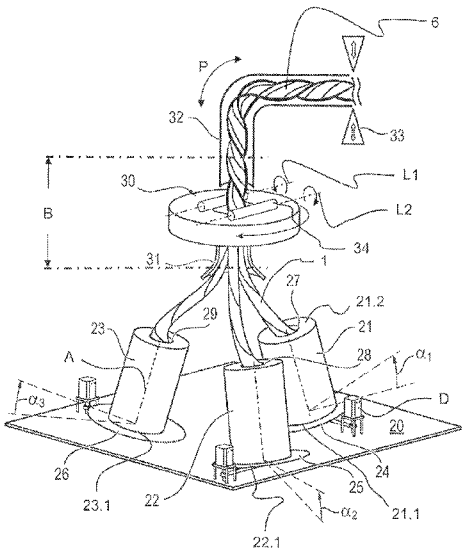

FIG. 6

(57) Abstract: The Invention relates to a method for plaiting paper from paper material reserved in at least one paper roll. Said at least one paper roll has two opposite flat sides. The at least one paper roll is e.g. received on its first flat side. A hose paper for plaiting is taken out through this first or the second flat side and introduced into a plaiting mechanism. Said hose paper is built up when the paper material is taken from the inner diameter of said at least one paper roll throughout its flat side with or without rotating of said paper roll.

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Method and apparatus for plaiting paper

This invention relates broadly to a method and an apparatus for forming paper to a paper plait, and more particularly to a unitary apparatus into which at least two rolls of paper may be introduced and from which plaited paper may be processed e.g. for packaging purposes, as disclosed in GB 901569.

Paper plaits are known in diverse forms e.g. from DE 70 09 305 U1, DE 69 14 996 U1, DE 18 45 078 U1, DE 1 111 329 A1, DE 182 969 A or DE 196 03 706 C1.

It is still a problem to economically plait paper for packaging purposes, especially for producing a paper plait as cushioning material. Taking into account transport business it is a further object to develop a small and smart apparatus that may deliver such converted packaging material without great machine surroundings or complicated operations.

This problem is solved via the method and apparatus for plaiting paper according to independent claims.

Advantageous forms of methods and apparatuses according to the invention are subject of dependent claims.

Plated paper ropes, including twisted paper hoses, or plated paper layers are formed gaining volume and structural properties compared to the base paper material itself so that this plated paper product is of advantage for several packaging purposes. With mixing different paper materials of several introduced paper rolls such properties may be influenced by the operator individually, no matter if he just

claims optical properties like color or static properties for saving packed goods or both.

According to the invention paper is plaited from paper material reserved in at least one paper roll. Said at least one paper roll has two opposite flat sides. The at least one paper roll is e.g. received on its first flat side. A hose paper for plaiting is taken out through this first or the second flat side and introduced into a plaiting mechanism. Said hose paper is built up when the paper material is taken from the inner diameter of said at least one paper roll throughout its flat side with or without rotating of said paper roll.

The hose is generated automatically due to the fact that the paper rolls are preferably wounded without spools. So paper web may be unwinded from the inner circle of the reserve paper roll, no matter if the reserve paper roll is lying on its round wall or standing on its first flat side. When reserve paper rolls are presented above a plaiting mechanism, it is a possible arrangement of the invention to receive reserve paper rolls on their first flat sides on plates with center holes the paper hoses leaving the inner circle through this first flat sides and through the receiving plates downwards in direction of the plaiting mechanism.

According to a preferred embodiment more than one paper roll, especially three paper rolls, are received generally independent from each other on their first flat sides whereby the paper material for plaiting is taken as hoses from the inner diameters of said paper rolls throughout their second flat sides.

I such case of more than one paper roll it has been of advantage to receive at least two reserve paper rolls in opposite orientations concerning their windings. When a first reserve paper roll was e.g. lying on supporting tires with an inner end raising up in the inner diameter of said roll in front then the second reserve paper roll was positioned axially aligned to said first roll but with its inner paper end raising up in backside of its inner diameter. A first hose paper was taken out from the first reserve paper roll on the second reserve paper roll's flat side and a second hose paper was taken out from the second roll on second roll's flat side being presented toward the first roll. These two hose papers were joined and they mixed up because of their opposite orientation.

According to a further preferred embodiment at least one plaiting mechanism is positioned on the first flat side's side such that said at least one paper roll is rotated around its axis and / or on the second flat side's side such that said at least one hose paper is rotated at least in a section around its longitudinal axis progression.

With one or two plaiting mechanisms it is possible to form a wide range of plated paper products economically, even complicated plated paper ropes.

According to another preferred embodiment at least one paper roll is received with its first flat side on reserve plates adjusting roll axis with angle(s), in case of more than one roll especially such that all rolls with their axis are oriented with their second flat sides jacked through in their centers by said hose paper axis in direction of a common guiding means.

Production velocity may be higher with such angling said reserve paper rolls.

According to another preferred embodiment said reserve plates are rotatable, especially being independently driven. Hose build up may be accelerated and height of a construction for producing plaited paper ropes according to the invention be reduced.

According to another preferred embodiment said paper rolls are received in positions being movable independently from each other, especially resulting in a braiding moving for producing a plated paper layer or a threefold fourfold or multiple times closed plait as plaited paper rope.

According to another preferred embodiment said plating mechanism integrating two movements of said paper hose(s) changing at least one property so that plaited paper rope with new safe liaisons is derived rotating of hose(s)/rope and forwarding hoses(s)/rope.

Such success was gained when surprisingly the produced plaited paper rope itself did not rotate anymore after some distance following the plaiting mechanism. And this plaited paper rope did not lose its form anymore. So the mechanical energy invested during plaiting was stored in the product and no feared deplaiting followed.

According to another preferred embodiment said plating mechanism rotating around the longitudinal paper direction carries at least two opposite rotating driving rolls, both of them rotating around lateral axis, favorably around two

parallel lateral axis, which driving rolls are forwarding the hose(s) / plaited paper rope between them, forming a wide low-compressing nip. In favorable forms this rotatable nip is the only drive forwarding paper material in the whole plaiting process.

According to another preferred embodiment cutting and/or perforating means are used to close rope sections and / or at least partly divide rope sections from each other without completely cutting of, and prepare for use, especially use in packaging purposes.

In further advantageous embodiments with cutting and/or perforating means these means got their position in an inner arrangement area to hinder working accidents. A perforating and pressing was e.g. integrated shortly before said plaiting mechanism. Dividing into cushions was one effect. But the pressing section before and after the perforating line made a locking effect within perforated paper rope, which did not self-delock later.

A preferred embodiment of above mentioned plating mechanism integrates exactly two movements of paper hose(s) therewith changing at least one property of such so that a plaited paper rope with new safe liaisons is derived with means for rotating of hose(s)/rope and forwarding hoses(s)/rope.

The invention further covers paper ropes or paper layers plaited according to one of the plaiting methods described above. The invention further covers the use of such plaited paper for packaging purposes. Independent of this packaging use the above described idea to use the inner end of paper rolls for forming a plaited paper layer or a plaited paper

rope from self-upbuilding hoses is a claim of this application.

Crimpings or other deformations according to the invention may also be understood also as a preparing step before or during a certain plait forming procedure, especially with compressing in sections. Paper ropes produced with above described embodiments have been steerable. Successful sequences of such plaiting methods have been compressing, guiding, rotating, and/or further compressing.
The novel features of the invention will be best understood from the following description when taken together with the accompanying drawings in which one embodiment of an apparatus and several embodiments of plated paper products for packaging purposes are disclosed, and in which the separate parts are designated by suitable reference characters in each of the views, and in which:

Fig. 1 is a schematical drawing of a three times closed plait formed by means of a method / apparatus according to the invention,
Fig. 2 is a schematical drawing of a four times closed plait formed by means of a method / apparatus according to the invention,
Fig. 3 is a schematical drawing of a two times closed plait with two inner core paper hoses formed by means of a method / apparatus according to the invention,
Fig. 4 is a schematical drawing of a multiple times closed plait formed by means of a method / apparatus according to the invention,
Fig. 5 is a schematical drawing of a plaited paper layer formed by means of a method / apparatus according to the invention, and

Fig. 6 is a schematical perspective view on an apparatus according to a demonstrative embodiment of the invention.

Figures 1 to 4 show four embodiments of plaited paper ropes 3, 4, 4', 5 that are produced using a method for plaiting paper according to the invention. Figure 5 shows a plaited paper layer 2 as a fifth product embodiment. These plaited paper products 2, 3, 4, 4', 5 consist of paper hoses 10 – 19 that are pulled out from an inner dimeter 27, 28, 29 of a corresponding reserve paper roll 21, 22, 23 positioned with their first flat sides 21.1 on a reserve base plain 20. An overview of a machine arrangement for operating such inventive method according to a favorable arrangement embodiment is shown in figure 6.

Said method for plaiting paper employs at least one paper roll 21, 22, 23. Paper material is reserved in three such paper rolls according to the embodiment given with figure 6. Each of these paper rolls 21, 22, 23 has two opposite flat sides 21.1, 21.2. The aim of this method is to produce a plaited paper rope 6 and / or a plaited paper layer as examples are given with figures 1 to 5.

To achieve that, the invention teaches to receive said paper rolls 21, 22, 23 on their first flat sides 21.1, 22.1, 23.1. Then hose papers 1 for plaiting are introduced into a plaiting mechanism 30, which hose paper 1 is built up by taking the paper material from the inner diameters 29 of said paper rolls 21, 22, 23 throughout their second flat sides 21.2.

According to the advantageous embodiment of figure 6 the three paper rolls 21, 22, 23 are received independent from each other on their first flat sides 21.1, 22.1, 23.1 whereby the

paper material for plaiting is taken as hoses 10, 11, 12 from the inner diameters of said paper rolls throughout their second flat sides 21.2. These three hose papers 1 have same orientation as may be seen by drawn helix on their round surfaces. Each paper roll has its own receiving reserve plate 25. Such reserve plate is according to the shown embodiment supporting the paper roll rotatable around its axis A. For rotating a drive D is schematically drawn in Figure 6 adjacent to each reserve plate 25. In an advantageous embodiment reserve plates are all parallel to a horizontal reserve base plane 20. The embodiment of figure 6 shows such reserve base plane 20, too, but the shown reserve plates 25 are themselves not horizontal but positioned is an angle α to said reserve base plane 20 for orienting all of the paper roll axis A toward a guiding means 31 being the entrance of said plaiting mechanism 30.

Following the idea of the invention, generally – but not shown in any figure - at least one plaiting mechanism may be positioned on the first flat side's 21.1 side such that said at least one paper roll 21, 22, 23 is e.g. rotated around its axis A and said rolls 21, 22, 23 change their positions on the reserve base plain 20.

According to figure 6 said plating mechanism 30 is positioned on the second flat side's 21.2 side such that said three hose papers 1 are rotated by this plaiting mechanism 30 in a section B even when none of the paper rolls 21, 22, 23 is driven or self-rotating. In case of the shown plaiting mechanism 30 the three hoses are nipped between driving rolls 34 rotating around horizontal nip roll axis L1, L2 and rotated by this plaiting mechanism 30 around the paper hoses' 1 common longitudinal paper rope 6 axis progression P.

The method for plaiting paper according to figure 6 shows three equal angles α1, α2, α3. But advantageous embodiments not shown in Figure 6 had at least two paper rolls received with their first flat sides on reserve plates adjusting roll axis with different angles α, even different paper grades 18, 19 to form such rope 4' designs as given by figure 3.

Said driving rolls 34 are forwarding the hoses 1 together while they change to continue common movement as one plaited paper rope 6 between them. This plaiting mechanism is therewith the only drive forwarding paper material in the whole inventive plaiting process according to the shown embodiment. The shown method for plaiting paper according to figure 6 is finalized with a cutting and perforating means 33 closing rope sections and cutting them into packaging material sections or just perforating to just dispose plaited paper rope 6 to separate by hand later section by section from each other. However this finishing means is prepare for use, especially use in packaging purposes.

As mentioned before different paper qualities are mixed in plaited paper ropes 6 or layers 2 employing papers with special specific paper weight, sort of paper, thickness, number of e.g. functional layers of base papers and / or color. The special marking of different surfaces or papers shown in figure 3 of a fourfold paper plait 4' with two parallel inner hoses highlight this possibility of using different grades for different jobs to be fulfilled by such grades in their rope function. It has been advantageous to use coated paper for the two outer paper hoses 19.1, 19.2 while

hiding within them inner paper hoses 18.1, 18.2 made from uncoated 100% recovered paper.

Threefold paper plait 3 according to figure 1 and fourfold paper plait 4 according to figure 2 are plaitet from equal paper grade paper hoses 10, 11, 12, 13, 14, 15, 16.

List with reference characters:

1	hose paper
2	plaited paper layer
3	threefold paper plait
4, 4'	fourfold paper plait
5	multiple times closed plait
6	plaited paper rope
10	first paper hose
11	second paper hose
12	third paper hose
13	first paper hose
14	second paper hose
15	third paper hose
16	forth paper hose
16.f	further paper hose
18.1	first inner paper hose
18.2	second inner paper hose
19.1	first outer paper hose
19.2	second outer paper hose
20	reserve base plain
21	first reserve paper roll
21.1	first flat side
21.2	second flat side
22	second reserve paper roll
23	third reserve paper roll
24	first adjustable reserve plate
25	second adjustable reserve plate
26	third adjustable reserve plate
27	first inner diameter
28	second inner diameter
29	third inner diameter

30	plaiting mechanism
31	guiding means
32	output connection
33	cutting and/or perforating means
34	driving rolls

α	angle
A	axis
B	section
D	drive
L1, L2	axis
P	curve progression

Claims:

1. A method for plaiting paper from paper material reserved in at least one paper roll (21, 22, 23), said at least one paper roll (21, 22, 23) having two opposite flat sides (21.1, 21.2), this method producing a plaited paper rope (6) or plaited paper layer (2),
c h a r a c t e r i z e d in that

1.1 said at least one paper roll (21, 22, 23) is received

1.1.1 on its first flat side (21.1) or

1.1.2 on at least a round wall section between both flat sides (21.1, 21.2) with both flat sides (21.1, 21.2) presented open and

1.2 hose paper (1) for plaiting is introduced into a plaiting mechanism (30), which hose paper (1) is built up when the paper material is taken from the inner diameter (29) of said paper roll (21, 22, 23) throughout its second flat side (21.2).

2. Method for plaiting paper according to claim 1, characterized in that more than one paper roll (21), especially three paper rolls (21, 22, 23), are received generally independent from each other on their first flat sides (21.1, 22.1, 23.1) whereby the paper material for plaiting is taken as hoses (10, 11, 12) from the inner diameters of said paper rolls throughout their second flat sides (21.2).

3. Method for plaiting paper, especially according to one of the claims 1 or 2, characterized in that at least one plaiting mechanism (30) is positioned

3.1 on the first flat side's (21.1) side such that said at least one paper roll (21, 22, 23) is rotated around its axis (A) and / or

3.2 on the second flat side's (21.2) side such that said at least one hose paper (1) is rotated at least in a section (B) around its longitudinal axis progression (P).

4. Method for plaiting paper according to one of the preceding claims, characterized in that said at least one paper roll (21, 22, 23) is received with its first flat side (21.1, 22.1, 23.1) on reserve plates (24, 25, 26) adjusting roll axis with angle(s) (α1, α2, α3), in case of more than one roll (21, 22, 23) especially such that all rolls with their axis (A) are oriented with their second flat sides (21.2) jacked through in their centers by said hose paper (1) axis (A) in direction of a common guiding means (31).

5. Method for plaiting paper according to claim 4, characterized by said reserve plates (24, 25, 26) are rotatable, especially being independently driven (D).

6. Method for plaiting paper according to one of the preceding claims, especially according to feature 3.1, characterized in that said paper rolls (21, 22, 23) are received in positions being movable independently from each other, especially resulting in a braiding moving for producing

6.1 a plated paper layer (2) or

6.2 a threefold (3) fourfold(4, 4') or multiple times closed plait (5) as plaited paper rope (6).

7. Method for plaiting paper according to at least claim 3, characterized by said plating mechanism (30) integrating two movements of said paper hose(s) (1) changing at least one property so that plaited paper rope (6) with new safe liaisons is derived:

7.1 rotating of hose(s)/rope and

7.2 forwarding hoses(s)/rope.

8. Method for plaiting paper according to claim 7, characterized in that said plating mechanism (30) rotating around the longitudinal paper direction carries at least two opposite rotating driving rolls (34), both of them rotating around lateral axis (L1, L2), favorably around two parallel lateral axis, which driving rolls (34) are forwarding the hose(s) (1) / plaited paper rope (6) between them, especially being the only drive forwarding paper material in the whole process.

9. Method for plaiting paper according to one of the preceding claims, characterized in that cutting and/or perforating means (33) are used, especially within said plaiting mechanism in an inner machine part, to

9.1 close rope sections and / or

9.2 at least partly divide rope sections from each other without completely cutting of, and prepare for use, especially use in packaging purposes.

10. Plating mechanism integrating two movements of paper hose(s) (1) changing at least one property of such so that a plaited paper rope (6) with new safe liaisons is derived with means for

10.1 rotating of hose(s)/rope and

10.2 forwarding hoses(s)/rope.

11. Machine arrangement for operating a method according to one of the claims 1 to 9, especially with a plating mechanism according to claim 10.

12. Paper rope (6) or paper layer (2) plaited according to one of the methods of claims 1 to 9.

13. Use of plaited paper (2, 6) according to one of the methods of claims 1 to 9 for packaging purposes.

14. Use of an inner end of paper rolls (21, 22, 23) for forming a plaited paper layer (2) or plaited paper rope (6).

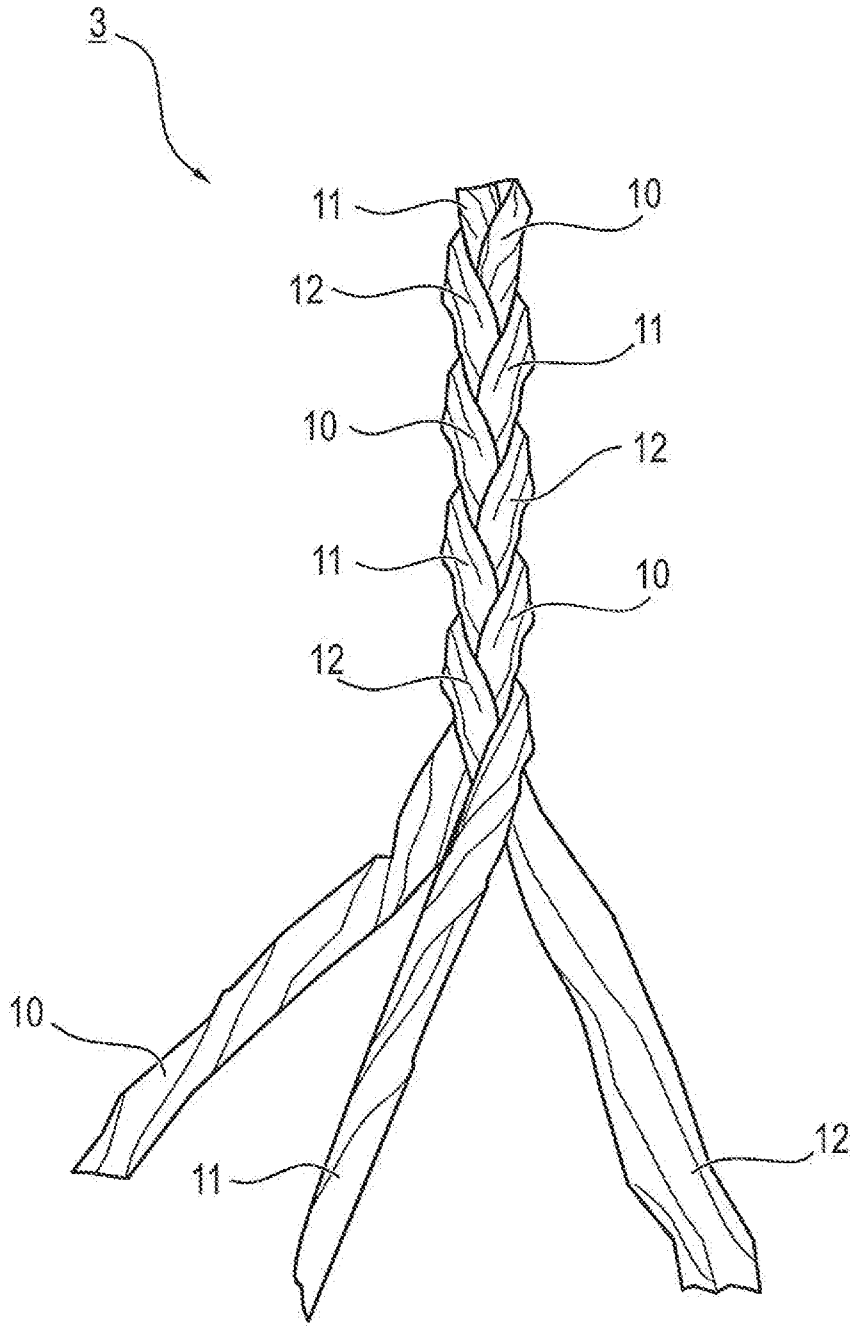

FIG. 1

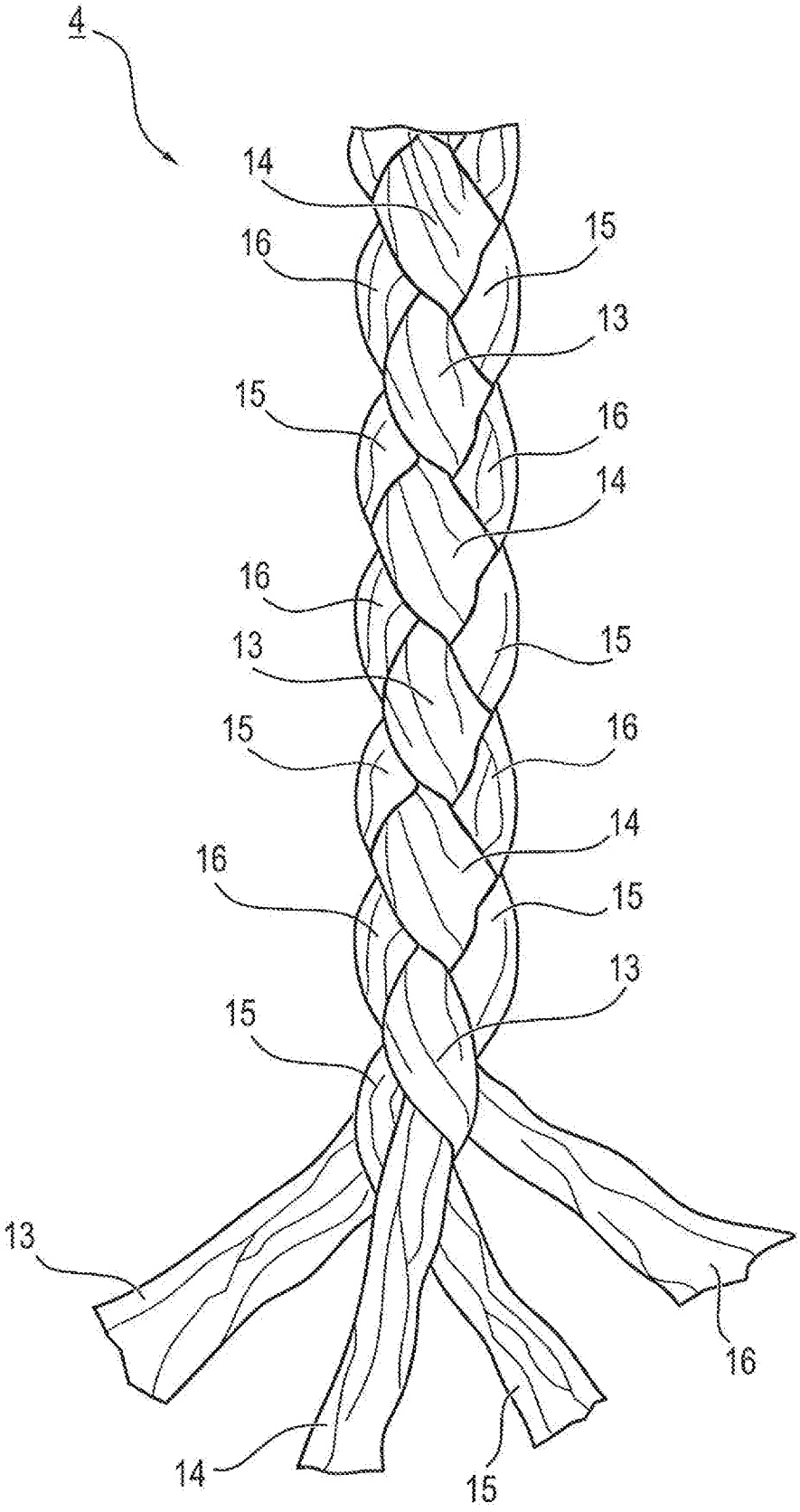

FIG. 2

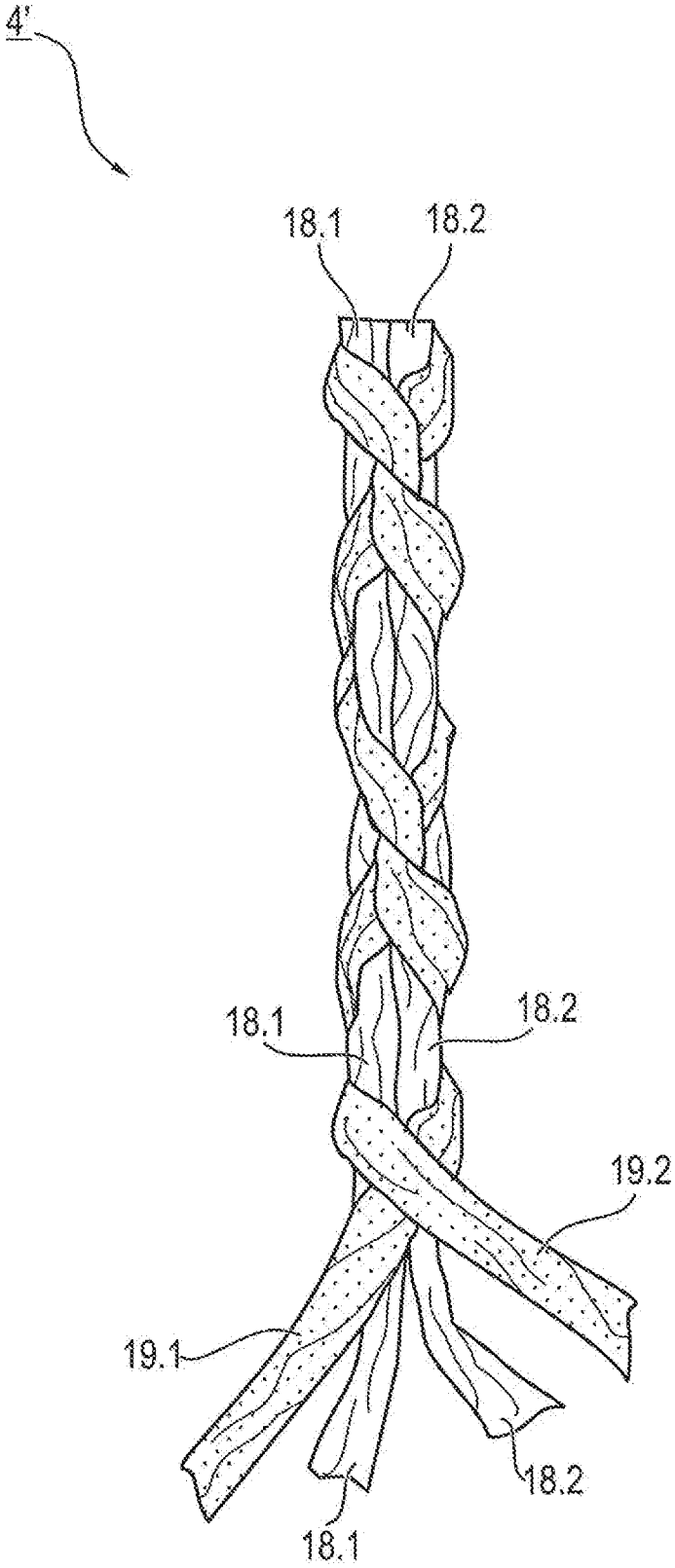

FIG. 3

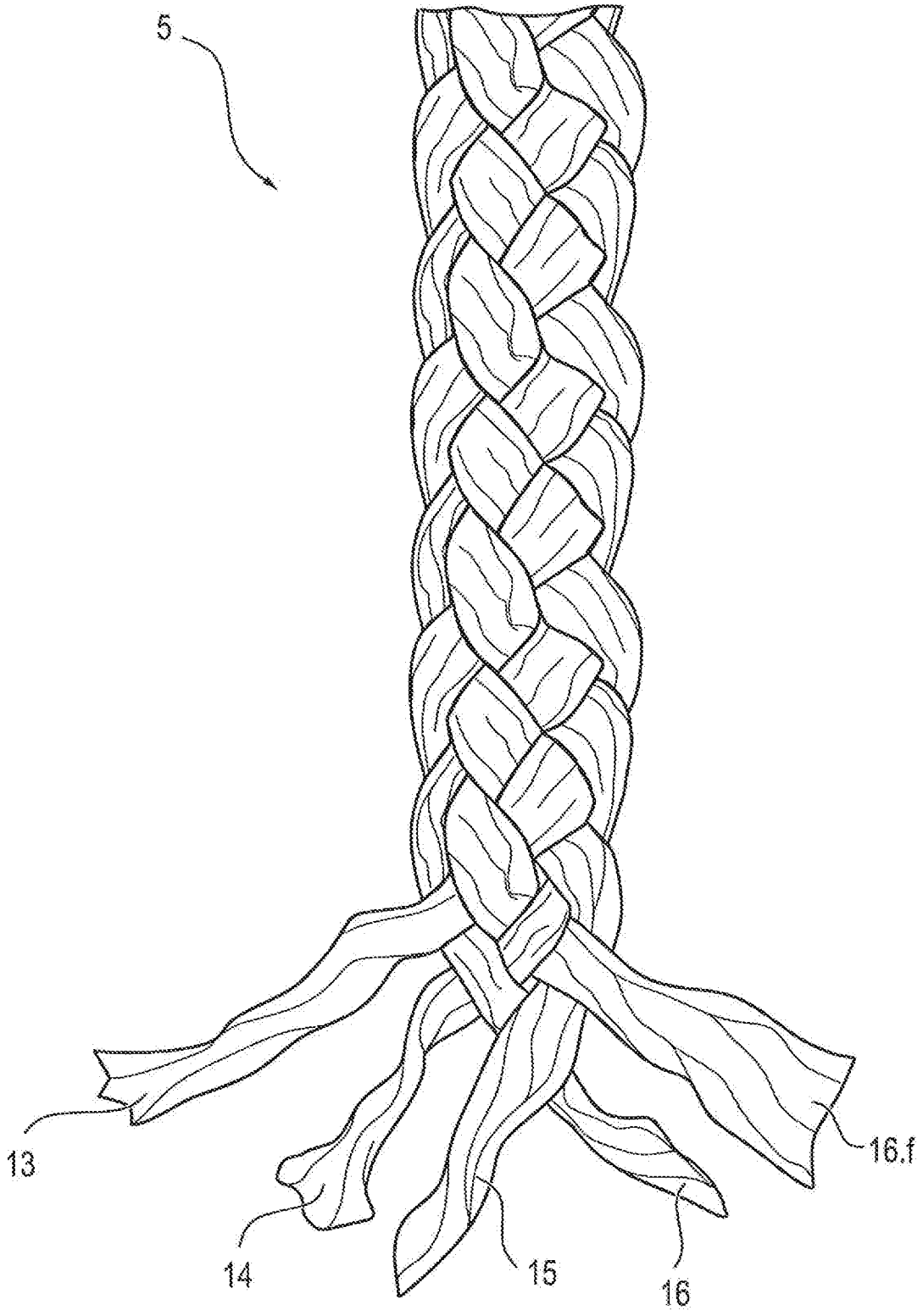

FIG. 4

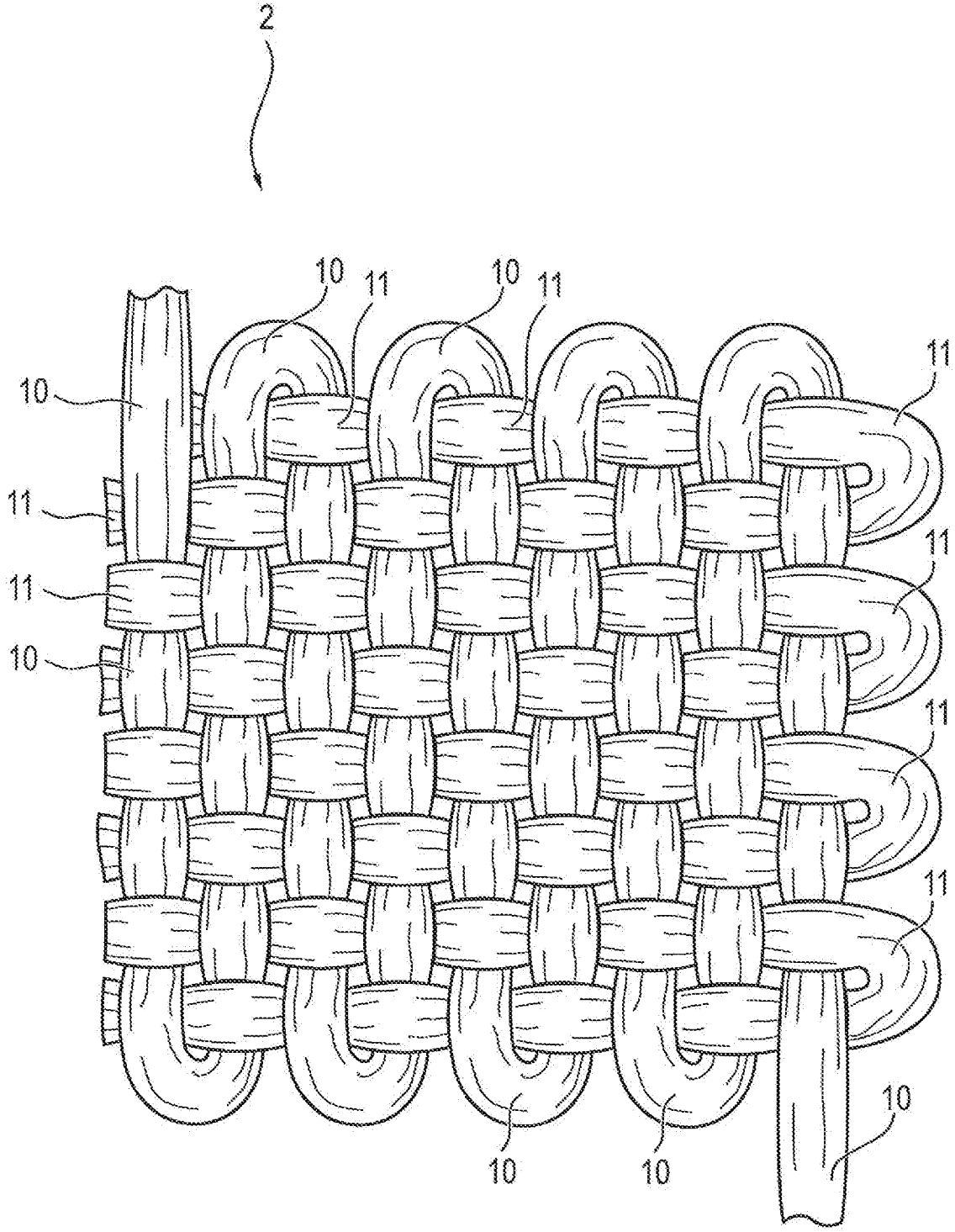

FIG. 5

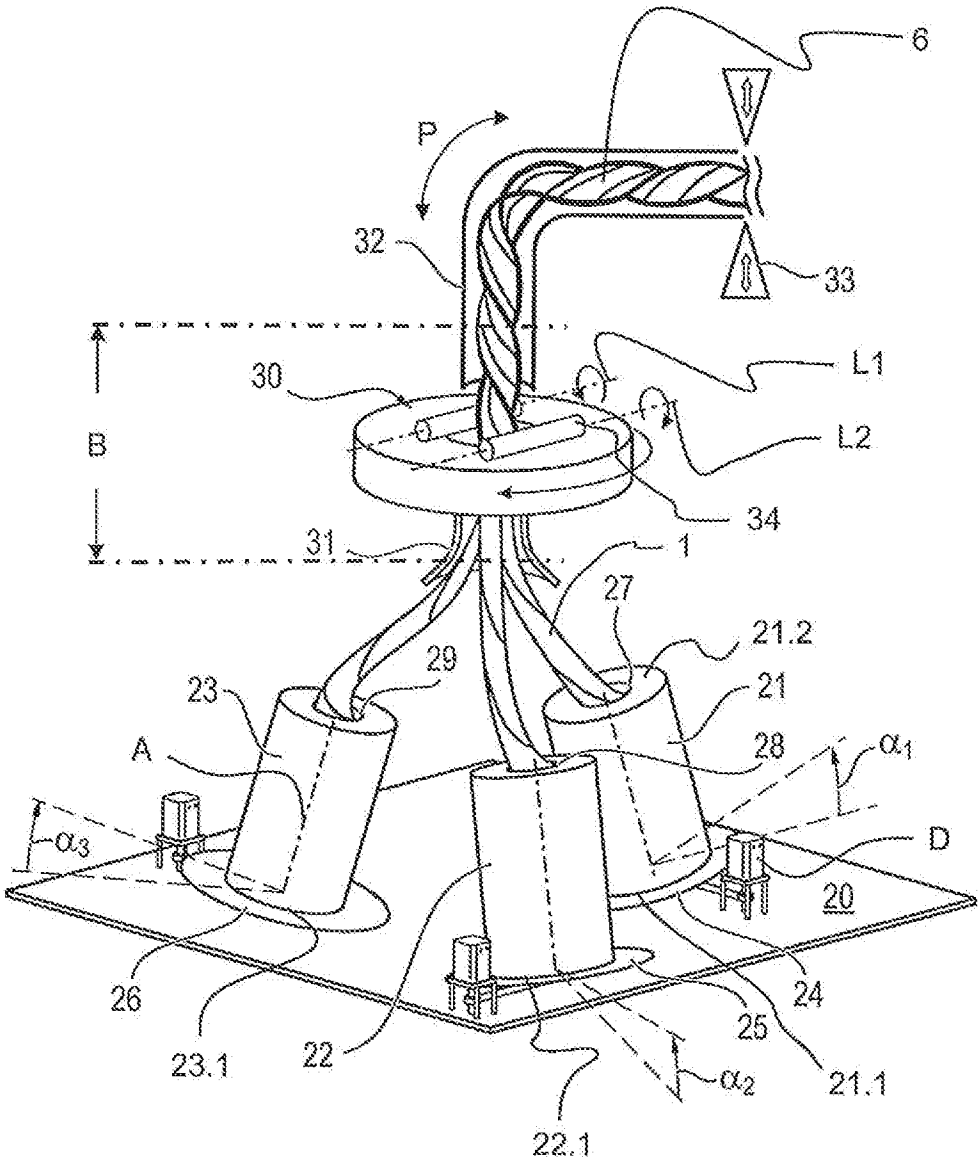
6
P
32
33
L1
30
L2
B
34
31
1
27
21.2
29
23
21
A
28
α_1
α_3
D
20
26
24
25
23.1
22
21.1
α_2
22.1

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2016/053711

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B65H, D01H, D04C, D07B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 450267 A (GARNFABRIKATION AG F), 20 March 1913 (1913-03-20); whole document --	1-9, 11-14
A	US 1995696 A (WALLACH ROGER N), 26 March 1935 (1935-03-26); figures 1-13 --	1-9, 11-14
A	US 2324668 A (BARNUM LESLIE F), 20 July 1943 (1943-07-20); figures 1,2,5 --	1-9, 11-14
A	US 1949065 A (TWITCHELL EARL W), 27 February 1934 (1934-02-27); figures 1-4 --	1-9, 11-14

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08-11-2016	08-11-2016

Name and mailing address of the ISA/SE	Authorized officer
Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Barbara Silén Telephone No. + 46 8 782 28 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2016/053711

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2981052 A (RICHARD MACHENRY), 25 April 1961 (1961-04-25); figures -- --------	1-9, 11-14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2016/053711

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The following separate inventions were identified:

1: Claims 1-9 and 11-13 directed to a method for plaiting paper from a paper material reserved in at least one paper roll for producing a plaited paper rope or plaited paper layer; a machine arrangement for operating a such a method; a paper rope or paper layer plaited according to said method; the use of plaited paper according to said method for packaging purposes and the use of an inner end of paper rolls for forming a plaited paper layer or

.../...

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-9,11-14

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Continuation of: Box No. III

plaited paper rope.

2: Claim 10 directed to a plaiting mechanism integrating two movements of paper hose changing at least one property of such so that a plaited paper rope with new safe liaisons is derived with means for rotating of hose/rope and forwarding hoses/rope.

3: Claim 14 directed to a use of inner end of paper rolls for forming a plaited paper layer or plaited paper rope.

International application No.
PCT/IB2016/053711

Continuation of: second sheet

International Patent Classification (IPC)

D04C 1/02 (2006.01)
D04C 1/06 (2006.01)
D04C 3/18 (2006.01)

FR	450267	A	20/03/1913	NONE
US	1995696	A	26/03/1935	NONE
US	2324668	A	20/07/1943	NONE
US	1949065	A	27/02/1934	NONE
US	2981052	A	25/04/1961	NONE