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### (54) A roll product comprising a core, and a method and an apparatus for its manufacture

(57) The present invention relates to a roll product consisting of a band-shaped web of material having a first end and a second end and a hollow cylindrical core (101) onto which the band-shaped web of material is wound, the hollow cylindrical core having a longitudinal direction and a radial direction, the hollow cylindrical core (101) comprises an inner surface (102), an outer surface (103), and at least one protuberance (104) protruding outwardly from the outer surface of the hollow

cylindrical core (101), principally in the radial direction of the hollow cylindrical core, for mechanically and releasably engage and hold the first end of the band-shaped web of material. The protuberance (104) is an integral part of the hollow cylindrical core and comprises the inner surface (102) and the outer surface (103) of the hollow cylindrical core.

The invention also relates to a method for the manufacture of a roll product and an apparatus for the manufacture of a hollow cylindrical core.

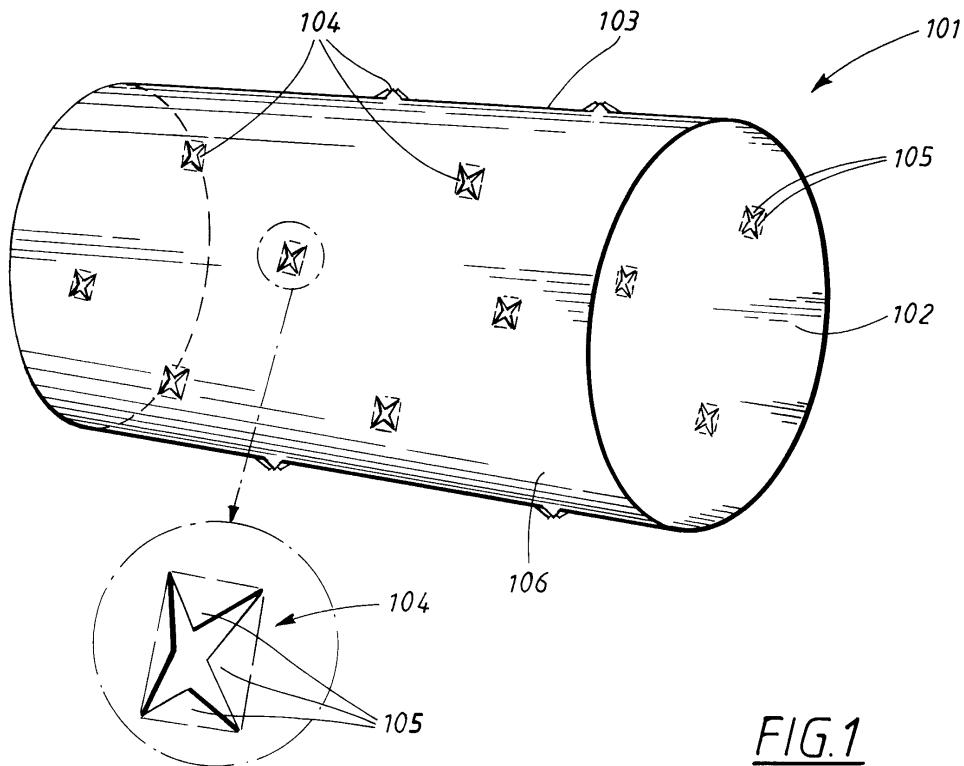


FIG. 1

**Description****TECHNICAL FIELD:**

**[0001]** The present invention relates to a roll product consisting of a band-shaped web of material having a first end and a second end and a hollow cylindrical core 101 onto which the band-shaped web of material is wound, the hollow cylindrical core having a longitudinal direction and a radial direction, the hollow cylindrical core comprises an inner surface, an outer surface, and at least one protuberance protruding outwardly from the outer surface of the hollow cylindrical core, principally in the radial direction of the hollow cylindrical core, for mechanically and releasably engage and hold the first end of the band-shaped web of material.

**[0002]** The present invention also relates to a method for the manufacture of a roll product wherein a band-shaped web of material is wound onto a hollow cylindrical core, the band-shaped web of material comprises a first end and a second end, wherein the first end of the band-shaped web of material is advanced into contact with the hollow cylindrical core and brought into mechanical and releasable engagement with protuberances protruding outwardly from an outer surface of the hollow cylindrical core.

**[0003]** The present invention further relates to an apparatus for the manufacture of a hollow cylindrical core for mechanically and releasably engaging and holding a first end of a band-shaped web of material in an initial winding of the band-shaped web of material.

**BACKGROUND ART:**

**[0004]** Roll products, such as for example toilet paper and kitchen paper, are often obtained by unwinding a wound web from a parent roll and then rewinding the web onto a winding core, thus forming smaller rolls.

**[0005]** To prevent separation of the web from the winding core during the initial winding, various methods have been developed in the art for holding the leading end of the web to the winding core. For example, glue can be used to adhesively unite the leading end of the web with the winding core.

**[0006]** A problem with the above-mentioned method is that the glue may penetrate through the layers nearest the winding core which indirectly will adhere these layers firmly to the winding core. Accordingly, these layers are often thrown away together with the winding core.

**[0007]** A method to releasably engage a fibrous web without the need to adhesively uniting the leading end of the fibrous web to the winding core is disclosed in WO 98/55386. The document WO 98/55386 discloses a winding core having an integral entangling mechanism. The entangling mechanism is obtained by embossing a thick paper or thin cardboard. A surface is then formed having protrusions said to have sufficient size, shape and number to grab or entangle the fibrous web. There-

after, with use of glue or other adhesive, the embossed paper or cardboard is laminated to the initially smooth surface of the core. The embossed paper or cardboard is laminated to the core with the protrusions facing outward from the core.

**[0008]** The problem with the known winding core with entangling mechanism is that a large number of manufacturing steps are required to obtain the winding core. In addition, to manufacture such a winding core requires consumption of lots of material. Accordingly, with regard to costs and environmental reasons, it is important to lower the consumption of material and the number of manufacturing steps in manufacturing of winding cores with entangling mechanism. In addition, it is desirable to manufacture winding cores with entangling mechanism without the need of adhesives.

**DISCLOSURE OF THE INVENTION**

**[0009]** One object of the present invention, is to provide a roll product comprising a hollow cylindrical core, which hollow cylindrical core substantially eliminates the problems set out above.

**[0010]** A roll product of the type indicated in the introduction is distinguished mainly by the fact that the protuberance is an integral part of the hollow cylindrical core and comprises the inner surface and the outer surface of the hollow cylindrical core.

**[0011]** Hence, as used herein the term "integral part" means that the protuberance is made from the same material as the hollow cylindrical core and originates from the hollow cylindrical core itself.

**[0012]** In one embodiment of the invention, the protuberance consists of at least one protruding element.

**[0013]** In another embodiment of the invention, the protuberance consists of protruding elements, which, at least partly, surround a through hole in the hollow cylindrical core.

**[0014]** In one embodiment of the invention, protuberances are arranged uniformly on the outer side of the hollow cylindrical core.

**[0015]** In another embodiment of the invention, protuberances are arranged irregularly on the outer surface of the hollow cylindrical core.

**[0016]** Preferably, the protuberances are staggered on the outer surface of the hollow cylindrical core.

**[0017]** Of course, the protuberances may be arranged in any pattern on the surface. Generally, the distance between two immediate protuberances in the longitudinal direction may range from about 10 mm to 24 mm and in the circumferential direction from about 3 mm to 33 mm.

**[0018]** The number of protuberances per m<sup>2</sup> may vary from 100 to 3400.

**[0019]** The hollow cylindrical core according to the invention may be made from cardboard, paperboard, synthetic material, or the like. In addition, it is important that the hollow cylindrical core according to the present in-

vention has sufficient shape stability to provide a stable support for a band-shaped web of material wound thereon.

**[0020]** Another object of the present invention is to provide an apparatus for the manufacture of the hollow cylindrical core.

**[0021]** An apparatus of the type indicated in the introduction is distinguished mainly by the fact that it comprises a mandrel with an outer, perforated cylinder, the mandrel further comprises an inner hollow cylinder with penetrating means arranged on the outer surface of the inner hollow cylinder and an expanding core having a first non-expanded state and a second expanded state wherein penetrating means protrudes out through the perforations in the outer perforated cylinder when the expanding core is in the expanded state.

**[0022]** The expanding core may be an inflatable tube, such as for example a rubber bellows, or any other expandable material or means. The expanding part of the core could also be constructed on a mechanical basis like the mechanism of mandrels for lifting rolls.

**[0023]** The apparatus further comprises means for expanding the expanding core such as a hydraulic device, a pneumatic device, an electrical device, a mechanical device, or the like.

**[0024]** In one embodiment of the invention the penetrating means have a substantially square shape. Preferably, the penetrating means has a tapering pointed end.

**[0025]** Generally, the penetrating means may have any suitable shape that has the ability to penetrate the hollow cylindrical core and to create protuberances on the outer surface of the hollow cylindrical core that are able to mechanically and releasably engage and hold a first end of a band-shaped web of material in an initial winding of the web.

**[0026]** Further, protuberances on the outer surface of the hollow cylindrical core

**[0027]** The penetrating means may be made of a material showing constancy against deformation when penetrating the hollow cylindrical core, for example, metal, ceramic, or plastic.

**[0028]** In one embodiment the penetrating means are arranged uniformly on the inner hollow cylinder. Of course, it is also possible to arrange the penetrating means irregularly on the inner hollow cylinder or in another suitable pattern.

**[0029]** In one embodiment of the invention the apparatus is provided with means for rotating the mandrel provided with the hollow cylindrical core and that the apparatus further comprises means for advancing the band-shaped web of material into contact with the rotating hollow cylindrical core.

**[0030]** Still another object of the present invention is to provide a method for the manufacture of the hollow cylindrical core.

**[0031]** A method of the type indicated in the introduction is distinguished mainly by the fact that the hollow

cylindrical core is slid onto a perforated mandrel, wherein the mandrel comprises penetrating means for penetrating the hollow cylindrical core in a direction from the inner surface of the hollow cylindrical core, and wherein

5 the mandrel further comprises an inner expanding core which is made to expand and at which the penetrating means are pressed against the inner surface of the hollow cylindrical core and whereby protuberances are formed protruding outwardly from the outer surface of 10 the hollow cylindrical core, principally in the radial direction of the hollow cylindrical core.

**[0032]** In one embodiment of the invention the means for penetrating the hollow cylindrical core forming the protuberances are retracted before the first end of the 15 web of material is mechanically and releasably engaged by the protuberances of the hollow cylindrical core.

**[0033]** However, to stabilise the protuberances, at least in the initial winding of the band-shaped web of material onto the hollow cylindrical core, is it possible to 20 leave the penetrating means in the position where they protrude outwardly from the outer surface of the hollow cylindrical core. In addition, such an embodiment of the invention will prevent the hollow cylindrical core from any sliding on the mandrel.

**[0034]** In order to further stabilise the protuberances is it possible to varnish the outer surface of the hollow cylindrical core. The stabilising effect of the varnish is enhanced if the varnish is allowed to migrate some distance into the hollow cylindrical core.

**[0035]** The hollow cylindrical core can be varnished before or after the protuberances being formed.

**[0036]** To further facilitate the band-shaped web to adhere to the hollow cylindrical core, suction may be applied over the hollow cylindrical core through the perforations of the outer cylinder and the openings formed by the creation of the protuberances.

**[0037]** Of course, the hollow cylindrical core may already be provided with the protuberances before being slid onto the mandrel in position for the winding step. 40 However, if suction is to be applied over the hollow cylindrical core, it is more practical to integrate the step of forming protuberances with the winding step as it ensures accurate alignment of the perforations of the outer cylinder and the through holes in the hollow cylindrical core. Further, the hollow cylindrical core is more readily slid onto the mandrel in tight relation therewith prior to formation of protuberances.

**[0038]** In another embodiment of the invention, the hollow cylindrical core is made of a material that is able 50 to deform to such an extent that protuberances are formed in the casing of the hollow cylindrical core without the need to penetrate through the outer surface of the hollow cylindrical core, i.e. penetrating means will deform the casing of the hollow cylindrical core so that each protuberance, protruding principally in the radial direction of the hollow cylindrical core, is an integral part of the intact casing of the hollow cylindrical core.

**[0039]** As mentioned herein, the term "intact casing"

means that the hollow cylindrical core does not show penetrating holes i.e. the hollow cylindrical core is just nearly punctured.

**[0040]** The protuberances are preferably made using heated penetrating means. The penetrating means will heat a thermo-deformable material of the hollow cylindrical core to a temperature which is slightly below the melting point of the material of the hollow cylindrical core and above the softening-temperature of the material of the hollow cylindrical core.

**[0041]** In the event of the heated penetrating means are caused to melt the deformable material one or more through holes may form. However, the melted material will solidify and the protuberance formed will function as a catching mechanism in a satisfactory manner.

**[0042]** In one embodiment of the invention, the deformable material is a synthetic material.

**[0043]** In another embodiment, the synthetic material comprises a thermoplastic component.

**[0044]** In one embodiment of the invention the method for the manufacture of the hollow cylindrical core comprises a step wherein the penetrating means are heated to a temperature exceeding the softening-temperature of the irreversibly deformable material of the hollow cylindrical core but below the melting temperature of the irreversibly deformable core material.

**[0045]** In one embodiment of the invention, the apparatus for the manufacture of the hollow cylindrical core comprises means for heating the penetrating means.

#### BRIEF DESCRIPTION OF DRAWINGS

**[0046]** The invention will now be described in greater detail with reference to the illustrative embodiments represented in the attached drawings, in which:

Figure 1 shows a view of a hollow cylindrical core according to the invention;

Figure 2a shows a side sectional view of an apparatus according to the invention;

Figure 2b shows a side sectional view of an apparatus according to the invention;

Figure 3 shows a view of a hollow cylindrical core according to the invention.

#### DETAILED DESCRIPTION OF EMBODIMENTS

**[0047]** In Fig. 1 a hollow cylindrical core 101 is shown, having a radial direction and a longitudinal direction which is parallel to the axis of the cylinder. The material of the hollow cylindrical core 101 can be, for example, cardboard, paperboard, plastic, or laminates. The hollow cylindrical core 101 comprises an inner surface 102, an outer surface 103 and a plurality of spaced-apart protuberances 104, protruding outwardly from the outer

surface 103 of the hollow cylindrical core 101, principally in the radial direction of the hollow cylindrical core 101. The protuberances 104 are integral parts of the hollow cylindrical core 101 and comprise both the inner and the outer surface 102, 103 of the hollow cylindrical core 101. The protuberances 104 are preferably spaced apart at a distance from about 3 mm to about 30 mm.

**[0048]** As can be seen in Fig. 1, the protuberances 104 are arranged in a more or less regular pattern.

**[0049]** As can be seen in Fig. 1, each protuberance 104 consists of four protruding elements 105. It can also be seen that the protruding elements 105 have a triangular shape with the base of the triangle nearest to the casing 106 of the hollow cylindrical core 101 and the peak of the triangle farthest away from the casing 106. This can be even more readily seen in the enlarged view of the encircled area in Fig. 1. Of course, the protruding elements 105 can have any suitable shape as long as the protuberances 104 have the ability to mechanically and releasably engage and hold a first end of a band-shaped web of material in the initial winding of the web.

**[0050]** The hollow cylindrical core 101 can be made of cardboard, paperboard, synthetic material, or the like.

**[0051]** Referring to Fig. 2 an apparatus 210 is described for the manufacture of a hollow cylindrical core for mechanically and releasably engage and hold a first end of a band-shaped web of material in the initial winding of the web of material. The apparatus 210 comprises a mandrel 211 with an outer, perforated hollow cylinder 212 and an inner hollow cylinder 213 with means 214 for penetrating the hollow cylindrical core 201. The penetrating means 214 are arranged uniformly on the inner hollow cylinder 213.

**[0052]** Inside the inner hollow cylinder 213 is arranged an expanding core 215 having a first non-expanded state and a second expanded state. See Figs. 2a and 2b, respectively.

**[0053]** When the expanding core 215 is in the expanded state, the means 214 for penetrating the hollow cylindrical core 201 protrude out through the perforations in the outer cylinder 212. See Fig. 2b and the enlarged view of the encircled area in Fig. 2b.

**[0054]** It can also be seen that the penetrating means 214 have a tapered shape in the direction from the inner hollow cylinder 213.

**[0055]** The expanding core 215 can be a pneumatic core or be made to expand by the use of for example, electricity, hydraulics or by mechanical means.

**[0056]** The expanding core 215 shown in Fig. 2 is a rubber bellows connected to a device (not shown in Fig. 2) which is able to expand the expanding core 215.

**[0057]** Further, the apparatus 210 may comprise means for advancing the band-shaped web of material into contact with the hollow cylindrical core 201.

**[0058]** With reference to Figs. 1 and 2, a method will now be described for the manufacture of a hollow cylindrical core 101', 201' for mechanically and releasably engage and hold a first end of a band-shaped web of

material in the initial winding of the web of material.

**[0059]** The hollow cylindrical core 101', 201' is slid onto the mandrel 211. The inner expanding core 215 of the mandrel is then made to expand and at which the penetrating means 214 are pressed against the inner surface of the hollow cylindrical core 101, 201. The penetrating means 214 will then puncture or nearly puncture the hollow cylindrical core 101, 201 at which protuberances 104', 204' protruding outwardly from the outer surface 103', 203' of the hollow cylindrical core 101', 201' are formed.

**[0060]** The expanding core 215 is made to expand by the use of a pneumatic device.

**[0061]** The method further comprises a step wherein the band-shaped web of material is advanced into contact with the hollow cylindrical core and brought into mechanical and releasable engagement with the protuberance. (Not shown in Figs. 2a and 2b).

**[0062]** After penetration of the hollow cylindrical core, but before the web is mechanically and releasably engaged by the protuberances, the penetrating means are either retracted or left to stay in the position where they protrude outwardly from the outer surface of the hollow cylindrical core, at least during the initial phase of winding the band-shaped web of material. (Not shown in Figs. 2a and 2b). The latter will give a stabilising effect to the protuberances and also prevent the hollow cylindrical core from sliding on the mandrel.

**[0063]** Another embodiment of the invention can be seen in Fig. 3 wherein a hollow cylindrical core 301 is shown, having a radial direction and a longitudinal direction which is parallel to the axis of the cylinder. The hollow cylindrical core 301 comprises an inner surface 302, an outer surface 303 and a plurality of spaced-apart protuberances 304, protruding outwardly from the outer surface 303 of the hollow cylindrical core 301, principally in the radial direction of the hollow cylindrical core 301. The protuberances 304 are integral parts of the hollow cylindrical core 301 and comprise both the inner and the outer surface 302, 303 of the hollow cylindrical core 301. The protuberances 304 are preferably spaced apart at a distance from about 3 mm to about 30 mm.

**[0064]** As can be seen in Fig. 3, the protuberances 304 are arranged in a more or less regular pattern. Of course, it is possible to arrange the protuberances 304 in any suitable pattern.

**[0065]** The hollow cylindrical core 301 consists of a material that is irreversibly deformable. Synthetic materials having a thermoplastic component are suitable for this purpose.

**[0066]** A similar apparatus and method as described in connection with Figs. 2a and 2b can be used for the manufacture of the hollow cylindrical core 301 shown in Fig. 3. However, an apparatus according to this embodiment further comprises means for heating the penetrating means and a method according to this embodiment further includes a step wherein the penetrating means are heated to a temperature exceeding the softening-

temperature of the irreversibly deformable material of the hollow cylindrical core 301 but below the melting temperature of the irreversibly deformable material of the hollow cylindrical core 301.

**5** **[0067]** The band-shaped web of material mentioned herein may be a non-woven material or paper product, consisting of, for example, tissue and/or tissue-like material. Preferably, the web of material has a high degree of absorbency. The web of material may comprise one  
**10** or more plies.

## Claims

- 15** 1. A roll product consisting of a band-shaped web of material having a first end and a second end and a hollow cylindrical core 101 onto which the band-shaped web of material is wound, the hollow cylindrical core 101 having a longitudinal direction and a radial direction, the hollow cylindrical core 101 comprises an inner surface 102, an outer surface 103, and at least one protuberance 104 protruding outwardly from the outer surface 103 of the hollow cylindrical core 101, principally in the radial direction of the hollow cylindrical core 101, for mechanically and releasably engage and hold the first end of the band-shaped web of material, **characterized in that** the protuberance 104 is an integral part of the hollow cylindrical core 101 and comprises the inner surface 102 and the outer surface 103 of the hollow cylindrical core.
- 20** 2. A roll product according to claim 1, wherein a plurality of protuberances 104 are arranged uniformly on the casing of the hollow cylindrical core 101.
- 25** 3. A roll product according to claim 1, wherein a plurality of protuberances 104 are arranged irregularly on the casing of the hollow cylindrical core 101.
- 30** 4. A roll product according to any one of claims 1-3, wherein the protuberance 104 consists of at least one protruding element 105.
- 35** 5. A roll product according to any one of the preceding claims, wherein the hollow cylindrical core is made from cardboard, paperboard, or the like.
- 40** 6. A roll product according to any one of the claims 1-4, wherein the hollow cylindrical core is made from a synthetic material.
- 45** 7. A roll product according to claim 6, wherein the synthetic material comprises a thermoplastic component.
- 50** 8. A method for the manufacture of a roll product wherein a band-shaped web of material is wound
- 55**

onto a hollow cylindrical core 201, the band-shaped web of material comprises a first end and a second end, wherein the first end of the band-shaped web of material is advanced into contact with the hollow cylindrical core 201 and brought into mechanical and releasable engagement with protuberances protruding outwardly from an outer surface of the hollow cylindrical core 201, **characterized in that** the hollow cylindrical core 201 is slid onto a perforated mandrel 211, wherein the mandrel 211 comprises penetrating means 214 for penetrating the hollow cylindrical core 201 in a direction from the inner surface of the hollow cylindrical core 201, and wherein the mandrel 211 further comprises an inner expanding core 215 which is made to expand and at which the penetrating means 214 are pressed against the inner surface of the hollow cylindrical core 201 and whereby protuberances 204 are formed protruding outwardly from the outer surface of the hollow cylindrical core, principally in the radial direction of the hollow cylindrical core 201.

9. A method according to claim 8, wherein the penetrating means 214 are heated.

10. A method according to claim 8 or 9, wherein the penetrating means 214 are retracted before the first end of the band-shaped web of material is mechanically and releasably engaged by the protuberances 204.

11. A method according to claim 8 or 9, wherein the penetrating means 214 are protruding outwardly from the outer surface 203 of the hollow cylindrical core 201 at least during the initial winding step.

12. A method according to any one of claims 8-11, wherein suction is applied over the hollow cylindrical core 201 through the perforations in the outer cylinder 212.

13. An apparatus for the manufacture of a hollow cylindrical core 201 for mechanically and releasably engaging and holding a first end of a band-shaped web of material in an initial winding of the band-shaped web of material, **characterized in that** it comprises a mandrel 211 with an outer, perforated cylinder 212, the mandrel 211 further comprises an inner hollow cylinder 213 with penetrating means 214 arranged on the outer surface of the inner hollow cylinder 213 and an expanding core 215 having a first non-expanded state and a second expanded state wherein penetrating means 214 protrudes out through the perforations in the outer perforated cylinder 212 when the expanding core 215 is in the expanded state.

14. An apparatus according to claim 13, wherein the

penetrating means 214 have a substantially square shape.

5 15. An apparatus according to claims 13 or 14, wherein the penetrating means 214 have a shape which tapers to a point.

10 16. An apparatus according to any one of claims 13-15, wherein the penetrating means 214 are made of metal.

15 17. An apparatus according to any one of claims 13-16, wherein the penetrating means 214 are arranged uniformly on the inner hollow cylinder 213.

20 18. An apparatus according to any one of claims 13-16, wherein the penetrating means 214 are arranged irregularly on the inner hollow cylinder 213.

25 19. An apparatus according to any one of claims 13-18, wherein the apparatus further comprises means for advancing the band-shaped web of material into contact with the hollow cylindrical core 201.

30 20. An apparatus according to any one of claims 13-19, wherein the apparatus further comprises means for applying suction over the hollow cylindrical core 201.

35 21. An apparatus according to any one of claims 13-20, wherein the apparatus further comprises means for expanding the expanding core 215.

40 22. An apparatus according to any one of claims 13-21, wherein the apparatus further comprises means for heating the penetrating means 214.

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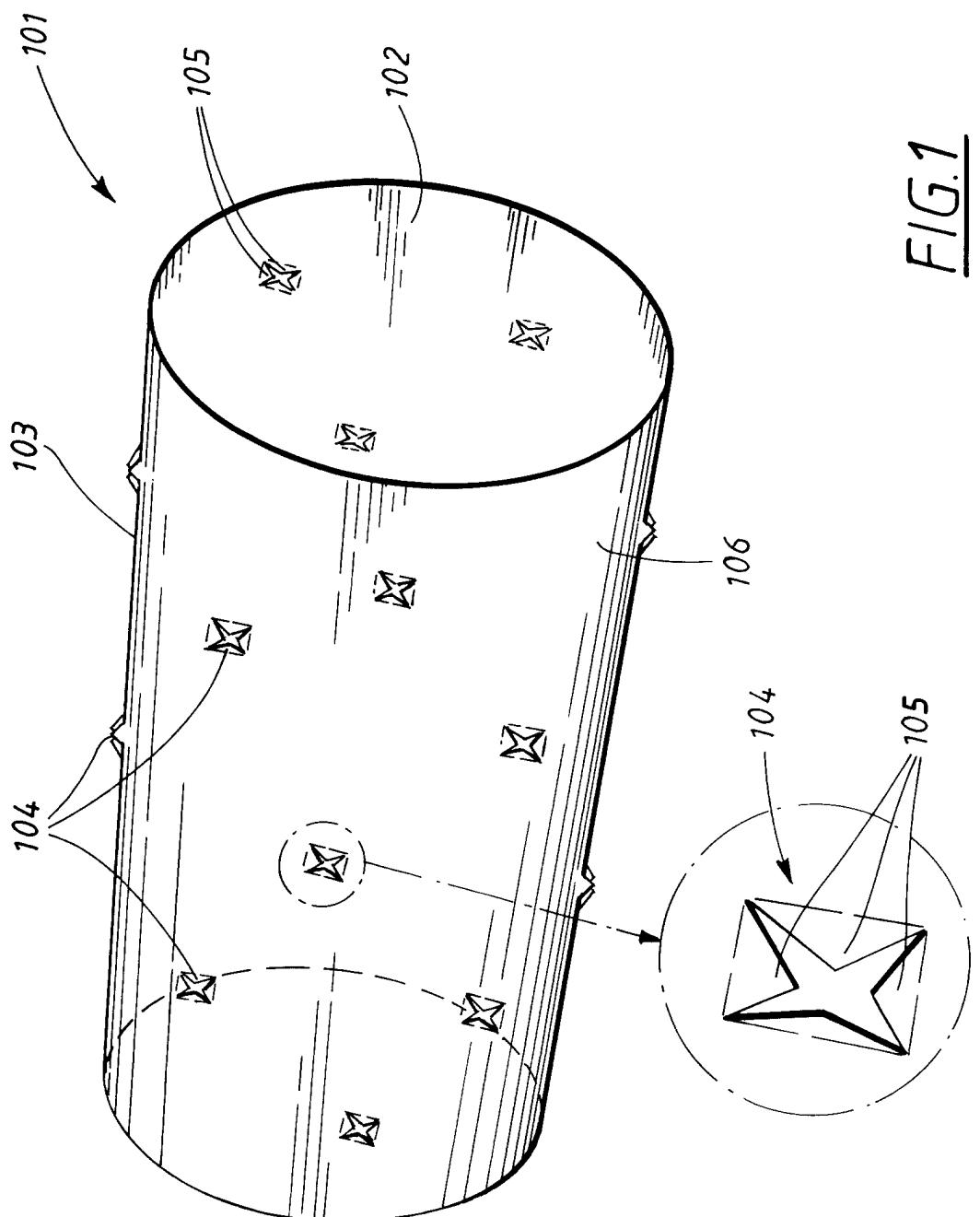
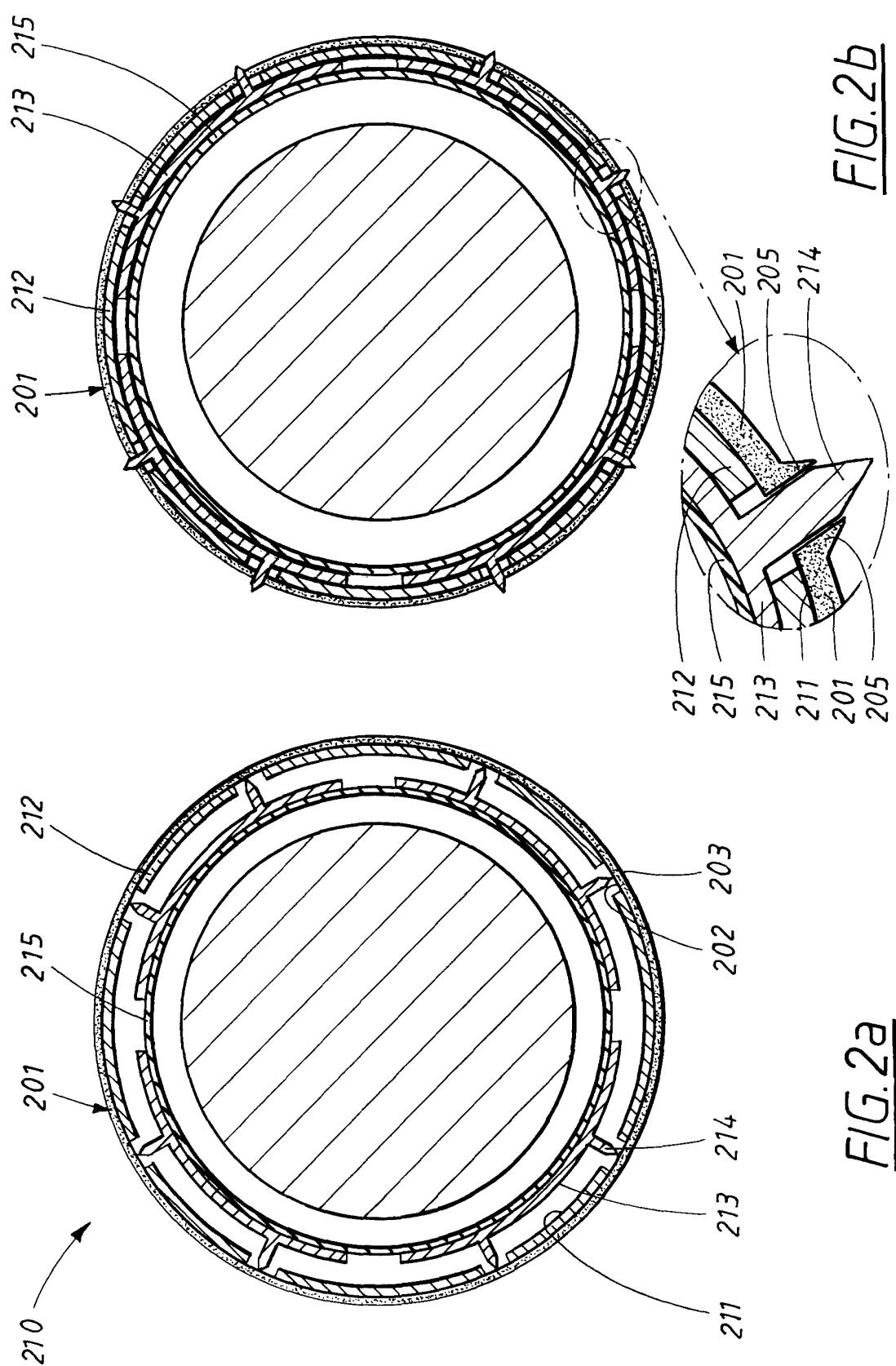


FIG. 1



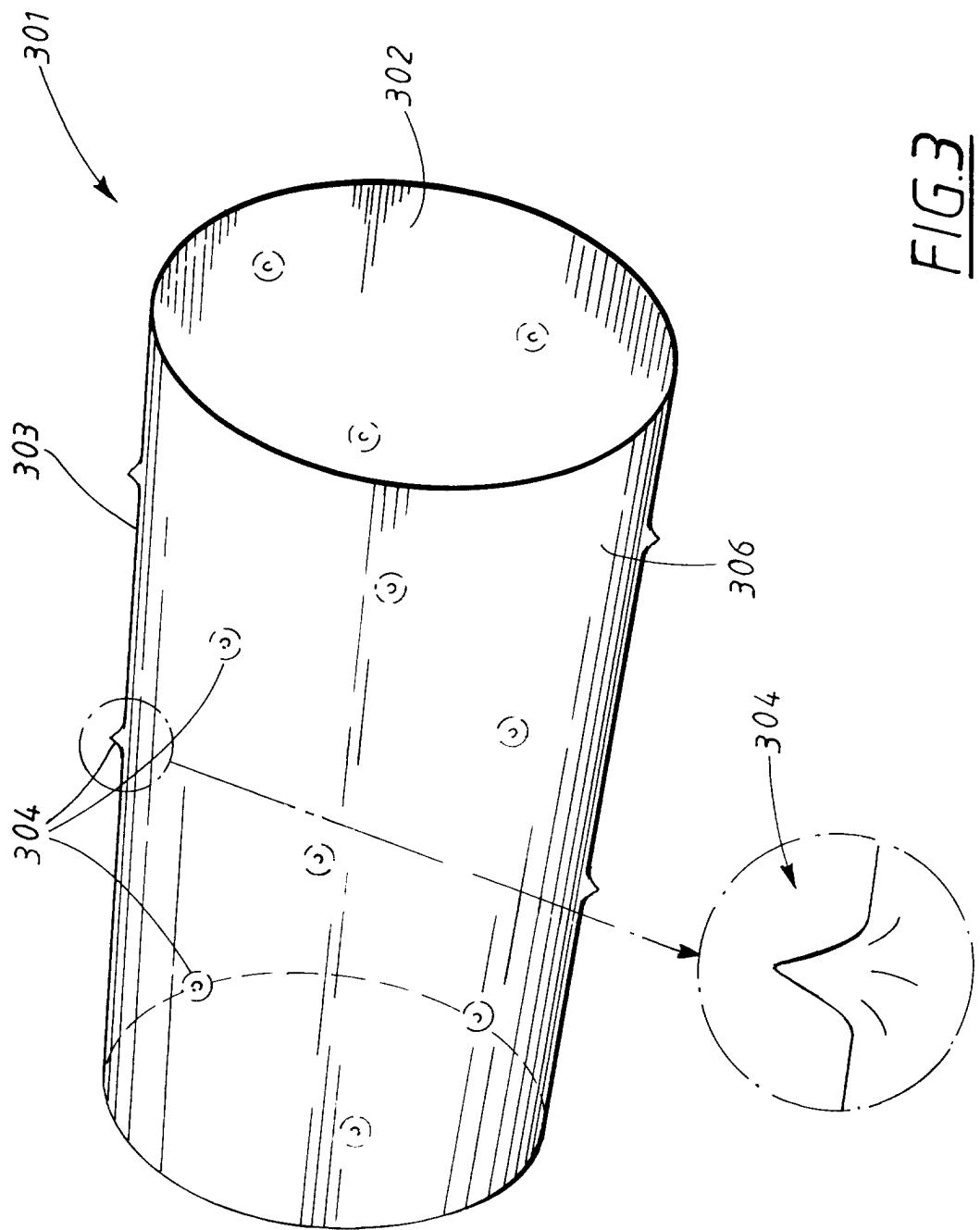


FIG.3



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## EUROPEAN SEARCH REPORT

Application Number  
EP 01 85 0177

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
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A	* page 5, line 10 - line 17 * * page 7, line 14 - line 16; claims 1-3,11,12,16-21 *	8	B26F1/00 B26F1/24
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The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	18 March 2002	D'Hulster, E	
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone	T : theory or principle underlying the invention		
Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date		
A : technological background	D : document cited in the application		
O : non-written disclosure	L : document cited for other reasons		
P : intermediate document	& : member of the same patent family, corresponding document		



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## EUROPEAN SEARCH REPORT

Application Number  
EP 01 85 0177

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<p>PATENT ABSTRACTS OF JAPAN vol. 1999, no. 08, 30 June 1999 (1999-06-30) -&amp; JP 11 059995 A (JIMUKEN:KK), 2 March 1999 (1999-03-02) * abstract *</p> <p>-----</p>		
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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CATEGORY OF CITED DOCUMENTS			
<p>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</p>			
<p>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</p> <p>.....</p> <p>&amp; : member of the same patent family, corresponding document</p>			

ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 01 85 0177

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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