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(54) **LAMINATED WOODEN POLE AND ITS MANUFACTURING METHOD**

(57) A tubular structure comprising one or more layers wherein the layer is formed of one round of a wooden sheet and the structure further comprises one or more longitudinal elements configured to cover at least part of at least one layer of the tubular structure.

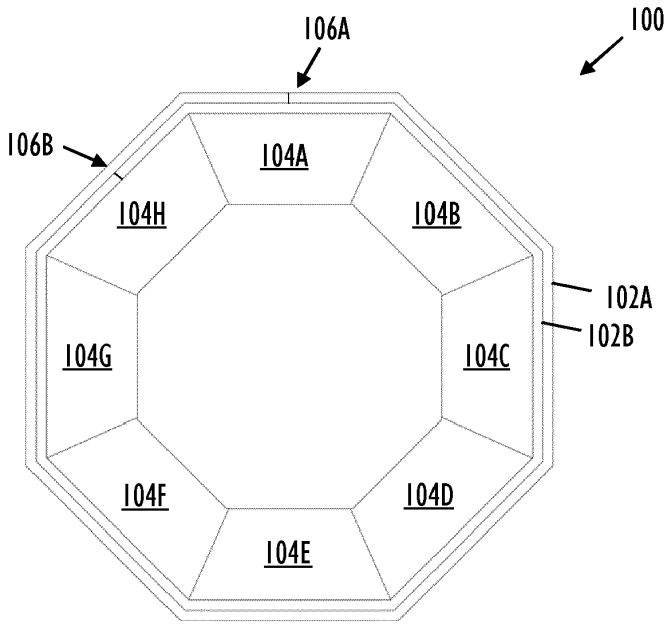

FIG. 1

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Description

Technical Field

[0001] The present invention relates to a field of laminated wooden poles, especially the laminated wooden poles having high strength properties.

Technical Background

[0002] Laminated wooden poles are widely used in different kind of purposes. There is a plurality of the laminated wooden poles available in the market having different structures. The laminated wooden poles provide a way to build poles ecologically but many of the know solutions are not very suitable for carrying heavy loads because of relatively low strength properties. Therefore, there is a need for a further sophisticated laminated wooden pole having high strength properties.

Brief Description

[0003] The present invention is defined by the subject matter of the independent claims.

[0004] Embodiments are defined in the dependent claims.

[0005] The embodiments and features, if any, described in this specification that do not fall under the scope of the independent claim are to be interpreted as examples useful for understanding various embodiments of the invention.

List of Drawings

[0006] Some example embodiments will now be described with reference to the accompanying drawings, in which

FIG. 1, 4, 5, 6, 7 and 8 illustrate a laminated wooden pole structure according to an embodiment of the invention;

FIG. 2A and 2B illustrate a wooden sheet used in the structure of the laminated wooden pole according to an embodiment of the invention;

FIG. 3 illustrates a longitudinal element used in the structure of the laminated wooden pole according to an embodiment of the invention;

FIG. 9 illustrates a flow chart of a method for manufacturing the laminated wooden pole according to an embodiment of the invention; and

FIG. 10, 11, 12 and 13 illustrate a mould of the laminated wooden pole according to an embodiment of the invention.

Description of Embodiments

[0007] The following embodiments are only examples. Although the specification may refer to "an" embodiment in several locations, this does not necessarily mean that each such reference is to the same embodiment(s), or that the feature only applies to a single embodiment. Single features of different embodiments may also be combined to provide other embodiments. Furthermore, words "comprising" and "including" should be understood as not limiting the described embodiments to consist of only those features that have been mentioned and such embodiments may contain also features/structures that have not been specifically mentioned.

[0008] Poles used for carrying heavy and large items like, for example, electronic and telecommunication devices, different kind of signs, light sources, solar panels and wind turbines are traditionally made of metals. The known wooden pole structures are not very suitable for above mentioned purposes because of relatively low strength properties. Nevertheless, the wooded structures provide a way to produce ecological solutions which is very essential nowadays. Therefore, the wooden pole having the high strength properties is clearly desirable.

[0009] The laminated wooden pole according to an invention tries to eliminate drawbacks of the know wooden pole solutions.

[0010] According to an aspect, there is provided the laminated wooden pole, comprising a tubular structure comprising one or more layers wherein the layer is formed of one round of a wooden sheet and one or more longitudinal elements configured to cover at least a part of at least one layer of the tubular structure.

[0011] Referring to Figure 1, which illustrates the laminated wooden pole from the end of the pole such that a cross section of the pole is visible. The laminated wooden pole structure 100 comprises the one or more layers 102A that are formed of one wooden sheet such that the layer 102A comprises one round of the wooden sheet. The one round means that the wooden sheet is once rolled around a centre axis of the tubular structure to form the one layer of the tubular structure. The centre axis refers to a longitudinal centre axis of the tubular structure. Figure 2A illustrates the one wooden sheet 200 used to form the layer 102A - D such that the sheet 200 is not rolled around the centre axis, in other words, the sheet is straight. The sheet comprises two side edges 202A - B and two end edges 204A - B. The side edges may be longer that the end edges. Figure 2B illustrates the sheet 200 according to an embodiment, wherein the sheet is at least partly rolled such that the side edges 200A - B come close to each other. The side edges may be in contact in the layer of the tubular structure. Figure 2B illustrates the sheet 200 from direction of the other end edge 204A. A shape of the cross section of the partly rolled sheet is circular in Figure 2B but it can also be any other shape as well. Figure 2B is just used to illustrate a principle how the layer is formed of the sheet.

[0012] Referring to Figure 1, the laminated wooden pole 100 further comprises the one or more longitudinal elements 104A - H. Figure 3 illustrates an isometric view of the one longitudinal element 104A - H according to an

embodiment. The longitudinal element is elongated part that may extend in the longitudinal direction of the pole. It may cover the at least partly the at least one layer of the tubular structure in the longitudinal direction such that is extends from a first end to a second end of the tubular structure. In another embodiment, the longitudinal element covers just a part of the at least one layer in the longitudinal direction. Hence, it may not extend from the first end to the second end of the tubular structure. A shape of the longitudinal element may vary according to the needs.

[0013] In an embodiment, the longitudinal element covers the at least a part of the circumference of the one layer.

[0014] In an embodiment, a material of the longitudinal element comprises wood. In another embodiment, the material of the longitudinal element comprises metal. The laminated wooden pole may comprise wooden layers enforced by the longitudinal elements made of metal. The longitudinal element may also be made of any other material than wood or metal, it may be composite, for example. It may also be combination of a plurality of different materials.

[0015] In an embodiment, the tubular structure of the laminated wooden pole comprises a plurality of the longitudinal elements such that the elements are in different places of the pole. The elements may not be in direct contact with each other in the pole. For example, two elements may be placed opposite sides of the pole like, for example, elements 104A and 104E in Figure 1. In an embodiment, the element(s) extends from the first end of the pole to the second end of the pole in the longitudinal direction. In another embodiment, the element(s) covers the pole in the longitudinal direction just partly, in other words, the element does not necessary extend fully from the first end to the second end or the other way around. Another example, the tubular structure may comprise four longitudinal elements that are arranged evenly around the pole like, for example, elements 104A, 104C, 104E and 104G in Figure 1. Then there may be empty spaces between the longitudinal elements that can be used for routing cables, for example. The empty space may also be filled with some certain material.

[0016] A size and shape of each longitudinal element may be same or different. All the longitudinal elements illustrated, for example, in Figure 1 have substantially the same shape and size but this is just because of the illustration. For example, there may be two longitudinal elements and a first covers four eights (half) of the circumference of the pole and a second element only one eighth.

[0017] In an embodiment, the one or more layers and/or the one or more longitudinal elements are laminated together by chemical fixing means like glue, for example.

[0018] In an embodiment, the one or more layers and/or the one or more longitudinal elements are coupled together by mechanical fixing means like screw, for example. In addition, combination of chemical and mechanical fixing means may be used.

[0019] In an embodiment, the one layer formed of the one round of the wooden sheet covers substantially the circumference of the laminated wooden pole. Referring to Figure 1, the side edges of the sheet used for forming the layer 102A meet at the joining point 106A, hence the one layer 102A covers substantially the circumference of the pole 100. The side edges can be in connection or there may be a gap between the side edges in the joining point.

[0020] In an embodiment, the tubular structure comprises a plurality of layers formed of the one sheet such that each layer is formed of the one round of the sheet. Then the sheet is rounded several times about the central axis to form desired amount of the layers. This is not illustrated in Figures. For example, three layers may be formed such that the one sheet is rolled three times about the central axis and then the one sheet forms all the three layers.

[0021] In an embodiment, the tubular structure of the laminated wooden pole comprises a plurality of the layers, wherein each layer is formed of one round of the one wooden sheet. Referring to Figure 1, the tubular structure comprises two layers 102A - B wherein each layer is formed of the one wooden sheet, in other words, there are used two wooden sheets to form the two layers. The wooden sheet may be laminated together.

[0022] In an embodiment, the joining points of the adjacent layers are configured to be apart from each other. Referring to Figure 1, the tubular structure of the laminated wooden pole 100 may comprise, for example, two layers 102A - B and each is made of the one wooden sheet. The joining points 106A and 106B may be arranged such that they are not close to each other. This makes the structure of the pole more robust and it can tolerate bigger stress. If the layers are not adjacent, in other words, there is/are layer(s) between them, then joining points can be in the same line.

[0023] In an embodiment, the shape of the cross section of the laminated wooden pole is substantially circular. It may be a circle or oval, for example. Some of Figures illustrate an octagon cross section but it is just one example of the shape of the cross sections. The circular cross section is preferred especially in the outer surface. In addition, very strong structure can be achieved with the circular cross section.

[0024] In an embodiment, a shape of a cross section of the laminated wooden pole is polygon. The polygon may be regular or unregular (irregular).

[0025] In an embodiment, the shape of the cross section of the laminated wooden pole is octagon. For example, Figure 1 illustrates the laminated wooden pole 100 with the tubular structure having the octagon cross section. The octagon is the regular polygon and is very suitable cross section for the pole structure because of the high strength properties.

[0026] The cross section described in this application may refer to an inner and/or outer shape of the cross

section of the pole. In an embodiment, the shape of the inner cross section may differ from the shape of the outer cross section. The outer cross section may be circle and the inner may be octagon, for example.

[0027] In an embodiment, the cross section of the laminated wooden pole may be different in the different point of the pole in the longitudinal direction. For example, the first end of pole may have the different cross section than the second end of the pole.

[0028] In an embodiment, the one or more longitudinal elements are inside the one or more layers. Referring to Figure 1, the one or more longitudinal elements 104A - H are arranged to be inside the one or more layers 102A - B. Then the one or more layers made of the wooden sheet forms an outer side of the pole and the one or more longitudinal elements are inside covering at least part of the inner side and supporting the layers.

[0029] In an embodiment, the one or more longitudinal elements are outside the one or more layers. Referring to Figure 4, the one or more longitudinal elements 104A - H are arranged to be outside the one or more layers 102A - B. Then the one or more longitudinal elements cover at least a part of the outer side of the tubular structure.

[0030] In an embodiment, the laminated wooden pole comprises a plurality of the longitudinal elements configured to be inside and outside of the one or more layers. Referring to Figure 5, the tubular structure of the laminated wooden pole comprises two layers 102A - B, each made of the one wooden sheet, and the one or more longitudinal elements 104A - H outside and further the one or more longitudinal elements 1041 - P inside of the layers 102A - B. The layers 102A - B are arranged between the inner and outer longitudinal elements 104A - P. The one or more longitudinal elements cover at least partly the outer and inner surface of the tubular structure of the pole.

[0031] In an embodiment, the one or more longitudinal elements are between the layers. Referring to Figure 6, the tubular structure comprises four layers 102A - D and the one or more longitudinal elements 104A - H are arranged to be between the layers such that two layers 102A - B form the outer side of the tubular structure and two other layers 102C - D form the inner side of the tubular structure.

[0032] In an embodiment, the tubular structure of the laminated wooden pole comprises a plurality of the longitudinal elements such that the longitudinal elements cover the circumference of the tubular structure. Referring to Figure 1, the longitudinal elements 104A - H cover the whole circumference of the pole 100. The elements may be coupled together and also with the layer 102B. Figure 1 illustrates the embodiment wherein the elements are inside the layer(s) 102A - B. In addition to the circumference of the pole, the elements may cover the pole also in the longitudinal direction of the pole. In another embodiment, the longitudinal elements cover the whole circumference of the pole and a part of the pole in the longitudinal direction. In further embodiment, the longitudinal elements cover the whole circumference of the pole in two or more places of the pole separately in the longitudinal direction. For example, a first set of the elements that covers the circumference may locate in vicinity of the first end of the pole and a second set of the elements that covers the circumference may locate in vicinity of the second end of the pole.

[0033] Amount of the elements covering the whole circumference may vary. If the shape of the cross section of the tubular structure is octagon, there may be eight elements as illustrated in Figure 1, for example. One surface of the element may be against the layer and coupled with it, two other surfaces of the element may be against and coupled with the other elements.

[0034] It is obvious to the skilled person that the structure illustrated, for example, in Figures 6 can be repeated such that outside of the layer 102A and/or inside the layer 102C may again be the one or more longitudinal elements. Respectively, the structure illustrated in Figure 5 may further comprise one or more layers outside the one or more longitudinal elements 104A - H and/or inside the longitudinal elements 1041 - P. The layers and the elements may alternate in the structure as many times as needed to get desired structure.

[0035] In an embodiment, one end of the laminated wooden pole comprises an outer narrowing and a second end of the laminated wooden pole comprises an inner recess wherein the inner recess is configured to receive the outer narrowing. Figure 7 illustrates the pole having the narrowing 700 in the first end and the recess 702 in the second end. When two poles are coupled together, the narrowing of the first pole is set inside the recess of the second pole. Like this a plurality of the poles can be coupled together and the structure is modular. The pole may further comprise means for locking the narrowing and the recess together.

[0036] In an embodiment, the laminated wooden pole structure comprises fixing means for fixing the narrowing of the one pole into the recess of the other pole.

[0037] In an embodiment, the laminated wooden pole structure comprises a plurality of the layers in which each is made of the one wooden sheet and ends of the at least two layers are configured to be on the same level at the end(s) of the pole. Referring to Figure 8, the pole structure comprises three layers 102A - C that are arranged such that the ends of each layer in a first and/or a second end E1, E2 of the pole 100 are on the same level. The pole further comprises three more layers 102 D - F that are arranged such the ends of each layer in the first and/or the second end E1, E2 of the pole 100 are on the same level, but are on the different level than the ends of the first three layers 102A - C. By arranging thee layers this way the narrowing N and the recess R can be made.

[0038] In an embodiment, the narrowing N and recess R are made with the elongated elements such that the ends of the elongated elements are inside the layers at the one end and respectively the elongated elements are

outside of the layers in the second end. The end in which the ends of the elongated elements are inside creates the recess R and the end in which the elongated elements are outside of the layers creates the narrowing.

[0039] In another embodiment, the one or more elongated elements can be outside of the layers and the recess is made by arranging the layers such that the first ends of the layers are inside the elongated elements and respectively the narrowing such that the second end of the layers are outside of the elongated elements.

[0040] In an embodiment, two or more the laminated pole structures are arranged inside the one laminated pole structure. For example, laminated pole structure illustrated in Figure 1 may comprise inside two or more same kind of structures in a smaller size.

[0041] In an embodiment, the laminated pole structure is coated. The coating may be paint, varnish and/or metal coating, for example. The coating may be used to get protection for the pole and/or to get special properties for the pole like, for example, electrical conductivity.

[0042] In an embodiment, the pole comprises a cap in one end of the pole configured to cover, at least partly, the open end. The cap may be used for preventing, for example, ingress of water inside the pole when the pole is in the upright position. It may also prevent entering of animals inside the pole.

[0043] In an embodiment, the cap is arranged to the end of the pole such that there is a gap between the end of the pole and the cap. The gap may be used, for example, routing the cables inside the hollow pole structure.

[0044] In an embodiment, the cap is arranged inside the tubular pole structure. The cap inside the tubular structure may be, for example, a fire break preventing progress of fire inside the pole.

[0045] The cap may be made of the wood, metal and/or any other suitable material, for example.

[0046] Referring to Figure 9, a method for producing the laminated wooden pole, comprising: (block 900) arranging one or more wooden sheets and one or more longitudinal elements with a glue inside a tubular mould; (block 902) arranging a vacuum element inside the tubular mould such that the one or more wooden sheet and the one or more longitudinal elements with the glue are between the vacuum element and the mould; and (block 904) pressing, by the vacuum element, the one or more wooden sheet and the one or more longitudinal elements with the glue together and towards an inner surface of the tubular mould.

[0047] Referring to Figure 10, in an embodiment, the mould 1000 is configured to receive the one or more wooden sheets 200 and the longitudinal elements 104 into a cavity of the mould. The wooden sheet(s) form the layer(s) in the pole 100. The glue is dispensed to the layer(s) and element(s). The cavity of the mould refers to inner side of the mould. The inner side of the mould has substantially the same shape as the pole structure's outer shape. For example, if the cross section of the pole structure is circle, the cavity of the mould has the same shape as illustrated in Figure 10.

[0048] In an embodiment, the vacuum element is a sleeve (tube). The sleeve is used to form a vacuum presser for pressing the sheet(s) and the longitudinal element(s) towards the inner surface of the mould such that the outermost sheet(s) and/or longitudinal element(s) of the structure are pressed against in the inner surface of the mould.

[0049] Referring to Figure 11, the vacuum element 1100 is arranged inside the mould 1000 and the tubular structure of the pole 100 comprising the one or more wooden sheets 200 and longitudinal elements 104. Figure 11 illustrates the mould from the end. The vacuum element 1100 is configured to press the sheet(s) 200 and longitudinal element(s) 104 with glue against the inner surface of the mould 1000. Arrows in Figure 11 illustrate how the vacuum element presses the sheet(s) and/or longitudinal element(s) against the inner surface of the mould.

[0050] Referring to Figure 12, in an embodiment, the tubular mould 1000 is open at least at the one end and the vacuum element 1100 extends from inside of the mould 1100 to outer surface of the mould 1100 at the end of the mould. Figure 12 is a cross section of the mould 1000 having sheet(s) 200, longitudinal element(s) 104 and the vacuum element 1100 inside. The vacuum element illustrated in Figure 12 is the sleeve that is arranged inside the mould such that the sheet(s) 102 and the longitudinal member(s) 104 are between the sleeve and the inner surface 1000_IS of the mould. Both ends of the sleeve 1100_1, 1100_2 extend out of the mould. The ends of the sleeve 1100_1, 1100_2 are turned against the outer surface 1000_OS of the mould. Then the surface of the sleeve that is against the inner surface of the mould, sheet(s) and longitudinal elements(s) inside the mould is also against the outer surface of the mould in vicinity of both ends of the mould. The vacuum sleeve may be elastic and when the ends of the sleeve are turned against the outer surface of the mould, the sleeve stretches and forms a sealed interface with the outer surface of the mould. In other words, the interface between the ends of the sleeve 1100_1, 1100_2 and the outer surface of the mould 1000_OS is air proof. In an embodiment, the sealing interface between the vacuum sleeve and the mould comprises a sealing element. The sealing element may be a tape and/or a collar, for example. The sealing element may also be a sealing composition. The mould and the vacuum sleeve form the air proof structure to which the vacuum can be formed.

[0051] The mould may comprise a vent 1200 for creating the vacuum between the mould and the sleeve that causes pressing of the sleeve against the sheet(s) and the longitudinal element(s) such that the outer sheet(s) and/or the longitudinal element(s) are pressed against the inner surface of the mould. The sleeve presses the sheet(s) and the longitudinal element(s) together and against the inner surface of the mould such that air is removed between them and the glue laminates the

sheet(s) and the longitudinal element(s) together.

[0052] When the glue is dry, the vacuum element can be removed from the mould and then also the laminated wooden pole structure can be removed from the cavity of the mould. The sheet(s) 200 forms the layer(s) 102 and the longitudinal elements 104 are integrated with the layer(s) 102.

[0053] The vacuum between the vacuum element and the mould may be formed by a vacuum pump and/or compressor that is coupled to the vent of the mould. In an embodiment, the vent is in the vacuum element.

[0054] Referring to Figure 13, in an embodiment, the mould is openable in a longitudinal direction of the mould, in other words, the mould comprises two halves 1000_1, 1000_2. Figure 13 illustrates the tubular mould structure that is open at both ends and is also openable in the longitudinal direction of the mould.

[0055] The mould is openable in the longitudinal direction such that the laminated wooden pole structure can be removed from the cavity of the mould and respectively the sheets and/or longitudinal elements can be inserted into the cavity of the mould. The halves of the mould 1000_1, 1000_2 may be coupled together, for example, by hinge 1300 such that the halves stay together when the mould is open. In addition, the mould may comprise locking mechanism to keep the halves together during the lamination process.

[0056] The laminated wooden pole according to the invention may be used in a plurality of the applications. It is possible to adjust the strength of the structure with the layers and/or longitudinal elements such that the poles can tolerate a lot of mechanical stress. This make possible to use the wooden pole in the places in which conventionally are used metal poles. The wooden pole is still more ecological solution compared to the metal poles.

[0057] In an embodiment, the laminated wooden pole is used as a mounting pole. The mounting pole refers to the structure used for mounting, for example, an electrical equipment, solar panels, wind turbines, antennas, telecommunication devices, lights and/or signs. The laminated wooden pole according to the invention, enables very strong but still relatively light structure for mounting different kind of items. The modular structure makes possible to adjust the length of the pole to meet desired length requirements of the pole.

[0058] The laminated wooden pole may also be used as a climbing pole wherein holds/grips are assembled on the pole. The laminated wooden pole may also be used for training purposes such that the real mast/pole assembly conditions and environment can be achieved by using the pole.

[0059] In an embodiment, a plurality of the vertically assembled laminated wooden poles may be coupled with horizontally assembled laminated wooden poles. This enables building of desired environment, for example, for training purposes.

[0060] Even though the invention has been described with reference to one or more example embodiments according to the accompanying drawings, it is clear that the invention is not restricted thereto but can be modified in several ways within the scope of the appended claims. All words and expressions should be interpreted broadly, and they are intended to illustrate, not to restrict, the example embodiments. It will be obvious to a person skilled in the art that, as technology advances, the inventive concept can be implemented in various ways.

Claims

1. A laminated wooden pole, comprising:

   a tubular structure comprising one or more layers wherein the layer is formed of one round of a wooden sheet; and
   one or more longitudinal elements configured to cover at least a part of at least one layer of the tubular structure.

2. The laminated wooden pole of claim 1, wherein the layer covers a circumference of the tubular structure.

3. The laminated wooden pole of any preceding claims, wherein the tubular structure comprises a plurality of the layers, wherein each layer is formed of one round of the one wooden sheet.

4. The laminated wooden pole of claim 3, wherein joining points of the adjacent layers are configured to be apart from each other.

5. The laminated wooden pole of any preceding claim, wherein a shape of a cross section of the pole is circle.

6. The laminated wooden pole of any preceding claim, wherein the shape of the cross section of the pole is polygon.

7. The laminated wooden pole of any preceding claims, wherein the one or more longitudinal elements are inside the one or more layers.

8. The laminated wooden pole of any preceding claims, wherein the one or more longitudinal elements are outside the one or more layers.

9. The laminated wooden pole of any preceding claims, wherein the pole comprises a plurality of the longitudinal elements configured to be inside and outside of the one or more layers.

10. The laminated wooden pole of claim 3, wherein the one or more longitudinal elements are between the layers.

11. The laminated wooden pole of any preceding claims, wherein the tubular structure comprises a plurality of the longitudinal elements such that the longitudinal elements cover the circumference of the tubular structure.

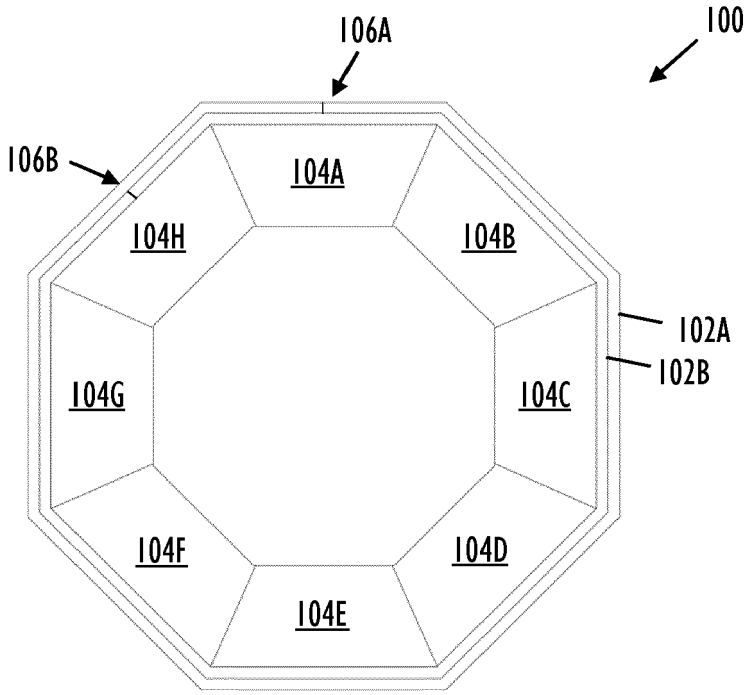
12. The laminated wooden pole of any preceding claims, wherein a first end of the pole comprises an outer narrowing and a second end of the pole comprises an inner recess wherein the inner recess is configured to receive the outer narrowing.

13. A method for producing a laminated wooden pole, comprising:

arranging one or more wooden sheets and one or more longitudinal elements with a glue inside a tubular mould;
arranging a vacuum element inside the tubular mould such that the one or more wooden sheets and the one or more longitudinal elements with the glue are between the vacuum element and the mould; and
pressing, by the vacuum element, the one or more wooden sheets and the one or more longitudinal elements with the glue together and towards an inner surface of the tubular mould.

14. The method for producing the laminated wooden pole of claim 13, wherein the tubular mould is open at least at one end and the vacuum element extends from inside of the mould to outer surface of the mould at the end of the mould.

15. Use of a laminated wooden pole of claim 1 as a mounting pole.


100
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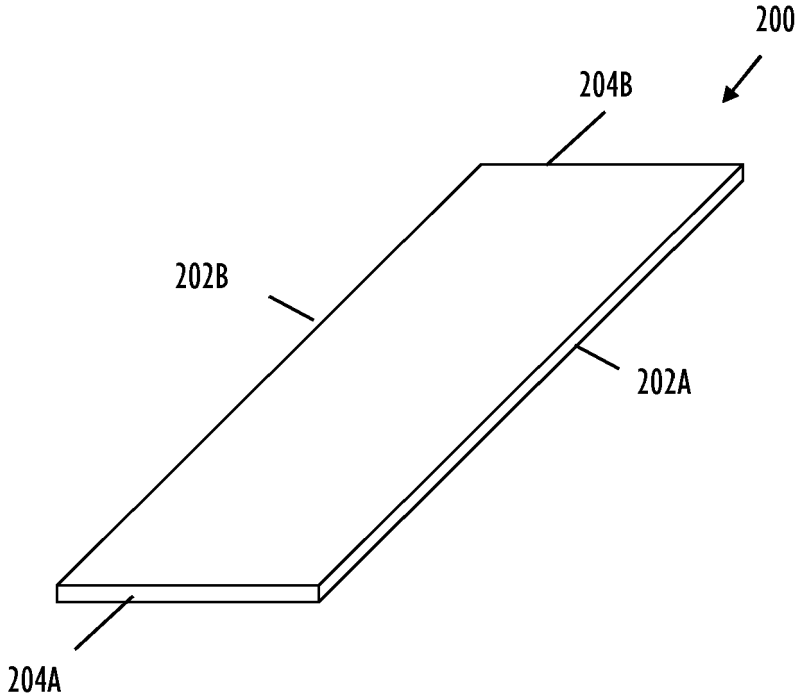
106B
104A
104B
104C
104D
104E
104F
104G
104H
102A
102B

FIG. 1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202B
202A
204A

FIG. 2A

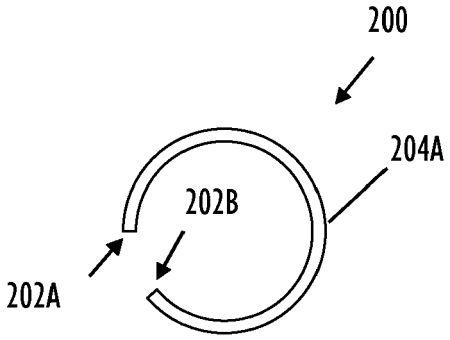


FIG. 2B

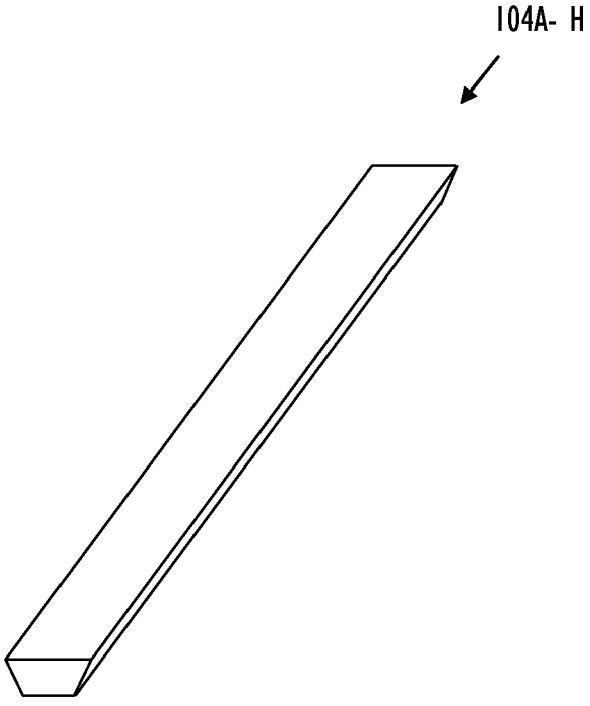
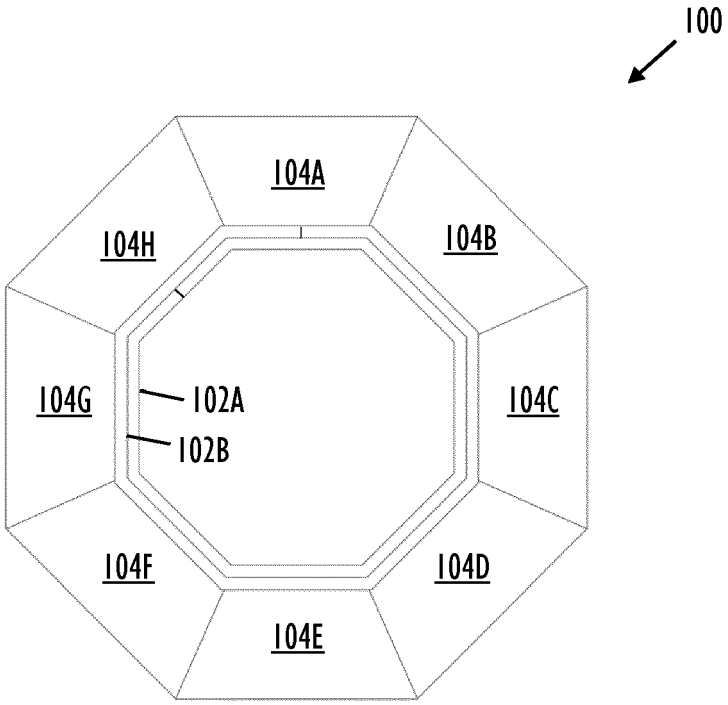


FIG. 3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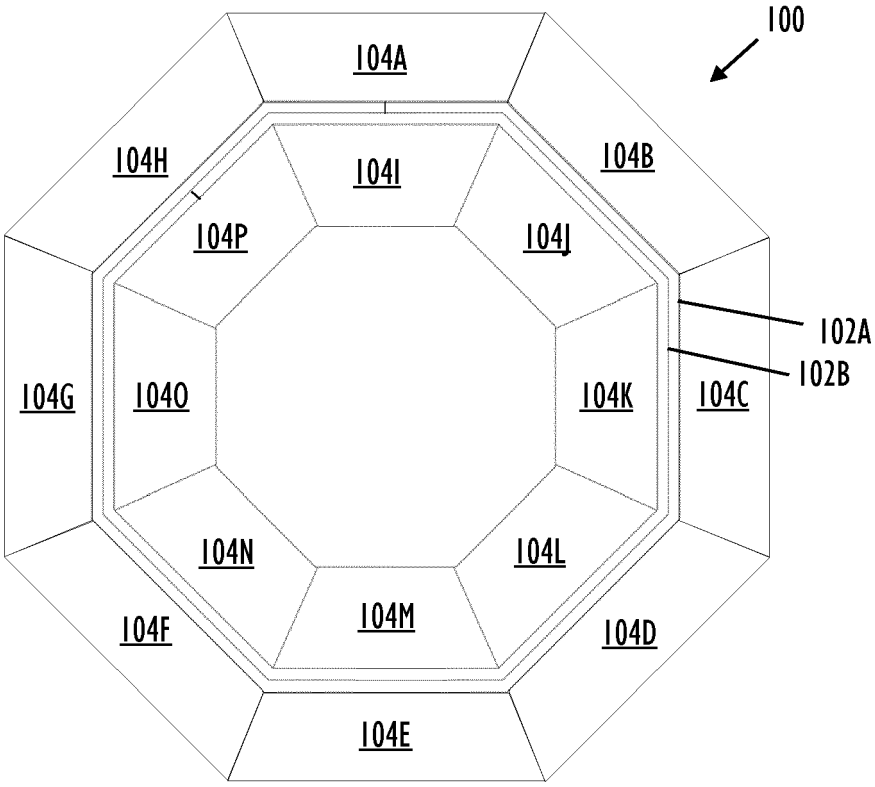
104B
104C
104D
104E
104F
104G
104H
102A
102B

FIG. 4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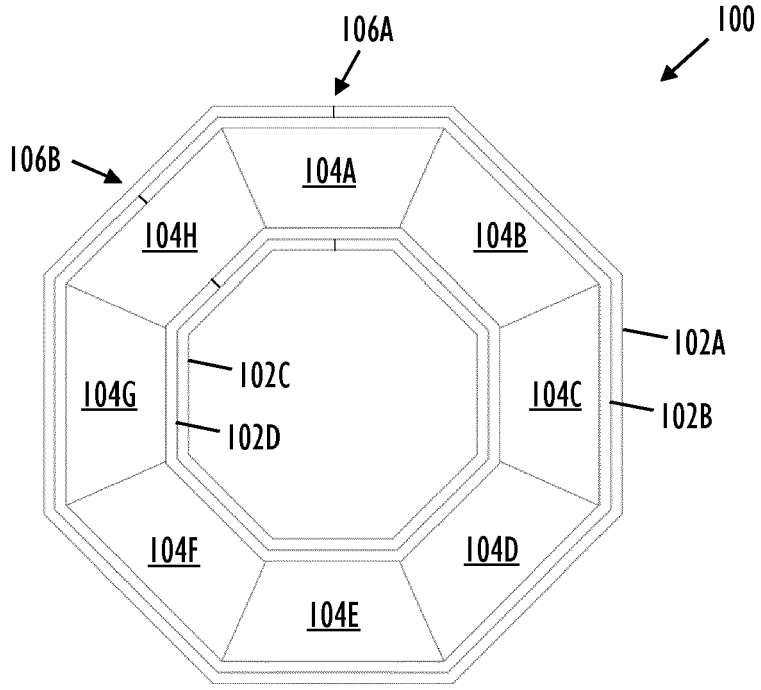
102B

FIG. 5


106A
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106B
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104H
104B
102A
102C
104G
104C
102B
102D
104F
104D
104E

FIG. 6

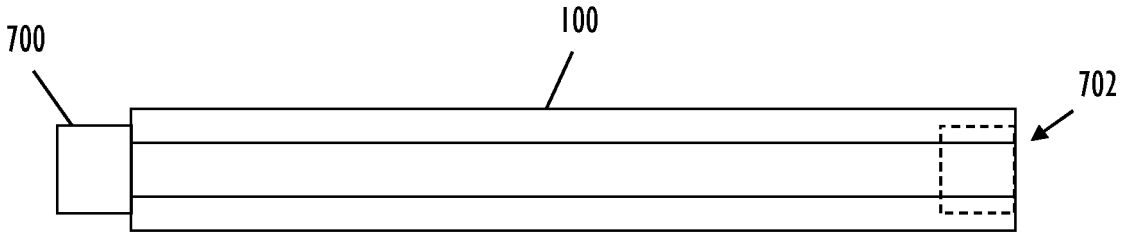
700
100
702

FIG. 7

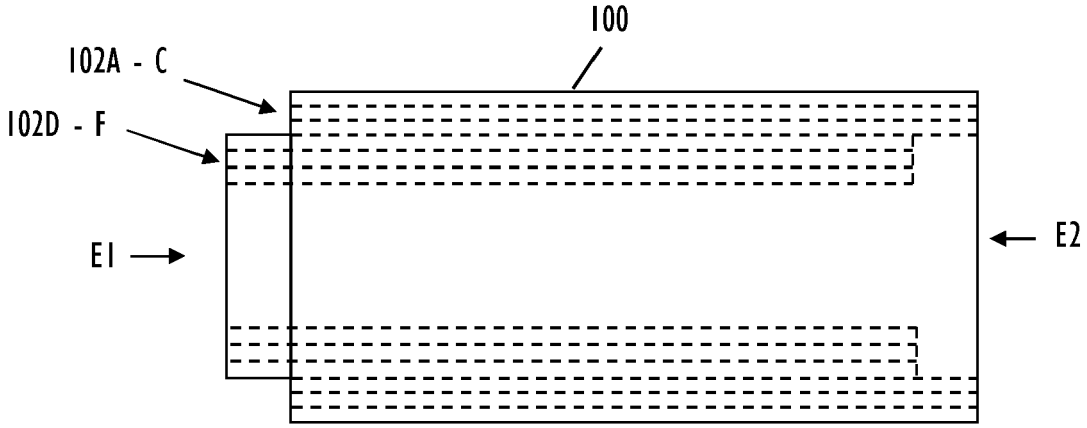
100
102A - C
102D - F
E1
E2

FIG. 8

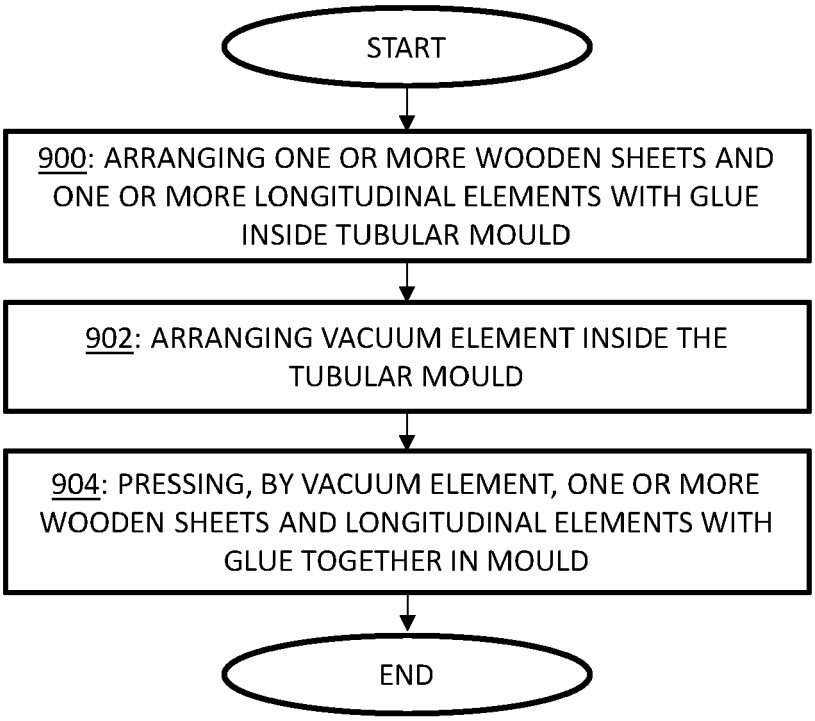
START
900: ARRANGING ONE OR MORE WOODEN SHEETS AND ONE OR MORE LONGITUDINAL ELEMENTS WITH GLUE INSIDE TUBULAR MOULD
902: ARRANGING VACUUM ELEMENT INSIDE THE TUBULAR MOULD
904: PRESSING, BY VACUUM ELEMENT, ONE OR MORE WOODEN SHEETS AND LONGITUDINAL ELEMENTS WITH GLUE TOGETHER IN MOULD
END

FIG. 9

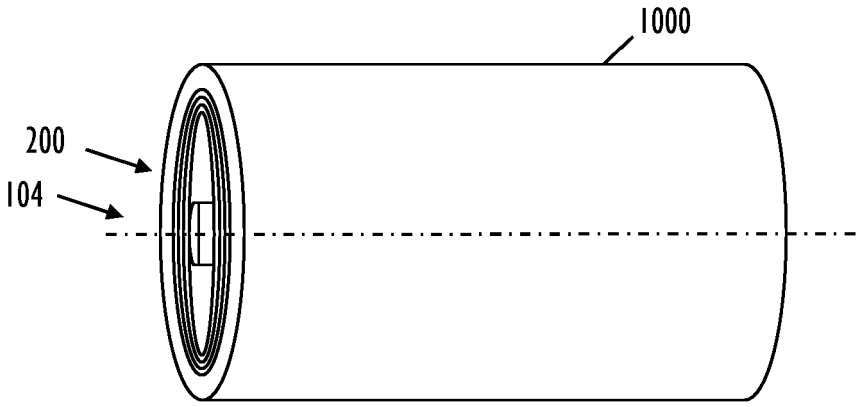

FIG. 10

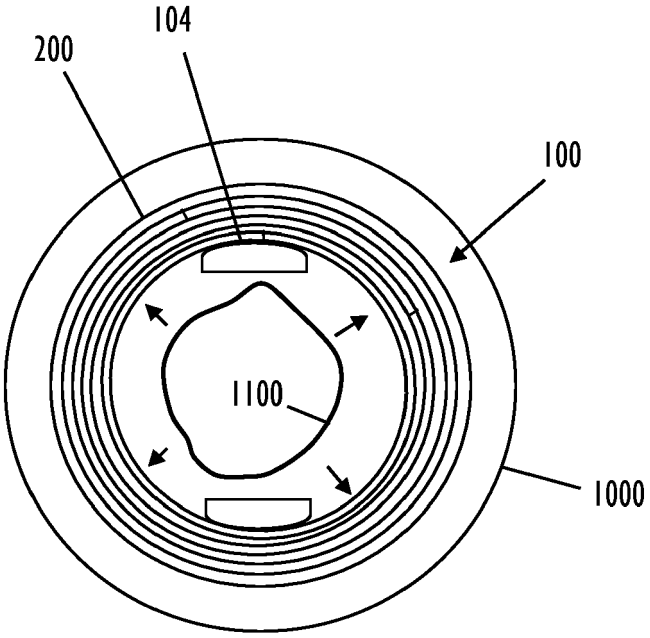

FIG. 11

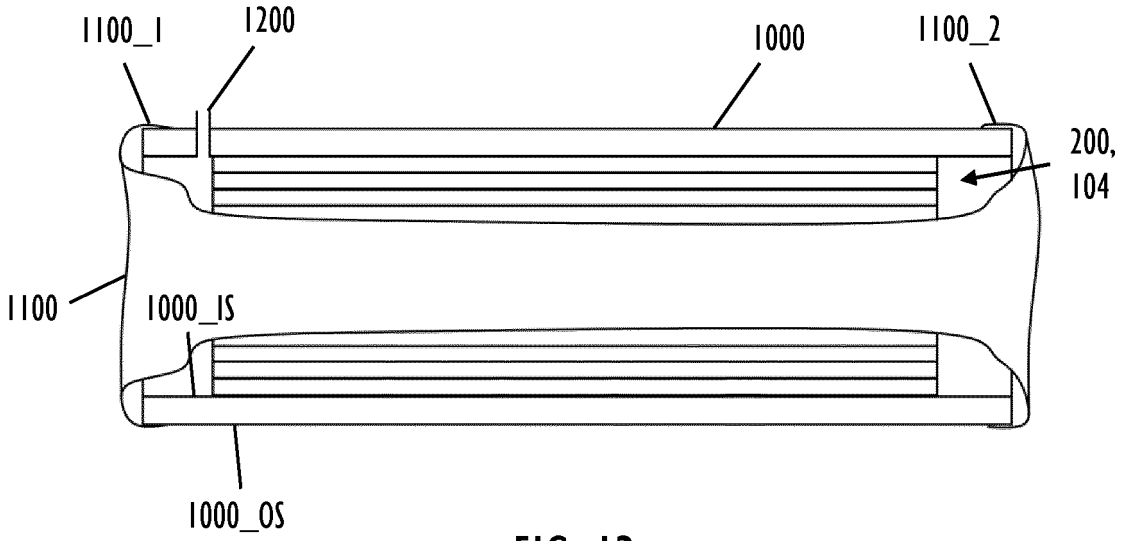
1100_1
1200
1000
1100_2
200,
104
1100
1000_IS
1000_OS

FIG. 12

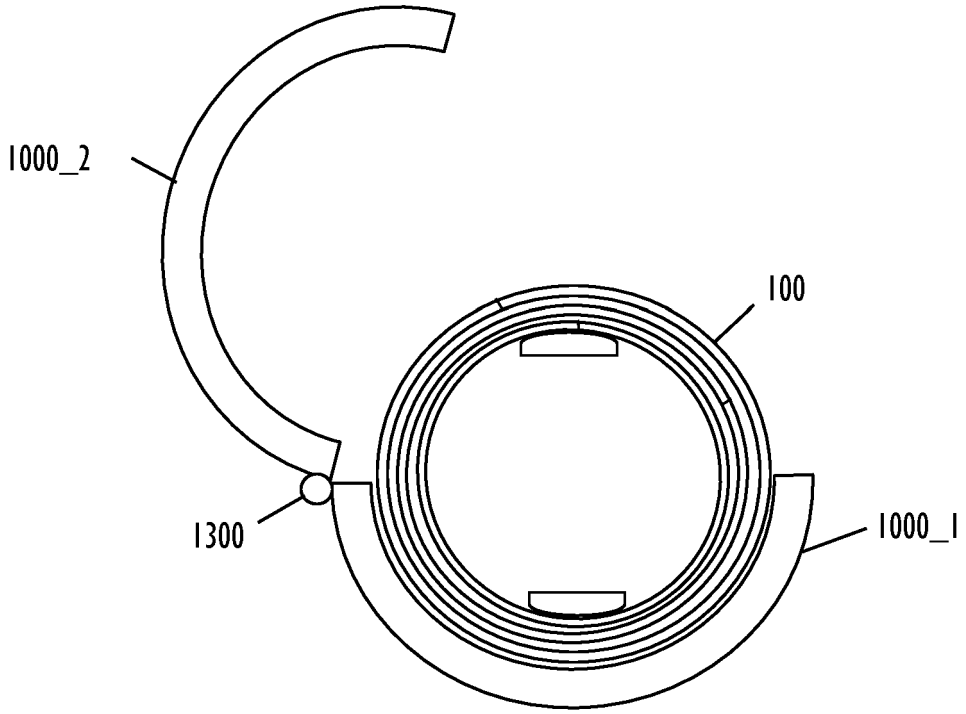
1000_2
100
1300
1000_1

FIG. 13

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EUROPEAN SEARCH REPORT

Application Number
EP 21 17 8952

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	CA 2 269 548 A1 (DANOMAST GT GLASFIBER AS [DK]) 23 April 1998 (1998-04-23) * figures 3, 4 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

B27M
E04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 November 2021	Brucksch, Carola

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19-11-2021

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