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The invention relates to a spar cap assembly for a wind turbine rotor blade that has a spar cap reinforced with carbon fibers.

Such a spar cap assembly is disclosed by the document EP 2 561 977 A1. The
5 prefabricated spar cap assembly is integrated into a rotor blade half-shell after the curing of a polymer matrix in which the carbon fibers are embedded.

Since the carbon fibers forming the spar cap are electrically conductive, special measures for effective lightning protection are required in the case of such a rotor
10 blade. These include, in particular, effective potential equalization between a lightning conductor, which is incorporated in the wind turbine rotor blade and connects a lightning receptor arranged particularly at the tip of the blade to the root of the blade, and the spar cap. The potential equalization can have the effect of preventing an electromagnetically induced discharge of a high lightning-stroke
15 current by way of the lightning conductor from causing such great differences in potential between the lightning conductor and the spar cap that voltage flashovers occur. As a result, damage to the wind turbine rotor blade by a lightning strike can be avoided.

20 The document EP 1 692 752 B1 discloses a wind turbine rotor blade in which an internal, electrically conductive spar is connected to an adjacently arranged lightning conductor. Provided for this purpose are potential-equalizing elements, which connect the spar and the lightning conductor to one another by way of an electrical line. The contact with the spar is established by way of a conductive
25 ribbon.

From the document EP 1 112 448 B2 which discloses a spar cap assembly according to the preamble of claim 1, a wind turbine rotor blade with a number of electrically conductive spar caps of a carbon fiber material has become known.
30 To increase the electrical conductivity of the spar caps, metal-coated carbon fibers are used, so that the current-carrying capacity of the spar caps should be sufficient for use as a lightning conductor. In addition, a centrally arranged metallic lightning conductor may be used. The spar caps and possibly the additional

metallic lightning conductor are connected to one another at a number of longitudinal positions by way of potential-equalizing elements in the form of internal electrical conductors.

- 5 The document EP 1 664 528 B1 discloses a wind turbine rotor blade with electrically conductive main spar caps of a carbon fiber material and two lightning conductors arranged inside the rotor blade. Potential equalization between a main spar cap and a lightning conductor is established by way of a copper mesh, which electrically contacts the main spar cap, and an electrical connecting line. A middle
10 portion of the connecting line is screwed to the lightning conductor. A free end of the connecting line is screwed along with metallic adapters and the copper mesh to a lightning receptor.

The document EP 2 110 552 A1 discloses a wind turbine rotor blade in which a
15 flat or braided lightning conductor is arranged in the region of a web. The lightning conductor is integrated into a laminate in a vacuum-infusion process during the production of the wind turbine rotor blade.

Against this background, the object of the invention is to provide a spar cap assembly for a wind turbine rotor blade with a carbon-fiber-reinforced spar cap that
20 makes easier production of a wind turbine rotor blade with a lightning protection device possible, and also a corresponding production process.

This object is achieved by the spar cap assembly with the features of claim 1.
25 Advantageous refinements are specified in the subclaims following thereafter.

The spar cap assembly for a wind turbine rotor blade has the following:

- a spar cap reinforced with carbon fibers,
- a lightning conductor, which is arranged so as to run along the spar cap,
30 and
- at least one potential-equalizing element, which establishes an electrical connection between the spar cap and the lightning conductor,

- the carbon fibers of the spar cap, the lightning conductor and the at least one potential-equalizing element being embedded in a common polymer matrix and being designed as a prefabricated assembly for integration into a wind turbine rotor blade half-shell after the curing of the polymer matrix.

5

The spar cap forms an element of the supporting structure of the wind turbine rotor blade. In particular, it may be a main spar cap, which absorbs a large part of the tensile loads occurring during the operation of the wind turbine rotor blade. The carbon fibers forming the spar cap may be placed into a spar-cap-assembly production mold in the form of scrims, in a multiplicity of layers lying one on top of the other. The spar cap may be of a rectangular or trapezoidal form in cross section. It may have a length of for example 40 m or more.

The lightning conductor runs along the spar cap and, in particular, extends over the entire length of the spar cap, possibly even beyond it. It has a current-carrying capacity that is sufficient for discharging a lightning-strike current. For this purpose, it may for example consist of copper and have an effective cross section of 25 mm² or more, in particular of approximately 50 mm². It extends parallel to the spar cap and may be arranged directly on the spar cap or parallel thereto at a distance, in particular closely alongside the spar cap. The lightning conductor may be a solid metallic conductor or comprise a multiplicity of individual wires, in particular in the form of a braided tube, for example of copper.

The potential-equalizing element is electrically conductive and is in electrical contact on the one hand with the spar cap and on the other hand with the lightning conductor. It may likewise comprise a multiplicity of individual wires, in particular of copper. For example, it may be a woven or knitted fabric or mesh of a multiplicity of individual wires, in particular a filter braid, which is usually used as a filter medium.

30

In the case of the invention, the carbon fibers of the spar cap, the lightning conductor and the at least one potential-equalizing element are embedded in a com-

mon polymer matrix. This may take place, in particular, in a vacuum-infusion process in a production mold for the spar cap assembly. In a vacuum-infusion process, the elements to be embedded are arranged in a production mold, which is closed in an airtight manner and subsequently evacuated. The negative pressure
5 within the production mold causes a liquid polymer material to flow into the mold. After the curing of the liquid polymer material, the elements are embedded in a polymer matrix.

The prefabricated spar cap assembly obtained after the curing of the polymer
10 matrix can be removed from its production mold and subsequently integrated into a wind turbine rotor blade half-shell. For this purpose, it may for example be adhesively bonded to a prefabricated wind turbine rotor blade half-shell and/or be embedded along with reinforcing fibers and possibly further elements of the wind turbine rotor blade half-shell in a polymer matrix in a further vacuum-infusion process.
15

The invention is based on the finding that it is laborious for a rotor blade to be subsequently provided with a prefabricated main spar cap with a lightning protection device, which particularly provides potential equalization with respect to the
20 main spar cap. The inclusion of the lightning conductor and the at least one potential-equalizing element in the production process for the spar cap assembly, as provided by the invention, has the effect of simplifying the further production of the wind turbine rotor blade. In particular, the large-format production molds that are used for the production of the wind turbine rotor blade half-shell can be
25 used more efficiently, because central elements of the lightning protection device are already prefabricated along with the spar cap. A further advantage is in the electrical contacting of the lightning conductor, and in particular the spar cap, by the at least one potential-equalizing element, which in the case of the invention is particularly simple and reliable.

30

In a refinement, the potential-equalizing element is arranged obliquely in relation to a longitudinal direction of the spar cap. The angle between a longitudinal direction of the potential-equalizing element and the longitudinal direction of the

spar cap may for example lie in the range from 10° to 80°, preferably in the range from approximately 30° to approximately 60°. This refinement takes into account the additional strength given to the spar cap by the potential-equalizing element and ensures that there is no abrupt change in strength in the longitudinal direction of the spar cap assembly as a result of the potential-equalizing element.

In a refinement, a portion of the potential-equalizing element lies against a first layer of the carbon fibers of the spar cap and is covered over by a second layer of carbon fibers of the spar cap or a layer of further carbon fibers, which reaches up to the lightning conductor. The portion of the potential-equalizing element is consequently arranged between two layers of carbon fibers. As a result, the transfer resistance between the potential-equalizing element and the spar cap can be reduced. The application of an electrically conductive top layer of carbon fibers also improves the electrical contact between the spar cap and the lightning conductor.

In a refinement, the lightning conductor has a solid connecting body of metal for the connection to an element of a lightning protection device that does not belong to the spar cap assembly. In the finished wind turbine rotor blade, the lightning conductor must generally be connected to further elements of a lightning protection device that are not integrated into the spar cap assembly. This may be for example one or more lightning receptors or a further potential-equalizing element, which brings about an equalization of the potential between the lightning conductor and some other electrically conductive element of the wind turbine rotor blade. For example, a further carbon-containing spar cap of the wind turbine rotor blade, a further lightning conductor, a shielding of a signaling line or an electrical supply line may be connected in this way to the lightning conductor. The connecting body may, in particular, consist of copper. The solid form provides sufficiently large contact areas and makes it possible to establish a connection that has a sufficient current-carrying capacity.

In a refinement, the solid connecting body has an internal thread. The internal thread may be arranged in a through-bore in the connecting body. It makes it possible to produce a screwed connection to establish the electrical connection.

- 5 In a refinement, the solid connecting body connects the lightning conductor and the potential-equalizing element electrically to one another. In particular, the connecting body may have been produced in an exothermic welding process, so that portions of the potential-equalizing element and of the lightning conductor, in particular in each case a multiplicity of individual wires forming these elements, may
10 have been fused to one another in the connecting body. The connecting body may perform a dual function. On the one hand it establishes a permanent and reliable electrical connection between the lightning conductor and the potential-equalizing element, on the other hand it offers a connection possibility for establishing a further electrical connection, as already described.

15

- In a refinement, the solid connecting body is arranged on an inner side of the spar cap assembly, which after integration of the spar cap assembly into a wind turbine rotor blade half-shell is facing an interior space of the wind turbine rotor blade half-shell. In the case of this arrangement, the connecting body is accessible from
20 the interior space of the wind turbine rotor blade half-shell, so that internal potential-equalizing elements can be connected particularly easily.

- In a refinement, the spar cap assembly has an inlay of a core material arranged to the side of the carbon fibers of the spar cap, and the lightning conductor is
25 arranged in a groove of the inlay. The core material may be for example balsa wood or an expanded plastics material, as is customary for the production of a middle layer of components of fiber-reinforced plastics materials produced in a sandwich type of construction. The material of the inlay may, in particular, correspond to the core material at the respective longitudinal position of the rotor
30 blade. There may be a number of inlays integrated into the spar cap assembly, in particular arranged to both sides of the carbon fibers of the spar cap. The inlays may be formed in a way that complements lateral surfaces of the spar cap, so that they directly adjoin the carbon fibers and supplement the cross section of the

spar cap in such a way that the spar cap assembly as a whole has a form that is advantageous for the integration into a wind turbine rotor blade half-shell. Altogether, the spar cap assembly supplemented by one or more inlays may be of an approximately rectangular or approximately trapezoidal form in cross section.

- 5 What is meant by approximately rectangular or approximately trapezoidal is that, in particular, the longitudinal sides of the cross-sectional form may possibly be slightly curved, in particular in a way corresponding to the geometry of an aerodynamic envelope of the wind turbine rotor blade for which the spar cap assembly is intended. The forming of a groove in the inlay (it may for example be a cross-
- 10 sectionally wedge-shaped inlay directly adjoining the carbon fibers or a cross-sectionally substantially rectangular inlay arranged alongside) simplifies the arrangement of the lightning conductor, which is predetermined by the groove. At the same time, this is conducive to complete embedding of the lightning conductor in the polymer matrix while maintaining a desired cross-sectional geometry of
- 15 the spar cap assembly. If the cross section of the spar cap assembly as a whole is approximately rectangular, the two longitudinal sides of the rectangle may – always with respect to the intended arrangement of the spar cap assembly in a wind turbine rotor blade half-shell – be facing an inner side and an outer side, respectively, of the wind turbine rotor blade, or form these sides, and the two
- 20 narrow sides of the rectangle may be facing a profile leading edge and a profile trailing edge of the wind turbine rotor blade half-shell. The lightning conductor may, in particular, be arranged in a groove of an inlay that is arranged on the side of the spar cap assembly that is facing the profile trailing edge.

- 25 In a refinement, the inlay has a through-opening, which leads from the groove to an opposite side of the inlay and in which a metal body electrically connected to the lightning conductor may be arranged. In particular, the groove may be arranged on an inner side of the spar cap assembly and the through-opening may lead from there to an outer side of the inlay. The metal body may, in particular,
- 30 lie against a connecting body and/or be fastened to it. In this way, the metal body provides a connection point for the lightning conductor on the outer side or near the outer side of the spar cap assembly. To this connection point there may be

connected for example a potential-equalizing element arranged on the outer side of the wind turbine rotor blade half-shell or a lightning conductor arranged there.

5 In a refinement, the inlay has in the region of the through-opening an insert of a stronger material, in which the through-opening is arranged. The stronger material has a greater strength than the core material of which the other regions of the inlay consist. The stronger material may be for example glass-fiber-reinforced plastic. The use of a stronger material in an area around the through-opening makes possible mechanically more stable fixing of the metal body in the through-
10 opening and/or more stable lining of the connecting body for a fastening to the wind turbine rotor blade that engages on the blade from an outer side. The insert of the stronger material may also extend over the region of the potential-equalizing element. As a result, unification of the inserts over the length of the rotor blade is possible, irrespective of whether or not there are through-openings.

15

In a refinement, the metal body is a metal bush that is screwed into an internal thread of the connecting body and has a continuous threaded bore, which runs from an inner side of the spar cap assembly to the opposite outer side of the spar cap assembly. In the case of this refinement, the metal body is fastened to the
20 connecting body securely and with sufficient current-carrying capacity, and offers a simple connection possibility on the inner side and the outer side of the spar cap assembly in the form of the threaded bore arranged there. The metal bush may for example consist of copper, aluminum, steel, brass or some other alloy.

25 In a refinement, the spar cap assembly has a layer of a fiber material, which is arranged on an outer side of the spar cap assembly opposite from the inner side and adjoins the carbon fibers of the spar cap. The layer of the fiber material may comprise a number of layers of a fiber material, for example one or more layers of a glass-fiber fabric or scrim. During the production of the spar cap assembly in
30 a vacuum-infusion process, this layer may be conducive to a uniform distribution of the liquid polymer material. The layer of the fiber material may also adjoin one or more inlays or be arranged under them, so that the layer of the fiber material

connects the inlay or inlays and the carbon fiber material of the spar cap to form a stable unit.

The aforementioned object is likewise achieved by the process with the features of claim 13. Advantageous refinements are specified in the subclaims that follow
5 thereafter. The process serves for the production of a wind turbine rotor blade half-shell and has the following steps:

- providing a production mold for the wind turbine rotor blade half-shell,
- placing reinforcing fibers into the production mold,
- 10 • arranging a spar cap assembly with the features of one of claims 1 to 12 in the production mold,
- embedding the reinforcing fibers and the spar cap assembly in a polymer matrix.

15 In the process, the spar cap assembly described above is integrated into a wind turbine rotor blade half-shell. This may, in particular, take place in a vacuum-infusion process, in which the reinforcing fibers are first embedded in a polymer matrix and at the same time connected to the already cured, prefabricated spar cap assembly. It goes without saying that the spar cap assembly does not nec-
20 essarily have to be embedded on all sides in the polymer matrix of the wind turbine rotor blade half-shell. The embedding of the spar cap assembly may also substantially comprise an adhesive bonding of the spar cap assembly to the reinforcing fibers of the wind turbine rotor blade half-shell.

25 For the features of the process and its advantages, reference is made to the explanations above relating to the spar cap assembly that is used in the process, which apply correspondingly.

In a refinement of the process, an electrical connection between the lightning
30 conductor and an element of a lightning protection device that does not belong to the spar cap assembly is established after the embedding of the reinforcing fibers and the spar cap assembly in the polymer matrix. The element of the lightning

protection device that does not belong to the spar cap assembly may be for example a further spar cap, a further lightning conductor, a lightning receptor or a further potential-equalizing element, as already described in connection with the spar cap assembly. The connection may, in particular, be established by using a
5 connecting body or metal body integrated into the spar cap assembly, as explained above. In this way, the lightning protection device of the wind turbine rotor blade can be completed particularly easily by using the prefabricated assembly.

In a refinement, an opening in the spar cap assembly that is used for establishing
10 the electrical connection is closed by a covering before the embedding of the reinforcing fibers and the spar cap assembly in the polymer matrix. The covering may, in particular, be an adhesive pad that is stuck onto the opening in the spar cap assembly. The opening may, in particular, be a threaded bore in a connecting body or a metal body of the spar cap assembly, as explained above. After the
15 embedding of the reinforcing fibers and the spar cap assembly in the polymer matrix, the opening can be easily made freely accessible again by drilling through the laminate lying over it and the adhesive pad.

The invention is explained in more detail below on the basis of an exemplary
20 embodiment that is represented in the figures, in which:

Figure 1 shows a detail of a spar cap assembly according to the invention in a plan view of the inner side,

25 Figure 2 shows a cross section through the spar cap assembly from Figure 1 along the plane denoted by A-A,

Figure 3 shows a cross section through the spar cap assembly of Figure 1 along the plane denoted by B-B,

30

Figure 4 shows a cross section through the spar cap assembly from Figure 1 along the plane denoted by C-C,

Figure 5 shows a perspective representation of a portion of an inlay of the spar cap assembly from Figure 1,

Figure 6 shows a cross section through the spar cap assembly from Figure 1
5 along the plane denoted in Figure 4 by D-D,

Figure 7 shows the detail of the spar cap assembly from Figure 1 that is represented in Figure 6 after integration into a wind turbine rotor blade half-shell.

10 In Figure 1, a portion about 2 m long of a spar cap assembly 10 for a wind turbine rotor blade is shown in a plan view. The portion shown continues in the downward direction to an end on the blade root side, in the upward direction to an end on the blade tip side. Altogether, the spar cap assembly 10 has a length of for example 40 m or more.

15

A multiplicity of carbon fibers extend along a longitudinal direction of the spar cap assembly 10 from the end on the blade root side to the end on the blade tip side. They form a spar cap 12. The spar cap assembly 10 has an inner side 14, which is facing the viewer and, after integration of the spar cap assembly 10 into a wind
20 turbine rotor blade half-shell, faces into an interior space of the half-shell. The side face 16 that is arranged on the right in Figure 1 is facing a profile trailing edge and is formed by an inlay 18 of a core material. The side face 20 of the spar cap assembly 10 that is arranged on the left in Figure 1 is facing a profile leading edge and is formed by a further inlay 22.

25

The inlay 18 has on the inner side 14 of the spar cap assembly 10 a groove 24, in which a lightning conductor 26, which consists of a copper braided tube, is arranged. In the region of the potential-equalizing elements 28, the inlay 18 has inserts 19 of a glass-fiber-reinforced plastics material, in order to achieve a
30 greater strength.

The two rhomboidal potential-equalizing elements 28 are blanks cut out from a copper filter braid. They lie with a large part of their surface area against the inner

side of the spar cap 12 and are connected to the lightning conductor 26 by each of three connecting bodies 30. In this way, an electrical connection is established between the spar cap 12 and the lightning conductor 26.

- 5 The lower of the two potential-equalizing elements 28 shown is partially covered by a top layer 34 of a carbon fiber material. Such a top layer 34 is likewise present in the case of the upper potential-equalizing element 28, but is not shown for illustrative reasons. Applying the electrically conductive top layer 34 has the effect of improving the electrical contact between the spar cap 12 and the lightning con-
- 10 ductor 26. The top layer 34 extends over part of the width and over the length of the spar cap 12. At its ends, it is beveled at an angle of about 45°. Alternatively, the top layer 34 may also only be arranged in the region of the potential-equalizing element 28. It is then likewise of a rhomboidal form and in the region of the lightning conductor 26 projects beyond the potential-equalizing element 28. In
- 15 this variant, the potential-equalizing elements 28 and also the top layers 34 are arranged obliquely in relation to a longitudinal direction of the spar cap 12, at an angle of about 45°.

The cross-sectional representation of Figure 2 illustrates the construction of the spar cap assembly 10 in a region in which no potential-equalizing element 28 is

20 arranged. In the cross section there can be seen at the bottom a layer 36, which consists of a number of layers of a glass-fiber material and extends over the entire width of the spar cap assembly 10, i.e. from the side face 16 to the side face 20. It can be seen that the spar cap 12 is trapezoidal in cross section and consists of

25 a multiplicity of layers of a carbon fiber material. The two inlays 18, 22 are arranged on both sides of the spar cap 12 and are of a wedge-shaped form, so that they adjoin the oblique sides of the cross-sectionally trapezoidal spar cap 12 in a complementary manner. As a whole, the spar cap assembly 10 is substantially rectangular in cross section.

30

The cross-sectionally rectangular groove 24 in the inlay 18, in which the lightning conductor 26 is arranged, can be seen well. The groove 24 is of such dimensions that it is substantially filled by the lightning conductor 26, without the lightning

conductor 26 protruding from the groove. As a result, the inner side 14 of the spar cap assembly 10 is provided with a straight contour.

The layer 36 forms an outer side 32 of the spar cap assembly 10 and lies against
5 the spar cap 12 and against the two inlays 18, 22.

Figure 3 shows the cross section of the spar cap assembly 10 along the plane that is denoted by B-B, in which a connecting body 38 is arranged. The connecting body 38 is a substantially cuboidal block of solid copper, which establishes
10 an electrical connection between the potential-equalizing element 28 and the lightning conductor 26. For this purpose, it has been produced in an exothermic welding process, so that individual wires of the potential-equalizing element 28 and individual wires of the lightning conductor 26 are fused together in it. In the region of the connecting body 38, the inlay 18 is divided in two in cross section,
15 into a wedge-shaped portion 18a and a rectangular portion 18b, in which the groove 24 is formed. The wedge-shaped portion 18a consists of a foam-like material, while the rectangular portion 18b consists of a cured glass-fiber-reinforced plastic. The covering of the potential-equalizing element 28 by the top layer 34 can be seen well in Figure 3. In the region of the connecting bodies 38, the top
20 layer has cutouts.

Figure 4 shows a cross section through the spar cap assembly 10 in the region of the plane denoted by C-C, in which a connecting body 42 and a metal bush 44 are arranged. The connecting body 42 corresponds to the already explained connecting body 38, but additionally has an internal thread 46. The internal thread
25 46 can be used to easily establish an electrical connection with the lightning conductor 26 from the inner side of the wind turbine rotor blade half-shell.

In the example shown, the portion 18b of the inlay 18 is formed by an insert 40 of
30 a glass-fiber-reinforced plastic, in which there is formed under the connecting body 42 a through-opening 44, which leads from the groove 24 to an underside 46 of the insert 40 that is facing the outer side 32. Inserted in the through-opening 44 is a metal bush 48, which is screwed by a threaded portion into the internal

thread 50 of the connecting body 42. The metal bush 48 has for its part a threaded bore 52, which reaches up to the underside 46 of the insert 40, and consequently to the layer 36. After integration of the spar cap assembly 10 into a wind turbine rotor blade half-shell, this threaded bore 52 is accessible from the outer side thereof when drilling through the layer 36 is performed for this purpose.

In the perspective representation of Figure 5, the arrangement of the insert 40 in the inlay 18b is illustrated once again. The insert 40, which consists of a glass-fiber-reinforced plastic and is trapezoidal in longitudinal section, and the further portions of the inlay adjoining said insert and consisting of a core material, such as for example balsa wood or a plastic foam, can be seen. The groove 24, into which the lightning conductor 26 (not represented) is placed, extends over the entire length of the inlay 18b. In the insert 40, the through-opening 44 can be seen.

15

The cross-sectional representation of Figure 6 illustrates once again the arrangement of the metal bush 48 in the insert 40. The threaded portion of the metal bush 48 screwed into the connecting body 42 and the threaded bore 52 formed therein can be seen particularly well. The connecting body 42 connects the lightning conductor 26 and the potential-equalizing element 28 arranged directly above the latter to one another. The metal bush 48 is screwed into the connecting body 42 and is pushed into the through-opening 44 in the insert 40 when the lightning conductor 26 is placed into the groove of the inlay. The potential-equalizing element 28 is placed flat onto the layers of the spar cap and covered by a top layer 34 of carbon-fiber-reinforced plastic. The layer 36 of glass-fiber-reinforced plastic extends under the entire arrangement and adjoins with its underside the indicated production mold 54 for the spar cap assembly 10. The threaded bore 52 in the metal bush 48 is closed on both sides by an adhesive pad 62, so that neither during the vacuum infusion for the production of the spar cap assembly 10 nor during the subsequent integration of the spar cap assembly 10 into a wind turbine rotor blade half-shell in a further vacuum-infusion process can liquid polymer material get into the threaded bore 52.

Figure 7 shows in cross section how the spar cap assembly 10 is integrated into a wind turbine rotor blade half-shell. For this purpose, the spar cap assembly 10 is removed from the production mold 54 for the spar cap assembly and placed into the production mold 56 for the wind turbine rotor blade half-shell, after a number of layers of reinforcing fibers 58 have first been placed into the production mold 56. Further layers of reinforcing fibers 58 are arranged above the spar cap assembly 10. The entire arrangement is then embedded in a polymer matrix in a vacuum-infusion process. The metal bush 48, the threaded bore 52 arranged therein and/or the adhesive pads 62 remain visible from the outside, or at least locatable, through the layers of reinforcing fibers 58, 60, so that they can be made accessible by specifically intended drillings from the inner side or outer side of the wind turbine rotor blade half-shell.

List of the designations used:

15	10	Spar cap assembly
	12	Spar cap
	14	Inner side
	16	Side face
	18	Inlay
20	19	Glass-fiber-reinforced insert
	20	Side face
	22	Further inlay
	24	Groove
	26	Lightning conductor
25	28	Potential-equalizing element
	30	Connecting body
	32	Outer side
	34	Top layer
	36	Layer
30	38	Connecting body
	40	Insert
	42	Connecting body
	44	Through-opening

	46	Underside
	48	Metal bush
	50	Internal thread
	52	Threaded bore
5	54	Production mold for spar cap assembly
	56	Production mold for wind turbine rotor blade half-shell
	58	Reinforcing fibers
	60	Reinforcing fibers
	62	Adhesive pad

Patentkrav

1. Båndkomponent (10) til et vindenergianlæg-rotorblad, hvorved båndkomponenten (10) omfatter et bånd (12), som er forstærket med carbonfibre, **kendeteg-**
5 **net ved**
 - en lynbeskyttelsesleder (26), som er anbragt forløbende langs båndet (12),
og
 - mindst et potentialudligningselement (28), som danner en elektrisk forbindelse imellem båndet (12) og lynbeskyttelseslederen (26), hvorved
 - 10 · båndets (12) carbonfibre, lynbeskyttelseslederen (26) og det mindste ene potentialudligningselement (28) er indlejret i en fælles plastmatrix og er til-
 - dannet som på forhånd fremstillet komponent til integrationen i en halv vind-
 - energianlæg-rotorbladskal efter hærdeningen af plastmatrixen.
- 15 2. Båndkomponent (10) ifølge krav 1, **kendetegnet ved**, at det mindst ene potentialudligningselement (28) er anbragt skråt i forhold til båndets (12) længde-
- retning.
- 20 3. Båndkomponent (10) ifølge krav 1 eller 2, **kendetegnet ved**, at et afsnit af det mindst ene potentialudligningselement (28) ligger an imod et første lag af båndets (12) carbonfibre og er dækket af et andet lag af båndets (12) carbonfibre eller et lag af yderligere carbonfibre.
- 25 4. Båndkomponent (10) ifølge et af kravene 1 til 3, **kendetegnet ved**, at lynbeskyttelseslederen (26) omfatter et massivt forbindelseslegeme (42) af metal til forbindelsen med et ikke til båndkomponenten (10) hørende element i en lynbeskyttelsesindretning.
- 30 5. Båndkomponent (10) ifølge krav 4, **kendetegnet ved**, at det massive forbindelseslegeme (42) har et indvendigt gevind (50).

6. Båndkomponent (10) ifølge krav 4 eller 5, **kendetegnet ved**, at det massive forbindelseslegeme (42) forbinder lynbeskyttelseslederen (26) og det mindst ene potentialudligningselement (28) elektrisk med hinanden.
- 5 7. Båndkomponent (10) ifølge et af kravene 4 til 6, **kendetegnet ved**, at det massive forbindelseslegeme (42) er anbragt på en inderside (14) af båndkomponenten (10), som efter båndkomponentens (10) integration i en vindenergianlæg-rotorbladhalvskal vender ind imod et indre rum i vindenergianlæg-rotorbladhalvskallen.
- 10 8. Båndkomponent (10) ifølge et af kravene 1 til 7, **kendetegnet ved**, at båndkomponenten (10) har en ved siden af båndets (12) carbonfibre anbragt indlægningsindretning (18, 22) af et kernemateriale, og at lynbeskyttelseslederen (26) er anbragt i en not (24) i indlægningsindretningen (18).
- 15 9. Båndkomponent (10) ifølge krav 8, **kendetegnet ved**, at indlægningsindretningen (18) omfatter en gennemgangsåbning (44), som fører fra noten (24) til en modsat beliggende side af indlægningsindretningen (18), og hvori der er anbragt et metallegeme, som er elektrisk forbundet med lynbeskyttelseslederen (26).
- 20 10. Båndkomponent (10) ifølge krav 9, **kendetegnet ved**, at indlægningsindretningen (18) inden for området af gennemgangsåbningen (44) har en indsats (40) af et materiale, som er hårdere end kernematerialet, og hvori gennemgangsåbningen (44) er anbragt.
- 25 11. Båndkomponent (10) ifølge krav 9 eller 10, **kendetegnet ved**, at metallegemet er en metalbøsning (48), som er skruet ind i et indvendigt gevind (50) i forbindelseslegemet (42), og som omfatter en gennemgående gevindboring, som strækker sig fra båndkomponentens (10) inderside til båndkomponentens (10)
- 30 modsat beliggende yderside (32).
12. Båndkomponent (10) ifølge et af kravene 1 til 11, **kendetegnet ved**, at båndkomponenten (10) har et lag (36) af et fibermateriale, og som er anbragt på en

modsat indersiden (14) værende yderside (32) på båndkomponenten (10) og støder op til båndets (12) carbonfiber.

13. Fremgangsmåde til fremstilling af en vindenergianlæg-rotorbladhalvskal
5 med følgende trin:

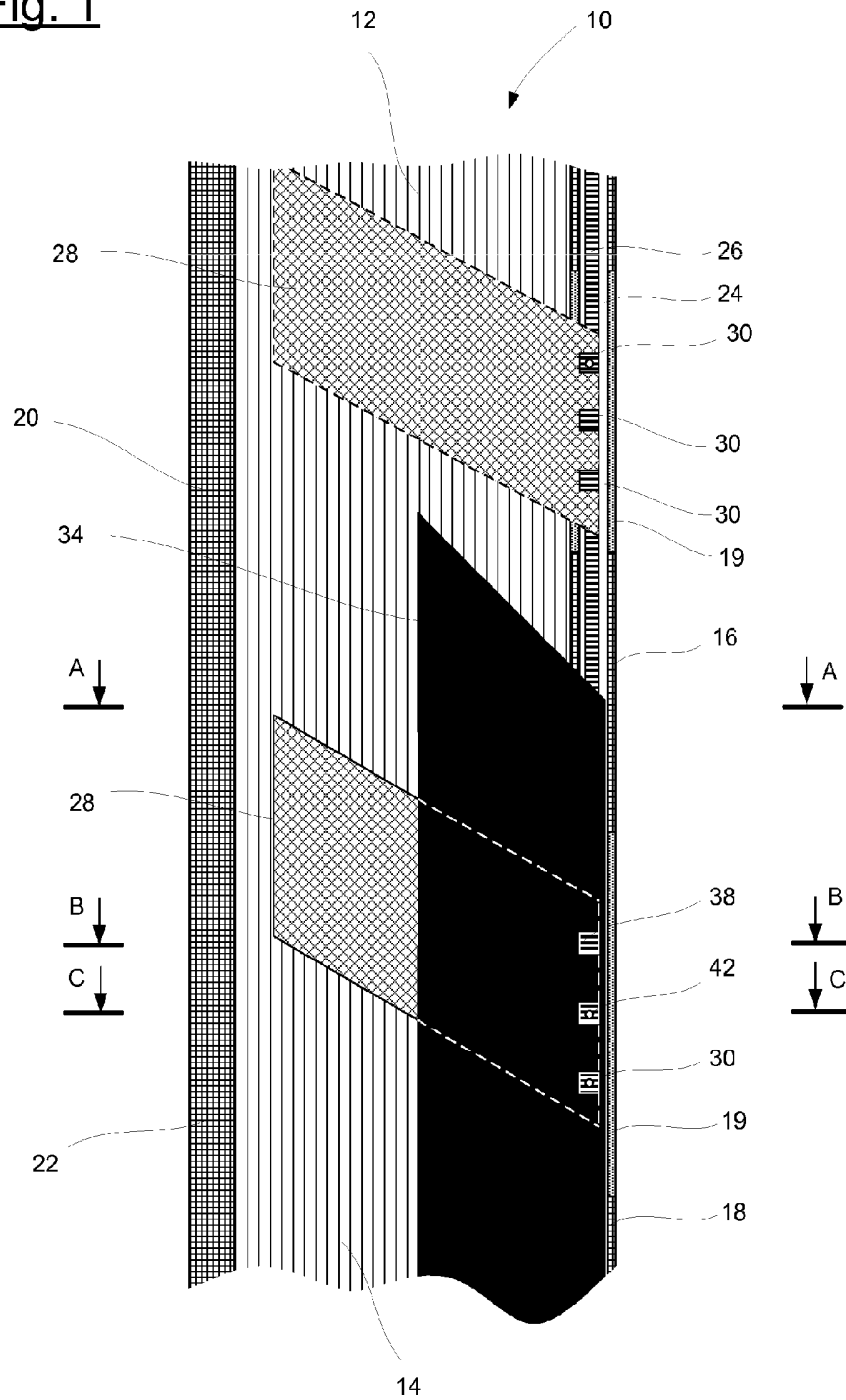
- tilvejebringelse af en fremstillingsform (56) til vindenergianlæg-rotorbladhalvskallen (56),
- indlægning af forstærkningsfibre (58, 60) i fremstillingsformen (56),
- 10 · anbringelse af en båndkomponent (10) med trækkene ifølge krav 1 til 12 i fremstillingsformen (56),
- indlejring af forstærkningsfibre (58, 60) og båndkomponenten (10) i en plastmatrix.

15 14. Fremgangsmåde ifølge krav 13, **kendetegnet ved**, at der etableres en elektrisk forbindelse imellem lynbeskyttelseslederen (26) og et ikke til båndkomponenten (10) hørende element i en lynbeskyttelsesindretning efter indlejringen af forstærkningsfibre (58, 60) og båndkomponenten (10) i plastmatrixen.

20 15. Fremgangsmåde ifølge krav 14, **kendetegnet ved**, at en åbning i båndkomponenten (10), som anvendes til fremstillingen af den elektriske forbindelse, aflukkes ved indlejringen af forstærkningsfibre (58, 60) og båndkomponenten (10) i plastmatrixen med en afdækning.

1

Fig. 1



2

Fig. 2

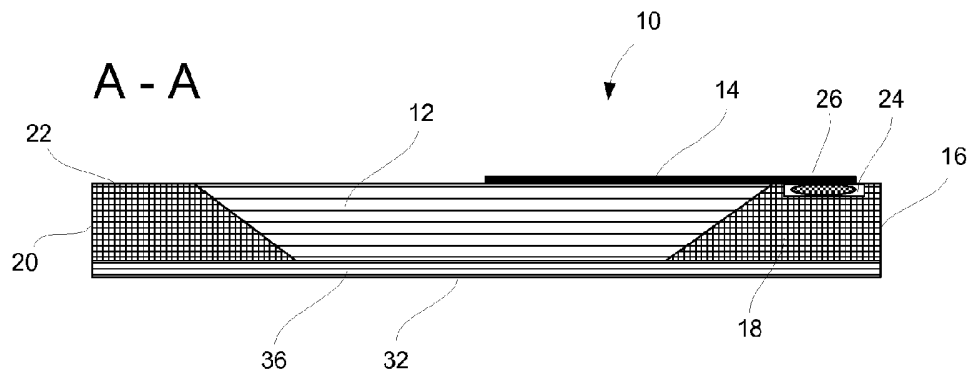


Fig. 3

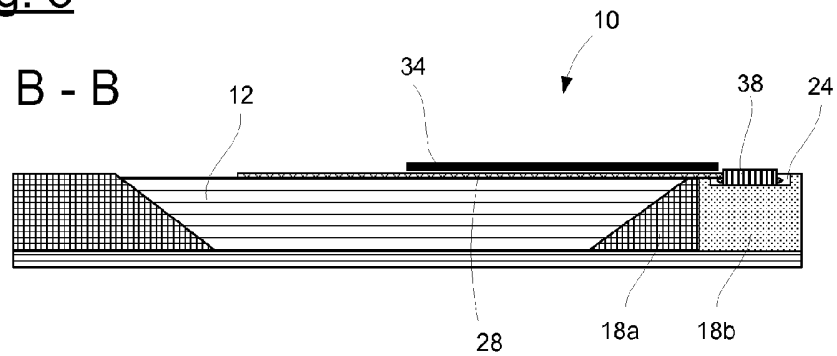
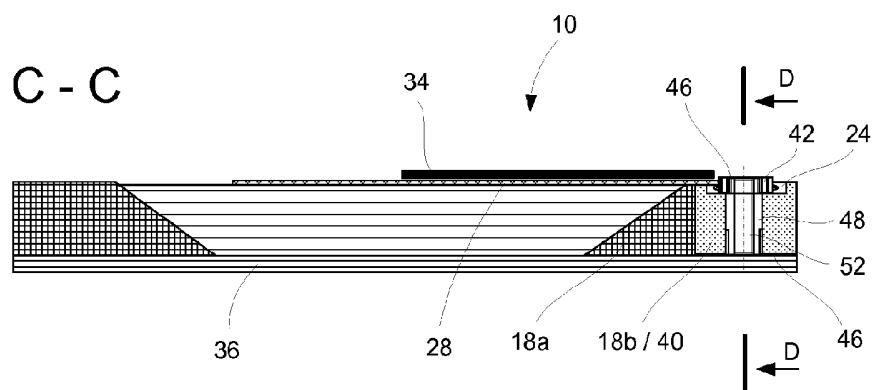
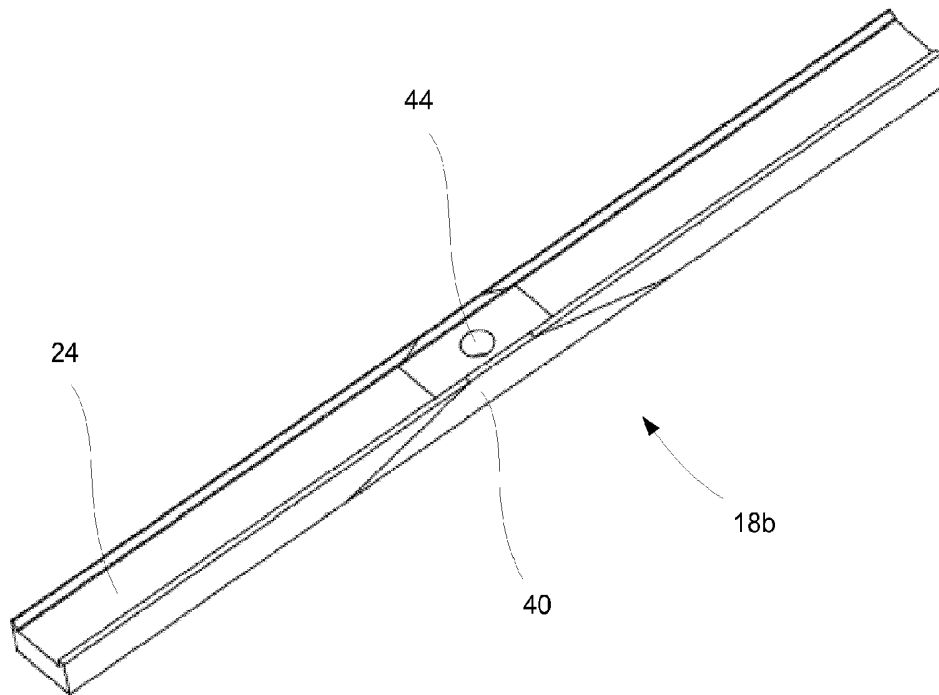


Fig. 4



3

Fig. 5



4

Fig. 6

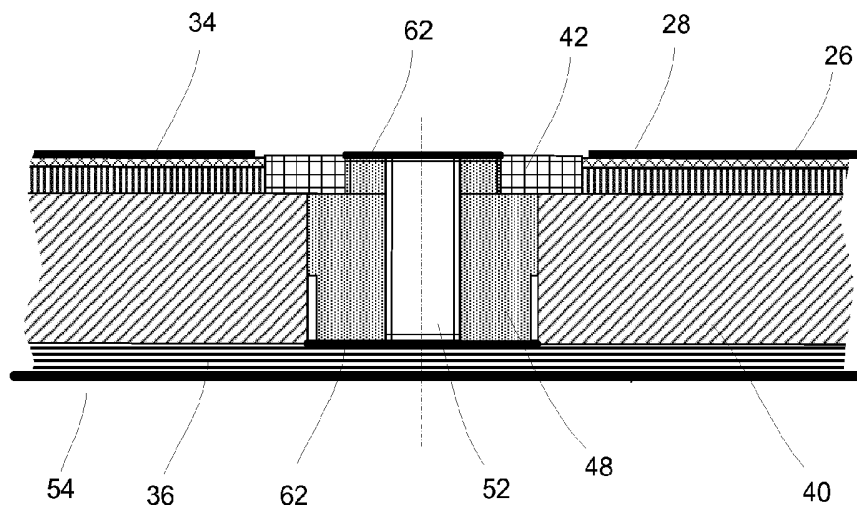


Fig. 7

