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- (54) Benævnelse: **ROTORBLAD OMFATTENDE EN ELEKTRISK FORBINDELSE TIL ET LYNAFLEDERSYSTEM**
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DESCRIPTION

Description

[0001] The invention relates to a rotor blade according to the preamble to claim 1 and to a method for the production of a rotor blade with a lightning conductor system with a lightning conductor cable.

[0002] Rotor blades with caps containing carbon fibres are known in the prior art. Lightning strikes during the operation of a wind turbine usually occur in the rotor blades, preferably in the outermost tips of the rotor blades. Therefore according to the prior art lightning receptors are arranged on the rotor blade tip and in the tip section of the rotor blade tip. Lightning receptors are metal bolts which are aligned with the outer skin of the rotor blade and are connected internally by means of an insulated lightning conductor cable to the rotor blade hub and from there are earthed by means of a further lightning conductor cable.

[0003] When caps containing carbon fibres are used it has been shown that lightning strikes can also take place in the caps containing carbon fibres, since the carbon fibres are likewise electrically conductive. It is therefore known in the prior art to use the electrical line of the caps and to allow a current flow through the caps and to earth the caps themselves and thus to draw off the current from the caps. In this case it is a disadvantage that the caps could be damaged by the current flow.

[0004] CN 110219784 A discloses a rotor blade with a lightning protection system with a connecting plate in which a metal mesh is fixed and through which, a bolt with a bolt head is arranged while the bolt head operates as a lightning receptor and is arranged outside the rotor blade shell.

[0005] EP 2 930 355 A1 discloses a rotor blade with a lightning protection system with a connecting plate which connects a mesh with a lightning conducting cable while the connecting plate is melted with the mesh.

[0006] A further possibility of the lightning protection is to insulate the caps at least in the region of the rotor blade tip. This usually takes place by introducing an electrically conductive layer which completely shields the cap between the cap and the rotor blade outer skin. Here the problem arises of connecting the electrically conductive shielding layer and the lightning conductor system.

[0007] It is therefore an object of the present invention to provide an above-mentioned rotor blade which connects a protective shield of a cap containing carbon fibres to a lightning conductor system.

[0008] It is also an object of the present invention to provide a method for the production of a rotor blade by which the shielding of a cap containing carbon fibres can be produced advantageously by a lightning conductor system.

[0009] With regard to the rotor blade, the object is achieved by a rotor blade having the features of claim 1.

[0010] The rotor blade has at least one cap containing carbon fibres. The rotor blade can be assembled from two half-shells and can also be formed from one shell. But also other compositions are possible. The rotor blade has one or two or a higher number of caps, wherein pairs of caps lie opposite one another in the rotor blade and are preferably connected to one another in each case by a web.

[0011] The at least one cap containing carbon fibres is shielded on the rotor blade outer side by at least one electrically conductive mesh layer against lightning strikes. The at least one mesh layer can cover the entire cap on the rotor blade outer side or can also cover the cap only in sections. In particular the at least one mesh layer covers a tip section of the cap. The rotor blade has a lightning conductor system with a lightning conductor cable. The lightning conductor system can comprise a metal rotor blade tip as well as lightning receptors, which are preferably recessed into the rotor blade outer skin, in particular in the tip end section of the rotor blade, and have a metal surface which is aligned with the rotor blade outer skin. A preferably highly insulated lightning conductor cable is arranged in an interior of the rotor blade and electrically conductively connects the metal rotor blade tip, if present, and the lightning receptor to the lightning conductor cable. The lightning conductor cable is guided through the entire interior of the rotor blade as far as the rotor blade hub and connected there to a grounding cable which conducts the current of a lightning strike away into the earth.

[0012] According to the invention an electrically conductive connecting device is provided between the at least one mesh layer and the lightning conductor cable and comprises an electrically conductive disc into which the at least one mesh layer is conductively introduced and which comprises an electrically conductive connecting means which is guided through the disc and is electrically conductively connected to the lightning conductor cable.

[0013] Advantageously, in a simple manner the connecting device according to the invention facilitates an electrically conductive connection between the at least one mesh layer, which is provided in order to protect the caps containing carbon fibres, and a lightning conductor system preferably already arranged in a rotor blade in a conventional manner.

[0014] In a cross-section the at least one mesh layer advantageously projects laterally beyond the cap, where the at least one mesh layer is electrically conductively connected to the connecting device. For effective protection of the cap containing carbon fibres in one, preferably in each cross-section perpendicular to the longitudinal direction of the rotor blade the at least one electrically conductive mesh layer is designed to be broader than the cap itself,

so that the mesh layer projects beyond the cap laterally both on the rotor blade leading edge side and also on the rotor blade trailing edge side. The connecting device is advantageously provided in this region of the at least one mesh layer projecting over the cap, and the at least one mesh layer is connected by means of the connecting device to the lightning conductor cable. In this way the mechanical stability of the cap remains unaffected, and nevertheless an electrically conductive connection is produced between the at least one mesh layer and the lightning conductor cable.

[0015] A connector block, into which a section of the connecting means is introduced, preferably screwed, and which is electrically conductively connected to the lightning conductor cable, is advantageously arranged on the rotor blade inner side of the electrically conductive disc. Connector blocks are known in the prior art. Here the known connector block, which is used per se for screwing in lightning receptors, is used for fastening the connecting means of the connecting device according to the invention.

[0016] Two opposing caps containing carbon fibres are preferably provided, which have opposing connecting devices each having a connecting means which is introduced in the same connector block with a section in each case. This is a form of the lightning conductor system which can be produced cost-effectively for two caps.

[0017] The connecting means is designed as a bolt having a head. The bolt can have a thread on the opposite end of the bolt. The thread then forms the section which is introduced, preferably screwed, into the connector block. This embodiment is also advantageously based on known connector blocks and provides further developments thereof.

[0018] According to the invention, the connecting means is designed as a bolt having a head which abuts the electrically conductive disc and forms an electrically conductive contact therewith.

[0019] Particularly preferably the at least one mesh layer is designed with multiple layers in the region of the connecting device. Particularly high currents occur, in particular on transition lines between the at least one mesh layer and the connecting device, since after a lightning strike the current initially flows through the entire mesh layer and is then concentrated in the direction of the connecting device, in particular on the connecting means, onto a small region, so that there the at least one mesh layer has a higher current flowing through it and is protected against excessive heating by reinforcement of the at least one mesh layer by forming it with multiple layers, preferably two, three or more layers. The at least one mesh layer can be formed in one piece and/or in one layer over the cap or at least one section of the cap. The at least one mesh layer on the connecting device is preferably multi-layered, and it is also conceivable that the at least one mesh layer in the connecting device is formed separately from the at least one mesh layer along the cap, and in the connecting device the at least one mesh layer rests, preferably directly, completely around the connecting device on the at least one mesh layer of the cap rests and thus an electrically conductive connection is formed.

[0020] In this respect this design is advantageous, because the connecting device with locally delimited mesh layers makes it possible to form the connecting device as a separate component which can be integrated between the cap and the rotor blade shell during the assembly of the rotor blade.

[0021] Advantageously, teeth which press into the disc are arranged on the rotor blade inner side of the bolt. As a result a particularly good electrical line is produced between the connecting means and the disc.

[0022] The disc is advantageously soldered or welded into the at least one mesh layer. For this purpose the at least one mesh layer can be surrounded by the electrically conductive disc and can be penetrated preferably equatorially by the mesh layer. As a result a particularly good conductive contact is produced.

[0023] A hole through which the connecting means can be introduced is preferably guided centrally through the disc and the at least one mesh layer. In this way a simple assembly is advantageously possible.

[0024] The disc is advantageously introduced between two halves of an electrically insulating shim, of which the boundary regions, if the two halves are joined to one another, in each cross-section form an S-shaped gap in which the at least one mesh layer is arranged and which in each cross-section likewise takes the form of an S-shaped twist.

[0025] Due to the S-shaped twisting of the at least one mesh layer the contact point between mesh layer and disc is less sensitive to tensile loads.

[0026] A channel is advantageously introduced into the rotor blade shell on the rotor blade outer side of the connecting means and is closed with laminate.

[0027] On the rotor blade inner side the connecting device is preferably laminated onto a rotor blade inner side.

[0028] With regard to the method, the object is achieved by a method with the features of claim 13.

[0029] The method according to the invention is suitable for the production of one of the above-mentioned rotor blades, and conversely each of the above-mentioned rotor blades can be produced by one of the following methods.

[0030] The method is suitable for the production of a rotor blade with a lightning conductor system with a lightning conductor cable, wherein at least one electrically conductive mesh layer, which in a cross-section extends laterally alongside the cap, is arranged between at least one cap containing carbon fibres and a rotor blade shell, and an electrically conductive disc is introduced conductively into the at least one mesh layer and an electrically conductive

connecting means is guided through the disc and is electrically conductively connected to the lightning conductor cable. Caps containing carbon fibres are usually protected against lightning strikes by electrically conductive mesh layers which are arranged between the cap and the rotor blade shell. In this case the at least one mesh layer can also be provided just below the rotor blade outer skin, for example if the caps are already integrated into the rotor blade shell as part of the rotor blade outer shell.

[0031] The at least one electrically conductive mesh layer extends in a cross-section laterally alongside the cap, and according to the invention an electrically conductive disc is introduced conductively in a connection region of the at least one mesh layer arranged laterally alongside the cap, and an electrically conductive connecting means is guided through the disc and is electrically conductively connected to the lightning conductor cable.

[0032] Thus the method of production according to the invention makes it possible, also in the case of conventional rotor blades, for the mesh layers inserted into the rotor blade shell to be connected electrically conductively in a reliable manner to the preferably already existing lightning conductor cable.

[0033] For this purpose the conductive disc is advantageously cast around the at least one electrically conductive mesh layer, so that at the same time the at least one electrically conductive mesh layer is integrated into the disc and runs through the disc preferably equatorially.

[0034] The disc is preferably introduced between two halves of an electrically insulating shim, of which the boundary regions, after the two halves have been joined to one another, in each section form an S-shaped gap in which is arranged a section of the at least one mesh layer which in each cross-section takes on the S-shaped form of the gap. Due to the S-shaped twisting of the at least one mesh layer this layer is less sensitive to lateral loads, and breakages of the at least one mesh layer directly at the transition between mesh layer and disc occur more rarely.

[0035] Particularly preferably a channel is drilled from the outside through the rotor blade shell to a hole in the disc, and the connecting means is guided from outside through the channel and the opening and is electrically conductively connected to the lightning conductor cable. As already described above, the connecting means is designed as a bolt. The bolt can be screwed into a connector block which in turn is connected to a lightning conductor cable.

[0036] Advantageously, the channel is closed again after the assembly in order not to create any aerodynamic resistance.

[0037] On the rotor blade inner side the connecting device can be overlaminated in order to protect it.

[0038] The invention is described with reference to three exemplary embodiments in eight

drawings.

[0039] In the drawings:

Fig. 1 shows a perspective plan view of a rotor blade tip according to the invention.

Fig. 2 shows a section along the line II-II in Figure 1,

Fig. 3 shows a connecting device according to the invention between the mesh layer and the connector block,

Fig. 4 shows a disc according to the invention,

Figs. 5a, 5b, 5c show three different embodiments of a surface of a bolt inside the rotor blade,

Fig. 6 shows an exploded view of the connecting device according to the invention with three mesh layers.

[0040] A tip section 1a of a rotor blade 1 according to the invention is illustrated in Figure 1. The rotor blade 1 is composed of two rotor blade half-shells. However, other designs, for example with a shell, are also conceivable. Each of the rotor blade half-shells has two caps 3, 4 on the inner wall of a rotor blade half-shell 2 inside a rotor blade. A main cap 3 and a secondary cap 4 are illustrated in Figure 1. The main cap 3 extends along a leading edge of the rotor blade 1, and the secondary cap 4 extends nearer to a trailing edge of the rotor blade 1.

[0041] Both caps 3, 4 are constructed from at least one, preferably a plurality of woven and laid fabric layers, possibly also pultruded layers. At least one of the layers contains carbon fibres. The layers of the belt 3, 4 are electrically conductive. The consequence of this is that a lightning strike is more likely to take place in the caps containing carbon fibres, in particular in the tip section, than for example in glass fibre layers. It has been shown that lightning strikes take place almost exclusively in the tip section 1a of the rotor blade 1, regardless of whether the rotor blade 1 has exclusively fabric layers containing glass fibres or also has fabric layers containing carbon fibres. If fabric layers containing carbon fibres are present, the lightning strike preferably takes place into the carbon fibres in the tip section 1a. In order to protect the cap 3, 4, therefore, the cap 3, 4 is shielded on the outside of the rotor blade by an electrically conductive mesh layer 6. The mesh layer 6 is a type of fine wire mesh which, in a cross-section perpendicular to a longitudinal direction L of the rotor blade 1, completely covers the cap 3, 4 on the outside of the rotor blade in the tip section 1a and projects laterally on both long sides over cap 3, 4. In Figure 1 this applies both to the tip section 1a of the main cap 3 and also to the tip section 1a of the secondary cap 4. In a tip end section 7, which constitutes an end of the tip section 1a, there is no main cap 3 or secondary cap 4 containing carbon fibres.

[0042] A tip of the rotor blade 1 is formed as a metal tip 8 in Figure 1. A lightning conductor

cable 9 leads off from this. The lightning conductor cable 9 is guided into a rotor blade hub. The lightning conductor cable 9 adhered on the rotor blade half-shell inner wall 2 advantageously extends along the main cap 3. The lightning conductor cable 9 is highly insulated. In Figure 1 three lightning receptors 11a, 11b, 11c are provided alongside the metal tip 8 in the tip end section 7. In this case these lightning receptors are metal bolts which have a metal surface directly aligned with a rotor blade outer skin and are guided to the lightning conductor cable 9 and are electrically conductively connected thereto. A current of a lightning strike into the tip end section 7 into one of the lightning receptors 11a, 11b, 11c is conducted by the lightning conductor cable 9 into the rotor blade hub and from there further into the ground.

[0043] In Figure 1 a connecting device 14 according to the invention is arranged between the mesh layer 6 and the lightning conductor cable 9 at the end of the electrically conductive mesh layer 6 near the tip. Further appropriately constructed connecting devices 14 can also be provided along the mesh layer 6. In particular, a further connecting device 14 can be provided at the end of the mesh layer 6 near the rotor blade hub. The construction of the connecting device 14 is shown in detail in Figure 3.

[0044] Figure 2 shows a section along the line II-II in Figure 1. The rotor blade 1 has two rotor blade half-shells. Each of the rotor blade half-shells has a main cap 3 and a secondary cap 4 which lie opposite one another and are connected to one another in each case by means of a web. Figure 2 shows the tip end section 7 in which no more cap 3, 4 is provided in Figure 1. However, the mesh layer 6 extends into the cross-section and there, arranged on the trailing edge, there is a connector block 16 which is electrically conductively connected to the electrically conductive mesh layer 6 by means of the connecting device 14 according to the invention according to Figure 3. The lightning conductor cable 9 extending from the metal tip 8 along the tip end section 7 is electrically conductively introduced into the connector block 16, and the electrically conductive lightning conductor cable 9 extends further in the direction of the rotor blade hub, so that the electrically conductive mesh layer 6 is also electrically conductively connected by means of the connecting device 14 to the lightning conductor cable 9.

[0045] Figure 3 shows a construction of the connecting device 14 according to the invention. An exploded view of Figure 3 is illustrated in Figure 6. The connecting device 14 comprises three mesh layer discs 6a, 6b, 6c, wherein each mesh layer disc 6a, 6b, 6c has a circular shape in plan view. The mesh layer disc 6a on the rotor blade outer side has a diameter of 400 mm, the central mesh layer disc 6b has a diameter of 350 mm and the mesh layer disc 6c on the rotor blade inner side has a diameter of 300 mm. The three mesh layer discs 6a, 6b, 6c are placed one upon the other and thus are designed to be electrically conductively connected to one another. Each mesh layer disc 6a, 6b, 6c is made from a conductive material such as aluminium or copper. Thus these are in each case a copper mesh or an aluminium mesh, wherein the individual fibres are not insulated.

[0046] The connecting device 14 illustrated in Figure 6 is provided as a separate component. The three mesh layer discs 6a, 6b, 6c of the connecting device 14 form a connection region 17 with the mesh layer 6 of the rotor blade, wherein for example a hole is cut into the mesh layer

6 of the rotor blade 1 and the connecting device 14 according to Figure 6 is placed onto the hole fitted and the three mesh layers 6a, 6b, 6c with the mesh layer 6 of the rotor blade lie on one another, forming an electrical contact in the connection region 17.

[0047] The three mesh layers 6a, 6b, 6c are electrically conductively connected to one another centrally by means of an electrically conductive disc 18 which is illustrated in Figure 4. Preferably the mesh layers 6a, 6b, 6c are laid one above the other and the central region is introduced into a production mould, and then an electrically conductive material is poured into the mould, so that the electrically conductive disc 18 conductively connects the three mesh layer discs 6a, 6b, 6c to one another centrally. The arrangement is shown in Figure 3, in the which the three mesh layer discs 6a, 6b, 6c are guided through the conductive disc 18 for instance along the equator of the conductive disc 18. A hole is drilled through the conductive disc 18 and the three mesh layer discs 6a, 6b, 6c cast around thereby, and according to Figure 3 an electrically conductive bolt 21 is inserted through the hole. The electrically conductive bolt 21 has a head 22, the surface 23 of which on the rotor blade inner side of the electrically conductive contact with the electrically conductive disc 18 according to Figure 5a, 5b or 5c can have teeth 24.

[0048] In Figure 5a these teeth 24 are oriented parallel to one another and are arranged along the outer circumference of the surface 23 of the bolt 21 on the rotor blade inner side.

[0049] In Figure 5b the tooth 24 is formed by means of a radially extending protrusion which is continuous, whereas in Figure 5c the radially extending protrusion has individual teeth 24 which are spaced apart from one another. The bolt 21 has on its end on the rotor blade inner side a thread by means of which the bolt 21 can be screwed into the connector block 16 according to Figure 2.

[0050] The electrically conductive disc 18 is surrounded on the rotor blade inner side and the rotor blade outer side by two halves 26a, 26b of a shim 26, the cross-section of which is illustrated in Figure 6, but also in Figure 3. The shim 26 has a greater diameter than the electrically conductive disc 18. Both are preferably circular. In particular the two halves 26a, 26b of the shim 26, when they are laid onto both sides of the conductive disc 18, form an S-shaped gap 28 in each cross-section through which the three mesh layer discs 6a, 6b, 6c are guided in an S-shape. The S-shaped twisting of the mesh layers 6a, 6b, 6c in the region of the connecting device 14 gives the mesh layer discs 6a, 6b, 6c a certain elasticity relative to the pulling forces which, in particular during operation of the wind turbine, are formed by bending of the rotor blade 1 a in flap or impact direction and act laterally on the mesh layer discs 6a, 6b, 6c.

[0051] The connecting device 14 illustrated in Figure 3 is initially positioned on the inner wall of the rotor blade 1 at a predetermined location where it lies behind the mesh layer 6 of the rotor blade. The three individual mesh layer discs 6a, 6b, 6c of the connecting device 14 conductively overlay the mesh layer 6 of the rotor blade 1 in the connection region 17.

[0052] Then a channel 29 is drilled through a rotor blade shell 31 on the rotor blade outer side. The channel 29 precisely meets a hole 19 in the conductive disc 18. From the outside the bolt 21 with an external thread is inserted through the electrically conductive disc 18 and is firmly screwed into the connector block 16. In this case an electrically conductive connection forms between the head 22 of the bolt 21 and the conductive disc 18. The bolt 21 is preferably made from stainless steel and has a head with a diameter of 35 mm or more, although other dimensions are also conceivable. The shim 26 is overlaminated internally, so that the shim 26 with the conductive disc 18 accommodated therein is firmly laminated onto the inner side of the rotor blade shell 31. Then the channel 29 introduced from the outside can be closed again with laminate.

[0053] The conductive disc 18 is preferably soldered around the three mesh layers 6a, 6b, 6c in an exothermic welding method or soldering method using a material containing aluminium, in particular an aluminium alloy. The conductive disc 18 preferably has a diameter of 50 mm and a thickness of 5 mm; however, other dimensions are also conceivable. The disc has rounded corners in order to reduce electromagnetic fields during the lightning strike and in order to simplify the soldering method.

List of references

[0054]

- 1a tip section
- 1 rotor blade
- 2 rotor blade shell inner wall
- 3 main cap
- 4 secondary cap
- 6 mesh layer
- 6a mesh layer disc
- 6b mesh layer disc
- 6c mesh layer disc
- 7 tip end section

- 8
 - metal tip
- 9
 - lightning conductor cable
- 11a
 - lightning receptor
- 11b
 - lightning receptor
- 11c
 - lightning receptor
- 14
 - connecting device
- 16
 - connector block
- 17
 - connection region
- 18
 - electrically conductive element
- 19
 - hole
- 21
 - electrically conductive bolt
- 22
 - head
- 23
 - surface
- 24
 - teeth
- 26
 - shim
- 26a
 - shim half
- 26b
 - shim half
- 28
 - gap
- 29
 - channel
- 31

rotor blade shell

L

longitudinal direction

REFERENCES CITED IN THE DESCRIPTION

Cited references

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

Patent documents cited in the description

- [CN110219784A \[0004\]](#)
- [EP2930355A1 \[0005\]](#)

PATENTKRAV

1. Rotorblad med

mindst et dække (3, 4) omfattende kulstoffibre og

med mindst et elektrisk ledende netlag (6), som er anbragt på kulstoffibrenes
5 rotorbladsydside, og

med et lynafledersystem med et lynaflederkabel (9),

og en elektrisk ledende forbindelsesindretning (14), der er tilvejebragt mellem
netlaget (6) og lynaflederkablet (9), og som omfatter en elektrisk ledende skive (18), i
hvilken et forbindelsesområde (17) af netlaget (6) er ledende indsat, og som omfatter
10 en elektrisk ledende forbindelsesenhed (21), der er ført gennem skiven (18) og er
elektrisk ledende forbundet til lynaflederkablet (9), **kendetegnet ved, at**
forbindelsesenheden er udformet som en bolt (21) med et hoved (22), der er i anlæg
med skiven (18) og danner en elektrisk ledende kontakt dermed.

2. Rotorblad ifølge krav 1, **kendetegnet ved, at** netlaget (6), i et tværsnit,
15 stikker frem lateralt over dækket (3, 4), og netlagets (6) forbindelsesområde (17) er
anbragt lateralt langs dækket (3, 4).

3. Rotorblad ifølge krav 1 eller 2, **kendetegnet ved, at** en konnektorblok (16), i
hvilken et afsnit af forbindelsesenheden (21) er indsat, og som er elektrisk ledende
forbundet til lynaflederkablet (9), med fordel er anbragt på skivens (18)
20 rotorbladsindside.

4. Rotorblad ifølge krav 1, 2 eller 3, **kendetegnet ved, at** to modstående hætter
(3) indeholdende kulstoffibre er tilvejebragt, hvilke dækker har modstående
forbindelsesindretninger (14) med hver sin forbindelsesenhed (21), der er indsat i
samme konnektorblok (16).

25 5. Rotorblad ifølge et af de foregående krav, **kendetegnet ved, at** netlaget (6)
dækker et spidsafsnit af dækket (3, 4) på rotorbladsydside fuldt ud.

6. Rotorblad ifølge et af de foregående krav, **kendetegnet ved, at** netlaget (6)
er udformet med flere lag i forbindelsesområdet (17).

7. Rotorblad ifølge krav 6, **kendetegnet ved, at** netlagene (6), der løber ud af skiven (18), hviler på netlag (6) langs dækket (3, 4).
8. Rotorblad ifølge krav 7, **kendetegnet ved, at** der på en rotorbladsunderside af hovedet (22) er anbragt tænder (24), der trykker ind i skiven (18).
- 5 9. Rotorblad ifølge et af de foregående krav, **kendetegnet ved, at** skiven (18) er loddet eller svejset ind i forbindelsesområdet (17).
10. Rotorblad ifølge et af de foregående krav, **kendetegnet ved, at** skiven (18) er indsat mellem to halvdele (26a, 26b) af et elektrisk isolerende mellemlæg (26), hvis randområder, hvis de to halvdele (26a, 26b) er forbundet med hinanden, i hvert
- 10 tværsnit danner et S-formet mellemrum (28), i hvilket det mindst ene netlag (6) er anbragt, og som i hvert tværsnit tilsvarende antager en S-form.
11. Rotorblad ifølge et af de foregående krav, **kendetegnet ved, at** der på forbindelsesenhedens (21) rotorbladsunderside er indsat en kanal (29), som er lukket med laminat, i rotorbladsskallen (31).
- 15 12. Rotorblad ifølge et af de foregående krav, **kendetegnet ved, at** forbindelsesenheden (14), på rotorbladsundersiden, er lamineret på en rotorbladsskalunderside.
13. Fremgangsmåde til fremstilling af et rotorblad med et lynafledersystem med et lynaflederkabel (9), hvor mindst et elektrisk ledende netlag (6), som i et tværsnit
- 20 forløber lateralt langs mindst et dække (3, 4), er anbragt mellem det mindst ene dække (3, 4) indeholdende kulstoffibre og en rotorbladsskal (31), og en elektrisk ledende skive (18) indføres ledende i det mindst ene netlag (6) i et forbindelsesområde (17) anbragt lateralt langs dækket (3, 4), og en elektrisk ledende forbindelsesenhed (21) føres gennem skiven (18) og forbindes elektrisk ledende til
- 25 lynaflederkablet (9), **kendetegnet ved, at** forbindelsesenheden er udformet som en bolt (21) med et hoved (22), der er i anlæg med skiven (18) og danner en elektrisk ledende kontakt dermed.
14. Fremgangsmåde ifølge krav 13, **kendetegnet ved, at** den ledende skive (18) støbes rundt om det mindst ene elektrisk ledende netlags (6) forbindelsesområde
- 30 (17).

15. Fremgangsmåde ifølge krav 13 eller 14, **kendetegnet ved, at** skiven (18) indsættes mellem to halvdele (26a, 26b) af et elektrisk isolerende mellemlæg (26), hvis randområder, efter at de to halvdele (26a, 26b) er blevet forbundet til hinanden, i hvert tværsnit danner et S-formet mellemrum (28), i hvilket det mindst ene netlags (6) 5 forbindelsesområde er anbragt, og som i hvert tværsnit tilsvarende antager en S-form.

16. Fremgangsmåde ifølge krav 13 til 15, **kendetegnet ved, at** der bores en kanal (29) fra ydersiden gennem rotorbladsskallen (31) til en åbning i skiven (18), og forbindelsesenheden (21) føres udefra gennem kanalen (29) og åbningen og forbindes elektrisk ledende til lynaflederkablet (9).

10 17. Fremgangsmåde ifølge krav 16, **kendetegnet ved, at** forbindelsesenheden (21) indsættes elektrisk ledende i en receptorblok.

18. Fremgangsmåde ifølge krav 16, **kendetegnet ved, at** kanalen (29) lukkes igen, efter at forbindelsesenheden (21) er blevet ført igennem.

15 19. Fremgangsmåde ifølge krav 13 til 18, **kendetegnet ved, at** skiven (18) og forbindelsesområdet (17) overlamineres på rotorbladsundersiden.

DRAWINGS

Drawing

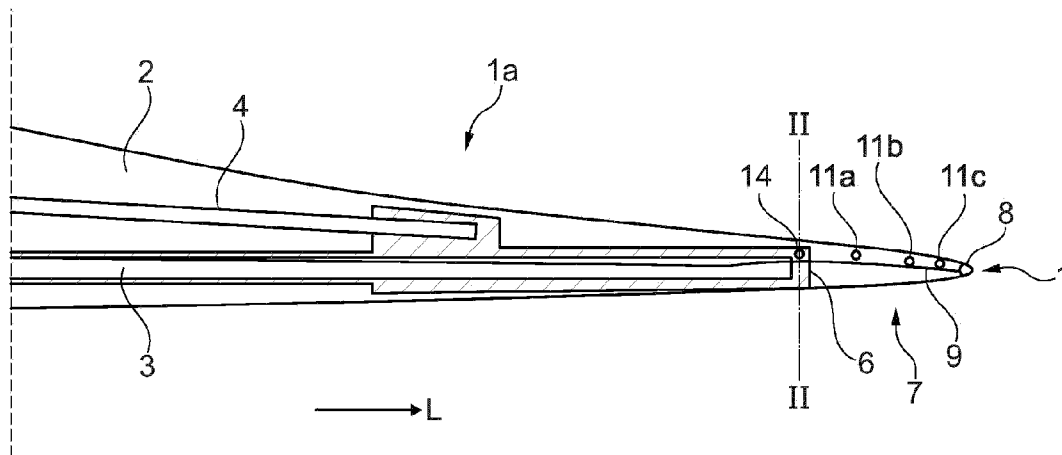


Fig. 1

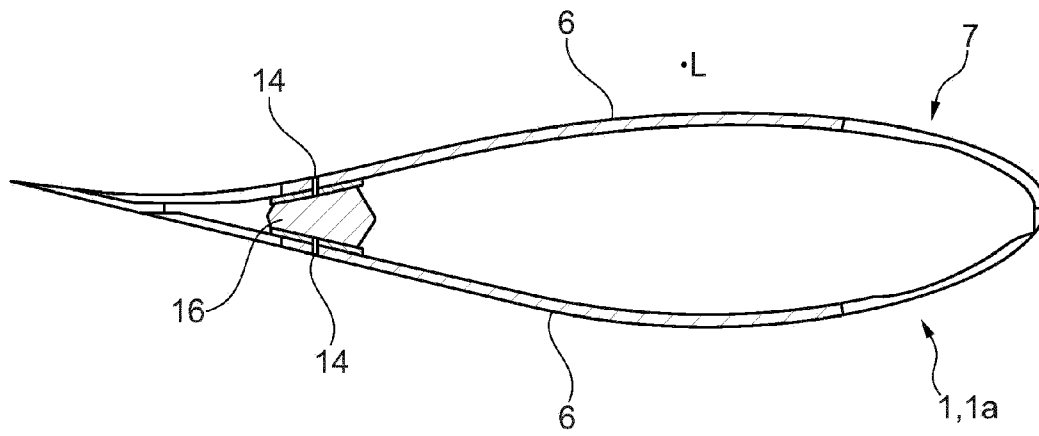


Fig. 2

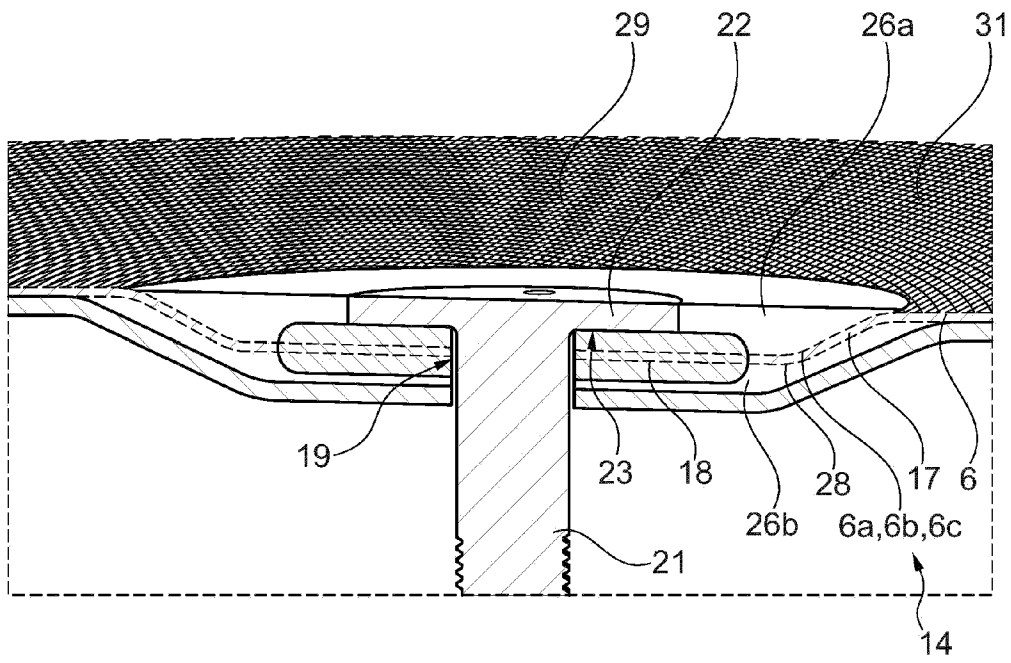


Fig. 3

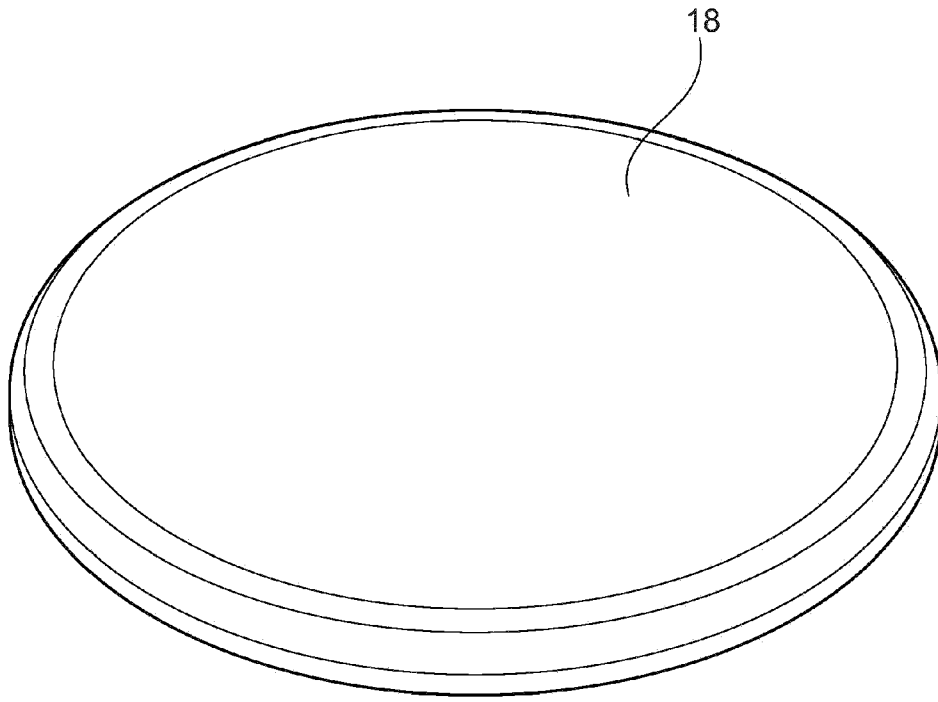


Fig. 4

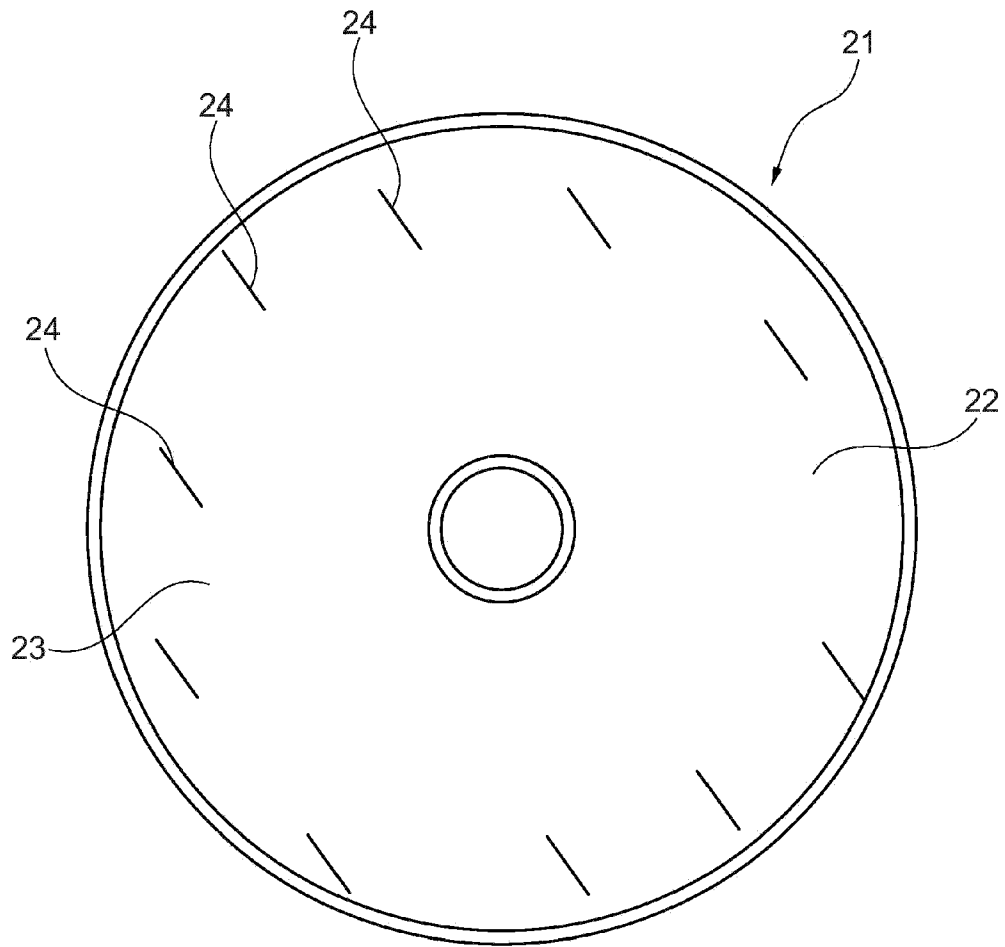


Fig. 5a

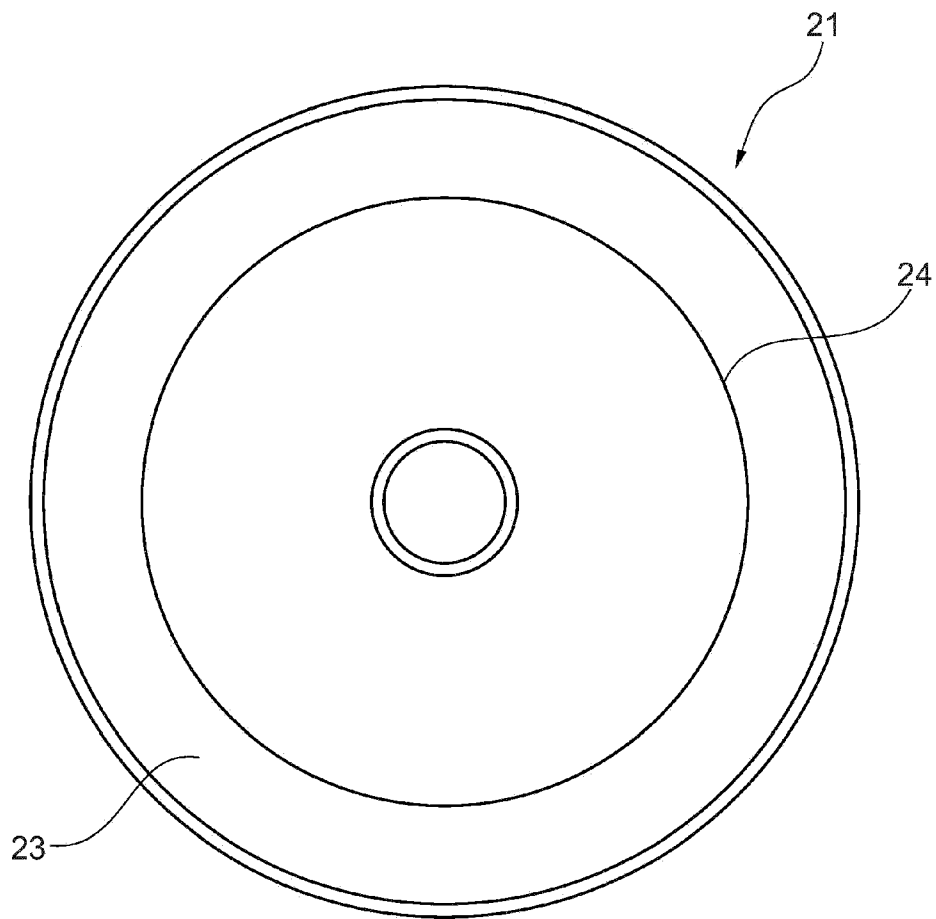


Fig. 5b

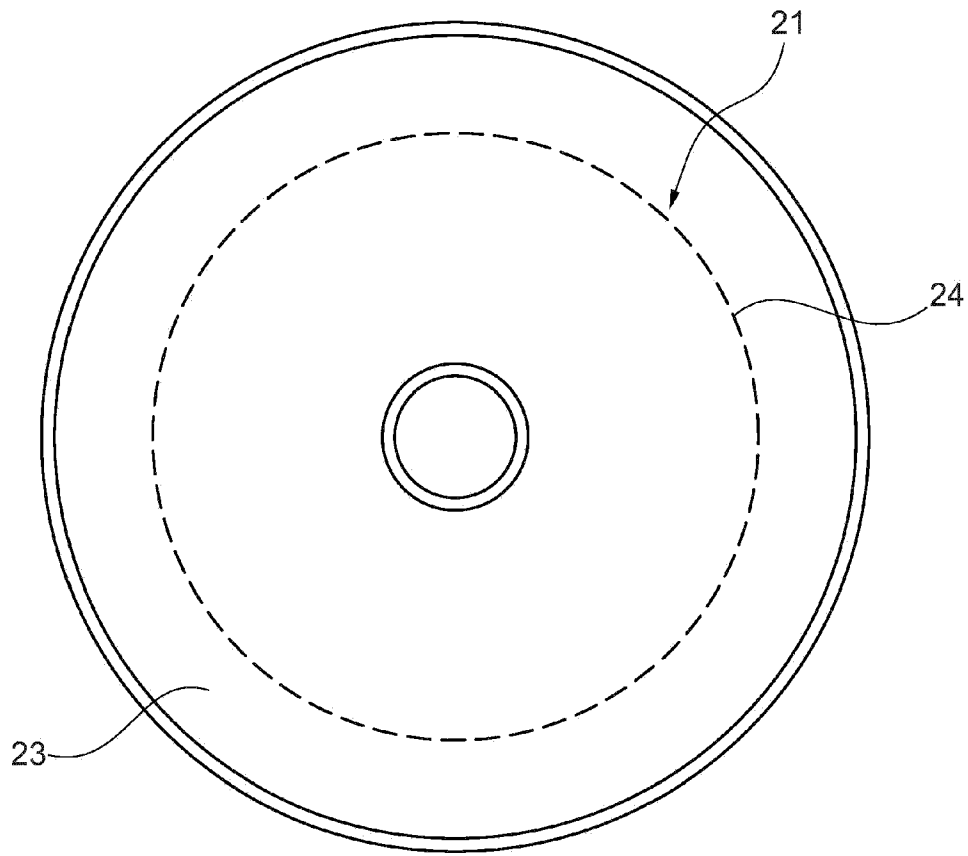


Fig. 5c

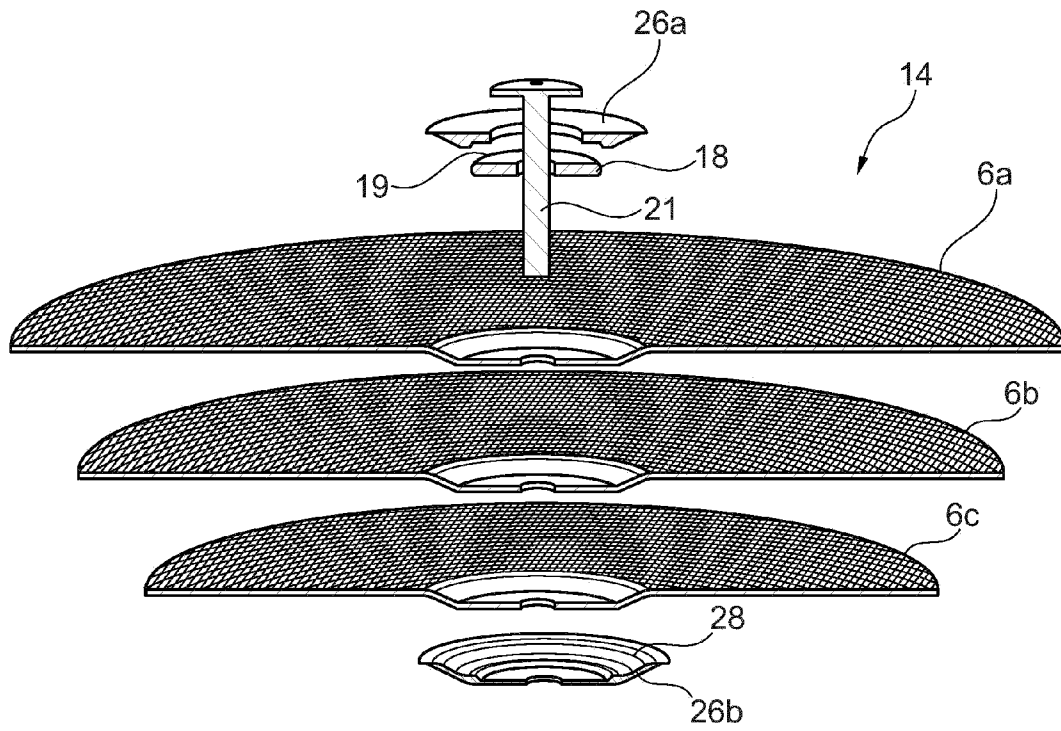


Fig. 6