(19) DANMARK

(10) **DK/EP 2736692 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

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(51) Int.Cl.: *B 29 C 33/26 (2006.01)* *B 29 C 31/04 (2006.01)* *B 29 C 70/38 (2006.01)* *F 03 D 1/06 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2017-01-30**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2016-12-07**

(86) Europæisk ansøgning nr.: **12746010.3**

(86) Europæisk indleveringsdag: **2012-07-19**

(87) Den europæiske ansøgnings publiceringsdag: **2014-06-04**

(86) International ansøgning nr.: **DK2012050272**

(87) Internationalt publikationsnr.: **WO2013013676**

(30) Prioritet: **2011-07-28 DK 201170418** **2011-07-28 DK 201170417** **2011-07-28 DK 201170419** **2011-08-08 US 201161521367 P** **2011-08-08 US 201161521369 P** **2011-08-08 US 201161521371 P**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(54) Benævnelse: **Produktionsanlæg omfattende et transportsystem til at bearbejde forlængede produkter, især vindmøllevinger, med forlængede formsamlinger**

(56) Fremdragne publikationer:
WO-A1-2004/043679
WO-A1-2011/035539
WO-A2-2010/129492
CA-A1- 2 762 777

DESCRIPTION

TECHNICAL FIELD AND BACKGROUND

[0001] The present invention relates to a production facility with a transport system, wherein elongated products, in particular wind turbine blades, are formed by using moulds that extend along the length of the elongated product and by combining the moulds to form the complete elongated product.

[0002] Elongated products, such as wind turbine blades, are frequently formed on the basis of fibre reinforced polymer materials, wherein a technique is frequently used, in which a first half of the elongated product is formed by applying layer after layer in one of the moulds and at the same time preparing the second half of the elongated product layer after layer in the second mould and finally combining the two moulds so as to join the two halves of the elongated product. Typically, the two halves have to be prepared on the basis of a specific process strategy with high precision, in particular when considering wind turbine blades, so that there is generally a continuous attempt in this field of industry to increasingly apply automated process techniques, which, for instance, require the usage of some sort of robot system, and the like. Due to the significant length of, for instance wind turbine blades, a corresponding robot system has to appropriately be positioned along the length of the elongated moulds, thereby typically requiring an adequate transport system. A corresponding transport system has to be configured in such a way that a movable part, which may carry a robot device and the like, can be positioned at any location along the length of the elongated mould, however, without unduly restricting accessibility of the mould by operators and workers. Preferably, the two moulds may be accessed individually and independently by a robot device, which in turn may require an appropriate support assembly in the form of rails, and the like, which, on the one hand, allows access of the moulds during the preparation of the various layer systems, while on the other hand, the moulds may be brought into contact with each other so as to form the composite mould assembly and thus enable the joining of the two halves of the elongated product.

[0003] Frequently, the two mould assemblies are brought into contact with each other by providing an appropriate mould drive mechanism connected to a movable mould assembly, which is rotated around at least one axis of rotation in order to position the movable mould assembly above the non-movable mould assembly, thereby "closing" the composite mould assembly. In particular, when a high degree of flexibility in operating a robot system on the basis of a transport system is required, as discussed above, typically the transport system comprises at least one centre rail positioned laterally between the movable and non-movable mould assemblies, wherein, however, the central position of this rail may significantly interfere with the rotational movement of the movable mould assembly.

[0004] In this respect WO2011/035539 describes an automated production system for wind turbine blades, in which two gantries can be independently operated so as to allow each gantry to be positioned along the corresponding mould on the basis of a centre rail that is positioned at a height level selected so as to provide for superior accessibility by workers. On the other hand, the centre rail comprises gaps that are positioned such along the entire length of the centre rail that the various hinge mechanisms for rotating one of the moulds can move through the corresponding gaps when closing the mould. In the open position of the mould assemblies the gaps may be "bridged" upon moving the gantry by providing a specific wheel system that allows the crossing of the gaps without losing contact to the centre rail. In other embodiments the gaps can temporarily be closed by laterally moving corresponding bridge sections from a first position, allowing the crossing of the hinge mechanisms, into a second position, in which the gap in the centre rail is closed.

[0005] WO 2010/129492 discloses an installation for moulding wind turbine blades in which two elongated mould halves are positioned longitudinally side-by-side. Plies of fiber reinforcing material are robotically placed in the moulds. Two gantries are located at the root end of each mould. The two gantries are independently movable along the length of the mould, and are used to carry out different operations during the molding cycle.

[0006] CA 2762777 discloses a system including an installation for the manufacture of wind turbine blades by means of applying dry fiber "cloth" mats, above two die halves where respective halves or "shells" are formed making up the body of the desired blade when attached to one another. The installation consists of a common gantry structure arranged above the assembly of the two die halves, one of which is fixed and the other one being susceptible of being turned over onto the former to attach the "shells" formed therein in opposition. Respective individual gantry structures are further arranged above each of the die halves. The heads of each individual gantry structure have the same structural formation but a different width, such that one of them can be used with "cloth" mats having a width less than a certain value, whereas the other one can be used with "cloth" mats having a greater width.

[0007] Although the production system described in this document may provide for certain advantages with respect to allowing access of the moulds by workers and robot systems, there is still room for improvement so as to increase one or more of productivity, flexibility, efficiency and controllability of the production process.

[0008] It is thus an object of the present invention to provide a production facility including a transport system in order to enable the fabrication of elongated products, in particular of wind turbine blades, while taking into account one or more of the above identified aspects with respect to an improvement over the previously described prior art.

SUMMARY OF THE INVENTION

[0009] According to the present invention the object is solved by a production facility. The production facility comprises a first elongated mould assembly and a second elongated mould assembly extending in parallel to the first elongated mould assembly. Moreover, the production facility comprises a transport system that comprises an elongated support member extending along and laterally between the first and second elongated mould assemblies. The transport system further comprises a movable part configured to be positioned at least along the first and second elongated mould assemblies by using the elongated support member. Additionally, the transport system comprises a drive mechanism coupled to the elongated support member and configured to change a position of the elongated support member with respect to the first and second elongated mould assemblies.

[0010] The inventive production facility thus comprises a transport system whose configuration is selected such that the elongated support member is appropriately positioned so as to enable an appropriate positioning of the movable part along the entire length of the mould assemblies, while at the same time enabling movement of the elongated support member. Hence, the position of the elongated support member with respect to the first and second mould assemblies may be changed, for instance in correlation to a corresponding phase of the overall fabrication process, for example selecting different height levels as may be considered advantageous for the specific stage of the production process, thereby for instance, providing superior accessibility of the mould assemblies by workers, robot devices, and the like.

[0011] In one advantageous embodiment the production facility further comprises a mould drive mechanism coupled at least to the second elongated mould assembly and configured to position the second elongated mould assembly relatively to the first mould assembly so as to form a composite mould assembly.

[0012] Since at least the second mould assembly can be positioned with respect to the first mould assembly so as to form a composite mould assembly, even highly complex fabrication processes can be implemented in the production facility, such as the fabrication of wind turbine blades, typically requiring accessibility of the first and second mould assemblies over the entire length by the movable part of the transport system. Furthermore, in combination with the capability of changing position of the support member generally an increased degree of flexibility in implementing automated manufacturing sequences is achieved.

[0013] In one preferred embodiment of the production facility the drive mechanism is configured to perform a change of position of the elongated support member so as to position the elongated support member at a non-interference position that avoids interference with the positioning of the second elongated mould assembly relatively to the first mould assembly when forming the composite mould assembly.

[0014] Hence, the drive mechanism not only provides for superior flexibility in appropriately positioning the support member, but also enables the support member to be positioned at the non-interference position so that generally a superior degree of freedom is achieved in appropriately configuring the mould drive mechanism, for instance with respect to the drive components, hinge mechanisms, and the like, since the support member as a whole is moved to a non-critical position.

[0015] In one illustrative embodiment the mould drive mechanism is configured to rotate the second mould assembly around an axis of rotation extending along the first and second elongated mould assemblies. Consequently, a plurality of well established mechanical systems may be used for implementing a rotational movement on the basis of the mould drive mechanism, wherein in one illustrative embodiment, the mould drive mechanism is configured to rotate the second mould assembly around a single axis of rotation that extends along the first and second elongated mould assemblies. Hence, in this embodiment, a simple and single movement is sufficient to appropriately position the first and second mould assemblies relatively with respect to each other in order to form the composite mould assembly while at the same time, due to the positioning of the entire support member at the non-interference position, the moulds drive mechanism may have any appropriate configuration, for instance in terms of the hinge system, turn leverages, and the like.

[0016] In one preferable embodiment the drive mechanism is configured to perform change of position by initiating at least a translational movement of the elongated support member. In this case, a simple and robust construction of the drive mechanism may be implemented, since a linear movement can be realised by a plurality of well-established actuators, such as hydraulic cylinders, pneumatic cylinders, motors and gearbox combinations, and the like.

[0017] In one illustrative embodiment the translational movement is a vertical movement. That is, the elongated support member may be lifted or lowered so as to appropriately position the support member in accordance with the process strategy to be applied upon forming the elongated product.

[0018] To this end, in one illustrative embodiment the drive mechanism is configured to lift the elongated support member into the non-interference position. Consequently, the non-interference position may be selected to be well above the height level of the first and second mould assemblies, thereby also ensuring superior accessibility for workers and operators, even when moving the second mould assembly into the closed position.

[0019] In another illustrative embodiment the drive mechanism is configured to lower the elongated support member into the non-interference position. In this case, the vertical movement may be implemented on the basis of robust mechanical components without requiring an installation, for instance, at the ceiling of the facility. Furthermore, in some illustrative embodiments, the support member may be lowered into the non-interference position such that workers and operators may walk above the support member, which, for instance, may be accomplished by providing an appropriate recess and the floor of the facility. In this case, the support member may be positioned at a first height level during operation of the transport system, in which also superior accessibility of the mould assemblies may be achieved, while the second height level corresponding to the non-interference position may also allow substantially complete access of the space between the mould assemblies, when the support member is in the non-interference position. It should be appreciated that the non-interference position may also be used at any appropriate stage of the overall production process, even if the first and second mould assemblies do not form the composite mould assembly.

[0020] In a further illustrative embodiment of the drive mechanism is configured to perform change of position by initiating at least a rotational movement of the elongated support member along an axis of rotation that extends along the first and second mould assemblies. In this case, a movement of the support member may be initiated in a very space efficient manner by using well-established actuators, such as electric motors, and the like.

[0021] In one preferred embodiment the drive assembly is configured to bring the elongated support member into the non-interference position by the rotational movement only. In this case, an efficient rotating mechanism may be implemented in order to select an appropriate position of the support member. That is, although only a single rotational movement is sufficient to bring the support member into the non-interference position, nevertheless any intermediate angular position may also be selected, if considered appropriate for enhancing accessibility of the space between the first and second mould assemblies.

[0022] In one illustrative embodiment the drive mechanism and the mould drive mechanism are coupled and configured so as to perform the rotational movement while positioning the second elongated mould assembly relatively to the first mould assembly so as to form a composite mould assembly. The coupling of these drive mechanisms may reduce the number of required components and may also allow a very space efficient construction of the combined drive mechanism. Moreover, by mechanically coupling these drive mechanisms it may automatically be ensured that the support member is moved into the non-interference position while the second mould assembly is brought into contact with the first mould assembly. If the positioning of the support member at the non-interference position requires a different angle of rotation compared to positioning the second mould assembly above the first mould assembly, a corresponding adaptation made readily be obtained by using an appropriate gearbox. For example, if combining the first and second mould assemblies requires an angle of rotation of approximately 180°, while it is advantageous to rotate the support member by an angle of approximately 90°, a corresponding 2:1 gear ratio may be implemented. Hence, the same drive components, such as motors, hydraulic systems, and the like may be used for moving the support member and the second mould assembly, even if different angles of rotation are required.

[0023] In one illustrative embodiment the transport system comprises an outer elongated support member extending along one of the first and second elongated mould assemblies. In this manner a plurality of appropriate constructions may be implemented, for instance in order to enhanced robustness and mechanical stability, and the like since the movable part of the transport system may thus be supported by the elongated support member and at least one additional outer support member. In further illustrative embodiments, the transport system comprises a second outer elongated support member extending along the other one of the first and second elongated mould assemblies. Hence, two individually controllable parts may be used in the transport system, while nevertheless providing superior mechanical stability for each of the movable parts.

[0024] In a further illustrative embodiment the first and second mould assemblies comprise mould half shelves for forming a wind turbine blade. Thus, the production facility is appropriately configured to form highly complex elongated products in the form of wind turbine blades, wherein the configuration of the transport system allows a high degree of automation, while still providing for superior flexibility and accessibility of the first and second mould assemblies during the fabrication process.

[0025] According to a further aspect of the present invention the object is solved by a method for forming an elongated product, in particular a wind turbine blade, wherein elongated mould assemblies may be filled with appropriate materials on the basis of a transport system comprising a movable part that may be positioned along the length of the elongated mould assemblies by using an elongated support member. The elongated mould assemblies may be brought into a closed position by turning at least one of these elongated mould assemblies, wherein the support member is positioned in a non-interference position, thereby providing space for moving one or both of the elongated mould assemblies.

[0026] In further illustrative embodiments the positioning of the elongated support member at the non-interference position and that an appropriate work position or at any intermediate position may be accomplished by a translational movement, for instance in the vertical or horizontal direction and/or by a rotational movement around an axis of rotation that is oriented along a length direction of the elongated mould assemblies.

DESCRIPTION OF THE DRAWINGS

[0027] The present invention will now be described in more detail with reference to the accompanying drawings, in which:

Figure 1 a schematically illustrates a top view of a production facility comprising a transport system,

Figure 1 b schematically illustrates a cross-sectional view of the production facility including the transport system having a drive mechanism for changing position of a support member with respect to the first and second mould assembly according to one illustrative embodiment,

Figures 2a and 2b schematically illustrate the production facility including a transport system that is configured to lift or lower the support member according to illustrative embodiments,

Figures 3a and 3b schematically illustrate the production facility with a transport system that is configured to rotate the support member according to illustrative embodiments,

Figures 4a and 4b schematically illustrate the production facility with a transport system that is mechanically coupled to a mould drive mechanism according to illustrative embodiments,

Figures 5a and 5b schematically illustrate the production facility with the transport system that is configured to rotate the support member independently with respect to the second mould assembly according to still further illustrative embodiments,

DETAILED DESCRIPTION OF EMBODIMENTS

[0028] A first version of the present invention will now be described in more detail with reference to the accompanying drawings with figures 1 a to 5b, wherein generally like components are denoted by the same reference numbers except for the first digit, which generally refers to the corresponding figure, in which an embodiment is illustrated. Thus, it should be appreciated that the description of components having the same reference number except for the first digit may be omitted, if appropriate, while it is nevertheless to be understood that the component in question may have one or more of the features of corresponding components referred to in previously described or later-described embodiments.

[0029] Figure 1 a schematically illustrates a top view of a production facility 100, in which are installed a first mould assembly 110a and a second mould assembly 110b, which are arranged in parallel to each other. The first and second mould assemblies 110a, 110b are elongated mould assemblies, which is to be understood such that the length, i.e. the dimension along a length direction L is significantly greater compared to the lateral perpendicular dimension. In one particular embodiment, the first and second mould assemblies 110a, 110b are configured to form corresponding halves of a wind turbine blade. The production facility 100 further comprises a transport system 150, which comprises an elongated support member 151 extending along the length direction L in parallel with the first and second mould assemblies 110a, 110b. Furthermore, the elongated support member 151, which may be provided in the form of a rail, or any other carrier that is appropriately configured to enable a movable part 155 of the transport system 150 to be moved along the support member 151, is positioned laterally between the first and second mould assemblies 110a, 110b. Furthermore, the elongated support member 151 has a length that is appropriate for allowing access of at least a significant portion of the first and second mould assemblies 110a, 110b by the movable part 155. In this respect "a significant portion" is to be understood as at least half of the entire length of the first and second mould assemblies 110a, 110b.

[0030] Furthermore, in illustrative embodiments the transport system 150 may comprise at least one outer support member 153 so that a movable part 155 may substantially completely span the space, in which the second mould assembly 110b is installed. Similarly, if required, a second outer support member 154 may be provided so as to provide for the possibility of moving a second movable part 156 above the first mould assembly 110a. In this case, the support member 151 is appropriately configured to enable independent movement of the movable parts 155, 156.

[0031] Furthermore, the transport system 150 comprises an additional support member 152, which may represent a continuation of the support member 151 in order to provide a "parking" position for the movable part 155, 156, when changing the position of the support member 151. A change of position of the support member 151 can be initialised on the basis of a drive mechanism (not shown in figure 1 a). Figure 1 b schematically illustrates a cross-sectional view of the production facility 100. As illustrated, the transport system 150 comprises at least the elongated support member 151 positioned laterally between the first and second mould assemblies 110a, 110b and being mechanically coupled to a drive mechanism 157, which is appropriately configured to enable a change of position of the support member 151, for instance by causing the support member 151 to perform a translational movement and/or a rotational movement. To this end, the drive mechanism 157 comprises any appropriate components, such as electric motors, hydraulic components, pneumatic components, gear systems, and the like. Moreover, a mould drive mechanism 120 is provided and is mechanically coupled to the second mould assembly 110b. The mould drive mechanism 120 is appropriately configured to move the second mould assembly 110b into a position above the first mould assembly 110a in order to form a composite mould assembly 111. Depending on the manufacturing concept used, the first and second mould assemblies 110a, 110b may be combined into the composite mould assembly 111 once or may be separated and re-combined one or several times so as to finally form a complete elongated product, such as a wind turbine blade.

[0032] The transport system 150 is thus appropriately configured so as to allow the repositioning of the elongated support member 151 when activating the mould drive mechanism 120 in order to form of the composite mould assembly 111. That is, the support member 151 is moved from a working position, i.e. from a position, in which the movable part 155 and/or 156 (cf. Figure 1 a) can be moved along the support member 151, into a non-interference position, which thus allows the second mould assembly 110b to be moved freely to the first mould assembly 110a by the mould drive mechanism 120.

[0033] Figure 2a schematically illustrates a perspective view of a production facility 200 including a transport system 250 that enables a repositioning of an elongated support member 251 with respect to first and second mould assemblies 210a, 210b. It should be appreciated that with respect to the components described so far also the same criteria may apply as previously explained with reference to the facility 100. As shown, the first and second mould assemblies 210a, 210b are positioned at any appropriate height level above a floor 201 and similarly the support member 251 is positioned at an appropriate height level in order to provide for superior accessibility of the first and second mould assemblies 210a, 210b. In this embodiment the transport system 250 comprises a drive mechanism 257 that is configured to lift the support member 251 to any appropriate height so as to enable a non-disturbed movement of the mould assembly 210b, as for instance explained above with reference to figures 1 a and 1 b. For example, the drive mechanism 257 may comprise an appropriate actuator, such as a motor, and the like, which is not shown in figure 2a, in combination with two or more appropriately positioned mechanical connections 257a, 257b which enable a vertical movement of the member 251. As shown, the support member 251 may comprise a guide element 251 a so as to precisely define the working position of the member 251.

[0034] Figure 2b schematically illustrates a cross-sectional view of the facility 200, wherein the drive mechanism 257 is appropriately configured to lower the position of the support member 251 in order to define an appropriate non-interference positioned 202n. To this end the drive mechanism 257 may be positioned in a recess 201 r in the floor 201, wherein even a substantially flush configuration may be obtained in the non-interference position 202n. On the other hand, the support member 251 may be lifted into the working position 202w or in any other intermediate position.

[0035] Figure 2C schematically illustrates a cross-sectional view of the facility 200, wherein the drive mechanism 257 is configured to move the elongated support member 251 from the working position 202w into the non-interference position 202n and vice versa by initiating a translational movement in the horizontal direction. To this end, any appropriate components, such as a rail system attached to the floor or ceiling of the facility 200 may be provided with appropriately positioned and configured support members (not shown) that in turn are coupled to a drive component, such as a motor, and the like.

[0036] Figure 3a schematically illustrates a cross-sectional view of a production facility 300, in which a transport system 350 is configured so as to enable a rotational movement of a support member 351. As shown, a drive mechanism 357 is positioned in close proximity or attached to a mould drive mechanism 320 and enables a rotation of the support member 351 between the working position 302w and a non-interference position 302n. In figure 3a a second mould assembly 310b is positioned above a first mould assembly 310a, thereby forming the composite mould assembly, as is also discussed above. In the embodiment shown, the rotation of the second mould assembly 310b is performed around an axis of rotation 325 that extends along the length direction and thus in parallel with the elongated mould assemblies 310a, 310b. In this embodiment and also in the previously described embodiments as well as in the embodiments still to be described the axis of rotation, such as the axis 325, represents the only axis of rotation for forming the composite mould assembly, while it is to be appreciated, however, that a more complex composite movement may be applied so as to appropriately position the first and second mould assemblies. For example, a composite movement of the first and/or the second mould assembly may comprise the patients about to laterally offset axis of rotation, possibly in combination with a translational movement. Irrespective of the complexity of the movement provided by the mould drive mechanism, such as the mechanism 320, the drive mechanism connected to the elongated support member is appropriately configured to position the support member in the non-interference position.

[0037] Figure 3b schematically illustrates the support member 351 in its working position. As shown, the hinge mechanism 358 is provided, for instance attached to the mould drive mechanism 320.

[0038] Figure 4a schematically illustrates a perspective view of a production facility 400, in which a mould drive mechanism 420 is illustrated in the form of two individual drive components 421 a, 421 b, which in turn are configured to rotate a second mould assembly 410b by an appropriate angle of rotation, for instance by approximately 180° so as to position the mould assembly 410b above a first mould assembly (not shown), as discussed above. Furthermore, a transport system 450 comprises a support member 451 with drive components 458a, 458b, which are mechanically coupled to the drive components 421 a, 421 b, respectively. Consequently, upon activating the drive components 421 a, 421 b also a rotational movement of the support member 451 is initiated. Since typically the support member 451 may require a reduced angle of rotation compared to the mould assembly 410b, the drive components 458a, 458b may include a corresponding period system so as to adjust the ratio of the angles of rotation. For example, the corresponding gearboxes may result in a reduction of the angle of rotation of approximately 2:1, wherein an angle of rotation of approximately 90° is appropriate for moving the support member 451 into the non-interference position.

[0039] Figure 4b schematically illustrates the support member for 51 when rotated into the working position 402n, which is accomplished by activating the drive components 421 a, 421 b in order to bring the mould assembly into the desired closed position.

[0040] Figure 5a schematically illustrates a perspective view of a production facility 500, in which a support member 551 is connected to a drive mechanism 557 that comprises a plurality of individual drive components 557a, 557b, 557c that are individually controllable, for instance by means of a control unit 559, with respect to a drive mechanism 520 that comprises a plurality of drive components 521 a, 521 b for rotating a mould assembly 510b into a closed position. Hence, contrary to the embodiments as described with reference to figures 3a, 3b the support member 551 is movable independently with respect to the mould assembly 510b.

[0041] Figure 5b schematically illustrates the production facility, when the support member 551 has been rotated into the non-interference position 502n in order to allow the subsequent activation of the mould drive assembly 520, thereby bringing the corresponding mould assemblies into the closed position.

[0042] In the above described embodiments the production facilities 100, 200, 300, 400 and 500 are appropriately configured to move the elongated support member "as a whole", thereby allowing for superior flexibility with respect to providing access to the mould assemblies by workers and operators, while, when moving the elongated support member into its working position, one or both mould assemblies may be accessed by the movable parts of the transport system, which may be used for positioning a robot device, and the like. On the other hand, the movement of the elongated support member may be appropriately controlled so as to position the support member at a non-interference position, in which a movement or rotation of the movable mould assembly is accomplished without interference by the support member. To this end, an appropriate control unit may be provided so as to coordinate the motions of the support member and the movable mould assembly. In this manner it is ensured that the one or more movable parts of the transport system are positioned in a "parking position", i.e. in the position without contact to the elongated support member, while also movement of the movable mould assembly is initiated only when the support member is positioned in its non-interference position. In one illustrative embodiment the movements of the mould assembly and the support member are mechanically coupled, thereby automatically ensuring an appropriate coordination of these two movements.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO2011035539A **[0004]**
- WO2010129492A **[0005]**
- CA2762777 **[0006]**

Patentkrav

1. Produktionsanlæg (100; 200; 300; 400; 500) omfattende:

en første forlænget formsamling (110a; 210a; 310a),

en anden forlænget formsamling (110b; 210b; 310b; 410b; 510b) der strækker sig parallelt med den første forlængede formsamling (110a; 210a)
og

et transportsystem (150; 250; 350; 450; 550) omfattende

et forlænget støtteelement (151; 251; 351; 451; 551) der strækker sig langs og lateralt mellem den første og anden forlængede formsamling (110a, 110b; 310a; 210a; 210b; 310b; 410b; 510b),

en bevægelig del (155, 156) konfigureret til at blive placeret mindst langs den første og anden forlængede formsamling (110a; 210a; 310a 110b; 210b; 310b; 410b 510b) under anvendelse af det forlængede støtteelement (151; 251; 351; 451; 551);

hvor det forlængede støtteelement (151; 251; 351; 451; 551) strækker sig langs længderetningen L parallelt med den første og anden formsamling (110a, 110b; 310a; 210a; 210b; 310b; 410b; 510b), og hvor det forlængede støtteelement (151; 251; 351; 451; 551) er passende konfigureret til at muliggøre at den bevægelige del (155, 156) i transportsystemet (150; 250; 350; 450; 550) flyttes langs det forlængede støtteelement (151; 251; 351; 451; 551);

og hvor det forlængede støtteelement (151; 251; 351; 451; 551) har en længde der er passende til at give adgang til mindst en væsentlig del af den første og anden formsamling (110a, 110b; 310a; 210a; 210b; 310b; 410b; 510b) med den bevægelige del (155, 156), og en drevmekanisme (157; 257; 357; 457; 557) forbundet med det forlængede støtteelement (151; 251; 351; 451; 551) og konfigureret til at ændre en position af det forlængede støtteelement (151; 251; 351; 451; 551) med hensyn til den første og anden forlængede formsamling (110a; 210a; 310a; 110b; 210b; 310b; 410b; 510b),

hvor den væsentlige del skal forstås som mindst halvdelen af længden af den første og anden formsamling (110a, 110b).

2. Produktionsanlæg ifølge krav 1, endvidere omfattende en formdrevmekanisme (120; 220; 320; 420; 520) forbundet til mindst den anden forlængede formsamling og konfigureret til at placere den anden forlængede formsamling i forhold til den første formsamling for at danne en kompositformsamling (111).

3. Produktionsanlæg ifølge krav 2, hvor drevmekanismen (157; 257; 357; 457; 557) konfigureres til at udføre en ændring af positionen af det forlængede støtteelement for at placere det forlængede støtteelement ved en ikke-indblandingsposition (202n) der forhindrer indblanding i placeringen af den anden forlængede formsamling i forhold til den første formsamling for at danne en kompositformsamling.

4. Produktionsanlæg ifølge et hvilket som helst af kravene 1 til 3, hvor drevmekanismen (157; 257) konfigureres til at udføre en ændring af positionen ved at starte mindst en parallelforskydning af det forlængede støtteelement.

5. Produktionsanlæg ifølge krav 4, hvor parallelforskydningen er en horisontal bevægelse.

6. Produktionsanlæg ifølge krav 4, hvor parallelforskydningen er en vertikal bevægelse.

7. Produktionsanlæg ifølge kravene 2 og 6, hvor drevmekanismen (257a, 257b) konfigureres til at løfte det forlængede støtteelement til ikke-indblandingspositionen.

8. Produktionsanlæg ifølge krav 1, hvor drevmekanismen konfigureres til at sænke det forlængede støtteelement ned i ikke-indblandingspositionen (202n).

9. Produktionsanlæg ifølge et hvilket som helst af kravene 1 til 6, hvor drevmekanismen (157; 357; 458a, 458b; 557, 557a, 557b, 557c) konfigureres til at udføre ændring af position ved at starte mindst en roterende bevægelse af det forlængede støtteelement langs en rotationsakse.

10. Produktionsanlæg ifølge kravene 2 og 9, hvor drevmekanismen og formdrevmekanismen (420, 421 a, 421 b, 458a, 458b) forbindes og konfigureres således at de udfører den roterende bevægelse mens den anden forlængede formsamling placeres i forhold til den første formsamling for at danne en kompositformsamling.

11. Fremgangsmåde til et forme et forlænget produkt, især en vindmøllevinge, idet fremgangsmåden omfatter:

at fylde materiale i en første forlænget formsamling (110a; 210a; 310a) og en anden forlænget formsamling (110b; 210b; 310b; 410b; 510b) under anvendelse af en bevægelig del i et transportsystem (150; 250; 350; 450; 550) der er bevægeligt langs et forlænget støtteelement (151; 251; 351; 451; 551) i transportsystemet der strækker sig langs længderetningen L parallelt med den første og anden formsamling (110a, 110b; 310a; 210a; 210b; 310b; 410b; 510b), idet det forlængede støtteelement strækker sig langs og lateralt mellem den første og anden forlængede formsamling (110a, 110b; 310a; 210a; 210b;

310b; 410b; 510b), og hvor det forlængede støtteelement (151; 251; 351; 451; 551) har en længde der er passende til at give adgang til mindst en væsentlig del af den første og anden formsamling (110a, 110b; 310a; 210a; 210b; 310b; 410b; 510b) med den bevægelige del (155, 156), idet den væsentlige del er mindst halvdelen af hele længden på den første og anden formsamling (110a, 110b), at danne en kompositformsamling ved at dreje mindst en af den første og anden formsamling og ved at placere det forlængede støtteelement (151; 251; 351; 451; 551) ved en ikke-indblandingsposition.

12. Fremgangsmåde ifølge krav 11, hvor placering af det forlængede støtteelement ved en ikke-indblandingsposition omfatter at udføre en parallelforskydning af det forlængede støtteelement.

13. Fremgangsmåde ifølge krav 12, hvor parallelforskydningen er en horisontal bevægelse.

14. Fremgangsmåde ifølge krav 12, hvor parallelforskydningen er en vertikal bevægelse.

15. Fremgangsmåde ifølge et hvilket som helst af kravene 11 til 14, hvor placering af det forlængede støtteelement ved en ikke-indblandingsposition omfatter at udføre en roterende bevægelse af det forlængede støtteelement rundt om en rotationsakse der er placeret langs en længderetning på den første og anden forlængede formsamling.

DRAWINGS

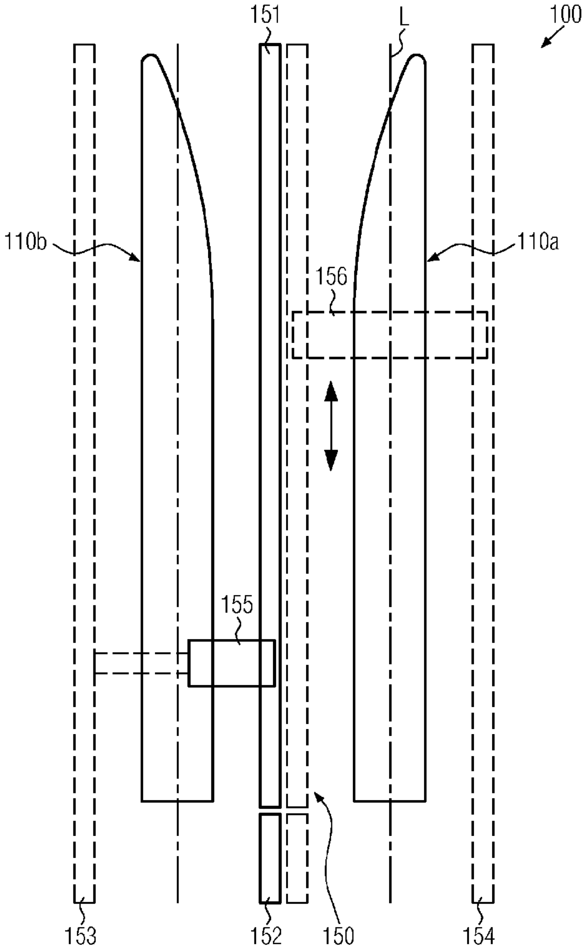

FIG. 1a

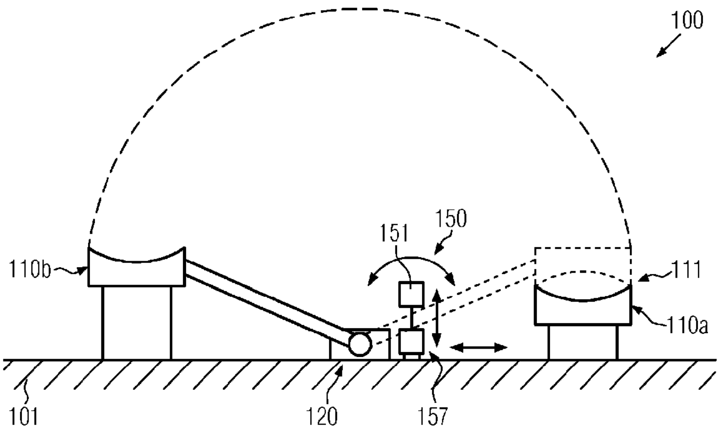

FIG. 1b

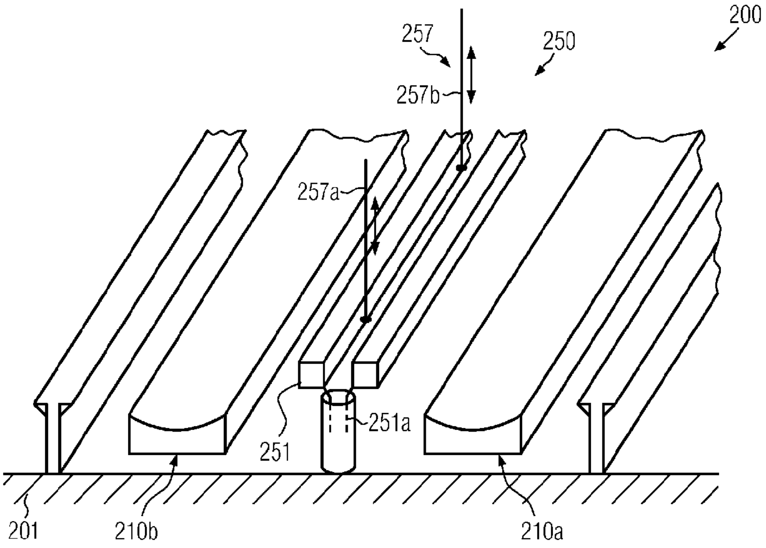
200
257
250
257b
257a
251a
251
201
210b
210a

FIG. 2a

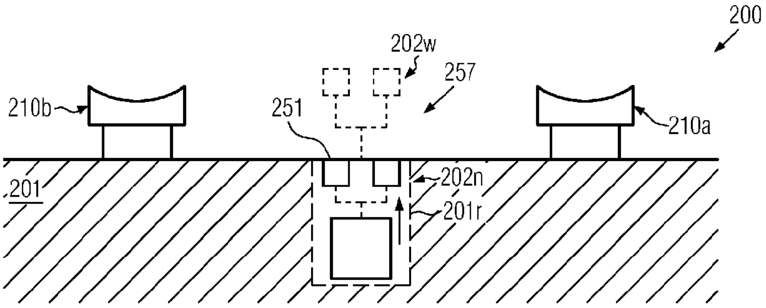
200
202w
257
210b
251
210a
201
202n
201r

FIG. 2b

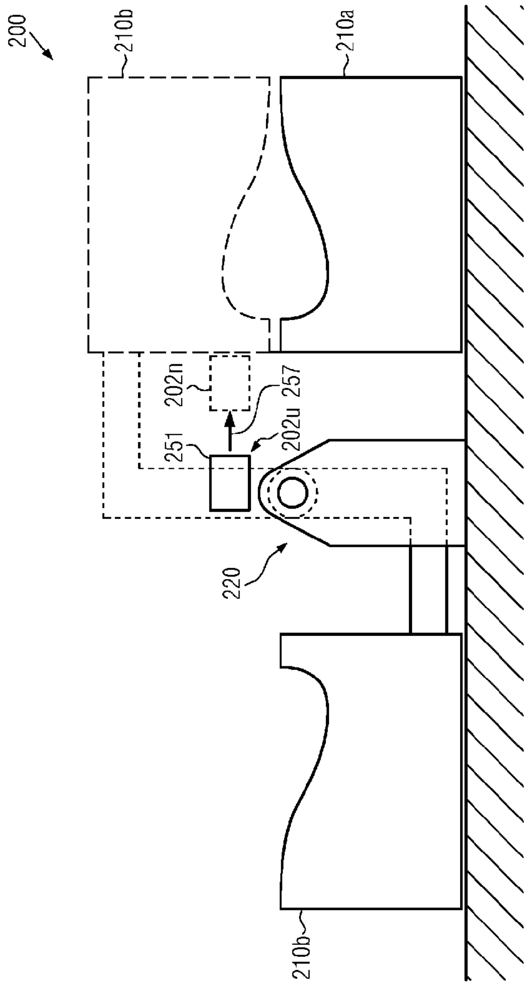

FIG. 2c

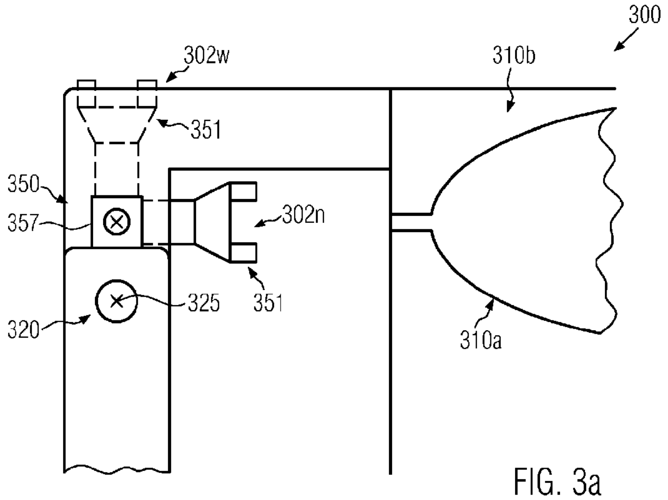

FIG. 3a

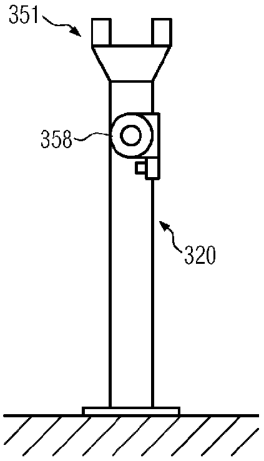

FIG. 3b

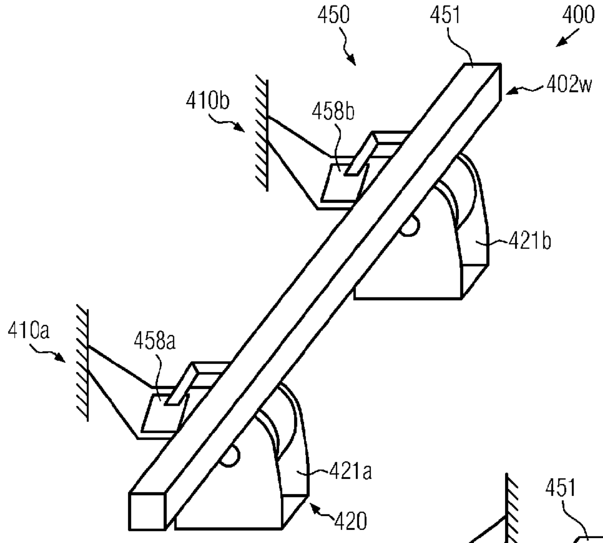
450
451
400
402w
410b
458b
421b
410a
458a
421a
420

FIG. 4a

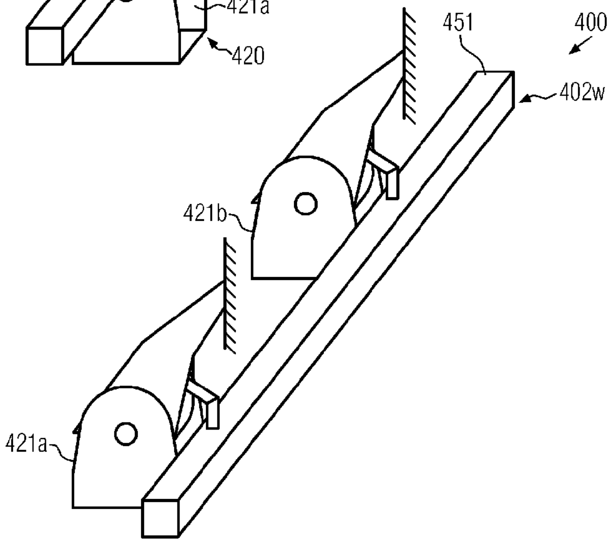
451
400
402w
421b
421a

FIG. 4b

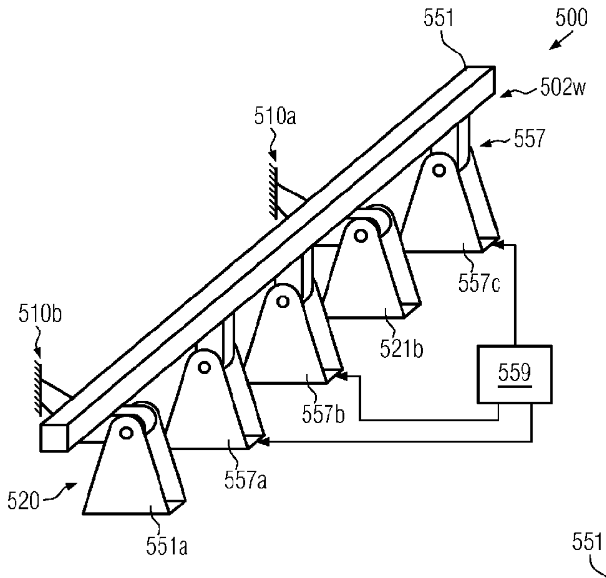
551
500
502w
510a
557
557c
510b
521b
559
557b
520
557a
551a

FIG. 5a

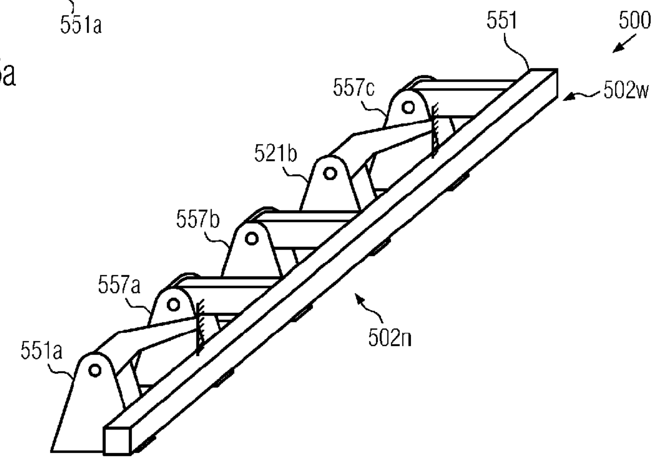
551
500
557c
502w
521b
557b
557a
502n
551a

FIG. 5b