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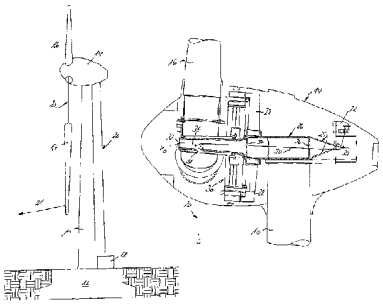
(54) Title: METHOD FOR ASSEMBLING/DISMOUNTING COMPONENTS OF A WIND POWER PLANT

(54) Bezeichnung: VORRICHTUNG ZUR MESSUNG VON AUSSEN-,INNENABMESSUNGEN UND ABSRÄNDEN VON MESSOBJEKTEN



(57) Abstract: The invention relates to a wind power plant and a method for assembling/dismounting components of a wind power plant. The aim of the invention is for a crane to be required to a lesser extent during assembly/dismounting of components of a wind power plant. Said aim is achieved by providing the inventive wind power plant with at least one rope passage (35, 36, 37, 38) in the area of the tower head (14), through which a traction rope (20) of a winch (22,18) is guided. Said aim is also achieved by a method for assembling/dismounting components of a wind power plant, comprising the following steps: - a traction rope (20) is directed from the winch (22, 18) to at least one deflecting roller (24) that is located in the area of the tower head and then to the component that is to be assembled/dismounted; - the traction rope is mounted on the component; and - the component is detached and lowered or raised and fastened. The invention is based on the fact that at least some of the components of a wind power plant can be assembled or replaced without the aid of a crane by using a suitable lifting device. The inventive solution allows technically complex additional installations to be dispensed with on any wind power plant while making a versatile lifting device available quickly and at a low expense.

(57) Zusammenfassung: Die vorliegende Erfindung betrifft eine Windenergieanlage sowie ein Verfahren zur Montage/Demontage von Komponenten einer Windenergieanlage Damit ein Kran bei der Montage/Demontage von Komponenten einer Windenergieanlage in geringerem Umfang gebunden ist, ist bei einer erfindungsgemässen Windenergieanlage wenigstens eine Seildurchführung (35,36, 37,38) im Bereich

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TM), europäisches Patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI-Patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

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— *mit internationalem Recherchenbericht*

des Turmkopfes (14) zum Durchführen eines Zugseiles (20) von einer Winde (22,18) gelöst. Weiterhin wird die Aufgabe gelöst durch ein Verfahren zur Montage/Demontage von Komponenten einer Windenergieanlage, mit den Schritten: -Verlegen eines Zugseiles (20) von der Winde (22,18) zu wenigstens einer Umlenkrolle (24) im Bereich Turmkopfes und weiter zu der montierenden/demontierenden Komponente, - Anbringen des Zugseils an der Komponente, und - Lösen and Herunterlassen bzw. Hochziehen und Befestigen der Komponente. Dabei liegt der Erfindung die Erkenntnis zu Grunde, dass wenigstens ein Teil der Komponenten einer Windenergieanlage auch ohne Hilfe eines Kranes montiert bzw. ausgetauscht werden kann, wenn eine geeignete Hebeeinrichtung zur Verfügung steht. Durch die erfindungsgemässe Lösung werden aufwändige Zusatzinstallationen an jeder Windenergieanlage vermieden. Trotzdem ist eine vielseitige Hebeeinrichtung mit geringem Aufwand schnell verfügbar.

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Method of fitting/removing components of a wind power installation

The present invention concerns a wind power installation and a method of fitting/removing components of a wind power installation.

Wind power installations have long been known. The considerable dimensions and weights of modern installations means that on the one hand components have to be transported individually to the building site. There the components are then fitted together. In that respect in the meantime loads of 50 tonnes and more certainly have to be lifted.

On the other hand loads also have to be lifted to a considerable height of over 100 meters. Admittedly winches are known in wind power installations and in particular therein in the pods but those winches are mostly disposed in the rear part of the pod of the wind power installation.

In addition a load-lifting apparatus on a wind power installation is known from WO 96/10130. In that known load-lifting apparatus, a winch is arranged on a machine frame. A hauling cable passes from the winch by way of a pivotable linkage. Such a load-lifting apparatus is provided on any wind power installation. In that respect the size of the load-lifting apparatus provided on any wind power installation is dependent on the required carrying capacity and therefore increases with the size of the wind power installation or with the weight of the components thereof.

Alternatively, as will be appreciated, lifting operations are possible using appropriately large cranes with a suitable load-bearing capacity, which once again can only be provided at a high level of complication and expenditure. As the expenditure involved in operating such a crane, that is to say dismantling it, operating it and again setting it up, is considerable, the crane generally remains on a wind power installation until the erection of the installation has progressed to such a degree that the crane is no longer required there. It is only then that the crane is transported to the next building site. In that respect the distance between those building sites represents a secondary consideration for the working operations required

for relocating a crane always have to be carried out, irrespective of whether it is relocated only by some hundred meters or by some hundred kilometers.

It will be appreciated that the replacement of components of a wind power installation such as for example the rotor blades also requires a crane which has to be transported, with attendant expenditure.

Therefore the object of the present invention is to develop a method and a wind power installation of the kind set forth in the opening part of this specification, in such a way that a crane is tied in to a lesser degree in fitting/removing components of a wind power installation.

In a wind power installation of the kind set forth in the opening part of this specification that object is attained by at least one deflection roller and at least one cable passage means in the region of the pylon head for passing therethrough a hauling cable from a winch.

In addition the object is attained by a method of fitting/removing components of a wind power installation comprising the steps:

- laying a hauling cable from the winch to at least one deflection roller in the region of the pylon head and further to the component being fitted/removed,
- attaching the hauling cable to the component, and
- releasing and letting down or pulling up and fixing the component.

In that respect the invention is based on the realisation that at least a part of the components of a wind power installation can be fitted or replaced even without the aid of a crane if a suitable lifting apparatus is available. The solution according to the invention avoids expensive and complicated additional installations on any wind power installation. Nonetheless a versatile lifting apparatus is quickly available at low cost.

By virtue thereof the winch which is already present in the rear part of the pod can also be used in the front region of the pod without the position of the winch within the pod having to be altered.

In a preferred development of the invention there is provided a cable passage means in the pod for passing therethrough a hauling cable from a winch at the base of the wind power installation. In that way it is possible

to use a sufficiently strong winch with a sufficiently load-bearing hauling cable for lifting and lowering heavy components so that even such components can be fitted or replaced without the use of a crane. It is accordingly completely sufficient for the winch to be transported to the wind power installation, for its hauling cable to be pulled up into the pod with the winch present in the wind power installation, for the hauling cable to be there laid over the deflection roller or rollers, and for the corresponding fitting/removal procedures to be carried out. In that respect the expense involved in transporting a winch is naturally considerably lower than that involved in transporting a sufficiently powerful and in particular sufficiently large crane.

In a particularly preferred embodiment of the invention there is provided a holding arrangement for an additional winch, the holding arrangement being fixedly connected to the foundation. That also already attains the object of reliably anchoring that winch in a simple fashion so that the winch can be correspondingly quickly used when it has arrived at its destination.

Further advantageous embodiments of the invention are set forth in the appendant claims.

The invention is described in greater detail hereinafter with reference to the Figures in which:

Figure 1 shows a wind power installation having a winch arranged at the base of the pylon,

Figure 2 shows a simplified view in cross-section of the pod with a first embodiment of the invention, and

Figure 3 shows a simplified view in cross-section of the pod with a second embodiment of the invention.

In Figure 1 a pylon 10 of a wind power installation is anchored on a foundation 12. Disposed at the tip of the pylon 10 is a pod 14 to which a first rotor blade 16 is fixed.

At the base of the pylon 10 a winch 18 is also anchored on the foundation 12. A hauling cable 20 extends from the winch 18 at the rear side of the pylon 10 (for viewing this the front side and the rear side of the

pylon 10 are those sides at which the corresponding portions of the pod 14 are disposed) to the pod 14, it passes through the pod and issues from the pod 14 again at a fitting opening provided for a second rotor blade 17 and extends downwardly to the rotor blade 17 which is fixed to that hauling cable and which is pulled up or let down towards the ground by the winch. Illustrated at the second rotor blade 17 is an arrow 21 which symbolises the use of a guide cable 21. The use of a guide cable 21 makes it possible for the rotor blade 17 to be guided in a suitable fashion so that it cannot unintentionally strike against the pylon 10. In addition such a guide cable 21 can ensure that, when it is being let down, the rotor blade 17 is not set down with its tip on the ground and suffers damage, but it can be pulled in the direction of the arrow and can thus be guided into a horizontal position.

Figure 2 shows a simplified view in cross-section of the pod 14. This Figure shows the head portion of the pylon 10. Disposed on that head portion of the pylon 10 is a machine carrier 26 which carries the stator carrier 28 with the stator 30. The machine carrier 26 also carries a shaft journal 32. Rotatably mounted on the shaft trunnion 32 is the rotor having the rotor blades 16, 17 and the rotor member 30 of the generator.

Disposed at the side of the machine carrier 26, which is remote from the stator carrier 28, is a winch 22 which is already provided as standard in most wind power installations. Also provided there are holding bars 25, with a first deflection roller 24 being provided at the ends of the holding bars 25, which are remote from the machine carrier 26. A second deflection roller 34 is disposed within the shaft trunnion 32.

The Figure also illustrates the hauling cable 20 which passes into the pod 14 at the rear side. In this case the passage opening for that hauling cable 20 can also be a closable opening which is provided in any case beneath the winch 22 in the bottom of the pod 14.

After passing into the pod 14 the hauling cable 20 passes over the first deflection roller 24 through a second cable passage means 36 (the first cable passage means is accordingly the opening in the bottom of the pod 14), through a third cable passage means 37 to the deflection roller 34 and

from there to a fourth cable passage means 38 in the shaft trunnion 32, for example to the rotor blade 17 which is to be moved.

Pulling up the hauling cable 20 or letting it down on the way between the pod 14 and the winch 18 on the foundation 12 of the pylon 10 can be assisted by the winch 22.

Figure 3 shows a second embodiment of the invention. The components in this Figure are denoted by the same references as those in Figure 2. The essential difference in relation to the first embodiment of the invention as shown in Figure 2 is that here the cable of the winch 22 which is provided in any case in the wind power installation is used as the hauling cable 20. The carrying capacity of that winch is admittedly limited, but nonetheless it is possible to lift components of relatively low weight, for example through the rotor blade opening, into the front part of the pod 14. Mention may be made here by way of example of a pitch motor, that is to say a motor which serves to adjust a rotor blade. Otherwise that motor would have to be lifted into the rear part of the pod 14 and from there transported into the front part, in a complicated procedure. That naturally presupposes that the rotor blade opening is open and is not closed off by a rotor blade.

As can be clearly seen from the Figure, the cable run then passes from the winch 22 by way of the first deflection roller 24, through the second cable passage means 36, the third cable passage means 37, by way of the second deflection roller 34 and through the fourth cable passage means 38.

Besides the example described and illustrated, attention may also be directed to a further alternative which is not illustrated. In this case a cable guide means or deflection roller can be arranged above the pylon head so that the cable can then be let down into the interior of the pylon or pulled up out of same. In that way also loads within the pylon, in particular in the region of the base of the pylon, for example power cabinets, transformers, etc can be raised or lowered if required by way of the cable, which is advantageous if those parts have to be moved out of the base region of the pylon, which is usually effected by way of side doors in the pylon which

however are not all at the level of the component in question which is to be replaced.

Instead of a simple deflection roller as the cable it is also possible to provide any other kind of cable guide means in which the cable can be guided into the pylon through the machine carrier 26.

A further alternative can also provide that the winch 18 itself is not disposed outside the pylon but within the pylon in the region of the base thereof. Then the hauling cable is always disposed in a protected condition within the installation and raising and lowering of cargo is possible at a plurality of locations, on the one hand in the region of the rear of the pod (by way of the deflection roller 24), at a further location in the region of the hub (by way of the roller 38), and it is also possible to lower components within the pylon.

It is also possible to provide a further deflection roller (in the manner of the roller 38) which is disposed in the region of the hub tip 40 so that the cable can be guided out of the hub of the wind power installation past the rotor blades. In that way loads can then be lifted from the ground into the region of the rotor hub, more specifically also past the rotor blades. If that load is for example a working platform, it is possible for the personnel to move up and down directly at the rotor blades on the outside in order to inspect the rotor blades or if necessary to carry out service or cleaning procedures.

It will be appreciated that where necessary, further cable guide or deflection rollers can be provided within the machine carrier, the pylon, the pod or the hub, without that needing to be particularly mentioned at this juncture.

If a winch which is disposed at the base of the wind power installation is used, that also does not necessarily have to be fixedly connected to the foundation of the wind power installation, but can also be mounted in an open condition to the transport vehicle and can be connected thereto so that highly flexible use of the winch is possible. It is also possible for the winch to be fixed on a support frame structure so that a sufficiently great counterweight is always guaranteed, by the winch.

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Claims

1. A system for fitting / removing components of a wind power installation characterised by the wind power installation comprising at least one deflection roller and at least one cable passage means in the region of a pylon head for passing there through a hauling cable from a winch, wherein the winch is mounted outside the pylon at a base of the wind power installation on a vehicle.

2. A system for fitting / removing components of a wind power installation as set forth in claim 1 characterised by a first cable passage means in a pod for passing through the hauling cable from the winch at the base of the wind power installation.

3. A system for fitting / removing components of a wind power installation as set forth in claim 1 or 2, characterised in that there is provided a second cable passage means which is disposed above the pylon head and through which components of the wind power installation can be raised or lowered within the pylon.

4. A method of fitting / removing components of a wind power installation comprising the steps:

- transporting a winch mounted on a transport vehicle to a base of the wind power installation,
- laying a hauling cable from the winch to at least one deflection roller in the region of a pylon head and further to the component to be fitted / removed,
- attaching the hauling cable to the component, and
- one of releasing and letting down or pulling up and fixing the component.

5. A system for fitting / removing components of a wind power installation as set forth in claim 2 characterised by the hauling cable running from

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the winch through the first cable passage means by way of a first deflection roller to a second cable passage means into a machine carrier, next through a third cable passage means into a shaft trunnion, next by way of a second deflection roller to a fourth cable passage means out of a fitting opening for a rotor blade such that a rotor blade can be pulled up or let down by the winch.

6. A system for fitting / removing components of a wind power installation substantially as herein described.

7. A method of fitting/removing components of a wind power installation substantially as herein described.

Fig. 1

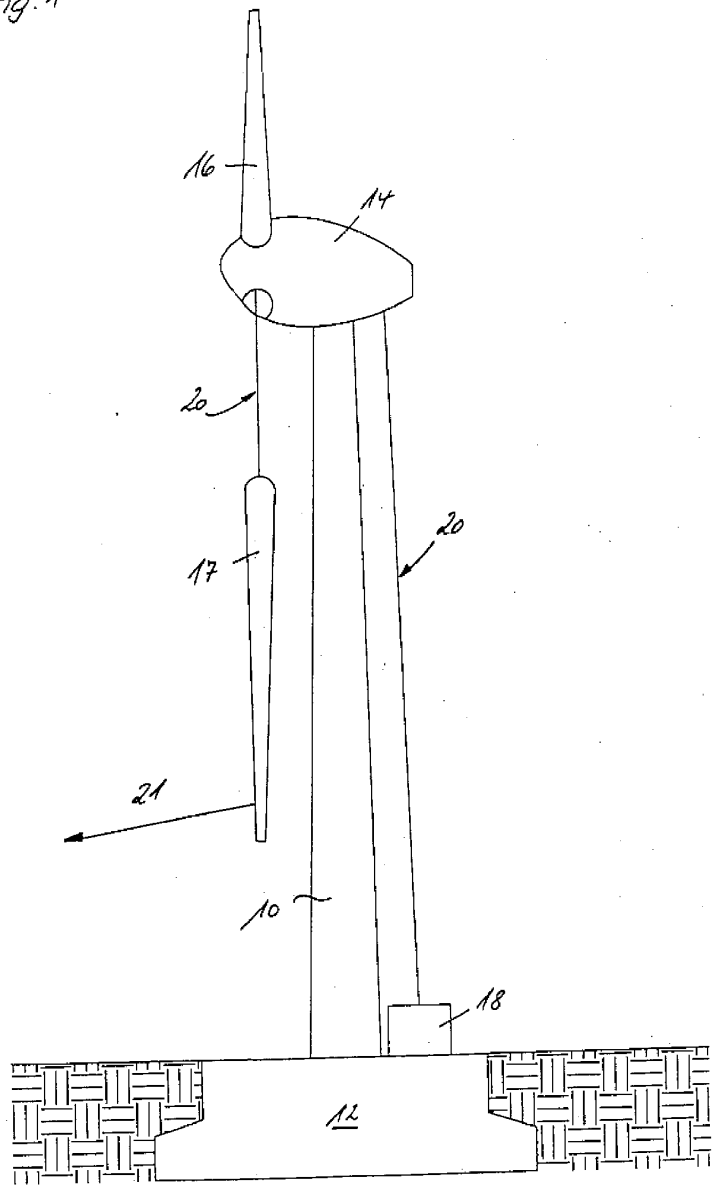

Fig. 2

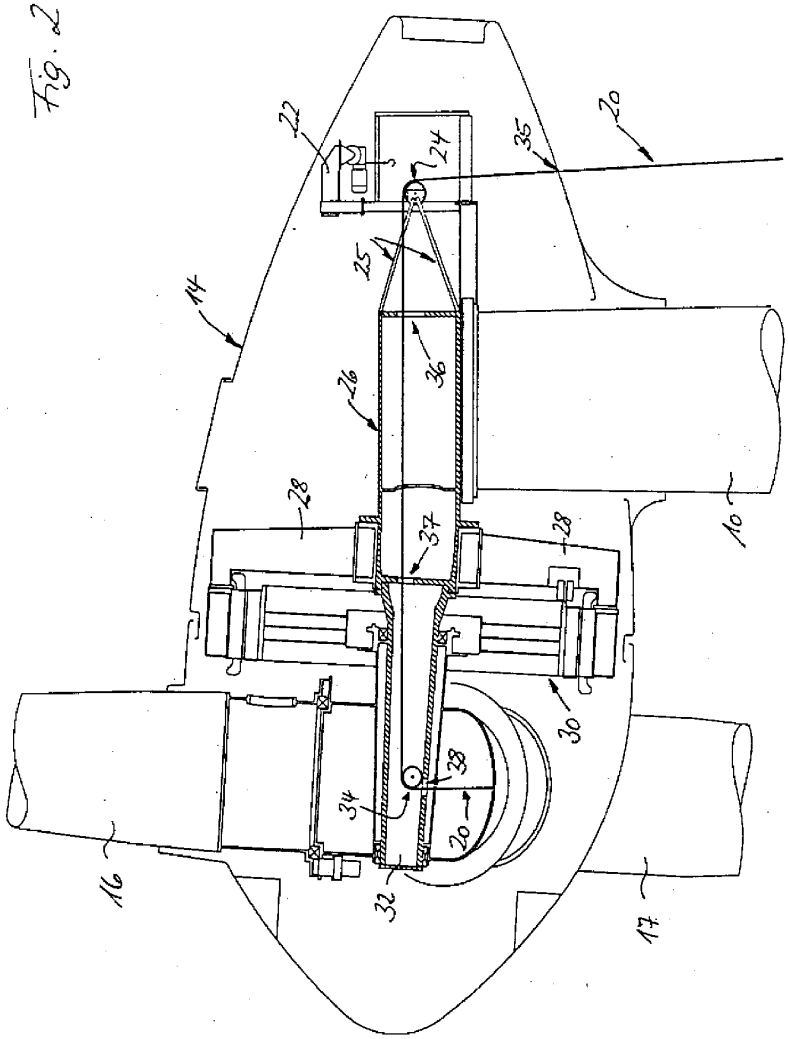

Fig. 3