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(54) **A non tractive vehicle for the transport of a long windmill wing**

Nicht angetriebenes Fahrzeug für den Transport eines langen Windmühlenflügels

Véhicule non propulsé permettant le transport d'une longue pale d'éolienne

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Description

[0001] The invention relates to a non-tractive vehicle for the transport of a long windmill wing, said non-tractive vehicle being a part of a vehicle composed of a tractive vehicle equipped with a hydraulic system to which one end of the windmill wing is secured, and a non-tractive vehicle to which the other end of the windmill wing is secured, said non-tractive vehicle comprising a platform on which a rotatable part is arranged with a carrier arrangement secured on the top.

[0002] In the production of energy in the form of electricity, ever great demands are made by politicians and citizens in general with respect to replacing the fossil fuels with alternative renewable sources of energy, such as biogas systems, wave systems and windmill energy.

[0003] Windmill energy in particular has obtained an ever more prominent position in recent years, as it has been developed such that not inconsiderable amounts of energy can be produced by ever more effective windmills.

[0004] The greater efficiency of the windmills has been achieved technologically on the basis of the development of new materials having mechanical properties which make it possible today to manufacture windmill wings with a length of up to more than 60 metres and with a weight of about 18 tons.

[0005] Within a few years it will presumably be possible to manufacture windmill wings which have a length of between 80 and 100 metres.

[0006] When so large windmill wings are to be transported from the factory to the installation site, long special vehicles have been used till now where the windmill wing has rested on a long metal connection profile which is connected between the tractive part of a vehicle and a wheeled platform at the opposite end of the vehicle.

[0007] Such a vehicle may typically have a weight of the order of 35 - 40 tons. When the weight of the windmill wing is added, the total weight is of the order of 53 - 58 tons, which gives a considerable axle load on the vehicle which transports the windmill wing.

[0008] As the distance of the connection profile to the surface of the ground is very small, it may of course be difficult to manoeuvre the vehicle round corners if road signs or differences in level, e.g., are present at the corners.

[0009] WO 03/057528 A1 discloses a vehicle for the transport of a windmill wing, where the windmill wing is suspended between a tractive and a non-tractive vehicle.

[0010] As will be known, a windmill wing is configured as a partially flat structure which may have a thickness of 3.5 - 4.5 metres at its thick place at the root of the windmill wing, and a width which may be 4.5 - 5.5 metres at its widest place.

[0011] The suspension according to the WO publication is configured such that the windmill wing may be rotated about its longitudinal axis so that it may assume a "high" as well as a "wide" position, which means that if

the windmill wing is to be moved through a viaduct having a height which is smaller than the width of the windmill wing, the windmill wing may be rotated about its longitudinal axis and thus be placed with its faces in a position such that the normal of the faces is perpendicular to the road. The windmill wing will hereby assume a position where the distance to the road surface is greatest.

[0012] Thus, in the known structure, it is the dimensions of the windmill which decide how high or how low the lowermost part of the windmill wing may be placed above a road, as the highest level means that the windmill wing must assume the widest position on the road, while the lowest level is achieved when the windmill wing stands up.

[0013] The supporting means on the non-tractive vehicle are configured such that they may be rotated about its longitudinal axis, and about its vertical axis. The supporting means are adapted to the profile of the windmill wing.

[0014] Accordingly, an object of the invention is to provide a non-tractive vehicle with effective securing means for the windmill wing, which in cooperation with a tractive vehicle is capable of adjusting the distance between the lowest part of the windmill wing and the surface of the road independently of the orientation of the windmill wing, and in a range which is greater than is possible in the known structure, and such that the distance between the lowest part of the windmill wing and the road surface may be adjusted without changing the position of the windmill wing on the vehicle.

[0015] The object of the invention is achieved by a non-tractive vehicle of the type defined in the introductory portion of claim 1, characterized in that the carrier arrangement is formed as a support which is composed of a plurality of holding profiles, said profiles being secured to the top of the carrier arrangement by a fixing frame and the holding profiles comprising an upper profile part and a lower profile part for positioning on each side of the other end of the windmill wing, and that the holding profiles are placed inside the fixing frame for fixating said holding profiles around the windmill wing, said fixing frame comprising a transverse rod and a vertical rod.

[0016] Hereby, it is possible to hold the windmill wing between the profiles and secured to the non-tractive vehicle.

[0017] It is an advantage that the holding profiles are placed inside the fixing frames, and that the fixing frames comprise a transverse rod and a vertical rod.

[0018] Hereby, it is possible to change the holding profiles and to select the profile which fits the transverse surface profile of the wing.

[0019] It is an advantage, as stated in claim 2, that the transverse rod is movable in the vertical direction and is fixable to the vertical rod.

[0020] Hereby, it is possible to place and to secure the wing between the profiles and to the non-tractive vehicle.

[0021] It is a further advantage, as stated in claim 3, that the non-tractive vehicle is connected hydraulically

and electrically to the tractive vehicle, thereby improving the overall steering of the vehicle.

[0022] The tractive vehicle is provided with a hydraulic system comprising a cylinder housing and a carrier member, which hydraulic system is arranged on a bracket provided on the tractive vehicle, and that the hydraulic system is adapted to raise or lower the windmill wing.

[0023] Hereby, it is possible during transport to adjust the height of the distance of the windmill wing from the road surface in a great range, and without it being necessary to rotate the windmill wing about its longitudinal axis, which can generally be a risky operation because of the inevitable forces that are generated during such a rotating movement.

[0024] To improve the manoeuvrability of the vehicle additionally, it is an advantage if, the hydraulic system is arranged rotatably about an axis perpendicular to the road on which the vehicle is manoeuvred.

[0025] For easy coupling of the tractive vehicle to the windmill wing it is an advantage if, the hydraulic system comprises coupling means in the form of posts for coupling to a holding frame which is mounted at one end of the windmill wing. The manufactured windmill wings may hereby rapidly be made ready for transport merely by mounting the holding frame on one end of the windmill wing.

[0026] The invention will now be explained more fully with reference to the drawing, in which

fig. 1 shows the vehicle with mounted windmill wing,

fig. 2 shows the vehicle of fig. 1 during turning,

fig. 3 shows the tractive vehicle where the windmill wing has just been mounted,

fig. 4 shows the tractive vehicle of fig. 3, but with raised windmill wing made ready for transport,

fig. 5 shows the root end of a windmill wing with mounted holding frame, while

fig. 6 shows the non-tractive vehicle with mounted windmill wing fixed in holding profiles.

[0027] In figs. 1 and 2, the numeral 1 generally designates a vehicle which consists of a tractive vehicle 3 and a non-tractive vehicle 5. A windmill wing 2 is suspended between the tractive vehicle 3 and the non-tractive vehicle 5, as will be explained below. As will be seen, the tractive vehicle 3 and the non-tractive vehicle 5 are connected with each other only via the windmill wing 2 and hydraulic/electrical connections, which are shown at 6.

[0028] In fig. 1, the vehicle is shown on a straight stretch of road, while in fig. 2 it is shown during turning, and, as will be seen, the windmill wing 2 passes over a sign 7.

[0029] With reference now to fig. 3 and fig. 4, it will be

explained how the windmill wing is secured to the tractive vehicle.

[0030] The tractive vehicle rotatably mounts a hydraulic system which is formed by a cylinder housing 4 in which a piston on a piston rod 11 may be moved in and out. The piston rod is secured to a pivot 10 on a bracket 21 which is fixed between two posts 12, while the cylinder housing 4 is secured to a pivot 14 on a bracket 18 which is in turn connected with a carrier member 15.

[0031] Via a bracket 19, the carrier member 15 is secured at its one end rotatably about a pivot 8 on a bracket 20, resting on a ball turntable on the tractive vehicle. The opposite end of the carrier member 15 is connected with a pivot 9 on a holding part 22 which is arranged in extension of the posts 12.

[0032] At the bottom, the two posts 12 are inserted into the holding parts 23, 24 on a holding frame 13 which is secured to the windmill wing 2.

[0033] The hydraulic system operates in the following manner:

When pressure is supplied to the cylinder housing 4 from the position shown in fig. 3, the holding frame 13 with the windmill wing 2 will be pulled upwards to the position shown in fig. 4, as the carrier member prevents the frame from being moved rearwards during the travel of the piston rod out of the cylinder housing 4. As will be seen, the angle between the carrier frame 15 and the cylinder housing 4 has become more acute.

[0034] When the windmill wing 2 on the frame 13 is to be lowered, the process is repeated in the reverse order.

[0035] Fig. 5 shows the windmill wing 2 with mounted frame 13 and the holding parts 23, 24 for receiving the posts 12 on the hydraulic system. As will be appreciated, it is relatively easy to make a windmill wing ready for transport, since just the bracket 13 is to be mounted on the windmill wing.

[0036] With reference now to fig. 6, it will be explained how the non-tractive vehicle 5 is constructed. A carrier arrangement 26 is secured on a rotatable part 25 on a platform 28, said carrier arrangement 26 being in the form of a support composed of a plurality of holding profiles (31) which are terminated at the top by fixing frames 27, which may be fixed around the rear end of the windmill wing, in that upper transverse rods 29 may be moved in a vertical direction and be fixed in vertical rods 30.

[0037] As will be seen in fig. 6, the holding profiles (31) comprise an upper profile part (32) and a lower profile part (33), having a surface profile which fits the surface profile of the windmill wing (2).

[0038] As will be seen in fig. 6, the windmill wing is safely secured to the vehicle by the transverse rod (29) which is fixed in the vertical rod (30). To release the wing, it is obvious that the fixation between the rods (29,30) has to be unfixed and the transverse rod (29) removed in a vertical direction.

[0039] With the fixing frames (27) open, it is obvious that the wings may be removed and replaced by another wing. If the wing has another surface profile, the holding profiles may easily be replaced by holding profiles which fit the new wing profile.

Claims

1. A non-tractive vehicle (5) for the transport of a long windmill wing (2), said non-tractive vehicle being a part of a vehicle (1) composed of a tractive vehicle (3) equipped with a hydraulic system to which one end of the windmill wing is secured, and a non-tractive vehicle to which the other end of the windmill wing is secured, said non-tractive vehicle comprising a platform (28) on which a rotatable part (25) is arranged with a carrier arrangement (26) secured on the top, **characterized in that** the carrier arrangement (26) is formed as a support which is composed of a plurality of holding profiles (31), said profiles being secured to the top of the carrier arrangement by a fixing frame (27) and the holding profiles (31) comprising an upper profile part (32) and a lower profile part (33) for positioning on each side of the other end of the windmill wing and that the holding profiles are placed inside the fixing frame (27), for fixating said holding profiles around the windmill wing, said fixing frame comprising a transverse rod (29) and a vertical rod (30) and the transverse rod (29) is movable in the vertical direction and is fixable to the vertical rod (30).
2. A non-tractive vehicle according to claims 1, **characterized in that** the non-tractive vehicle is connected hydraulically and electrically to the tractive vehicle, thereby improving the overall steering of the vehicle.

Patentansprüche

1. Nicht angetriebenes Fahrzeug (5) für den Transport eines langen Windmühlenflügels (2), welches nicht angetriebene Fahrzeug ein Teil eines Fahrzeugs (1) ist, bestehend aus einem mit einem Hydrauliksystem versehenen Zugfahrzeug (3), an dem das eine Ende des Windmühlenflügels befestigt ist, und einem nicht angetriebenen Fahrzeug, an dem das andere Ende des Windmühlenflügels befestigt ist, welches nicht angetriebene Fahrzeug eine Plattform (28) umfasst, an der ein rotierbarer Teil (25) mit einer an der Spitze befestigten Trägeranordnung (26) angebracht ist, **dadurch gekennzeichnet, dass** die Trägeranordnung (26) als eine aus einer Vielzahl von Halteprofilen (31) bestehende Stütze ausgebildet ist, welche Profile durch einen Fixierungsrahmen (27) an der Spitze der Trägeranordnung befestigt sind, und die

Halteprofile (31) einen oberen Profiltteil (32) und einen unteren Profiltteil (33) zur Positionierung an jeder Seite des anderen Endes des Windmühlenflügels umfassen, und dass die Halteprofile im Inneren des Fixierungsrahmens (27) zum Fixieren der Halteprofile um den Windmühlenflügel angebracht sind, welcher Fixierungsrahmen eine Querstange (29) und eine Vertikalstange (30) umfasst, und die Querstange (29) in der vertikalen Richtung bewegbar ist und an der Vertikalstange (30) fixierbar ist.

2. Nicht angetriebenes Fahrzeug nach Anspruch 1, **dadurch gekennzeichnet, dass** das nicht angetriebene Fahrzeug hydraulisch und elektrisch mit dem Zugfahrzeug verbunden ist, wobei sich die Gesamtsteuerung des Fahrzeugs verbessert.

Revendications

1. Véhicule non propulsé (5) pour le transport d'une longue pale d'éolienne (2), véhicule non propulsé qui fait partie d'un véhicule (1) composé d'un véhicule propulsé (3) pourvu d'un système hydraulique auquel l'une extrémité de la pale d'éolienne est fixée, et d'un véhicule non propulsé auquel l'autre extrémité de la pale d'éolienne est fixée, véhicule non propulsé qui comprend une plateforme (28) sur laquelle est arrangée une partie rotative (25) avec un dispositif de support (26) fixé à la partie supérieure, **caractérisé en ce que** le dispositif de support (26) est agencé comme un support composé d'une pluralité de profils de maintien (31), profils qui sont fixés à la partie supérieure du dispositif de support par un cadre de fixation (27) et les profils de maintien (31) comprenant une partie supérieure de profil (32) et une partie inférieure de profil (33) à positionner sur chaque côté de l'autre extrémité de la pale d'éolienne, et **en ce que** les profils de maintien sont arrangés à l'intérieur du cadre de fixation (27) pour fixer les profils de maintien autour de la pale d'éolienne, cadre de fixation qui comprend une tige transversale (29) et une tige verticale (30), et la tige transversale (29) peut se déplacer dans la direction verticale et peut être fixée à la tige verticale (30).
2. Véhicule non propulsé selon la revendication 1, **caractérisé en ce que** le véhicule non propulsé est relié de manière hydraulique et électrique au véhicule propulsé, ainsi améliorant la conduite générale du véhicule.

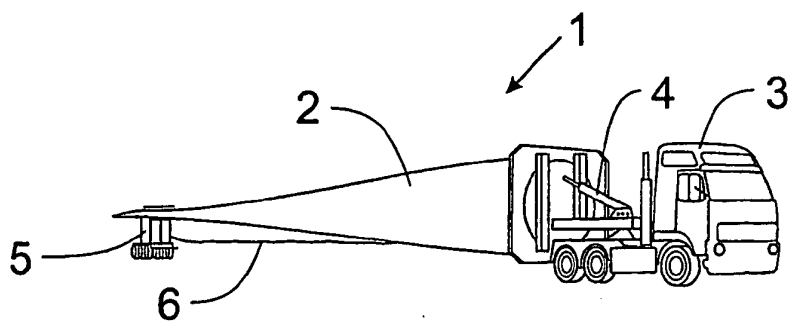


Fig. 1

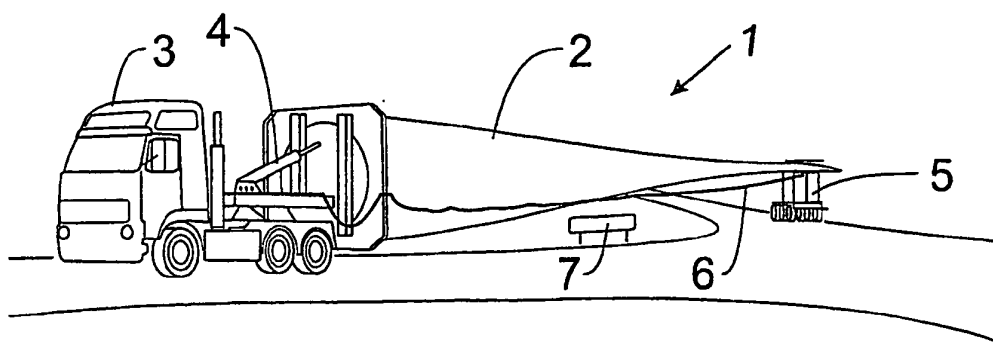
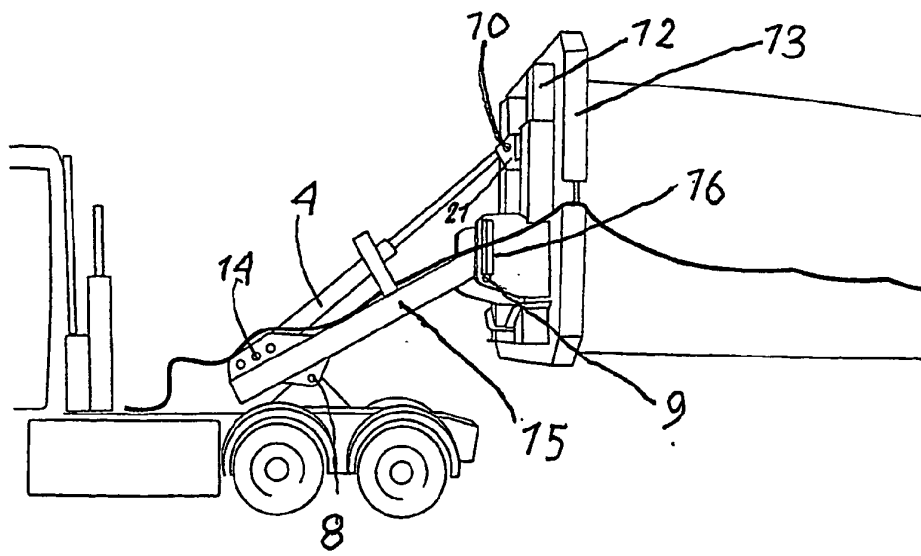
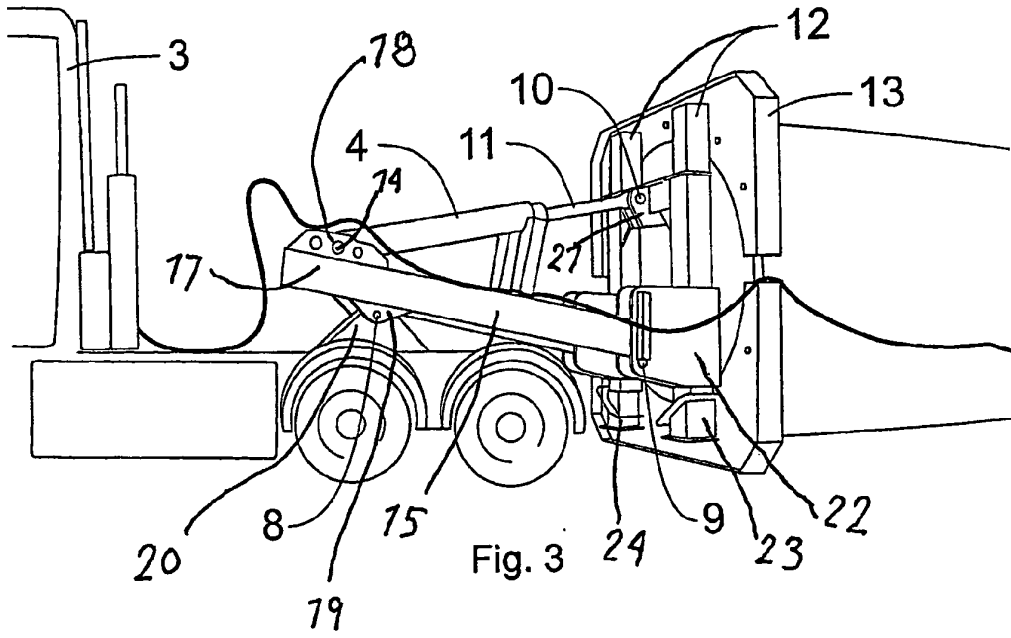


Fig. 2



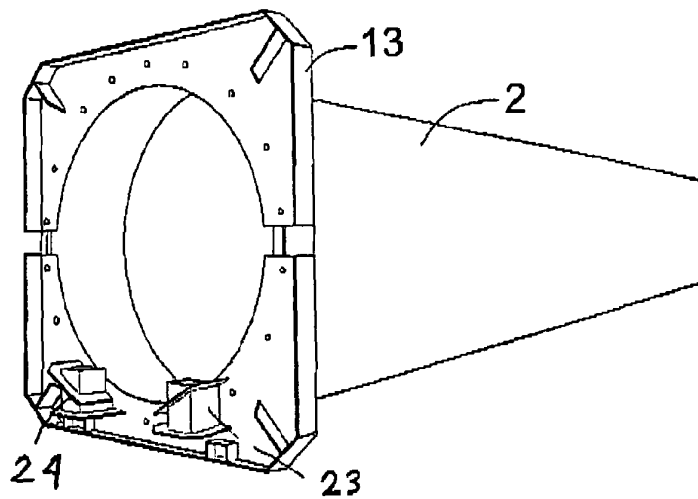


Fig. 5

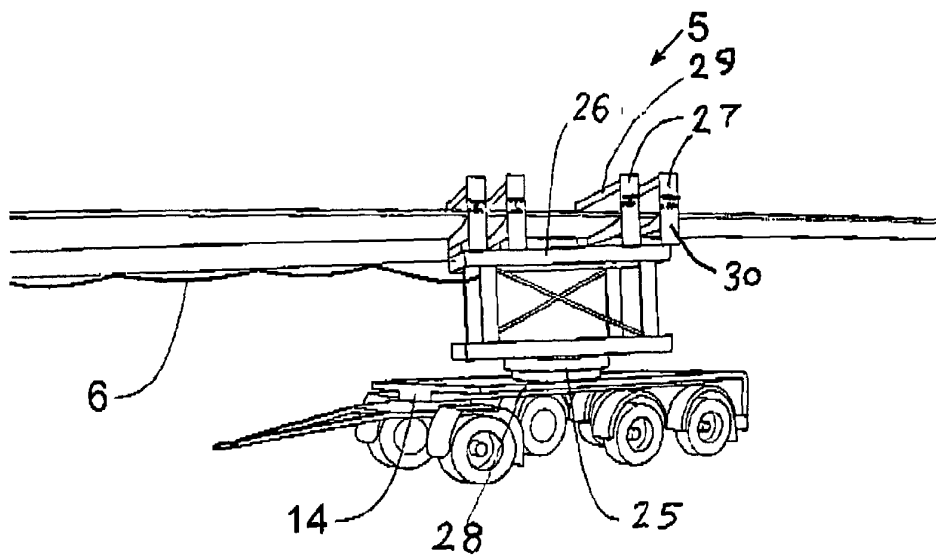


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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