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(54) **Title:** A FLEXIBLE TORQUE TRANSMITTING MEANS FOR WIND TURBINE

(57) **Abstract:** The present invention relates to a flexible mechanical power/torque transmitting means for wind turbine. The flexible torque transmitting means allows torque as input at one member of turbine and transfer's to another member of turbine. By considering rotor assembly as one member of the wind turbine, it acts as torque transmitting member during generation mode and torque receiving member during motoring mode. This configuration of flexible torque transmitting means eliminates stress on both members, short coming of rigid connecting member, shifts centre of gravity of turbine to a lower point, structurally isolate the generators, transmit torque alone flexible means from rotor assembly to driving member while power generation, reduce stress and fatigue. The torque transmitting member can be connected with rotor of generator or driving means of plurality of generator or combination thereof.



FIELD OF THE INVENTION

The invention relates to a field of mechanical power transmission system through a flexible member more particularly to a flexible torque transmitting means for wind turbine.

5 BACKGROUND OF THE INVENTION

Wind turbines are used for generation of renewable energy without harming environment. Vertical axis wind turbines (VAWTs) are wind turbines that rotate about a vertical axis and perpendicular to wind direction. VAWTs have one or more aerofoil blades that are mounted for rotation about vertical axis which causes rotor to rotate and generate electrical energy. Vertical axis wind turbines operate with
10 wind from any direction.

Rotor creates torque and transfers to gearbox with the help of low speed shaft by using fast speed shaft torque are transmitted from gearbox to generator. Generator converts mechanical energy into electricity. The connection between transmitting member and static member is rigid structure which
15 meets much mechanical impacts.

Generally in vertical axis wind turbine, the connection between transmitting/connecting member and receiving member always in rigid structure. But, the rigid structure meets much mechanical impacts such as bending stress, etc... during both generation mode and motoring mode.
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Due to rigid structure of connecting member/transmitting member, the generator assembly need to provide near the rotor assembly, so the system need to design within some structural limitations. So, there is a need for a system which needs to remove above constrains.

25 The proposed invention generates electrical power by capturing aerodynamic force and transferring mechanical force to generator using flexible member. So, the system eliminates above said drawback. Further, advantage of the proposed invention is explained in following lines.

30 OBJECT OF THE INVENTION:

The object of the invention is to eliminate stress particularly bending stress on both transmitting member side and receiving member side.

Another object of the invention is to eliminate the impact due to phase difference between transmitting
35 member and receiving member during motoring mode's and generation mode's initial condition.

Yet another object of the invention is to eliminate a short coming of rigid connecting member.

Yet another object of the invention is to shift the centre of gravity of the turbine to a lower point.
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Yet another object of the invention is to isolate the generators from the rotor by moving the generator
assembly nearby bottom side for obtaining turbine dynamic/static stability and protecting from sudden
change in torque due to wind gusts.

45 Yet another object of the invention is to provide an option to adjust the distance between rotor and
generator assembly by simply increase or decrease the length of the flexible means.

Yet another object of the invention is to generate power even the centre rotating axis of the second
rotating member slightly moved condition.
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Yet another objective of the invention is second rotating means can be permanent magnet/generator.

Yet another objective of the present invention flexible means can be made up of any material like
polymer composition or alloy of plurality of metals or combination of thereof.
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Yet another object of the present invention is to adapt flexible torque transmitting configuration in any
form of generator assembly by directly or indirectly rotating the rotor assembly of generator for electrical
power generation.

60 Further object of the invention is to transmit torque alone through flexible means from first rotating
member.

SUMMARY OF THE INVENTION

The present invention relates to a flexible mechanical power/torque transmitting means for wind turbine.
65 The flexible torque transmitting means allows torque to be input at one member of the turbine and
transferred to another member of the turbine. If we consider the rotor assembly as a one of the member

of the wind turbine and it can be act as a torque transmitting member during generation mode and the same can be a torque receiving member during motoring mode.

70 Generation mode: Turbine taps wind energy and drives the generators for power generation. Rotor assembly acts as torque transmitting member during generation mode.

Motoring mode : The generators initially drive the turbine until reach generation mode. Rotor assembly acts as torque receiving member during motoring mode.

75 The above configuration of the flexible torque transmitting means eliminates stress on both members, eliminates a short coming of rigid connecting member, shifts the centre of gravity of the turbine to a lower point, structurally isolate the generators from the rotor for obtaining turbine dynamic/static stability, transmit torque alone flexible means from rotor assembly to driving member while power
80 generation, reduce stress and fatigue induced due to phase difference between rotor and driving member during motoring mode's and generation mode's initial condition. The flexible torque transmitting means is provided between first transmitting member and second transmitting member. The first rotating member can be part of rotor assembly. Second rotating member can be a rotor of generator or main driving means of plurality of generators driven means or combination of thereof.

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BRIEF DESCRIPTION OF THE DRAWINGS:

S.NO	PART NAME	PART NO
1.	First rotating member/rotor assembly	1
2.	Second rotating member	2
3.	Torque /flexible torque transmitting means	3
4.	Rolling means/wheel	4
5.	Generator assembly	5
6.	Tower	6
7.	Stator of generator assembly	7
8.	Bearing	8

90 Fig 1&Fig 2 illustrates the phase difference between generator rotor start up while generation mode and motoring mode.

Fig 3, 3a 3b illustrates the embodiment of the invention, which shows the torque transmitting means configuration between first rotating member (1) and second rotating member (2).

95 Fig 4 illustrates the embodiment of the invention, which shows the torque transmitting means configuration within the rotor of generator assembly.

The above drawing illustrates the details has been given and will be provided with respect to certain specific embodiments, it is to be understood that the scope of the disclosure should not be limited to such embodiments but that the same are provided simply for enablement and best mode purposes.
100 The breadth and spirit of the present disclosure is broader than the embodiments specifically disclosed and encompassed within the claims eventually appended hereto.

DETAILED DESCRIPTION OF THE INVENTION:

One of the embodiment of the invention discloses about a wind turbine with flexible torque transmitting
105 (3) system for disabling stress (bending stress) and impact of the phase difference between rotating members (1 & 2), and obtaining high static and dynamic stability by isolate second rotating member (2) by means of flexible torque transmitting means (3). The wind turbine and its torque transmitting (3) system comprises of a tower assembly (6) and a stem assembly mounted on the tower assembly. Rotor assembly includes plurality of bearings configured to enable rotor rotation along with a first rotating
110 member. Characterises elements are second rotating member (2) and plurality of flexible torque transmitting means. Each flexible torque transmitting means comprises of at least one connecting means at both ends a configured to connect with the first and second rotating member (1 & 2). Each flexible means circumferentially arranged around the first and second rotating member (1 & 2). Each flexible means circumferentially arranged around the first and second rotating member and enable
115 connection between them thereby transferring mechanical power from the first rotating member to the second rotating member and second rotating member to first rotating member vice versa during generation mode motoring mode respectively.

Another embodiment of the invention discloses about a wind turbine with flexible torque transmitting
120 system (3) for disabling stress (bending stress) and impact of phase difference between rotating members (1&2), and obtaining high static and dynamic stability by isolate second rotating member (2) by means of flexible torque transmitting means (3), the said wind turbine and its torque transmitting system comprises of a tower assembly (6), a first rotating member (1), a second rotating member(2), plurality of generator attached with the tower assembly, each generator connected with at least one

125 rolling means (4), each rolling means (4) engaged with the second rotating member (2). Further plurality
of flexible torque transmitting means (3) comprises of at least one connecting means at both ends
configured to connect with the first and second rotating member (1&2), each said connecting means
connected with respect provision of first and second rotating member. Each flexible means
circumferentially (3) arranged around the first and second rotating member and enable connection
130 between them thereby transferring mechanical power from the first rotating member (1) to plurality of
rolling means (4) through the second rotating member (2) and the flexible torque transmitting means (3)
during generation mode and similarly transfer power from the plurality of rolling means (4) to first
rotating member (1) through second rotating member (2) and the flexible means (3) during motoring
mode. Wherein, when the turbine running at motoring mode, the first rotating member initiate rotation
135 followed by second rotating member's rotation where the flexible means (3) eliminates the impact due
to phase different and similarly eliminates the impact at generation mode also.

Yet another embodiment of the invention discloses about adaptability of second rotating member. The
flexible torque transmitting means is provided between first rotating member and second rotating
140 member. The first rotating member can be a part of rotor assembly. According to one aspect, the
second rotating member can be a rotor of permanent magnet generator or main driving means of
plurality of generators driven means or combination of thereof. In other aspect, the second rotating
member engaged with plurality of rollers of generators for transferring mechanical power to generator.
Another aspect, the second rotating member engaged with plurality of rollers via belt drive for
145 transferring mechanical power to generator. Further aspects, the second rotating member can be a
gear drive for transferring power to gear box of generators. Main function of flexible torque transmitting
means is to transfer torque without bending stress and phase difference.

Yet another embodiment of the invention discloses about flexible means, it can be a rope made by high
150 durability polymer composition or alloy of plurality of metals or combination thereof, transmitting means
may transfer the torque through tensile force between first rotating member (1) to second rotating
member (2) and vice versa.

Yet another embodiment of the invention discloses about various aspect of the said second rotating
155 member (2) can be connected with the said generator (7) via geared drive or belt drive or gearless drive
or direct drive or combination thereof.

Yet another embodiment of the invention discloses about the said second rotating member (2) can be moved between plurality of pair of/combinations of roller arrangements of plurality of generators for transferring mechanical power. (refer figure 3a&3b).

Yet further embodiment of the invention discloses about the generator which can either be a motor of a permanently excited variable reluctance motor or PMLDC or any suitable motor or combination thereof.

In one aspect the connection of the present invention, the said second rotating member isolated by means of flexible means arrangement. This configuration enables multistage installation process, which means the installation process can be split into multi stage. Instead of mounting rotor assembly along with generator, this configuration provide flexibility to install turbine assembly first and install rotor assembly, then connection can be enabled between first and second rotating member. This is one option, in this similar way installation progress can be modified.

Yet another embodiment of the invention discloses about possibilities of adapting flexible means in various power transmission area, it can be used in any type of power transmission wherever stress (bending stress) and impact of the phase difference elimination needed,

Yet another embodiment of the invention discloses about first rotating member is a rotor assembly of the turbine. The first rotating member can be attached with bottom side or any suitable position of rotor assembly either rigidly or detachably.

Yet another embodiment of the invention discloses about more than one second rotating members (2) in wind turbine, each second rotating member (2) can be connected with the first rotating member (1) through more than one flexible torque transmitting means (3). Second rotating member (2) can be a disc or track or gear or plate or any suitable means to rotate rolling means (4). Wherein the said flexible torque transmitting means may transfer the torque through tensile force between first rotating member (1) to second rotating member (2) and vice versa.

Yet another embodiment of the invention discloses about flexible torque transmitting means, it can be connected with rotor of generator or main driving means of plurality of generator or combination thereof.

Yet another embodiment of the invention discloses about the second rotating member, the second rotating member can be a rotor of generator or main driving means of plurality of generator or combination thereof.

195 Further embodiment of the invention discloses about a flexible torque transmitting means (3) and it can be a rope made by high durability polymer composition or alloy of plurality of metals or combination thereof.

ADVANTAGE OF THE INVENTION:

- 200 1. The flexible torque transmitting means eliminate stress on both rotor side and driving member side.
2. The flexible torque transmitting means eliminate impact of phase difference between rotor and driving member during motoring mode's and generation mode's initial condition.
- 205 3. The flexible means configuration can be adapted to any type of generators.
4. If the system use rigid connecting member instead of proposed invention's flexible means that the system has to meet many mechanical impacts like buckling etc.
- 210 5. The flexible torque transmitting means achieve high static and dynamic stability by moving the centre of gravity at lower point because the flexible connection provide many options for adjustment. Further, the flexible torque transmitting means structurally isolate the generators from the rotor for obtaining turbine dynamic/static stability.
- 215 6. The system generates power even the centre rotating axis of the second rotating member slightly moved condition.
- 220 7. The system transmits torque alone through flexible means from rotor assembly to driving member while power generation.

So that the manner in which the features, advantages and objects of the invention, as well as others which will become apparent, may be understood in more detail, more particular description

225 of the invention briefly summarized above may be had by reference to the embodiment thereof which is illustrated in the appended drawings, which form a part of this specification. It is to be noted, however, that the drawing illustrate only a preferred embodiment of the invention and is therefore not to be considered limiting of the invention's scope as it may admit to other equally effective embodiments.

230 **I CLAIM**

1. A wind turbine with flexible torque transmitting system for disabling stress/bending stress and impact of phase difference between rotating members, and obtaining high static and dynamic stability by isolate second rotating member by means of flexible torque transmitting means, the said wind turbine and its torque transmitting system comprises of;

- 235 - a tower assembly,
- a stem assembly mounted on the tower assembly,
- plurality of bearing assembly enables rotor rotation along with a first rotating member,

Characterised in that

- a second rotating member,
240 - plurality of flexible means comprises of;
- at least one connecting means at both ends configured to connect with the first and second rotating member,
- each flexible means circumferentially arranged around the first and second rotating member and enable connection between them thereby transferring mechanical power from the first rotating member to the second rotating member and second rotating member to first rotating member vice versa during
245 generation mode motoring mode respectively.

2. The wind turbine as claimed in claim 1, wherein the said second rotating member can be a rotor of generator or main driving means of plurality of generator driven means or combination thereof.

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3. The wind turbine as claimed in claim 1, wherein the said first rotating member can be a rigid or detachable part of rotor assembly.

4. The wind turbine as claimed in claim 1, wherein the said flexible means can be a rope made by high
255 durability polymer composition or alloy of plurality of metals or combination thereof.

5. The wind turbine as claimed in claim 1, wherein the said flexible torque transmitting means may transfer the torque through tensile force between first rotating member to second rotating member and
260 vice versa.

6. The wind turbine as claimed in claim 1, wherein the said second rotating member can be connected with the said generator via geared drive or belt drive or gearless drive or direct drive or combination thereof.

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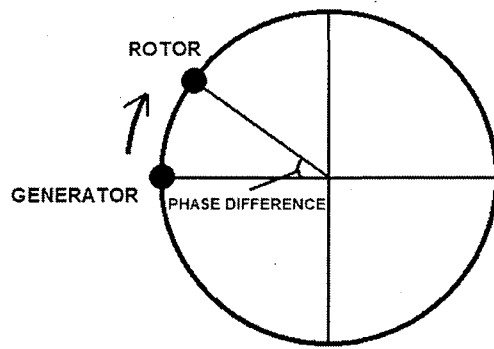
7. The wind turbine as claimed in claim 1, wherein the said second rotating member can be moved between plurality of pair of/combinations of roller arrangements of plurality of generators for transferring mechanical power.

270 8. The wind turbine as claimed in claim 1, wherein the said flexible means can be used in any type of power transmission wherever stress/bending stress and impact of phase difference elimination needed.

9. The wind turbine as claimed in claim 1, wherein the said isolated second rotating member by means of flexible means arrangement configured to enable multistage installation process thereby reducing
275 lifting assembly's weights.

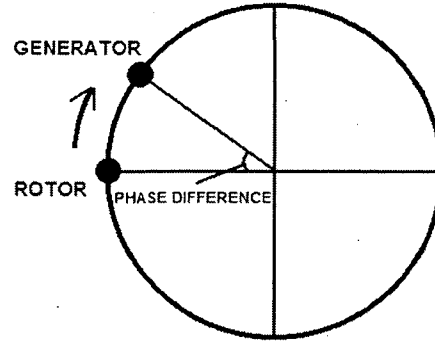
10. The wind turbine as claimed in claim 1 and 2, wherein the generator can be a motor of a permanently excited variable reluctance motor or PMBLDC or any suitable motor or combination thereof.

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GENERATING MODE

FIG 1



MOTRING MODE

FIG 2

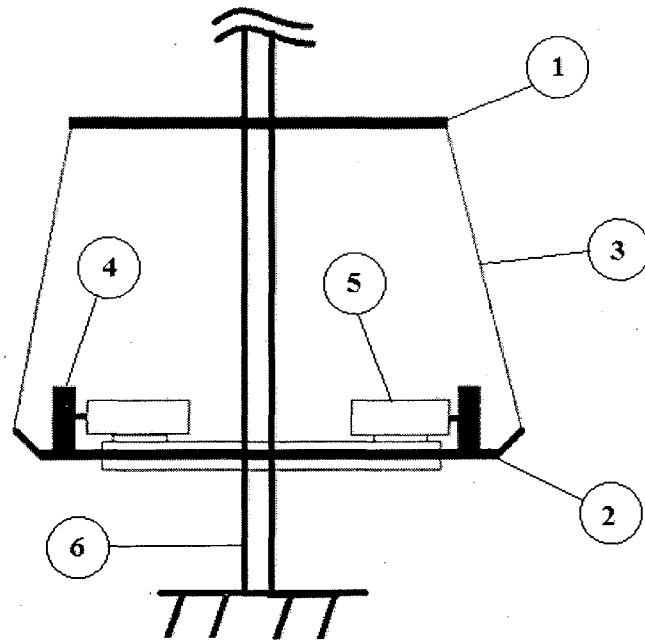


Fig 3

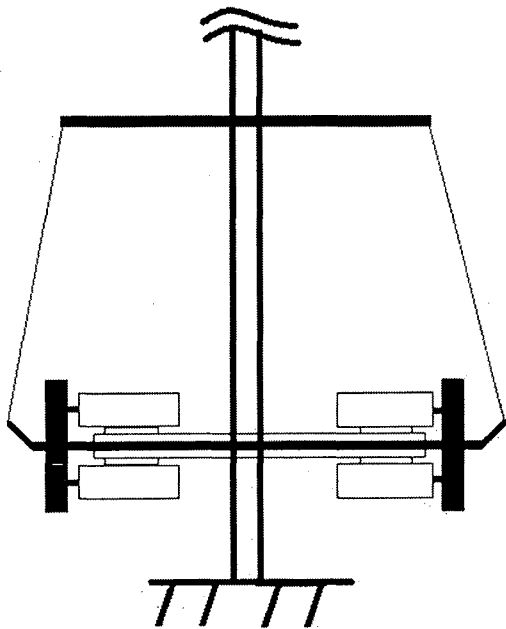


Fig 3a

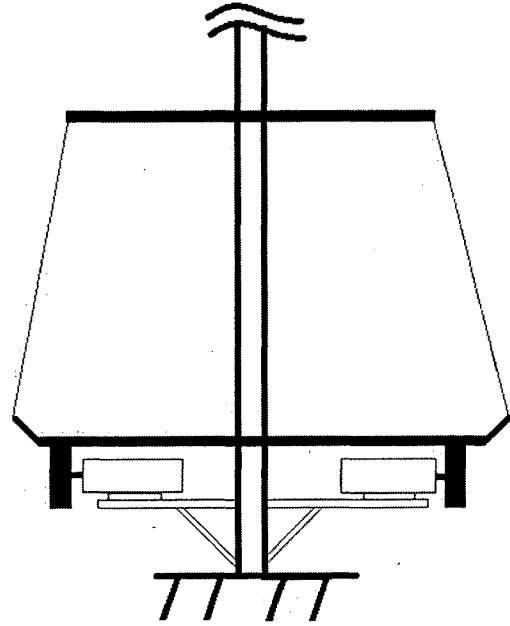


Fig 3b

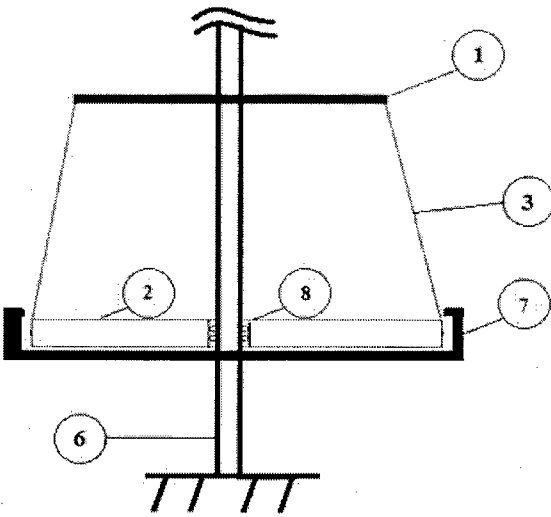


Fig 4