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Generation of Electricity for Charging Moving Vehicles Using Gearless Power Transmission

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***Abstract*— Gearless power transmission mechanism to transmit power from input to output shafts by means of sliding links that form revolute pair with the hub. This mechanism is a replacement for bevel gears in low cost and low torque applications. The turbine is positioned on the roof of the car near the wind screen, where the velocity of air flowing around the vehicle is highest due to its aerodynamic nature. A portable power output, a significant amount of electrical power is restored to the batteries when the vehicle is moving.**

***Index Terms*—Gearless transmission, Orbital transmission system, Power generation, Electric car.**

1) Introduction

Power management is one of the demandable system in these days hence the usage of power is exceeding the limited amount, an alternative solution is to be found to enhance the future power and can be through any source like modification of a system, adding additives, boosters, power backup etc.

Gears are costly to manufacture but need to increase the efficiency of transmission which cannot be done using geared power transmission. Gearless transmission mechanism is capable of transmitting power at any angle without any gears being manufactured.

So here we introduced a gearless power transmission system which reduce the losses, cost and saves a lot of time and space. This transmission allows the changing in the orientation of shafts during the motion which is very interesting and fascinating about this mechanism[4].

2) Objectives

The main purpose is to generate power by means of converting the rotary motion into source of power by means of an energy converting device, which can be used in automobiles for enhancing the rate of power in absence exhausted battery charge to boost up the performance of vehicle, This mounted on a automobile body or interior which is nearby the battery circuit so that the amount of power that is produced by the air medium in turn be stored in the battery by means of energy convertor. This can be achieved by placing series of fans in the respective place where the probability of aerodynamics is higher so that rapid movement of fans provide enormous power backup battery.

Figure 1shows the basic setup of the circuit with various arrangements like battery, energy converter and battery for storage [2].

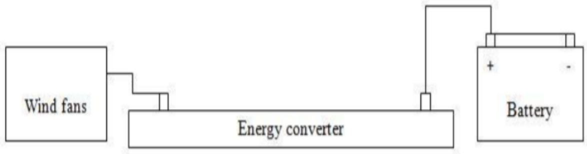


Fig. 1 : working layout [7]

3) Experimental setup

This setup is made to mount on automobiles (part were aerodynamic flow enhances) so that the device may work as effective power generator for future generations, It is found that while placing the object over the aerodynamic flow of high pressure area were the amount of air traverse increases as a result the outcome of power is also enhanced with increasing efficiency. While placing the device in between the region of hood and radiator grill position a region of high air pressure flow induces dynamic effect of power for storage [5].

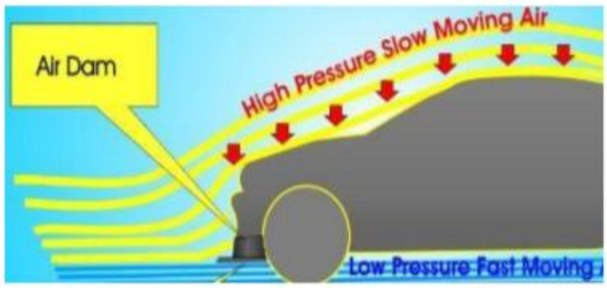


Fig. 2 : showing the application of usage[3]

In case as shown in figure 2 rate of power produced is higher which may be added advantage for batteries durability, the front portion also provides easy access for the connection with the car battery which may make the purpose simpler as shown in figure 3.

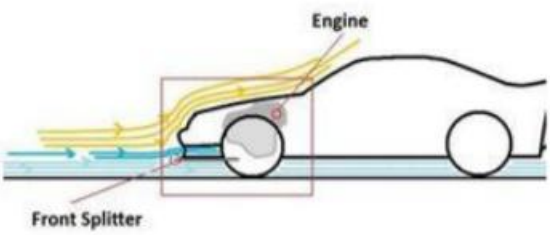


Fig. 3 : showing area of mounting.[4]

4) OBSERVATION

Following are the values are observed under the pressure applied by the compressor air to the device as follows:

Table 1 : Axial Force ,Power Of Wind And Velocity

S NO.	AXIAL FORCE (N)	POWER in wind (W)	VELOCITY(Km/hr)
1.	1.58	13.99	25
2.	2.80	27.3	35
3.	3.76	41.59	45
4.	4.82	61.36	55
5.	5.96	78.52	65

The number of revolution also estimates the amount of power produced, For 5 V = 120 RPM as measured with the help of a tachometer.

Table 2 : power developed vs efficiency .

S NO.	POWER DEVELOPED (W)	EFFICIENCY (%)
1.	0.7	3.98
2.	1.4	5.3
3.	2.5	5.89
4.	3.8	5.9
5.	4.2	6.3

5) POWER CALCULATIONS AND AERODYNAMICS

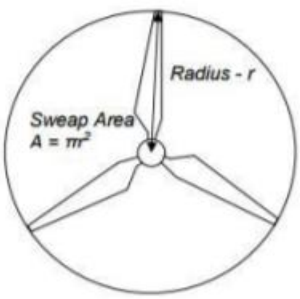


Fig. 4: showing the model fan

In case finding power produced as follows:

Blade Length, L = 0.045 m

Assumed wind speed, v = 12 m/sec

Air density, ρ = 1.23 kg/m3

Power Coefficient, Cp = 0.4

Hence the area of the blade is 0.0064 m2.

Power can be calculated as follows:

Power Produced
= 0.5 × ρAv3Cp
= 0.5 × 1.23 × 0.0064 × 123 × 0.4
= 2.72 Mw

6) MATERIAL SELECTION

Sr no	PART NAME	MATERIAL NAME	TENSILE STRESS	SHEAR STRESS	BHN	QUANTITY
01	SHAFT	MS – 45C8	60MPa	40MPa	220	2
02	ELBOW ROD	SS-X6CR17	60MPa	40MPa	230	4
03	FRAME	MS – 45C8	60MPa	40MPa	220	1
04	HUB	MS – 45C8	60MPa	40MPa	220	2
05	BEARING		-	-	-	4
06	MOTOR	-	-	-	-	1
07	PULLEY	-	-	-	-	1

7) DESIGN CALCULATIONS

Testing of the machine and for functioning:

Power of motor = ¼ H.P = 746 x 0.25 = 186.5 N- m /s
RPM of motor N = 1440 rpm
Power of motor P =186.5 watt.

P = 2 πN TP /60 --------- (Eq.1)

Where, N = Rpm of motor = 1440

T = Torque transmitted
From eq.1 we get,
186.5 = 2π×140×T/60
T = 1.23 N-m
T = 1238 N-mm.

6.1 DESIGNING OF SHAFT

Following stresses are normally adopted in shaft design:

Max tensile stress = 60 N/mm2
Max shear stress = 40 N/mm2
Considering 25 % overload

T max = 1238 x 1.25
= 1.525 x 10 3 N-mm

The shaft is subject to pure torsional stress

We know , T= 3. 14/16 x fs x d3 15250
= 3. 14/ 16 x 70x d3
D =10.20mm

Taking factor of safety = 2 D = 2 x 10 = 20mm
A shaft diameter is 20mm and length is 230mm

$M = 2151.11N \times 230mm = 494755.3\ Nmm$

Bending stress for shaft
$\sigma = 32M\pi \times d3 = 186.649 N/mm^2$

Tensional shear stress of shaft
$Mt = 60 \times 106kw2\pi n$
Where, Kw=7.5,

n=120
Mt=596831.03Nmm

$\tau = 16Mt/\pi d^3$
$= 16 \times 596831.03/\pi \times 203$
$= 112.57 N/mm^2$

6.2 DESIGNING OF HUB

Consider a hub of internal diameter is 32mm and
Outer diameter = 92mm,
Length = 82mm.

$p = 100 \times 9.81 = 981$

$\sigma b = pDi2\ /D02 - Di2$
$= 980 \times 322\ /922 - 322$
$= 135.01 N/mm$

6.3 DESIGNING OF EL-BOW ROD

As we know that, same torque is transmitted to bent link shaft

So torque on each shaft = T /3
= 15250 /3
= 5083 N mm

T = (3. 14/16) x fs x d3
= (3. 14/ 16) x 70 x d3

D = 7.17 mm.

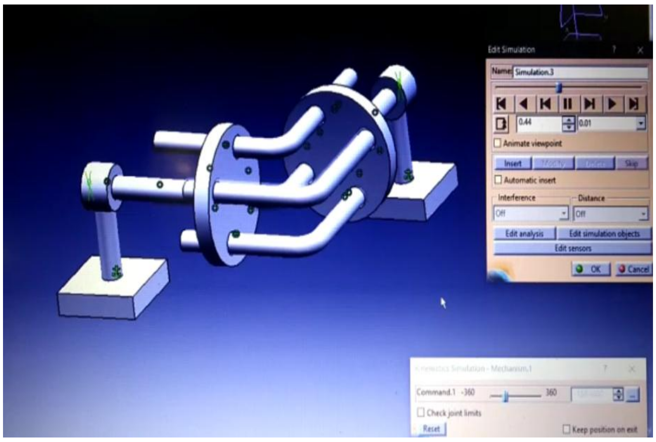
Take approximately D=8mm.

Diameter of rod is 8mm and
Length is 300mm

$Z = 0.78R3$
$= 0.78 \times 43 = 49.92\ kg/mm^2$

Bending stress of rod
$\sigma = PL/4Z$
$= 186.5 \times 300/4 \times 49.92$
$= 280.19\ N/mm^2$

8) SIMULATION IN CATIA



9) WORKING

The Gearless power transmission or orbital transmission system is a device used for transmitting motion at any fixed angle between the driving and driven shaft. The synthesis of the mechanism would reveal that it comprises of a number of links would be in between 3 to 8, the more the number of links the smoother is the operation.

These links slide inside the hub thus formatting a sliding pair. Our mechanism has 4 such sliding pairs. These cylinders are placed in a Hollow pipe and are fastened at 120 degree to each other. This whole assembly is mounted on a wooden table. The working of the mechanism is understood by the fig 5.

Motion is transmitted from driving to the driven shaft through the roads which are bent to conform to the angles between the shafts. These roads are located at in the holes equally spaced around a circle and they are free to slide in & out as the shaft revolves. This type of drive is especially suitable where quite operation at high speed is essential but only recommended for high duty.

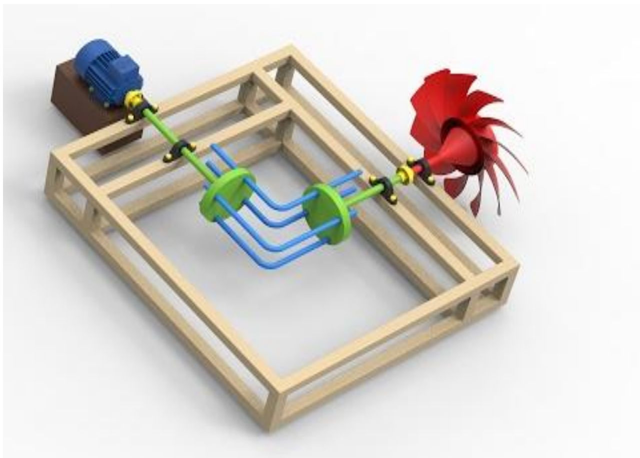


Fig. 5 working model [3]

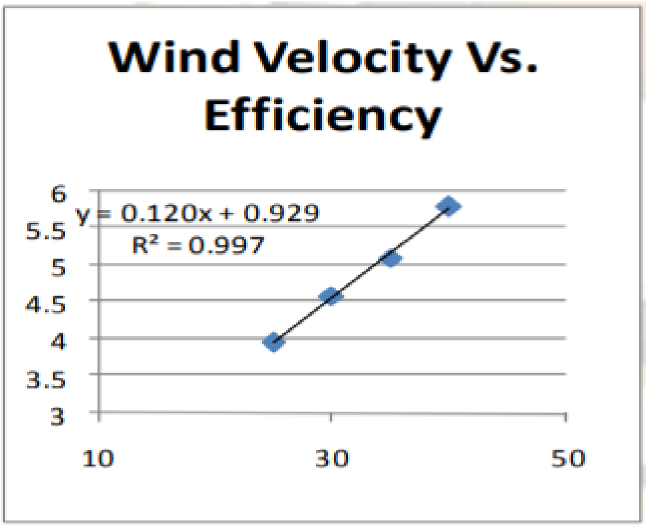
Although this transmission is an old one many mechanics are skeptical about its operation, however it is not only practicable but has proved satisfactory for various applications when the drive is for shafts which are permanently located at given angle. Although this illustration shows a right angle transmission. This drive can be applied also to shafts located at intermediate angle between (0 and 90 degree) respectively.

In the design of this transmission, it is essential to have the holes for a given rod located accurately in the same holes must be equally spaced in radial and circumferential directions, should be parallel to each rod should be bent to at angle at which the shaft are to be located. If the holes drilled in the ends of the shafts have closed ends, there may be a small vent at the bottom of each rod hole for the escape of air compressed by the pumping action of the rods.

10) Results

The final design thus obtained is capable of transmitting torque and power at varied angles depending on the angular limitation of the hooks joint. With further research and advanced analysis in the design wide-ranging applications of the drive can be discovered.

The model works correctly as per the design. With the help of this system, we can efficiently reduce the cost in power transmission and further advancement in this technology can be made.



wind velocity vs efficiency graph [5]

11) Conclusion

Hence the following power generation technique can be used in automobiles and various zones of parts were air is the source of power generation. When the device is placed in a region of aerodynamics flow the results obtained favours the battery life time in increasing the durability.

There are number of sources for generation of power but in the recent years wind energy shown its potential as the clean source of energy and contributing to the high energy demands of the world. Vertical axis wind turbine by using gearless generator is the best option for the area which are under load shading The vertical axis wind turbine using gearless technology is a small power generating unit with the help of free source of wind energy. It is designed under consideration of household use. The analysis results of the wind turbine governs that the design is under safe limit.

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REFERENCES

[1] S.Naveen Kumaar, M.Anbarasan, Power Generation through Grab Handles, IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 3, March 2015.

[2] S. Clarke, FACT Sheet, Electricity Generation using Small wind turbines at your home or farm, September 2003.

[3] RWE npower renewable, Wind Turbine Power Calculations, The royal academy of Engineering.

[4] Mr. Kalpesh chavda, Tushar thakar, Design and fabrication of highway wind turbine, IJSRD, Vol.1 issue 10, 2013.

[5] J.G Leishmanchailenges in modelling the unsteadyaerodynamics of wind turbine.

[6] R.S. Bajpai, Rajesh Gupta, "Design of simulator for modelling of wind turbine and transfer of maximum power using buck-boost converter", Int. J. of Renewable Energy Technology, 2011 Vol.2, No.4, pp.373 – 391

[7] Gilles Notton, Ludmil Stoyanov, "Productivity of small wind turbines for various wind potentials conditions: application in Bulgaria and Corsica",

[8]. NPTEL – Mechanical – Mechatronics and Manufacturing Automation, Module 5, pp. 21-24

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