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# ALTERING WIND BELT DESIGN FOR BETTER EFFICIENCY

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**Abstract**— Harnessing energy from high and low wind with present wind belt is not so efficient. This paper deals with increasing the efficiency of the wind belt by the change of present wind belt by adjust the tension and length of the belt. Abstract must be of

**Keywords**— aerodynamic fluttering, wind-based generator, electromagnetic generator, energy harvesting Introduction.

## INTRODUCTION

This design is low cost and a small device which harness energy by the belt vibration due to wind and is used to oscillate magnets in between copper wire coils in order to create an EMF. This phenomenon is used to produce electrical energy from the wind. The amount of energy produced from the wind is proportional to the Length, Tension and Magnet size

### Energy Produced

Amount of EMF produced from the wind belt is given by

$$E=2\pi NfAB$$

Where

E= EMF produced

N=Number of turns in the coil

f= Frequency with which flutter vibrates

A= Area of the magnetic core

B=Magnetic field strength

Also

f= v/d

Where

v= velocity of the wind

d= maximum flutter distance

## DESIGN PROCEDURE

The 'Stiffness of the belt' and 'Length of the belt' are the important factor for the amount of energy produced. The tension required. Smaller belt produced more fluttering in high speed wind so longer belt is best suitable for harvesting power from low wind speeds and for high wind length of the belt should be less. Therefore, belt length can be maintained from 50cm to 100cm according to wind speed.

## DESIGN.

Designing done by keeping Efficiency in mind. Length of the belt are adjusted by rollers which can move in the frame. Coil are fixed to the rollers i.e. if the rollers are moved coils will move along with it. Rubber bush is added behind the coil so that the vibration of the belt is arrested between the coils. For adjusting belt tension screw is given at the other end of the frame to increase or decrease the tension in belt.

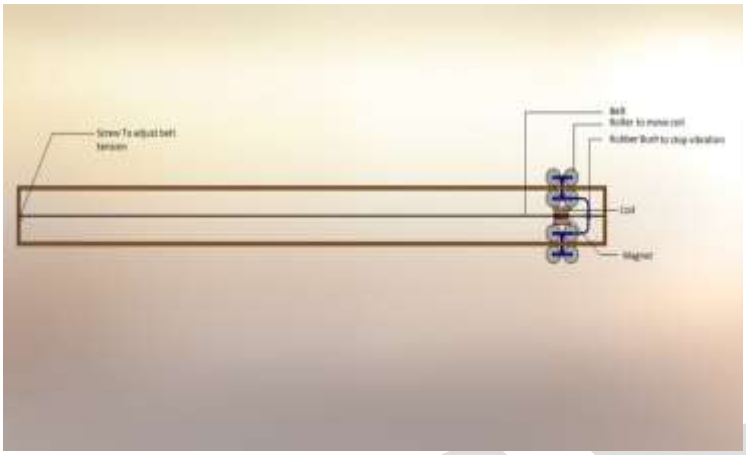


*Fig. 15 Wind belt design*

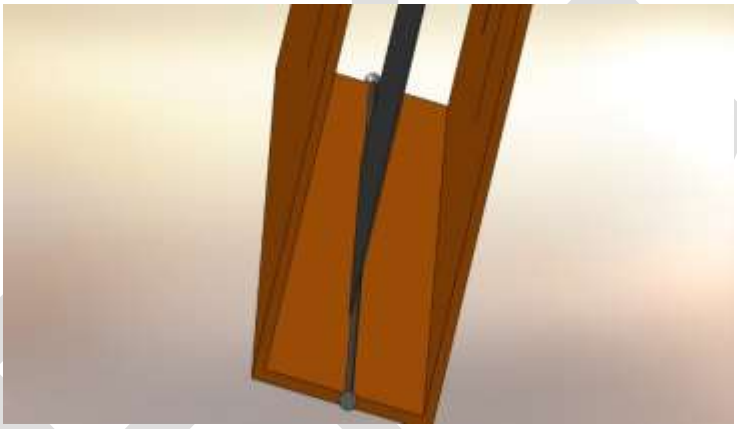

*Fig. 2 Screw to adjust Tension*

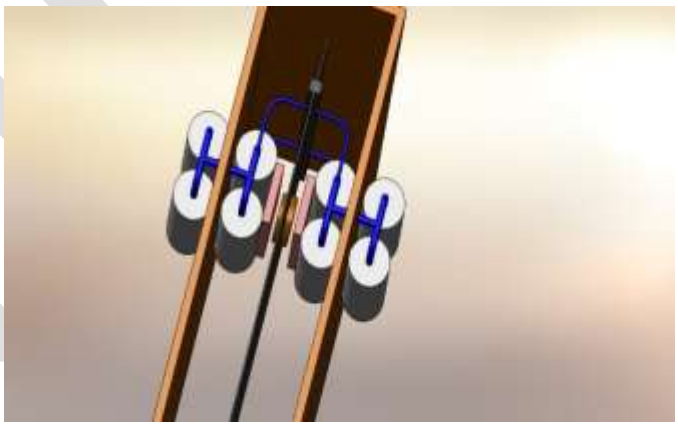

**Fig. 3 Roller, Coil, Bush Arrangement**

Assumption

Wind velocity varies from 5 m/s to 10 m/s.

With this velocity radius of the magnet is fixed as r= 2.5 cm,

d-1M, N= 50 turns, and B= 0.02 Tesla,

With reference to formula value of EMF generated varies as shown:

**Table 1 EMF for Various wind speed**

| Velocity | f/d | EMF |
|---|---|---|
| 5 | 5 | 0.123 |
| 5.25 | 5.25 | 0.129 |
| 5.5 | 5.5 | 0.136 |
| 5.75 | 5.75 | 0.142 |
| 6 | 6 | 0.148 |
| 6.25 | 6.25 | 0.154 |
| 6.5 | 6.5 | 0.160 |
| 6.75 | 6.75 | 0.166 |
| 7 | 7 | 0.173 |
| 7.25 | 7.25 | 0.179 |
| 7.5 | 7.5 | 0.185 |
| 7.75 | 7.75 | 0.191 |
| 8 | 8 | 0.197 |
| 8.25 | 8.25 | 0.203 |
| 8.5 | 8.5 | 0.210 |
| 8.75 | 8.75 | 0.216 |
| 9 | 9 | 0.222 |
| 9.25 | 9.25 | 0.228 |
| 9.5 | 9.5 | 0.234 |
| 9.75 | 9.75 | 0.240 |
| 10 | 10 | 0.246 |

By the above table it's clear that EMF produced will increase with the increase in the wind velocity.

The vibration of the strip increases with decrease in the length of the strip.

Below table shows the EMF produced by various length of the flutter at constant wind speed of 5m/s.

*Table 2 EMF for Various length*

| Length | f/d | EMF |
|---|---|---|
| 1 | 5 | 0.12325 |
| 0.95 | 5.26316 | 0.12973 |
| 0.9 | 5.55556 | 0.13694 |
| 0.85 | 5.88235 | 0.14499 |
| 0.8 | 6.25 | 0.15406 |
| 0.75 | 6.66667 | 0.16433 |
| 0.7 | 7.14286 | 0.17606 |

| | | |
|---|---|---|
| 0.65 | 7.69231 | 0.18961 |
| 0.6 | 8.33333 | 0.20541 |
| 0.5 | 10 | 0.24649 |

## CONCLUSION

The design described here can efficiently produce more EMF, This is a small scale design, and the material which are used are cheap and easily available. This can even be used in the places where the wind potential is low or high, this design can be fixed in the coastal area where continues wind supply is available.

## REFERENCES:

[1] Shawn Frayne „Windbelt generator" „Humdinger Wind Energy" Energy harvesting and storage journal 17 July 2009.

[2] Shawn Frayne Windbelt Innovation: Medium windbelt; Humdinger Wind Energy, February 12, 2010

[3] Matt Schelke ,Wind Energy with Windbelt Generator Technology Article by Matt Schelke Edited & published by Whitney Worden on Jul 23, 2010

[4] Fei Fei, Wen J. Li, "A Fluttering-to-Electrical Energy Transduction System for Consumer Electronics Applications" IEEE International Conference on Robotics and Biomimetics December 19 -23, 2009, Guilin, China

[5] J. Park, K. Kim, S. Kwon and K. H. Law, " An Aero-elastic Flutter Based Electromagnetic Energy Harvester with Wind Speed Augmenting Funnel ," The 2012 Int'l Conference on Advances in Wind and Structures (AWAS 2012). Seoul, Korea, August 26, 2012 .

[6] Shuguang Li, Jianping Yuan, Hod Lipson."Ambient wind energy harvesting using cross-flow fluttering" Journal of applied physics 109, 026104 (2011)

[7] Geoff Johnson, Lucas Hartman, Tejus Goenka"Power Generation from Aeroelastic Flutter at Low Reynolds Number"

[8] Faraz Ahmad, Shazia Shakeel, Kehkeshan Naz,"Powering-Up Charging Stations for the Hybrid Electrical Vehicles by Harvesting Wind Energy Using Modified Wind Belt System"

[9] J. A. Paradiso and T. Starner, "Energy scavenging for mobile and wireless electronics," Pervasive Computing, IEEE, vol. 4, no. 1, pp. 18-27, 2005.

[10] "Wind Turbines: Power Performance Measurements of Electricity Producing Wind Turbines," Part 1 of 12, 2005.

[11] www.humdingerwind.com

[12] www.kjmagnetics.com