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Wind Energy Operated Hacksaw

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Abstract: There are many industrial applications where round bar or square bars are required to be operated on different machines to make machine components such as Shafts, Bolts, Screws etc. This needs more and more number of pieces to be cut for mass production of those components. To achieve this goal the wind operated hacksaw machine is developed. The model implies conversion of rotary motion into the reciprocating motion for proper working of hacksaw. It is able to cut PVC bars at same time and will be helpful in many industries due its compatibility, reliability and efficiency
Keywords: Savonius Vertical axis wind turbine, hacksaw, Renewable energy

I. INTRODUCTION

In present condition many electrically operated power hacksaw machines of different companies with different specifications are available for the use in shop floor. These machines are so precise that they can cut metal bars with minimum time made up of different materials but they have one and major disadvantage that those are able to cut single piece of bar at a time. For industries to achieve the mass production, it is necessary to cut metal bars with high rate. So it is impossible to depend upon conventional single frame power hacksaw machines and need the improvement in technology and design of such machines. With the help of this multi-way power hacksaw machine the four metal bars can be cut simultaneously to get high speed cutting rate and to achieve mass production for maximum profit in related companies. As this machine overcomes all the limitations and drawbacks of conventional hacksaw machines, it is also helpful for small scale industries due to its simple working and operating conditions along with its compatibility, efficiency and affordable price.

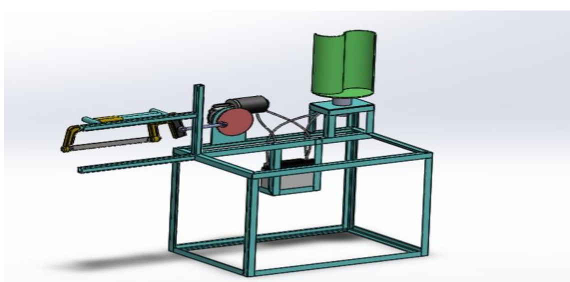
A. Project Ideation

Current scenario of industry focuses on the high production rate with less consumption of resources.
To achieve this, we need to minimize idle time and machine time per unit. The wind Operated hacksaw improves those factors by reducing time per unit to increase the production.

List of components

No.	COMPONENET	MATERIAL
1	Electric motor	-
2	Hacksaw Blade	Bimetallic
3	Hacksaw Frame	MS
4	Guide ways	MS
5	Universal joints	Alloy Steel
6	Connecting rods	MS
7	Bearings	High C-Cr steel
8	Material holding vise	MS
9	Frame	MS

B. Cad Model



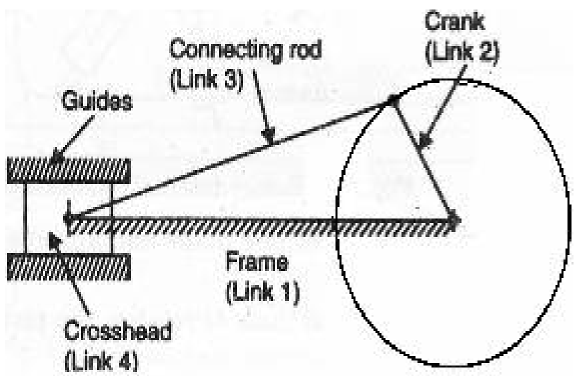
II. PROJECT METHODOLOGY

A. Wind Turbine

Vertical axis wind turbines (VAWTs) have great potential to contribute to growing worldwide reliance on green energy. For these machines to be efficient, they must be applied outside of their traditional farm environment. The target for this project is to better understand the effects of three design considerations: air foils, air foil arm supports, and bearings that will contribute to a more efficient turbine. It is hoped that this research and experimentation will make a small contribution to the evolving field of "green" energy and reduce dependence on fossil fuels. The target is energy production at or below 12 cents per kilowatt hour in order to be cost competitive with solar power. This project will test three different air foils.

B. Mechanism

A crank is an arm attached at a right angle to a rotating shaft by which reciprocating motion is imparted to or received from the shaft. It is used to convert circular motion into reciprocating motion, or vice versa. The arm may be a bent portion of the shaft, or a separate arm or disk attached to it. Attached to the end of the crank by a pivot is a rod, usually called a connecting rod (conrod). The end of the rod attached to the crank moves in a circular motion, while the other end is usually constrained to move in a linear sliding motion.



The Slider-crank mechanism is used to transform rotational motion into translational motion by means of a rotating driving beam, a connection rod and a sliding body. In the present example, a flexible body is used for the connection rod. The sliding mass is not allowed to rotate and three revolute joints are used to connect the bodies. While each body has six degrees of freedom in space, the kinematical conditions lead to one degree of freedom for the whole system. A slider crank mechanism converts circular motion of the crank into linear motion of the slider. In order for the crank to rotate fully the condition L> R+E must be satisfied where R is the crank lengthily is the length of the link connecting crank and slider and E is the offset of slider. A slider crank is a RRRP type of mechanism i.e. It has three revolute joints and 1 prismatic joint. The total distance covered by the slider between its two extreme positions is called the path length. Kinematic inversion of slier crank mechanisms produces ordinary a with work quick return mechanism.

C. Actual Setup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III.CALCULATION

A. Turbine

1) The main parameter that are considered in finding theoretical power generated are as follows: -
2) wind speed (V) – 4.16 m/s – 15 km/hr
3) Density of air (X) – 1.225 kg/m3.
4) Diameter (d) – 0.152 m
5) Height (H) – 0.203 m

Now,

m = X*A*V kg/s -------- (1).

6) m – Mass of air transversing / sec.
7) A famous scientist Hayashi found that swept area for Savonius wind turbine is given by multiplication of rotor diameter and height.

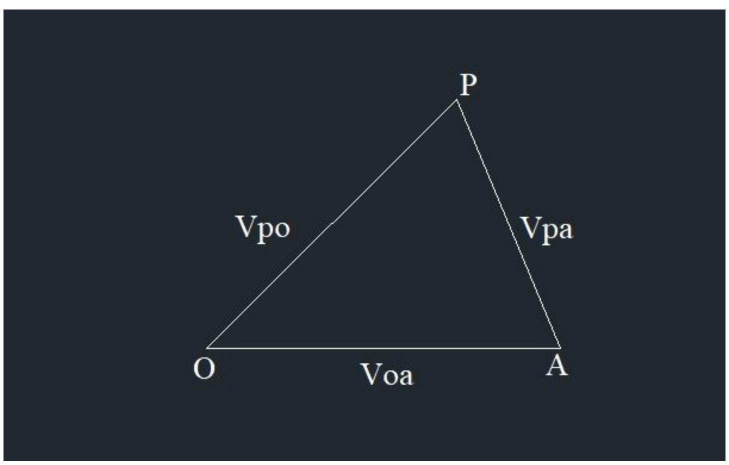
Swept Area = d*H
= 0.03085 m2.

Now, according to Manwell, it is not possible for all energy being converted into useful work.

M = X*A*V
= 1.225*0.03085*4.16
= 0.1572 kg/s
Power (p) = 0.5*m*v2
= 0.5*0.1572*17.3056
= 1.36 watt

B. Torque

Stroke Length (l) = 120mm
We know l=2*r
Where r = Crank Radius
R = 60mm
Speed taken as per specification (N) = 60 rpm
Angular Velocity (Wpo) = 2*3.14*N/60 = 6.28 rad/sec
Length of Connecting Rod = 300 mm



From Velocity Diagram,
OP = 0.06 m
Vp of P w.r.t O,
Vpo = OP*Wpo = 0.06*6.28 = 0.3768 m/s
Scale = 0.3768 m/s = 5 cm
VOA = 5cm = 0.3768 m/s

4.1 cm = 0.3089 m/s
VPA = 3.9 cm = 0.2939 m/s = VA
Available Torque
Power of Motor = 80 w
Torque = P*60/2*3.14*N
= 12.73 N.m
Required Torque
Power Output = Torque output * Angular Velocity
Force (FA) = 100 N
Power input (Pin) = FA * VA
= 100 * 0.2939
= 29.39 N.m/s
Neglecting Power Losses,
Power input = Power output
29.39 = To * 6.28
To = 4.679 N.m

IV. CONCLUSIONS

We can see that all the production-based industries wanted low production cost and high work rate which is possible through the utilization of multi-function operating machine which will less power as well as less time, since this machine provides working at different centre it really reduced the time consumption up to appreciable limit.

V. ACKNOWLEDGMENT

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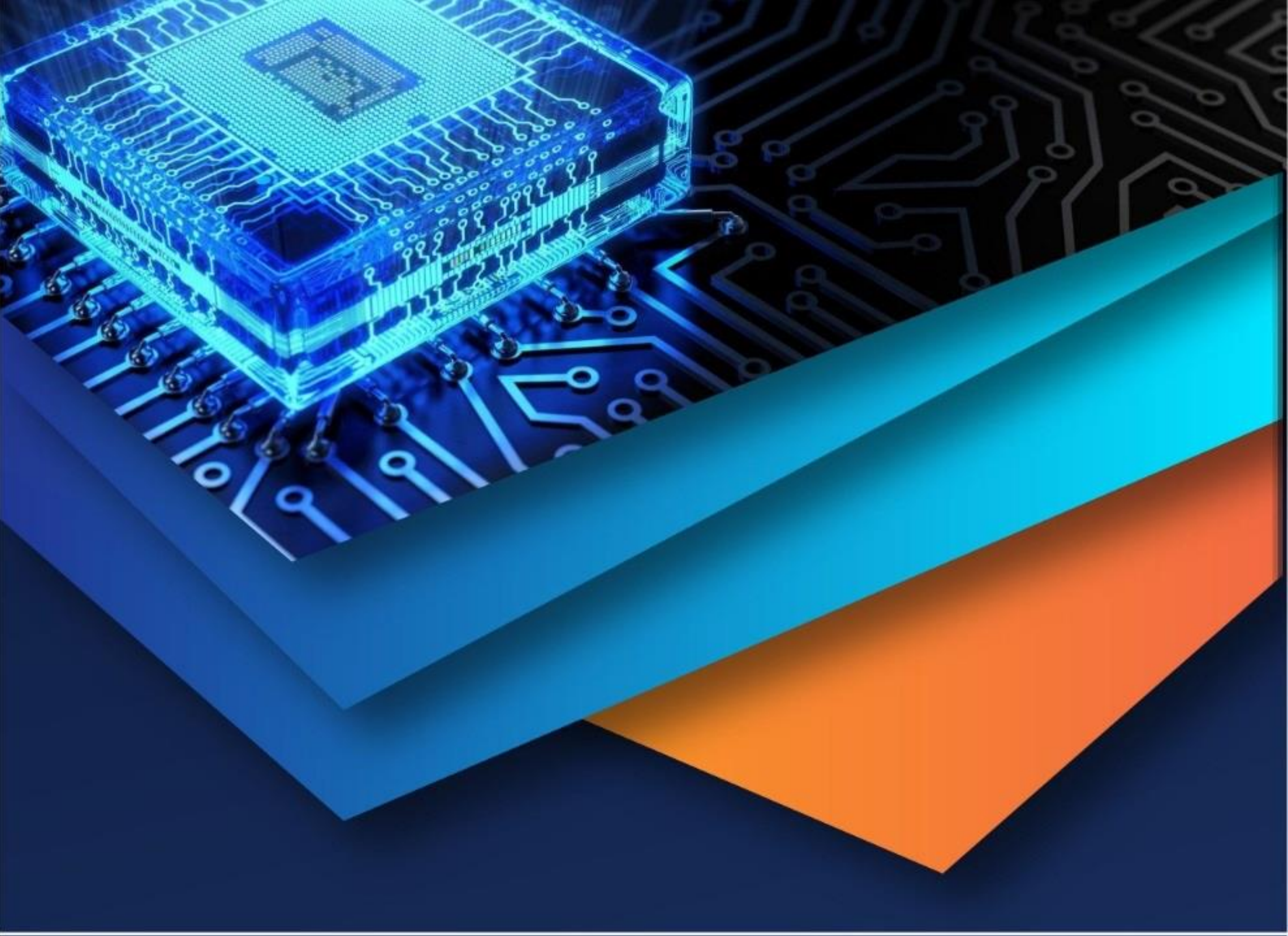

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