

Review Article

HUMAN POWER UTILIZATION: A REVIEW

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ABSTRACT

In the age of fossil fuels, human power was neglected but the hazardous environment pollution caused by fossil fuel again brought the human power resources in the stream of renewable power resources. So in recent past, vast research has been taking place to harness human power for energizing various process units. This review paper is based on one of that renewable power resources which is human power. Human has applied energy through the use of arms, hands and back, with the invention of bicycle and pedaling, legs also began to be considered as a means to develop power from human muscles. A person can generate four times more power by pedaling than by hand-cranking. The power levels that a human being can produce through pedaling depend on how strong the pedaling person is and on how long he or she needs to pedal. If the task to be powered will continue for hours of time, 75 watt mechanical power is generally considered the limit for a larger healthy non-athlete. A healthy athletic person of the same build might produce up the twice the amount. Therefore human power may be used for a process if the power enables a person to drive device at same rate as that achieved by hand-cranking but with far less effort and fatigue.

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INTRODUCTION

Since even increasing fuel crisis, energy crisis, busy schedule of load shedding, unemployment justify the need of human powered machines. The constant efforts are continuously made to optimize the various parameters of these machines, so as to provide the ease for the operator and consequently make efficient use of human energy. This project present the concept of human powered multi-purpose machine mainly carried out for domestic purpose. Basically the objectives of this machine is to reduce the human effort, human time and carry out the number of operation simultaneously. It is economically efficient. This machine can be used in remote places where electricity is irregular or insufficient. It is designed as a portable one. The machine is operated without any external energy like fuel or electric supply. Sine machine uses no electric power and fuel, it is very cheap.

Literature Review

H S.Bhatkulkar and J P.Modak: From this paper we came to understand that human power can be used to make a fertilizer mixing machine.

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The fertilizer used in nursery are mixed in various proportion by using this mixer. The machine comprises of pedaling/energy unit, speed rising gear, flywheel motor. This machine is very much beneficial in agricultural field as it is ecofriendly and does not involve any toxic constituents. We also came to know that average work rate of a man working continuously is equivalent to 0.13 HP. Therefore only continuous manufacturing process requiring less than 0.13 HP can be man powered. The basic function of this machine is that the fertilizers along with sand, soil& cow dung is mixed in required proportions by mixer blades in the drum. & operator pedals by sitting on the seat. By this study, model which helps to predict the performance of manually driven nursery fertilizer mixer were established and optimum values of various parameters were recorded. The main objective of this human powered mixer was on cost & ergonomic design so that this equipment can adequately replace high use of electric motor driven fertilizer mixer. As in many of the rural regions electricity crisis is a major concern even today.

J.P.Modak

A human powered bricks making machine had been designed. This machine uses human operated flywheel motor as power energy source and according to their report this concept can be adopted for human powered process unit needing more than 2

KW short term power which could have been intermitted operation without affecting the end product.

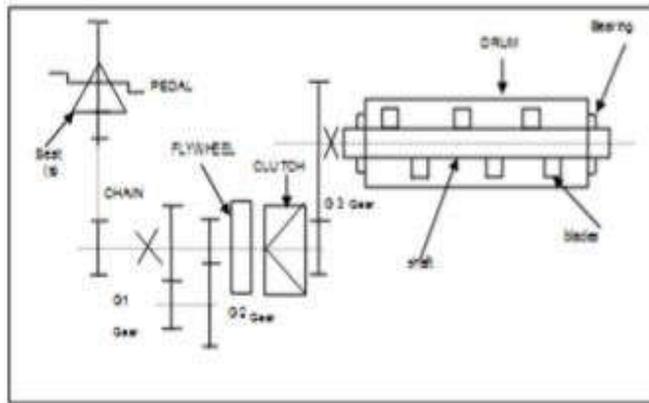


Figure 1. Schematic arrangement of a Nursery Fertilizer mixer machine

Machine consist of 3 subsystem

- Energy unit
- Appropriate transmission
- Processing unit

And they have used gear pair for torque increment and other one for speed increasing while connecting with spiral jaw clutch.

AkshayN.Shirbhate, AlokS.Sharma, PalashR.Shirrao, Kunal H.Sharma, Vijay B.Talan, Chetan S.Tayde

From this research paper we learned that human power can be a useful resource of energy if properly harnessed. The main objective is to provide multi-operational machine which can work when there is no availability of electricity. This project consist of a pedal operated hacksaw, water pump, dc motor, grinding assembly.



The machine comprise of various linkages, sprocket, chain drive mechanism and pedal assembly on which force is applied by an operator which indirectly convert the pedaling power into working stroke of hacksaw, which is 60 stroke/min and can cut 30mm diameter work piece of various materials like wood, PVC, plywood, hollow metal pipes and bars. Also the water pump can lift up the water from 10m to 16m by attaining speed up to 1890 to 1900 RPM. The DC motor can generate 12 v of

DC power which can be used for charging mobiles, laptops, lamps etc.

Devraj Singh, Genith I

Pedaling is the most efficient way of utilizing power from human muscles.

Sr.no	Product	30-50rpm	50-70rpm	70-90rpm
1	Daliya (min/kg)	25	20	10-15
2	Flour (min/kg)	40	25	15-20
3	Maida (min/kg)	55	30	20-25



Figure 3. Pedal Operated Flour Machine

It enables person to drive devices at higher rates as compared to hand-cranking. Keeping this in mind a pedal operated flour mill was developed. The Machine consistof chain drive and belt drive that turnsand rotates stone wheels and wheat gets crushed to produce flour. The person can generate 4 times more power by pedaling than hand-cranking. The power level that can be produce by an average healthy athlete is 75 watt maximum. when the pedaling rate is up to 50-70 rpm continuously for an hour. Maximum power produce with legs is generally limited by adoptions within the oxygen transportation system, on the other hand the capacity of arm is dependent upon amount of muscle mass engaged that's why more power is developed by pedaling rather than hand-cranking.

Conclusion

Based on the above study we came to know that because of the ever increasing energy crisis we have to switch to other option of energy generation, one of which is Human Power because of reasons such as unavailability of power, less skilled operator, unemployment, bicycle exercising related health issues. In this review paper we have studied evaluation, fabrication and performance of pedal operated Machines and came to know the different parameters like it's efficiency, application, future scope of work, cost and ergonomic designs. In the above literature review we came to know that the pedal operated fertilizer mixer can replace electric motor-driven fertilizer mixer in rural areas where there is no or limited supply of electricity. In the pedal operated brick making machine, we got knowledge about the brick manufacturing to get the final output which is bricks by using lime, fly-ash and sand. In the pedal operated multi-operational machine we have concluded that the power generated is used to operate small power devices such as mobile, laptops, LED lights, charging units. hacksaw assembly is used to cut the MS bar up to 20 mm diameter, PVC pipes, plywood etc. In the pedal operated flour machine the designed

pedal operated flour machine can be operated by any person and easily get the good quality of flour (wheat,daliya) in very less time, such as 1 kilogram of wheat in 45 minutes of average time. From the above literature review of different authors we conclude that pedaling mechanism can be used in different machine and it is better to use human energy instead of using fuel consuming machines.

REFERENCES

- Akshay N. Shirbhate, AlokS. Sharma, Palash R. shrirao, KunalH.Sharma, Vijay B.Talan, Chetan s.Tayde "Development And Fabrication Of Pedal Operated Multi-Operational Machine" *International Journal For Emerging Technology In Engineering Research*, volume-4, Issue-5, may-2016.
- Bhatkulkar, H.S. and Modak J.P.2014. "Design And Development Of Nursery Fertilizer Mixer Energized By Human Powered Flywheel Motor" *International Journal For Research In Emerging Science And Technology*, volume-1, Issue-5, October.
- Khope, P.B. and Modak, J. P. 2013. "Development and Performance Evaluation of a Human Powered Flywheel Motor Operated Forge Cutter." *international journal of scientific & technology research volume 2, issue 3, March*.
- Modak, J. P. 1982. "Manufacture of Lime-Flyash-Sand Bricks using Manually Driven Brick Making Machine". Project Report - Project Sponsored by MHADA, Bombay.
- Modak, J.P. 1985. "Bicycle and its kinematics and modifications". National conference machMech; February; pp5-11.
- Modak, J.P., Bapat, A.R. "Various efficiencies of human powered flywheel motor" *Human power number volume 54*; pp21-23.
- Pitale, A.K., Hatwalne P.A. "A review on – Flywheel motor" ISSN: 2319-5967.
- Ramawat, R.B., Khope, P.B., Choudhary, P.S.2014. "Design and Performance Evaluation of Pedal Operated Ice-cream Making Machine", Vol. 3 No. 4 *International Journal of Engineering Research & Technology (IJERT)*, 1780-1783, April.
