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GENERATING ELECTRIC POWER BY PEDAL DRIVEN SYSTEM: A REVIEW

Pratik Dhage[1], Amit Gavhad[2]

[1,2]*Students of M Tech, G H Raisoni College Of Engineering,Nagpur*

Abstract - *For the purpose of storing energy, designing of man-machine model is an important unit operation and if the energy is to be stored in remote rural areas then this operation becomes more vital. The Human powered flywheel motor is such a kind of man-machine system model. The main parts of the model are shortlisted to three parts that are a pedal driven flywheel motor, the transmission between the flywheel shaft and the input shaft of the process unit, and the process unit. The pedal drives and allows the flywheel motor to store the generated energy and then the available energy is transferred to the input of the process unit. To give a review about human powered flywheel motor a literature review was developed. Further a detailed survey was carried out consisting of various performance parameters to prove that the system is functional and economically viable.*

1.INTRODUCTION

In the present age the use of electricity, petrol, diesel, fossil fuels, etc. are the main sources of production. In this age the human power was neglected but due to hazardous environmental pollution caused by fossil fuels it has now became a new challenge for the researchers to think about its re-introduction as a mainstream of renewable energy resources. A stationary system akin to a bicycle having a flywheel system joined to it is conceptualized as Human Powered Flywheel Motor (HPFM) in which a human being spins a flywheel at the rate of 600 RPM to store energy. The flywheel will store the energy which is generated by pedaling at the energy-input rate convenient to the peddler. The energy stored in the flywheel will be made available for the actuation of process unit. Due to some resisting torque it is not necessary to pedal while the flywheel will be supplying energy to the process unit. This system can be a replacement for the electric motor which requires power in the range 3-9 HP for short intervals even though the human energy input rate to the flywheel is 75 watts only. HPFM can be used only on the applications where product quality doesn't get affected due to variations in the speed because of the process resistance of clutched process unit speed of flywheel goes on continuously diminishing.

A Human powered flywheel motor is developed using the following main parts:

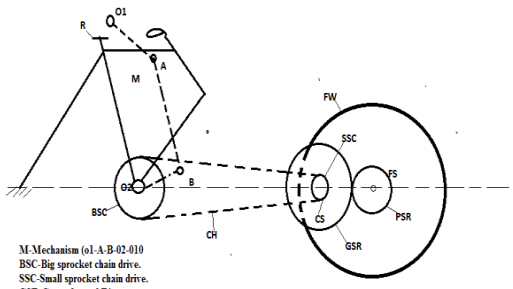
1.1 ENERGY UNIT:

The Flywheel is used to store the energy, which in turn is applied to the process unit. The Flywheel size and its moment of inertia play the importantl role in the terminal velocity of flywheel. In 1987, J.P Modak experimented and observed that for a normal person of about 20-22 years of age and 165 cm height maximum thigh oscillation is 40. Therefore a flywheel speed of 240 rpm at full pace was found suitable on a standard 22" bicycle structure with suitable chain drive. Therefore J.P Modak determined the size of flywheel 180-240 rpm as best suited in order to store the utmost energy in flywheel irrespective of speed variation.

1.2 TRANSMISSION UNIT:

For the purpose of smooth operation and providing ease to operator it is necessary to reduce the harness effect of vibration and jerk at the process unit shaft.In order to provide the ease to operator it is necessary to reduce the harness effect of vibration and jerk at the process unit shaft. Hence Modak J.P.[4] (1987) suggested the value of gear ratio as 4:1 so as to minimize the effect of jerk induced at process unit shaft as result of energy or momentum exchange in the clutch engagement. If lesser value of gear ratio is to be used then flywheel velocity Should be kept higher than 240rpm. A speed enlargement would be an added advantage to the arrangement as the rotational velocity of the flywheel is also responsible for quantity of energy stored in the flywheel. Thus, a combination of gear and chain drive is used in most of the application oriented study or research carried out so far.

1.3 PROCESS UNIT



2 LITERATURE REVIEW

In 2012, D. Dhale used human powered flywheel motor as the main energy source to formulate an experimental data based model for oil press. During the experimentation an approximate generalized data based model for an oil press was developed by varying parameters and the model was optimized. The design data was established for low to medium capacity oil press. All the independent variables were varied over the widest possible range, response data was collected and an analytical relationship was established.

In 2014, for the process of manufacturing utensils using HPFM, an experimental data based model was developed by Mohammed Shakebuddin. This was carried out to generate data based model for human energized utensils manufacturing unit, to develop a machine which uses human power as the main source of energy, to provide an alternate source of power generation. The ideal aim to design this model was to provide an opportunity for human powered system performance improvement. The method implied for production of utensils in this experiment was spinning because it required low capital investment, low tooling and energy costs, quick and inexpensive adaptation of tooling and methods to accommodate design changes, ability to carry out other operations like beading, profiling etc.

In 2014, a stirrup making machine energized by human powered flywheel motor was designed and developed by Subhash N. Waghmare. The function of this set-up is to bend the round bar. The stirrups are used for providing strength to columns and beams and avoiding both, buckling of long slender column and sagging of horizontal beam. Traditionally stirrups are made on a wooden platform provided with pins and the rod is bent with the help of a lever. The pin works as a fulcrum point for bending the rod when force is applied on the lever. There are many drawbacks of using the conventional stirrup machine such as lack of accuracy and due to repetitive motion of hands; man is subject to have internal injuries like carpel tunnel syndrome, spondylitis,muskulo-skeletal disorder, etc. therefore keeping these things in mind a human power stirrup machine is developed to ensure good performance as well as safety.

In 2015, H.S. Bhatkulkar used the concept of human powered flywheel motor for designing and development of a nursery fertilizer mixer. The paper presents the development, performance and experimental validation of a human powered flywheel motor operated nursery fertilizer mixer to mix nursery fertilizers in proper proportions which is then used for small size plantations. The development of this machine was to establish data for low to medium capacity nursery fertilizer mixer energized by human power and if required could be partly used as an aid to low/medium capacity farmer or as an alternative to small scale businessmen to execute readymade nursery fertilizer business. From the results of experimentation, empirical models to predict the performance of the equipment was established and optimum values of various parameters were also derived.

In 2015, a pedal powered washing machine was designed and fabricated by G. Bhatawadekar. This model was developed to overcome the problem of electric supply in rural areas by setting up a manually operated washing machine incorporated with a simple cycling mechanism to run the washing machine. A washing machine is a machine designed to wash laundry such as clothing, towels and sheets. Mechanical energy, thermal energy and chemical energy are the key combination for the working of a washing machine. Mechanical energy was imparted to the clothes load by the rotation of the agitator in top loader type of washing machine or by the tumbling action of the drum in front loader type. Thermal energy was supplied by the temperature of the wash bath. 500-1600 rpm was the spin speed range of this machine.

CONCLUSION

Thus the literature survey on flywheel motor is carried out. Initially the flywheel motor was developed for the manufacturing of lime fly ash bricks. Later on various applications are developed such as chaff cutter, forge hammers, potters wheel etc. Because of its numerous advantages, the flywheel motor is finding the importance in the rural side of developing countries like India. And hence it is necessary to optimize its performance parameters. In an attempt lots of experimental and numerical models are developed which are already discussed. The effect of multiple operators with alteration in the mechanisms such as double lever inversion, can also be analyzed as future work for the flywheel motor.

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