

Human Powered Machine – A Case Study

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Abstract

In the present investigation, in the recent past human powered flywheel motor concept has been used for chaff cutter, bricks making, wood turning, cloth washing, turmeric polishing. The machine uses bicycle technology, with speed increasing gearing and a flywheel, which drive the process unit through a spiral jaw clutch and torque increasing gearing. The operator uses the pedal power to operate the machine and transmit this power through crank chain to free wheel to the working unit. This human powered flywheel motor concept (HPFM) provide new era in the human powered agriculture processing, harvesting, post harvested operations equipment's. Considering social, cultural and environmental factor as well as in many rural operations utilizing unskilled worker and in Vidharbha rejoin there is more problem of electricity so this kind of HPFM concept is helpful in driving various rural machines. The machine is economically viable, can be adopted for human powered process units which could have intermitted operation without affecting the end product.

Keywords- Human power machine, turmeric polishing

I. INTRODUCTION

Agriculture is the prime business of India. Mahatma Gandhi Institute of Rural Industrialization (MGIRI) at Wardha started in 1934, soon it became a hub of rural industrial activity and a center to coordinate industrial experiences and knowledge from all parts of the country with focus on research, production, training, extension, organization propaganda and publication and Centre of Science for Villages (CSV) started functioning in 1976 by its founder Chairman and Director Late Dr. Devendra Kumar from the premises of Maganwadi in Wardha from where Mahatma Gandhi began the "All India Village Industries Association" (AIVIA) in 1934 and Dr. J. C. Kumarappa gave shape to Gandhian concept of Rural Economy. During the case study it is found that lots of human powered machines are developed at MGIRI and CVS which can be further modify by using Human powered flywheel motor concept as similar recently mechanical polisher developed which energized with human powered flywheel motor (S.M.Moghe, K.S.Zakiuddin) at Nagpur university Maharashtra, India. It is operated by 1hp motor. This polishing machine can be operated manually. Traditionally polishing is carried out by hand polishing in which labors who have to rub turmeric finger on hard surface or trample them under feet wrapped in gunny bags wherein chances of damage

II. PAST REVIEW ON HUMAN POWERED MACHINE

[1] David Gardon Wilson, This paper deals with the understanding of Pedal power. If the task to be powered will continue for hour at a time, 75 watts' mechanical power is generally considered the limit for a large healthy non athlete. Fig. shows human powered output pedaling. Pedaling rate: A simple rule that most people engaged in delivering power continuously for an hour or more be most efficient when pedaling in the range of 50 and 70 revolutions per min. fig shows how optimum pedaling rate verses desired power rate.

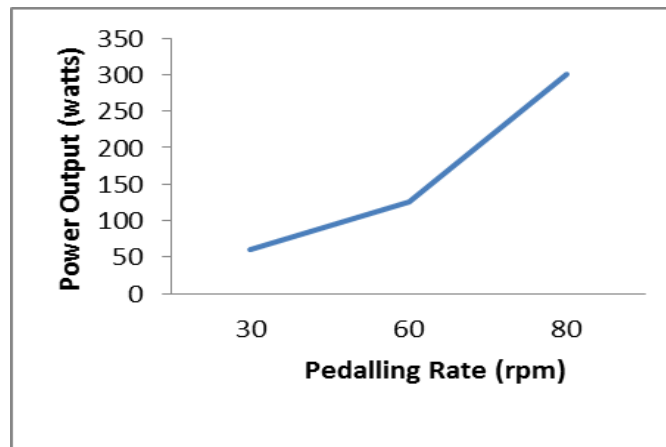


Fig. 1: How to optimum pedaling rate varies with direct power output.

[2] K.S.Zakiuddin, Stated the importance of Human Power from the earliest time to the present and its necessity to different machine with future scope. They categorized human powered Machine with its different examples according to its type. Provided information about Dynapods. Finally, this paper explains the Human Powered Flywheel Motor concept with line diagram which contain Bicycle, Chain, Gear pair, Flywheel. Recently this concept they used in Chaff Cutter [4].

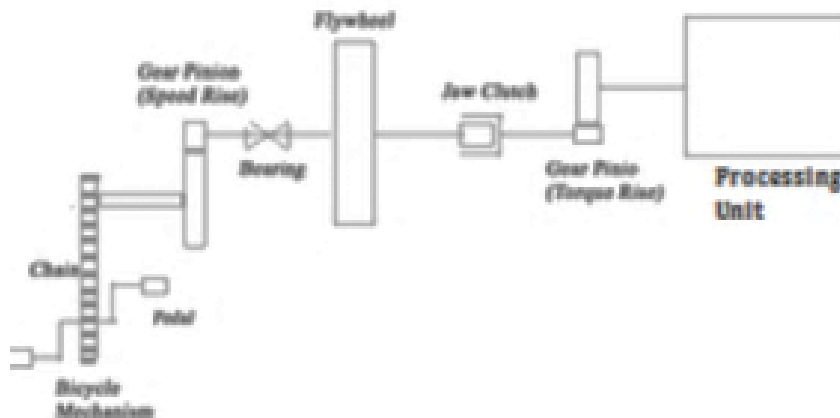


Fig. 2: Human Powered Flywheel Motor Concept

[3]J.P.Modak. In this paper, a human powered bricks making machine has been designed and development. The machine uses the human flywheel motor as an energy source and they said that this concept can be adopted for human powered process unit needing more than 2 KW short term power and which could have intermittent operation without affecting the end product. Essentially machine consist of three sub system i.e. 1. Energy Unit, 2. Appropriate transmission, 3. Process Unit. from schematic arrangement of the machine and specification of major part of machine. They have used gear pair for torque amplification and other one for speed increasing and connected with spiral jaw clutch.

III.METHODOLOGY OF DATA COLLECTION

Places visited regarding study of human-powered machines:

A. Centre of Science for Villages, Training Centre
Kumarappapuram - Dattapur, Wardha

1) CSV at a Glance

- Non-Conventional Energy
- Solar Energy Equipments& their maintenance
- Biogas Construction, Maintenance and Supervision
- Ecology Environment & Agriculture
- Watershed Management & Cover Management
- Organic Compost Manure

- Emitter irrigation
- Herbal Pesticides
- Improved Agricultural Tools

2) *Rural Industries*

- Honey Bee Apiary & Honey Production by Nonviolent Method from Rock bee
- Handmade paper & Banana Fiber Board Technology
- Low Cost Spirulina Production Technology
- Rural Pottery
- Ambadi Juice & Other Ambadi Products, Gum Products

3) *Women Technology*

- Propagation & Training of Different Women Technologies
- Training & Extension of Modern Science
- Training in Appropriate Rural Technologies

B. Mahatma Gandhi Institute for Rural Industrialization

Maganwadi, Wardha, Maharashtra, India

1) *MGIRI at a Glance*

- Non-Conventional Energy
- Solar Energy Equipments & their maintenance
- Biogas Construction, Maintenance and Supervision

2) *Rural Industries*

- Honey Bee Apiary & Honey Production by Nonviolent Method from Rock bee
- Rural Pottery

3) *Women Technology*

- Propagation & Training of Different Women Technologies
- Training & Extension of Modern Science
- Training in Appropriate Rural Technologies

IV. DATA COLLECTED

A. Screw Press



Fig. 3: Screw press

A screw press is a type of machine press in which the ram is driven up and down by a screw. The screw shaft can be driven by a handle or a wheel. It works by using a coarse screw to convert the rotation of the handle or drive-wheel into a small downward movement of greater force. The overhead handle usually incorporates balls as flyweights. The weights help to maintain the momentum and thrust of the tool to make it easier to operate.

The screw press was first invented and used by the Romans in the first century C.E. It was used primarily in wine and olive oil production. The screw press was also used in Gutenberg's printing press in the mid-15th century.

A press is a metalworking machine tool used to shape or cut metal by deforming it. It is frequently used to punch holes in sheet metal in one operation, rather than by cutting the hole or drilling.

If used as a punch, the tool itself consists of a punch and a matching die, into which it very closely fits. Both are usually precision machined and then hardened. The material is introduced between the punch and die, and the machine operated. The punch will cut through the material in one movement by shearing it. The punch and die may be of any desired shape, so odd shaped holes and cut-outs may be created.

B. Potter's Wheel



Fig. 4: Potter's wheel

Many early ceramics were hand-built using a simple coiling technique in which clay was rolled into long threads that were then pinched and beaten together to form the body of a vessel. In the coiling method of construction all of the energy required to form the main part of a piece is supplied indirectly by the hands of the potter. Early ceramics built by coiling were often placed on mats or large leaves to allow them to be worked more conveniently. The evidence of this lies in mat or leaf impressions left in the clay of the base of the pot. This arrangement allowed the potter to turn the vessel under construction, rather than walk around it to add coils of clay.

A round, moist lump of clay body is thrown down onto the wheel head or a bat attached to it. The lump is made even and forced to the center of the wheel by applying pressure with the hands. The thrower finds the center of the clay by moving a thumb across the lump until no more friction is felt. The thumb is pressed into the center of the lump, stopping about 5 mm from the wheel head. The hole thus made is widened. The sides thus defined are pulled up and made thinner by pressure between the hands. The vessel is shaped, and the mouth is smoothed. The vessel is cut from the wheel head with a cheese wire and left to stiffen. Sometimes the stiffened vessel is inverted on the wheel and trimmed with a sharp tool.

A skilled potter can quickly throw a vessel from 15 kg of clay. Alternatively, by throwing and adding coils of clay then throwing again, pots up to four feet high may be made, the heat of a blowlamp being used to firm each thrown section before adding the next coil.

C. Pedal Operated Circular Hacksaw



Fig. 5: Pedal operated circular saw

First of all, human power via pedals is transmitted to gearing drives, with the help of gearing ratios the power is transmitted to circular hacksaw and flywheel is attached to gear drives for proper manipulation and control of fluctuating speed and power.

D. Pedal Operated Hammer



Fig. 6: Pedal operated hammer

As shown in fig. it consists of pedals, chain and sprocket, and cam & follower mechanism. The motion provided to pedal by the operator is transmitted to a flywheel through chain. The flywheel stores the energy which is then supplied using chain and sprocket to a shaft having cam. A separate arm with a hammer at one end and pivoted to body of machine at other end acts as a follower. The cam is so designed that the output of hammering action is obtained.

V. PROPOSED MODEL OF MANUALLY OPERATED MACHINES ENERGIZED BY HFM

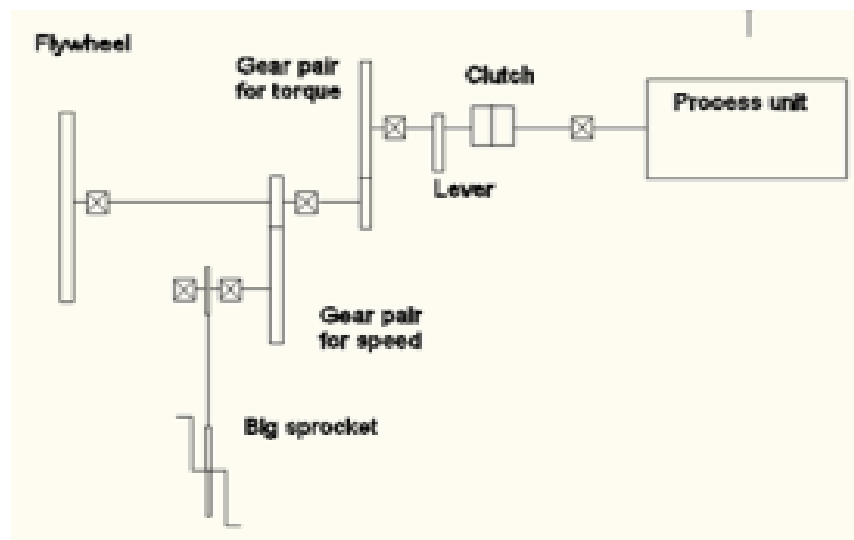


Fig. 7: Conceptual model of Manually Operated Machines Energized by Human Power Flywheel Motor

From the literature search made produces data for proposed model of manually operated machine consist of three sub system 1. Energy unit. 2. Transmission 3. Process Unit. Fig Line diagram of manually operated machines energized with HFM. This model consists of bicycle mechanism for energy unit which will consist big sprocket1, and small sprocket2, speed increasing gear pair G1P1, Flywheel which store this input energy. After storing the maximum possible energy in the flywheel, this available energy transmits towards processing unit with the help of spiral jaw clutch C1, before transmitting the flywheel will decelerate depending actual resisting torque offered by the process unit, this torque amplification before engagement of clutch done by gear pair G2P2.

VI. CONCLUSION

Based on the above study of human powered motor concept and its different applications, turmeric polishing process, polishing machines following conclusion can be drawn.

- 1) Above research work and the proposed model can provide benefit in the manually operated machines.
- 2) Model will provide to design and development such that will be simple to build and labor required to operate this machine is only one and less skilled labor can operate this model.
- 3) Some development in existing machine and process unit with the proposed model which is based on past work carried on human powered will efficient and should be equal or more than existing machine.

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