DESIGN & FABRICATION OF HUMAN POWERED MULTI-PURPOSE MACHINE

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ABSTRACT

This paper presents the concept of Human Powered Multi-Purpose Machine mainly carried out for production based industries. Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure, every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost. We have developed a conceptual model of a machine which would be capable of performing different operation simultaneously, and it should be economically efficient .This machine can be used in remote places where electricity is irregular or insufficient. It is designed as a portable one which can be used for cutting in various places. It can be used for operating on materials like thin metals,wood and p.v.c.The material can be cut without any external energy like fuel or current. Since machine uses no electric power and fuel, this is very cheap.Energy is the most vital aspect in the development of modern technological civilization. In the present work, a human powered multipurpose machine is developed which can perform three types of operations drilling, sawing and grinding. Power required for pedalling is well below the capacity of an average healthy human being. The system is also useful for the work out purpose because pedalling will act as a health exercise and also doing a useful work.

Keywords: Drilling, Drinding, Multipurpose, Sawing, Pedal Operated

I. INRODUCTION

Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure, every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost

In an industry a considerable portion of investment is being made for machinery installation. So in this paper we have a proposed a machine which can perform operations like drilling, sawing, grinding, some lathe operations

at different working centers simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously.

Economics of manufacturing: According to some economists, manufacturing is a wealth-producing sector of an economy, whereas a service sector tends to be wealth-consuming. Emerging technologies have provided some new growth in advanced manufacturing employment opportunities in the Manufacturing Belt in the United States. Manufacturing provides important material support for national infrastructure and for national defense.

II. PROBLEM STATEMENT

(i) Current machines are costly.

(ii) This machines requires electric supply or fuels for working.

(iii) The unit operating by means of electricity has limited applications in the rural area

III. LITERATURE REVIEW

The surveys of the literature regarding the Pedal driven machines are listed:

Dharwa Chaitanya Kirtikumar **[1]** designed and developed a multipurpose machine which does not require electricity for several operations like cutting, grinding etc. This is a human powered machine runs on chain drives mainly with human efforts. But if you wanted to operate this machine by electric power this machine can also does that. It has some special attachment so use both human power as well as electric power. The design is ideal for use in the developing world because it doesn't require electricity and can be built using metal base, chain, pulley ,rubber belt, grinding wheel, saw, bearing, foot pedal (for operated by human) ,electric motor, chain socket.

S.G.Bahaley, Dr. A.U. Awate, S.V. Saharkar **[2]** designed and fabricated a pedal powered multipurpose machine. It is a human powered machine wich is developed for lifting the water to a height 10 meter and generates 14 Volt, 4 ampere of electricity in most effective way. Power required for pedaling is well below the capacity of an average healthy human being. The system is also useful for the work out purpose because pedaling will act as a health exercise and also doing a useful work.

Linxu, Weinan Bai, Jingyu Ru,Qiang Li **[3]** designed and developed an automatically reciprocating pedal powered electricity generator (ARPPEG) in conjunction with the management and control over harvesting the kinetic energy, electricity generation, electric storage and the output of electricity. According to the operation testing results, this system has been proved to effective in power generation. In view of the simple structure and low costs of this system without territory and time limits, the application of ARPPEG designed by them could open a new path to saving the energy and helping build a new energy society.

Heinrich Arnold1 November 2001: Rather long re-investment cycles of about 15 years have created the notion that innovation in the machine tool industry happens incrementally. But looking at its recent history, the integration of digital controls technology and computers into machine tools have hit the industry in three waves of technology shocks. Most companies underestimated the impact of this new technology. This article gives an overview of the history of the machine tool industry since numerical controls were invented and introduced and analyzes the disruptive character of this new technology on the market. About 100 interviews were conducted with decision-makers and industry experts who witnessed the development of the industry over the last forty years. The study establishes a connection between radical technological change, industry structure, and

competitive environment. It reveals a number of important occurrences and interrelations that have so far gone unnoticed.

Dr. Toshimichi Moriwaki (2006): Recent trends in the machine tool technologies are surveyed from the view points of high speed and high performance machine tools, combined multifunctional machine tools, ultra precision machine tools and advanced and intelligent control technologies.

Frankfurt-am Main, 10 January 2011. : The crisis is over, but selling machinery remains a tough business. Machine tools nowadays have to be veritable "jack of all trades", able to handle all kinds of materials, to manage without any process materials as far as possible, and be capable of adapting to new job profiles with maximized flexibility. Two highly respected experts on machining and forming from Dortmund and Chemnitz report on what's in store for machine tool manufacturers and users.

Multi-purpose machines are the declarations of independence. The trend towards the kind of multi-purpose machining centers that are able to cost efficiently handle a broad portfolio of products with small batch sizes accelerated significantly during the crisis. "With a multi-purpose machine, you're less dependent on particular products and sectors", explains Biermann

IV. EXPERIMENTAL SETUP

The Pedal powered machine consists of 3 operations i.e. drilling, grinding and cutting. It consists of chain drive and two v belt drives for power transmisssion.The chain used is simplex chain. It consists of chain and sprocket arrangement on which chain is fitted .The pedal is fitted at big sprocket and small sprocket is fitted on shaft .The shaft consists of two pulleys mounted on it .One pulley is attached to the drilling machine by means of v belt.Other pulley is attached to grinding wheel shaft by means of v belt drive and the same pulley by means of mechanical linkage is connected to hacksaw frame mechanism .The mechanical linkage is connected to the pulley by means of nut and bolts.Therefore hacksaw frame can be removed from the pulley when we have to disengage hacksaw frame from mechanism.Also the v belt drive on the drilling attachments can be removed easily to disengage drilling mechanism from machine .In this way we can use each of the function simultaneously or two at a time.The Figure 1. shows the pedal driven machine mechanism. The pedal powered machine specifications are shown below:

4.1 Specification

1. Size of machine = B*H*L = 60*90*165 cm
2. Pedal crank radii = 19 cm
3. Bigger pulley radii = 14 cm
   Small pulley radii = 12.5 cm
   Grinder pulley radii = 4 cm
4. Shaft length = 56 cm
5. Bigger pulley to drill centre = 72.5 cm
6. Grinding wheel radius = 10 cm
7. Connecting link hack saw length = 29 cm
8. Chain sprocket:
   Pitch = 1.2 cm

Big sprocket = 48 teeth ; 10 cm rad

Small sprocket = 18 teeth ; 3 cm rad

Centre to centre distance = 70 cm

9. drilling centre pulley = 3 cm rad

Figure 1 :Fabricated Model of Human Powered Multipurpose Machine

V. EXPERIMENTAL PROCEDURE

The pedal powered machine set up, has a simple mechanism operate with chain and sprocket arrangement. The chain is placed on the teeth of the wheel and pinion. .The shaft is mounted on pedestal bearings .First mechanical linkage is removed by removing nut and bolts and v belt drive of drilling attachment .Thus only grinding is in working condition .Then by attaching v belt ;drilling and grinding is performed. Similarly by removing v belt and attaching mechanical linkage ;grinding and cutting can be used two at a time .Thus it is used individually or two at a time.The work piece is placed on the work piece holder, which is to prevent the movement of work piece during cutting. Here for reducing the power, loss chain mechanism is used.This can be used for light woks of plywood,wooden materials ,thin sheets of metal

VI. RESULTS AND DISCUSSIONS

Figure 2. gives the variation of number of strokes of Hacksaw with rpm . It is observed that the number of strokes increases uniformly with the pedal rpm. The variation in the obtained plot is due to errors in observation and due to power transmission losses.

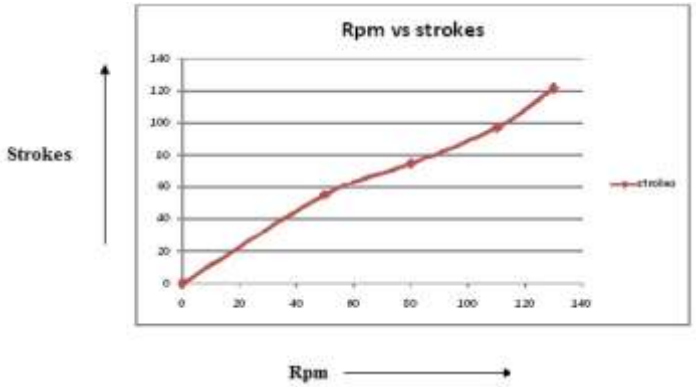

Figure 2: Variation of Number of Strokes with Rpm

Figure 3. shows the variation of cutting depth with rpm . It is observed that the cutting depth increases with the pedal rpm. Experimental result shows cutting depth of about 16mm can be obtained can be obtained in one cycle of strokes for around 100rpm. The variation in the obtained plot is due to errors in observation and due to power transmission losses.

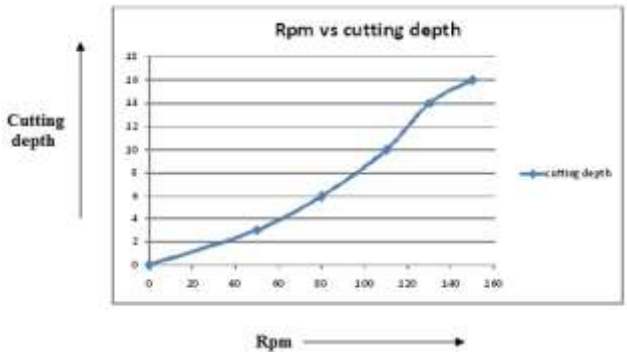

Figure 3: Variation of Cutting Depth with Rpm

The main objective is to provide a multipurpose machine which can work when there is no electricity. It has to be understood that in rural areas where there is problem of electricityshortage or no electricity, it is a very stressful and laborious task to perform machining operations. So the product which is a pedal driven machine, it satisfies the need of rural people by giving them an alternative way of performing machining operations such as cutting, drilling and grinding which cost-effective and eco-friendly. The product designed has zero operating cost, cost-effective.

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