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Multi Operational Mechanical Machine

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Abstract – *The concept of Multi-Operational Mechanical Machine is mainly conceived for production based industries. Industries are basically meant for production of useful goods and services at low production cost. Today in this world every task have been made quicker and easier by making use of technology advancement but this advancement also demands huge investment and expenditure. Every industry tries to achieve high productivity 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 operations simultaneously at high efficiency. The machine proposed in this project can perform tasks like drilling, sawing, cutting and grinding at one work station. It also reduces the cost of installing four different machines for performing each task and reduces the movement of work and operator. It will also improve efficiency and reduce cost of the product.*

Key Words: Single slider mechanism, bevel gear, drilling, cutting, sawing, grinding, multi-operational, bearings.

1. INTRODUCTION

The reason to design a multi-operational mechanical machine is that there is no machine which can perform various operations (i.e. drilling, cutting, sawing & grinding) at the same time. This machine is operated by DC motor and uses a single slider mechanism and bevel gears. This model of the multi operation mechanical machine may be used in small scale industries dealing with light materials like wood, cardboard etc. and domestic purpose. As many a time operations like cutting, grinding and drilling are required in daily life. Industries are basically meant for production of useful goods and services at low production cost. This project work is proposed where a machine is designed which can perform operations namely drilling, sawing, grinding and cutting at different working centers simultaneously. It implies that manufacturer need not to pay for machine performing above tasks individually.

2. LITERATURE REVIEW

According to Arnold, Heinrich (2001), Talking about last 15 years there has been incremented innovation in the machine tool industry as old models are continuously being replaced by new ones. And also the integration of digital controls technology and computers into machine tools has affected the industry in these areas. Most companies underestimated the impact of this new technology. 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.

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

According to Frankfurt-am Main, 10 January (2011): Machine tools nowadays must be able to handle all kinds of materials, and offer maximum 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- operational machines are the declarations of independence. The recent trend demands for multi- operational machining centers that are able to handle a broad portfolio of products with small batch sizes cost effectively. "With a multi-operational machine, you're less dependent on particular products and sectors", explains Biermann.

3. METHODOLOGY USED

In this project, we have used two mechanism the first one is a single slider mechanism operating the hacksaw and the other is bevel gear arrangement to transfer the power at different work centers.

With the help of a dc motor power is supplied to the shaft on which a bevel gear is mounted and three more bevel gear, two gears at a right angle to main shaft and one gear opposite to the shaft has been mounted. At one end of the shaft, power is given through motor and this end is connected to a circular disc through this circular disc single slider mechanism is made for hacksaw operation. The other two shafts at right angle are provided with cutting blade and grinding wheel which start operating when the power is supplied to the main shaft. All tools of machine start operating along with main shaft due to meshing between them by means of bevel gear. The shaft opposite to the main shaft is provided with drill bit. This machine is operated by DC motor. This machine is based on the mechanism of single slider and gears. This model of the multi operational mechanical machine may be used in industries and domestic operation which can perform mechanical operation namely drilling, cutting, grinding and

sawing of a thin metallic sheet as well as wooden model or body. It is highly suitable for batch production of such items which are composed of all four above mentioned operations. Movement of man machine and material involves lot of time and efforts which ultimately results in higher per unit cost at the same time installation of separate machine for each operation include huge initial cost, higher running cost and maintenance cost and requirement of large space. Our machine is cost effective solution of all such problems.

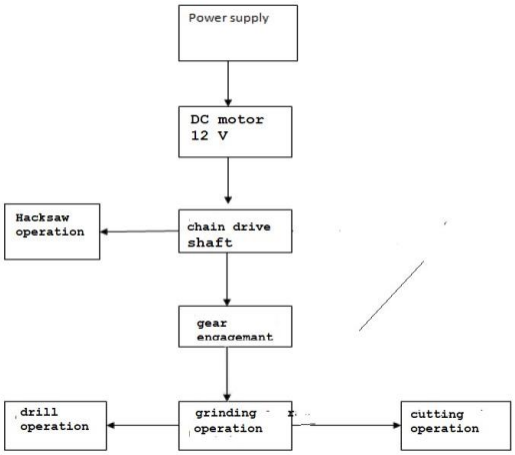
There are only two major principles on which our proposed machine generally works:

1. Single Slider mechanism

Application of single slider mechanism

Power transmission through gears (Bevel gear)

Arrangement of gear for power transmission



Power transmission in machine

4. SPECIFICATIONS OF MACHINE

Frame of model	Length= 475mm Width= 475mm Height= 525mm Material: cast iron
Bevel gears	Base radius= 4.2cm No. of teeth(T_1)= 17(power transmission) No. of teeth(T_2)= 13(drill tool) Pitch cone angle= 45^0 Pitch diameter= 5cm
Shaft	Diameter= 16mm Material: mild steel
Roller bearing(center)	Number of bearing= 4 Inner diameter= 15mm Outer diameter= 35mm Width= 11mm Weight= 0.043kg
Roller bearing(drill)	Inner diameter= 12mm Outer diameter= 32mm Width= 10mm Weight= 0.034kg
Free wheel	Number of teeth= 18
Motor	RPM=110, 12V DC
Operations	sawing, cutting, drilling, grinding.

5. ANALYSIS

Analysis on basis of time:

Manually

Cutting= 2min 30 sec (*4)

Filing= 1 min 30 sec (*4)

Drill= 20 sec

Cutting of base= 2 min

Total time= 18 min 30 sec

On multi operational mechanical machine

Cutting= 1 min 10 sec (*4)

Grinding= 40 sec (*4)

Drill= 3 sec

Cutting of base= 50 sec

Total time= 6 min 33 sec

$Time_{manual}$ /$Time_{machine}$ = 18 min 30sec/6min 33 sec

= 3:1

Time required manually is 3 times the time required by operation mechanical machine=270/90 machine.

=3:1

All machines occupy 3 times the space occupied by multi operational mechanical machine

Analysis on basis of space required

Space required for each machine

Drill machine= 60 cm^2

Motorised hacksaw= 90 cm^2 Grinding wheel= 60 cm^2
Cutting blade= 60 cm^2

Total space= 270 cm^2

Multi operational mechanical machine

Total space= 90 cm^2

Space occupied by all machines/space occupied by multi

6. CONCLUSION

We know that aim of every production based industry is to minimize the production cost and increase the production rate which can be achieved by utilization of multi operational mechanical machine. This machine reduces the power as well as time consumption by providing different operations at same time. In an industry a considerable amount of investment is required for machinery installation. So in this paper we have proposed a machine which can perform operation like drilling, sawing, grinding and cutting at different work centers simultaneously which implies that investment is not required for machines performing the above tasks individually. Also, floor required to setup this machine is very less as compared to floor required for setting up individual machines which implies a very simple product layout.

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