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Multi Operated Machining Unit with Drilling, Grinding & Cutting

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Abstract: The basic concept of Multi Operating 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 has been made quicker and faster 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 .In this machine we are actually giving drive to the main shaft to which scotch yoke mechanism is directly attached, scotch yoke mechanism is used for sawing operation. On the main shaft we have use bevel gear system for power transmission at two locations. Objectives of this model are conservation of electricity (power supply), reduction in cost associated with power usage, increase in productivity and reduced floor space.

Keywords: Bevel gear, Cutting, Drilling, Grinding, Scotch Yoke Mechanism,

I. INTRODUCTION

The main proposed idea and reason being stated , a machine is designed which can perform operations like drilling, sawing, grinding, some lathe operations at different working centers simultaneously which implies that industrialist will not have to pay for machine performing above tasks individually for operating operation simultaneously.

In an industry, a considerable portion of investment is being made for machinery installation. So in this project we have a proposed a machine which can perform operations like drilling, grinding, cutting and some lathe operations at different working centers simultaneously which implies that industrialist need not pay for machine performing above tasks individually for operating operation simultaneously. The concept of Multi Operating Machining is mainly carried out for production based industries. The development of a conceptual model of a machine which would be capable of performing different operations simultaneously and is also economically efficient is the main aim here. In this machine, the main shaft to which scotch yoke mechanism is directly attached is given main drive power.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. Objective of this model are conservation of electricity (power supply), reduction in cost associated with power usage, increase in productivity, reduced floor space.

II. LITERATURE SURVEY

According to Heinrich Arnold [1], the incremented innovation in the machine tool industry as old models is 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. 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.

According to Dr. ToshimichiMoriwaki [2], 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.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 do that. It has some special attachment so use both human power as well as electric power.

According to Ludwig Biermann [3], 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.

F.W. Taylor,[4], explains Modeling can be said to have it's beginning as an organized process in the late 1890s to early 1900s originated with the pioneering engineering research and development of empirical methodology (and equations) for estimating reasonably economic machining conditions. Science-based modeling began to emerge in the 1940s by Merchant's physics-based modeling in a machining process.

Eli Whitney[5] in the year 1827 from United States of America developed the milling machine, which utilized a rotary cutter with multiple edges. Initially, it was mainly used to machine flat surfaces. This was later modified and expanded to include its application to two and three dimensional surfaces.

III. OBJECTIVES AND METHODOLOGY

3.1 Objectives

The main objectives behind this project are listed below:

- The objective of this experiment is to investigate the performance of a Scotch Yoke mechanism.
- To reduce size of model.
- To perform all three operations simultaneously on same machine and individually if required.
- We can perform multipurpose operations on thin metallic as well as wooden model.
- Operation of any complicated components can be done with this machine.
- We can perform various operations like cutting, drilling, or grinding individually by introducing coupling (engagement & disengagement) between them.
- We can perform grinding operation by introducing a grinding tool at the main shaft.
- We can perform boring operation by introducing a boring tool by replacing drilling tool.
- We can change the speed of motor by regulator.

3.2 Methodology

Supplying power to shaft by means of Electrical motor mechanism containing one big pulley and one small pulley which is fitted on shaft and belt on pulley helps to rotating shaft, on which a pulleys are mounted on it by means of motor pulley arrangement. One pulley transmits power by v belt to the grinding wheel under it and also by link attachment the power is transmitted to the hacksaw frame (rotator motion is converted to reciprocating motion). Also other pulley transmits power by v belt to the drilling attachment.

The important parts of the designed synchronous machine includes a motor, which drives all the units, hacksaw blade fitted in a frame, steel frame, set of shafts which hold pulley, bearings which support the shaft, pulley for transmission of power, belt etc. Based on the principles of design and formulas from the design handbook, the size and the material of each component required under the situation of operation was calculated and selected. The methodology covers the selection of material and its size for its parts discussed above according to the situation under which the setup will be operated. The fig 3 shows theBlock Diagram of Methodology.

IV. WORKING PRINCIPLE

There are only two major principles on which this proposed model generally works.

They are: 1) Scotch-Yoke mechanism

2) Power transmission through gears -Bevel gears

The Fig. 2 shows the scotch yoke mechanism is constructed with iron bars. Here the crank is made of wood in some length and the yoke is made of iron. It is noted that the minimum length of the yoke should be double the length of the crank. The crank and yoke is connected with a pin. Iron bars are welded to both sides of the yoke to get the reciprocating motion. The yoke with the iron bars is fixed on the display board with the help of square pipe that is a bit bigger than that of the iron bars. Now the crank is connected through a screw mechanism to the end of the shaft of the bevel gear mechanism. Now the pin on the crank is connected to the yoke. The pin used to connect yoke and crank is a bolt.

The Fig. 3 shows the Bevel Gears, these are Bevel Gears are basically used for drilling operation.

Bevel Gears are basically used for drilling operation

4.1 Advantages

- Multi operations can be performed at the same time.
- Size is compact therefore it requires less space.
- Time is saved as all operations can be done at once.
- Less man power is required.
- Low manufacturing & maintenance cost.
- Machinery is easy to use.
- Energy is saved as there are fewer moving parts.
- Operation is smoother.
- Affordable and cost effective.

4.2 Disadvantages

- It is totally manually operated.
- Time consuming as compared to completely automatic one.
- Cannot be automated
- Not fit for heavy production.
- Rapid wear of the slot in the yoke caused by sliding friction and high contact pressures.
- Lesser percentage of the time spent at bottom dead center reducing blow down time for two stroke engines, when compared with a conventional piston and crank shaft mechanism.

V. FIGURES

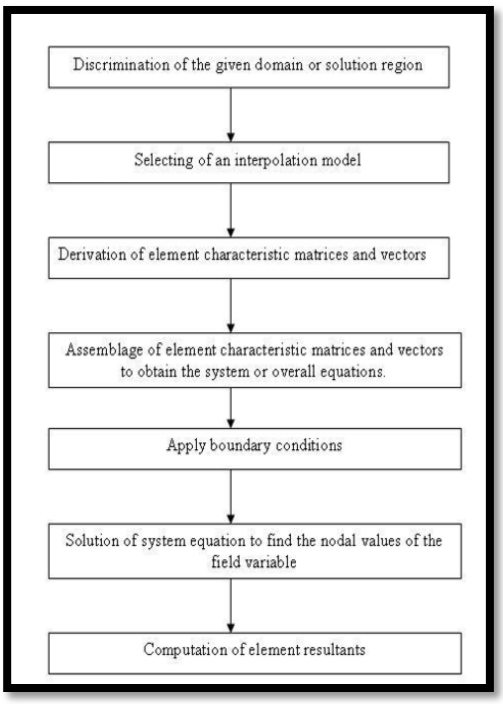

Fig. 1 Block Diagram of Methodology

Fig.2 Scotch Yoke Mechanism

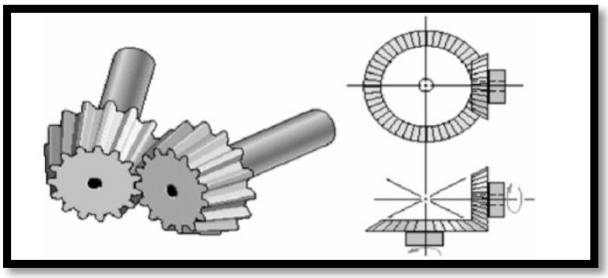

Fig.3 Bevel Gear

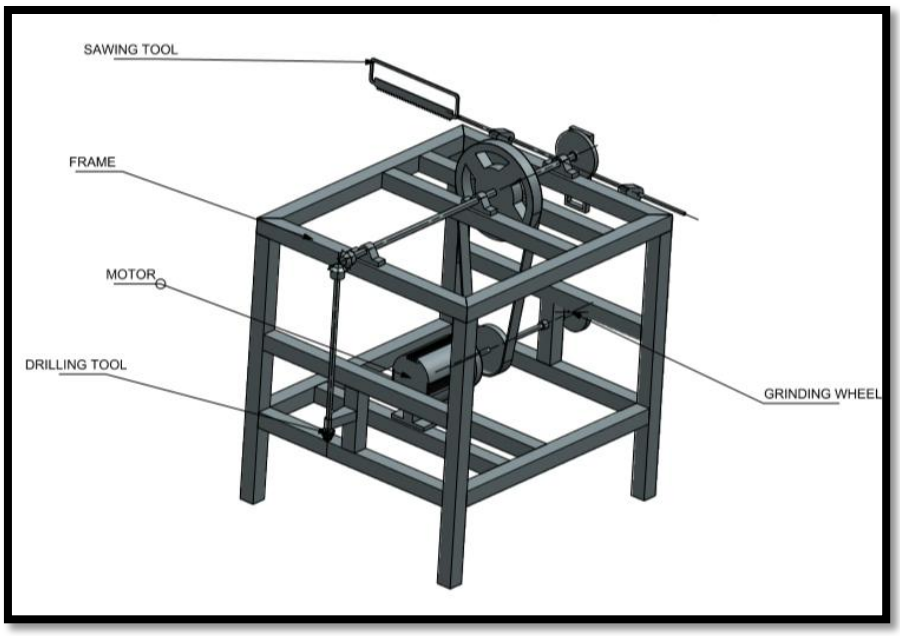

Fig. 4 3D Model of The Project

VI. CONCLUSIONS AND FUTURE SCOPE OF THE WORK

6.1 Conclusions

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. This machine can perform operations like drilling, sawing, grinding and cutting at different work centers simultaneously which imply 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.

The scotch yoke mechanism is made and its advantages and disadvantages are discussed. Its motion characteristics are studied. It is concluded that this mechanism is a good choice to convert rotating motion into reciprocating motion because of fewer moving parts and smoother operation.

6.2 Future Scope of Work

- Other operations can also be incorporated in to the machine.
- The machine can be made more portable.
- Cost can also be reduced to some extent by manufacturing it on a mass scale.
- Regulator can also be incorporated onto the AC motor to regulate the speed of moving motor (varying speed of motor).

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