

Design of Multi-Operational Machine

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Abstract: *The Multi-Function Operating Machine mainly carried out for production-based industries are meant for the 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 fast due to technological 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 low average cost. We have developed a conceptual model of a machine that would be capable of performing different operations simultaneously, and it should be economically efficient in this machine we are giving drive to the main shaft to which the scotch yoke mechanism is directly attached, scotch yoke mechanism is used for sawing operation. On the main shaft, we have used a bevel gear system for power transmission at two locations. Through bevel gear, we will give drive to the drilling centre and grinding centre. The model facilitates us to get the operation performed at different working centres simultaneously as it is getting driven from the single power source. Objectives of this model are conservation of electricity (power supply), reduction in cost associated with power usage, increase in productivity, reduced floor space.*

Keywords: Single slider mechanism, bevel gear, drilling, cutting, sawing, grinding, multi-operational, bearings

I. INTRODUCTION

Industries are designed to provide valuable products and services at minimal production, equipment, and inventory costs. Due to technological advancement, every task has become quicker and easier to complete in the modern world. However, this advancement also necessitates significant financial outlays. Every industry aspires to achieve high productivity rates while maintaining product standards and quality at a low average cost. A large amount of an industry's expenditure goes towards installing machinery. So, we have suggested a machine in this project that is capable of doing tasks like drilling. The simultaneous use of a few lathe operations for cutting and grinding suggests that industrialists do not need to pay for separate machines to conduct the aforementioned functions.

Yet this development also necessitates significant financial outlays. Given this, every sector aspires to increase production while keeping costs down and product standards and quality high. The goal of this project is to create a theoretical machine tool that can carry out several tasks at once while being cost-effective. One of the manufacturing processes is machining, which involves removing excess material to give any object the desired form. By interacting with the workpiece using the proper tool, this extra material from the workpiece is often removed from it as chips. A relative rotator or translatory motion between a tool and the workpiece during metal cutting affects the chip formation process in a negative way.

II. LITERATURE REVIEW AND OBJECTIVE

Pratik P Bargode et al (2015) has invested that, the multipurpose machine having wood cutting, grinding, and buffing wheels on a single base are described. The practical measurement results have shown that the performance of this machine is better than the existing one. It requires less power for its operation. It is also convenient to move from one place to another, due to its compact size and being installed on a single frame. It is easy for maintenance with low maintenance cost and requires very little skill for its operation. This machine causes an increase in production capacity. Thus this machine is a better choice than machines performing those operations individually. [1]

Dr. Saif Imam et al (2016) have introduced that, the test carried out, it has been established after the completion of the project that this project offers a simple low capital machine tool for the machine shop producing a job that follows a

particular sequence of operation. The capital cost involved in the construction of a machine tool is much lowered than that of a commercially available single-unit machine tool.[2]

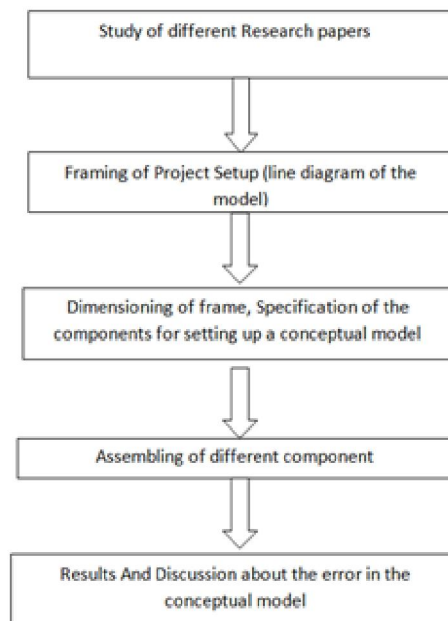
Kevin Patel et al (2013) have studied that, the project is done by a team of undergraduate students to produce something new and innovative. The idea of the project is very much clear and has the practical implementation. For the students of technical college, it will be very useful and effective. On the other hand, it can be used for domestic purposes and also for small commercial jobs. [3]

Ravi Teggan, et al (2015) has studied that, the incorporates wood cutting tool, forming tool, planing tool, drilling tool, are the very basic equipment for every woodworking processes. The machine is highly efficient and economically feasible for woodworkers. The power consumption is also less and works with all kinds of wood. The machine is constructed based on worker safety and space available to carry out work and has less vibration (has a strong base made with MS metal). Finally, the machine is comfortable for working and recommended to use.

This work entitled "Multi-purpose woodworking Machine" can perform cutting, Planning, forming, and drilling operations. And also turning operation will be added in future. Noise and vibration will be reduced. This can be used for the mass production of wooden furniture. [4]

III. METHODOLOGY

In this project we give power supply to grinder wheel shaft and to first counter shaft then the power transmitted from first counter shaft to second counter shaft then from second counter shaft to drilling machine shaft and scotch yoke mechanism.



IV. WORKING PRINCIPLE

There are only two major principles on which our proposed machine (conceptual model) generally works:

1. Scotch-Yoke mechanism
2. Power transmission through gears: a. Bevel gears
3. Working of the Model

1. Scotch Yoke Mechanism

The Scotch Yoke is a mechanism for converting the linear motion of a slider into rotational motion or vice-versa. The piston or other reciprocating part is directly coupled to a sliding yoke with a slot that engages a pin on the rotating part. The shape of the motion of the piston is a pure sine wave over time given a constant rotational speed.

2. Power Transmission through Gears

Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart but can be designed to work at other angles as well. The pitch surface of a gear is the imaginary toothless surface that you would have by averaging out the peaks and valleys of the individual teeth. The pitch surface of an ordinary gear is the shape of a cylinder. The pitch angle of a gear is the angle between the face of the pitch surface and the axis.

3. Working of the Model

In the conceptual model of "Multi-operational machine," we are giving supply to the main shaft as we move along the axis of the shaft, we have mounted a pair of bevel gears, through the pinion shaft, we are giving the drive to drill shaft through belt-pulley the arrangement, we have installed the stepped pulley in the arrangement, therefore, we can make the speed variation. Now again as we move along the axis of the main shaft further, we have again used the bevel gear arrangement to give the drive to the grinding centre. As we can see that the scotch yoke mechanisms are directly fabricated to the main shaft and have the same angular velocity as that of the main shaft as shown in fig.

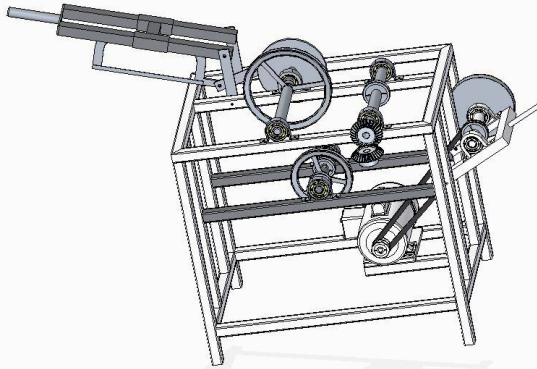


Fig. Cad model of Multi-operational Machine

V. MACHINE AND METHODS

1. Drilling

Drilling is the operation of producing a circular hole in the workpiece by using a rotating cutter called Drill Machine.

1. The machine used for drilling is called a drilling machine.
2. The drilling operation can also be accomplished in the lathe, in which the drill is held in the tailstock and the work is held by the chuck.
3. The most common drill used is the twist drill.
4. Drilling Machine
5. It is the simplest and most accurate machine used in the production shop.
6. The workpiece is held stationary i.e. clamped in position and the drill rotates to make a hole.

2. Grinding

A grinding wheel is a wheel composed of an abrasive compound and used for various grinding (abrasive cutting) and abrasive machining operations. Such wheels are used in machines. The wheels are generally made from a composite material consisting of coarse particle aggregate pressed and bonded together by a cementing matrix (called the bond in grinding wheel terminology) to form a solid, circular shape.

Various profiles and cross-sections are available depending on the intended usage for the wheel. They may also be made from a solid steel or aluminum disc with particles bonded to the surface. Today most grinding wheels are artificial composites made with artificial aggregates, but the history of grinding wheels began with natural composite stones, such as those used for millstones.

3. Cutting

A hacksaw is a fine-tooth saw with a blade held under tension in a frame, used for cutting materials such as metal or plastics. Hand-held hacksaws consist of a metal arch with a handle, usually a pistol grip, with pins for attaching a narrow disposable blade. A screw or other mechanism is used to put the thin blade under tension. The blade can be mounted with the teeth facing toward or away from the handle, resulting in cutting action on either the push or pull stroke. On the push stroke, the arch will flex slightly, decreasing the tension on the blade. Blades are available in standardized lengths, usually 10 or 12 inches for a standard hand hacksaw. "Junior" hacksaws are half this size. Powered hacksaws may use large blades in a range of sizes, or small machines may use the same hand blades.

VI. SPECIFICATION OF MACHINE

Frame of the model	Length = 760mm Width = 530mm Height = 690mm Material = M.S.
V-Belt	Type of belt = A Size = 1. A-38 2. A-44
Pulley	Number of pulleys = 7
Hacksaw	Standard
Grinding wheel	Diameter = 190mm SMPM = 438.73
Motor	HP = 0.5 RPM = 1440 Φ = 1 phase 50 Hz Volt = 230v
Drill machine	Standard
Bearings	Number of bearings = 8 Type = Ball Bearings Bearing Number = 6305 Diameter = 30
Bevel gear	No. of teeth = 18 Diameter = 54mm

VII. 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

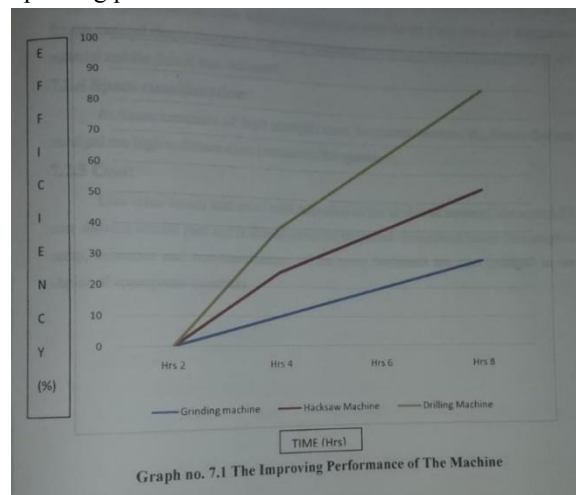
Cutting = 1 min 10 sec (*4)
Grinding = 40 sec (*4)
Drill = 3 sec
Cutting of base = 50 sec
Total time = 6 min 33 sec

$$\text{Time}_{(\text{manual})} / \text{Time}_{(\text{machine})} = 18 \text{ min } 30 \text{ sec} / 6 \text{ min } 33 \text{ sec} = 3:1$$

Time required manually is 3 times the time required by operation mechanical machine
=270/90 machine. =3:1

VIII. RESULT

From the design carried out, the following result was made. It has been established after completion of the project offer a simple low capital machine tool for the machine shop producing a job that follows a particular sequence of operation. The following graph shows the improving performance of the machine.



IX. CONCLUSION

It is clear that all the industries that are based on production, require a lower production cost and high work rate which are viable by making use of multi-function operating device that uses lesser power and time. As this machine offers functionalities at various centres, it was found to be effective in reducing the time that was consumed up to a considerable limit. When it comes to an industry, a substantial part of the investment is used up for the installation purpose of the device. So, in this work, a machine is proposed so that it does the machining functionalities like drilling, cutting, and grinding without additional paying for machines that function above the individual tasks for performing simultaneous operations. This project proposed exhibited an exciting task in the arena of industrial as well as automated workshops. It is found to be useful for the workers who work in the service stations of the industrial workshops. This project has been found itself superior in terms of reduction in cost that is usually indulged in the fabrication of the tasks stated for the project

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