

## GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES FABRICATION OF MULTI - PURPOSE MACHINE TOOL: APPROACH TO ENHANCE THE PRODUCTIVITY

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### ABSTRACT

The work aims to design and fabricate a multipurpose machine tool which is able to perform various tasks simultaneously. Bevel gear mechanism is used for the purpose of power transmission through main shaft in the radial direction which drives the drilling Centre. The machine is operated by giving drive to the main shaft to which worm gear mechanism is directly attached. worm gear mechanism is used for sawing operation. Grinding wheel which is used for the purpose of machining is directly attached to the motor shaft. All the three operations (Drilling, Sawing and Grinding) can be performed simultaneously by this model with a single power source. Pro-e 2.0 software was used to design this machine and Ansys software was used to perform the various test on the designed model. Fabricated machine tool has several advantages like less requirement of floor space, less power requirement, increase in productivity which will ultimately leads to reduced manufacturing cost.

**Keywords:** *Multipurpose machine tool, Productivity, Space area requirement, Power requirement, Cost of Manufacturing.*

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### I. INTRODUCTION

Industries are basically meant for higher productivity means higher quality of products at lower production and machinery cost. In any industry certain amount of money is being invested on inventory, set up cost and machine installation etc. In today's world, because of advancement in technology each and every task is performed in less amount of time but these all advantages comes with a huge cost.

In the present work, we have proposed a machine which is Multi- Purpose Mechanical Machine or MPMM as we call it is a machine that is made especially for the small scale industries where labor working have very little technical knowledge and also the cost of machines is very high. This machine can perform three different operations viz. Drilling, Grinding and Sawing. These operations can be performed simultaneously.

This machine performs multiple operation simultaneously, giving the workers more opportunity to perform their work quickly and efficiently without the hassle of using different machines for performing different operations [4]. This machine is automatic and is controlled or operated by motor which runs with the help of electricity. The mechanism of this machine is based on the mechanism which worth quick return motion mechanism. This model of multi operational machine can be used in industries and domestic purposes which can perform mechanical operation like drilling, cutting & shaping of a thin metallic as well as wooden model or body.

### II. MULTI PURPOSE MACHINE TOOL

The multi-purpose machine tool basically consists of the components like grinding wheel, hack saw blade, pulleys, bearings, wheel, motor, gear arrangement, machine frame etc.



*Figure 1. Multi-Purpose Machine Tool*

As discussed earlier that this machine can perform various operations simultaneously like:

#### ***Sawing***

Sawing is a process into which material is removed from the work-piece by cutting action and the semi-finished product is converted into the finished product of desired dimension, shape and accuracy [2-6].

#### ***Grinding***

Grinding is the category of semi-finished machining operation in which the material is removed from the work material in form of chips. Grinding wheel basically consists of abrasives and these abrasives acts as a cutting medium to achieve the product of desired size and shape for specific amount of volume [2-6].

#### ***Drilling***

Drilling operation is performed by help of drill tool which is also known as double point cutting tool. Drilling operation is performed to make or impart circular holes in a work piece of desired diameter and length. Mostly twist drill is used for drilling operation. Drill operation can also be performed on lathe machine by using tail stock.

So, this machine is basically combination of these three operation which can be performed simultaneously and ultimately it leads to enhancement in productivity [2-6].

### **III. METHODOLOGY**

The methodology used for the present work is shown by the following flow chart [1].

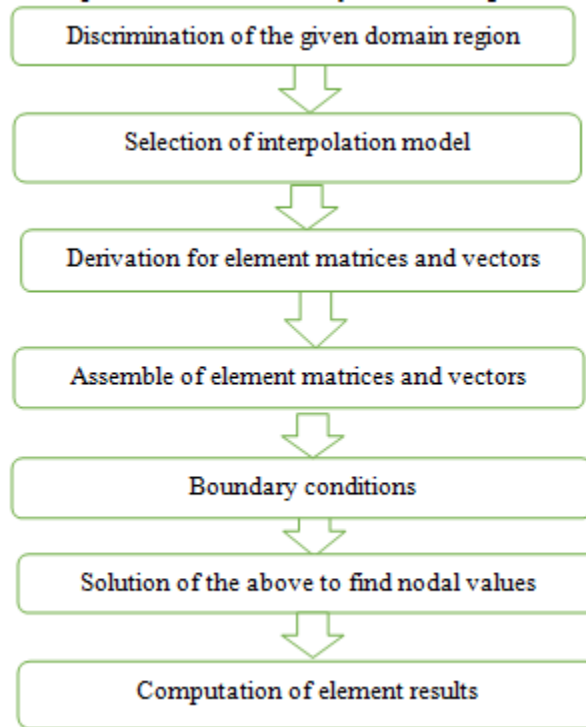


Figure 2. Flow chart of methodology

#### IV. DEVELOPMENT OF MODEL

The machine consists of hacksaw blade, mild steel frame, wood block panel, chuck, bearing, vice, motor etc. and the model was developed by using Pro-e 2.0 and ANSYS software.

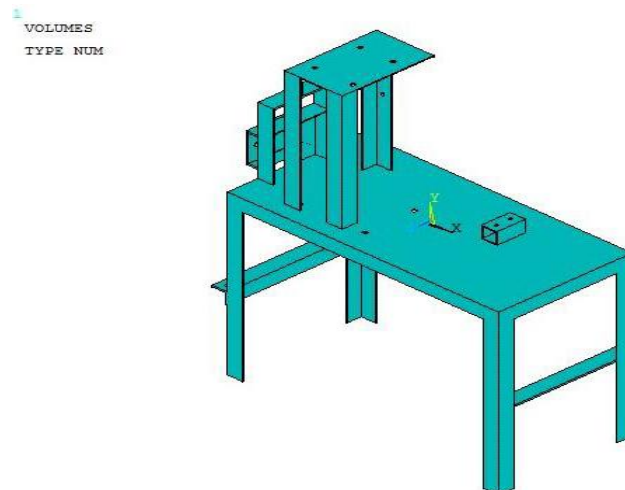


Fig 3. Multi- Purpose machine model

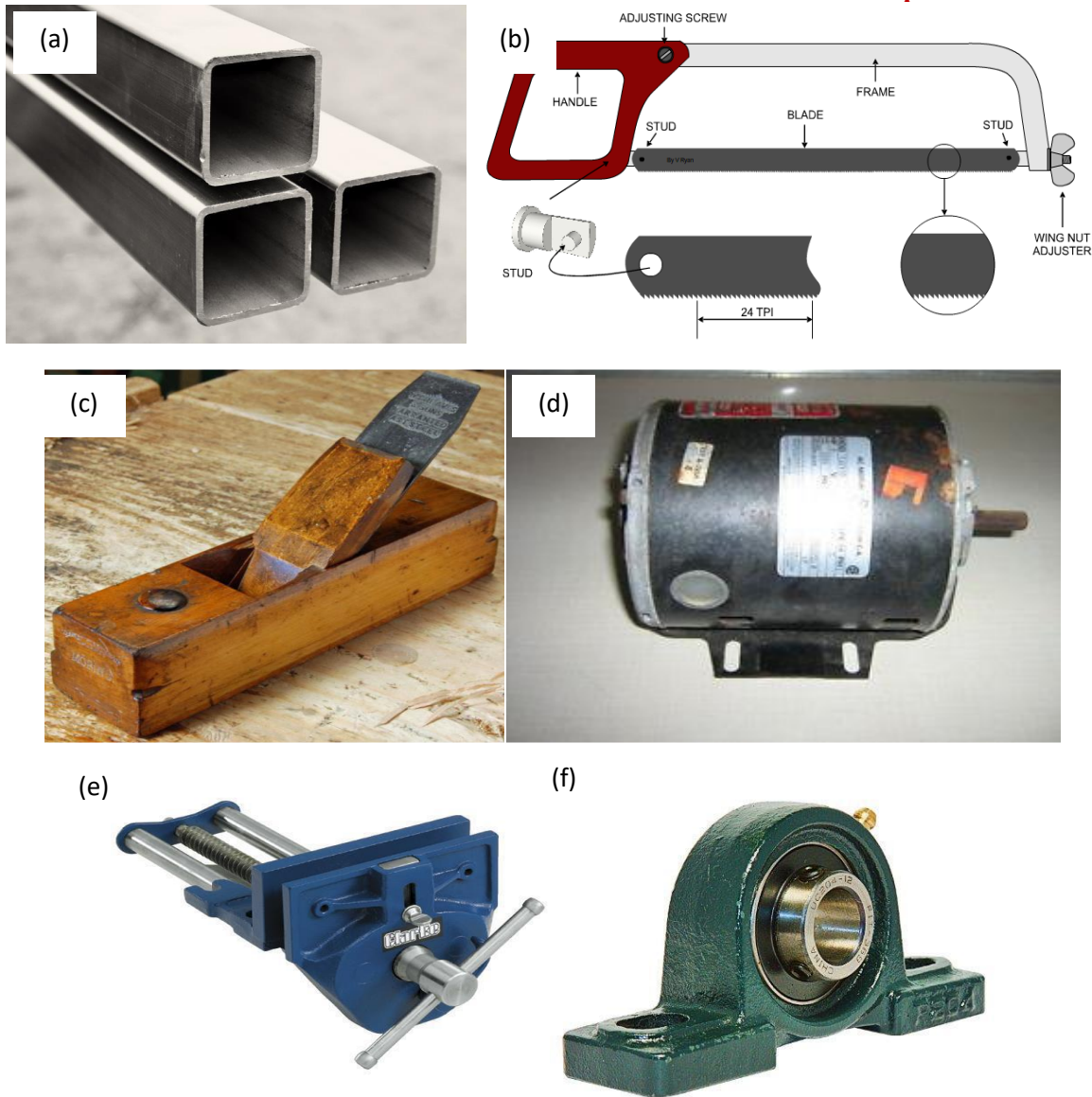


Fig. 4 (a-f) (a). mild steel frame (b) hack saw blade (c) wood block panel (d) motor (e) vice (f) bearing

**Specification of machine components:**

Following are the specification of machine components which are used for model development.

1. Frame-Mild steel  
Thickness- 1.5 mm  
Size- 1.5 sq. inch  
L\*B\*H- 4ft\*2ft\*2ft
2. Pipe gripper vice-Mild steel
3. Wood gripper vice-Cast iron
4. Belt-V belt (A grade type)  
Length – 85 inch
5. Motor-0.5 HP (AC)@1440rpm
6. Pulley ratio-d/D =1/13

7. Main axle (Mild steel) diameter-20mm
- Main axle ratio-1440/13
8. Drill width-1.5-13mm
9. Bearing ball (internal diameter)-20mm
10. Crank travel-4,6,8 inch (variation with bolt arrangement)
11. Connecting rod for shaper & saw, pipe size -0.75 inch
- Thickness-2mm
12. Arc welding-250 & 300 volts.

## V. COMPARISON BETWEEN MULTI PURPOSE MACHINE AND INDIVIDUAL MACHINES

*Table 1. Multi-Purpose Machine Vs Individual Machine*

| S. No. | Type of Machine       | Cost   |
|--------|-----------------------|--|
| 1.     | Multi-Purpose Machine | Rs. 15,000   |
| 2.     | Individual Machine    | Grinding Machine: Rs. 5,000-6,000<br>Sawing Machine: Rs. 5,500-7,500<br>Drilling Machine: Rs. 8,500-10,500 |

So ultimately we can reduce the manufacturing cost by 30% - 40% by using multi-purpose machine instead of individual machine and also it will lead to less floor space requirement and power consumption and this all will lead to enhancement in productivity.

## VI. CONCLUSION

The multi-purpose machine was successfully fabricated and which can do three operations (drilling, sawing & grinding) simultaneously and the following conclusion can be drawn:

- ❖ Higher Productivity
- ❖ Less Cost
- ❖ Less floor space requirement
- ❖ Reduction in power consumption
- ❖ Workers movement is minimized
- ❖ Three operations can be performed simultaneously.

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