

Fabrication of a Compact Multi-Operational Machining System

B. Vasu, MD. Asif, S. Murali Kumar, K.Thanveer, G. Siva Sai Ram

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, buffing, metal 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: Drilling, cutting, buffing, grinding, bearings, drill bit

1.INTRODUCTION

The reason to fabricate a multi-operational mechanical machine is that there is no machine which can perform various operations (i.e. drilling, cutting, buffing & 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, buffing 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 fabricated which can perform operations namely drilling, buffing, 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 multioperation machine, you're less dependent on particular products and sectors", explains Biermann.

3 COMPONENTS

3.1 INDUCTION MOTOR

An induction motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical connections to the rotor. An induction motor's rotor can be either wound type or squirrel-cage type



Fig: INDUCTION MOTOR

3.2 SHAFT:

A shaft is a rotating machine element, usually circular in cross-section, used to transmit power from one part to another. It typically supports parts like gears, pulleys, and sprockets, which are used to transfer motion and torque.



Fig: SHAFT

3.3 PILLOW BLOCK BEARING

A pillow block bearing, also known as a plumber block or housed bearing unit, is a pedestal used to provide support for a rotating shaft with the help of compatible bearings & various accessories. Housing material for a pillow block is typically made of cast iron or cast steel



Fig: Pillow block bearing

3.4 DRILLING CHUCK

A chuck is a specialized type of clamp. It is used to hold an object with radial symmetry, especially a cylinder. In drills and mills it holds the rotating tool whereas in lathes it holds the rotating work piece. On a lathe the chuck is mounted on the spindle which rotates within the headstock. For some purposes (such as drilling) an additional chuck may be mounted on the non-rotating tailstock.



Fig: Drilling Chuk

3.5 DRILL BIT

Drill bits are cutting tools used to remove material to create holes, almost always of circular cross-section. Drill bits come in many sizes and shape and can create different kinds of holes in many different materials. In order to create holes drill bits are attached to a drill, which powers them to cut through the work piece, typically by rotation.



Fig: Drill bit

3.6 METAL CUTTING WHEEL

A metal cutting wheel (also known as a cutoff wheel) is a thin, circular abrasive disc used with power tools like angle grinders or chop saws to slice through hard materials such as steel, iron, and aluminum. Unlike a hacksaw, which relies on a serrated blade and physical strokes, a cutting wheel utilizes high-speed rotation and friction to wear away the material



Fig: Metal Cutting Wheel

3.7 Buffing wheels

Buffing wheels are rotating discs made of materials like cotton, felt, or sisal, used with compounds to polish, cut, or finish surfaces to a high-luster, mirror-like, or satin sheen. They work by friction, requiring specific compounds (e.g., Tripoli, rouge) to remove minor scratches and oxidation on metal, plastic, and wood.

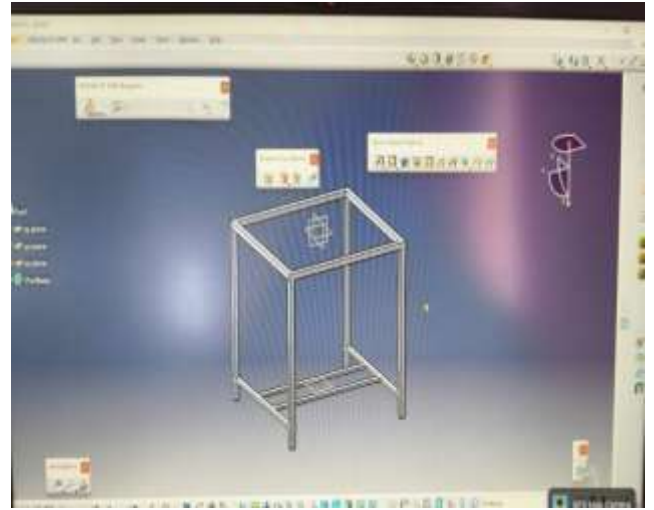


Fig: Buffing Wheel

4. Design of Frame

The frame design is based on the requirement of our operations. That a motor of around 2 HP will be more than sufficient for most operations. Hence, we select a motor of 2 HP. After selecting the motor, we calculate the height and width of the frame. For this we first need to calculate the power transmission capacity of our belt drive system. Based on these calculations we have found that we will require two shafts of diameter greater than 15 mm. We choose a shaft of 20 mm diameter. Based on the power to be transmitted and the strength of our materials, the distance between the shafts is calculated and hence we get the width of our frame. The

height of the frame is chosen by considering what is comfortable for the operator. Hence a height of around 80 cm'' is selected.



5. TESTING AND RESULTS

Drilling Operation



Fig: Drilling operation on metal

Diameter of Drill bit = 5 mm

Speed (r.p.m.) = 1440 r.p.m

Cutting Speed = π * Diameter of drill bit * r.p.m.

/1000

= $3.14 * 5 * 1440 / 1000$

= 22.608 m/min

GRINDING OPERATION



Fig: Grinding operation on metal(Before)



Fig: Grinding operation on metal (After)

Diameter of grinding wheel = 100

Speed (rpm)=1440 rpm

Length of work piece=45mm

Width of work piece=40mm

Surface speed=

$$\frac{\pi * \text{Diameter of wheel} * N}{1000}$$

$$= 3.14 * 100 * 1440 / 1000$$

$$\text{Cutting Speed} = 452.16 \text{ m/min}$$

CUTTING OPERATION



Diameter of cutting wheel = 100

Speed (rpm)=1440 rpm

Length of work piece=45mm

Width of work piece=40mm

Surface

$$= \frac{\pi * \text{Diameter of wheel} * N}{1000}$$

$$= 3.14 * 100 * 1440 / 1000$$

$$\text{Cutting Speed} = 452.16 \text{ m/min}$$

BUFFING OPERATION



6. .RESULT

The expected results for this project was to assemble a group of various however necessary operations on one

platform. The machine will perform all basic operations except turning. there's a small drawback of vibrations which may be resolved by correct fabrication and alignment of components.

we've found this machine's style to be terribly versatile because it is simply changed to accommodate a good form of operations like attachment, plasma cutting, hacksaw, etc. With a little a lot of planning the machine will deliver even bigger performance and still cut price.

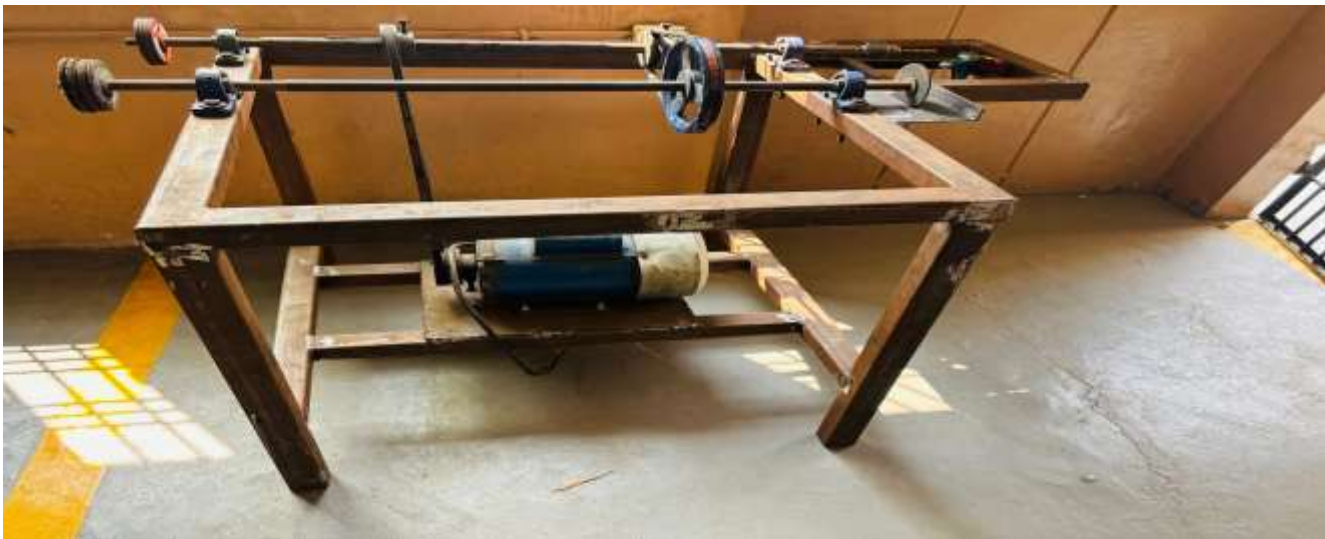


Fig: Experimental setup of multi operation machining system

7. CONCLUSION

We see that all the industries, which are production based want low production cost and high work rate which is only possible through the utilization of multi-function operating machine which will use less power as well as less time and less labor. Since this machine provides working at different center so it reduces the time consumption up to an appreciable limit. In an industry a considerable portion of investment is being made for machinery installation which is very costly. So we have proposed a machine that can perform operations like drilling, cutting & grinding, buffing at different working centers simultaneously which shows that industrialist have not to pay for machine performing above tasks individually for operating the operations simultaneously. The following conclusions can also be drawn that the machine is useful particularly for small scale industries. Workers movements can be minimized. Number of operations can be carried out on the single machine. Power consumption is reduced. Floor area required is reduced. Cost of manufacturing is also reduced.

8. FUTURE SCOPE

1. Other operations can also be incorporated in to the machine.
2. The machine can be made more portable.
3. Cost can also be reduced to some extent by manufacturing it on a mass scale.

In future operations can be done with materials of higher density and sizes by fabricating a bigger

machine.

By placing a high speed motor operations can be done more quicker than of now.

Implementations like each operation can be controlled in such a way that unnecessary operations are stopped in order to transfer all the energy to one machining operation can be done.

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