Fabrication of Multi-Operation Machine for Disaster Management

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Abstract: *Useful machine has received nice development and a focus right from the beginning of the commercial revolution, however review of previous low cost multioperation machines shows a typical trend of poor quality machining expertise. during this paper we tend to gift the planning and fabrication on a multioperation machine that's each low cost nonetheless reliable. The most operations that this machine is intended for area unit as follows.*

- *Horizontal Drilling.*
- *Cutting (Wood, Metal, PVC Pipe).*
- *Grinding.*
- *Circular Sawing.*

In this paper we'll discuss the methodology that helps US to grasp however we tend to arrive on the idea of useful machine regarding on our expectations. Giving the ability to the most shaft by motor and distributing the rev with facilitate of pulleys and belts, we tend to machine mistreatment totally different cutters. Then we tend to calculate the forces functioning on the machine and therefore the initial style was supported it. The structure of this paper shows the approach that we tend to take to style and fabricate this machine. The result's ended on the idea of sensible approaches.

1. INTRODUCTION

At present, the machining business worldwide is enjoying Associate in Nursing unprecedented demand, for production of helpful merchandise and services at low value. the company world is driven with creating profits. The R&D business is boosting with the large boost from competition. however, this boost typically neglects the necessity of non-profit driven production. The antique issues of disasters, each natural and artificial like wars still exist. the current industries principally specialize in coming up with and developing of new machine with innovative technology. Thus, they aim for solutions of the developing areas however neglect the issues of peoples in crisis. These are the people that cannot afford workshop category facility. we tend to believe that the event should be achieved on each side and Profits mustn't be a bottleneck for undeveloped areas. during this paper we tend to will address such issues with an inexpensive answer.

2. LITERATURE REVIEW

Yashia Higuchi Keio [1] As consistent with this paper we tend to study disaster-stricken areas however, the impact of disaster affects the economy, employment associated chiefly the industries by learning all these things this paper describes however the recovery a rising in production of producing studies Michael K Lindell [2] this paper addresses the social and behavioral matter of at the same time stress and the way the expansion rate shows down industries involves get stop. the whole industrial setup and resources area unit completed stop. And there's an inexpensive machine needed.

Adarch Adeppa [3] As once producing name comes then cutting of materials and in trade metals area unit chiefly used thus for the elaborate study and to grasp the structure of cutting metals it's short a close study of forces, feed, and depth needed.

Heinrich Arnold [4] this paper shows the however the producing technology is developed consistent with several specialists. The revolution once the globe war- II takes within each aspect of coin the means that few industries grow and a few razed and therefore the space wherever everything got destroyed and therefore, the areas wherever everything must be compelled to push up for coming back in previous stage.

Dr. Toshimichi Moriwaki [5] It shows however the demand is growing, however the advancement is carried on.

Frankfurt am Main [6] this paper shows however useful machine is that the appropriate possibility. however, the money saves the little producing may become older the patch size. Production may additionally have done.

3. METHODOLOGY

In this section we shall see the methodology for our work. We focus on disaster struck situations and figure out how technology can help them. As we know that there is a demand for a machine suitable of handling small jobs for such situations which brings different variety of operations on a single platform. It may be otherwise stated that we intend to replace highly specialized machines with simpler and multifunctional one. Hence, we design the multipurpose machine. This machine is designed with taking in account final output that the machine is expected to carry out.

2.1 An overview of operations

There are many ways to shape metal. As metal is difficult to cut with primary hand tools as used throughout ages, machines become a simple choice. In machining, operations like turning, metal cutting, drilling and grinding are very basic and of huge importance. First, we consider the various operations that are necessary for this machine to perform. The operations that we came up with are cutting, drilling, grinding. Other operations such as hacksaw cutting, turning are eliminated as they require much reinforcements and they may interfere with the other operations by consuming too much power and creating too much vibrations.

4. CUTTING FORCES OVERVIEW

The spindle speed in expressed in rev/min of the workpiece or the tool. However, the tangential linear speed which is expressed in m/min is the linear velocity with which the cutting edge of the tool is moving and hence it depends on its eccentricity from the axis of rotation of the spindle. Hence the cutting speed or the surface speed is expressed as surface foot per minute i.e. sfm. We understand that, there are two different kinds of speeds i.e. the spindle speed and the cutting speed. As the combined input of both spindle speed and feed are both necessary for the machine to cut, hence there is always a correlation and the relationship between them is expressed in terms of mathematical expressions. If the cutter geometry and the rigidity of the machine is neglected, then we can be limited only by the horsepower of our machine. As all materials in nature have a definite limitation on the rigidity and the geometry, hence mathematical expressions are used for defining the relationship between these entities. We can balance these speed for optimal cutting by considering the rigidity of the machine and the cutter geometry. We shall see the correlation between all these terms in the coming section.

Table -1: Power Requirement

Typical Power Requirement	
Type of Metal	Horsepower Required
Aluminum	0.25 HP
Brass (Soft)	0.33 HP
Brass (Hard)	0.50 HP
Bronze (Hard)	0.71 HP
Bronze (Very Hard)	1.54 HP
C1 (200 BHN)	0.67 HP
C1 (Over 200 BHN)	1.00 HP
Malleable Iron	0.80 HP
Steel 100 BHN	1.25 HP
Steel 150 BHN	1.43 HP
Steel 200 BHN	1.54 HP
Steel 250 BHN	1.82 HP
Steel 400 BHN	2.00 HP

	RPM				
Drill Bit Diameter (mm)	Wood	Acrylic	Brass	Aluminium	Steel
1.5-4.5	3000	2500	3000	3000	3000
6.3-9.3	1500-3000	2000	1200	2500	1000
11-15.5	750-1500	1500	750	1500	600
17-25	500-750	NR	400	1000	350

5. SPINDLE SPEED CALCULATIONS

The spindle speeds may be calculated for all machining operations once the SFM or MPM is known. The following formulae may be used to estimate this value.

RPM = cutting speed*12/π*Diameter

FEED RATE = RPM*T*CL

Where;

T= no of teeth on cutter

CL = Chip Load

Now we can calculate the Spindle Speed required for the various kinds of materials of out machine. After calculating the spindle speed, we have tabulated the RPM as given below.

Depending on the set of the machining conditions, there will be an optimum cutting speed for each material and the spindle speed (RPM) can be calculated from this speed. Factors affecting the calculation of cutting speed are:

- The material to be being machined
- The Tool Material
- The Economic Life of the cutter

The optimal cutting speed hence can be calculated if the below terms can be derived. These include:

- Metal removal rate (it is more for a rough cut but less for finishing cut)
- Flow of cutting fluid (depends on the optimal temperature and lubrication required)
- Rigidity of the machine and tooling setup (more stiffness means less energy wasted on vibration and stress and strain development)
- Continuity of cut (intermittent cut produce shock which are bad for both workpiece and tool)
- Metallurgical aspects of the material (mill scale, hard spots due to white cast iron forming in castings)

6. Design of Frame

The frame design is based on the requirement of our operations. It is clear from table No.1 that a motor of around 2 HP will be more than sufficient for most operations. Hence, we select a motor of 1.5 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 three shafts of diameter greater than 15 mm. We choose a shaft of 25 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 36'' is selected.

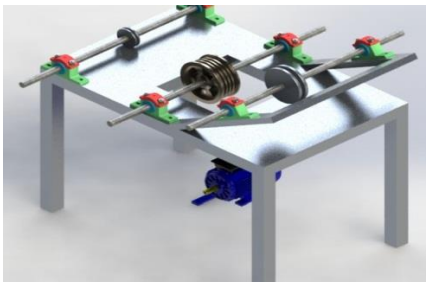

Fig -1: Predicted CAD Model

The above CAD model is just for representative purpose for helping in visual feedback. The final product is based on the feedback on what can be achieved during the fabrication phase.

Fig -2: CAD model of Multipurpose Machine.

The above CAD model is the original model developed by us. It can perform more than four operations. The primary operations that it can perform is drilling, metal and tiles cutting, grinding and angle cutting. It can be easily upgraded to accommodate more operations like welding, plasma cutting, etc. Other operations like turning and hacksaw cutting will probably require more reinforcements.

7. Results

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.

8. CONCLUSION

Most analysis in multimachine is targeted on premium machine business. However, with our result we've shown that a multimachine addressed at non-profitable things however still reliable will be simply fancied. supported our expertise of this work, it's obligatory that there's a requirement of additional versatile fixtures like vice for holding the work. The values of vibrations obtained below high-speed machining, indicates that there's slight imbalance which may be by experimentation mounted. The machine wants additional reinforcements to figure out the vibrations. Also, the rise in stiffness may result in reduction of around 100% of cutting force needed. So, it will be finished that by an additional refined style the potency of the drive system will be magnified and because the style continues to be terribly versatile it permits additional options to be more while not a lot of problem. In terminal this paper, we've well-tried that the machine delivers evidently with some area for improvement.

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