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Design and Fabrication of Multi Operational Material Removal Machine

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Abstract:*In an industry a considerable portion of investment is being made for machinery installation. Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. So in this paper we have a proposed a machine which can perform operations like grinding, cutting, filing and super finishing at different working centres simultaneously which implies that industrialist need not to pay for machine performing above tasks individually. This paper presents the concept of multi-functional material removal machine mainly carried out for production based industries. We have developed a conceptual model of a machine which would be capable of performing different operations simultaneously and is also economically efficient. In this machine we are actually transmitting power by using V belt which is attached to the main shaft on which pulleys are mounted. Mainly this belt provides the power at two ends i.e. two shafts and at the end of each shaft we are fixing the tools for operation to be carried. This machine can carry the number of operations at a time but in some cases if we required to operate the machine with single or two operations we are providing the simple flange and gasket mechanism to main shaft on which the four tools are fixed. This arrangement reduces the power consumption by keeping the required operations running and rest of the operations idle.*

Keywords :Grinding, Superfinishing, Cutting, Filing.

I. Introduction

Research into machines is expanding rapidly. There are several reasons why this is happening at this particular time. In production system the cycle time is very important term. The tendency of manufacturing industry is continuously done design & development in reducing cycle time. For performing multiple operations on single components required number of machines which carries single operation.

So, concentrating on the above points, it seemed to be necessary to design a machine, which can overcome the above difficulty. So we designing a machine which is answer to above problem & which will prove to be effective & greatly useful to industries.

Grinding, Cutting, Super Finishing, Filing are the operations which are required numbers of times in each and every industry for producing small as well as large components, also for installation of all small or large machine this basic operations or tools are required to settle the machines correctly. This operation is required in number of manufacturing operation to remove burr & sized the job. Grinding is an art and science of metal removing and makes the surface smooth. Basically it is the process or removing material by abrasive action of grinding wheel on the surface finish to the desired dimension.

The operations are performed at different machining centers. The simple arrangements are used to provide the drive from the single motor to the different working tools. The tools material and geometry of tools are selected as per the material of the work piece, load on the machine tools, cycle time, and rate of material to be remove etc. For selecting the tool material for different operations are mainly depends upon the tool life and the number of work pieces are to be handle in certain time.

II. Design Calculations

(1) Calculation of Torque:

Power of Motor Shaft = Pm = 1 hp x 746 = 746 watt.

Rpm of motor =1420 rpm

Motor shaft Torque: Tm

$$Pm = \frac{2\pi \text{ Nm Tm}}{60}$$

$$746 = \frac{2\pi \times 1420 \times Tm}{\quad}$$

60
Tm = 5.016 x 10^3 N-mm

(2) Shaft Design
Material selection –C 45
Syt = 360 N/mm^2
F.O.S = 3
Allowable tensile stress st = Syt / F.O.S
st = 360 / 3
st = 120 N/mm^2

Allowable shear stress = 0.5 st
0.5 X 120 = 60 N/mm^2

Select pulley of diameter 65 mm for motor shaft and grinding shaft pulley is 75 mm, So grinding shaft is near to motor speed.
Nm/Ns = Ds/Dm
1420/Ns = 75/65
Ns = 1230 rpm
Now torque on grinding shaft
T = (π /16)X d^3 X □
5.016 X 10^3 = (π /16) X 20^3 X □ □
□ □ □= 3.19 N/mm^2
So induced shear stress is less than allowable shear stress.
So design of grinding shaft is safe

(3) Selection of bearing
For 20mm dia shaft select the bearing from PSG P204
P = Pedestal
2 = deep groove ball bearing
04 = 4 x 5 = 20mm inside bore diameter

(4) Checking the strength of the welded joints for safety
The transverse fillet weld welds the side plate and the edge stiffness plates.
The maximum load which the plate can carry for transverse fillet weld is
P = 0.707 X S XL X ft
Where, S = Size of weld, L = Contact length = 45 mm
The load of shear along with the friction is 50 kg = 500 N
Hence let us find the safe value of 'ft'

$$\text{Therefore, } Ft = \frac{500}{0.707 \times 5 \times 45}$$

Ft = 3.14 N/mm^2

Since the calculated value of the tensile load is very smaller than
The permissible value as Ft = 56 N/mm^2 . Hence welded joint is safe.

III. model description and working

The Fig.1 shows the simplest model of machine. A prototype model of multi-purpose machine which operates on single motor with the help of V-Belt which is used for power transmission with the help of pulleys to the shafts. The shaft rotated with the pulley and at both the end of shaft we are making an arrangement of tools for the machining purpose. The shaft rotated with the help of pulley therefore the speed of the shaft and pulleys are same. As to operate the various operations at various speeds, the speed of rotation of the tools should be different. So we are selecting the various sizes pulleys which are maintaining the speed of rotation of the shaft or the tools as per the requirement of operations. To operate required operation at one time rest are to keep ideal we are introduce the lawjaw coupling on shaft at each side of pulley.

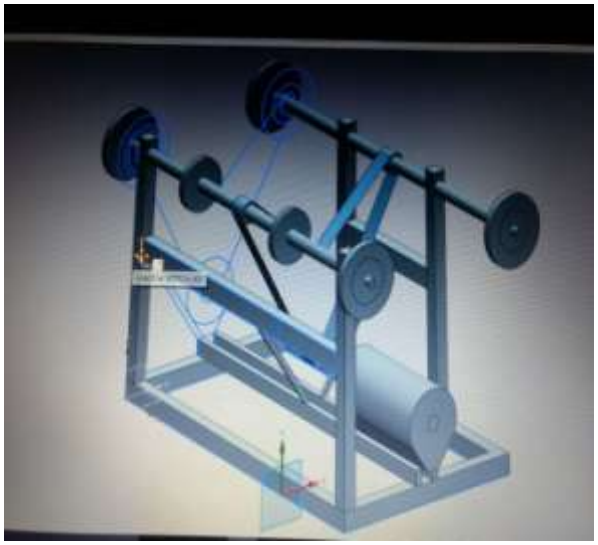
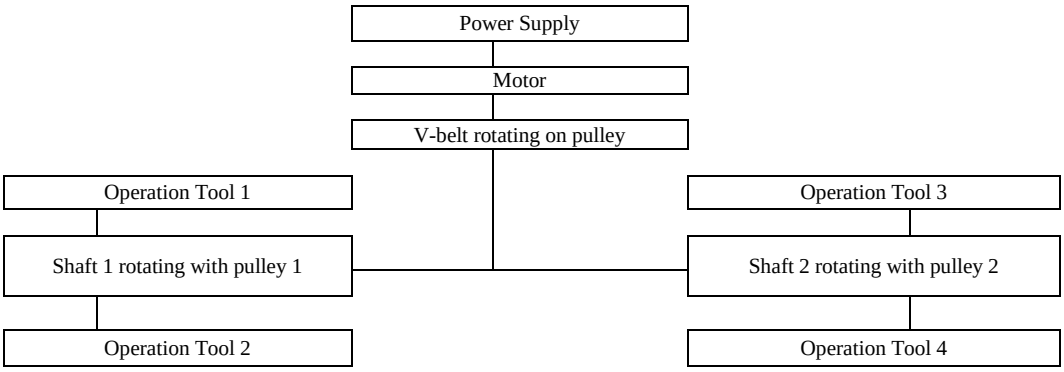


Fig 1 – Plan view of model



Process Flow Chart

IV. Conclusion

We conclude that this machine is perform the multiple operations i.e. Grinding, Cutting, Super finishing, and Filing operation on single motor operated machine to reduce power consumption, minimize the cost of producing the product and also reducing the floor space area.

This machine fulfill the requirement of small workshop of multi-operations.

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