International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.03, February 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

Design & Development of Multipurpose Machine

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ABSTRACT

The various machining process in manufacturing industries are carried out by separate machining machine. It need more space requirement and time with high expenses. But the fabrication of multi operation machine, which contains three operations in a single machine. The operations are namely drilling, slotting and shapingg. It is a new concept specially meant to reduce the work time and save the cost. Instead of using a slotting machine we are using the special arrangements for slotting operation in the drilling machine same for the shaping operation also, so we can save the investment cost of exceed slotting and shaping machine in the industries. The machine operates through drilling machine with the bevel gear and cam mechanism arrangements. Hence exactly we can carry out three operations in this machine, namely drilling, slotting and shaping. In this project we have tried to operate the all machining tools with powered by one motor only.

Key Words:Drilling, slotting ,shaping, ,Cam mechanism

I.INTRODUCTION

The multi process machine is used to do the multi operations like Drilling, Shaping, Slotting at a time and which is used to save the time and space requirement of an industry. The main concept of machine is to do the operations like slotting and shaping by the use of drilling operation using cam arrangement.This paper presents the concept of Multi-Function Operating Machine mainly carried out for production based industries. Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology 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 at low average cost. We have developed a conceptual model of a machine which would be capable of performing different operation simultaneously, and it should be economically efficient .In this machine we are actually giving drive to the main shaft to which scotch yoke mechanism is directly attached, scotch yoke mechanism is used for sawing operation. On the main shaft we have use bevel gear system for power transmission at two locations. Through bevel gear we will give drive to drilling centre and grinding centre. The model facilitate us to get the operation performed at different working centre simultaneously as it is getting drive from single power source. Also it reduces the machining equipment cost as three machines can be used simultaneously on same platform.

II.OBJECTIVE

1) To reduce time and man power.

2) Reduce machining equipment cost.

3) Three machine can be used simultaneously on same platform.

4) Reduce floor space.

5) Increase in productivity

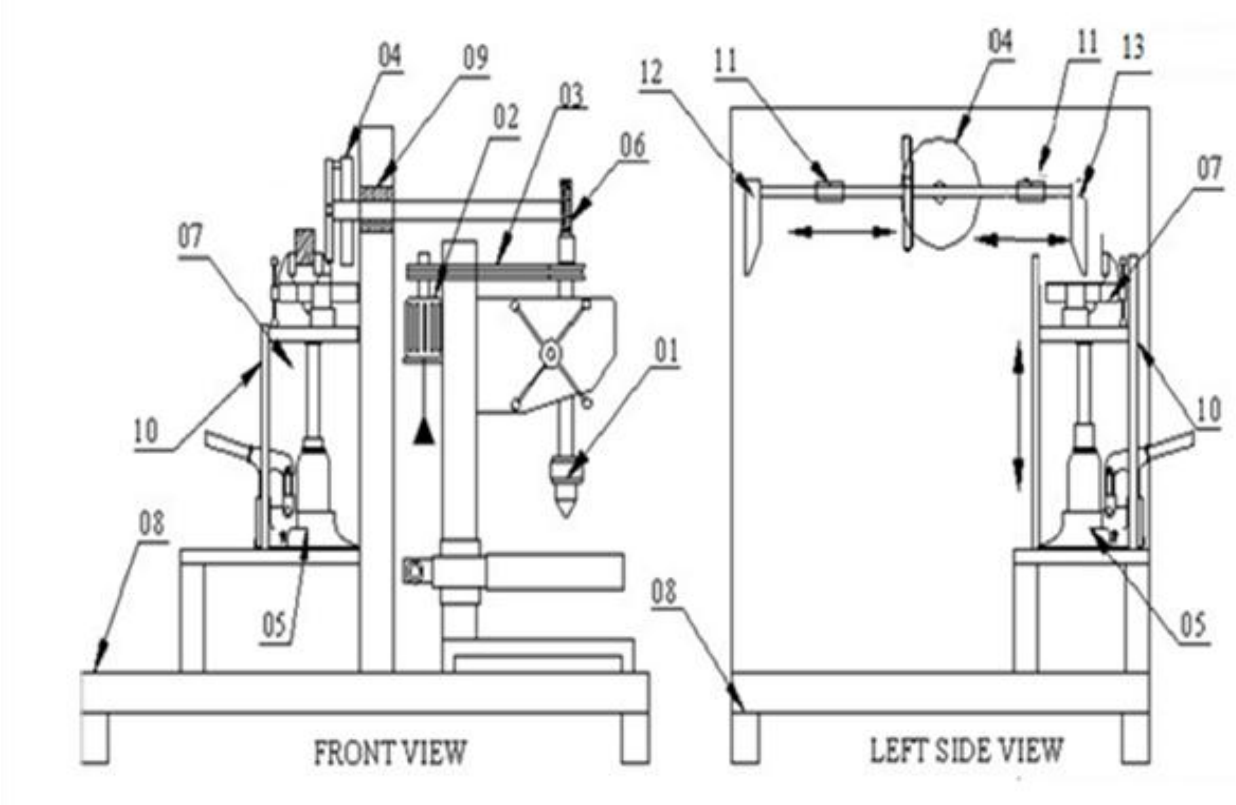
III.LITERATUREREVIE

SharadSrivastava et.al has given This paper presents the concept of Multi-Function Operating Machine mainly carried out for production based industries. Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology 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 at low average cost.RakeshAmbade et.al It is designed as a portable one which can be used for cutting in various places. It can be used for operating on materials like thin metals,wood and p.v.c.The material can be cut without any external energy like fuel or current. Since machine uses no electric power and fuel, this is very cheap.Energy is the most vital aspect in the development of modern technological civilization. In the present work, a human powered multipurpose machine is developed which can perform three types of operations drilling, sawing and grinding. Power required for pedalling is well below the capacity of an average healthy human being. The system is also useful for the work out purpose because pedalling will act as a health exercise and also doing a useful work

KshirsagarPrashant et.al In this literature author has given information about, the There are many industrial applications where round bar or square bars are required to be operated on different machines to make machine components such as Shafts, Bolts, Screws etc. This needs more and more number of pieces to be cut for mass production of those components. To achieve this goal the Multi-way power hacksaw machine is developed. This paper proposes the model of multi-way hacksaw machine which is able to cut four pieces simultaneously without any jerk and minimum vibrations. The model implies conversion of rotary motion into the reciprocating motion for proper working of hacksaw.

IV.EXPERIMENTAL SETUP

1)Setup diagram:



2)Design of experiment set up:

When designing our attachment, the following considerations were taken into account

1. The device should be suitable for local manufacturing capabilities.
2. The attachment should employ low-cost materials and manufacturing methods.
3. It should be accessible and affordable by low-income groups, and should fulfill their basic need for mechanical power
4. It should be simple to manufacture, operate, maintain and repair.
5. It should be as multi-purpose as possible, providing power for various agricultural implements and for small machines used in rural industry.
6. It should employ locally available materials and skills. Standard steel pieces such as steel plates, iron rods, angle iron, and flat stock that are locally available should be used. Standard tools used in machine shop such as hack saw, files, punches, taps & dies; medium duty welder; drill press; small lathe and milling machine should be adequate to fabricate the parts needed for the dual-purpose machine.

The standard available motor speed = 1450 rpm

For hack saw for two stroke one second we have considered.

Hence considered speed of crank = 290 rpm approx (neglecting the losses)

To achieve the speed up to output shaft we have used for speed reduction V- grroved pulley and belt drive

So pulley dia selected in first stage

First stage speed reduction = 5

Pulley on motor shaft = 50mm

Pulley on intermediate shaft = 5 x 50 = 225mm

The speed

The load considered 70 kg during the cutting operation

Total torque on crank = 700 x 150 = 105000N-m

T = Max Torque generated to rotating Crank

6 = 145 N/ mm2 considering factor of safety = 4

As per Design data book shaft material is selected Carbon steel C40

$C40 \Rightarrow Sut = 580\ N/mm^2 \quad Yield = 435\ N/mm^2$

σ = 145 N/mm2

As per ASME code

0.3 X Yield strength N/mm2

0.18 X ultimate strength N/mm2} whichever is smaller

0.3 x 330 = 99 N/mm2 …….(a)

0.18 x 580 = 104 N/mm2 ……..(b)

From equation (a) & (b)

Allowable stress value will be 99 N/mm2

If key ways will provide to shaft then

τ = 99 x 0.75 = 74.25 N/mm2

Where T = 105000N-mm

By using above equation drive shaft dia d = 19.33mm …….A

Fig. 1 Drive shaft loading condition.

P = 1000 N

$\sum F_Y = 0$

RA = 1000

Calculation of bending moment at loading point P,

BM at M = 1000 x 50 = 50000N-mm

we know,

$$M = \frac{\pi}{32} d^3 \sigma$$

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6 = 145 N/ mm2 considering factor of safety = 4

By using above equation drive shaft dia d = 15.49mm ……..B

From equation A and B we have selected the diameter of shaft = 20mm considering extra jerk and for safe design.

According to maximum shear stress theory

Equivalent Torque :-

$$T_e = \sqrt{(K_b M_A)^2 + (K_t T)^2}$$

From design data book service factor K_b & K_t = 1.

Equivalent bending moment

$$M_e = \frac{1}{2}\left[M + \sqrt{(K_b M_A)^2 + (K_t T)^2}\right]$$

Te = 116297 N-mm

Me = 83148 N-mm

we know, we know,

τ = $T_e = \frac{\pi}{16} d^3 \tau$ 73 < $M = \frac{\pi}{32} d^3 \sigma$ 74 N/mm2 and

6 = 105 < 145 N/mm2

By using above equation we have checked the allowable shear stress and allowable bending stress and it is seen that the both values are within limit hence design is safe.

6.1 Selection of bearing :-

$$\frac{F_a}{F_r} = 0 \leq e$$

so x = 1 & y = 0

Equivalent dynamic load

$$P = X F_r + Y F_q$$

P = RB = 1000 N

Life in hrs = 10000 hrs

Life in million

$$L = \frac{60\,n\,L_h}{10^6}$$

L = 36 millions of rev

dynamic load capacity

$$L = \left(\frac{C}{P}\right)^a$$

a = 3 for ball bearing.

From SKF bearing catalogue we have selected the bearing static capacity for shaft dia 20mm = Co = 2.32 KN

From above equation = C = 360 N

So calculated dynamic capacity C < bearing catalogue dynamic capacity C = 4.32KN

Hence from catalogue bearing selected = 61804

V.CONCLUSION

Multipurpose machine we can perform number of operation on single machine.

It helps to improve production rate and machining quality. We can see that all the production based industries wanted low production cost and high work rate which is possible through the utilization of multi-function operating machine which will less power as well as less time, since this machine provides working at different center it really reduced the time consumption up to appreciable limit. In an industry a considerable portion of investment is being made for machinery installation. So in this paper we have proposed a machine which can perform operations like drilling, sawing, grinding at different working centers simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously.

VI.ACKNOWLEDGEMENT

I would like to express profound gratitude to my guide **prof. S.S.LANDE** for his invaluable support, encouragement, supervision and useful suggestions throughout this project work. His moral support and continuous guidance enabled us to complete our work successfully. I am grateful for the cooperation and constant encouragement from my honorable Head of Department, **prof.N.M SANE** His regular suggestions made our work easy and proficient. Last but not least, I am thankful and indebted to all those who helped me directly or indirectly in the completion of this project report. It is indeed a great pleasure and moment of immense satisfaction for us to present a project report on "***Design AndDevlopement of Multipurpose machine***" amongst a wide panorama that provided us inspiring guidance and encouragement, we take the opportunity to

thanks those who gave us their indebted assistance. At last but not least we express our sincere thanks to our Institute's Principal **Dr J.A .TABOLI,** for providing us infrastructure and technical environment

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