Development and Optimization of Magnetic Vice in Drilling Machine

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Abstract - The Drilling is a metal removing process carried out by a rotating cutting tool to make rounded hole in the strong materials. A power operated machine tool which hold the drill in the spindle rotating high speeds and when actuated mode linearly against the work-piece produced a hole Jig and fixture is replaced by the magnetic vice so we can reduced the clamping time of work piece. The magnetic vice is the use for habit is the utilized for holding and supporting work-piece. This magnetic vice is arrangement at base on the drilling machine and switch direct connection with magnetic vice. The work-piece is fit at the magnetic vice. Exactness is higher compared to the other work-holding device. Power consumption is diminished. Clamping time is reduce and increased production. DC base system is used work is not pending and system is continuous working when power will be off. So no human harmful. We will Research on magnetic vice and Define the parameters decide Size of sample and select the sample.

IndexTerms - *magnetic vice, clamp, drilling machine metal working operation, industrial application Etc.*

I. INTRODUCTION

Drilling is a metal supplanted process carried out by a rotating cutting tool to make rounded hole in the strong and solid materials. When actuated mode linearly against the work-piece produced a hole. The drilling machine used job holding or supporting devices, but this clamping system is the required more time. There is various type of penetrating machine use Drilling machines are produced in various sorts and sizes as indicated by the sort of activity, measure of feed, profundity of cut speeds of rotating spindle is high, and the required accuracy. Jig and apparatus is replaced by the magnetic vice so we can reduced the set up time of work piece. Location system is use to perform properly, work holders should precisely and reliably position to the work piece for the most part to cutting device, part to achieve this the locator must guarantee that work piece is legitimately referenced and process is being repeated. We use DC base system so system is continuous working when power will be off.

A. Working principle-

A vice is a mechanical examination use to verify an item to enable work to be performed on it. Bad habit has two parallel installations, one fixed and other mobile, string out by a screw and switch. An engineering vice also known as a metal working process is used hold work piece and produced accurate holes it is made cast still or pliant steel iron, yet most are made solid metal. Anyway most rock solid bad habit is 55000 psi solid metal body yet a steel. Some bad habit is made solid metal yet body is steel channel bar. Cast iron is most popular due to it is ordinarily 30 KSI dark iron which is inflexible, solid and modest. The jaw is frequently discrete and replaceable, generally engraved with serrated or jewel teeth. Delicate jaw spread aluminum or copper might be copy work. Jaw opening of a building bad habit is quite often indistinguishable size from the jaw width, if not greater. An engineering vice or fixture is fixed on the top surface of a workbench, with the face of the fixed fixture just forward of its front edge the vice may include other feature such as small anvil on the back of its body. Most engineering vice have a swivel base. Locating system to perform legitimately, work holders should precisely and reliably position to the work piece generally to cutting apparatus, part to achieve this the locator must guarantee that work piece is appropriately referenced and process is repeated.

B. Type of magnetic vice

1. Light weight- Very light weight type's magnetic drills are very popular to perform several operations
2. Automatic and semi-automatic feed-Magnetic core drilling machines with fully and semi-automatic drill feed are very popular these days.
3. Cordless-Battery operated magnetic core drilling machines are used for a work place where there is no electricity.
4. Pneumatic- Pneumatic drilling machines are specially use where there is a danger of fire due to electricity.
5. Bits-The magnetic drilling machine utilizes core drill bits.
6. Horizontal-Horizontal magnetic core drilling machines with angular gears are made for confined drilling situations.

II Literature review

Y. Ras Mathew, j. gowthem et al 2010 [1], They Design and Fabrication of Work Holding Device for Drilling and Spot Facing of Bucket Wheel Excavator Teeth. In this paper a work holding device excavator teeth was model by using solid works and ProE Software. Modelled work holding device have a capacity to hold ten no. of teeth at a time around its periphery. Therefore time for

loading, setting, Clamping and unloading of teeth was reduced. From the comparative study it was concluded that by use special work holding device up to 50% of overall production time was reduced.

Fig 1. Drilling Machine

Charles Chikwendu Okpala, Ezeanyim Okechuku C.et al 2015 [2], They Design and Need for Jigs and Fixtures in Manufacture. They rate of production increase, cost reduction, interchangeability and high exactness of parts, decrease of the requirement for examination and quality control costs.

P. Stephen Antony Pradeep, S.Sivason raja, C. Rammurugan, R.SenthilKumaeret al 2015 [3]''Optimizing the Method of Work Holding Device- Drill Jig with Adjustable Drill Bush. They unique endeavour has been made to create customization kind of drill shrub, which can improve for the holding of work piece with variable measurement. This task is to various the breadth of the drill shrub dependent on the application. Drill dance and apparatuses is use to guarantee a gap to be bored, tapped or reamed in the work piece at appropriate spot. Dances are commonly utilized for large scale manufacturing.

Mr A. S. Kadam; Mr R. M. Rupanawar , Mr T. V. Daundkar al 2016 [4], Design and Modification of Bench Vice by Increasing the Degrees of Freedom The principle point is to find, backing and hold the work safely so we can play out the required machining tasks. We are going to plan a work holding gadget which will almost certainly hold the work piece in any direction. The work piece is move in any direction.

Shubham Misal, Kalpesh Tatar and Amol Vyavahare et al 2018[5], Design and Analysis of a Jig and Fixture for Drilling an inclined hole in a TEE Plain Adapter. This administrative work goes for structure and examination of a Jig and Fixture for boring a slanted opening at a point of 45°. This builds the rate of creation as well as reductions the measure of work that was performed for modifying the work piece for drilling operation in conventional method.

Smith Patel, Sahil Vasoya, Ankur Joshi et al [6], They design and manufacturing of jigs for drilling machine Large scale manufacturing goes for high profitability to decrease unit cost, and exchange capacity to encourage simple get together. They made the dance of boring machine of various material as opposed to gentle steel to lessen the weight and to facilitate the work dealing with jig.

Mr A. S. Kadam; Mr R. M. Rupanawar , Mr T. V. Daundkar et al 2016 [7], Design and Modification of Bench Vice by Increasing the Degrees of Freedom The principle point is to find, backing and hold the work safely so we can play out the required machining tasks. We are going to plan a work holding gadget which will most likely hold the work piece in any direction. The work piece is move in any direction.

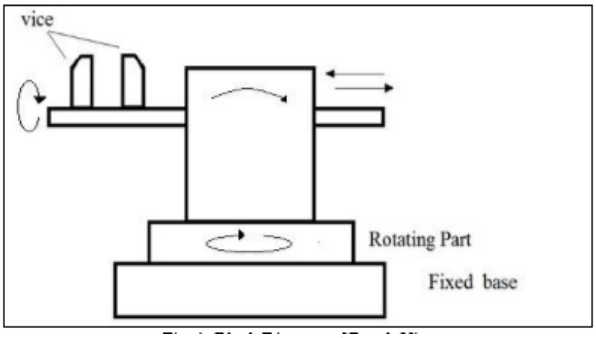

Fig 2. Design of vice

III Design of magnetic vice

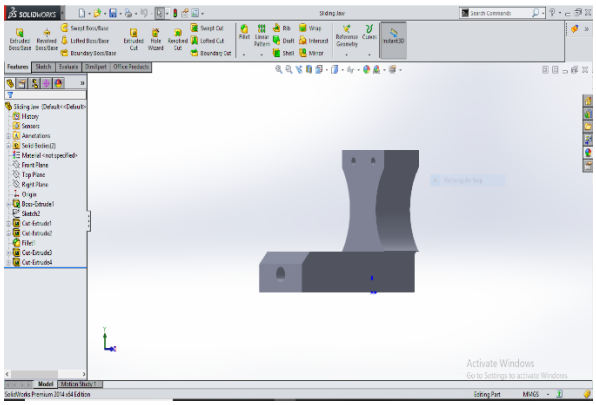

Fig 3. Design of Sliding Jaw

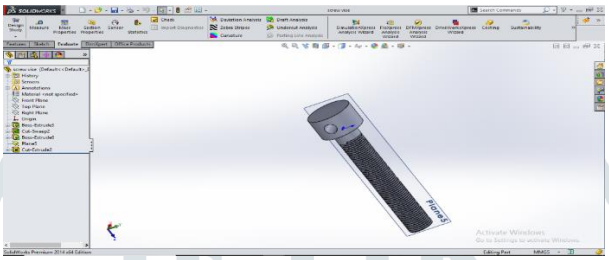

Fig 4. Design of vice screw

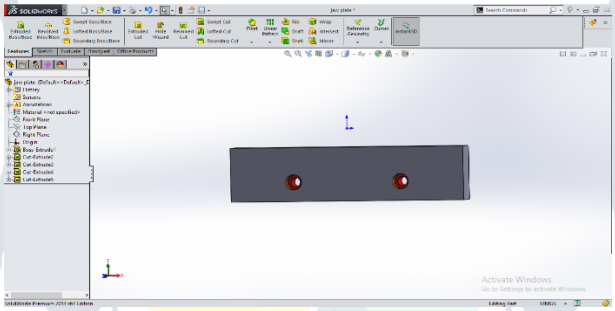

Fig 5. Design of jaw plate

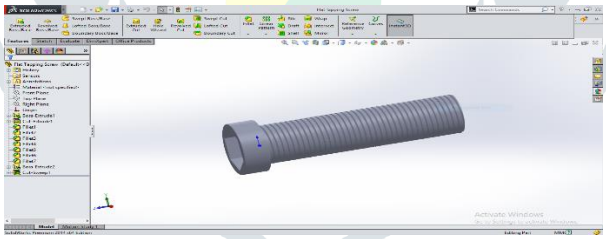

Fig 6. Design of clamp screw

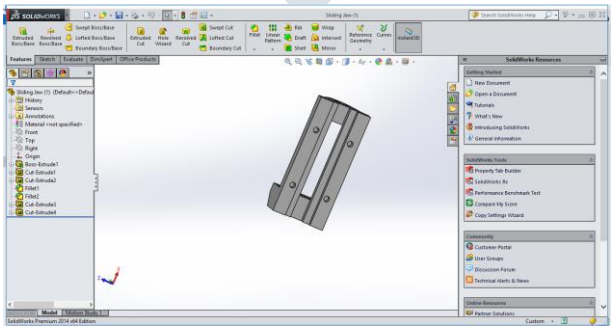

Fig 7. Design of jaw

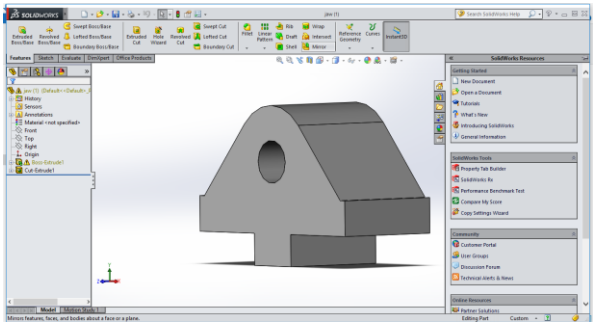

Fig 8. Design of base plate

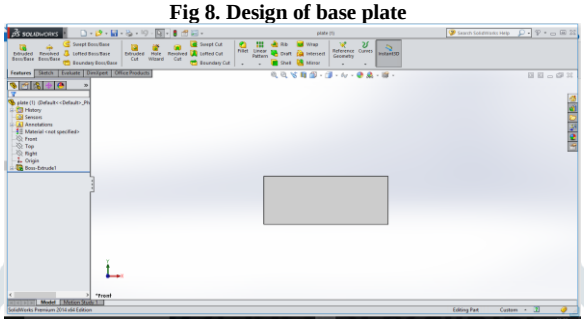

Fig 9. Design of jaw plate

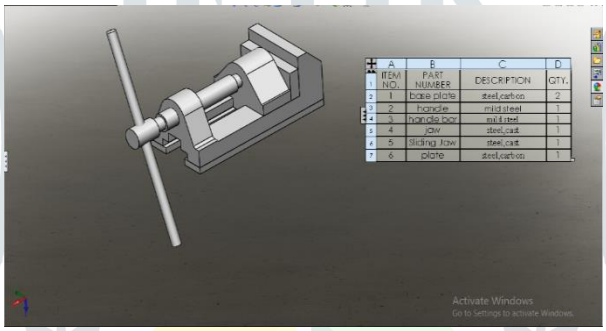

Fig 10. Design of magnetic vice

IV CALUCATION

Power- The ability or capacity to do something or act in particular way.

Torque -A force tend to rotation of object.

S_{yt}= Ultimate yield strength [n/mm^2]

E= Modules of Elasticity [n/mm^2]

W= Load [N]

F.O.S

F_{cr}= force of compressive

K = Stiffness N/mm^2

d_c = Nominal diameter of screw [mm]

d_o= outer diameter of screw [mm]

d_m= mean diameter of screw [mm]

α = Angle [degree]

T = Total torque [N. MM]

T_1= Tensile force [$n/mm2$]

T_2= compressive force [$n/mm2$]

P= power [kW]

σ_{comp}= compressive stress [n/$mm2$]

$\sigma_{max} = Maximum\ stress\ n/mm2$

p_b= pressure of bearing [kW]

H= height of work pieces [mm]

$selecting$

SAE = 1020 material of lead screw

SYT = 246 N/ /mm^2, E=250*103 N/mm^2

Assume F.O.S = 2 W=600N

Design of screw spindle

By Rankin formulae

S_{yt}= $\frac{Fcr}{A}$[1 + $\frac{1}{\alpha_n}$[$\frac{1}{K}$]]

F_{cr} = W * F.O.S=600*2=1200N=1.2*103N

K=$\frac{dc}{4}$

246 = $\frac{1.2\times10^3}{\frac{\pi}{4}*dc^2}$[1+1[300/$\frac{dc}{4}$]/10.03*10 $*$ 10^3*0.25]

d_c=9.44mm=10mm

Screw terms

Mean diameter d_m=$d_o - \frac{p}{2}$

$d_m = 24 - \frac{5}{2}$=21.5mm

Lead =2P=10

$\alpha = tan^{-1}[\frac{2*3}{\pi*21.5}]$

$\alpha = 5.07$

$\emptyset = tan^{-1}[\frac{laed}{\pi d_m}]= tan^{-1}[\frac{0.12}{sin90}]$

=6.84

Load on the screw thread

Torque,

T= [$\frac{Wd_m}{2}$] tan [$\alpha + \emptyset$]

=[$\frac{W*21.5}{2}$]tan[5.07 + 6.84]

T = 2.267 W, N-mm …… (1)

Torque due to applied force by lever

T = 600 * 200= 120000 N-mm

T= 120 *10^3N-mm…… (2)

Put the value of 'T' in equation (1), we get,

120 *10^3= 2.267W

W= $\frac{120*10^3}{2.267}$ = 52933.39N

Power required

To engage the load

T_1 = [$\frac{Wd_m}{2}$] tan [$\alpha + \emptyset$]

= [$\frac{52.933*10^3*21.5}{2}$] tan [$\alpha + \emptyset$]

T_1 = 120017.1049N-mm

= 120.017N-m

Torque require to disengage

T_2=$\frac{W*d_{c*}\mu c}{2}$ = $\frac{52.933*10^3*0.12*21.5}{2}$

= 25185.52N-mm

T2 = 25.18552N-m

Total Torque T= T1+ T2

T= 120.017 + 25.18552

T= 145.2026N-m

Power Required

(N= 20 rpm) Assume for human being

P= $\frac{2\pi nT}{60}$

P = 2π×20×145.2025 / 60

P = 304.11KW

Stresses in lead screw

Screw in lead screw

d_c= 7.93mm

d_o= 10mm

σ_{comp}=$\frac{W*4*dc^2}{\pi}$

τ= $\frac{16T}{\pi dc^3}$

= $16.800n - mm^2$

Principal stress

σ_{max}=$\frac{1}{2}$[σ_{comp}+$\sqrt{\sigma}_{comp+4\tau^2}$]

= $\frac{1}{2}$[112.14+$\sqrt{12.14 + 4[16.80^2]}$]

σ_{max}= 22.96n/n/mm^2

$\tau_{max} = \frac{1}{2}[\sqrt{\sigma_{comp}{}^{2} + 4\tau^2}$

$= 16.89\ N/mm^2$

Number of thread in engagement

$p_b = \frac{4w}{\pi(do2 - dc2)h}$

$p_b = \frac{4 \times 59.933 \times 103}{\pi(d_o{}^2 - d_c{}^2)h} =$ 121*3 =363mm

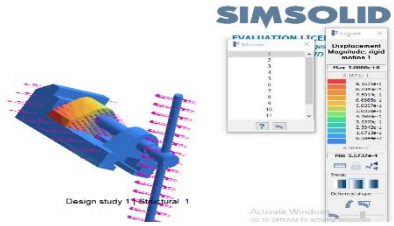

Fig 10. Analysis of magnetic vice

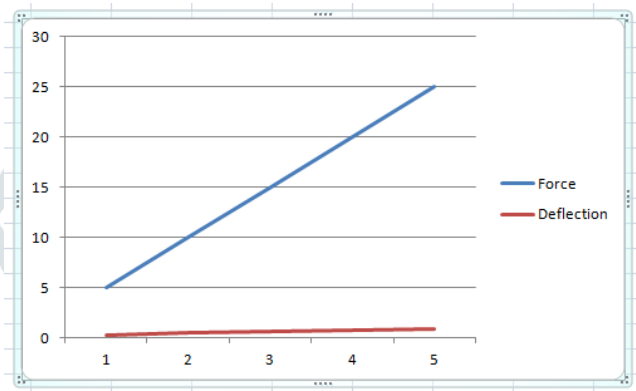

Fig 11. Graph Force and displacement

V Conclusion

The parameter related to flexibility, set up time production, shifting of job regularly by fixture. Design automated system and also increase accuracy. Work piece set up time is reduce. So we can use magnetic vice in drilling machine to reduced time of clamping, lifting job regularly accuracy .Moreover we use DC base system so system is continuous working when power will be off Location system is cutting tool easy find work piece location.

ACKNOWLEDGMENT

It is indeed a great pleasure and moment of immense satisfaction for we to present a project report on ‘’development and optimization of magnetic vice in drilling machine amongst a wide panorama that provide us inspiring guidance and encouragement, we take the opportunity to thanks to thanks those who gave us their indebted assistance. Thanks to our internal guide Prof. Rakesh Prajapati for his everlasting guidance. It was his inspiration, which helped us in completing our project.

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