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Design and Manufacturing of Edge Honing Machine

[1]Aher Balu, [2]Bondarde Shridhar

[1,2]Department Of Mechanical Engineering, Late G. N. Sapkal College of Engineering, Nashik, Maharashtra, India.

[1]*balukaher@gmail.com* , [2]*bondardeshri3@gmaol.com*

Abstract **Generally, in any tool industry after manufacturing the tools such as tap and other products as well the small particles remains on surface of tool that causes local heating of edges and sometimes the cutting edge very sharp which may deteriorate the surface finish of work piece or product. Cutting edge may damage which adversely affect tool performance hence its life. Hence to avoid above effect honing operation is performed over the product. Honing is finishing process which removes very minute material. Therefore as per the condition it is necessary to design and manufacture a machine called "Edge honing machine". It consist of a gear drive which is driven by the variable frequency drive, the gear drive is design in such a way that it has double rotating motion. There are four output spindles that come out from gear drive. Tool that is to be honed is attached to the spindles. Hence in one cycle four tools can be honed. Whole assembly including gear box with electric motor is given to be up and down motion by hydraulic system.**

Keywords – Manufacturing, Edge Honing Machine, Hydraulic System.

I. INTRODUCTION

When company manufacture the tool such as taps their cutting edges are too sharp and burrs also there at their cutting edges. Because of extra sharpness and burrs overheating of cutting edges take place and their life reduces. So to increase the life of taps, honing operation is performed on cutting edges. For efficient honing of cutting edges of taps machine tool is required which hone the number of taps in a day with a good repeatability. So for this purpose it is essential to design and manufacture the "EDGE HONING MACHINE".

A. Used Materials

One of the important tasks in honing operation is that selection of honing materials because different tool material requires different abrasive materials also the honing is depend on size of abrasives. Abrasive generally rely upon a difference in hardness between the abrasive and the material being worked upon, the abrasive being the harder of the two substances. However, this is not necessary as any two solid materials that repeatedly run against each other will tend to wear each other away (such as softer shoe soles wearing away wooden or stone steps over decades or centuries or glaciers abrading stone valleys). Some factors which will affect how quickly a substance is abraded include Difference in

a) Hardness between the two substances: A much harder abrasive will cut faster and deeper.

b) Grain size (grit size): Larger grains will cut faster as they also cut deeper Adhesion between grains and backing, between grains and matrix: determines how quickly grains are lost from the abrasive and how soon fresh grains, if present, are exposed.

c) Contact force: More force will cause faster abrasion.

d) Loading: Worn abrasive and cast off work material tends to fill spaces between abrasive grains so reducing cutting efficiency while increasing friction.

B. Abrasive Selection

Selection of abrasives for honing applications is dependent on many factors. Bore configuration, material being honed, coolant used, stock removal requirements, incoming surface finish, final surface finish surface finish requirements, cycle time, and quantities of parts to be processed all play a part in the abrasive selection. While there is no easy way to assure the abrasive selected will meet all of your requirements, understanding the basics of abrasive selection will greatly enhance the potential for success.

II. LITRATURE SURVEY

The material removal rate (MRR) and surface roughness play an important role in productivity improvement. Surface finish increases as well as MRR increases. Gray cast iron (BHN 150) as selected a work piece material. Here input parameter are selected like feed pressure and spindle speed and output parameters are MRR and surface roughness respectively. Also three factors and their levels are selected. In this method Silicon carbide or Aluminum oxide material is used for honing stones. This paper is related with the optimization process parameters which are carried out on hydraulic vertical honing machine. The speed selection depends upon hardness of crank case material as well as diameter of the bore to be finished. The spindle speed range between 150rpm - 700rpm. The coolant is used as servo park-2 or honing oil is used. The results revealed that using MRR gets as stroke pressure increases. Stroke pressure has greatest effect on MRR and the rank indicates the feed pressure has a greatest effect on surface roughness. The objectives of research summarized that feed pressure increases as its surface roughness decreases. [9]

The effect of speed, feed and depth of cut on surface roughness and cutting force in turning mild steel using high speed steel cutting tool. In case of surface roughness, the influencing factors were found to be feed and the interaction of speed and feed. As turning of mild steel using HSS is one among the major machining operations in manufacturing industry, the revelation made in this research would significantly contribute to the cutting parameters optimization. [11]

Machining without the use of any cutting fluid (dry machining) is becoming increasingly more popular due to concern regarding the safety of the environment. Because of this demands for increasing tool life without use of coolants are arising. Here attempt is to review the different techniques employed to improve the tool life. Some of the techniques are reviewing tool wear, different methods to measure wear, and different approaches employed to improve tool life such as tool geometry, machining parameters, **Edge Honing** and film coating. [10].

III. HYDRAULIC SYSTEM DESIGN

A. Steps of Designing a Hydraulic System:

1) First step should be the selection of a hydraulic cylinder.

2) The stroke length of the cylinder would be at least equal to the distance the load must be moved.

3) Area is calculated by force required to move the load and operating pressure.

4) The forward and the return travel of the piston rod would be controlled by a direction valve. If the load is to be stopped at intermediate points in its travel, the dc valve should have a neutral position in which oil flow from the underside of piston is blocked to support the weight of the cylinder.

5) The rate at which the load must travel will be determined by pump size.

6) HP needed to drive the pump is a function on its delivery and the maximum pressure at which it will operate.

Formula for size of electric motor required

Motor power in

$$KW = P \times Q612 \times \eta p$$

Where,

P=Working pressure in kg/cm².

Q=Flow capacity of pump in LPM.

η=Pump efficiency.

a) To prevent overloading of the electric motor and to protect the pump and other component from excess pressure, a relief valve is set between pump outlet and inlet port of the dv valve.

b) Reservoir size is 4 to 5 times of the pump capacity in LPM.

B. Construction of Hydraulic Circuit

1) Fig. Shows hydraulic circuit for edge honing machine.

2) The source of power for hydraulic system is an electric motor.

3) The input component of the system is positive displacement gear pump.

4) Coupling is provided between the pump and electric motor.

5) Manually operated 4/3 direction control valve and 4/2 directional control valve is connected between pump and hydraulic cylinder.

6) The pressure relief valve is set between the pressure line (pump outlet) and the reservoir.

7) Flow control valve is set between the directional control valve and cylinder which control the speed of cylinder.

8) The filter is placed in return line of system.

9) Function of 4/3 direction control valve is to control slow movement of turret mechanism while inserting the taps into the tray.

10) Function of 4/3 direction control valve is to achieve faster movement of turret mechanism from the point of tap loading to surface of abrasive particles in the tray.

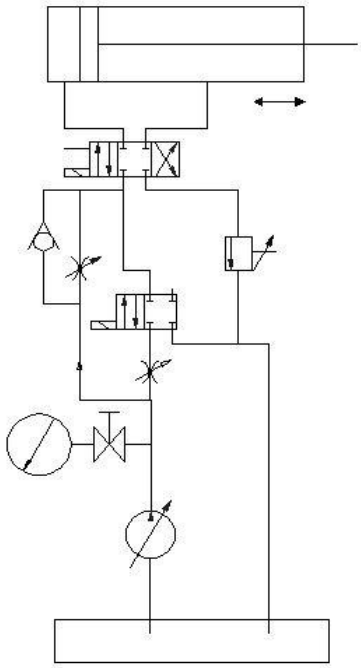

Fig: 1 Hydraulic Circuit

C. Working

1) This system is based on the hydraulic power transmissions means transmitting power by pushing on a confined liquid. The oil under pressure is forced into the system.

2) An electric motor drives the pumps converts the electrical energy into the mechanical energy and creates flow of oil. This Mechanical energy is converted into hydraulic energy by using hydraulic gear pump and it pushes the oil into the hydraulic circuit.

3) High pressure oil is supplied through the inlet port (P) of the direction control valve -1. The directional control valve decides that the oil should go to the head end or piston rod end of the cylinder.

4) During forward stroke, the oil flows from inlet port (P) to supply port (P) to piston rod end of cylinder. Cylinder takes the turret mechanism in upward direction in the forward stroke and in the downward direction during the reverse stroke.

IV. RESULT ANALYSIS

A. Graphical Outlook of Machine

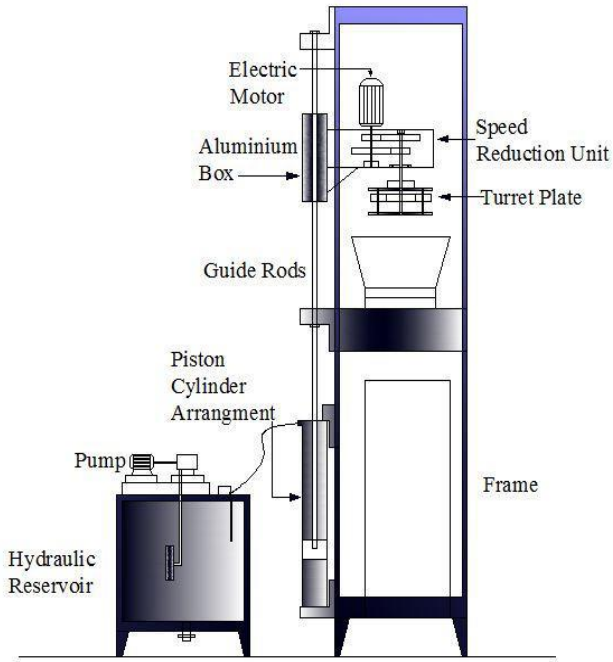

Fig 2 Machine Model

The present situation of tap honing is that we are sending the taps to outside industries for honing. So cost of tool is increasing at the same time there is time delay till the taps are returned by the outside industries. So to reduce the cost and time it is necessary to design and manufacture the "EDGE HONING MACHINE".

B. Machine Side View

Fig. 3 Machine Side View

Cutting edge may damage which adversely affect tool performance hence its life. Hence to avoid above effect honing operation is performed over the product.

C. Machine Front View

Fig. 4 Machine Front View

It consist of a gear drive which is driven by the variable frequency drive, the gear drive is design in such a way that it has double rotating motion. There are four output spindles that come out from gear drive

D. Tools Storage

Fig. 5 Tools Storage

Tool that is to be honed is attached to the spindles. Hence in one cycle four tools can be honed. Whole assembly including gear box with electric motor is given to be up and down motion by hydraulic system. Table containing trough having abrasive material in it placed below spindles.

V. CONCLUSION

For effective honing operation successful design and manufacturing of this project idea is accomplished by the group to suit for company requirement. Industrial requirement of finishing high speed cutting tools is gratified by implementing the idea of edge honing machine. High surface finish is attained by using edge honing machine for an extensive range of High Speed Steel Cutting Tools in various grades (M2, M35, M42, & T42). Surface finishing of high speed cutting tools with edge honing machine results into increased life, quality, and reliability of the product. The system is proves to be cost effective.

After complete assembly of the system trial is taken on the machine and it is found that the system gave satisfactory performance and all previous difficulties have been resolved. The company has started using the machine in order to recover previous progression. This modified machine system for honing operation is reduces the time delay and cost existing with the former practice.

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