Design and Implementation of Reducing Stick Mark in Honing Machining Process by using Universal Joint

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Abstract—Honing is an internal finishing technique that uses abrasives on a rotating tool to produce extremely accurate holes that require a very smooth finish. Where abrasive sticks are mounted in a rotating tool. Honing is a finishing process, in which a tool called hone carries out a combined rotary and reciprocating motion while the work piece does not perform any working motion. Most honing is done on internal cylindrical surface, such as automobile cylindrical walls. The honing stones are held against the work piece with controlled light pressure. Here the stick mark had reduced in the honing process hence the rejection of work piece had reduced and productivity increases.

Keywords—Honing machine, stick mark, spindle, abrasive stick.

1. INTRODUCTION

Honing is a low velocity abrasive machining process in which stock is removed from metallic or non-metallic surfaces by bonded abrasive sticks. An abrasive stone against it along a controlled path. Honing is primarily used to improve the geometric form of a surface, but may also improve the surface texture. It is a finishing operation employed not only to produce high finish but also to correct out-of-roundness, taper and axial distortion in work piece. In honing, since a simultaneous rotating and reciprocating motion is given to the stick, the surface produced will have a characteristic cross-hatch lay pattern.

Fig 1: Honing process

Typical applications are the finishing of cylinders for internal combustion engines, Yokes for steering column, air bearing spindles and gears. Finish boring or internal grinding may do the job. However only 0.002 in. to 0.020 in. stock is left on the diameter for honing.

2. HONING CONDITION

2.1. Spindle Speed

The spindle speed depends mainly on the diameter of the bore to be honed. The choice of spindle speed is influenced by the following factors:

1) Material being honed: - Higher speeds are used for metals that shear easily such as cast iron and non-ferrous metals.
2) Hardness: The harder the work piece, the lower is honing speed.
3) Surface finish: Rough surfaces that dress the stone mechanically allow higher speeds.
4) Number and width of stones in a tool: - Speed should be decreased as the area of abrasive per unit area of bore increases.
5) Finish requirement: - Higher speeds usually result in finer finish. Excessive speeds contribute to decreased dimensional accuracy, overheating of the work piece and glazing or dulling of the abrasive

2.2. Reciprocating Speed:

The reciprocating speed, which depends mainly on the length of the honing tool and the depth of the bore, is expressed in meters per minute as the product of number of strokes per minute and twice the stroke length. Since reciprocating speed, rotary speed and cross-hatch angle are related functions, the cross-hatch angle can be controlled by varying the reciprocation speed when rotation is constant. Reciprocation speed has considerable influence on the finish of the job. If the reciprocating speed is high, the dressing action is greater and consequently results in a rougher finish on the job.

2.3. Cross-hatch:

Abrasive grains are bonded in the Form of sticks by a vitreous or resin material and sticks are presented to the work. So that their full cutting forces are in contact with the work surfaces. Since a large number of abrasive grains are presented to the work surface simultaneously, substantial material removal takes place. For cylindrical surfaces the abrasive grains are given a combination of two motion-rotation and reciprocation. The resultant motion of the grains
is a Crosshatch lay pattern with included angle between 20 and 60.

2.4. Honing Pressure:
A wide range of pressure is used to obtain higher rates of material overall and better results. In some of the equipment the hydraulic force for feed-out varied from 10 to 32 kg/cm². However, honing is more often controlled by the rate feed-out than by gauge pressure. Insufficient pressure leads to a low rate of material removal. When the pressure is excessive, a rougher finish will result as the abrasive breaks down very fast. This increases the tooling cost as well as the machine down time for frequent interchange of the stones. The trial and error method is usually employed for determining the optimum pressure for honing. To start with, a low pressure is used and then gradually using work piece finish as the reference, the pressure can be increased.

2.5. Cutting fluid:
A fluid must be used with honing. This has several purposes: to clean the small chips from the stones and the work piece, to cool the work and the hone and to lubricate the cutting action. Anonical 961 type oil is used in this honing process.

2.6. Honing stone:
Honing stones sometimes known as honing stick consist of particles of aluminum oxide, silicon carbide and diamond bounded together with play, resinoid, corn, carbon etc. The porosity of the structure of the stick, depending on the mixture of grit and bond, methods and pressure used in the forming the sticks, facility cheap clearance, thereby minimizing the generation of heat.

2.6. Abrasive:
1. Selection of the abrasive depends mainly on the composition, hardness of the metal being honed, finish required and the cost
2. Normal aluminum oxides for the steel and silicon carbide for CI and non ferrous materials are used as abrasives.
3. Diamond is used for honing extremely hard and wear resistant materials such as tungsten, carbide or ceramics.

2.7. Designation of honing stones:
1. The marking system employed for designation of grinding wheels is also applicable for honing stones.
2. The marking normally specifies types of abrasive, grit size, hardness and type of bond

3. NORMAL HONING (RIGID SPINDLE)
Generally the rigid spindle used in the honing process. This rigid spindle does not having a fluctuation movement. In rigid spindle linear and rotary actions are acted. Rigid spindle has no springs, instead uses a gear drive to advance the 2 stones, and the 2 stone guides.

To rapidly remove material, with a cylinder torque plated, and secured very tight in a shop vice. Start at the bottom of the cylinder in the unworn area, adjusting the hone snug there. Run the hone all the way through, catching the narrow unworn are at the top of the cylinder.

When the 100% of production is produced at that time 5% of component will be rejected through rigid spindle. The main reason for this rejection (5%) is the stick mark occurs in the cylindrical surface.

4. STICK MARK CONTROLLED REQUIREMENTS
- Coolant oil tank cleaning in every week.
- Stick proper round up.
- Honing stick diameter (38-40-45) using properly.
• Every one honing box two piece checking to final inspection daily.
• Every one box once cleaning the edge oil stones.
• Don’t change the pressure setting.
• Bore rework separately doing operation.
• Rework piece carefully doing operation in particular stroke.
• Hold the work piece centre to the fixture centre.
• To check the straightness of the work piece then before machining.
• Burr proper way to cleaning the operator.

5. IMPLEMENTATION HONING (FLEXIBLE SPINDLE)

The main reason for implementation of flexible spindle in honing process is reduce the rejection percentage of producing component. This flexible spindle honing process method reduces the rejection level and increasing the productivity. We are provided universal joint in the flexible spindle.

![Fig 6: Flexible Spindle](image)

The rejection level is reduced 5% into 1% through flexible spindle. In flexible spindle linear and rotary actions are acted. Now one thing can be noted here that, this flexible spindle is not guided by the machine honing machine, but it is guided by the hole which is originally made on the work piece. So to have proper alignment of this honing head, we have to provide some flexibility here and which is nothing but to universal joints.

![Fig 7: Finishing Component](image)

6. WORKING PRINCIPLE

Honing is a low velocity abrading process in which stock is removed from metallic or non-metallic surfaces by bonded abrasive sticks. It is a finishing operation employed not only to produce high finish but also to correct out-of-roundness, taper and axial distortion in work piece. In honing, since a simultaneous rotating and reciprocating motion is given to the stick, the surface produced will have a characteristic cross-hatch lay pattern.

In this project the rigid spindle is changed into flexible spindle. Because the stick mark is occur in the cylindrical surface of the component. The main reason for stick mark occurs in the work piece by using a rigid spindle. But the flexible spindle to avoid the stick mark because the universal joint is provided between the honing sticks head and spindle. The honing stones or sticks are fitted another end of the spindle.

![Fig 8: working](image)

Generally the honing stones are made from the abrasive and bonding materials. The sulphur, resin or waxes are to improving the cutting action and increasing the tool life. Basically honing is a super finishing process. The surface roughness value of a honing process is 0.13 to 1.25 micron. The main reason for implementation of flexible spindle in honing process is reduce the rejection percentage of producing component. This flexible spindle honing process method reduces the rejection level and increasing the productivity.

The rejection level is reduced 5% into 1% through flexible spindle. In flexible spindle linear and rotary actions are acted. When the machine is ON at that time the spindle is rotated. The spindle is divided into two parts. One is upper spindle and another one is lower spindle. The two spindles are connected in between the universal joint. The honing stones or sticks are fitted in lower spindle. This flexible movement reduces the friction and increasing the tool life.

ADVANTAGES

- High accuracy and Precision.
- It increasing the productivity.
- Reducing the rejection level and stick mark.
- High efficiency of the life hone spindles.
- Easy operation and easy to dismantle the spindle.

APPLICATIONS

- Automobile components and Textile components.
- Hydraulic cylinders for power steering system of passenger cars.
7 CONCLUSION

Now a day the major concept of all production industries are zero elimination and increasing the productivity. This project is used to reduce the stick mark in the honing process. And major benefit of the project is reduces the rejection level from 5% to 1%. Rejection level of a product had decreases and simultaneously the productivity increases. Here the stick mark is reduced and precise component had produced when the flexible spindle is used.

REFERENCES