Pneumatic Honing Machine

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ABSTRACT

This project aims to design and develop a Pneumatic Honing Machine, an innovative solution for precision surface finishing in manufacturing processes. Honing, a critical machining operation, involves the use of abrasive stones to remove minute material from internal cylindrical surfaces, enhancing their dimensional accuracy, geometric form, and surface texture. Traditional honing machines, which often rely on manual operation or complex hydraulic systems, face limitations in terms of efficiency, consistency, and cost-effectiveness. The Pneumatic Honing Machine leverages compressed air to drive the honing process, offering several key advantages. The use of pneumatics simplifies the machine's design, reducing manufacturing and maintenance costs while ensuring reliable and consistent performance. The machine's pneumatic actuators provide precise control over the honing stones' movement and pressure, leading to superior surface finishes and improved dimensional accuracy.

Keywords: Honing, Pneumatic, Surface, Machines, Design, Machine, Manufacturing, Operation, Stones, Dimensional

INTRODUCTION

The dimensional and geometrical accuracies obtained by normal methods of machining like turning, milling, etc. are limited. The geometrical errors include circularity, cylindricity, flatness and parallelism of frictional surfaces. Also, the surface finish has a vital influence on most important properties such as wear resistance and power losses due to a friction. Poor surface finish on the peaks of mirco irregularities, which lead to a state approaching dry friction, and result in excessive wear of the rubbing surfaces. Therefore, fine finishing processes are employed in machining the surface of many critical components to be obtain a very high surface finish or high dimensional and geometrical accuracies. The better finish may be desired for looks accuracy, wearing qualities or for any other reason. Such processes include lapping, super finishing, burnishing, polishing, buffing and HONING. It is very difficult today down specific rules regarding the choice of any of these methods because of the many variables involved, the most important being the particular piece to be machined. Basically honing finishing process and not metal removing process but during our industrial visit it was noticed that when the length/diameter ratio exceeds by 15 times, it becomes very difficult to maintain straightness of the length of bores, hence it was observed that in industrial honing is done to remove metal to extent of1mm (depending upon the length of job). Although this takes larger time it avoids rejections due to tool marks which might occur during the process of boring. When cylindrical holes or bores require a high degree of surface finish and accuracy of the honing process is certain to be adopted. The ever increasing use of hydrical power as a motivator of mechanical equipment has held led to the need for cylindrical bores to be machined to close degrees of both accuracy and surface finish.

Selection and Scope

The ‘HONING MACHINE can be made in college successfully. It is special purpose equipment and requires more skill. These parts can be made in college. Its sub-Components price is also moderate. This project gives us knowledge, experience and skill along with new ideas of manufacturing. It is working project and have guarantee of success. Also , some of the material is available from our college. This project we could manufacture in less time. So we have selected this machine. Also by working on this project it have fulfilled following objectives laid by curriculum of Maharashtra state board of technical education.

BASIC HONING PRINCIPLE

A. What Is Honing ?

Honing is a low velocity abrading process in which stock is removed from metallic of non metallic surface by the shearing action of the bonded abrasive grains of a honing stone or stick and produces highly characteristic surface having a particular texture, which exhibits a cross hatched pattern.The honing tool, consists of a holder carrying three to six abrasive sticks which fit in slots arranged radialy around the body of the hone. It has provision by taper bushes or other means, to force the sticks outwards against the side of bore to be honed and expansion ceasing when the desired size has been attained. Both mechanical and hydraulic methods are used to bring about expansion of the abrasive sticks; in the production honing of large numbers of components, expansion and retraction of the sticks is completely under automatic control. Honing stones- It have a relatively large area of abrasive in contact with the work at relatively show speeds and low pressure surface Grinding, on the other hand, has relatively high pressure and a line contact between abrasive and bore, and runs at high speeds. Extremely high surface temperature is developed and the surface structure of the bore may be permanently finer surface finish than grinding, andprovides a sets-free base metal surface in the bore.

B. Selection of Material

To prepare any machine part, the type of material should be properly selected, considering design, safety and following points:-

The selection of material for engineering application is given by the following factors:-

1) Availability of materials. 2) Suitability of the material for the required components. 3) Suitability of the material for the desired working conditions. 4) Cost of the materials. 5) In addition to the above factors the other properties to be conside red while selecting the material are as follows :Physical properties:- These properties are colour, shape, density, thermal conductivity, electrical conductivity, melting point etc.

Mechanical Properties:- The properties are associated with the ability of the material to resist the mechanical forces and load. The various properties are:- Strength:- It is the property of material due to which it can resist the external forces without breaking or yielding. Stiffness :- It is the ability of material to withstand the deformation under stress. Ductility:- It is the property of material due to which it can be drawn into wires under a tensile load. Malleability:- It is the property of material which enables it to be rolled in to sheets. Brittleness:- It is the property of material due to which it breaks into pieces with little deformation. Hardness :- It is the property of material to resist wear, deformation and the ability to cut another material. Resilence :- It is the ability of the material to store energy and resistCreep :- the shock and impact loads. It is the slow and permanent deformation induced in part subjected to a constant stress at high temperature.

C. Bore Problems

CAUSES OF COMMON BORE PROBLEMS :- 1) OUT OF ROUND 1) Improper tool set up on tool holder. 2) Improper holding of job in fixture. 2) TAPER 1) Loose fitting tool in tool holder. 2) Faulty guide ways of machine. 3) BELLMOUNTH 1) Oscillation of tool when enters or exists from bore. 4) BORING MARKS 1) Worn out tool applied for operation. 2) Due to excessive vibrations. 3) Scratches on tool. 5) WAVINESS 1) Vibration in tool or job due to high speed. 2) Improper application of force on tool. 6) REAMER CHATTER 1) Effect of improper reamer operation.7) DIA. TOLERANCE 1. Misalignment of axis of tool & job. 2. Asymmetry of tool. 8) RAINBOW 1) Bending of boring bar in boring machine. 9) BARREL 1) Deflection at middle of boring bar due to long length. 10) MISALINGNMENT 1) Improper support to tool for boring long length job. 2) Fluctuation in tool axis. 3) Improper fixture of job.

Advantages of Honing

HONING Vs OTHER PROCESS 1) It is possible to created dimensions i.e. the desired size thought honing while super finishing is employed only for obtaining a high quality surface finish with no appreciable amount of stock removed. 2) The honing process needs only two motions, whereas super finishing may involve many. With the result, the path of an abrasive grain never repeated. 3) The process is mostly employed for finishing internal surface, whereas super finishing is largely used for outside surface. 4) Super finishing is done at much lower operating seeds than honing. 5) The total pressure on the work is too in super finishing as compared to honing enabling finishing of even the very delicate parts. 6) The length of stroke in super finishing is very short, usually 1.5 mm to 6 mm, as compared to honing. With the result, there is an appreciable accumulation of chips and therefore, no scratches are produced on the job surface. 7) Lapping is the process for improving the surface finished by reducing reoughness, waviness and other irregularities on the surface, while super finishing is employed only for obtaining a high quality surface finish.

Construction

Pneumatic engine consist following component and their applications PNEUMATIC ACTUATOR: here we are using double acting cylinder for generating continuous reciprocating motion size of cylinder is dia 25 mm and stroke 50 mm. 5/2 Direction Control Valve : 5/2 direction control vale change the direction of air supply of cylinder with the help of solenoid valve which is controlled by electrical circuit. SOLENOID VALVE : solenoid valve is attached with 5/2 DCV in this a set of electro magnetic coil is fitted with assembly and when electric supply through contactor is provided it will magnetize and pull the plunger of 5/2 DCV and change direction of pneumatic cylinder and when supply is off it will come to their original position and piston move opposite direction this process is going on with high speed and rotate axel of wheel shaft. CONTACTOR: contactor is an electrical component having 4 numbers of normally open points and 4 numbers of normally closed points. What ever position we need we con connect that point as per application. LIMIT

Switch: limit switch control the extreme position of pneumatic cylinder and send signal to contactor which turn on and off position of 5/2 dcv Pneumatic systems use the potential energy stored in compressed air to do work. By controlling the release of the air to pneumatic cylinders, which are installed above the frame holding the motor for rotary motion of the tool. Pneumatic systems use the potential energy stored in compressed air to do work. By controlling the release of the air to pneumatic cylinders, which are installed below the engine for tilting purpose, we can turn that energy into movement of the engine bed. Pneumatic components are arranged in circuits - much like electronic circuits - using symbols for each component. You need to be familiar with the operation of two of most common pneumatic components - a single-acting cylinder with a three-port valve, and a double-acting cylinder with a five-port valve. You also need to understand how time-delayed pneumatic circuits and pneumatic logic circuits work. Finally you need to know how to work out the force output from a cylinder.

Fabrication

MACHINING OF PARTS GENERAL WORKSHOP TECHNOLOGY: The components of project models have been machined to the required dimensions on the center lathe machine. The raw material stocks are either cut to size on power hacksaw machine or by hand hack saw on the worktable. The drilling of notes have been carried out on pillar drill machine prior to scribing the center lines & cross lines & marking out the inch marks at the drill centers. 1) Hack Saw Cutting:- The speed is 350RPM & the feed is automatic, maintain a cutting margin of about 3 to 5 mm. Extra for large sections & 1 to 2 mm extra for light sections. This is an Auto operation. 2) Lathe Machine:- a) Facing & turning speed - 650 to 850 rpm. b) Boring, Reaming, Thread - 70 rpm. c) Lapping, Honing & Polishing Speed – 1000 rpm. Cutting Tools:- i) ii) iii) Tungsten carbide Tipped tools either side or crank types. Parting tools or V threading tools. High speed steel tools (H.S.S.) as above. 3) Drill Machine : i) ii) Parallel shank in H.S.S. – Reading Taper shank in H.S.S. – available 4) Coolants & Cutting Oils : i) Proprietary Brand : - Hindustan petroleum Oil Mixed in water in 1:10 ratio ii) Kerosene:- iii) No cutting Oil or coolant :- 5) Threading :- For machining M.S., L.C.S. H.S.C. Alloy Steels & Stainless Steels. For machining of all grades of L.M. – 1 to L.M.-6 Aluminium (L.M. = Light Metal) For machining in dry state of brass copper Cast iron, raw material.Light duty threading is done with the help of H.S.S. Tap set (Inside Threading) & H.S.S. Round Dies (outside threading) by hand tap & die wrenches. 6) Drilling of Holes :- Please note that similar the hole x dia. The higher the speed. Larger the hole dia., lower the speed. Micro drilling speeds are above 1000 rpm. 7) Reaming of Holes :- Drilled or bored holes are finished to close tolerance by parallel or taper shank reamers readily available in the market. 8)Measuring Instruments : During Machining operations the dimensions are measured accurately by using :- Hand Verniers , Micrometers, Merrier Depth Gauges, Thread Gauges. Radius Gauges, Go/No-Go Plug Gauges, Snap Gauges, Inside & Outside Calipers. 9)Fabrication: - Various steel sections are aluminium sections are employed in the fabrication work such as angles, clits, gussets, fillets flats & the round bars. These sections are cut to required size marked for drilled holes & then fastened together with the help of rivets & bolts, Nuts & Screws. Welding, Brazing & Soft Soldering of fabricated joints are obtained from outside parties & not in the consoler's workshop. i) Electric Arc Welding : For heavy duty parts. ii) Gas Welding : For light duty parts. iii) Gas Brazing : For Brass & copper parts. iv) Soft Tin soldering : For light duty parts in M.S. Brass & copper.".

Trouble Shooting

As in all abrasive applications, various problems like loading, glazing, poor life, bad finish, form error etc.canarise during honing. It should be appreciated that variation in operating parameters (speeds, pressure, etc.)can help in eliminating or minimizing such problems. The following guidelines may be found helpful. PROBLEM :- Glazing poor material removal burning. SOLUTION :- a) Increase the reciprocating speed(include angle between sprial should be about go degree for fastest cutting) b) Decrease the rotation speed. c) Increase the hydraulic pressure. d) Change to softer grade. e) Change to a corner grit size if surface finish is not critical. f) Sulphur treat if loading is server. g) Increase coolant flow.PROBLEM : Taper, belt-mouth, geomatrical inaccuracy. SOLUTION:- a) Reduce over run at the ends of strokes cover run at the ends of strokes should never exceed 1/3 of the stick length. b) Eliminate error in straightness at start by using longer honing sticks for roughing. c) Check whether machining allowance is sufficient. (allowance should be at least twice the initial form error). d) Stick length should be increase for recessed holes & stick width increased forholes with key ways, etc.

CONCLUSION

The development of a pneumatic honing machine marks a significant achievement in precision engineering and manufacturing technology. This project has successfully demonstrated the feasibility and advantages of utilizing pneumatic systems to achieve high-quality surface finishes and precise dimensional tolerances.

Throughout the project, we have designed, constructed, and tested a prototype that integrates key components such as the pneumatic actuator, honing tool, and control system. Our results have shown that the pneumatic honing machine is capable of producing consistent and repeatable surface finishes that meet industry standards. The machine's flexibility, ease of control, and ability to operate at varying pressures and speeds make it a versatile tool suitable for a wide range of applications.

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