Modification of Drill Honing Tool for Engine Head Burr Cleaning

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Abstract—
Honing is an important precision-finishing process used to improve the dimensional accuracy, surface finish, roundness, and geometrical accuracy of internal cylindrical surfaces. Conventional manual honing generally uses abrasive stones and requires the operator to manually guide the honing tool or work piece, providing considerable control over the operation. However, the manual process is relatively time-consuming and may result in dimensional or shape deviations when the work piece is not adequately supported. The present study focuses on the application and significance of hand drill honing as an alternative approach for precision bore finishing. Hand drill honing combines the rotational motion of a hand-operated drill with abrasive honing elements to improve the internal surface of previously drilled holes. The process is capable of reducing surface irregularities and correcting minor geometrical errors such as ovality and taper while achieving the required bore size and surface finish. The applicability of honing is discussed for critical components such as automobile engine cylinders, hydraulic cylinders, bearing housings, gears, pumps, valves, aerospace components, and tools and dies. The study indicates that hand drill honing can provide improved control and flexibility for small-scale and precision finishing applications. Overall, honing offers an effective method for producing accurate and smooth internal surfaces and can contribute to improved dimensional quality and functional performance of engineering components.

Keywords: Honing, Hand Drill Honing, Abrasive Stones, Bore Finishing, Surface Finish, Dimensional Accuracy, Roundness, Ovality, Taper.

I. INTRODUCTION

Internal combustion engine converts fuel into motion through a four-stroke cycle: Intake, Compression, Power, and Exhaust. A piston moves down to draw in fuel/air, up to compress it, down again from the ignition-driven explosion, and up to expel exhaust. This converts reciprocating (up-and-down) motion into rotational power for wheels

An internal combustion (IC) engine is a heat engine that converts chemical energy from fuel into mechanical power by burning fuel inside a combustion chamber. High-pressure combustion gases push a piston within a cylinder, converting linear motion into rotational energy via a crankshaft to power vehicles or machines. Working of IC engine.

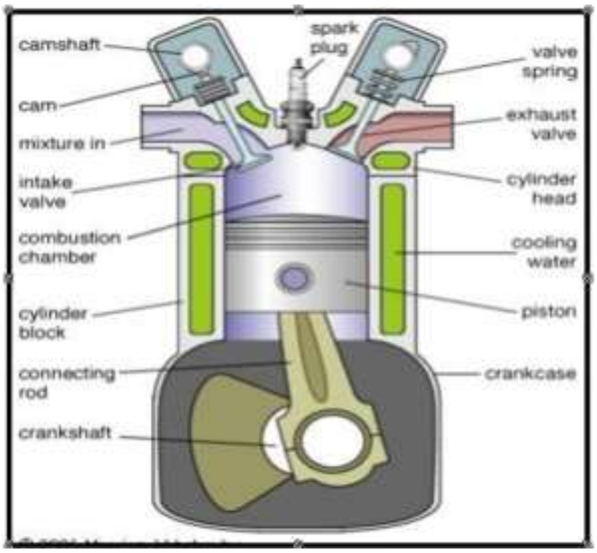

Figure 1 Diagram of IC Engine

The cylinder block (or engine block) is the main structural component of an internal combustion engine, housing the cylinders, pistons, and crankshaft. It acts as the backbone, providing a rigid base for mounting components like the cylinder head, oil pan, and accessories. Key functions include cooling and lubrication support, guiding piston movement, and withstanding combustion pressures.

Figure 2 Cylinder block

II. LITERATURE REVIEW

Research indicates that ultrasonic vibration-assisted drilling significantly enhances performance compared to conventional drilling methods. The literature review highlights that the drill horn is a critical component in ultrasonic drilling machines, enabling efficient and precise machining of hard materials. Its ability to transmit and amplify vibrations makes it indispensable in modern manufacturing and advanced applications such as aerospace and medical industries. Although challenges exist in design and cost, ongoing research continues to improve its performance and expand its applications. The future of drill horn technology lies in automation, smart systems, and hybrid machining processes.

Honing is an abrasive machining process used to improve the surface finish and dimensional accuracy of holes. It is commonly performed after drilling or boring operations.

According to research, honing involves rotational and reciprocating motion of abrasive stones that remove small amounts of material from the work piece surface.

The literature survey shows that honing is an essential process in modern manufacturing. The development of drill honing machines has improved productivity by combining drilling and finishing operations.

Research studies highlight that optimizing process parameters, selecting proper tools, and using advanced technologies can significantly enhance machining performance. The continuous advancement in honing technology ensures better accuracy, efficiency, and industrial application.

III. METHODOLOGY AND CONSTRUCTION

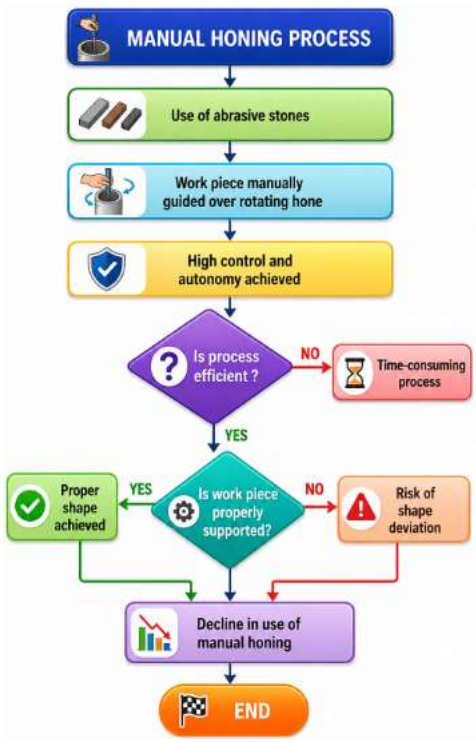

Figure 3. Methodology of Process.

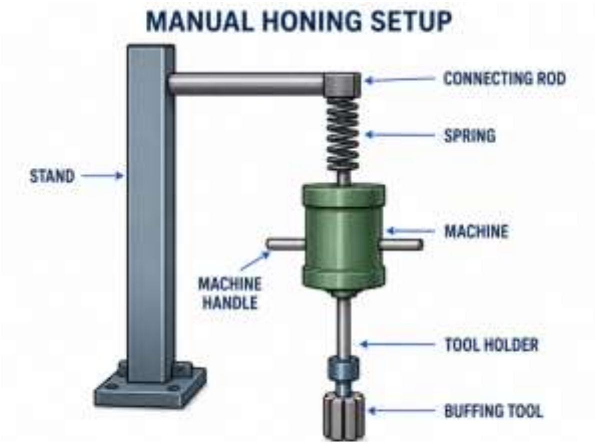

Figure 4. Schematic Drawing of Drill Honing Tool

The working of the machine involves the following components:
Spindle
Motor
Drill tool
Honing tool (abrasive stones)
Work table
Handle
Spring mechanism
Control buttons
Machine body

Figure 5. Spindle

Spindle: The spindle is one of the most important parts of a drill honing machine. It is the rotating shaft that holds and drives the honing tool. The spindle is a rotating component connected to the drill motor. It transfers power from the motor to the honing tool, making it rotate at high speed.

Figure 6. Button

Button: The button (switch/control button) in a drill honing machine is used to start, stop, and control the operation of the drill. It is usually located near the handle for easy use. In a drill honing machine, the button is a small but important control component used to operate and control the machine functions. It is generally used to start, stop, or control different operations such as spindle rotation, motor activation, and emergency stopping.

Figure 7 Hanger

The hanger in a drill honing machine is a supporting part used to hang or hold the machine safely when it is not in use. It is commonly seen in workshops to keep tools organized and protected.

Figure 8 Body

The body provides strength, rigidity, and stability to the machine during operation. Since machining processes involve vibrations and forces, the body must be designed to withstand these stresses without deformation. The body of a drill honing machine is defined as the main supporting structure that houses and supports all machine components.

Figure. 9 spring

A spring is a mechanical component used in a drill honing machine to store and release energy. It plays an important role in controlling movement, maintaining tension, and absorbing shocks during machine operation.

Figure. 10 Table

The table is essential for holding the work piece securely and ensuring accurate machining. It directly affects the quality and precision of the drilling and honing operations. The table is a key component of a drill honing machine that provides support, stability, and alignment for the work piece. Proper design, material selection, and maintenance are essential for achieving high machining accuracy and efficiency.

IV. WORKING

Figure. 11 Working of Drill Honing Machine

Manual honing involves the use of abrasive stones to attain the desired size and surface finish of bores. In this honing process, the machinist manually guides the workpiece over the rotating hone using their hands, offering a higher degree of control and autonomy over the honing operation.the practice of manual honing is on the decline for several reasons. One prevalent reason is that manual honing is a time-consuming endeavour. Additionally, if the workpiece is not adequately supported, there is a risk of deviating from the intended hole shape during manual honing.

A drill honing machine is a combined machining setup that performs both drilling and honing operations in a single system. It is designed to improve productivity by reducing machining time and increasing accuracy.

Drilling is used to create holes, while honing is a finishing process used to improve surface finish, dimensional accuracy, and roundness of the hole. The combination of these two processes makes the drill honing machine highly efficient for precision engineering applications.

Drill honing machines are widely used in industries where high precision and surface finish are required. They improve product quality and reduce production time. The drill honing machine is an advanced and efficient machine used for precision machining. It combines drilling and honing operations, reducing time and improving accuracy. With modern developments, it has become an essential tool in manufacturing industries.

IV.DISCUSSION

Precision hole finishing: Honing is effective for achieving high dimensional accuracy and precision in holes, making it suitable for metal components requiring close tolerances. **Automobile engine cylinders:** The process is widely applicable to engine cylinder bores, where improved dimensional accuracy, roundness, and surface finish are essential for efficient engine operation.

Hydraulic cylinders: Honing produces smooth and uniform internal surfaces in hydraulic cylinders, helping to reduce friction, leakage, and wear during operation.

Bearing housings: Honing can be used for finishing bearing housing bores to obtain accurate dimensions and improved surface quality, which supports proper bearing alignment and performance.

Gear manufacturing: In gear manufacturing, honing is useful for accurate bore finishing, ensuring proper fit and alignment of gears with shafts.

Pump and valve components: The process is suitable for internal bores of pumps and valves where smooth surfaces and dimensional accuracy are important for reliable operation.

Aerospace components: Honing is applicable to aerospace parts that require high dimensional accuracy, consistent surface finish, and reliable component performance.

Improvement of drilled holes: Honing can be performed after drilling to improve the surface finish, dimensional accuracy, and roundness of the drilled hole.

Correction of geometrical errors: One of the important advantages of honing is its ability to reduce geometrical errors such as **ovality and taper**, resulting in a more accurate cylindrical bore.

Tool and die industries: Honing is useful in tool and die manufacturing for producing precise holes and improving the surface quality of critical components.

V. CONCLUSIONS

- Honing is an effective precision-finishing process for achieving accurate dimensions, improved roundness, and better surface finish in internal cylindrical holes.
- The process is widely applicable in automobile, hydraulic, aerospace, pump, valve, bearing, gear, and tool-and-die industries, demonstrating its versatility in precision manufacturing.
- Honing is particularly effective for finishing drilled and machined holes, where it can improve surface quality and dimensional accuracy.
- The process can effectively reduce geometrical errors such as ovality and taper, resulting in more accurate and uniform cylindrical bores.
- In automobile engine cylinders and hydraulic cylinders, improved surface finish obtained through honing can contribute to reduced friction, better sealing, and improved component performance.
- For bearing housings, gears, pumps, and valves, accurate bore dimensions and improved surface quality help ensure proper assembly, alignment, and reliable operation.
- The application of honing in aerospace and other high-precision components demonstrates its suitability for manufacturing parts where stringent dimensional and surface-finish requirements are essential.
- Overall, the study indicates that honing is a reliable and versatile finishing operation for achieving high-quality internal surfaces and maintaining the dimensional and geometrical accuracy of precision components.

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