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Design and Development of Automated Valve Lapping Machine

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ABSTRACT:

Automobiles play a vital role in each and every segment of mankind, whether it comes to transporting people or carrying out various operations for different industries whose byproducts are basic human needs. So to carry out these continuous operations, maintenance of these machines is an important aspect to look forward. There are various methods which are currently being used in these maintenance workshops which are not effective, require manual efforts and also are time consuming. To overcome these problems an Automated Valve lapping machine is designed. The process consists of designing the machine, carrying out data analysis to make any amendments and finally carry out its fabrication. Lapping is a machining process in which two shells are rubbed together with an abrasive between them, by phase motion or utilizing power tools.

The idea is to minimize the human efforts during the lapping process and also to reduce the time required for the operation. This will also help in boosting the production rate in the maintenance workshops.

1. INTRODUCTION:

In internal combustion engines the valves are meant to open the inlet and exhaust ports by means of a cam mechanism and due to the continuous operation of the valves there is a pitting of valve and the valve seats occurs due to which the unwanted clearance is developed. This damages the surface of the valve and the valve seat must be removed and smoothed up and for this purpose lapping process is needed. Automotive lapping is necessary for several reasons related to engine performance, sealing efficiency and overall reliability. The main purpose of automotive lapping is to ensure a proper fit and seal between engine valves and their seats. Here are the main reasons why an automobile needs lapping:

1. **Seal Efficiency:** The lapping creates a tight seal between the engine valve and valve seat. It is essential for proper combustion in engine cylinders, preventing gassing and optimizing power output. Lapping creates a smooth, consistent contact surface between the valve and seat, improving sealing efficiency.
2. **Compression and Performance:** In internal combustion engines, proper sealing between valves and seats is essential to achieve the optimum compression ratio. The lapping process ensures an even mating surface between the valve and seat, reducing the risk of leakage and maintaining a constant level of compression. This increases engine power and performance.
3. **Leak Proof:** Lapping can prevent or minimize leakage of combustion gases between valve and seat. Leakage can lead to loss of power, reduced fuel efficiency and increased emissions. Lapping reduces the risk of leaks by creating a precise, airtight seal, ensuring efficient engine operation and compliance with emissions standards.
4. **Heat Dissipation:** Lapping improves heat transfer between valves and seats, and efficient heat dissipation is critical to prevent overheating and potential engine damage. Lapping promotes heat transfer by creating a smooth and consistent contact surface and helps keep the valve and seat within safe operating temperatures.
5. **Valve Life:** Lapping helps to extend the life of engine valves. Lapping provides a good seal, reduces wear on the valve and seating surfaces, and minimizes the risk of valve burn and pitting. Hence lapping contributes to engine longevity and reliability by maintaining the integrity of valve components.
6. **Smooth operation:** Lapping ensures smooth and precise operation of engine valves. Properly lapped valves and seats ensure smooth opening and closing, minimizing friction and performance issues such as valve sticking and inaccurate timing. Smooth valve action contributes to overall engine efficiency and durability.

PROBLEM STATEMENT:

In many workshops or garages the workers are doing lapping of valves manually by hand and with the help of sucker loaded with fine abrasive material and oil, this sucker is rotated in clockwise and counter clockwise enabling the particles of abrasive to rub against valve and valve seat later giving

it extremely fine finish and remove undulations present priorly .This includes so much of time, efforts, and talking about small scale industrial this leads to lots of loss to entrepreneurs.

So to overcome this problem , an idea of mechanized valve lapping machine was put forward. Thid product makes the lapping process very efficient and reduces the tough work into a quite easy operation

2. LITERATURE REVIEW:

Shreyas V. Bhingarkar^[1] stated that Lapping process is characterized by its low speed, low pressure, and low material junking rate. This process is used in achieving finer shells and near fits, correction of minor defects, and maintaining close forbearance. They introduced a valve lapping machine by using a cam and cam follower mechanism. The lower motor is controlled by a Arduino which uses C++ programming . The lower motor rotates clockwise 8 secs and anticlockwise 8 secs for proper lapping.

Pankaj Pujari^[2] proposed development of a valve lapping machine using cam and follower mechanism. This would reduce human efforts and also save time during operation. They used a valve holding piece in this assembly because one problem during the process of lapping was that while the lapping process was going on , the engine valve used to get disconnected from valve holding unit.

Ashraf Q Khan^[3] stated Valve lapping, i.e. creating a good fit between an engine valve and the corresponding valve seat area of an internal combustion engine head, is a task that must be performed with great precision. Preventing the air-fuel mixture or air from entering the combustion chamber is critical to a good seal, as is preventing exhaust gases from flowing from the combustion chamber to the exhaust manifold at the right time. When any of the situations described above occur, the efficiency of the engine is greatly reduced. The engine valve retention problem was solved with the development of valve holding pieces. Introduced a valve lapping mechanism to replace manual work. Cylinder head supports facilitate horizontal movement of the cylinder head. The valve lapping mechanism is designed as a multi-part assembly to simplify machine maintenance.

S. M. Fulmali^[4] stated Lapping valves is an integral part of maintenance work that often disrupts production. Repairing leaky valves in industry is a tedious process with extended downtime, lost production and undesirably high costs. This paper displayed the need to lapping the valves. It stated the size and type of abrasive needed and proposed a machine that is pocket friendly to perform the valve lapping operations.

3. DESIGN

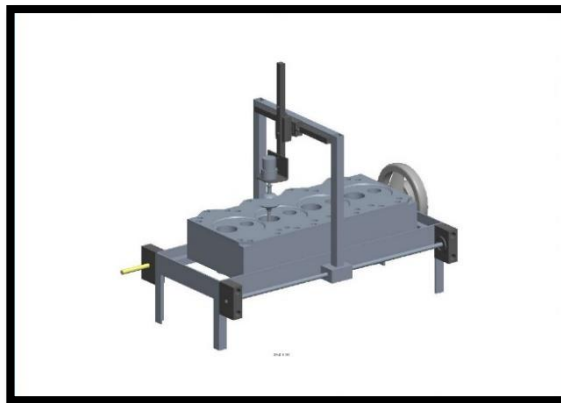


Fig 1. Iso-rear view of Valve Lapping machine

A. MACHINE BED

Machine bed is the foundation of the whole assembly of this valve lapping machine. The engine head is allowed to rest over this bed. The bed is designed in such a way that it can accommodate the head without any issue.

B. MACHINING ARMS

These are welded together and are allowed to freely slide over a shaft and a lead screw. These carry whole assemble of valve lapping tool on it.

C. VALVE LAPPING DEVICE

Aluminium profile/extrusion is mounted on these machining arms and with the help of a gantry plate another aluminium extrusion is allowed to roll over the one attached to the machining arm. Because of this gantry plate the lapping tool is allowed to move in x and y direction thus allowing precise movement of the tool across the cylinder head.

D. A HIGH TORQUE , 100 RPM DC GEAR MOTOR

A dc gear motor of 100 rpm and a torque of range : 5kg-cm(approx); Stall torque :28kg-cm . An L shaped clamp was used to hold dc motor keeping its shaft vertically inverted on vertical aluminium extrusion. A rubber sucker is attached at the end of the shaft of motor to hold the engine valve.

E. ARDUINO

Arduino is used in this machine to program the rotation of motor shaft in both clockwise and anticlockwise direction for 10 sec and is connected to motor through wires. It was programmed with help of C++.

4. CONCLUSION

This newly designed machine makes the lapping process much easier and faster .The necessary torque required was delivered by the motor and the accurate movement was provided by assembly of gantry plate and aluminium profiles. The machine bed was able to withstand the load and forces during the operation. As compared to the other lapping machines available. The proposed machine is cheaper . This machine reduced the human efforts required and at same time reduced the time required for the operation

5. REFERENCES

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