

Design and Development of Valve Lapping Machine

Amit Chavan¹, Amjad Siddiqui², Ashwin Pujari³, Danish Sayyed⁴, Prof. Dr. Nandu Durge⁵

^{1,2,3,4}Department of Mechanical Engineering,

⁵Faculty of Mechanical Engineering,

IETES Bharat College of Engineering, Badlapur, Maharashtra, India

ABSTRACT: Automobile modernization plays a significant part in the vehicle manufacturing industry and, also main source of income to the business. Currently, Internal Combustion Engine maintenance can be termed as the most crucial part in vehicle modernization and the valve lapping process which is put in this research which is done all through IC engine maintenance. The present-day techniques utilized in most automobile organizations for valve lapping are not productive and spend a lot of operating hours. 'Valve lapping Machine' for Internal Combustion Engine, is a tool which is mapped out to vanquish these problems through minimizing/reducing the human interference during the process. The research includes the report of designing the device, methodologies that are utilized, results received by using facts & analysis so, that we can enhance the design and design of the valve lapping system. Lapping is a machining mechanism wherein, two surfaces are rubbed together with an abrasive among them, via hand motion or using a system. This can take two forms, the first form of lapping (traditionally called grinding), involves rubbing a brittle material which includes glass towards a floor along with iron or glass itself (also called the "lap" or grinding tool) with an abrasive along with aluminum oxide, optician's rouge, silicon carbide, etc., in between them.

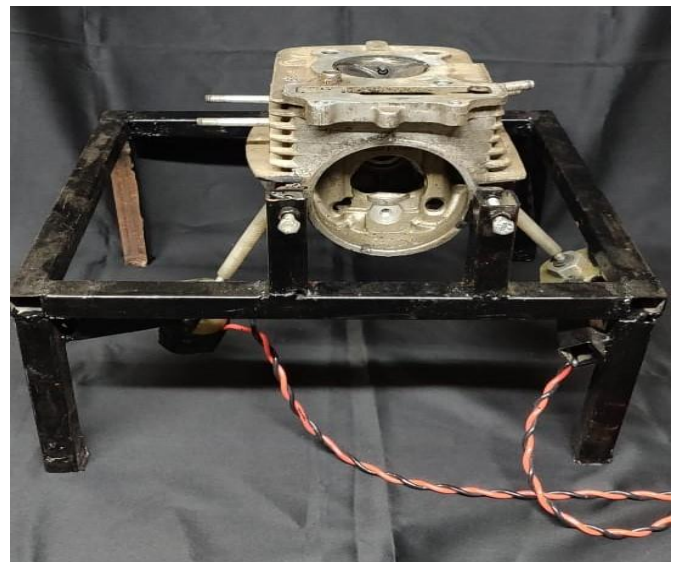
Keywords: Maintenance, Engine Cylinder, Valve Lapping Machine, Engine valves

1. INTRODUCTION:

The approach of valve lapping is put into effect to obtain the flawless seat of valve in valve sitting area. Valve lapping or the manner of creating a seat in alloying valves of engine & the interrelated valve-seat area within the IC (internal combustion) engine head (cylinder head) is a piece of work which requires to be achieved very perfectly. The significance of obtaining a correct seat is that the air/fuel mixture (in petrol engines) or air (in diesel engines) is restricted from flowing into the combustion chamber, as the exhaust fuel is avoided from flowing to the exhaust manifold from the combustion chamber till the proper time. And, also a seat prevents condensation leaks. This system of valve lapping is usually concluded with the usage of a valve lapping stick or an energy tool. As, both tools are not very robust, those tools may be replaced with the help of the 'Valve Lapping Machine

for Internal Combustion Engines', particularly sketched for the strategy of engine valve lapping. The mechanical device will execute one of a kind of motion in directions formerly carried out by using hands. Comparatively the valve lapping device is very effective due to the fact the human interference is very limited in this method.

The thought of inventing a system for the valve lapping system came to us, while we studied that the conventional method used for valve cleaning are not green and additionally time consuming. Engine head polishing and sustenance procedure plays an important role for proper working of engine. The system of valve cleansing approximately takes 1 hour to complete inclusive of testing of the valve seat high-quality using petrol. As, the conventional procedure is executed by employing a valve lapping stick, it is very tough and not much efficient. This led us to think how beneficial it could be if there can be a gadget that has a higher overall performance over conventional technique for valve lapping.



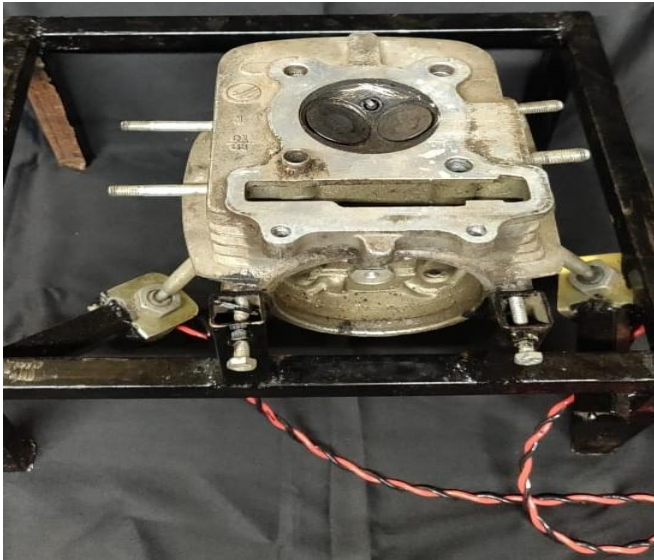


Fig.1 Diagram of Valve Lapping Machine

1.1 LITERATURE REVIEW

M.R. Kumar Pratheesh et. Al [1] authenticated that Lapping is a finalizing process where material extraction takes place due to relative/corresponding flow among the work material, free abrasive grains, and the lapping plate. This procedure is utilized in accomplishing finer surfaces and closer fits, and keeping near sufferance level. Even though, a sizable underlying science base exists about physics, mechanics, and thermal outcomes. Lapping is been contemplated as an art, rather than a science. Hence exploring lapping at essential degree will assist to enhance its usage. This discusses the results of the diverse technique parameters influencing the material removal change and surface finish. This is finished by conducting a chain of experiments with the aid of varying the technique of guidelines and calculating the material extraction rate and floor roughness.

S. M. Fulmali, et. Al [2] explained the Lapping method which is characterized by using its low speed, low strain, and occasional material elimination price. This method is used in reaching thin surfaces and closer fits, correction of imperfections, and keeping near tolerances. During the method of lapping, the mechanisms of surface formation and elimination price are decisively influenced via the movement sort of the man or woman grains within the lapping abrasive. A gate valve is used to begin with and forestall the flow of fluid. So, the wedge and the seat ring of a valve are in continuous stress of fluid float and due to starting and remaining of valve these elements get depleted and they need lapping at some stage in refurbishing. This paper will share the requirement and application of lapping during the reconditioning of valve. This paper will discover the modern-day operating condition of lapping machine in Automobile industry.

Eraldo Jannone da Silva, et. Al [4] defined that the grinding manner is widely used to produce surfaces of properly dimensional accuracy and finish (Moulik et al., 2001). Besides these features, the grinding method must make sure that the designed mechanical system for the workpiece will no longer be negatively affected. During grinding, because of the chip formation mechanism, a part of the produced energy is converted into warmth and excessive temperatures are generated at the interface among the abrasive grain and the workpiece. These temperatures are the primary supply of damage at the machined floor (Shaw, 1984). It was discovered that thermal stresses generated in the grinding system had been the primary cause of the tensile residual stresses (Chen et al., 2000), which motive a reduction within the carrier life under stress corrosion or fatigue conditions. In many cases, the thermal properties of the workpiece limit the productiveness of superior grinding methods.

Prof. D. Kotkar, et. Al [3] confirmed that the method concerned of reaching proper seat, finer surfaces, nearer fits, correction of imperfection and preserving near tolerances between engine valves and the corresponding valve seat area inside the inner combustion engine cylinder head is a task which ought to be accomplished very accurately. The importance of securing a seat is that the air/fuel aggregate in petrol engines or air in diesel engines is prevented from flowing into the combustion chamber, equal as the exhaust gasoline is avoided from flowing to the exhaust manifold from the combustion chamber until the proper time. And, also a good seat prevents compression leaks. The engine will leave its performance through large probabilities if any of the circumstances explained above happens. So, as that is a very essential challenge in IC engine maintenance, extra interest is given to this mission by means of technicians. This method of valve lapping is typically done with the usage of a valve lapping stick or a power tool. As each of these tools are not very high powered these tools can be replaced by the 'Valve Lapping Machine for Internal Combustion Engines', particularly designed for the strategy of engine valve lapping. The system employs a completely mechanical and automated device which performs two one-of-a-kind motions in two directions previously executed by using hand when the usage of valve lapping stick and power tool. Comparatively the valve lapping device could be very effective because the human involvement could be very limited in the method. Author concluded that the capability and the performance of the valve lapping machine, its miles had to be developed.

DIFFERENT METHODOLOGY ADOPTED FOR ENHANCING SURFACE FINISH OF CYLINDER HEAD:

➤ **Valve Lapping Stick:** Valve lapping stick & hand motion
Valve lapping sticks are the tools that are used to lap valves by hand fluctuation. The valve is fixed to the sucker at the tip

of the stick and lapping compound is put in before the operation starts. This operation takes approximately half an hour to lap one valve of a 3.0 L engine.

➤ **Grinding Machine:** By holding valve against the grinding wheel, lapping can be done machine-like. However, the operator must work repeatedly. It will take less than 25 minutes to lap a valve using the power tool. Power tool works using electric motor or pneumatically using compressed air.

➤ **Drilling Machine:** A rubber bush is located at a drill-bit and operation is accomplished. However, the operator must work repeatedly.

2. GOAL & OBJECTIVE:

The main purpose of this project is to design a machine both efficient and effective than formerly used methods for valve lapping and to lessen the labor cost by reducing the human participation in the process. The objectives that had to be executed in order to accomplish the main goal were plotting the basic model of the machine(structure), drawing the valve lapping mechanism, building of the whole machine by designing the parts needed, calculating and plotting the cam needed, inspect the data and classify them in order to design five valve holding pieces, investigate data to obtain the requisition of the machine, seeking two high torque dc motors that has specific RPM(revolutions per minute) values and determine what materials must be used in order for the design to be long-lasting and cost-effective.

2.1 SCOPE:

The purpose of this work is to advance a New Automatic operated Machine of Valve Lapping. This idea allows us to achieve our goal as well as better space management. The new model considers all the real time conveying system and furnish solution over their short coming. The new prototype will give good competence compared to traditional method.

2.2 DESIGN OF MACHINE COMPONENT:

➤ **Machine Frame:** The entire fabrication is assembled on a machine bed and cylinder head reclined on it.

Particulars: Mild Steel

➤ **Lapping Compound:** Lapping compound is put in to the valve seat before the start of the procedure. Lapping compound rub down the surfaces of the valve and the valve seat of the cylinder block levelling out both surfaces and creating a good seat. A lapping compound tube usually has two types of compounds available in the top end and bottom end independently. The two types named as fine and coarse. Technician chooses which type of compound

must be used by noticing the valve seat. If the valve seat has been unpolished, coarse compound is used. Otherwise, fine compound is used to obtain an even surface.



➤ **DC Motors:** Two dc motors are used in valve lapping machine, one as the drive for cam system and one as the motor for valve lapping.

Low Torque: Volts12 V, RPM-300

Reason: High initial speed is required to run the cam follower arrangement.

High Torque: Volts-12 V, RPM-30

Reason: High Torque is required due to opposition during Lapping of Cylindrical Head

3.1 SUMMARY

The process of creating a good seat between engine valves and the valve seat area in the IC engine head is a task which have to be done very accurately. To obtain a good seat the air-fuel mixture (petrol engine) or air (diesel engine) must be prevented from flowing to the combustion chamber, similar as of the exhaust gas is prevented from flowing to the exhaust manifold until the right time. Compression leaks can also be prevented if good seat is obtained. If any of the above situation happens, engine's efficiency will reduce by a huge percentage. So, it becomes a vital task for the maintenance of IC engine. Valve lapping stick or a power tool are conventionally used for the process of valve lapping. But both of this tool are not much effective, instead Valve lapping machine can be used to obtain much satisfactory results. The machine uses mechanical system to perform the two motions in two directions replacing the previously task using hand or power tool. Also, the machine facilitates very limited amount of human involvement.

4.1 ACKNOWLEDGEMENT:

We would like to take this opportunity to express our deep regard and profound gratitude to Dr. Prof. Nandu Durge for

his guidance, constant encouragement, and valuable feedback throughout the project work.

We would also express our sincere gratitude to IETES BHARAT COLLEGE OF ENGINEERING and our engineering and technology department for providing us with the platform where we could implement our innovative ideas.

5.1 REFERENCES:

1. M. R. Pratheesh Kumar: "Optimization of Process Parameters in Lapping of Stainless Steel", International Journal of Engineering Research & Technology (IJERT),2013.
2. S. M. Fulmali: "Need of Lapping Machine for Valve Component: A Case Study", International Journal of Modern Engineering Research. IJMER, Vol. 2, Issue. 6, Nov.-Dec. 2012 pp4609-4612.
3. Eraldo Jannone da Silva (2002)." The Inlet Engine Valves Grinding Using Different Types of Cutting Fluids and Grinding Wheels", Materials Research, Vol. 5, No.2, 187-194, 2002.
4. Prof. D. Kotkar (2019), "Design and Development of Valve Lapping Machine", IJERT, Vol. 8 Issue 06, June-2019