

# Design And Manufacturing of Valve Lapping Automatic Machine

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**Abstract-** 'Valve lapping Machine for internal Combustion engines' is a machine designed to overcome these problems by minimizing the human involvement in the process. This can take two forms. The first type of lapping involves rubbing a brittle material such as glass against a surface such as iron or glass itself with an abrasive such as aluminum oxide, jeweler's rouge, optician's emery, silicon carbide, diamond, etc., in between them. This produces microscopic conchoidal fractures as the abrasive roll about between two surfaces and removes material from both. Other form of lapping involves a softer material such as pitch or a ceramic for the lap, which is "charged" with abrasive. The lap is then used to cut a harder material – the workpiece. Since the machine used nowadays is costlier so we have designed a machine which is less costly.

**Keywords-** Design of Valve, Valve lapping, Cam Follower.

## I. INTRODUCTION

Valve lapping or the process of creating a good seat between engine valves and corresponding valve seat area in the IC engine head is a task which have to be done accurately. The importance of obtaining a good sea is that the air/fuel mixture or air is prevented from flowing into the combination chamber until the right time. And also a good seat prevents compression leaks. The engine will lose its efficiency by huge percentages if any of the situations explained above happens. So as this is a very important task in IC engine maintenance, Extra attention is given to this particular task by technicians. This process of valve lapping is typically done using a valve lapping stick or a power tool. As both of this tools are not very effective, these tools can be replaced by the "Valve Lapping Machine for Internal Combustion Engines", specifically designed for the process of engine valve lapping. The machine employs a fully mechanical system which performs two different motions in two directions previously performed by hand when using valve lapping stick and power tool. Comparatively the valve lapping machine is very effective because the human involvement is very limited in the process. In the earliest automotive engines, the valves needed to be removed and the sealing surfaces sanded ground or lapped multiple times during the life of a typical engine. As the decades passed, however, engines ran cleaner and the addition

of tetraethyl lead in gasoline meant that such maintenance, although they are still quite common with high-performance cars. Some reasons that may induce the need for a valve job in a modern passenger include: excessive RPM, high mileage, overheating, material failure, and foreign object damage (FOD).

## II. PROBLEM DEFINITION

The main purpose of the project is to minimize the human effort with excellent machines but, if we use a machine instead of the person the person can do another job by this time. Also the efforts which are given by employee will be reduced.

## III. OBJECTIVE

The main goal of this project is to design a machine both efficient and effective than previously used methods for valve lapping and to reduce the labor cost by reducing the human involvement in the process. The objectives that had to be achieved in order to achieve the main goal were designing the basic model of the machine designing the valve lapping mechanism, assembly of the whole machine by designing the parts needed, calculating the designing the cam needed, analyzing data and categorizing them in order to design five valve holding pieces, analyzing data to obtain the specification of the machine, obtaining to high torque dc motor that has specific rpm (revolution per minute) valves and deciding what material must be used in order for design to be durable and economical.

## Organization of dissertation

The idea of designing a machine for the valve lapping process came to me when I was working as a trainee automobile technician at Transmec Engineering PVT (LTD) of Micro Holding Group from June to September 2014. I was assigned to the engine room section where the maintenance of an IC engine is done. Engine overhauling was a daily maintenance process and I came through the valve lapping process during my 3<sup>rd</sup> week. The valve of a 3.0L 20 valve in-line engine. The process took about ten hours to finish

including testing of the valve seat quality using petrol. As the process was done using a valve lapping stick, it was very hard and my efficient of performing the process was very low after couple of hours. During my 11<sup>th</sup> week, I was introduced to valve lapping power tool which is comparatively more efficient than the valve lapping sticks and took less time to complete the process. But still the hand holding the power tool and performing the hand motion was hard. This leads me to think how easy this process will be if there was a machine that has the performance of the power tool and the motion of the hand. ‘Valve Lapping Machine for Internal Combustion Engines’ was designed by the motivation of that idea.

### What is Valve Lapping?

In the process of valve lapping in an internal combustion engine cylinder head, the goal is to achieve a good seat between valve seating area of an engine valve and the valve seat area of cylinder head in order to avoid the compression leaks through the seating. The internal combustion engine operates by achieving a certain compression ratio which is differing from engine to engine and combusting an air fuel mixture which is compressed to a certain volume decided by the compression ratio. And if the air –fuel mixture leaks through the seating, the volume of the air –fuel mixture will change and combustion process will not be accurate resulting a reduction in productivity of the engine. Therefore it is vital to valve a fully sealed combustion chamber and the valve seating is very important in acquiring a fully sealed combustion chamber.



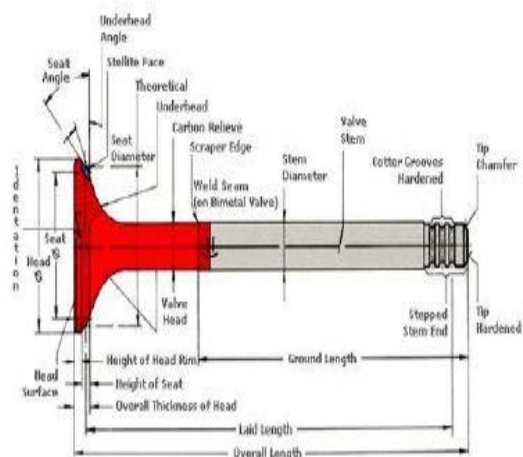
**Figure: Valve positioned in the cylinder head**

### Lapping process

While the valve lapping process, we have to observe the valve seat area time to time by the naked eye. It's the normal way to conclude whether the valve seat is good or

further valve lapping is needed. Figure shows a lapped valve and a non-lapped valve. After the valve lapping process, the most common way to observe the seating of valves is a technique using petrol. After the valve job is done, the mechanic or technician place the precise valve in the precise spot in the cylinder head and pour petrol to the stem of the valve which he have to observe. This poured petrol then to the stem of the valve. Then it is observed if petrol leaks through the seat. If the petrol leaks through the valve seat it concludes that the valve job is not successful and if petrol does not leaks through the valve seat it concludes that the valve has acquired a good seat, so recommending to assemble the engine using the valve.

The most commonly used valve design is poppet valve design. Then there is sodium valves used in some turbo-charges engines. And mask valves, mushroom valves, tulip valves could be observed in different situations. The following figure shows a detailed diagram of a valve.



**Figure: Detailed diagram of an engine valve**

While lapping valves as shown in figure, the technician has to decide whether to apply compound from observing the valve seat area time to time. This method is still used in basic garages.

### Valve lapping power tool

Using the valve lapping power tool is much more efficient than the valve lapping by hand movement. It will take less than 15 minutes to lap a valve using the power tool. But still we have to hold the power tool in position for lapping process, which is somewhat hard labor to undergo.

Technique used for doing valve lapping manual:-

Following figures shows the valve lapping sticks and the hand movement used to lap valves.



Figure commonly used valve lapping sticks



Figure Hand movement while lapping valves

Work using an electric motor or pneumatically using compressed air.



Figure Valve lapping using a power tool

**Conception Diagram:**

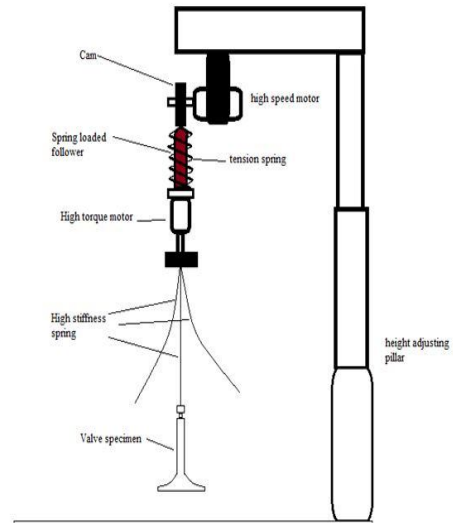


Figure Machine Setup Diagram

**Cam system**

As a cam system is implemented in the machine, it is better to have an idea about cam system. A cam follower, follower system and drive are four basic parts of cam system. Clyde H. Moon, P.E. states that “A cam is mechanical part which imparts a prescribed motion to another part by direct contact. It may remain stationary, translate or rotate “. Followers are directly contacting the cam while the follower system receives a specific motion through the follower give by the cam. Drive is the element which transmits motion to the cam or to the following system.

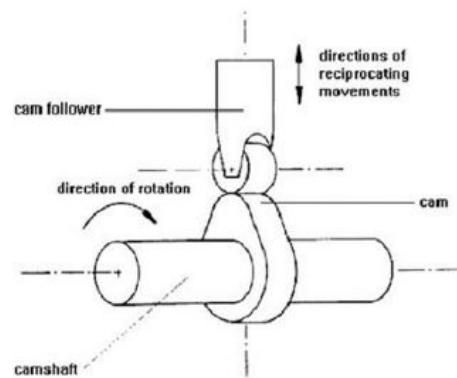


Figure Cam and Follower

**DC motors**

Two dc motors are used in the valve lapping machine, one as the drive for cam system and one as the for valve lapping.

**Table Specification of motor**

Content	Valves
Horse power	0.8W (80mA, no load)
Gear ratio	1:20
RPM	100
Reversibility	Reversible
Length of motor	54mm
Diameter of motor	25mm
Length of spindle	8mm
Diameter of spindle	4mm



**Figure Low torque mini 12v dc gear motor, 100rpm**

**Table Specification of second motor**

Content	Valves
RPM	60
No load current	120Ma
Load torque	10-19kg.cm
Load current	400mA
Length of motor	29mm
Diameter of motor	33mm
Length of spindle	13.5mm



**Figure High torque, heavy duty 12V dc gear motor, and 60 rpm**

**IV. SUMMARY**

In this paper we studied:-

1. The process of valve lapping in an internal combustion engine cylinder head.
2. The detailed Diagram of valve used in engine.
3. Technique used for doing valve lapping manually.
4. Conceptual Diagram for valve machine automatically.
5. About the cam system working.

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