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Design and manufacturing of Valve lapping machine

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ABSTRACT

Automobile maintenance could be a major space within the trade of automobile and additionally a significant financial gain to the business. In present, combustion engine maintenance is explicit as an important section in automobile maintenance and also the Valve Lapping method that's subjected during this thesis is finished throughout IC engine maintenance. This way employed in most automobile maintenance businesses for Valve lapping method aren't effective and consume heaps of operating hours.' Valve lapping Machine' for combustion Engine could be a machine designed to beat these issues by minimizing the human involvement within the method. The thesis consists of the background in coming up with the machine, methodologies used, results obtained by knowledge analysis so as to optimize the planning and style of the valve lapping machine. Lapping is a ma-chinning method within which 2 surfaces area unit rubbed alongside associate abrasive between them, by hand movement or employing a machine. This could take 2 forms. the primary style of lapping(traditionally referred to as grinding), involves rubbing a brittle material like glass against a surface like iron or glass itself (also referred to as the "lap" or grinding tool) with associate abrasive like aluminium oxide, jeweller's ,rouge, optician's rouge, emery, carbide, diamond, etc., between them. The lapping machine Stellite as associate abrasive has been developed and it's been determined that the time needed for getting a particular surface compared to standard methodology is a smaller amount. A lapping machine with suction is developed the suction is connected to the valve manifold that's in grips with the cylinder seat because of the mechanism of rotation in the dextral and anticlockwise direction the operation of lapping is performed. The rotation motion is provided by the utilization of Cam and Follower. A programming board referred to as Arduino is employed to realize the required motion at a specific measure. A correct comparison is formed with manual operations and it's been found that the machine becomes profitable once a breakeven purpose of forty-eight days. The time needed for the lapping of 3-cylinder head Stellite as abrasive is concerning forty-five minutes wherever because it takes concerning an hour for lapping while not using Stellite roughly ten Cylinder heads are lapped. So, productivity is improved by Stellite as abrasive.

Keywords— *Engine valves. Cylinder head*

1. INTRODUCTION

A valve job is associate operation that is performed on any four-stroke cycle, combustion engine, the aim of that is to resurface the conjugation surfaces of the poppet valve valves and their several valve seats that management the intake and exhaust of the air/fuel mixture that powers the motion of the pistons once the beginning cycle. Within the earliest automotive engines, the valves required to be removed and also waterproofing surfaces sanded, ground or lapped multiple times throughout the lifetime of typical engine. Today, valve jobs are unit done on traveller cars for the aim of maintenance, though they're still quite common with superior cars. Some reasons which will induce the requirement for a valve job in a modern passenger include: excessive revolutions per minute, high mileage, warming, material failure, and foreign object harm. This method of Valve lapping is often done employing a Valve lapping stick or an influence tool. As each of this tool aren't terribly effective, these tools are replaced by the 'Valve Lapping Machine for Combustion Engines', specifically designed for the method of engine valve lapping. Relatively the valve lapping machine is incredibly effective as a result of the human involvement is incredibly restricted within the method. Within the method of valve lapping in an indoor combustion engine plate, the goal is to realize a decent seat between valve of associate engine valve and also the valve seat area of plate so as to avoid the compression leaks through the seating from the combustion chamber and to avoid air-fuel mixture leaky in to the combustion chamber through the seating. The interior combustion chamber operates by

achieving an exact compression magnitude relation that is differing from engine to engine and combusting an air-fuel mixture that is compressed to an exact volume set by the compression magnitude relation. And if the air-fuel mixture leaks through the seating, the quantity of the air-fuel mixture can amendment and combustion method won't be correct ensuing a discount in productivity of the engine. Therefore, it's important to own a totally sealed combustion chamber and also the valve seating is incredibly important in deed a totally sealed combustion chamber.

2. LITERATURE REVIEW

Weiwei Liua et al investigated the carbonous deposited will cut back the sturdiness and performance of diesel engines. Chemical cleansing ways area unit wide accustomed take away the deposits in remanufacturing trade however the wasted liquid is harmful to the atmosphere. During this paper the critical greenhouse unit wide accustomed take away the deposits in remanufacturing trade however the wasted liquid is harmful to the atmosphere. During this paper the critical greenhouse emission cleansing technology, associate environmentally friendly approach, has been accustomed take away these contaminants. The testing results showed that almost all organic compounds were dissolved and also the stubborn contaminants were modified to be removed simply once cleansing by critical greenhouse emission fluid. [1]

S. M. Fulmali and R. B. Chadge investigated that lapping method is characterised by its low speed, air mass, and low material removal rate. This method is employed in achieving finer surfaces and nearer fits, correction of minor imperfections, and maintaining shut tolerances. Throughout the method of lapping, the mechanisms of surface formation and removal rate area unit resolutely influenced by the movement style of the individual grains among the lapping abrasive. A gate valve is employed to begin and stop the flow of fluid. That the wedge and seat ring of a valve area unit in continuous pressure of fluid flow and because of gap and shutting of valve these parts get wear and that they want lapping throughout reconditioning. This paper can share the requirement, demand and application of lapping throughout the reconditioning of valve. Lapping could be a small ending operation that is needed to want obtaining a mirror like surface finish on the meeting part. The lapping method is allotted by applying loose abrasive grains between 2 surfaces and inflicting a relative motion between the 2 surfaces leading to an end of multi-directional lay [2]

B. Seshagiri Rao and D. Gopi Chandu, the aim of this paper is to style associate valve for a hackney coach gas engine satellite theoretical calculations. Producing method that's 2nd drawings is written from the calculations and 3D model and transient thermal analysis is to be done on the valve once valve is open and closed. The fabric used for valve is EN52 steel. The valves employed in the IC engines area unit of 3 types: poppet valve, mushroom valve, Sleeve valve or Rotary valve of those 3 varieties, poppet is most ordinarily used. Since each the body of water and exhaust valves area unit subjected to high temperatures of 1930? C to 2200? C throughout the ability stroke, therefore, it's necessary that the materials of the valves ought to stand up to these temperatures. 2 body of water and one exhaust or 2 body of water and 2 exhaust valves prevents pollution and improves engine potency [3]

Y.V.V. Satyanarayana Murthy, the aim of this paper is to observe the "knock" in Diesel engines that deteriorate the engine performance adversely. The methodology introduced within the gift work suggests a freshly developed approach towards analysing the vibration analysis of diesel engines. The strategy is predicated on elementary relationship between the engine vibration pattern and also the relative characteristics of the combustion method in completely different cylinders. Knock in diesel motor is detected by measurement the vibration generated by the engine victimisation The DC quick Fourier remodel analyser with measuring instrument. Knock in diesel motor is especially because of the engine miss. A diesel motor miss results from one or additional cylinders once the fuel isn't burning properly. Engine miss causes fast combustion with terribly high pressures generating a rumble or uninteresting noisy sound. Abnormally loud sound with violent vibration is termed "knocking or detonation". [4]

Bhargav Khanpara and Pankaj Rathod shows that Weld overlay coating, additionally referred to as laborious facing, could be a methodology that involves application of laborious and wear resistant materials on the substrates requiring resistance against abrasion. Wear is that the predominant mechanism that controls the lifetime of the machine parts. Metal component usually fail in their supposed use not solely as a result of fracture, however as a result of they wear, that causes them to lose their dimensions and practicality commonest wear modes area unit Abrasion, impact, metal to metal contact and warmth, corrosion. Analysis goes on to boost the damage resistance, metal laborious facing is that the most versatile method to boost the damage lifetime of the components [.5]

3. VARIOUS METHODOLOGYADOPTED FOR IMPROVING SURFACE FINISH OF CYLINDER HEAD

3.1 Valve Lapping Stick

Valve lapping stick and hand motion Valve lapping sticks are the tools that we use to lap valves by hand movement. The valve is joined to the sucker at the tip of the stick and lapping compound is applied before the operation starts. This process takes approximately half an hour to lap one valve of a 3.0 L engine.

3.2 Grinding Machine

By holding valve against the grinding wheel lapping can be done manually. However, the operator has to work continuously. 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.

3.3 Drilling Machine

A rubber bush is installed at a drill-bit and operation is performed. However, the operator has to work continuously.

4. DESIGN OF MACHINE COMPONENT

4.1 Machine Bed

The entire assembly is assembled on machine bed and cylinder head rests on it.
Material: Mild Steel
Dimension: 460 x 380 x 88 (in mm)

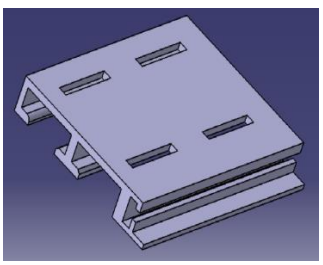

Fig. 1: Machine Bed

4.2 Cantilever Beam

It is vertical column which has adjustable vertical height on which the mechanism of valve specimen is assembled.

Material: Mild Steel

Force Acting: 5N

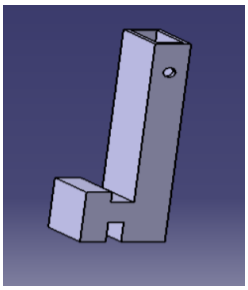

Fig. 2: Cantilever Beam

4.3 Cam and Follower

Cam and follower mechanism is used in the machine to convert the rotational motion of the motor into reciprocating motion for the valve specimen.

4.4 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

4.5 Spring

The function of the spring is to adjust the displacement that occurs during operation.

Fig. 3: Spring

4.6 Valve Specimen

It is the device that enters the cylinder head and initiates the cleaning.

Fig. 4: Valve Specimen

4.7 Stellite

Stellite is a wide range of cobalt-Chromium alloy Design for wear resistance. Stellite is family of completely non-magnetic and corrosion resistance cobalt alloy of various compositions that have been optimised for different use. It has good wear resistance ability and can work under high temperature range and resist hardening and annealing. The alloy may also content Tungsten and small but important amount of carbon. They are adaptable and can be refined due to its hard material property Stellite alloys are inherently difficult to machining. Type used is Stellite 6.

4.8 Mechanical Properties

- Hardness:373 BHN
- Tensile Strength:896 MPa
- Yield Strength: 541 MPa
- Density: 8.9 gm/cm^3
- Temperature Range: (1285-1395) ^{0}C

4.9 Composition

Stellite alloys are mixture of cobalt (43%), Chromium (29%), Carbon (1.2%), Iron (3%), Nickel (3%), Silicon (1%), Manganese (1%), and Tungsten (4.5%)

5. SUMMARY

The process of creating a good seat between engine valves and also 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.

6. REFERENCES

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