

Design of Loading and Unloading Device for Valve Lock Sheet of Automobile Engine

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Abstract: This design mainly provides one kind specially uses in the automobile engine valve lock piece loading and unloading device design. The aim of the device is to realize the loading and unloading of the automobile engine valve lock with high efficiency and low cost. The device is simple in design and can realize the loading and unloading of most of the automobile engine valve lock sheets. The device mainly uses rechargeable batteries to generate magnetism for metal materials, and loads and unloads the lock sheets according to the generation and disappearance of magnetism, the utility model is mainly composed of a rechargeable battery, a charging device, a switch, a plastic sleeve, a wire, a ductile metal arm and a rotatable concave front end. The design has the advantages of simple structure, convenient use and convenient operation, and can greatly improve the loading and unloading of automobile engine lock sheets.

1. Introduction

As an important part of the automotive industry, automobile maintenance plays a vital role in the safety and reliability of automobiles. The engine is the most critical part of the car and the most important factor in determining the performance of the car, which converts the thermal energy of fuel combustion into mechanical energy, and its quality affects the performance, reliability, and life of the car [1, 2]. Valve lock sheet is an integral part of the engine valve mechanism, which forms a valve group with valves, valve spring seats, valve springs, valve guides and other parts to ensure that the valve can reliably move according to the design trajectory, and its assembly affects the performance of the valve mechanism, which in turn affects the engine performance [3]. In the process of automobile engine maintenance, the replacement and maintenance of valve lock sheets is a common operation, and it is also a difficult and dangerous operation. The valve lock sheet of the engine is small in size and sinks into the center of the valve spring pressure sheet hole, which is often difficult to remove because the carbon deposits are cemented with the valve spring pressure sheet [4]. At present, the installation and removal of valve locks in automobile maintenance requires the help of a bow valve spring compressor, and then the valve locks are manually installed and dismantled. The traditional manual operation is prone to mistakes such as falling off, flipping and installation is not in place, which is not only inefficient, but also has certain safety hazards, and

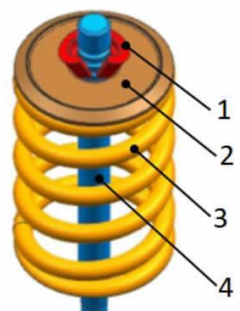
requires professional and technical personnel to operate. Therefore, in view of the problems and difficulties in the process of replacing the valve lock disc of automobile engine, we propose a new design scheme of the loading and unloading device of automobile engine valve lock sheet based on the principle of electromagnetism. The device is simple in structure, safe and stable, convenient in operation, can greatly improve the efficiency of valve lock sheet replacement, reduce the difficulty of operation and potential safety hazards, improve work efficiency and quality, and is suitable for the loading and unloading of most valve lock sheets. We have reason to believe that this new type of device will have great application prospects in the automobile maintenance industry.

2. Valve Lock Sheet Assembly Structure and Its Function

The valve lock sheet is an indispensable device on the valve of an automobile, the valve lock sheet is in the shape of a hollow inverted vertebral platform, and there is a flange inside to cooperate with the valve stem to fix the relative position with the valve spring seat, and the spring seat and the valve stem reciprocate at the same time through the elasticity of the spring [5]. For the design of the valve lock sheet removal device, it is necessary to be familiar with the structure and installation environment of the valve lock sheet. Only on the basis of understanding and understanding the structure around the valve lock sheet can the appropriate size of the loading and unloading device be designed and the design scheme of the loading and unloading device can be determined.

2.1 Assembly Structure of Valve Lock Sheet

In the valve train of the engine, the valve pack is the key moving component, which is responsible for the opening and closing of the engine's intake and exhaust valves [6]. The assembly structure of the valve lock sheet of the automobile engine valve mechanism is shown in Figure 1. The valve group mainly comprises valve lock sheet 1, valve spring upper seat 2, valve spring 3, valve guide 4 [7], two valve lock sheets are symmetrically distributed to wrap the lock groove part of the valve stem, the inner surface of the valve lock sheet is provided with a convex ring belt, the ring belt is matched with the lock groove of the valve stem and leaves a gap, the two valve lock sheets are matched with the cone surface of the inner hole of the valve spring seat after being held together, and the spring seat and the valve lock sheet are clamped through the valve spring. The valve lock sheet is clamped on the valve guide rod, while the lock lock is smaller, and there are many uncertainties in the installation process, so it is not very easy and inefficient when installing the valve lock sheet [8]. The cladding on the cylinder head of the engine is the most difficult part of the engine assembly because of its small parts and the need to be installed in combination with valves, valve springs, and spring seat inserts [9].



1- valve lock sheet, 2- valve spring seat, 3- valve spring, 4- valve stem

Figure 1: Valve train

2.2 The Role of Valve Lock Sheet

The valve lock sheet is located between the valve stem handle and the valve spring of the automobile engine, and it is the key component that connects the valve stem handle and the valve spring. Its function is to prevent the valve spring from loosening by locking the valve spring when the valve is closed, so as to ensure the tightness and tightness of the valve, so that the automobile engine can run normally. In automobiles, especially on high-speed roads such as highways, where engine speeds and temperatures are high, valve locks are critical to engine reliability, durability and fuel economy. Automobile engine valve lock sheet is a kind of part, its function is to achieve one-way connection between the valve and the spring seat and lock, to ensure that the valve can operate normally. Valve lock failure can have a great impact on the engine, for example, a stuck lock will cause the valve to close poorly, resulting in insufficient compression ratio, which will lead to a lack of cylinder in the engine, and a falling lock will cause the piston to be pierced by the valve, and then the engine will be scrapped. There are two ways to connect the valve stem and the spring, one is the lock clamp type, two semicircular conical lock clamps are installed on the groove at the end of the valve stem, and the spring seat is tightly pressed to the lock clamp to make it tight at the end of the valve stem, so that the spring seat, the lock clamp and the valve are connected as a whole and move together with the valve. The other is to use a locking pin instead of a radial hole for a locking clamp pin, which is connected by a locking pin. Valve lock replacement and repair is one of the important factors to ensure engine performance and life.

3. The Structure and Function of the Bow Valve Spring Compressor

There are many types of valve-specific disassembly and assembly tools on the market, which are mainly divided into lever type and bow type, and the bow type is commonly used [10]. Bow valve spring compressor, manually assembled with valve locks. The structure of a bow valve spring compressor is shown in Figure 2, and its main components include a sliding sleeve, a pressure bar, a front-end bracket, and a compression sleeve [11]. The compression sleeve is connected to the sliding sleeve by a hinge, and the function is to exert downward pressure on the valve spring in contact with the upper seat of the compressed valve spring. The bottom of the pressure sleeve adopts an annular closure structure, which is not convenient for the installation of valve lock sheets. The connecting pair between the sliding sleeve and the pressure rod is a sliding pair, and the pressure sleeve can be used to change the position of the loading and unloading valve through sliding. In addition, the front bracket is connected to the pressure bar by a hinge, and a downward pressure is applied at the end of the pressure bar to compress the valve spring that the pressure sleeve is in contact with. The mechanism of this compressor uses the lever principle to achieve the effect of labor-saving, and it is also a device that is used in conjunction with the cleats loading and unloading device designed this time.

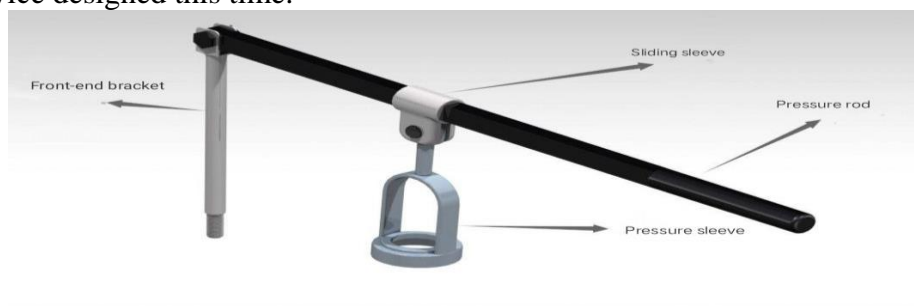


Figure 2: Bow valve spring compressor

4. Structure and Principle of Valve Lock Sheet Loader

4.1 Valve Lock Sheet Loader Principle

The compression sleeve is made of high-strength steel, and the bottom is designed to be supported by a semi-circular ring, which increases the hollow area and increases the operating space of valve assembly. The valve lock sheet loader designed for the compression sleeve is shown in Figure 3, which is mainly composed of a battery, a switch, a wire, a ductile plastic arm, and a concave front end that can be rotated to energize and generate magnetism. In the work, the switch needs to be turned on to energize the device, so that the concave front end is magnetic, press the plastic arm, the front end is clamped, and the front end clamps the lock piece to suck the lock piece, and the disassembly process is over. The same principle of the installation process, the cleat is placed at the concave front end with magnetism when energized, and the switch is turned off when the front end clamps the valve stem, and the front end is not magnetic, and the metal arm is released, and the cleat is installed. This device can be installed and dismantled on two locks at the same time, which greatly shortens the installation time and improves the production efficiency, in addition, due to its special disassembly mode, this device is suitable for most types of valve locks, and meets the needs of most of the needs of loading and unloading locks. The efficiency of the loading and unloading of the automobile engine valve lock disc loader has been greatly improved compared with the current automobile engine valve lock sheet loading and unloading, the loading and unloading time and loading and unloading energy of manual labor have been reduced, and the production cost of this device is low, suitable for the vast majority of automobile maintenance enterprises, which has an extremely important role in automobile engine maintenance and maintenance.

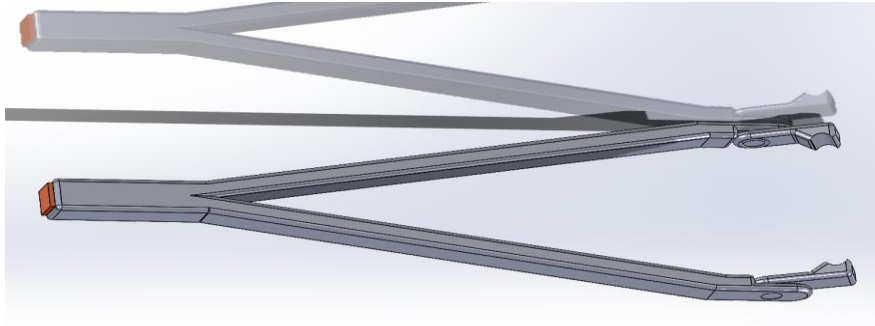


Figure 3: Valve lock sheet loader

4.2 Fault Analysis and Maintenance of Engine Valve Loader

(1) The locking piece cannot be adsorbed. It may be caused by insufficient power, short circuit of wires, etc. Recharge and see if the locking piece can be adsorbed.

(2) The rotatable concave front end does not rotate flexibly. It may be caused by the accumulation of a large number of stains at the joint, and the link can be wiped with items such as a face tag, or it may be that the joint is damaged and it is necessary to replace the connection or directly replace the rotatable concave front end.

(3) The position of the two locking pieces is one high and the other low. It may be that the design structure of the metal arm is deformed due to the long-term use or the structural deformation caused by accidents, and the rotatable concave front end is deformed due to long-term extrusion. At this time, if the deformation is not too large, it can be restored by simple tools, and if the structure is seriously deformed, its metal arm or rotatable concave front end can be replaced.

(4) The plastic sleeve outside the metal arm is damaged. If the plastic sleeve is damaged, it can be replaced directly or wrapped with adhesive tape (the plastic sleeve does not affect the normal use of the device, and the design purpose of the plastic sleeve is to conform to human mechanics and reduce the operating intensity of the operator when using it).

5. Solidworks Software Introduction

SolidWorks is a widely used three-dimensional computer aided design (CAD) software. It has the following characteristics:

- (1) 3D modeling: It can create complex 3D solid models.
- (2) Parametric design: it is convenient to modify and adjust the model.
- (3) Assembly design: support assembly and motion simulation of multiple parts.
- (4) Engineering drawing generation: automatically generate two-dimensional engineering drawings from three-dimensional models.
- (5) Analysis function: stress and strain analysis.
- (6) High design efficiency: providing abundant tools and quick operation.
- (7) Good compatibility: compatible with other CAD software.
- (8) Wide application fields: covering many fields such as machinery and industrial design.

It has the following advantages:

- (1) Improve the design quality and accuracy.
- (2) Shorten the product development cycle.
- (3) Reduce costs.
- (4) Facilitate communication and collaboration.
- (5) Support complex design and innovation.

In a word, SolidWorks is a powerful and easy-to-use CAD software, which provides engineers and designers with efficient design tools and solutions. By using SolidWorks software, users can quickly generate mechanical parts and assembly drawings and carry out complex design operations.

Figure 3 is mainly assembled by Solidworks to build 3D models such as Figure 4 and Figure 5.

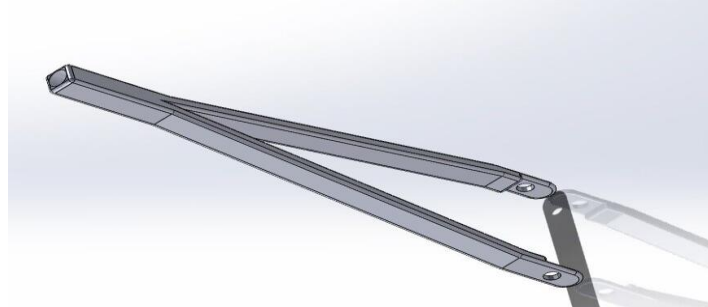


Figure 4: Metal arm

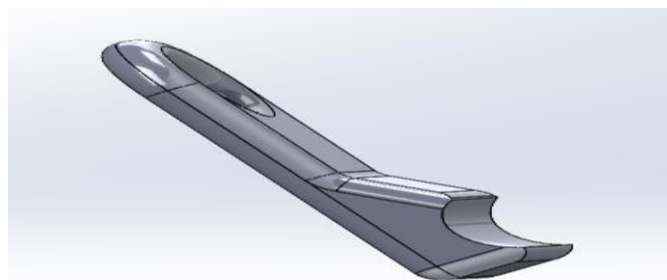


Figure 5: Concave front end

6. Summary

The engine valve lock loader can be widely used in the automobile maintenance and maintenance industry. The loading and unloading of the automobile engine valve lock skillfully uses the influence of the magnetic force on the valve lock to design a loader with convenient carrying, simple and compact structure, convenient operation and low manufacturing cost, which greatly saves the loading and unloading time, reduces the labor cost and relieves the fatigue strength of operators. The following is my summary of the car engine valve lock sheet loader:

6.1 Design Requirements

The valve lock sheet loader should have the following characteristics:

- (1) The valve lock sheet can be quickly and easily removed and installed;
- (2) Good stability, which can tightly fix the valve lock sheet to avoid damage;
- (3) Light weight, small volume and easy to carry and store;
- (4) Convenient maintenance, easy cleaning and maintenance.
- (5) It is suitable for the loading and unloading of most automobile engine valve lock sheet.

6.2 Design Principles

In order to meet the above requirements, the valve lock sheet loader should follow the following principles:

- (1) Material selection: Tough and durable materials, such as aluminum alloy or steel, should be selected;
- (2) Structural design: the ergonomic structure makes the operation more comfortable and convenient;
- (3) Safety considerations: Attention should be paid to potential safety hazards in the design, such as sharp edges and easy sliding, and corresponding measures should be taken to avoid them.

6.3 Future Improvement Direction of the Device

- (1) It is not necessary for the operator to compress the metal arm by hand to install and disassemble the locking piece, and the device can automatically shrink, only the operator needs to position it.
- (2) The structure is simpler and is suitable for mounting and dismounting more automobile engine valve lock sheet.

6.4 Application Prospect and Prospect

Application of loading and unloading tools for automobile engine valve lock sheet;

- (1) Improve work efficiency: help to assemble and disassemble valve lock sheet quickly and accurately, and reduce working hours.
- (2) Ensure operation safety: avoid possible damage caused by manual operation.
- (3) Ensure the assembly quality: ensure that the valve lock sheet are installed in place to improve the engine performance.
- (4) Wide application range: it can be used for loading and unloading valve lock sheet of various types of engines.

Outlook:

- (1) Intelligent development: It may be combined with automation equipment to realize full

automation of loading and unloading process.

(2) Accuracy improvement: the accuracy of the tool will be further improved to meet the higher requirements of the engine.

(3) Multifunctional: integrating multiple functions to improve the versatility of tools.

(4) Lightweight and portability: easy to carry and operate.

(5) Cost reduction: With the technological progress, the cost may be reduced and the popularity will increase.

The loader for automobile engine valve lock sheet can be widely used in automobile maintenance industry, which greatly improves the efficiency of loading and unloading the lock sheet, and the device is low in manufacturing cost and convenient to carry, and is suitable for loading and unloading most automobile engine valve lock sheet. The design of the loader for engine valve lock sheet improves the efficiency of loading and unloading engine valve lock sheet by nearly 70%.

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