Engine Body Water-tight Test Set Design and Production

Junzhen Gong, Hanlei Wang
Weihai Power Co., Ltd., Weifang, Shandong, China

Abstract: At present, most of the tests for engine block sealing performance are gas-tight tests. When the airtight test fails, only the current organism performance defects can be derived, and the position of the non-conformity cannot be specified. To quickly and accurately identify areas of non-conforming body leakage, studies have been carried out for water-tight test devices on engine bodies. The device proposed in this study uses water as a gas, which can rapidly judge the specific leakage area according to the water seepage of the body, effectively reducing the difficulty of sealing test detection, and can be suitable for different models of body, with a wide range of applications.

Keywords: Gas Tightness; Water Density Test; Engine Body; Precise Positioning

1. Introduction

Diesel engines derive kinetic energy by burning diesel fuel at high temperature and high pressure inside the engine, and dissipate heat through the cooling system and lubrication system, all of which need to be done under certain sealing conditions, so engine block sealing performance is critical to engine quality [1]. If there is a cross-leak between hot, high-pressure gases, cooling water, lubricating oil, and other media in the internal engine media, the engine reliability [2] will be seriously compromised. To ensure that the leak rate of the engine block is within a suitable range, the leak detector is normally tested by an air-tight test. The principle of operation of the gas-tight leak tester is to detect the pressure variation in the closed cavity, and then convert it to a gas leak per minute to determine whether the closed cavity is leaking. This can be achieved in two ways, pressure drop and differential pressure. The work process is divided into five stages [3] [4] of pre-inflation, inflation, balance, measurement and exhaust.

However, most of the current tests for sealing properties are gas-tight tests, and when the airtight test fails, only the currently detected organism has performance defects, and it is not possible to determine its specific location. In view of the current problems in the airtight detection of engine bodies, a device suitable for water-tight testing of engine bodies has been studied, which can quickly and accurately determine the leak area of unqualified bodies, effectively reducing the difficulty of sealing test testing.

2. Research Design for Roller Track Positioning System

2.1 Research Purpose

To ensure the efficiency of the water tightness test of the engine body, and to ensure that water-tight containment mechanisms in different directions accurately seal the water holes when sealing the water cavity, so as to avoid the occurrence of water leakage in the sealing holes, precise positioning of the test body is required. The design should meet the following requirements: Multiple position detection sensors and two different shaped dowel pins in conical and hexagon form ensure accurate positioning of the body, which in turn precisely seals the passages of the body between different bearing surfaces and the water cavity, thus ensuring a smooth water-tightness test and effectively detecting the sealing performance of the body.

2.2 Design Content

The block roller track locator system has been designed to carry and position the engine block, and is structured as shown in Figure 1. The main parts of the roller track positioning system are: I-1, motor; I-2, guide rail; I-3, roller; I-4, position detection sensor; I-5, bottom support; I-6, reduction signal sensor; I-7, locating pin; I-8, blocking plate.

First, t motor I-1 drives the roller I-3 on the guide I-2, which moves the workpiece for detection, while moving the workpiece, detects the movement and position of the workpiece in real time through the position detection sensor

I-4, and when the workpiece passes the speed reduction signal sensor I-6 position. The reduction signal sensor I-6 sends the reduction signal to the motor I-1, Motor I-1 control roller I-3 slows to a stop and the workpiece reaches the specified position. The guide I-2 is lowered, the workpiece is supported by the base support-5, and the dowel I-7 is extended, which snaps into the corresponding round hole in the bottom of the body to achieve one side of the two pins. If the reduction signal sensor I-6 fails, the workpiece fails to stop in the specified position and continues to move forward, the workpiece is blocked at the end of the guide rail I-8 by the stop barrier I-8, which is also transmitted to the motor I-1 stop signal to stop the movement of the rollers I-3 in time.

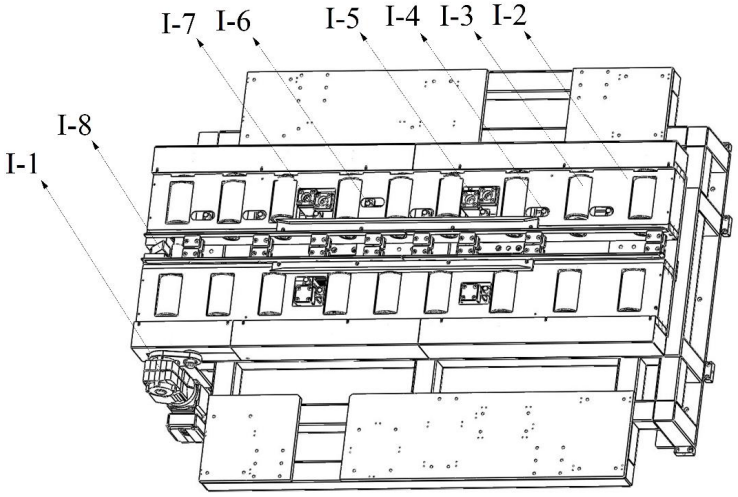

Figure 1. Engine Roller Track Locator System

3. Research Design for Sealing the Water Filling System

3.1 Research Purpose

The water injection unit is designed to evaluate the sealing performance of the engine body by filling the inside of the engine body with water and observing the exterior for water leaks, while ensuring that the unit is suitable for different models and is suitable for a wider range of applications. The first feature is an adjustable blocking design: An adjustable blocking mechanism based on line-type rails to accommodate inconsistent water hole positions in different body models, ensuring the equipment accurately seals the body water hole, increasing the versatility and flexibility of the equipment. Second, it has an efficient sealing system: Both side ramp blanking plates and the top and front and rear blanking blocks are designed with sealing rubber, which effectively blocks the flow of water from the blocked water holes, ensuring the body's water chamber is completely sealed during the water-tight test, improving the accuracy of the sealing test.

3.2 Design Content

A blanking device, mounted next to the roller track retainer described, is used to seal the water hole in the engine block, and a water filling mechanism, mounted next to the roller track retainer described, is used to seal the water inlet and outlet holes in the engine block and fill the coolant cavity through the water inlet hole.

The main components of the water-filling system are: II-1, fixed plate, II-2, wire-type rail, II-3, Servo motor; II-4, blocking; II-5, spring; II-6, rubber ring; II-7, blanking plate; II-8, Dowel; II-9, cylinder guide; II-10, cylinder.

After the workpiece is positioned on the roller track, the servo motor II-3 slides the side-slope blocking mechanism on-line rail II-2 to the specified position, then stops, and the cylinder rail then extends. The blanking plate II-7 with rubber ring II-6 blocks the water holes on the side slopes of the workpiece that connect to the water chambers. The alignment pins II-8 further confirm the position of the workpiece to ensure that the blanking plate II-7 accurately seals the water holes. After the side ramp blocking mechanism is closed, the top blocking mechanism lowers along the cylinder rails II-9, the servo motor drive rail extends, and the blocking-4 II is inserted into the water hole on the top of the body, under the influence of cylinders II-10. The rail continues to extend, squeezing the spring II-5 between the rail and

the seal II-4, so that the seal II-4 completely seals the water hole on the top of the workpiece.

The main components of the front and rear blocking mechanism and filling mechanism are: III-1, control regulator; III-2, signal data cable; III-3, backplane; III-4, servo motor; III-5, Rail; III-6, front and rear blocking; III-7, lower blocking; III-8, wire-type rail; III-9, water filling channel; III-10, The water exit channel.

The front and rear blanking mechanisms start to operate when the ramp and top water holes on both sides of the workpiece are closed. The servo motor III-4 drives the chain control floor plate III-3 extends into position, the guide rail III-5 extends forward so that the front and rear sealing III-6 blocks the front and rear water holes of the workpiece, then the servo motor drives the lower sealing III-7 blocks the bottom water holes of the workpiece from the bottom up. All of the holes in the body that connect to the water chamber, except the ones that enter and exit the water hole, are closed. After sealing the water chamber of the workpiece body by means of the blocking assembly, the servo motor drives the wire-type rail III-8, which stops the filling mechanism in the specified position, extending the rail inserts the filling channels III-9 and III-10 into the inner holes of the workpiece, respectively. The water cavity is sealed with pressurized water from the filling channel III-9. After the leak test is completed, the water flow inside the water chamber is discharged from outlet channel III-10 and is filtered and recovered, and each mechanism resets to complete the water-tightness test. If a part fails during the water-density test, the control controller III-1 can be reset artificially, and its control signal transmitted via signal data line III-2 to the fault area for process adjustment.

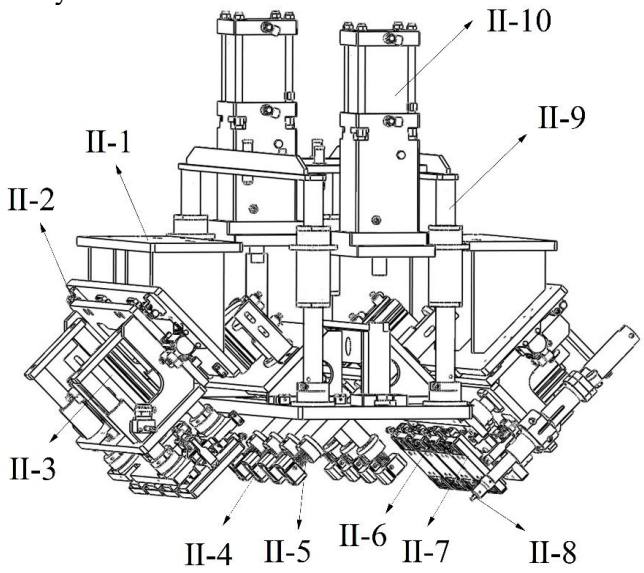

Figure 2. Bevel and Top Blanking Mechanism on Both Sides

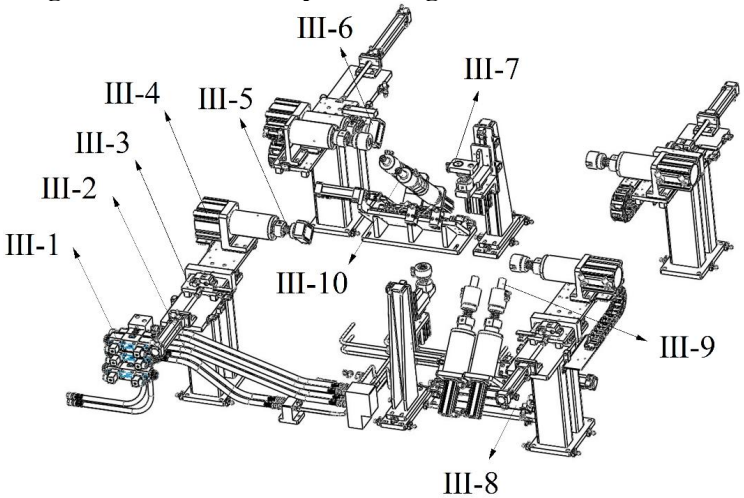

Figure 3. Front and Rear End Blanking and Filling Mechanism

4. Research Innovation Points

The research has solved the problem of the current engine gas-tightness test not identifying specific non-conforming locations. The device is gas-based in water, and can determine the leak site according to the body's water seepage, effectively reducing the difficulty of sealing test detection, while the device can be adapted to different models of airframes. Wide range of applications ensure accurate positioning of the body through the design of position detection sensors and two different shaped dowel pins in the cone and hex shape, thus accurately sealing the passages of the body between different bearing faces and the water cavity, thus ensuring smooth water-tightness testing and effectively detecting the sealing performance of the body. To widen to different models, both side ramp blanking plates and front and rear end seals can be adapted to match according to the position of the body, accurately sealing both sides and front and rear water holes, and two water inlet and exit channels at different locations are designed in the filling mechanism. This is to satisfy water hole inconsistencies between different body models.

The servo motor, as the core of the automatic control system, can control the components of various institutions to make changes in motion according to the device model, greatly reducing the labor force of workers, improving productivity and operating safety, and reducing the risk of human error. Increased automation.

In terms of sealing properties, sealing rubber is provided in the blocking mechanism in different directions of the body, ensuring that the water cavity is completely sealed during the test, effectively preventing water flow from flowing out of the sealing holes, improving the effectiveness and accuracy of the water-tightness test.

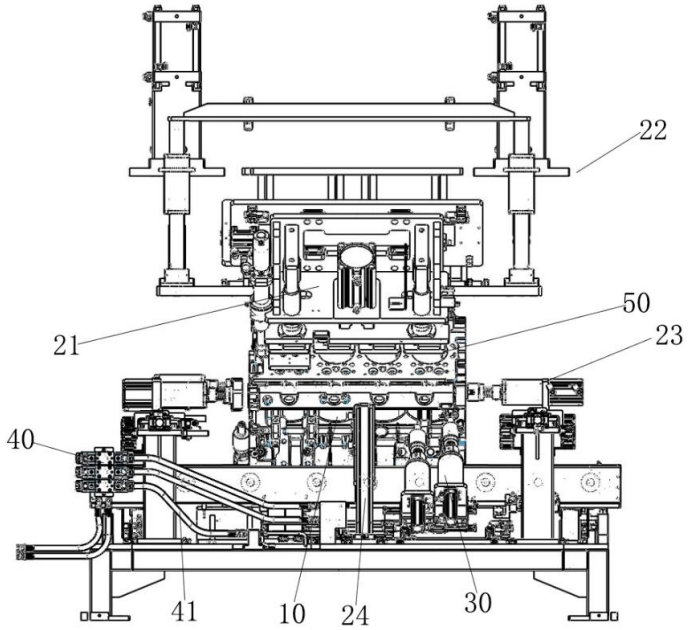

Figure 4. Complete Machine Diagram of the Water-Tight Test Device

5. Conclusion

The study is unable to determine the specific location of the leak based on the gas tightness test of the engine body. A water-tight test device was studied in terms of precise positioning and filling mechanism to quickly and accurately identify areas of non-conforming body leakage, effectively reducing the difficulty of sealing test detection, and providing accurate positioning, high degree of automation and superior sealing to suit the characteristics of different bodies.

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