Analysis and Research Based on Automobile Battery Tester

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Abstract: The car battery tester is an important equipment to detect the battery power and health status. The test methods are divided into two types: the traditional test method and the conductivity meter test. At present, most of the batteries in cars are lead-acid batteries. Its biggest feature is that the aging speed is too fast during use, especially when the battery capacity drops to 80% of its original capacity. Decline, although the electricity is not completely exhausted, and it can still supply energy, there is a risk of scrapping at any time. For the entire car, the role of the battery is very important and irreplaceable. Although the cost is not high, the status is not low. Through the analysis and research of the car battery tester, a simple and effective method can be obtained to detect whether the car battery is still good. Good preparations for replacing the batteries that will be scrapped in advance will help reduce car damage and contribute to the country’s GDP.

1. Introduction

1.1. Introduction of car battery
The engine is generally under the front cover of the car, the battery is next to the engine, and some are in an area under the passenger seat. The varieties can be divided into two categories. One is the traditional lead-acid battery, which is composed of positive and negative plates, separators, shell, electrolyte and terminal pile heads. The electrolytes of the positive and negative poles swim through the electrolyte and are composed of chemical energy. The positive and negative plates are made of lead-antimony alloy. During the working period of the electrolyte, antimony will contaminate the lead on the positive and negative electrodes, causing excessive decomposition of water and reducing the phenomenon of electrolyte reduction. If it is not in time, it will be scrapped over time. The general use time is 2 years, and it will be shorter if you do not pay attention; the other type is maintenance-free batteries. The biggest advantage of maintenance-free batteries is that they do not require regular maintenance, which is the same as the structure of lead-acid batteries. The difference is that the battery uses a lead-calcium alloy material as the grid. The amount of water decomposition generated during charging is less, and the electrolyte consumption is also less. Therefore, there is no need to continuously inject distilled water into it, which will corrode the terminal head and the battery itself. The battery is less, and the battery is stored for a long time. The service life is generally 3 years. Compared with the lead battery, it is longer, but the relative price is more expensive, so there are still more people who choose the lead battery.
1.2. The role of car batteries
The operation of the car is driven by the engine, and the energy supply is also provided by gasoline. On the surface, there is no place where electricity is used, but the battery is an indispensable part of the car. The battery provides power for starting the engine, the lights on the car, air conditioners, speakers, DVDs, etc. The specific work flow is: After the car is turned on, the starter motor gets power and starts to rotate. At this time, it will rotate with the engine, rotate and generate heat, and the ignition system Start, ignite the gasoline in the cylinder, and the gasoline burns and explodes to do work on the engine. When the engine starts normally, the starter motor is automatically disconnected and the car starts. Then the engine provides power for the lights, air conditioners, speakers and DVDs on the car, and all systems on the car normal operation. When the car needs to slow down or stop and wait for the traffic light, the battery starts to operate again and continues to supply power to the electrical equipment. All the electrical systems on the car will not be suddenly interrupted due to the deceleration or even stop of the engine. The function of voltage stabilization protects the electrical equipment on the car.

2. car battery test

2.1. Commonly used methods for measuring electric quantity of car batteries

2.1.1. Voltmeter plus load method
The voltmeter plus load method needs to use a voltmeter or a multimeter to measure the battery power of a car. This method is very simple to operate. First, under normal circumstances, connect the voltmeter or multimeter to the positive and negative poles of the battery, and pull out the injector wire to prevent the engine from running; then, start the engine and let it run for five to ten seconds. Observe the degree of the voltmeter or multimeter under the condition. Take a 12V battery as an example. 9.6V is the dividing line. If the display degree is greater than 9.6, it proves that the battery is good. On the contrary, it means that the battery has insufficient power and is in a state of loss. Other volt batteries also follow this The ratio can be judged.

2.1.2. Hydrometer method
The hydrometer method is the most common measurement method to measure the battery power of a car. The standard specific gravity of a fully charged electrolyte is 1.25-1.29kg/1. When measuring, put the hydrometer into the electrolyte, and if the measured value is less than greater than 1.06kg/11.25kg/1 indicates that the battery is insufficient and needs to be charged. If it is less than 1.06kg/1, it indicates that the battery is in a fully discharged state and has been damaged.
2.1.3. Internal resistance method
The internal resistance method uses a physical formula to measure the battery power of a car. There is internal resistance in the battery, and the relationship with electromotive force, voltage and current is

\[ R_f = \frac{E - U_f}{I_f} \]

as follows:

\( R_f \) represents the internal resistance of the battery, \( E \) represents the electromotive force of the battery, \( U_f \) represents the battery voltage, and \( I_f \) represents the battery current. Use the resistance tester to measure the current resistance of the car battery and keep the electromotive force and current unchanged. The larger the resistance, the lower the voltage and the smaller the battery power. The same electromotive force and current are measured when the battery is fully charged and when the power is less than 20%. The resistance below can be compared with this when measuring later.

2.2. Deficiencies
The measurement of the voltmeter plus load method is not accurate. During the discharge of the battery, there is a continuous electromotive force. Once the discharge stops, the battery reaches the open circuit voltage, and the entire battery is above 12.6V. At this time, turning on the headlights or pressing the horn will show that the battery is insufficient. Therefore, it is impossible to judge whether the battery is losing electricity or not. This method can only be used in the normal driving process of the vehicle. The hydrometer method has great limitations. Nowadays, the batteries on many automobiles are in a sealed state, such as valve-regulated lead-acid batteries, which cannot be measured with a hydrometer without a filling cap. The uncontrollable factors of the internal resistance method are too large, and the electromotive force and current of the battery cannot be 100% stable, and a slight deviation will lead to errors in the results. This method can only roughly predict the power of the car battery.

3. Three design of automobile battery tester

3.1. Circuit diagram

![Figure 2 Circuit diagram of battery tester](image)
One battery is 12V, and three batteries are installed into a battery pack with 36V. Use the battery as the power source and the car key as the button. Connect the car lights and the ammeter to form the first circuit. Connect an electric meter that can measure 50V in parallel to form the first circuit. Two circuits, the air conditioner, the relay winding resistance and the display screen are all connected in parallel in the circuit, the current is changed to alternating current through the quartz clock, and the circuit diagram of the battery tester is completed. In addition, an intelligent system is installed outside the line, which only takes effect when certain values change. The background program is set up, and what changes are made to react.

3.2. Device
The traditional battery tester can only simply use a universal meter to measure the voltage of the battery, and cannot accurately obtain the value, and there is no reminder if the battery is really in a state of loss of power. The battery tester designed in this paper is composed of a multimeter, a high-efficiency discharge meter and an intelligent system.

The multimeter display panel contains several areas. Among them is a charging area. As long as the pointer is pointing here, it is necessary to prepare to charge the battery. The internal resistance is very large, the effect of shunting is not obvious, and the measured value is fairly accurate.

The internal resistance of a high-efficiency discharge meter is relatively small compared to a multimeter. It will divide the current of the battery to a large extent in parallel with the battery, making the measured value small, which is very different from the actual value, but it can be in the battery Accurately judge the degree of discharge and starting ability during high-current discharge, and it can be used with a multimeter to measure the battery power and usage status.

The era of intelligence has arrived, and intelligent systems are the most popular type of system today. The English name Intelligence system refers to a computer-designed program with human intelligence and behavioral capabilities. The car battery tester uses a voice intelligence system to imitate human language to express the predicted situation.

4. Four analysis and research of automobile battery tester

4.1. Test method
When the multimeter measures the battery terminal voltage, the two wires are connected to the positive and negative poles of the battery. The measured data can only be used as a reference for detection. Usually, when the measuring terminal voltage is more than 12.6V, and the electrolyte density is greater than 1.22g/cm³, It can be basically judged that the battery is normal.

The high-efficiency discharge meter simulates the starter. The method of use is: (1) Clamp the test clip on the positive and negative electrodes of the battery, and read the no-load voltage value. It is normal between 11.8V and 13V; (2) Insert the key, Unscrew the key, the battery will work and discharge in an instant, and the battery voltage is measured. If the pointer is stable between 10V and 12V within 5 seconds, it proves that the battery is fully charged and does not need to be charged. If it is between 9V and 10V, it proves that the battery is insufficient. Charging, if it is below 9V, it proves that the battery is seriously deficient, and it needs to be charged immediately before it can be used again. If the pointer quickly points below 9V, it proves that the battery has been damaged. It should be noted that the interval between each detection of such a measurement cannot be less than one minute, otherwise the battery will be damaged.

4.2. Working principle
The basic principle of the multimeter is to use a microammeter as the meter head, and there will be a current display when the power is turned on, but the current should not be too large. When measuring high-power instruments, it is necessary to connect some resistors in series and parallel on the meter head to reduce voltage and shunt, and finally determine The size of the voltage. Using a high-efficiency discharge meter to measure the use of a car battery is equivalent to connecting the
discharge meter to the starter load. When the engine starts, there will be current passing through, and the measured value can be used as a basis for judgment. The working principle of the intelligent system is that the computer will collect facts about a certain situation through smart sensors or manual input. The computer will set the data and store it in the database. In the universal meter, when the pointer points to the charging or high-efficiency discharge meter, there is an abnormality. When the time, the intelligent system automatically compares with the data in the database and reports it to the driver so that the driver can make timely response measures.

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