

## Vertical Rotary Garage System Design

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### Abstract

At present, the mechanical parking equipment in our country most adopts mechanical promotion method, is a three-dimensional movement of the garage, therefore, the cost is high, the investment is big, many developers can't accept it. Caused by vehicle park, the park, the supermarket crowded places such as parking, vertical rotary parking equipment is designed to solve this problem, the purpose is to provide a low cost, safe and reliable, convenient and easy to realize automatic parking system for vehicle. This product is designed for real estate developers as a kind of ideal of the real estate industry 2 stereo garage. In this paper, a new kind of mechanical three-dimensional parking equipment, on the analysis of the structure of vertical rotary parking equipment. Experiments show that the device has the advantages of simple structure, safe and reliable running, access time is short, high automation level, easy to realize automation management.

### Keywords

Vertical rotary parking system; work process; safety devices.

### 1. Introduction

With the rapid development of the national economy and the continuous development of the city, traffic congestion has become a problem we face every day. There are more and more vehicles, and the parking is unreasonably set up, occupying roads, and parking in green spaces has become more and more common. It is easy to cause traffic chaos, so it is now very necessary to design a parking garage that is space-saving, convenient to store, and beautiful in appearance.

Three-dimensional car inventory has many advantages, but the development of China's three-dimensional garage is still very slow, there are still various problems, such as inconsistent technical standards; many products are only imitating foreign products, in line with international standards rarely; domestic few large companies Production, disorderly market competition, some enterprises to compete for the market to compete at low prices; scientific research and design unit's ability to participate in a serious lack of lack of technological innovation; policies are not perfect, vertical garage industry development and supervision seriously lagging behind.

### 2. Way of Working

#### 2.1 Parking Process

When the vehicle did not enter the garage, the carousel remained in its original place. When it is necessary to enter the parking garage, the driver presses the button to hold the car, and the SCM takes over the stored car signal and allocates 1 free parking space. The distribution principle is to keep the turntable level and not skewed. This is done by the SCM according to pre-programmed software. Completion). The driver drives the car into the garage and walks out of the door. Immediately afterwards, the driver will be prompted to put down the signpost and bring the driver's own parking card so that the vehicle parking process is over.

#### 2.2 Pickup Process

When there is a demand for a car, the driver first needs to put the parking card into the reader, and the microcontroller will know the message in the card, supply the parking space according to the message on the card, print out the charge ticket, and let the control. The circuit is started, driving the parking

space to operate at the ground level (because the encoder disk rotates with the turntable at the same time, causing the sensor to send out the induced information, and then allow the turntable to rotate the correct angular displacement), and when turning to the correct position, the single-chip microcomputer controls the speed of the speed reducer. Gradually reduce, when there is a stop message, the dial stops immediately and the driver drives the car out of the garage. The auto-sensing switch signal will have a completion signal to prompt the driver to implement the car.

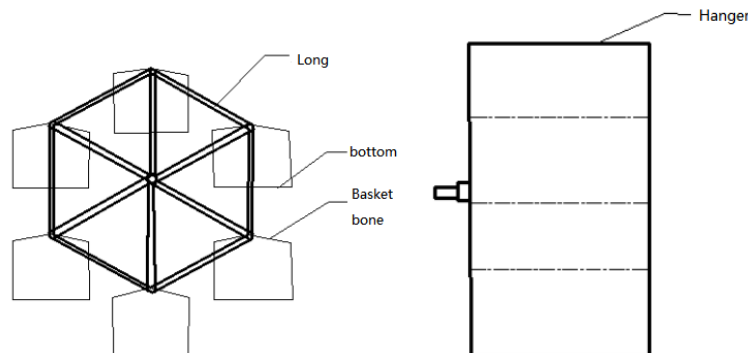


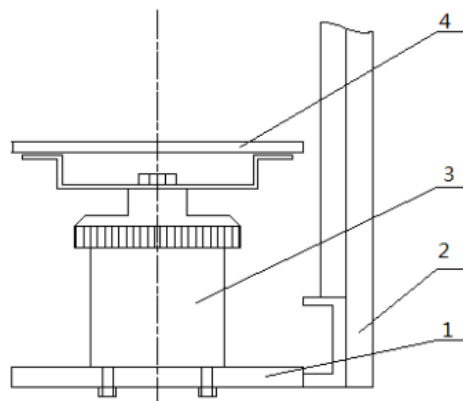
Fig. 1 Garage Structure

### 3. Design Safety Devices

In order to enable the safe operation of the rotating disk, it is very necessary to automatically limit the weight of the platform. At present, most of the commonly used overload devices in China are rubber blocks, levers, springs, sensors, and electronic scales. The first three are that when overloaded, gravity is transmitted to the bottom of the platform to cause a certain displacement, and then the lever-type linkage mechanism contacts the micro switch to perform overload protection. The last kind of overload protection device designed and manufactured according to the principle of electronic scales.

After many tests, the second type is not sensitive enough. For example, if you increase the load by about 40kg, an overload alarm will occur. However, when we re-unload the load by more than 40 times, the alarm will still not be released. The first and third types are not suitable for permanent use. If it is used for a long time, it will cause spring fatigue damage, buffer rubber strain, and then the second situation occurs. So the first three are not suitable for use, so the overload device used in the design is the fourth type.

The device has four load sensors at the bottom of the rotating platform, which is connected to the active platform. There are also four signal processing indicators, as shown in Figure 3.1 below.



1- Bearing plate (base plate) 2- surround frame 3-sensor 4-mobile platform base plate

Fig. 2 load sensor assembly diagram

When the four load sensors are affected by gravity, each sensor outputs a voltage signal (mv level) that is linearly related to gravity. The signal is superposed, selected, processed, amplified, compared,

and four corresponding boosts are applied after power amplification (Load, half-load, full-load, and overload) micro-relays output "sound" and "light" signals. Its circuit principle block diagram is shown in Fig 3.2.

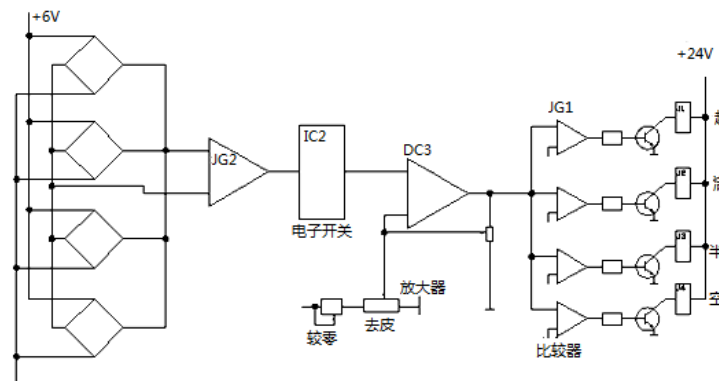


Fig. 3 Circuit diagram of the electronic overload device

The sensor assembly of this device is simple and convenient. The signal processing indicator is small in size and light in weight and can be mounted on the upper beam.

After field testing, the sensitivity (0~5t) is 5kg, the stability is  $\leq \pm 2\%$ , the nonlinearity is less than 1%, the overload capacity is 150%, the operating temperature is  $-20 \sim +60^\circ\text{C}$ , and the power supply is  $220\text{V} \pm 10\%$ . That is, it can work normally.

#### 4. Conclusion

Through the overall design of the vertical rotary garage and the circuit design of its overload detection device, the following conclusions are drawn:

- (1) The vertical garage can reduce the floor space and develop into the air. This will save more vehicles. It is the best parking method in some crowded cities.
- (2) Vertical garage can realize automatic control, simple and easy to operate. For example, the garage can be autonomously ascended and descended. When the owner stops, the corresponding space will rotate down to the ground as long as the number of the parking place is pressed. When the owner parks the vehicle, the parking space will rise and be reset.
- (3) The overload detection device has high sensitivity, good stability and strong bearing capacity, and can be effectively applied to a parking garage. The sensor assembly of the device is simple and convenient, and the signal processing display device is small in size and light in weight.

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