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Research on Straightness Detection Device for Elevator Guide Rail

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Research on Straightness Detection Device for Elevator Guide Rail

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Abstract. The elevator guide rail is composed of a plurality of section by section guide rails in series. The straightness of the guide rail needs to be detected when the elevator is installed. There are many detection methods in the prior art. The first is the vertical line method, but this method is too backward, low precision, time-consuming and laborious; The second is to use RSU (elevator guide rail straightness dynamic detector) for measurement. Its basic principle is to install RSU in the lift car. When the car slides up and down along the guide rail, multiple distance (displacement) sensors detect the horizontal offset of the guide rail in real time, and finally fit these horizontal offsets to analyze its straightness. The disadvantage of this method is that its accuracy will be affected by car shaking and its own error, and the improvement of measurement efficiency is limited. The purpose of this paper is to provide a straightness detection device for elevator guide rail in order to overcome the defects of the above existing technology. With low cost and high efficiency, it is worth popularizing in the inspection work.

1. Introduction

Elevator guide rail is two or more vertical or inclined rigid rails installed in the elevator shaft or between floors to ensure that the car and counterweight move up and down along it [1]. Provide guidance for elevator cars, counterweights or steps. From the definition of guide rail, it can be seen that guide rail is an important benchmark component of vertical elevator, automatic elevator and automatic sidewalk steps [2]. It controls the running track of elevator car, escalator and moving sidewalk and ensures the transmission of operation signal. It is also an important component related to elevator safety and operation quality [3]. Straightness and distortion of the guide rail [4]. The bending and distortion of any point on the guide rail will give the car a side force, affect the linear movement of the car up and down, and make the car shake [5]. With the increase of the elevator speed, the car will vibrate, thus affecting the comfort.

The elevator guide rail is composed of a plurality of section by section guide rails in series. The straightness of the guide rail needs to be detected when the elevator is installed. There are many detection methods in the prior art [6]. The first is the vertical line method, but this method is too backward, low precision, time-consuming and laborious; The second is to use RSU (elevator guide rail straightness dynamic detector) for measurement. Its basic principle is to install RSU in the lift car [7]. When the car slides up and down along the guide rail, multiple distance sensors detect the horizontal offset of the guide rail in real time, and finally fit these horizontal offsets to analyze its straightness. The disadvantage of this method is that its accuracy will be affected by car shaking and its own error, and the improvement of measurement efficiency is limited. The purpose of this paper is to provide a straightness detection device for elevator guide rail in order to overcome the defects of the above existing technology. With low cost and high efficiency, it is worth popularizing in the inspection work.

2. Technical scheme of straightness detection device for elevator guide rail

In order to solve the above technical problems, this paper provides an elevator guide rail straightness detection device, and the structure is shown in Figure 1. The reference signs are described as follows: 1. Guide rail, 2. Upper infrared component, 3. Scale component, 4. Infrared mounting bracket, 41. Guide rail connecting sleeve, 5. Infrared emitter, 6. Locking screw, 31, clamping slot, 32, magnet, 33, acrylic plate, 34 and dial.

The device can be realized by the following technical scheme. The device relates to an elevator guide rail straightness detection device, which comprises an upper infrared component installed on the uppermost end of a plurality of vertical series guide rails and a ruler component installed on the guide surface of the guide rail. The upper infrared component comprises an infrared mounting bracket and an infrared emitter installed on the infrared mounting bracket and emitting downward. The scale assembly comprises a transparent acrylic plate, and a dial matched with the infrared emitter is arranged on the acrylic plate.

The infrared mounting bracket is a rounded rectangle, its lower surface is provided with a guide rail connecting sleeve matching with the cross-section shape of the guide rail, and the infrared mounting bracket is buckled and sleeved at the upper end of the uppermost guide rail through the guide rail connecting sleeve. The cross-sectional shape of the guide rail and the shape of the guide rail connecting sleeve are T-shaped.

The infrared emitter is respectively installed in the mounting hole of the infrared mounting bracket through an upper adjusting nut and a lower adjusting nut. Two infrared emitters are arranged side by side. The scale assembly also includes a clamping groove arranged on the inner side of the acrylic plate. The shape of the clamping groove matches the guide surface of the guide rail and is adsorbed on the guide surface of the guide rail through a magnet.

Two dials are arranged side by side to align with the position of the transmitting surface of the infrared emitter. The dial is a circular dial. The scale assembly is provided with a plurality of scales and is arranged at equal intervals from top to bottom.

3. Working principle of straightness detection device for elevator guide rail

As shown in Fig. 1, this paper provides an elevator guide rail straightness detection device, which includes two parts, namely, the upper infrared component 2 installed on the uppermost part of a plurality of vertical series guide rails 1 and the scale component 3 installed on the guide surface of guide rail 1. Among them, the scale assembly 3 is provided with multiple groups, and its distribution density and height can be placed according to the actual situation. For example, each series guide rail 1 is provided with a scale assembly 3.

As shown in Fig. 2, the upper infrared assembly 2 includes an infrared mounting bracket 4 and an infrared emitter 5. The infrared mounting bracket 4 includes a guide rail connecting sleeve 41 sleeved at the upper end of the guide rail 1, and a T-shaped groove with the same section as the guide rail 1 is arranged in the guide rail connecting sleeve 41. The T-shaped groove is sleeved on the upper end of the uppermost guide rail 1, and then locked above the guide rail 1 through the locking screw 6 on the side of the guide rail connecting sleeve 41.

The number of infrared emitters 5 is two, and the two infrared emitters 5 are installed side by side on the lower surface of the infrared mounting bracket 4. The outer surface of each infrared emitter 5 is provided with two adjusting nuts, which are installed on the infrared mounting bracket 4 through the two adjusting nuts on the upper and lower surfaces of the infrared mounting bracket 4. The infrared emitter 5 is placed vertically, and its emission faces downward.

As shown in Fig. 3, the scale assembly 3 includes a transparent acrylic plate 33, two annular dials 34 are arranged on the acrylic plate 33, and a clamping groove 31 is installed on its inner edge. A magnet

32 is arranged above the card slot 31, which can adsorb the card slot 31 on the guide surface of the guide rail 1 and place the acrylic plate 33 directly below the infrared mounting bracket 4.

When in use, install the infrared mounting bracket 4 on the top of the guide rail 1 and lock it with the locking screw 6. A plurality of scale assemblies 3 are installed on the guide rail 1 according to the measurement needs. It is better to install the scale assembly 3 at an equal distance, for example, the spacing is set to 2.5m.

During detection, turn on the infrared emitter 5 and adjust the angle of the infrared mounting bracket 4. Make the ray of the infrared emitter 5 face the center of the dial 34 of the lowest scale assembly 3, and ensure that the two infrared emitters 5 are aligned with the center of the two dial 34 respectively.

Since the infrared emitter 5 passes through all acrylic plates 33, when the guide rail 1 in the middle position is offset, it can be read directly through the offset of the infrared penetration point relative to the center of the dial 34.

Observe and record the position where the infrared ray passes through the dial 34 on the acrylic plate 33 at all intermediate positions, and calculate the straightness in combination with the formula, or draw up the straightness curve.

In conclusion, the device can quickly and efficiently measure the straightness of elevator guide rail. Compared with the vertical line method, the device does not need setting out, and the measurement accuracy is higher. Compared with the RSU method, the device has higher test accuracy and can eliminate the error caused by the shaking of the lift car itself. In addition, the overall volume of the device is small, the quality of the whole detection device is small, and it is easy to store.

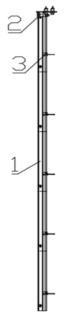

Figure 1 . Overall structure diagram

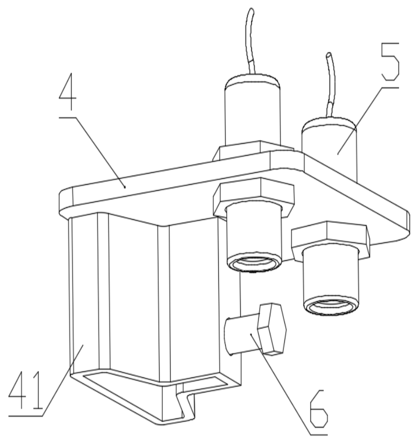

Figure 2 . Structural diagram of upper infrared component

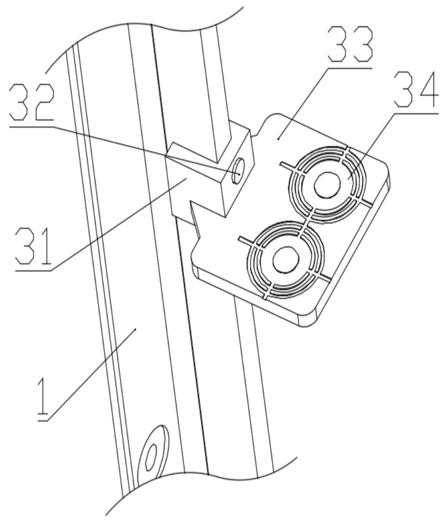

Figure 3. Structural diagram of ruler assembly

4. Conclusion

This paper studies an elevator guide rail straightness detection device, which includes an upper infrared component installed on the uppermost end of multiple vertical series guide rails and a ruler component installed on the guide surface of the guide rail. The upper infrared component comprises an infrared mounting bracket and an infrared emitter installed on the infrared mounting bracket and emitting downward. The scale assembly comprises a transparent acrylic plate, and a dial matched with the infrared emitter is arranged on the acrylic plate. Compared with the prior art, the device has the following advantages:

- It can quickly and efficiently measure the straightness of elevator guide rail. Compared with the vertical method, the device does not need setting out, and the measurement accuracy is higher.
- Compared with the RSU method, the device has higher test accuracy and can eliminate the error caused by the shaking of the lift car itself.
- In addition, the overall volume of the device is small, the quality of the whole detection device is small, and it is easy to store. The device has the advantages of simple structure, convenient operation and high detection accuracy.

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