Research on Foldable Elevator Manual Turning Device

Shuangchang Feng*, Jie Chen, Yanchun Liang and Xiaoqing Chang
Shanghai Institute of Special Equipment Inspection and Technical Research, Shanghai, 200062, China
*Corresponding author’s e-mail: fengsc@ssei.cn

Abstract. In the elevator main engine room, turning gear is one of the indispensable safety devices. The elevator turning gear is used to drive the main engine to rotate when the elevator is closed, and then stop the car at the corresponding position for rescue. The elevator turning mainly includes a disc and a drive shaft, wherein the drive shaft is provided with a gear, which is used to cooperate with the gear on the traction wheel of the main engine to drive the elevator traction wheel to rotate. The turning gear needs to be suspended when not in use. Because the disc is perpendicular to the drive shaft, when the drive shaft is normally installed on the disc, the drive shaft is horizontal, which will affect the space in the main engine room. Of course, there is also a separate design between the drive shaft and the disc. When the drive shaft needs to be installed on the disc through tools, the installation process is more troublesome. In order to solve the above technical problems, this paper studies a foldable manual turning of elevator, which saves space and is easy to install.

1. Introduction
According to the requirements of elevator supervision inspection and regular inspection rules, the elevator main engine room shall be equipped with manual emergency operation device [1]. Turning gear is one of the indispensable safety devices. Elevator turning gear is used to drive the main engine to rotate when the elevator is closed, and then stop the car at the corresponding position for rescue [2]. The elevator turning mainly includes a disc and a drive shaft, wherein the drive shaft is provided with a gear, which is used to cooperate with the gear on the traction wheel of the main engine to drive the elevator traction wheel to rotate [3]. The turning gear needs to be suspended when not in use. Because the disc is perpendicular to the drive shaft, when the drive shaft is normally installed on the disc, the drive shaft is horizontal, which will affect the space in the main engine room [4]. Of course, there is also a separate design between the drive shaft and the disc. When the drive shaft needs to be installed on the disc through tools, the installation process is more troublesome [5]. In order to solve the above technical problems, this paper studies a foldable manual turning of elevator, which saves space and is easy to install [6].

2. Technical scheme of foldable elevator manual turning device
In order to solve the above technical problems, a foldable elevator manual turning gear is designed in this paper. The utility model comprises a disc, the center of the disc is provided with a first base and a second base, the first base is rotatably connected with one side of the rotating seat, the other side of the rotating seat is detachably connected with the second base, and the rotating seat is fixedly connected with one end of the connecting pipe. The other end of the connecting pipe is telescopically connected with one end of the central shaft, and the other end of the central shaft is provided with a gear. The
inner surface of the disc is provided with a fixing device. When the rotating seat is separated from the second base, the connecting pipe rotates to a position close to or in contact with the inner surface of the disc and is firmly connected with the fixing device. The first base is rotatably connected with the rotating seat through a rotating shaft, and the other side of the rotating seat is connected with the second base through a buckle.

The other side of the rotating seat is provided with a card slot, the card slot is matched with the card hook on the sliding card seat, and the card hook is arranged on the side close to the rotating seat on the sliding card seat. The sliding card seat is also provided with a guide rod on the same side of the hook, the guide rod is located between the hook and the disc, and the guide rod passes through the guide rod hole on the second base and is sleeved with the spring. One end of the spring is against the second base, the other end of the spring is fixed on the guide rod, and the height of the sliding card seat is higher than that of the second base.

The back of the card slot and the hook are provided with inclined planes. When the connecting pipe is folded in the direction perpendicular to the disc, the two inclined planes squeeze each other to make the hook quickly enter into the card slot. The central shaft is provided with a row of positioning holes along the length direction of the central shaft, the side of the other end of the connecting pipe is provided with at least one hole corresponding to the positioning hole, and one of the positioning holes on the central shaft is connected with the hole on the connecting pipe through a positioning pin.

The other end of the central shaft is also provided with a retaining ring, which is arranged on the side of the gear close to the rotating seat. A notch parallel to the inner surface of the disc is arranged on one side of the fixing device on the retaining ring. The fixing device is a buckle, and the inner surface of the buckle is provided with a ball head protrusion for positioning the connecting pipe.

The connecting tube is a square tube, the central shaft is a circular tube, one end of the central shaft can be retracted and arranged inside the square tube, one end of the central shaft is provided with a block matching the inner hole of the square tube, the block becomes longer than the diameter of the central shaft, and the other end of the square tube is provided with a circular hole matching the central shaft. The outer edge of the disc is fixed with an outer ring, a plurality of hand holding grooves are arranged on the outer edge of the disc, and the hand holding groove forms a holding part with the outer ring. There are 2-5 support mounting slots and 2-3 cameras to meet the needs of three-dimensional reconstruction.

3. Working principle of foldable elevator manual turning device
In this paper, a foldable elevator manual turning gear is designed, as shown in Fig. 1-fig. 3. It includes a disc 1 and an outer ring 2 welded on the outer edge of the disc 1. A plurality of hand holding grooves 3 are evenly distributed on the outer edge of the disc 1. The hand holding groove 3 forms a holding part with the outer ring 2. There are two bases in the center of the disc 1, namely the first base 4 and the second base 5. The base is connected with the central part.

The central part includes a square tube 7 and a central shaft 8. One end of the square tube 7 is fixed with a rotating seat 6, one side of the rotating seat 6 is provided with a rotating shaft, the rotating shaft is fixed at both ends of the side of the rotating seat 6, the first base 4 is provided with a rotating shaft groove matched with the rotating shaft, and the rotating shaft is rotationally connected with the first base 4, so that the square tube 7 can rotate at a certain angle around the rotating seat 6.

The second base 5 is equipped with a sliding card seat 11. The sliding card seat 11 passes through the second base 5 through two guide rods, and then a spring 12 is sleeved on both guide rods. One end of the spring 12 is against the second base 5, and the other end of the spring 12 is fixed on the guide rod. The spring 12 is used to slide the sliding card seat 11 in the direction of the second base 5. The end of the sliding card seat 11 is provided with a hook, and the other side of the rotating seat 6 is provided with a groove 61. The groove 61 matches the hook on the sliding card seat 11, and the hook can hook the groove 61 under the push of the spring 12. Moreover, there are inclined planes on the back of the card slot 61 and the hook. When the square tube 7 is folded in the direction perpendicular to the disc 1, the two inclined planes squeeze each other, so that the hook can quickly enter the interior of the card slot 61,
so that the square tube 7 can be quickly and efficiently fixed vertically to the disc 1. Both the hook and the guide rod are arranged on the side of the sliding clamp seat 11 close to the rotating seat 6, and the guide rod is located between the hook and the disc 1. The height of the slide holder 11 is higher than that of the second base 5.

There is a central shaft 8 in the square tube 7. The central shaft 8 is a circular tube. The central shaft 8 can be retracted and placed inside the square tube 7. One end of the central shaft 8 is provided with a block matching the inner hole of the square tube 7. The block becomes longer than the diameter of the central shaft 8. On the one hand, the block can transmit torque; on the other hand, it can ensure that the square tube 7 and the central shaft 8 remain coaxial. The other end of the central shaft 8 is provided with a gear 9, the inner edge of the gear 9 is provided with a retaining ring, and one side of the retaining ring is provided with a notch, which is parallel to the inner surface of the disc 1, so that the square tube 7 fits more closely with the disc 1.

The other end of the square tube 7 is provided with a circular hole matched with the central shaft 8. Through the circular hole, the central shaft 8 is prevented from separating from the square tube 7, so that the central shaft 8 can expand and contract inside the square tube 7 and keep them concentric. The central shaft 8 is provided with a row of positioning holes 81 along the length direction of the central shaft 8, and the side of the end of the square tube 7 is also provided with holes. Through the positioning pin passing through the hole at the end of the square tube 7 and one of the positioning holes 81, the central shaft 8 can be fixed in the square tube 7. When the positioning pin passes through different positioning holes 81, the central shaft 8 can adjust different expansion amounts.

The inner surface of the disc 1 also has a buckle 10. The buckle 10 itself has certain elasticity. The inner surface of the buckle 10 has a ball head protrusion for positioning the opposite tube 7. When the square tube 7 is laid down (folded), that is, the square tube 7 lies on the inner surface of the disc 1, and the buckle 10 can clamp it. The switching process of the utility model when in use and when not in use is as follows:

When the elevator manual turning gear of the utility model is not used, the square tube 7 is clamped and fixed in the buckle 10. When it needs to be used, manually pick up the square tube 7 from the buckle 10 to make the square tube 7 rotate with the rotating seat 6, that is, the rotating shaft on one side of the rotating seat 6 rotates with the first base 4, so that the square tube 7 is gradually perpendicular to the disc 1. When the inclined plane on the back of the card slot 61 on the other side of the rotating seat 6 is pressed on the inclined plane on the back of the hook on the sliding card seat 11, through the sliding between the two inclined planes, the sliding card seat 11 overcomes the elastic force of the spring 12 and shrinks backward until the upper and lower positions of the two inclined planes are staggered, and the sliding card seat 11 rebounds through the action of the spring 12, so that the hook can quickly enter into the card slot 61 and clamp. At this time, the square tube 7 is completely perpendicular to the disc 1. Then, the elevator can be used for manual turning to drive the main engine to rotate, and then the lift car can be stopped at the corresponding position.

After the manual turning of the elevator of the utility model is used, manually pull the sliding clamp seat 11 to drive the hook at the ends of the two guide rods to retract and disengage from the clamp groove 61, so that the square tube 7 can rotate through the rotating seat 6, and then place (fold) the rotating seat 6 on the inner surface of the disc 1, and the square tube 7 is clamped into the buckle 10 for fixation. The space occupied by one side of the inner surface of disc 1 can be saved.
4. Conclusion
This paper studies a foldable elevator manual turning gear, which has the following advantages: The device can realize folding, and can reduce the occupation of main engine room space when not in use. When the square tube is unfolded, the hook can quickly enter into the interior of the card slot, so that the square tube can be quickly and efficiently fixed vertically to the disc, and the fixed square tube is safe and reliable and can bear large external force. The square tube and central shaft adopt retractable design, which can be applicable to different elevator hosts.

References
[1] X, Keai., Y, Jianlong., Z, Hongjun. (2020) Electric safety device for manual turning [J]. China special equipment safety, 15: 8-12.
[2] H, Guiyang. (2012) Discussion on setting turning gear for gearless traction driven elevator in organic room [J]. Scientific and technological innovation and application, 51:39-42.

[3] W, zesong. (2012) Determination of elevator balance coefficient by testing turning torque under no-load [J]. China elevator, 77: 89-92.

[4] L, Ying. (2019) Necessity and feasibility analysis of adding manual turning gear for elevator [J]. China elevator, 30: 26-28.

[5] L, liankun. (2005) Turning handwheel and relevant provisions in national standards [J]. China elevator, 9: 43-45.

[6] L, you., L,Xin., L, Xiao, et al. (2020) A device for elevator turning detection: cn210166066u [P].