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# Analysis and Discussion on the Guiding Protection of Steel Wire Ropes for Winches

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## Abstract

**Winches are widely used in industrial production, and proper maintenance of steel wire ropes is crucial for them. In this article, we propose a winch for guiding and protecting the steel wire rope, with the main purpose of protecting the steel wire rope of the winch. The composition includes a workbench, on which a drum is rotated and set, on which a group of support rods are symmetrically arranged. One end of the support rod is rotatably connected to the workbench, and the other end of the support rod is rotated and set with a pressure roller. A tension spring is set on the side of the support rod near the drum, One end of the tension spring is connected to the side of the support rod near the drum, and the other end of the tension spring is located below the drum and connected to the top of the workbench. This structure can reduce the looseness of the wire rope and extend the service life of the wire rope.**

## Keywords

**Winch; Wirerope; Guide; Protect.**

## 1. Introduction

A winch is a light and small lifting device that uses a drum to wind a steel wire rope or chain to lift and tow heavy objects. Most existing winches include a working platform, on which a drum is rotated and a steel wire rope is wound around the drum. A motor and reducer are fixed on the working platform, which are used to control the reducer to drive the drum to rotate, make the steel wire rope reel in or out, and then lift or tow heavy objects.

However, when the drum rotates to reel in the steel wire rope, it is easy to cause confusion and looseness in the reel, which can lead to mutual wear and tear between the steel wire rope and the steel structure, making the steel wire rope prone to damage.

## 2. Technical Scheme for Guiding and Protecting the Steel Wire Rope of the Winch

In order to reduce the looseness of wire rope winding and extend the service life of the wire rope, we propose a technical solution for guiding and protecting the wire rope of the winch. The plan is as follows: This type of winch that guides the steel wire rope includes a workbench, on which a drum is rotated and set. A group of support rods are symmetrically set on the workbench, with one end of the support rod rotating and connected to the workbench, and the other end of the support rod rotating and set with a pressure roller. A tension spring is set on the side of the support rod near the drum, and one end of the tension spring is connected to the side of the support rod near the drum, The other end of the tension spring is located below the drum and connected to the top of the workbench.

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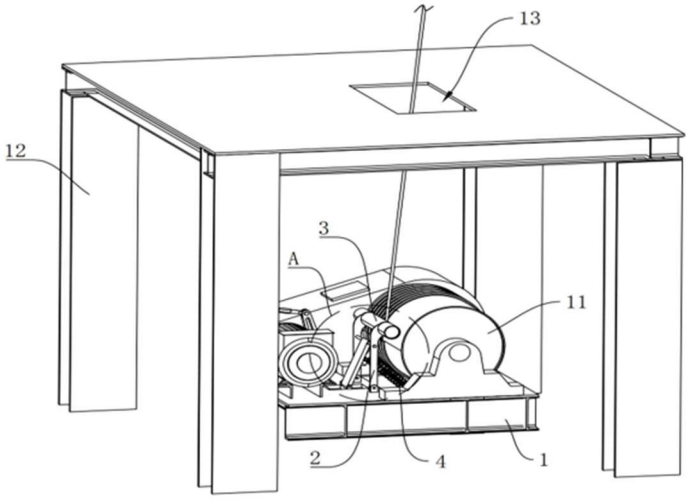


**Figure 1.** is a schematic diagram of the structure of a steel wire rope guided winch

By adopting the above technical solution, the tension spring tightens the support rod in the direction of the drum, and the support rod is subjected to a force in the direction of the drum. The support rod tilts in the direction of the drum, and the support rod drives the pressure roller to lean towards the drum, causing the outer wall of the pressure roller to come into contact with the outer wall of the drum. When the drum rotates to retract the steel wire rope, the steel wire rope passes between the pressure roller and the drum and is wound on the drum. As the tension spring tightens the support rod in the direction of the drum, Furthermore, the pressure roller compresses the steel wire rope onto the drum, and the rotation of the pressure roller reduces wear and tear on the steel wire rope, thereby reducing the looseness of the steel wire rope and extending its service life.

A set of bases is fixed on the workbench, and the bases are symmetrically arranged. One end of a support rod that is far away from the pressure roller is rotatably connected to one of the bases, while the other end of a support rod that is far away from the pressure roller is rotationally connected to the other base.

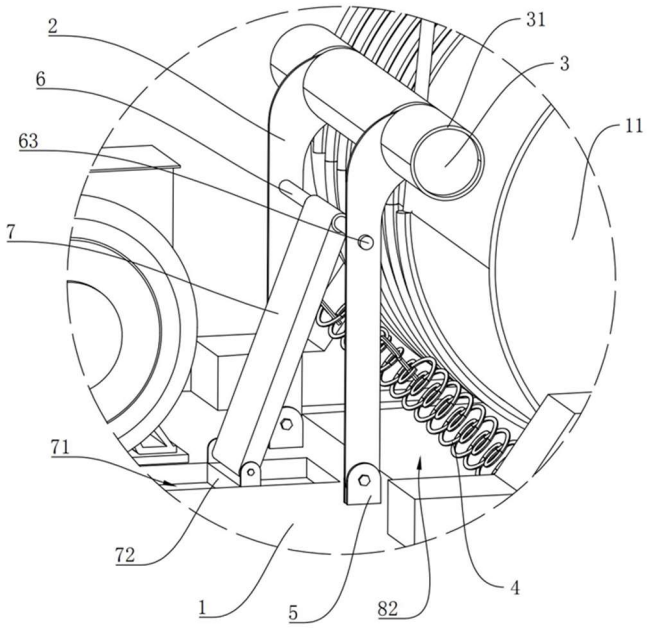


**Figure 2.** is an enlarged view of Part A in Figure 1

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The base is welded to the workbench, and the base is connected to the support rod through a rotating shaft, thereby enabling the support rod to be connected to the workbench through the base. A rubber layer is fixed on the surface of the pressure roller, which reduces the rigid contact between the pressure roller and the surface of the steel wire rope, thereby reducing the wear and tear between the pressure roller and the surface of the steel wire rope, and extending the service life of the steel wire rope.

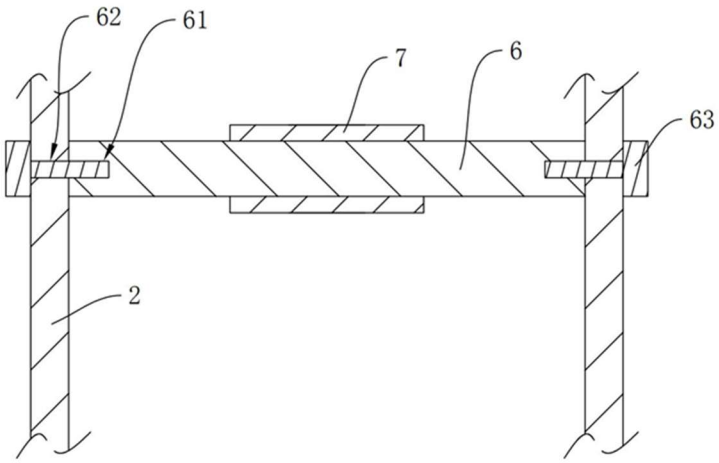


**Figure 3.** is a cross-sectional view of the connection relationship between the connecting rod and the supporting rod

A connecting rod is set between the support rods, and a connecting groove is set on the end wall of the connecting rod. A connecting hole is set on the side wall of the support rod, and a connecting bolt is set in the connecting hole. The connecting bolt runs through the connecting hole and is threaded to the connecting groove.

Due to the difficulty in maintaining consistency in the elastic coefficient of the tension spring, the tension of the tension spring on the support rod is not easy to maintain consistency. The connecting rod is connected to the support rod, causing the tilt degree of the support rod to be consistent, thereby making the squeezing force of the pressure roller on the steel wire rope consistent, reducing the situation of loose wire rope winding. A limit rod is set on the side of the connecting rod away from the drum, with one end of the limit rod rotating and connected to the connecting rod, and the other end of the limit rod sliding and connected to the workbench.

When the support rod tilts towards the drum direction, the limit rod slides on the workbench, and the limit rod has no support effect on the connecting rod. When the support rod tilts away from the drum direction, the limit rod supports the connecting rod, thereby reducing the failure of the tension spring caused by the support rod tilting towards the workbench.

A limit groove is set up on the workbench, and a limit block is set up for sliding inside the limit groove. One end of the limit rod is rotationally connected to the top of the limit block, and the other end of the limit rod is rotationally connected to the connecting rod. When the support rod rotates in the direction of the drum, the connecting rod drives the limit rod to move, and the other end of the limit rod drives the limit block to slide along the limit groove. When the support rod rotates in the direction of the drum, the limit block slides to the point where the limit groove is far away from the drum and touches the inner wall of the limit groove, causing the limit rod, limit block, and connecting rod to get stuck. The limit rod supports the connecting rod, making it difficult for the connecting rod to move, thereby making it difficult for the support rod to move, This in turn reduces the failure of the tension spring.

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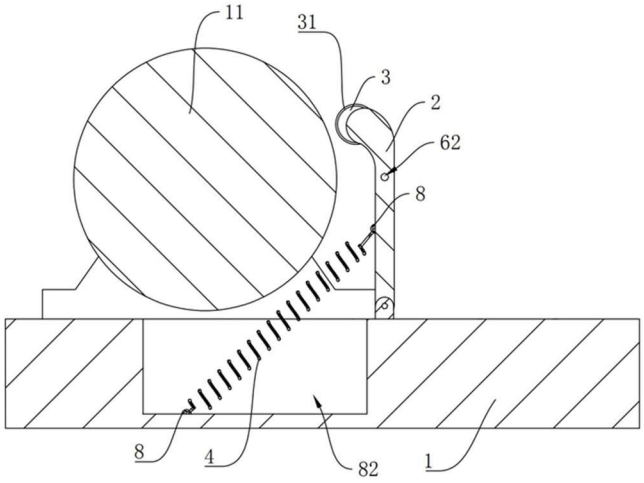


**Figure 4.** is a cross-sectional view of the relationship between the installation plate and the installation slot position

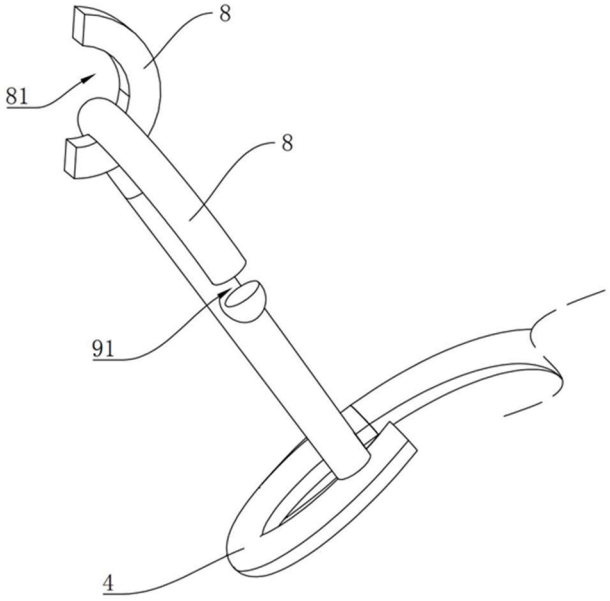


**Figure 5.** is a schematic diagram of the connection relationship between the installation plate and the tensioning ring

In the figure: 1. Workbench; 11. Reel; 12. Steel structure; 13. Holes; 2. Support rod; 3. Pressure roller; 31. Rubber layer; 4. Tighten the spring; 5. Base; 6. Connecting rod; 61. Connection slot; 62. Connection hole; 63. Connecting bolts; 7. Limit rod; 71. Limit groove; 72. Limit block; 8. Installation plate; 81. Installation holes; 82. Installation slot; 9. Tensioning ring; 91. Tighten the opening.

An installation groove is set below the drum, and an installation plate is fixed on the side of the support rod near the drum and on the inner wall of the installation groove. An installation hole is set on the installation plate, and a tension ring is fixed on the end wall of the tension spring. A tension opening is set on the tension ring, and the installation hole is used for hanging the tension ring.

Due to the decrease in elasticity coefficient of the tension spring, it is difficult for the pressure roller to compress the steel wire rope. Therefore, a new tension spring needs to be replaced. The tension ring is hung on the installation plate through the tension port, which connects the tension spring to the installation plate, making it easier for workers to replace the tension spring.

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## 3. Conclusion

In summary, the beneficial technical effect of this guide protection scheme for the hoist wire rope is to reduce the looseness of the wire rope winding and extend the service life of the wire rope by setting this device of support rod, pressure roller, and tension spring; The setting of connecting rods, connecting slots, connecting holes, and connecting bolts, as well as the setting of installation plates, installation holes, tension rings, and tension ports, greatly enhances this effect.

## References

[1] Wang Qiyi. Chinese Mechanical Design Classic. Nanchang: Jiangxi Science and Technology Press, 2002.

[2] Pan Ying. Design of Mining Hoisting Machinery. Xuzhou: China University of Mining and Technology Press, 2001.

[3] Kou Changqing. Fundamentals of Engineering Machinery. Xi'an: Xi'an Jiaotong University Press, 1989.

[4] Xiao Hanbin, Cheng Xianfu, Tao Dexin, and Fu Dunjian. Research on the Calculation Method of Welding Drum Stability. Hunan: Mechanical Strength, 2000.