

A New Type of Variable Diameter Wheel

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Abstract: A new type of variable diameter wheel is proposed, which has the characteristics of compact structure, strong obstacle-resisting ability, stable operation, light and flexible, etc. As a special walking mechanism, it works well with obstacles during its operation. The adaptability effectively improves the vehicle's ability to overcome obstacles. In the big wheel state, the rim will be segmented, forming a caster during operation, reducing the rolling resistance, greatly enhancing the adhesion to the ground relative to the complete rim, and increasing the traction of the machine. Because of the special terrain in the process of variable diameter operation, the vehicle can be adjusted to a certain degree to improve the passage and stability of the vehicle. It will be used in national infrastructure construction, industrial and agricultural production, Gobi Desert utilization, lunar exploration and the defense military and other fields have played a major role.

Keywords: Variable diameter wheel Obstacle ability Passivity.

1. VARIABLE DIAMETER DESIGN

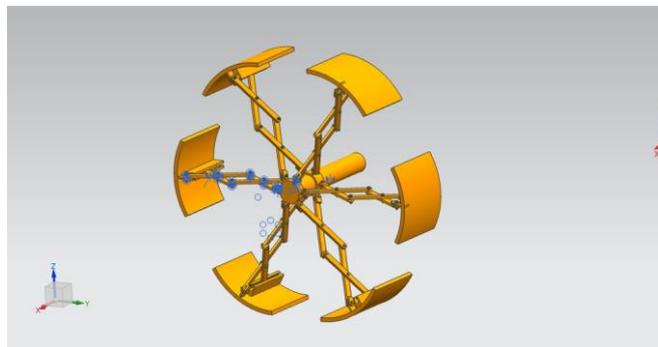


Fig 1. Three-dimensional structure diagram of variable diameter wheel

Variable diameter wheel components:

Rim

The rim is one-sixth of the outer diameter of 200mm full circle, and the design thickness is 5mm, which is directly in contact with the ground. Under the condition that the variable-diameter wheel is unfolded, the rim with broken running time will have feet on the ground. The effect of such a structure is to enhance the obstacle-over capability of the variable-diameter wheels. The large contact area between the rim and the ground increases the pressure and can be maintained under some soft ground conditions such as a desert wasteland environment. Driving will not sink. In use, according to the requirements of the application, the outer surface of the rim can also be covered with a layer of elastic rubber, which can increase the friction with the ground, improve the running speed to prevent slip, and can also play a very good role in reducing vibration. The inner surface has a hinged connecting hole and a section of T-shaped groove, which is connected to the connecting rod. The hinged connecting hole not only plays the role of restraining the rim from being removed, but also ensures the necessary activities in the process of changing the diameter. The T-slot can keep the axis of the rim always parallel to the axis during the diameter change.

(2) Connecting rod

The connecting rod a is a special connecting rod in the design. The cylindrical end of the connecting rod a contact the T-shaped groove inside the rim so that the end meets the linear movement in the rim groove so that the rim can be the axis is parallel to the axis, and the rotation of the rim around the other hinge connection is limited, and the other end is connected with other connecting rods to form a rotation pair.

(3) Connecting rod b

The connecting rod b is the other connecting rod of the design except the connecting rod a. In the design, a total of three connecting rods b are used in each of the spokes, and three connecting rods b and four connecting rods form a four-axis connecting rod. The lever mechanism, namely the scissor type telescopic mechanism, accomplishes the telescopic movement required for the wheel to change its diameter. One end of the connecting rod needs to form a turning pair with the hinge connection point of the connecting part on the wheel disc and the axle, and at the same time bears a large amount of the stress produced by the torque of the axle is a critical part of the wheel that affects the variable diameter wheel and is also a critical part of the process of changing the diameter.

(4) Axles

Axle is a part of the design of the transmission of power from the center part of the moving part, and it is the direct bearing part of the transmission torque of the original moving part. One end of the axle is connected with the spoke formed by the connecting rod and is one of the key parts that affect the strength of the variable diameter wheel. The other end is an ordinary cylindrical body that needs to be fitted into the wheel to act. The wheel moves axially along a section of the opening of the axle, and the transverse change amount is input to the spokes to be converted into a tribute to the longitudinal change amount.

(5) Roulette

The wheel is one of the key parts of the design. On the one hand, it is set on the axle for axial movement. On the one hand, the connecting rod on the spoke is connected, which is the direct-action part of the external horizontal input. The outside world converts the input into a wheel. The axial movement of the disc, the connecting rod b connected with the disc receives the input quantity and transmits the input quantity to the spokes, ie each scissor-type telescopic mechanism, and the telescopic mechanism converts the lateral input quantity in the axial direction into the longitudinal input which changes the diameter. Amount, so the wheel is a key component to change the diameter of the wheel. The wheel can be connected to control the horizontal input of the original move on the axle for axial sliding.

2. MECHANICAL PRINCIPLE ANALYSIS

The main use of six sets of four-bar scissor-type telescoping mechanism to change the size of the diameter. Seen from a single spoke, the variable diameter wheel adjusts to the minimum diameter when the ground moves, and the rims of the segments merge together to form a full circle. In the small-diameter working condition, the machine can maintain high speed and smoothness on the flat road surface. Travel; When in the face of obstacles need to be overturned, through the drive device so that the axle plate along the axial axial outer side of the movement, driving telescopic rod member lateral stretching, longitudinal stretching, so that variable diameter wheel spokes increase, increase the machine's the overall center of gravity, so adjust the attitude to achieve the obstacles across the function. When encountering obstacles of different heights, it is only necessary to change the distance between the wheel and the outside of the axle. However, due to the limited diameter of the variable diameter wheels, the height of obstacles crossed is also limited.

When the external force and the wheel are applied, the connecting rod b connected thereto and the other connecting rod b connected to the outer side of the axle are rotated around the middle cross point due to the pressure, and the longitudinal distance increases and the lateral distance decreases, and the two The connecting rod a and the connecting rod b connected at the other end of the connecting rod b cause the two connecting rods to rotate around the intermediate cross point due to the lateral compression, the longitudinal distance increases, the lateral distance decreases, and the other end of the connecting rod a is cylindrical inside the rim The T-shaped groove moves inwards. The moving pair of the T-shaped groove and the cylinder ensures that the rim can be parallel to the axis of the axle without being deflected. The rotating pair formed by the connecting rod b and the rim ensures that the diameter of the wheel can be changed freely. Thus, due to the law of lateral longitudinal variation, the two sets of crossbars on each spoke can be realized by changing the longitudinal expansion and contraction changes by controlling the distance between the outside of the wheel plate and the axle, that is, the lateral expansion and contraction. Size control.

3. PERFORMANCE ANALYSIS

The telescopic design of the spoke is unique, and the scissor-type telescoping mechanism is used skillfully to convert the relative axial movement between the movable wheel set on the wheel axle and the wheel disk fixed on the axle to the radial stretching movement of the spoke, and The smaller amount of axial activity becomes a larger amount of radial activity, and the flexibility of changing the diameter is greatly enhanced, so that it can respond quickly when the external environment suddenly changes, thereby reducing the safety risk caused by the machine. However, it also brings some problems. Due to the use of a plurality of rod connections, the wheels are less able to withstand impact loads when crossing obstacles. Therefore, it is necessary to use high-strength titanium alloy materials at the time of manufacture to increase the use cost.

4. CONCLUSION

The variable-diameter wheel structure proposed in this paper is light, fast, responsive, compact, stable, and analyzed for different environments, showing that the deployment of the wheel is conducive to improving the passage of the machine and achieving a wider range of diameters. Adjustment, suitable for a variety of applications such as desert, wasteland, planet exploration, disaster relief and other applications.

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