

19



**Octrooi Centrum
Nederland**

11

2036203

12 A OCTROOIAANVRAAG

21

Aanvraagnummer: **2036203**

51

Int. Cl.:
B66C 1/10 (2024.01) B66C 13/08 (2024.01)

22

Aanvraag ingediend: **7 november 2023**

62

30

Voorrang:
11 augustus 2023 CN 2023110149717

71

Aanvrager(s):
**Huaneng New Energy Co., LTD. Hebei branch
te Shijiazhuang, China, CN**

41

Aanvraag ingeschreven:
19 april 2024

72

Uitvinder(s):
**Haiyu Zhao te Shijiazhuang (CN)
Ruixue Gu te Shijiazhuang (CN)
Qiang Qiao te Shijiazhuang (CN)
Xuecheng Han te Shijiazhuang (CN)
Changjiang Zhao te Shijiazhuang (CN)
Lubing Han te Shijiazhuang (CN)**

43

Aanvraag gepubliceerd:
22 april 2024

74

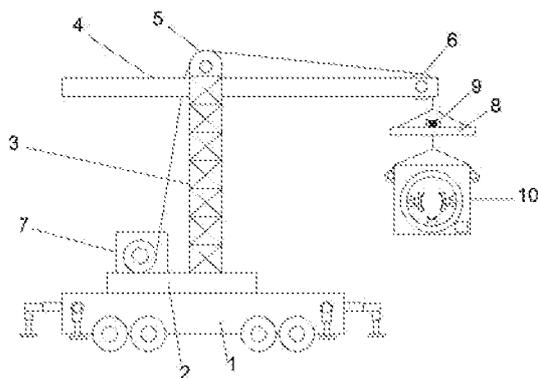
Gemachtigde:
dr. R.C. van Duijvenbode c.s. te Den Haag

54

A WINDMILL ROTARY BLADE LIFTING DEVICE

57

The present invention relates to the technical field of wind power generation, and particularly relates to a windmill rotary blade lifting device. The present invention comprises a base, and the top of the base is connected with a support column by an electric rotating table. The upper part of the support column is fixedly connected with a horizontal cantilever beam, the top of the support column is disposed with a first fixed pulley, and one end of the cantilever beam is disposed with a second fixed pulley. The top of the electric rotary table is disposed with a first winch, and the free end of the lifting rope of the first winch goes round the first fixed pulley and the second fixed pulley in turn and is fixedly connected with a support platform. The second winch is disposed at the top of the supporting platform, and the free end of the lifting rope of the second winch is connected with an angle adjusting tooling, which is located directly below the supporting platform. The angle adjusting tooling is used to fix the rotating blade of the windmill and adjust its angle. The present invention is disposed with an angle adjusting tooling, through which the angle of blades in the air can be adjusted. Therefore, blades can be better adjusted to the appropriate angle for alignment and fixing.



A WINDMILL ROTARY BLADE LIFTING DEVICE

Technical Field

The present invention relates to the technical field of wind power generation, and particularly relates to a windmill rotary blade lifting device.

Background Art

Wind power generation is to convert wind kinetic energy into mechanical kinetic energy, and then convert mechanical energy into electric kinetic energy. This means that the wind drives the windmill blades to rotate, and then the speed of rotation is increased through the speed reducer to promote the generator to generate electricity. Blade is one of the most important components in a wind power device. Its strict requirements in terms of shape and material allows the reduction of wind resistance and the enhance of anti-corrosion property as much as possible. Therefore, the shape of the blade is mostly in a streamlined spiral shape, with a larger size at the end near the motor and a smaller size at the tail part away from the motor.

The installation of a wind turbine generator system generally includes tower installation, engine room installation, hub installation, and blade installation. In the blade installation, the blade is generally lifted to the appropriate height by the lifting device, and aligned with corresponding installation positions on the hub and then fixed. The existing blade installation method is usually to determine the angle and orientation of the blade in advance on the ground, and to fix it through a tooling. Then the blades and tooling with a fixed angle are lifted to align with the installation position on the hub for fixed installation. However, there is often a certain deviation in the actual lifting process. As a result, the blade cannot be installed on the hub in the preset position. Existing lifting devices do not have the function of adjusting the angle of the blade in the air. Therefore, it is needed to move the blade back to the ground, recalculate the angle, and lift it again, which is time-consuming and inconvenient.

In this regard, it is urgent to design a lifting device which can temporarily adjust the blades in the air.

Summary of the Invention

In view of the existing technology, the present invention provides a windmill rotary blade lifting device, and specifically discloses the following technical schemes.

A windmill rotary blade lifting device, which comprises a base, and the top of the said base is connected with a support column by an electric rotating table. The upper part of the support column is fixedly connected with a horizontal cantilever beam, the top of the support column is disposed with a first fixed pulley, and one end of the cantilever beam is disposed with a

second fixed pulley. The top of the electric rotary table is disposed with a first winch, and the free end of the lifting rope of the first winch goes round the first fixed pulley and the second fixed pulley in turn and is fixedly connected with a support platform. The second winch is disposed at the top of the supporting platform, and the free end of the lifting rope of the second winch is connected with an angle adjusting tooling, which is located directly below the supporting platform. The angle adjusting tooling is used to fix the rotating blade of the windmill and adjust its angle.

Further, the said angle adjusting tooling comprises an outer frame, and an inner sleeve is rotatably connected in the outer frame. The bottom end of the inner sleeve is fixedly connected with a blade bracket on the inner wall, the inner wall on both sides of the inner sleeve is respectively connected with a clamping block through a hydraulic telescopic rod, and the outer wall of the inner sleeve is fixedly disposed with a ring teeth. A rotating shaft parallel to the inner sleeve is rotatably installed on the outer frame, and a transmission gear is disposed on the rotating shaft. The transmission gear meshes with the ring teeth, and one end of the rotating shaft is fixedly connected with the output terminal of the driving motor fixed on the end face of the outer frame.

Further, the upper surface of the said blade bracket and both sides of the two clamping blocks close to each other are curved surfaces, and a plurality of air bags are disposed on the blade bracket and both sides of the two clamping blocks close to each other.

Further, the said outer frame comprises two vertical support plates parallel to each other. The top ends of both vertical support plates are connected by a horizontal support plate. The mounting hole is disposed at the center of the said vertical support plates. Both ends of the inner sleeve pass through the mounting holes on both sides respectively, and are connected with a clamping table.

Further, a plurality of rollers are disposed between the outer wall of the said inner sleeve and the inner wall of the mounting hole. An annular groove is disposed on the inner wall of the mounting hole. The roller can be rotatably installed on the annular groove through the roller shaft.

Further, there are two second winches, and they are respectively fixed on both sides at the top of the support platform. Both sides of the said vertical support plates are respectively disposed with a pair of lifting rings, and the free end of the lifting rope on each of the second winch is divided into two parts and is respectively fixed with a pair of lifting lugs on the same side.

Further, the bottom end of the said base is disposed with a plurality of travelling wheels,

and a plurality of hydraulic telescopic legs are disposed around the said base.

Compared with the prior art, the present invention has the following benefits:

The present invention is disposed with an angle adjusting tooling, through which the angle of blades in the air can be adjusted. Therefore, blades can be better adjusted to the appropriate angle for alignment and fixing.

The present invention provides two second winches. Both the said second winches are fixed on each side of the top of the support platform. The free end of the lifting rope on each second winch is divided into two parts and is fixed with a pair of lifting rings on the same side, so as to adjust the height of both ends of the angle adjusting tooling, as well as the included angle between the blade and the horizontal plane, to better align the hub for assembly.

Description of Drawings

Fig. 1 is an overall structural diagram of the present invention.

Fig. 2 is a front view of the angle adjusting tooling in the present invention.

Fig. 3 is the right view of the angle adjusting tooling and the support platform in the present invention.

Fig. 4 is a sectional view of the angle adjusting tooling in the present invention.

1- Base, 2- Electric rotating table, 3- Support column, 4- Cantilever beam, 5- First fixed pulley, 6- Second fixed pulley, 7- First winch, 8- Support platform, 9- Second winch, 10- angle adjusting tooling, 101- Outer frame, 102- Inner sleeve, 103- Blade bracket, 104- Hydraulic telescopic rod, 105- Clamping block, 106 - Ring teeth, 107- Rotating shaft, 108- Transmission gear, 109- Driving motor, 1010- Clamping table, 1011- Roller, 1012- Lifting ring, 11- Travelling wheel, 12- Hydraulic telescopic leg.

Detailed Description of Embodiments

The technical schemes in the embodiments of the present invention will be clearly and completely described below in combination with the drawing in the embodiments of the present invention. Obviously, such embodiments are just a part of embodiments of the present invention, not all of them. Based on the embodiments of the present invention, all the other embodiments obtained by those ordinarily skilled in the art without making creative endeavors shall fall into the scope of protection of the present invention.

Referring to Fig. 1-4, A windmill rotary blade lifting device comprises a base 1, wherein the top end of the said base 1 is connected with a support column 3 through an electric rotating table 2, and the electric rotating table 2 can drive the support column 3 to rotate. The upper portion of the said support column 3 is fixedly connected a horizontal cantilever beam 4. The first fixed pulley 5 is disposed at the top end of the said support column 3. The second fixed

pulley 6 is disposed at one end of the said cantilever beam 4. The first winch 7 is disposed at the top portion of the said electric rotating table 2. The free end of a lifting rope of the first winch 7 is twisted around the first fixed pulley 5 and the second fixed pulley 6 in sequence and then is fixedly connected with a support platform 8. The said support platform 8 is positioned
5 under the second fixed pulley 6, and the second winch 9 is disposed at the top end of the said support platform 8. The free end of the lifting rope of the said second winch 9 is connected with an angle adjusting tooling 10 which is positioned below the support platform 8 and is used for fixing windmill rotating blades and adjusting the angle of the windmill rotating blades.

In the embodiment, the said angle adjusting tooling 10 comprises an outer frame 101, and
10 an inner sleeve 102 is rotatably connected in the outer frame 101. A blade bracket 103 is fixedly connected on the inner side wall of the bottom end of the inner sleeve 102 and is used for supporting the windmill rotating blades. Clamping blocks 105 are respectively connected on the inner side walls of the two sides of the inner sleeve 102 through hydraulic telescopic rods 104, and are used for clamping and fixing the windmill rotating blades, and the blades can be
15 clamped and unclamped by means of controlling telescoping of the hydraulic telescopic rods 104. A ring gear 106 is fixedly disposed on the outer wall of the inner sleeve 102, a rotating shaft 107 parallel to the inner sleeve 102 is rotatably disposed on the outer frame 101, and a transmission gear 108 is disposed on the rotating shaft 107 and is engaged with the ring gear 106. One end of the rotating shaft 107 is fixedly connected with the output terminal of a driving
20 motor 109 fixed on the end face of the outer frame 101. After the blades are lifted and the angle of blades is deviated, the driving motor 109 can be turned on, the rotating shaft 107 is driven by the driving motor 109 to drive the transmission gear 108 to rotate, the transmission gear 108 is engaged with the ring gear 106 to drive the inner sleeve 102 to rotate, and the blades clamped and fixed by the inner sleeve 102 are driven by the inner sleeve 102 to rotate until an appropriate
25 position to be aligned and fixed with a hub.

In the embodiment, the said curved surfaces are disposed on the upper surface of the blade bracket 103 and the side faces close to each other of the two clamping blocks 105, and the curved surfaces are adapted to the outer surfaces of the blades to better clamp and fix the blades. A plurality of air bags are disposed on the upper surface of the blade bracket 103 and the side
30 faces close to each other of the two clamping blocks 105, the air bags can provide cushioning for the blades after being inflated, and therefore the blade bracket 103 and the clamping blocks 105 can avoid damage to the surfaces of blades.

In the embodiment, the said outer frame 101 comprises two vertical support plates that are parallel with each other, and the top ends of the vertical support plates are connected through a

horizontal support plate to form the whole frame. Mounting holes are disposed in the centers of the vertical support plates in a penetrating mode, and both ends of the inner sleeve 102 pass respectively through the mounting holes in the two sides and are connected with the clamping table 1010. The clamping table 1010 protrudes beyond the mounting holes, the outer diameters of the clamping table 1010 are larger than the diameters of the mounting holes, and therefore the inner sleeve 102 is limited and fixed to avoid sliding in an axis direction.

In the embodiment, a plurality of rollers 1011 are disposed between the outer wall of the said inner sleeve 102 and the inner walls of the mounting holes, annular grooves are disposed in the inner walls of the mounting holes, and the idler wheels 1011 are rotatably installed in the annular grooves through idler wheel shafts. Friction can be effectively reduced by means of the arrangement of the idler wheels, so that the inner sleeve 102 is subjected to less resistance during rotation.

In the embodiment, the number of the said second winches 9 is two, the two second winches 9 are respectively fixedly connected to the two sides of the two ends of the support platform 8, a pair of lifting rings 1012 are respectively disposed on each of the two sides of the two vertical support plates, and the free end of the lifting rope on each second winch 9 is split in two and is respectively fixedly connected with the pair of lifting rings 1012 on the same side. The heights of both ends of the angle adjusting tooling 10 can be respectively adjusted by respectively controlling the two second winches 9, and therefore included angles between the blades and a horizontal plane can be adjusted to better align the hub so as to finish the assembly.

In the embodiment, a plurality of travelling wheels 11 are disposed at the bottom end of the said base 1 to facilitate movement of the base 1, a plurality of hydraulic telescopic legs 12 are respectively disposed at all sides of the base 1, and the hydraulic telescopic legs 12 can effectively improve stability of the device after stretching and supporting the ground.

In practical use of the present invention, the blades are fixed in the inner sleeve 102 of the angle adjusting tooling and are clamped and fixed by controlling the hydraulic telescopic rod 104 to extend, and then the first winch 7 is turned on to withdraw the lifting rope, so that the blades are lifted to a specified height to align the hub. When the angle of the blades is deviated and bolt holes in the blades cannot align with bolt holes in hub flanges, the driving motor 109 can be turned on to drive the rotating shaft 107 to rotate, the transmission gear 108 is driven by the rotating shaft 107 to rotate, the transmission gear 108 is engaged with the ring gear 106 to drive the inner sleeve 102 to rotate, and the blades clamped and fixed by the inner sleeve 102 are driven by the inner sleeve 102 to rotate until an appropriate position to be aligned and fixed with the hub.

The foregoing description only refers to a better embodiment of the present invention and does not impose any restrictions on the technical scope of the present invention. In this regard, any minor modifications and equivalent changes and modifications made to the above embodiment in line with the technical essence of the present invention, shall fall into the scope of the

5 technical scheme of the present invention.

Conclusies

1. Inrichting voor het opheffen en neerlaten van roterende bladen van windmolens, met het kenmerk, dat de inrichting een basis omvat, waarbij het bovenste uiteinde van de basis op een steunkolom wordt aangesloten door een elektrische draaitafel, het bovenste deel van de steunkolom bevestigd op een horizontale vrijdragende balk wordt aangesloten, het bovenste uiteinde van de steunkolom voorzien is van een eerste vaste katrol, het ene uiteinde van de vrijdragende balk voorzien is van een tweede vaste katrol, het bovenste deel van de elektrische draaitafel voorzien is van een eerste lier, het vrije uiteinde van de hefkabel op de eerste lier de eerste en de tweede vaste katrols op zijn beurt omzeilt en bevestigd op een ondersteuningsplatform wordt aangesloten, het bovenste uiteinde van het ondersteuningsplatform voorzien is van een tweede lier, het vrije uiteinde van de hefkabel op de tweede lier op een verstelbare hoekgereedschap wordt aangesloten, de verstelbare hoekgereedschap zich onder het ondersteuningsplatform direct bevindt en de verstelbare hoekbevestiging wordt gebruikt om de roterende bladen van de windmolen te bevestigen en hun hoek aan te passen.

2. Inrichting voor het opheffen en neerlaten van roterende bladen van windmolens volgens de conclusie 1, met het kenmerk, dat de verstelbare hoekgereedschap een buitenframe omvat, waarbij het binnenste draaibare buitenframe op een binnenhuls wordt aangesloten, de binnenste zijwand van het onderste uiteinde van de binnenhuls bevestigd op een bladbeuge wordt aangesloten, de binnenste zijwand aan beide zijden van de binnenhuls op een klemblok wordt aangesloten door een hydraulische telescopische stang, de buitenwand van de binnenhuls bevestigd voorzien is van ringvormige tanden, het buitenframe roterend voorzien is van een roterende as die parallel is aan de binnenhuls, de roterende as voorzien is van een transmissietandwiel, het transmissietandwiel en de ringvormige tand in elkaar grijpen, het ene uiteinde van de roterende as bevestigd op het uitgangseinde van de aandrijfmotor dat aan het uiteinde van het buitenframe is bevestigd, wordt aangesloten.

3. Inrichting voor het opheffen en neerlaten van roterende bladen van windmolens volgens de conclusie 2, met het kenmerk, dat het bovenoppervlak van de bladbeugel en de zijkanten van de twee klemblokken dicht bij elkaar zijn ontworpen als boogvormige gebogen oppervlakken, en het bovenoppervlak van de bladbeugel en de zijkanten van de twee klemblokken dicht bij elkaar voorzien zijn ontworpen met meerdere airbags.

4. Inrichting voor het opheffen en neerlaten van roterende bladen van windmolens volgens de conclusie 2, met het kenmerk, dat het buitenframe twee verticale steunplaten omvat die parallel zijn geplaatst, waarbij de bovenste uiteinden van de twee verticale steunplaten op elkaar worden aangesloten door een horizontale steunplaat, het midden van de verticale steunplaat door het
5 installatiegat loopt en de twee uiteinden van de binnenhuls respectievelijk door de montagegaten gaan aan beide zijden en op een klemtafel worden aangesloten.

5. Inrichting voor het opheffen en neerlaten van roterende bladen van windmolens volgens de conclusie 4, met het kenmerk, dat er voorzien is van een aantal rollen tussen de buitenwand van
10 de binnenhuls en de binnenwand van het montagegat, waarbij een ringvormige groef voorzien is op de binnenwand van het montagegat en de rol door de rollas roterend in de ringvormige groef geïnstalleerd kan worden.

6. Inrichting voor het opheffen en neerlaten van roterende bladen van windmolens volgens de
15 conclusie 4, met het kenmerk, dat het aantal tweede lieren twee zijn, waarbij de twee tweede lieren bevestigd op beide zijden van het bovenste uiteinde van het ondersteuningsplatform worden aangesloten, en beide zijden van de twee verticale steunplaten respectievelijk voorzien zijn van een paar hijsnokken, en het vrije uiteinde van de hefkabel op elke tweede lier in tweeën is gedeeld en bevestigd op een paar hijsnokken wordt aangesloten aan dezelfde kant.

20

7. Inrichting voor het opheffen en neerlaten van roterende bladen van windmolens volgens de conclusie 1, met het kenmerk, dat het onderste uiteinde van de basis voorzien is van meerdere rijdende wielen en er voorzien zijn van meerdere hydraulische telescopische steunpoten rond de basis.

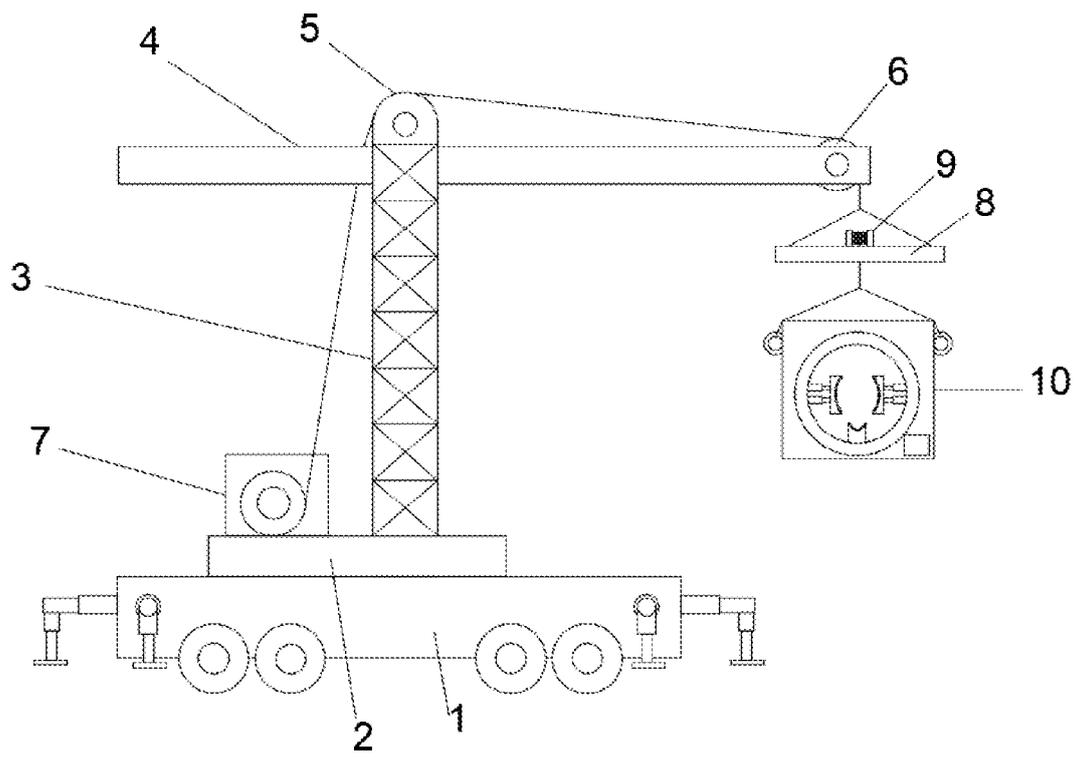


Fig. 1

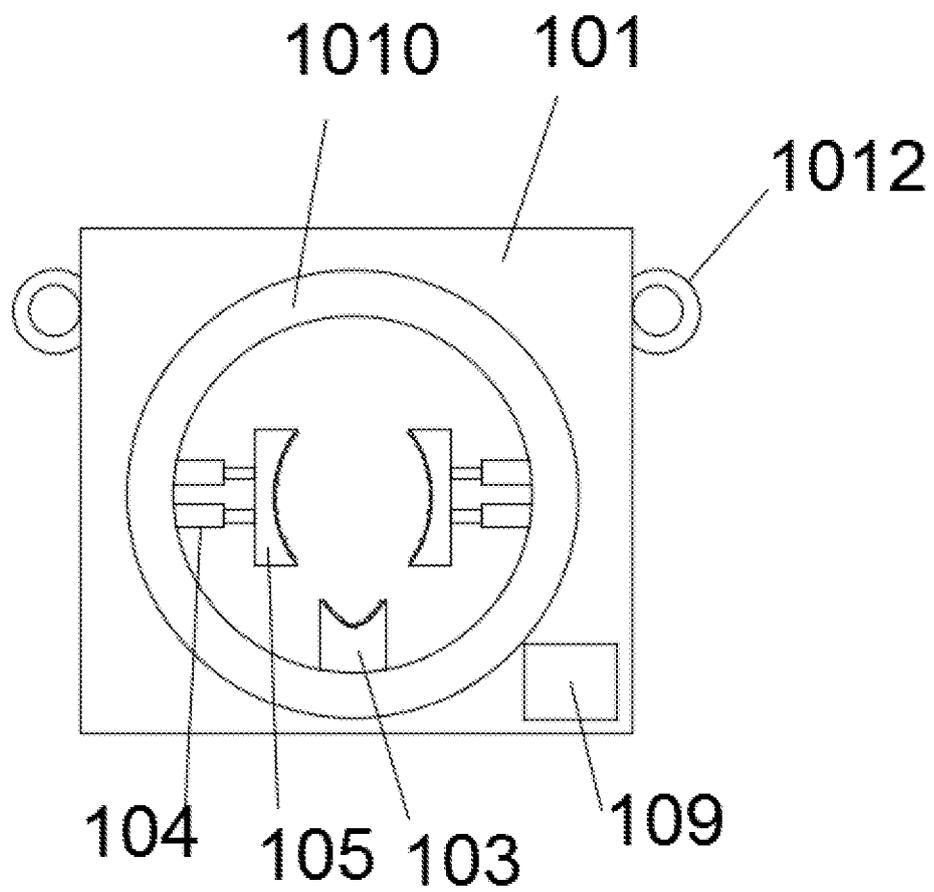


Fig. 2

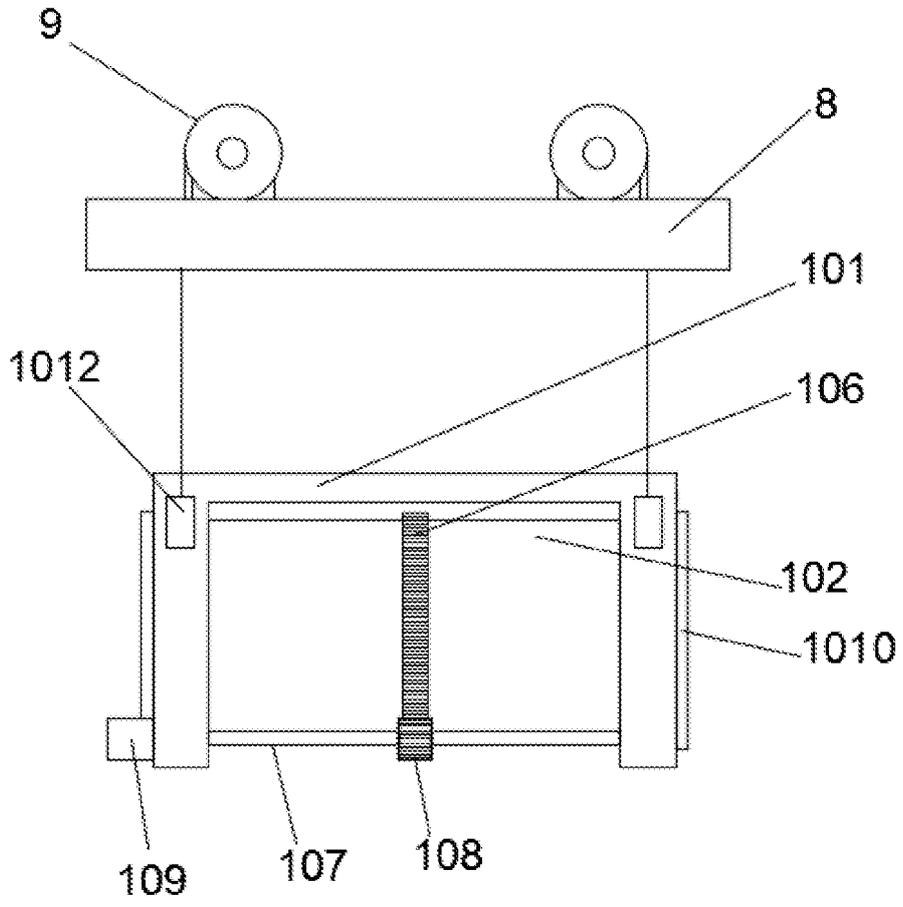


Fig. 3

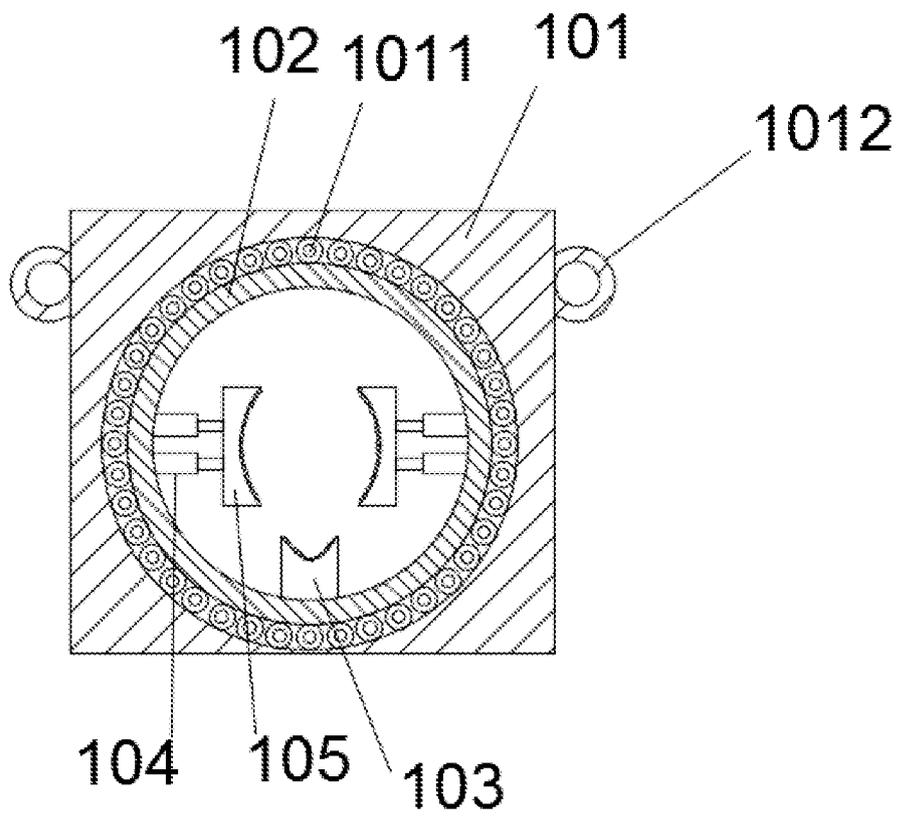


Fig. 4