

POLISHING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Chinese Patent Application No. 2014104061165 filed on Sep. 19, 2014 in the State Intellectual Property Office of China, the whole disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a polishing apparatus, more particularly, relates to a polishing apparatus for polishing end surfaces of fiber optic ferrule assemblies.

Description of the Related Art

The fiber optic ferrule assembly generally comprises a ferrule and an optical fiber inserted into an internal hole of the ferrule. The optical fiber can be fixed within the internal hole of the ferrule by adhesive. After fixing the optical fiber within the internal hole of the ferrule, a front end surface of the whole fiber optic ferrule assembly needs to be ground and polished precisely so as to achieve predetermined optical performance.

In prior art, when the front end surface of the fiber optic ferrule assembly is polished, generally, a plurality of fiber optic ferrule assemblies are clamped and fixed on a carrier. Then, a pressing mechanism presses a pressing head so as to press the carrier against a positioning component. In prior art, the carrier is generally formed as circle-shaped or square-shaped, and the pressing head presses the carrier at a central portion thereof. However, generally, pressing centrally is only adapted to the circle-shaped or square-shaped carrier, but is not adapted to a rectangle-shaped carrier. As compared to the circle-shaped or square-shaped carrier, the rectangle-shaped carrier may carry much more fiber optic ferrule assemblies each time so as to improve the efficiency of polishing. The person skilled in the art expects to improve the existing polishing apparatus so as to apply it to a rectangle-shaped carrier.

Furthermore, when the end surface of the fiber optic ferrule assembly is ground by a polishing mechanism, the posture of the carrier will change slightly. However, in prior art, the pressing head generally has a flat bottom and thus is not adapted to the change of posture of the carrier, such that the pressing force applied on the carrier is not always perpendicular to the surface of the carrier, thereby affecting the polish accuracy of the fiber optic ferrule

assembly.

Furthermore, in prior art, the pressing mechanism is not provided with an elastic buffer component. Thus, when the carrier is pressed, it is possible that the pressing force exerted on the carrier is suddenly increased from zero to a predetermined value, which will impact the carrier and affect the polish accuracy of the fiber optic ferrule assembly.

SUMMARY OF THE INVENTION

Embodiments of the present invention seek to overcome or alleviate at least one aspect of the above mentioned disadvantages.

Accordingly, embodiments of the present invention seek to provide a polishing apparatus capable of adapting to carriers having various shapes.

Embodiments of the present invention also seek to provide a polishing apparatus to make sure that pressing force exerted on the carrier is always held to be perpendicular to the surface of the carrier.

Embodiments of the present invention also seek to provide a polishing apparatus to make sure that the pressing force exerted on the carrier is gradually increased from zero to a predetermined value.

According to an aspect of the present invention, there is provided a polishing apparatus, comprising: a base seat; a carrier constructed to carry a plurality of work pieces to be polished thereon; an elevating mechanism mounted on the base seat and having a pair of positioning plates constructed to install and position the carrier thereon; a pressing mechanism mounted on the base seat and having a pair of pressing heads constructed to press both ends of the carrier against the pair of positioning plates, respectively; and a polishing mechanism mounted on the base seat and constructed to polish the work pieces carried on the carrier, wherein the pressing heads each has an arc-shaped protrusion which is constructed to press a surface of the carrier.

According to an exemplary embodiment of the present invention, the arc-shaped protrusion is formed as hemisphere-shaped or hemicylinder-shaped.

According to another exemplary embodiment of the present invention, the work pieces to be polished are fiber optic ferrule assemblies each comprising a ferrule and a optical fiber fixed within an internal hole of the ferrule; a plurality of positioning slots are formed on the carrier, the fiber optic ferrule assemblies being clamped and positioned within a plurality of positioning slots of the carrier, respectively; and the polishing mechanism is constructed to polish end surfaces of the fiber optic ferrule assemblies.

According to another exemplary embodiment of the present invention, the elevating mechanism comprising: a pair of vertical support plates oppositely mounted on the base seat; a pair of vertical slide rails provided on the support plates, respectively; a pair of slide blocks slidably mated with the vertical slide rails, respectively; a connection beam constructed to connect the pair of slide blocks and the pair of positioning plates so as to simultaneously move the slide blocks and the positioning plates; and a first driving mechanism mounted on one of the vertical support plates to drive the slide blocks to move up and down along the vertical slide rails, respectively.

According to another exemplary embodiment of the present invention, the first driving mechanism is a linear actuator.

According to another exemplary embodiment of the present invention, the first driving mechanism is an air cylinder, a hydraulic cylinder or an electrical actuator.

According to another exemplary embodiment of the present invention, the carrier is positioned on the positioning plates in the manner of pin-hole mating.

According to another exemplary embodiment of the present invention, each of the pair of positioning plates has a positioning pin extending vertically upward; each of both ends of the carrier is formed with a positioning hole; and the positioning pins of the positioning plates are fitted into the positioning holes of the carrier, respectively.

According to another exemplary embodiment of the present invention, the positioning pins and the positioning holes are clearance-fitted to allow to change a posture of the carrier.

According to another exemplary embodiment of the present invention, each of the positioning plates has a horizontal extending portion, the positioning pin being located on an end of the horizontal extending portion; and both ends of the carrier are placed on the horizontal extending portions of the pair of positioning plates, respectively.

According to another exemplary embodiment of the present invention, the polishing mechanism comprises a horizontal support plate provided below the positioning plates, and a polishing film placed on the horizontal support plate; and the polishing film reciprocatingly moves along with the horizontal support plate so as to polish the end surfaces of the fiber optic ferrule assemblies.

According to another exemplary embodiment of the present invention, the pressing mechanism comprises a pair of second driving mechanisms mounted on the pair of vertical support plates, respectively; and the pair of second driving mechanisms are constructed to drive the pair of pressing heads respectively to press the pair of pressing heads on the surface of the carrier.

According to another exemplary embodiment of the present invention, the pressing mechanism further comprises an elastic buffer component, the second driving mechanisms pressing the elastic buffer component, so as to press the pressing heads on the surface of the carrier through the elastic buffer component, such that the pressing force exerted on the carrier being gradually increased from zero to a predetermined value.

According to another exemplary embodiment of the present invention, the pressing heads each comprises an upper body portion and a lower body portion separate from the upper body portion; and receiving grooves are formed on the upper body portion and the lower body portion, respectively, the elastic buffer component being received in the receiving grooves.

According to another exemplary embodiment of the present invention, guiding holes are formed on the upper body portion and the lower body portion, respectively; and guide rods are inserted into guiding holes of the upper body portion and the respective guiding holes of the lower body portion respectively, such that during the pressing of the elastic buffer component, the upper body portion is guided to move in vertical direction with respect to the lower body portion.

According to another exemplary embodiment of the present invention, actuation ends of the second driving mechanisms are provided with horizontal pressing plates, respectively; and upper end surfaces of the pressing heads are attached to the horizontal pressing plates, respectively.

According to another exemplary embodiment of the present invention, the pressing heads are made of elastic materials such that the pressing force exerted on the carrier is gradually increased from zero to a predetermined value.

According to another exemplary embodiment of the present invention, the second driving mechanisms each is a linear actuator.

According to another exemplary embodiment of the present invention, the second driving mechanisms each is an air cylinder, a hydraulic cylinder or an electrical actuator.

According to another exemplary embodiment of the present invention, the vertical slide rails, the slide blocks and the first driving mechanism are mounted on outer side surfaces of the vertical support plates, respectively; and the second driving mechanisms are mounted on inner side surfaces of the vertical support plates, respectively.

According to another exemplary embodiment of the present invention, the carrier has a rectangle profile.

In various embodiments of the polishing apparatus of the present invention, a pair of pressing heads presses the carrier against a pair of positioning plates at both ends of the carrier, respectively. And the pressing heads each has an arc-shaped protrusion directly pressed the surface of the carrier, thus, the pressing force exerted on the carrier is always held to be perpendicular to the surface of the carrier. Furthermore, in an embodiment of the present invention, the pressing mechanism further comprises a spring buffer member, so that the pressing force exerted on the carrier may be prevented from suddenly increasing from zero to a predetermined value, avoiding a disadvantageous of impacting the carrier.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the accompanying drawings, in which:

Fig.1 is an illustrative perspective view of a polishing apparatus according to an exemplary embodiment of the present invention;

Fig.2 is a local cross-sectional view of the polishing apparatus of Fig.1; and

Fig.3 is an illustrative structure view of a pressing head of the polishing apparatus according to another exemplary embodiment of the present invention, wherein a spring is not pressed and held in a released state; and

Fig.4 is an illustrative structure view of the pressing head as shown in Fig. 3, wherein the spring is fully pressed.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Exemplary embodiments of the present disclosure will be described hereinafter in detail

with reference to the attached drawings, wherein the like reference numerals refer to the like elements. The present disclosure may, however, be embodied in many different forms and should not be construed as being limited to the embodiment set forth herein; rather, these embodiments are provided so that the present disclosure will be thorough and complete, and will fully convey the concept of the disclosure to those skilled in the art.

In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

According to a general concept of the present invention, there is provided a polishing apparatus, comprising: a base seat; a carrier constructed to carry a plurality of work pieces to be polished thereon; an elevating mechanism mounted on the base seat and having a pair of positioning plates constructed to install and position the carrier thereon; a pressing mechanism mounted on the base seat and having a pair of pressing heads constructed to press both ends of the carrier against the pair of positioning plates, respectively; and a polishing mechanism mounted on the base seat and constructed to polish the work pieces carried on the carrier, wherein the pressing heads each has an arc-shaped protrusion which is constructed to press a surface of the carrier.

Fig.1 shows an illustrative perspective view of a polishing apparatus according to an exemplary embodiment of the present invention; and Fig.2 shows a local cross-sectional view of the polishing apparatus of Fig.1.

As shown in Figs. 1 and 2, in an exemplary embodiment of the present invention, the polishing apparatus mainly comprises a base seat 10, a carrier 400, an elevating mechanism, a pressing mechanism and a polishing mechanism.

In the illustrated embodiment, as shown in Figs. 1 and 2, the elevating mechanism is mounted on the base seat 10 and has a pair of positioning plates 115 for installing and positioning the carrier 400 thereon. The carrier 400 is constructed to carry work pieces 50 to be polished thereon.

As shown in Fig.2, in an exemplary embodiment of the present invention, the work pieces to be polished may be fiber optic ferrule assemblies. As shown in Fig.2, each of the fiber optic ferrule assemblies comprises a ferrule 501 and an optical fiber 502 fixed within an internal hole of the ferrule 501. The polishing mechanism is mounted on the base seat 10 and constructed to polish end surfaces of the fiber optic ferrule assemblies mounted on the carrier 400.

Although not shown, in an embodiment of the present invention, a plurality of

positioning slots are formed in the carrier 400, and a plurality of fiber optic ferrule assemblies are clamped and positioned within the plurality of positioning slots of the carrier 400, respectively.

In an embodiment of the present invention, the pressing mechanism is mounted on the base seat 10 and has a pair of pressing heads 310, 320 constructed to press both ends of the carrier 400 against the pair of positioning plates 115, respectively.

In an exemplary embodiment of the present invention, the pressing heads 310, 320 each has an arc-shaped protrusion 310a, 320a for directly contacting a surface of the carrier 400 to directly press the surface of the carrier 400. The arc-shaped protrusions 310a, 320a each may be formed as hemisphere-shaped or hemicylinder-shaped.

As shown in Figs. 1 and 2, in the illustrated embodiment, the elevating mechanism comprises: a pair of vertical support plates 110, 120 oppositely mounted on the base seat 10; a pair of vertical slide rails 111 provided on the support plates 110, 120, respectively; a pair of slide blocks 112 slidably mated with the vertical slide rails 111, respectively; a connection beam 114 constructed to connect the pair of slide blocks 112 and the pair of positioning plates 115 so as to simultaneously move the slide blocks 112 and the positioning plates 115; and a first driving mechanism 130 mounted on one of the vertical support plates 110, 120 so as to drive the slide blocks 112 to move up and down along the vertical slide rails 111, respectively.

In an embodiment of the present invention, as shown in Fig.1, the slide block 112 is connected to the connection beam 114 by a connection plate 113.

In an exemplary embodiment of the present invention, the first driving mechanism 130 may comprises a linear actuator, for example, an air cylinder, a hydraulic cylinder or an electrical actuator.

As shown in Fig.2, in an exemplary embodiment of the present invention, the carrier 400 is positioned on the positioning plates 115 in the manner of pin-hole mating.

In the illustrated embodiment, as shown in Fig.2, each of the pair of positioning plates 115 comprises a positioning pin 115a extending vertically upward, and each of both ends of the carrier 400 is formed with a positioning hole 400a. Furthermore, the positioning pin 115a of the positioning plate 115 is fitted into the respective positioning hole 400a of the carrier 400.

In an exemplary embodiment of the present invention, there is a small gap between the positioning pin 115a and the positioning hole 400a. In this way, when the end surfaces of the fiber optic ferrule assemblies are ground, the posture of the carrier 400 will change slightly. In order to be compliant with the change of the posture of the carrier 400, in the illustrated embodiment of the present invention, the arc-shape protrusions 310a, 320a of the pressing heads 310, 320 each is formed as hemisphere-shaped or hemicylinder-shaped. In this way, the pressing force exerted on the carrier 400 is always perpendicular to the surface

of the carrier 400.

Continue to refer to Fig.2, in the illustrated embodiment, each of the positioning plates 115 has a horizontal extending portion 115b at an end of which the positioning pin 115a is located, and both ends of the carrier 400 are placed on the horizontal extending portions 115b of the pair of positioning plates 115, respectively.

As shown in Figs. 1 and 2, in an embodiment of the present invention, the polishing mechanism comprises a horizontal support plate 20 provided below the positioning plates 115, and a polishing film (not shown) placed on the horizontal support plate 20 and reciprocatingly moving along with the horizontal support plate 20 so as to polish the end surfaces of the fiber optic ferrule assemblies. When the polishing film needs to be replaced, the first driving mechanism 130 moves the pair of slide blocks 112 upward along with the pair of positioning plates 115 so as to rise up the carrier 400 mounted on the pair of positioning plates 115, thereby replacing the polishing film below the carrier 400. After replacing the polishing film, the first driving mechanism 130 moves the pair of slide blocks 112 downward along with the pair of positioning plates 115 so as to lower the carrier 400 mounted on the pair of positioning plates 115 until reach a predetermined position.

As shown in Figs. 1 and 2, in an exemplary embodiment of the present invention, the pressing mechanism comprises: a pair of second driving mechanisms 210, 220, which are mounted on the pair of vertical support plates 110, 120 and constructed to drive the pair of pressing heads 310, 320, respectively, so as to press the pair of pressing heads 310, 320 against the surface of the carrier 400.

In the embodiment illustrated in Figs. 1 and 2, actuation ends of the second driving mechanisms 210, 220 are provided with horizontal pressing plates 230, respectively. Upper end surfaces of the pressing heads 310, 320 are attached to the horizontal pressing plates 230, respectively.

In order to make sure that the pressing force exerted on the carrier 400 is gradually and smoothly increased from zero to a predetermined value, in an exemplary embodiment of the present invention, the pressing heads 310, 320 is made of elastic materials. In this way, when the pressing heads 310, 320 are pressed downward, it will be deformed elastically gradually, such that the pressing force exerted on the carrier 400 is gradually and smoothly increased from zero to a predetermined value, rather than impact the carrier 400.

In an exemplary embodiment of the present invention, the second driving mechanisms 210, 220 each may comprises a linear actuator, for example, an air cylinder, a hydraulic cylinder or an electrical actuator.

Fig.3 is an illustrative structure view of a pressing head 310' or 320' of the polishing apparatus according to another exemplary embodiment of the present invention, wherein a spring (an elastic buffer component 240) is not pressed and held in a released state; and Fig.4 is an illustrative structure view of the pressing head 310' or 320' as shown in Fig. 3,

wherein the spring (the elastic buffer component 240) is fully pressed.

In an exemplary embodiment of the present invention, as shown in Figs. 3 and 4, the pressing mechanism also comprises an elastic buffer component 240. The second driving mechanisms 210, 220 press the elastic buffer component 240 through which the pressing heads 310', 320' are pressed against the surface of the carrier 400, such that the pressing force exerted on the carrier 400 is gradually increased from zero to a predetermined value.

As shown in Figs. 3 and 4, in the illustrated embodiment, the pressing heads 310' and 320' each comprises an upper body portion 311 and a lower body portion 312 separated from the upper body portion 311. Receiving grooves, in which the elastic buffer component 240 is received, are formed on the upper body portion 311 and the lower body portion 312, respectively.

As shown in Figs. 3 and 4, in the illustrated embodiment, guiding holes are formed in the upper body portion 311 and the lower body portion 312, respectively, and guide rods 250 are inserted into guiding holes, respectively, such that during pressing the elastic buffer component 240, the upper body portion 310 is guided to move in the vertical direction with respect to the lower body portion 320.

As shown in Fig.3 and 4, in the illustrated embodiment, the lower body portion 312 of the pressing heads 310' or 320' is formed with an arc-shaped protrusion 312a for directly contacting a surface of the carrier 400 to directly press the surface of the carrier 400.

As shown in Figs. 3 and 4, in an exemplary embodiment of the present invention, the arc-shaped protrusions 312a may be formed as hemisphere-shaped or hemicylinder-shaped.

As shown in Fig.1, in an exemplary embodiment of the present invention, the vertical slide rails 111, the slide blocks 112 and the first driving mechanism 130 are mounted on outer sides of the vertical support plates 110, 120, respectively. The second driving mechanisms 210, 220 are mounted on inner sides of the vertical support plates 110, 120, respectively.

In an exemplary embodiment of the present invention, as shown in Fig.1, the carrier 400 has a substantial rectangle profile or any other proper profile.

It should be appreciated for those skilled in this art that the above embodiments are all exemplary embodiments. For example, many modifications may be made to the above embodiments by those skilled in this art, and various features described in different embodiments may be freely combined with each other without conflicting in configuration or principle.

Although the present disclosure has been described with reference to the attached drawings, the embodiments disclosed in the attached drawings are intended to describe the preferred embodiments of the present invention exemplarily, but should not be construed as a limitation to the present disclosure.

Although several embodiments of the general concept of the present disclosure have

been shown and described, it would be appreciated by those skilled in the art that various changes or modifications may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

As used herein, term “comprising” or “having” should be understood as not excluding other elements or steps, and term “a” or “an” should be understood as not excluding plural elements or steps. In addition, any reference numeral in claims should not be understood as the limitation of the scope of the present disclosure.

What is claimed is,

1. A polishing apparatus, comprising:

a base seat;

a carrier constructed to carry a plurality of work pieces to be polished thereon;

an elevating mechanism mounted on the base seat and having a pair of positioning plates constructed to install and position the carrier thereon;

a pressing mechanism mounted on the base seat and having a pair of pressing heads constructed to press both ends of the carrier against the pair of positioning plates, respectively; and

a polishing mechanism mounted on the base seat and constructed to polish the work pieces carried on the carrier,

wherein the pressing heads each has an arc-shaped protrusion which is constructed to press a surface of the carrier.

2. The polishing apparatus according to claim 1, wherein, the arc-shaped protrusion is formed as hemisphere-shaped or hemicylinder-shaped.

3. The polishing apparatus according to claim 1, wherein,

the work pieces to be polished are fiber optic ferrule assemblies each comprising a ferrule and a optical fiber fixed within an internal hole of the ferrule;

a plurality of positioning slots are formed on the carrier, the fiber optic ferrule assemblies being clamped and positioned within a plurality of positioning slots of the carrier, respectively; and

the polishing mechanism is constructed to polish end surfaces of the fiber optic ferrule assemblies.

4. The polishing apparatus according to claim 3, wherein, the elevating mechanism comprising:

a pair of vertical support plates oppositely mounted on the base seat;

a pair of vertical slide rails provided on the support plates, respectively;
a pair of slide blocks slidably mated with the vertical slide rails, respectively;
a connection beam constructed to connect the pair of slide blocks and the pair of positioning plates so as to simultaneously move the slide blocks and the positioning plates;
and
a first driving mechanism mounted on one of the vertical support plates to drive the slide blocks to move up and down along the vertical slide rails, respectively.

5. The polishing apparatus according to claim 4, wherein, the first driving mechanism comprises a linear actuator.

6. The polishing apparatus according to claim 5, wherein, the first driving mechanism comprises an air cylinder, a hydraulic cylinder or an electrical actuator.

7. The polishing apparatus according to claim 4, wherein, the carrier is positioned on the positioning plates in the manner of pin-hole mating.

8. The polishing apparatus according to claim 7, wherein,
each of the pair of positioning plates has a positioning pin extending vertically upward;
each of both ends of the carrier is formed with a positioning hole; and
the positioning pins of the positioning plates are fitted into the positioning holes of the carrier, respectively.

9. The polishing apparatus according to claim 8, wherein, the positioning pins and the positioning holes are clearance-fitted to allow to change a posture of the carrier.

10. The polishing apparatus according to claim 8, wherein,
each of the positioning plates has a horizontal extending portion, the positioning pin being located on an end of the horizontal extending portion; and
both ends of the carrier are placed on the horizontal extending portions of the pair of positioning plates, respectively.

11. The polishing apparatus according to claim 9, wherein,
the polishing mechanism comprises a horizontal support plate provided below the positioning plates, and a polishing film placed on the horizontal support plate; and
the polishing film constructed to reciprocatingly move along with the horizontal support plate so as to polish the end surfaces of the fiber optic ferrule assemblies.

12. The polishing apparatus according to claim 1, wherein,
the pressing mechanism comprises a pair of second driving mechanisms mounted on the pair of vertical support plates respectively; and
the pair of second driving mechanisms are constructed to drive the pair of pressing heads respectively to press the pair of pressing heads against the surface of the carrier.

13. The polishing apparatus according to claim 12, wherein,
the pressing mechanism further comprises an elastic buffer component, the second driving mechanisms pressing the elastic buffer component, to press the pressing heads against the surface of the carrier through the elastic buffer component, such that the pressing force exerted on the carrier being gradually increased from zero to a predetermined value.

14. The polishing apparatus according to claim 13, wherein,
the pressing heads each comprises an upper body portion and a lower body portion separate from the upper body portion; and
receiving grooves are formed on the upper body portion and the lower body

portion, respectively, the elastic buffer component being received in the receiving grooves.

15. The polishing apparatus according to claim 14, wherein,
guiding holes are formed in the upper body portion and the lower body portion ,
respectively; and

guide rods are inserted into guiding holes, respectively, such that during pressing the
elastic buffer component, the upper body portion is guided to move in vertical direction with
respect to the lower body portion.

16. The polishing apparatus according to claim 12, wherein,
actuation ends of the second driving mechanisms are provided with horizontal pressing
plates, respectively; and

upper end surfaces of the pressing heads are attached to the horizontal pressing plates,
respectively.

17. The polishing apparatus according to claim 16, wherein,
the pressing heads are made of elastic materials such that the pressing force exerted on
the carrier is gradually increased from zero to a predetermined value.

18. The polishing apparatus according to claim 12, wherein,
the second driving mechanisms each comprises a linear actuator.

19. The polishing apparatus according to claim 18, wherein,
the second driving mechanisms each comprises an air cylinder, a hydraulic cylinder or
an electrical actuator.

20. The polishing apparatus according to claim 12, wherein,
the vertical slide rails, the slide blocks and the first driving mechanism are mounted on
outer sides of the vertical support plates, respectively; and

the second driving mechanisms are mounted on inner sides of the vertical support plates, respectively.

21. The polishing apparatus according to claim 1, wherein,
the carrier has a rectangle profile.

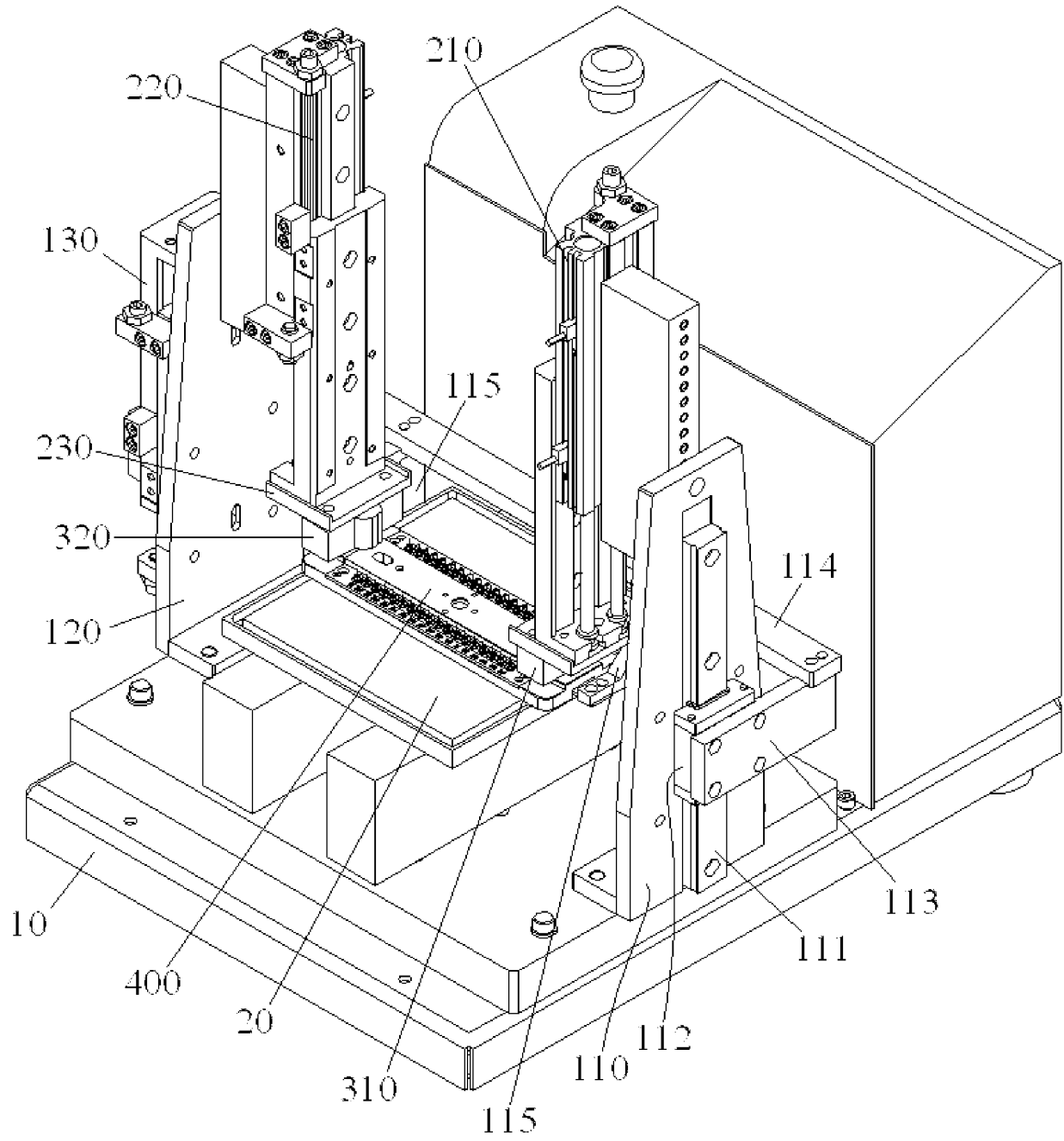


Fig. 1

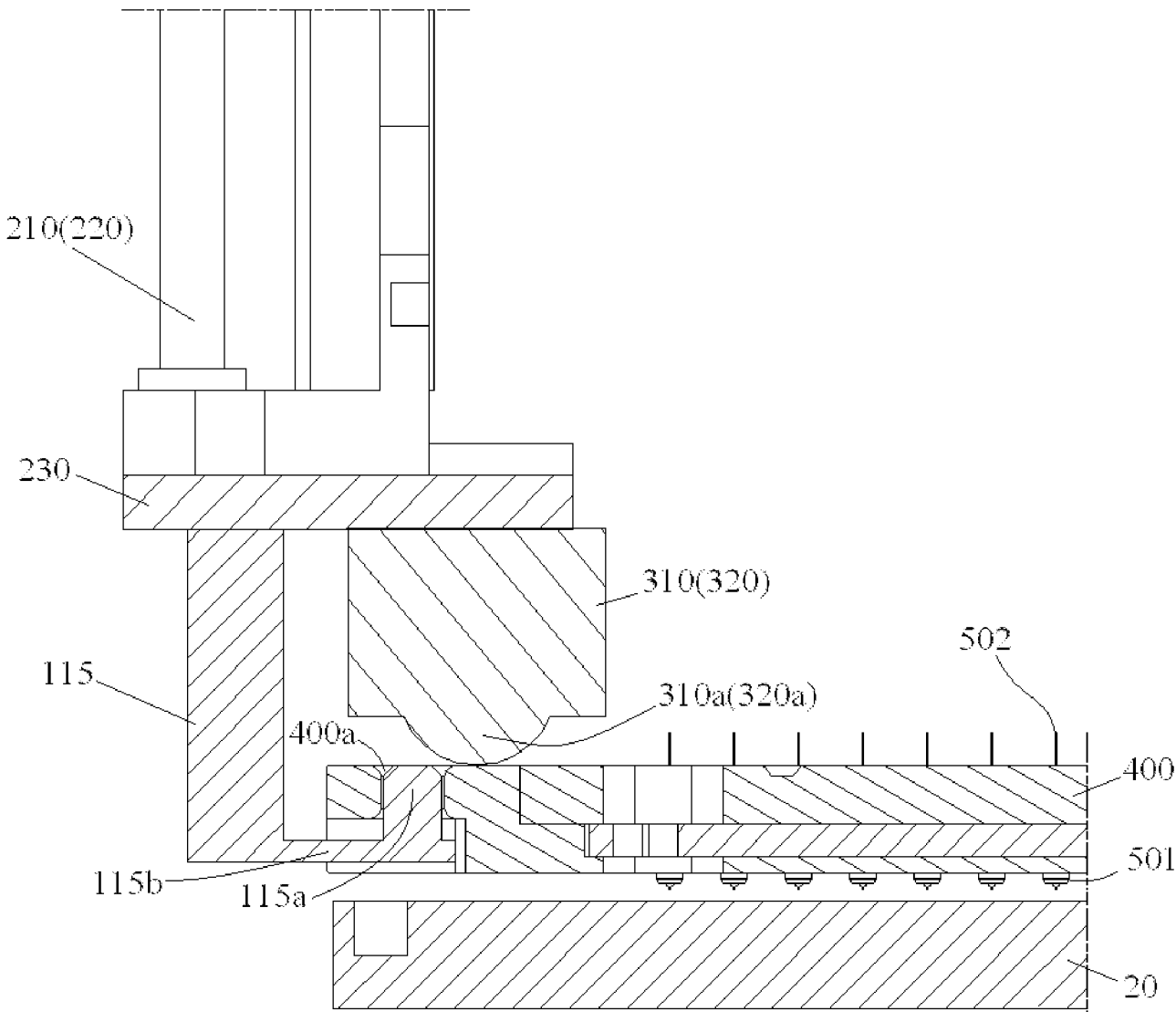


Fig. 2

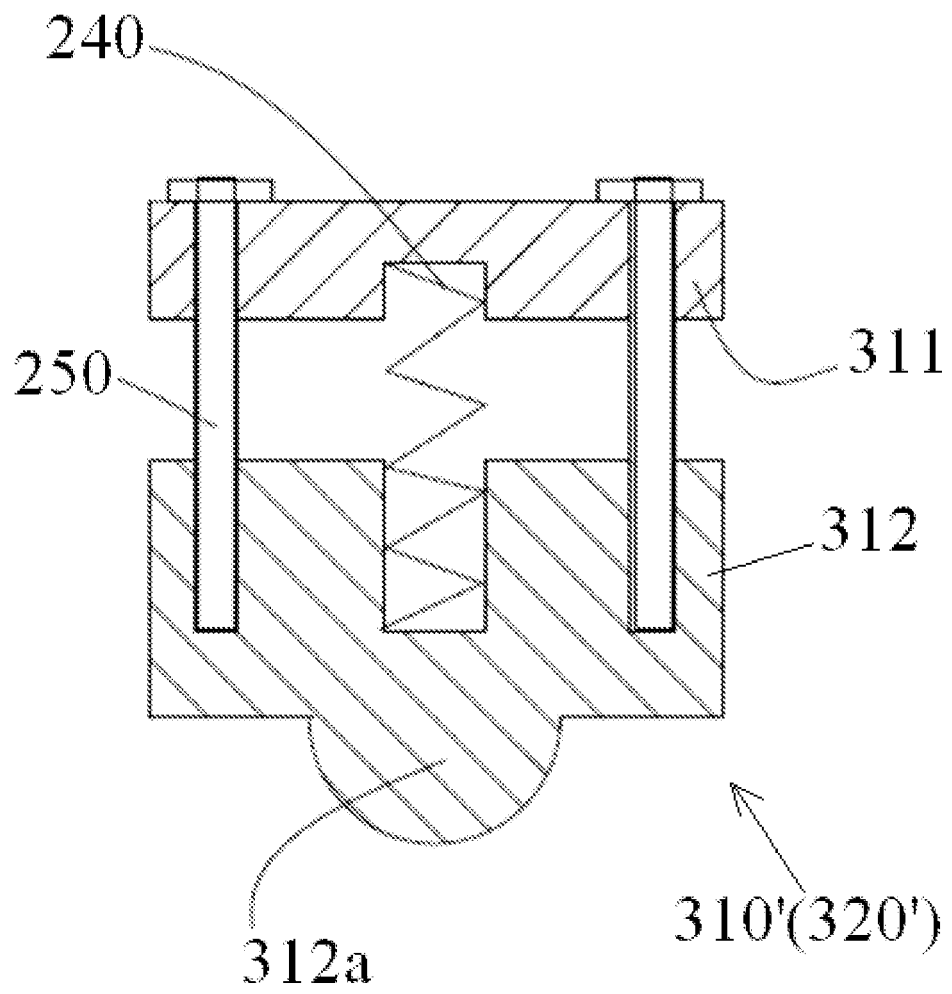


Fig. 3

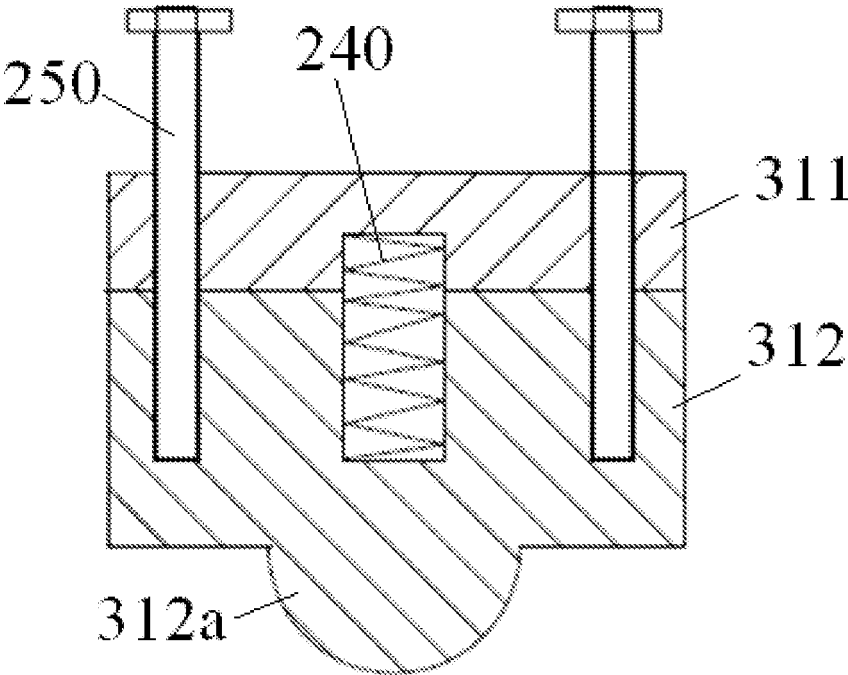


Fig. 4