ROTATION ANGLE CONTROL DEVICE, AUTOMATIC CLEARANCE ADJUSTER AND AUTOMOBILE BRAKE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present disclosure is based on and claims priority to China Patent Application No. 201911064001.1 filed on November 4, 2019, the disclosure of which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the technical field of automobile brakes, in particular to a rotation angle control device, an automatic clearance adjuster and an automobile brake.

BACKGROUND

[0003] The automatic clearance adjuster of the automobile brake realizes the automatic adjustment function of a brake clearance by controlling a rotation angle of the adjuster. When the rotation angle of the adjuster is greater than a set value, its automatic adjustment function may be triggered. In the related art, the rotation angle control device is implemented by unidirectional ratchet teeth meshing with each other.

SUMMARY

[0004] According to one aspect of the present disclosure, a

rotation angle control device is provided. The device includes: a mandrel; a transmission gear sleeved on the mandrel; a clutch sleeve sleeved on the mandrel and having a first axial counterbore in an end surface located on one side of the clutch sleeve away from the transmission gear; a second worm sleeved on the mandrel and having a second axial counterbore in an end surface located on one side of the second worm adjacent to the transmission gear; and an expansion spring sleeved over the mandrel and having an outer circular surface in interfere fit with inner hole surfaces of the first axial counterbore and the second axial counterbore.

[0005] In some embodiments, there is a preset rotation clearance between the transmission gear and the clutch sleeve in a circumferential direction, and the transmission gear is configured to drive the clutch sleeve to rotate along a first rotation direction when rotating to abut against the clutch sleeve relative to the second worm in the first rotation direction, such that the expansion spring is rotated to retract radially by a frictional force of the first axial counterbore of the clutch sleeve on an outer circular surface of the expansion spring, thereby causing slippage in rotation of the clutch sleeve relative to the expansion spring and the second worm; and drive the clutch sleeve to rotate along a second rotation direction when rotating to abut against the clutch sleeve relative to the second worm in the second rotation direction opposite to the first rotation direction, such that the expansion spring is

rotated to expand radially by a frictional force of the first axial counterbore of the clutch sleeve against the outer circular surface of the expansion spring, thereby causing locking of the clutch sleeve relative to the expansion spring and the second worm to implement synchronous rotation.

[0006] In some embodiments, the transmission gear has a slot extending along an axial direction, an insert block which is axially insertable into the slot is provided at one end of the clutch sleeve away from the second worm; the insert block is rotatable relative to the slot, and a circumferential width of the insert block is smaller than a circumferential width of the slot to form the preset rotation clearance between the transmission gear and the clutch sleeve.

[0007] In some embodiments, the rotation angle control device further includes: a return torsion spring sleeved over the mandrel and located between the transmission gear and the clutch sleeve, wherein hooks at both ends of the return torsion spring are respectively buckled to a side wall of the slot and the insert block.

[0008] In some embodiments, the expansion spring is a right-handed expansion spring, where the first rotation direction is a counterclockwise direction, and the second rotation direction is a clockwise direction.

[0009] In some embodiments, the rotation angle control device further includes: a spacer sleeve located between the expansion spring and the mandrel, wherein an outer circular diameter of

the spacer sleeve is smaller than an inner hole size of the expansion spring presenting a retracting tendency, and an outer circular diameter of the spacer sleeve is also smaller than an inner hole size of the expansion spring after interference fitting.

[0010] In some embodiments, an axial length of the spacer sleeve is smaller than a sum of depths of the first axial counterbore and the second axial counterbore.

[0011] In some embodiments, the rotation angle control device further includes: a shaft sleeve with one end abutting against an end of the second worm, and another end having a clearance elimination cavity; and a clearance elimination spring sleeved into the clearance elimination cavity, wherein the shaft sleeve is sleeved on the mandrel, and connected to the mandrel through a buckle.

[0012] In some embodiments, the sleeve further includes a fifth through hole communicating with the clearance elimination cavity, an inner wall of the fifth through hole has an elastic clamping block that extends into the clearance elimination cavity, one side of the elastic clamping block facing the fifth through hole has a guiding bevel, and the mandrel has a clamping slot engaging with the elastic clamping block.

[0013] According to one aspect of the present disclosure, an automatic clearance adjuster is provided. The automatic clearance adjuster includes: a housing having a first through hole and a second through hole that communicate with each other,

and a mounting hole parallel to an axis of the first through hole and communicating with the first through hole and the second through hole; a worm gear disposed within the first through hole; a first worm disposed within the second through hole and engaging with the worm gear; a coil spring arranged at one end of the first worm; a clutch gear sleeved on another end of the first worm; a control disc assembly arranged at one end of the first through hole and including a gear ring; and the foregoing rotation angle control device, which is disposed within the mounting hole, wherein the transmission gear in the rotation angle control device engaging with the gear ring, and the second worm in the rotation angle control device engaging with the clutch gear.

[0014] In some embodiments, the control disc assembly further includes: a cover plate covering one side of the first through hole along an axial direction of the first through hole and shielding an opening of the mounting hole; and a control arm, wherein the control arm and the gear ring are respectively located on both sides of the cover plate, and fixedly connected to the gear ring, and wherein the control arm and the gear ring are rotatable synchronously relative to the cover plate.

[0015] In some embodiments, the mounting hole is a blind hole, the rotation angle control device further includes a shaft sleeve and a clearance elimination spring, and the shaft sleeve is sleeved on the second worm and connected to the mandrel through a buckle, wherein one end of the sleeve abuts against an end of the second worm, and another end of the sleeve has a clearance

elimination cavity; and one end of the clearance elimination spring abuts into the clearance elimination cavity, and another end of the clearance elimination spring abuts into the installation hole.

[0016] In some embodiments, the automatic clearance adjuster further includes: an upper cover and a lower cover respectively arranged at both ends of the second through hole along an axial direction.

[0017] In some embodiments, the housing further includes a fourth through hole communicating with the second through hole, and the automatic clearance adjuster further includes an oil nozzle within the fourth through hole and a dustproof cover covered on the oil nozzle.

[0018] In one aspect of the present disclosure, an automobile brake is provided. The automobile brake includes the foregoing automatic clearance adjuster.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The accompanying drawings, which constitute part of this specification, illustrate exemplary embodiments of the present disclosure, and together with this specification, serve to explain the principles of the present disclosure.

[0020] The present disclosure may be more clearly understood from the following detailed description with reference to the accompanying drawings, in which:

[0021] Fig. 1 is a schematic structural exploded view according to an embodiment of the automatic clearance adjuster of the present disclosure;

[0022] Fig. 2 is a schematic structural exploded view according to an embodiment of the rotation angle control device of the present disclosure;

[0023] Fig. 3 is a partial cross-sectional view of a mounting structure according to an embodiment of the rotation angle control device of the present disclosure;

[0024] Fig. 4 is a schematic view of an external structure according to an embodiment of the rotation angle control device of the present disclosure;

[0025] Fig. 5 is a cross-sectional view of the A-A section in Fig. 4;

[0026] Fig. 6 is a cross-sectional view of the B-B section in Fig. 4;

[0027] Fig. 7 is a structural view of a control disc assembly according to an embodiment of the automatic clearance adjuster

of the present disclosure;

[0028] Fig. 8 is a cross-sectional view of a shaft sleeve according to an embodiment of the rotation angle control device of the present disclosure.

[0029] It should be understood that the dimensions of the various parts shown in the accompanying drawings are not drawn according to the actual scale. In addition, the same or similar reference signs are used to denote the same or similar components.

DETAILED DESCRIPTION

[0030] Various exemplary embodiments of the present disclosure will now be described in detail with reference to the accompanying drawings. The description of the exemplary embodiments is merely illustrative and is in no way intended as a limitation to the present disclosure, its application or use. The present disclosure may be implemented in many different forms, which are not limited to the embodiments described herein. These embodiments are provided to make the present disclosure thorough and complete, and fully convey the scope of the present disclosure to those skilled in the art. It should be noticed that: relative arrangement of components and steps, material composition, numerical expressions, and numerical values set forth in these embodiments, unless specifically stated otherwise, should be explained as merely illustrative, and not as a limitation.

[0031] The words “first”, “second”, and similar words used in the present disclosure do not denote any order, quantity or importance, but merely serve to distinguish different parts. Such similar words as “including” or “containing” mean that the element preceding the word encompasses the elements enumerated after the word, and does not exclude the possibility of encompassing other elements as well. The terms "up", "down", “left”, “right”, or the like are used only to represent a relative positional relationship, and the relative positional relationship may be changed correspondingly if the absolute

position of the described object changes.

[0032] In the present disclosure, when it is described that a particular device is located between the first device and the second device, there may be an intermediate device between the particular device and the first device or the second device, and alternatively, there may be no intermediate device. When it is described that a particular device is connected to other devices, the particular device may be directly connected to said other devices without an intermediate device, and alternatively, may not be directly connected to said other devices but with an intermediate device.

[0033] All the terms (including technical and scientific terms) used in the present disclosure have the same meanings as understood by those skilled in the art of the present disclosure unless otherwise defined. It should also be understood that terms as defined in general dictionaries, unless explicitly defined herein, should be interpreted as having meanings that are consistent with their meanings in the context of the relevant art, and not to be interpreted in an idealized or extremely formalized sense.

[0034] Techniques, methods, and apparatus known to those of ordinary skill in the relevant art may not be discussed in detail, but where appropriate, these techniques, methods, and apparatuses should be considered as part of this specification.

[0035] In some related technologies, due to factors such as the strength of the unidirectional ratchet, N teeth (N typically

consists in 10-20 teeth) may be generally arranged in a circumferential direction as the adjustment transmission mechanism. When the rotation angle of the adjuster is greater than a set value, and the gear tooth meshing part of the unidirectional ratchet is driven to cross one tooth, rotation occurs during the brake return stroke and the adjusting mechanism is driven to compensate a clearance. When the rotation angle of the adjuster is greater than a set value, but not enough to drive the gear tooth meshing part of the unidirectional ratchet to mesh to the next tooth, it is only possible to compensate slowly by other mechanisms, which renders a lagging automatic adjustment action of the adjuster. For example, after an automobile is newly assembled with an automatic adjuster in which an initial clearance is adjusted, there is a need to step on the brake 30-60 feet to reach a set clearance. Moreover, after the adjuster is automatically adjusted, there is a great fluctuation in a brake clearance.

[0036] In view of this, the present disclosure provides a rotation angle control device, an automatic clearance adjuster and an automobile brake, which can realize an automatic adjustment action of the adjustment arm more rapidly and reliably.

[0037] As shown in Fig. 1, it is a schematic structural exploded view according to an embodiment of the automatic clearance adjuster of the present disclosure. Referring to Fig. 1, in some embodiments, the automatic clearance adjuster includes: a

housing 1, a worm gear 4, a first worm 5, a coil spring 6, a clutch gear 7, a control disc assembly and a rotation angle control device. The housing 1 has a first through hole 2 and a second through hole 3 communicating with each other, and a mounting hole 10 parallel to an axis of the first through hole 2 and communicating with the first through hole 2 and the second through hole 3.

[0038] The worm gear 4 is disposed within the first through hole 2, and the first worm 5 is disposed within the second through hole 3, and engaging with the worm gear 4. The coil spring 6 is arranged at one end of the first worm 5, and the clutch gear 7 is sleeved on another end of the first worm 5. The control disc assembly is arranged at one end of the first through hole 2, and includes a gear ring 9. The rotation angle control device is disposed within the mounting hole 10.

[0039] As shown in Fig. 2, it is a schematic structural exploded view according to an embodiment of the rotation angle control device of the present disclosure. Referring to Fig. 2 in conjunction with Figs. 3 to 6, in some embodiments, the rotation angle control device includes: a mandrel 12, a transmission gear 13, a clutch sleeve 15, a second worm 18 and an expansion spring 16. The transmission gear 13 is sleeved on the mandrel 12, and may mesh with the gear ring 9. The clutch sleeve 15 is sleeved on the mandrel 12, and includes a first axial counterbore 141 in an end surface located on one side of the clutch sleeve 15 away from the transmission gear 13. The second worm 18 is sleeved

on the mandrel 12, and includes a second axial counterbore 161 in an end surface of the second worm 18 adjacent to the transmission gear 13. The expansion spring 16 is sleeved over the mandrel 12, and has an outer circular surface that is in interference fit with the inner hole surfaces of the first axial counterbore 141 and the second axial counterbore 161. The second worm 18 may mesh with the clutch gear 7.

[0040] In the present embodiment, the outer circular surfaces at both ends of the expansion spring 16 are respectively in interference fit with the inner hole surfaces of the first axial counterbore 141 of the clutch sleeve 15 and the second axial counterbore 161 of the second worm 18. In this way, the outer circular surface of the expansion spring 16 respectively forms friction pairs with the inner hole surfaces of the first axial counterbore 141 and the second axial counterbore 161, thereby forming a torsion spring clutch mechanism.

[0041] When the second worm 18 is fixed, and the clutch sleeve 15 has a tendency to rotate in a first rotation direction (for example, counterclockwise direction), the expansion spring 16 presents a tendency to deform towards a retracting direction under the action of a frictional force, so as to reduce a pressure of the friction pair, so that the clutch sleeve 15 can rotate relative to the second worm 18 against the frictional force. When the second worm 18 is fixed, and the clutch sleeve 15 has a tendency to rotate in a second rotation direction (for example, clockwise direction) opposite to the first rotation direction,

the expansion spring 16 presents a tendency to expand outwards under the action of a frictional force, so as to increase a pressure of the friction pair as the rotation torque of the clutch sleeve 15 in a second rotation direction increases, so that the clutch sleeve 15 is limited by a frictional force to be in locked state with the expansion spring 16 and the second worm 18 without relative rotation. At this time, the expansion spring 16 acts as a unidirectional clutch during the entire process.

[0042] Compared with the related technology using a unidirectional ratchet, in the present embodiment, the expansion spring 16 is used as an unidirectional clutch, which can implement infinitely equal division in a circumferential direction, thereby achieving faster stepless adjustment and avoiding the problem of a lagging automatic adjustment function in the related technology, thus ensuring driving safety. Moreover, after the adjuster is automatically adjusted, there is a small fluctuation in a brake clearance.

[0043] Compared with the related technology using a wrap spring, the expansion spring of the embodiment presents an outward tension tendency when locked. With such an extension trend, it is possible to increase a frictional force between the expansion spring and the inner hole surfaces of the first axial counterbore and the second axial counterbore, thereby realizing a self-locking effect. In other words, by way of a frictional fit between the expansion spring and the axial counterbore, it is possible to achieve a greater locking force as compared to the

wrap spring, so as to transmit a greater torque and avoid a slippage failure, thereby ensuring that the automatic adjustment function of the adjuster does not fail, and thus ensuring driving safety.

[0044] Referring to Fig. 6, in some embodiments, there is a preset rotation clearance α between the transmission gear 13 and the clutch sleeve 15 in a circumferential direction. When the transmission gear 13 can rotate relative to the second worm 18 to abut against the clutch sleeve 15 in a first rotation direction, the clutch sleeve 15 is driven to rotate along the first rotation direction such that the expansion spring 16 is rotated by a frictional force of the first axial counterbore 141 of the clutch sleeve 15 on the outer circular surface of the expansion spring 16 so as to retract radially, thereby causing slippage in rotation of the clutch sleeve 15 relative to the expansion spring 16 and the second worm 18.

[0045] When the transmission gear 13 rotates relative to the second worm 18 in a second rotation direction opposite to the first rotation direction to abut against the clutch sleeve 15, the transmission gear 13 can also drive the clutch sleeve 15 to rotate along the second rotation direction such that the expansion spring 16 is rotated by a frictional force of the first axial counterbore 141 of the clutch sleeve 15 on the outer circular surface of the expansion spring 16 so as to expand radially, thereby causing locking of the clutch sleeve 15 relative to the expansion spring 16 and the second worm 18 to

implement synchronous rotation.

[0046] In some embodiments, the expansion spring 16 is a right-handed expansion spring, wherein the first rotation direction is a counterclockwise direction, and the second rotation direction is a clockwise direction. For example, when an automobile performs a braking action, the gear ring 9 drives the transmission gear 13 to rotate counterclockwise. After the transmission gear 13 rotates by a preset rotation clearance α, the transmission gear 13 will drive the clutch sleeve 15 to rotate counterclockwise, and the expansion spring 16 presents a tendency to deform towards a retraction direction under the action of a frictional force. The pressure of the friction pair formed by the inner hole surface of the clutch sleeve 15 and the outer circular surface of the expansion spring 16 decreases, and the frictional force decreases accordingly. The clutch sleeve 15 rotates relative to the second worm 18 against the frictional force, and the rotation angle is the rotation angle of the clutch sleeve 15 minus the preset rotation clearance α.

[0047] When the automobile is returned to original position after the braking action is completed, the gear ring 9 drives the transmission gear 13 to rotate clockwise. After the transmission gear 13 rotates by the preset rotation clearance α, the transmission gear 13 will drive the clutch sleeve 15 to rotate clockwise, and the expansion spring 16 presents a tendency to deform towards an expansion direction under the action of a frictional force. The clutch sleeve 15 which is limited by

friction is locked with the expansion spring 16 and the second worm 18 to form an integral rigid structure. At this time, the clutch sleeve 15 drives the second worm 18 to rotate clockwise to eliminate an over-rotation angle exceeding the set value α°.

[0048] Referring to Figs. 2, 3 and 5, in some embodiments, the rotation angle control device further includes a spacer sleeve 17. The spacer sleeve 17 is located between the expansion spring 16 and the mandrel 12, and the outer circular diameter of the spacer sleeve 17 is smaller than the inner hole size of the expansion spring 16 presenting a retracting tendency. Correspondingly, the outer circular diameter of the spacer sleeve 17 is also smaller than the inner hole size of the expansion spring 16 after interference assembly.

[0049] The spacer sleeve 17 located between the expansion spring 16 and the mandrel 12 may maintain a coaxial relationship among the clutch sleeve 15, the expansion spring 16 and the second worm 18 when the clutch sleeve 15, the expansion spring 16 and the second worm 18 are locked and under stress, to produce the effect of limiting the expansion spring 16 and reduce the risk of misalignment between the clutch sleeve 15 and the second worm 18 caused by excessive tangential deformation of the expansion spring 16, thereby effectively improving the service life of the product.

[0050] In some embodiments, the axial length of the spacer sleeve 17 is smaller than the sum of the depths of the first axial counterbore 141 and the second axial counterbore 161, so as not

to limit the axial positions between the clutch sleeve 15 and the second worm 18.

[0051] Referring to Figs. 5 and 6, in some embodiments, the transmission gear 13 includes a slot 13a extending along an axial direction, and an insert block 15a which is axially insertable into the slot 13a is provided at one end of the clutch sleeve 15 away from the second worm 18. The insert block 15a is rotatable relative to the slot 13a, and a circumferential width of the insert block 15a is smaller than a circumferential width of the slot 13a to form the preset rotation clearance between the transmission gear 13 and the clutch sleeve 15.

[0052] The numbers of the slot 13a of the transmission gear 13 and the insert block 15a of the clutch sleeve 15 may be one or more respectively. Alternatively, the numbers of the slot 13a and the insert block 15a are both two, and the matching structure including two slots 13a and two insert blocks 15a can achieve a greater bearing capacity between the transmission gear 13 and the clutch sleeve 15 and make a more reliable structure.

[0053] In Fig. 6, the slot 13a has a first side wall 171 and a second side wall 172. When the transmission gear 13 rotates by α° clockwise, the first side wall 171 abuts against the side wall of the insert block 15a of the clutch sleeve 15, and the transmission gear 13 drives the clutch sleeve 15 to rotate clockwise. Then, when the transmission gear 13 further rotates by α° counterclockwise, the second side wall 172 abuts against the side wall of the insert block 15a of the clutch sleeve 15,

and the transmission gear 13 drives the clutch sleeve 15 to rotate counterclockwise.

[0054] Referring to Figs. 2 to 6, in some embodiments, the rotation angle control device further includes a return torsion spring 14. The return torsion spring 14 is sleeved over the mandrel 12 and located between the transmission gear 13 and the clutch sleeve 15. The hooks at both ends of the return torsion spring 14 are respectively buckled to the side wall of the slot 13a and the insert block 15a, so that the return torsion spring 14 can maintain the transmission gear 13 and the clutch sleeve 15 at set positions in a state where the transmission gear 13 and the clutch sleeve 15 do not receive an external force.

[0055] Referring to Figs. 3 to 5 and 8, in some embodiments, the rotation angle control device further includes a shaft sleeve 19 and a clearance elimination spring 20. One end of the shaft sleeve 19 abuts against the end of the second worm 18, and another end of the shaft sleeve 19 has a clearance elimination cavity 19a. The clearance elimination spring 20 is sleeved into the clearance elimination cavity 19a. The shaft sleeve 19 is sleeved on the mandrel 12, and connected to the mandrel 12 through a buckle.

[0056] In Fig. 8, the shaft sleeve 19 further includes a fifth through hole 28 that communicating with the clearance elimination cavity 19a, and the inner wall of the fifth through hole 28 has an elastic clamping block 29 that extends into the clearance elimination cavity 19a. One side of the elastic

clamping block 29 facing the fifth through hole 28 has a guiding bevel 31, and the mandrel 12 has a clamping slot 30 engaging with the elastic clamping block 29.

[0057] During the assembling, the front end of the mandrel 12 passes through the transmission gear 13, the return torsion spring 14, the clutch sleeve 15, the expansion spring 16, the spacer sleeve 17, the second worm 18 and the fifth through hole 28 successively to embed the elastic block 29 into the clamping slot 30 of the mandrel 12, so as to make the assembling simple and convenient. In order to make a more solid installation between the shaft sleeve 19 and the mandrel 12, the shaft sleeve 19 may have a plurality of elastic clamping blocks 29. The clamping slot 30 may be a circular clamping slot.

[0058] Referring to Figs. 1 and 7, in some embodiments, the control disc assembly in the automatic clearance adjuster may further include a cover plate 22 and a control arm 8. The cover plate 22 covers one side of the first through hole 2 along an axial direction of the first through hole 2 and shields an opening of the mounting hole 10. The mounting hole 10 may be a stepped hole, and the mounting hole 10 is shielded on a single side by the cover plate 22 to facilitate machining the mounting hole 10, reduce the production cost, and achieve the waterproof and dustproof effect.

[0059] The control arm 8 and the gear ring 9 are respectively located on both sides of the cover plate 22 and fixedly connected to the gear ring 9 (such as riveting or the like). The control

arm 8 and the gear ring 9 may rotate synchronously relative to the cover plate 22. One end of the clearance elimination spring 20 mentioned previously may abut into the clearance elimination cavity 19a and another end of the clearance elimination spring 20 mentioned previously may abut into the mounting hole 10.

[0060] Referring to Fig. 1, in some embodiments, the automatic clearance adjuster further includes: an upper cover 23 and a lower cover 24 respectively arranged at both ends of the second through hole 3 along an axial direction. The upper cover 23 and the lower cover 24 can produce the effect of sealing both ends of the second through hole 3. In addition, the housing 1 further includes a fourth through hole communicating with the second through hole 3, and the automatic clearance adjuster further includes an oil nozzle 25 located within the fourth through hole and a dustproof cover 26 covered on the oil nozzle 25. Lubricating oil or the like may be injected into the housing 1 through the oil nozzle 25 to reduce wear, improve the performance, and prolong the service life.

[0061] Various embodiments of the above-described automatic clearance adjuster may be applied to an automobile brake. Therefore, the present disclosure also provides an automobile brake including any of the foregoing automatic clearance adjuster.

[0062] Hereto, various embodiments of the present disclosure have been described in detail. Some details well known in the art are not described to avoid obscuring the concept of the

present disclosure. According to the above description, those skilled in the art would fully know how to implement the technical solutions disclosed herein.

[0063] Although some specific embodiments of the present disclosure have been described in detail by way of examples, those skilled in the art should understand that the above examples are only for the purpose of illustration and are not intended to limit the scope of the present disclosure. It should be understood by those skilled in the art that modifications to the above embodiments and equivalently substitution of part of the technical features may be made without departing from the scope and spirit of the present disclosure. The scope of the present disclosure is defined by the appended claims.

Claims

1. A rotation angle control device, comprising:

a mandrel (12);

a transmission gear (13) sleeved on the mandrel (12);

a clutch sleeve (15) sleeved on the mandrel (12) and having a first axial counterbore (141) in an end surface located on one side of the clutch sleeve (15) away from the transmission gear (13);

a second worm (18) sleeved on the mandrel (12) and having a second axial counterbore (161) in an end surface located on one side of the second worm (18) adjacent to the transmission gear (13); and

an expansion spring (16) sleeved over the mandrel (12) and having an outer circular surface in interfere fit with inner hole surfaces of the first axial counterbore (141) and the second axial counterbore (161),

wherein the rotation angle control device further comprises:

a spacer sleeve (17) located between the expansion spring (16) and the mandrel (12), wherein an outer circular diameter of the spacer sleeve (17) is smaller than an inner hole size of the expansion spring (16) presenting a retracting tendency, and an outer circular diameter of the spacer sleeve (17) is also smaller than an inner hole size of the expansion spring (16) after interference fitting.

2. The rotation angle control device according to claim 1,

wherein there is a preset rotation clearance between the transmission gear (13) and the clutch sleeve (15) in a circumferential direction, and

the transmission gear (13) is configured to drive the clutch sleeve (15) to rotate along a first rotation direction when rotating to abut against the clutch sleeve (15) relative to the second worm (18) in the first rotation direction, such that the expansion spring (16) is rotated to retract radially by a frictional force of the first axial counterbore (141) of the clutch sleeve (15) against an outer circular surface of the expansion spring (16), thereby causing slippage in rotation of the clutch sleeve (15) relative to the expansion spring (16) and the second worm (18); and

drive the clutch sleeve (15) to rotate along a second rotation direction when rotating to abut against the clutch sleeve (15) relative to the second worm (18) in the second rotation direction opposite to the first rotation direction, such that the expansion spring (16) is rotated to expand radially by a frictional force of the first axial counterbore (141) of the clutch sleeve (15) against the outer circular surface of the expansion spring (16), thereby causing locking of the clutch sleeve (15) relative to the expansion spring (16) and the second worm (18) to implement synchronous rotation.

3. The rotation angle control device according to claim 2, wherein the transmission gear (13) has a slot (13a) extending along an axial direction, an insert block (15a) which is axially

insertable into the slot (13a) is provided at one end of the clutch sleeve (15) away from the second worm (18), the insert block (15a) is rotatable relative to the slot (13a), and a circumferential width of the insert block (15a) is smaller than a circumferential width of the slot (13a) to form the preset rotation clearance between the transmission gear (13) and the clutch sleeve (15).

4. The rotation angle control device according to claim 3, further comprising:

a return torsion spring (14) sleeved over the mandrel (12) and located between the transmission gear (13) and the clutch sleeve (15), wherein hooks at both ends of the return torsion spring (14) are respectively buckled to a side wall of the slot (13a) and the insert block (15a).

5. The rotation angle control device according to claim 1, wherein the expansion spring (16) is a right-handed expansion spring, where the first rotation direction is a counterclockwise direction, and the second rotation direction is a clockwise direction.

6. The rotation angle control device according to claim 1, wherein an axial length of the spacer sleeve (17) is smaller than a sum of depths of the first axial counterbore (141) and the second axial counterbore (161).

7. The rotation angle control device according to claim 1, further comprising:

a shaft sleeve (19) with one end abutting against an end of the second worm (18), and another end having a clearance

elimination cavity (19a); and

a clearance elimination spring (20) sleeved into the clearance elimination cavity (19a),

wherein the shaft sleeve (19) is sleeved on the mandrel (12), and connected to the mandrel (12) through a buckle.

8. The rotation angle control device according to claim 7, wherein the sleeve (19) further comprises a fifth through hole (28) communicating with the clearance elimination cavity (19a), an inner wall of the fifth through hole (28) has an elastic clamping block (29) that extends into the clearance elimination cavity (19a), one side of the elastic clamping block (29) facing the fifth through hole (28) has a guiding bevel (31), and the mandrel (12) has a clamping slot (30) engaging with the elastic clamping block (29).

9. An automatic clearance adjuster, comprising:

a housing (1) having a first through hole (2) and a second through hole (3) that communicate with each other, and a mounting hole (10) parallel to an axis of the first through hole (2) and communicating with the first through hole (2) and the second through hole (3);

a worm gear (4) disposed within the first through hole (2);

a first worm (5) disposed within the second through hole (3) and engaging with the worm gear (4);

a coil spring (6) arranged at one end of the first worm (5);

a clutch gear (7) sleeved on another end of the first worm (5);

a control disc assembly arranged at one end of the first through hole (2) and comprising a gear ring (9); and

the rotation angle control device according to any one of claims 1-8, which is disposed within the mounting hole (10),

wherein the transmission gear (13) in the rotation angle control device engages with the gear ring (9), and the second worm (18) in the rotation angle control device engages with the clutch gear (7).

10. The automatic clearance adjuster according to claim 9, wherein the control disc assembly further comprises:

a cover plate (22) covering one side of the first through hole (2) along an axial direction of the first through hole (2) and shielding an opening of the mounting hole (10); and

a control arm (8), wherein the control arm (8) and the gear ring (9) are respectively located on both sides of the cover plate (22), and fixedly connected to the gear ring (9), and

wherein the control arm (8) and the gear ring (9) are rotatable synchronously relative to the cover plate (22).

11. The automatic clearance adjuster according to claim 9, wherein the mounting hole (10) is a blind hole, the rotation angle control device further comprises a shaft sleeve (19) and a clearance elimination spring (20), and the shaft sleeve (19) is sleeved on the second worm (18) and connected to the mandrel (12) through a buckle, wherein one end of the sleeve (19) abuts against an end of the second worm (18), and another end of the sleeve (19) has a clearance elimination cavity (19a); and one end of

the clearance elimination spring (20) abuts into the clearance elimination cavity (19a), and another end of the clearance elimination spring (20) abuts into the installation hole (10).

12. The automatic clearance adjuster according to claim 9, further comprising:

an upper cover (23) and a lower cover (24) respectively arranged at both ends of the second through hole (3) along an axial direction.

13. The automatic clearance adjuster according to claim 9, wherein the housing further comprises a fourth through hole communicating with the second through hole (3), and the automatic clearance adjuster further comprises an oil nozzle (25) within the fourth through hole and a dustproof cover (26) covered on the oil nozzle (25).

14. An automobile brake comprising the automatic clearance adjuster according to any one of claims 9-13.