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Hinge Mechanism and Terminal Device

Abstract

A hinge mechanism includes a base, a swing arm assembly, an elastic piece, and a first cam structure. The swing arm assembly includes a bearing member, a pair of swing arms, and an even number of gears. The even number of gears are in transmission connection between the pair of swing arms, and the bearing member is fastened to the base in an axial direction relative to the gears. An elastic piece is configured to apply an elastic force to the bearing member and/or the gears. A first cam structure is disposed between first end faces of the gears and the bearing member, and includes a first protrusion part and a second protrusion part disposed on the bearing member and/or the first end faces.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This is a continuation of International Patent Application No. PCT/CN2023/123238, filed on Oct. 7, 2023, which claims priority to Chinese Patent Application No. 202310185102.4, filed on Feb. 16, 2023. The disclosures of the aforementioned applications are hereby incorporated by reference in their entireties.

TECHNICAL FIELD
[0002] This disclosure relates to the field of terminal device technologies, and in particular, to a hinge mechanism and a terminal device.
BACKGROUND
[0003] With development of technologies, terminal devices change greatly in forms. The terminal devices such as a foldable mobile phone, a foldable tablet computer, and a foldable wearable device gradually become an important development direction of future intelligent terminal devices.
[0004] To keep the terminal device in a folded state and avoid unfolding the terminal device in a transportation or carrying process, a designer in some instances designs a locking structure on the terminal device, so that the terminal device remains in the folded state. The locking structure needs to be unlocked first to unfold the terminal device for use.
[0005] To facilitate unfolding of the terminal device after the locking structure is unlocked, a terminal device in some technologies is provided with a torsion spring in a hinge mechanism. As the hinge mechanism moves toward a folding position, the torsion spring deforms to store elastic potential energy. After the locking structure is unlocked, the terminal device is ejected at an angle under an action of the torsion spring. However, in a process of moving the hinge mechanism toward the folding position, the torsion spring deforms greatly, and a change amplitude of a reaction force exerted on the torsion spring is large. As a result, a service life of the torsion spring is affected. As a quantity of folding and unfolding times of the terminal device increases, elasticity of the torsion spring is weakened, affecting stability of an ejecting angle of a housing of the terminal device.
SUMMARY
[0006] Embodiments of this disclosure provide a hinge mechanism and a terminal device, to resolve a problem that stability of an ejecting angle of a hinge mechanism is poor after a locking structure of a terminal device is unlocked.
[0007] To achieve the foregoing objective, the following technical solutions are used in embodiments of this disclosure.
[0008] According to a first aspect, an embodiment provides a hinge mechanism, including a base, a swing arm assembly, an elastic piece, and a first cam structure. The swing arm assembly includes a bearing member, a pair of swing arms that are rotatably connected to edges of two opposite sides of the base, and an even number of gears, where the even number of gears are in transmission connection between the pair of swing arms for each swing arm to be synchronously rotatable relative to the base between a folding position and an unfolding position, the bearing member and the gear are arranged in an axial direction of the gear, and the bearing member is fastened relative to the base in a circumferential direction of the gear. The elastic piece is configured to apply an elastic force to at least one of the bearing member and the gear for the bearing member to be close to the gear. The first cam structure is disposed between a first end face of the gear and the bearing

member, and includes a first protrusion part disposed on one of the bearing member and the first end face, and a second protrusion part disposed on the other of the bearing member and the first end face, where the first protrusion part includes a first side surface. When the swing arm is at the folding position, the second protrusion part abuts against the first side surface, and under an action of the elastic force, the second protrusion part and the first side surface move relative to each other or have a trend of moving relative to each other, to apply, to the gear, an action force for driving the swing arm to rotate toward the unfolding position.

[0009] According to the hinge mechanism in this embodiment, the elastic piece applies the elastic force to at least one of the bearing member and the gear, so that the bearing member approaches the gear, to ensure that the second protrusion part can abut against the first side surface. In this way, in a process in which the swing arm rotates from the folding position to the unfolding position, a deformation amplitude of the elastic piece is determined by relative displacements of the first protrusion part and the second protrusion part in the axial direction of the gear, that is, the deformation amplitude of the elastic piece is determined by a height of the first protrusion part. Because the height of the first protrusion part is smaller than a rotation displacement of the swing arm relative to the base, a problem that the deformation amplitude of the elastic piece is large can be avoided, and a reaction force on the elastic piece can be reduced. This helps prolong a life of the elastic piece, and ensures stability of an ejecting angle of housings of the terminal device. In addition, according to the hinge mechanism in this embodiment, an action force generated by the first cam structure when the swing arm is at the folding position may be synchronously transferred to the pair of swing arms in the swing arm assembly through the even number of gears. In this way, an ejection force on the pair of swing arms is the same, so that stability of the pair of swing arms in an ejection process can be improved, and the pair of swing arms can be elastically ejected at a same angle.

[0010] In some embodiments, there is a plurality of first protrusion parts, the plurality of first protrusion parts is arranged in the circumferential direction of the gear, a first notch is formed between two adjacent first protrusion parts, and when the swing arm is at the folding position and the unfolding position, the second protrusion part extends into a same first notch. In this way, the deformation amplitude of the elastic piece can be smaller, to further prolong the service life of the elastic piece.

[0011] In some embodiments, a first bottom surface is disposed in the first notch, the first bottom surface is perpendicular to the axial direction of the gear, and when the swing arm is at the unfolding position, the second protrusion part abuts against the first bottom surface. In this way, stability of relative positions between the second protrusion part and the first protrusion part can be ensured, so that stability of the terminal device in an unfolded state can be ensured.

[0012] In some embodiments, the first protrusion part includes a second side surface, in the circumferential direction of the gear, the second side surface is disposed opposite to the first side surface, an inclination angle of the second side surface relative to the axial direction of the gear is less than an inclination angle of the first side surface relative to the axial direction of the gear, and the second side surface is connected to a first side surface of an adjacent first protrusion part through the first bottom surface. In this way, abrasion of the first protrusion part in a motion process can be reduced, and a service life of a product can be prolonged.

[0013] In some embodiments, when the swing arm is at the folding position, the second protrusion part is in surface contact with the first side surface. In this way, a probability of damage between the first protrusion part and the second protrusion part is reduced.

[0014] In some embodiments, when the swing arm is at the unfolding position, the second protrusion part is in surface contact with the first bottom surface. In this way, shake of the swing arm at the unfolding position can be reduced.

[0015] In some embodiments, there is a plurality of first protrusion parts, and the plurality of first protrusion parts is arranged in the circumferential direction of the gear; and when the swing arm is

at the folding position, the second protrusion part abuts against a first side surface of one first protrusion part; or when the swing arm is at the unfolding position, the second protrusion part abuts against a first side surface of another first protrusion part. In this way, the terminal device can have dual functions of self-ejecting in a folded state and keeping a stable unfolded state through the first cam structure, so that a layout of the cam structure is more compact.

[0016] In some embodiments, the first protrusion part includes a second side surface, in the circumferential direction of the gear, the second side surface is disposed opposite to the first side surface, and an inclination angle of the second side surface relative to the axial direction of the gear is greater than an inclination angle of the first side surface relative to the axial direction of the gear. In this way, resistance of the second protrusion part in a case in which the second protrusion part "climbs" along the second side surface is reduced, so that the swing arm can smoothly rotate from the folding position to the unfolding position.

[0017] In some embodiments, in the circumferential direction of the gear, a center angle corresponding to a distance between first side surfaces of two adjacent first protrusion parts is 90 degrees. In this way, a quantity of first protrusion parts crossed by the second protrusion parts can be reduced, to reduce the rotation resistance of the swing arm.

[0018] In some embodiments, in the swing arm assembly, the first cam structure is disposed between each gear and the bearing member. In this way, a larger torque may be generated to drive the swing arm to rotate toward the unfolding position.

[0019] In some embodiments, two outermost gears are fastened to corresponding swing arms, a gear other than the two outermost gears is slidably connected to the base in the axial direction of the gear, and the first cam structure is disposed between the gear and the bearing member. In this way, the swing arm can be more stable in a process of rotating relative to the base.

[0020] In some embodiments, in the swing arm assembly, bearing members are respectively disposed on two sides of the gear, the gear has two first end faces disposed opposite to each other, and the first cam structure is disposed between each first end face and a bearing member on a corresponding side. In this way, when the swing arm is at the folding position, first cam structures on the two sides of the gear may generate a larger ejection force, so that the hinge mechanism can be adapted to a terminal device that needs a large torque to eject.

[0021] In some embodiments, the hinge mechanism further includes a second cam structure disposed between a second end face of the gear and the bearing member, where the second cam structure includes a third protrusion part disposed on one of the bearing member and the second end face and a fourth protrusion part disposed on the other of the bearing member and the second end face, where the third protrusion part includes a third side surface. When the swing arm is at the unfolding position, the fourth protrusion part abuts against the third side surface, and under the action of the elastic force of the elastic piece, the fourth protrusion part and the third side surface have a trend of moving relative to each other, to apply, to the gear, an action force for preventing the swing arm from rotating in a direction close to the folding position. In this way, the terminal device can be stably kept in the unfolded state.

[0022] In some embodiments, the third protrusion part includes a fourth side surface, in the circumferential direction of the gear, the fourth side surface is disposed opposite to the third side surface, and an inclination angle of the fourth side surface relative to the axial direction of the gear is greater than an inclination angle of the third side surface relative to the axial direction of the gear. In this way, resistance of the fourth protrusion part in a case in which the fourth protrusion part "climbs" along the fourth side surface is reduced, so that the swing arm can smoothly rotate from the folding position to the unfolding position.

[0023] In some embodiments, there is a plurality of third protrusion parts, the plurality of third protrusion parts is arranged in the circumferential direction of the gear, a second notch is formed between two adjacent third protrusion parts, a first positioning part is disposed in the second notch, and when the swing arm is at the folding position, the first positioning part positions the fourth

protrusion part. In this way, shake of the swing arm at the folding position can be reduced, so that stability of the terminal device in the folded state can be ensured.

[0024] In some embodiments, the first positioning part includes a first positioning surface perpendicular to the axial direction of the gear, and when the swing arm is at the folding position, the fourth protrusion part is in surface contact with the first positioning surface. This helps reduce processing difficulty, thereby helping reduce processing costs.

[0025] In some embodiments, in the swing arm assembly, bearing members are respectively disposed on two sides of the gear, the first end face and the second end face are respectively two end faces disposed opposite to each other of the gear, the first cam structure is disposed between the first end face and a bearing member on a corresponding side, and the second cam structure is disposed between the second end face and a bearing member on a corresponding side. In this way, the terminal device can implement dual functions of self-ejecting in the folded state and keeping a stable unfolded state through a same swing arm assembly.

[0026] In some embodiments, there is a plurality of swing arm assemblies, the plurality of swing arm assemblies is arranged in the axial direction of the gear, in a part of the swing arm assemblies, bearing members are respectively disposed on two sides of the gear, the gear has two second end faces disposed opposite to each other, and the second cam structure is disposed between each second end face and a bearing member on a corresponding side; and in the other part of the swing arm assemblies, bearing members are respectively disposed on two sides of the gear, the gear has two first end faces disposed opposite to each other, and the first cam structure is disposed between each first end face and a bearing member on a corresponding side. In this way, positive and negative directions of the gear do not need to be confirmed during assembling, so that the gear is conveniently assembled.

[0027] In some embodiments, in the swing arm assembly, the second cam structure is disposed between each gear and the bearing member. In this way, a large unfolding force can be generated to prevent the swing arm from rotating toward the folding position, so that the terminal device can be more stable in the unfolded state.

[0028] In some embodiments, two outermost gears are fastened to corresponding swing arms, a gear other than the two outermost gears is slidably connected to the base in the axial direction of the gear, and the second cam structure is disposed between the gear and the bearing member. In this way, the swing arm can be more stable in a process of rotating relative to the base.

[0029] In some embodiments, the hinge mechanism further includes a damping mechanism. The damping mechanism includes a first friction member and a second friction member. The first friction member is rotatably connected to the base, and the first friction member is connected to the swing arm via a connector for the first friction member and the swing arm to be synchronously rotatable relative to the base. The second friction member is disposed on the base, and is in contact with the first friction member. When the swing arm rotates between the folding position and the unfolding position, the second friction member is capable of rubbing against the first friction member, to apply a rotation damping force to the swing arm. In this way, when one of the first friction member and the second friction member is damaged, the first friction member or the second friction member can be replaced, so that the entire damping mechanism does not need to be replaced.

[0030] In some embodiments, there are a plurality of first friction members and a plurality of second friction members, the plurality of first friction members and the plurality of second friction members are arranged in the axial direction of the gear, a first gap is formed between two adjacent second friction members, and each first friction member is inserted into a corresponding first gap and is in contact with an adjacent second friction member. In this way, an amplitude of the rotation damping force can be conveniently adjusted by adjusting a friction force between the first friction member and the second friction member.

[0031] In some embodiments, the first friction member includes an elastic part, a flat hole is

provided on the elastic part, and a hole wall of the flat hole has a first flat surface in a circumferential direction of the flat hole. The second friction member is a flat shaft disposed on the base, the flat shaft is fastened relative to the base in a circumferential direction of the flat shaft, the flat shaft has a second flat surface and a third flat surface that are spaced from each other, and the flat shaft penetrates the flat hole. When the swing arm is at the folding position, the first flat surface is disposed opposite to the second flat surface; and when the swing arm is at the unfolding position, the first flat surface is disposed opposite to the third flat surface. In this way, the swing arm can be stably kept at the folding position and the unfolding position, so that stability of the terminal device in the folded state and the unfolded state can be ensured.

[0032] In some embodiments, when the swing arm is at the folding position, a second gap is provided between the first flat surface and the second flat surface. In this way, when the swing arm rotates to a position near the folding position, no friction is generated between the first friction member and the second friction member, so that the first cam structure can easily eject the housing of the terminal device.

[0033] In some embodiments, when the swing arm is at the unfolding position, a third gap is provided between the first flat surface and the third flat surface. In this way, when the swing arm rotates to a position near the folding position, no friction is generated between the first friction member and the second friction member, so that the second cam structure can keep the terminal device in the unfolded state.

[0034] In some embodiments, the elastic part is formed by the first friction member through an edge rolling process. This not only helps improve assembling efficiency of the damping mechanism, but also improves reliability of a connection between the elastic part and a body of the first friction member.

[0035] In some embodiments, the first friction member is a sheet-like structure, there is a plurality of first friction members, the plurality of first friction members is stacked, each first friction member is provided with a notch at the flat hole for breaking the hole wall of the flat hole, and the notches of the plurality of first friction members form a slot extending in an axial direction of the flat shaft. This helps reduce processing difficulty and costs of the flat hole of the elastic part.

[0036] In some embodiments, the swing arm is rotatably connected to the base through a rotating shaft, a torsion spring is sleeved on the rotating shaft, and a first connection arm of the torsion spring is connected to the swing arm. A stop part is disposed on the base, and when the swing arm is at the unfolding position, a second connection arm is separated from the stop part for the torsion spring to be in a natural state. When the swing arm rotates between a middle position and the folding position, the second connection arm of the torsion spring abuts against the stop part for the torsion spring to be in a force storage state, to apply, to the swing arm, the action force for driving the swing arm to rotate toward the unfolding position, where the middle position is a position between the folding position and the unfolding position in a rotation direction of the swing arm. In this way, a magnitude of a reaction force, to which the torsion spring is applied, of the swing arm and the stop part can be reduced, so that the service life of the torsion spring can be prolonged.

[0037] In some embodiments, an arc-shaped groove for the second connection arm to extend into is provided on the base, the arc-shaped groove extends in a circumferential direction of the rotating shaft, and a groove wall at an end of the arc-shaped groove is the stop part. In this way, the stop part has a simple structure, thereby helping reducing costs. In addition, shake of the second connection arm in a motion process may be further reduced, so that the second connection arm moves more stably.

[0038] In some embodiments, the stop part is a stop surface disposed on the base, and motion space for the second connection arm to swing is provided between the stop surface and the torsion spring. In this way, the stop part has a simple structure, thereby helping reducing costs.

[0039] According to a second aspect, an embodiment of this disclosure provides a terminal device, including a display, at least two housings, and the hinge mechanism according to the first aspect,

where the housing is configured to carry the display, the hinge mechanism is at a joint of two adjacent housings, and each swing arm of the swing arm assembly in the hinge mechanism is connected to a corresponding housing.
[0040] A technical effect achieved by the terminal device is the same as that achieved by the hinge mechanism in the first aspect. Details are not described herein again.

Description

BRIEF DESCRIPTION OF DRAWINGS
[0041] FIG. **1** is a diagram of a structure of a hinge mechanism of a terminal device (a notebook computer);
[0042] FIG. **2** is a diagram of a structure of a terminal device (a mobile phone) in an unfolded state according to some embodiments of this disclosure;
[0043] FIG. **3** is a diagram of a structure of the terminal device in FIG. **2** after removal of a display;
[0044] FIG. **4** is a diagram of a structure of the terminal device in FIG. **2** in a folded state;
[0045] FIG. **5** is a partially enlarged view of the terminal device in FIG. **3** at A;
[0046] FIG. **6** is a diagram of a structure of a hinge mechanism according to a first embodiment;
[0047] FIG. **7** is a sectional view of the hinge mechanism in FIG. **6** at M-M;
[0048] FIG. **8** is a diagram of a swing arm of the hinge mechanism in FIG. **7** at a folding position;
[0049] FIG. **9** is an exploded view of the hinge mechanism in FIG. **6**;
[0050] FIG. **10** is a B-direction view of the hinge mechanism in FIG. **7**;
[0051] FIG. **11** is a three-dimensional diagram of a swing arm of the hinge mechanism at a folding position according to the first embodiment;
[0052] FIG. **12** is a partially enlarged view of the hinge mechanism in FIG. **11** at C;
[0053] FIG. **13** is a three-dimensional diagram of the swing arm of the hinge mechanism at an unfolding position according to the first embodiment;
[0054] FIG. **14** is a partially enlarged view of the hinge mechanism in FIG. **13** at D;
[0055] FIG. **15** is a circumferentially expanded view of a first cam structure between each of four gears of a swing arm assembly and a bearing member in a case in which the swing arm is at different positions according to the first embodiment;
[0056] FIG. **16** is a circumferentially expanded view of a first cam structure between a rightmost gear and the bearing member in FIG. **15** in a case in which a swing arm is at different positions;
[0057] FIG. **17** is a diagram of a first cam structure disposed on a gear connected to the swing arm of the hinge mechanism according to the first embodiment;
[0058] FIG. **18** is a diagram of a structure of a first cam structure disposed on a bearing member in the hinge mechanism according to the first embodiment;
[0059] FIG. **19** is a circumferentially expanded view of a second cam structure between each of the four gears of the swing arm assembly and the bearing member in the case in which the swing arm is at the different positions according to the first embodiment;
[0060] FIG. **20** is a circumferentially expanded view of a second cam structure between a rightmost gear and the bearing member in FIG. **19** in a case in which a swing arm is at different positions;
[0061] FIG. **21** is a diagram of a second cam structure disposed on a gear connected to the swing arm of the hinge mechanism according to the first embodiment;
[0062] FIG. **22** is a diagram of a second cam structure disposed on the bearing member in the hinge mechanism according to the first embodiment;
[0063] FIG. **23** is a diagram of another structure of a second cam structure according to an embodiment;
[0064] FIG. **24** is a diagram of a swing arm of a hinge mechanism at an unfolding position according to a second embodiment;

[0065] FIG. **25** is a diagram of a swing arm of a hinge mechanism at an unfolding position according to a third embodiment;
[0066] FIG. **26** is a three-dimensional diagram of the swing arm of the hinge mechanism at a folding position according to the third embodiment;
[0067] FIG. **27** is a partially enlarged view of the hinge mechanism in FIG. **26** at E;
[0068] FIG. **28** is a three-dimensional diagram of the swing arm of the hinge mechanism at the unfolding position according to the third embodiment;
[0069] FIG. **29** is a partially enlarged view of the hinge mechanism in FIG. **28** at F;
[0070] FIG. **30** is a circumferentially expanded view of a first cam structure between each of four gears of a swing arm assembly and a bearing member in a case in which the swing arm is at different positions according to the third embodiment;
[0071] FIG. **31** is a circumferentially expanded view of a first cam structure between a rightmost gear and the bearing member in FIG. **30** in a case in which a swing arm is at different positions;
[0072] FIG. **32** is a diagram of a structure of a first cam structure disposed on the bearing member in the hinge mechanism according to the third embodiment;
[0073] FIG. **33** is an exploded view of a damping mechanism of the hinge mechanism shown in FIG. **28**;
[0074] FIG. **34** is a sectional view of a first friction member after removal of a connection frame from the hinge mechanism shown in FIG. **28**;
[0075] FIG. **35** is a sectional view of a first friction member after removal of a connection frame from the hinge mechanism shown in FIG. **26**;
[0076] FIG. **36** is diagram of another structure of a damping mechanism in a hinge mechanism according to an embodiment;
[0077] FIG. **37** is a diagram of a position relationship between a first friction member and a second friction member in a rotation process in FIG. **36**;
[0078] FIG. **38** is a partially enlarged view of a joint between the first friction member and the second friction member in FIG. **37**;
[0079] FIG. **39** is diagram of a third structure of a damping mechanism in a hinge mechanism according to an embodiment;
[0080] FIG. **40** is a diagram of a structure of a hinge mechanism according to some embodiments;
[0081] FIG. **41** is a partially enlarged view of a position of a torsion spring in the hinge mechanism shown in FIG. **40**;
[0082] FIG. **42** is a sectional view of the hinge mechanism in FIG. **40** at H-H;
[0083] FIG. **43** is a status diagram of a torsion spring in a rotation process of a swing arm according to an embodiment;
[0084] FIG. **44** is a sectional view of a base of a hinge mechanism at a position close to a torsion spring according to some embodiments; and
[0085] FIG. **45** is a position status diagram of a second connection arm of a torsion spring in a rotation process of a swing arm according to an embodiment.

DESCRIPTION OF EMBODIMENTS

[0086] The terms “first” and “second” in embodiments of this disclosure are merely intended for a purpose of description, and shall not be understood as an indication or implication of relative importance or implicit indication of a quantity of indicated technical features. Therefore, a feature limited by “first” or “second” may explicitly or implicitly include one or more features.
[0087] With development of technologies, terminal devices change greatly in forms. The terminal devices such as a foldable mobile phone, a foldable tablet computer, and a foldable wearable device gradually become an important development direction of future intelligent terminal devices.
[0088] When the terminal device is inactive, the terminal device is folded to be carried conveniently. To keep the terminal device in a folded state and avoid unfolding the terminal device in a transportation or carrying process, a designer may design a locking structure (for example, a

buckle or a magnetic attraction member) on the terminal device, so that the terminal device remains in the folded state. The locking structure needs to be unlocked first to unfold the terminal device for use.

[0089] In some terminal devices, an auxiliary unfolding structure like a buckle slot or a buckle slope is disposed on a housing, to facilitate unfolding of the terminal device after the locking structure is unlocked, so that a user unfolds the terminal device through the auxiliary unfolding structure. However, adding the auxiliary unfolding structure not only affects an appearance of the terminal device, but also occupies much space on the housing. Especially for a foldable mobile phone, generally, there is no sufficient space on the housing for design. This increases difficulty in designing the auxiliary unfolding structure.

[0090] To resolve a problem that much space is occupied for deposing the auxiliary unfolding structure on the housing, in some other terminal devices, the auxiliary unfolding structure is disposed in a hinge mechanism (also referred to as a hinge mechanism) of the terminal device. In this way, after the locking structure of the terminal device is unlocked, the terminal device automatically ejects to an angle through the auxiliary unfolding structure, to facilitate a subsequent unfolding operation of a user.

[0091] As shown in FIG. **1**, FIG. **1** is a diagram of an example of a structure of a hinge mechanism of a terminal device (a notebook computer). The hinge mechanism includes a base **06**, main pin shafts **030**, a pair of fastening pieces P**1**, and torsion springs **050**. The fastening pieces P**1** are configured to be fastened to housings of the terminal device. Each fastening piece P**1** is rotatably connected to the base **06** through the main pin shaft **030**, and the torsion spring **050** is sleeved on the main pin shaft **030**. A fixed end of the torsion spring **050** is inserted into an opening of the base **06**, and a force-applying end of the torsion spring **050** separately abuts against the fastening piece P**1**.

[0092] When the fastening piece P**1** rotates along with the main pin shaft **030** toward a folding position, the force-applying end of the torsion spring **050** is driven to rotate, so that the torsion spring **050** deforms. After the housings connected to the two fastening pieces P**1** are folded, the torsion spring **050** deforms to the maximum, and stores elastic potential energy. Therefore, after the locking structure is unlocked, the housings connected to the two fastening pieces P**1** are ejected to an angle under an action of the torsion spring **050**.

[0093] In the hinge mechanism, the housing of the terminal device is controlled to be ejected only by an elastic force of the torsion spring **050**. However, in a process in which the fastening piece P**1** rotates from an unfolding position to the folding position, the force-applying end of the torsion spring **050** rotates together with the fastening piece P**1** until the folding position. In this way, a deformation amplitude of the torsion spring **050** is large, and a change amplitude of a reaction force of the torsion spring **050** is large. As a result, a service life of the torsion spring **050** is affected to an extent. As a quantity of folding and unfolding times of the terminal device increases, elasticity of the torsion spring **050** is weakened, an elastic force applied to the fastening piece P**1** is reduced, and an angle of ejecting the housing of the terminal device is reduced, affecting stability of the angle of ejecting the housing of the terminal device.

[0094] In view of this, embodiments of this disclosure provide a hinge mechanism and a terminal device. A cam structure is disposed in the hinge mechanism, so that the cam structure can provide an ejection force when the terminal device is in a folded state, to resolve a problem that the hinge mechanism has poor ejecting angle stability after a locking structure of the terminal device is unlocked.

[0095] The terminal device in embodiments of this disclosure may be a foldable terminal device like a mobile phone, a tablet computer, a notebook computer, or a wearable device. The following uses a mobile phone as an example to describe an example of a structure of the hinge mechanism in the terminal device. For another terminal device, refer to the hinge mechanism in the mobile phone embodiment. Details are not described herein again.

[0096] As shown in FIG. **2**, FIG. **3**, and FIG. **4**, FIG. **2** is a diagram of a structure of a terminal device (a mobile phone) in an unfolded state according to some embodiments; FIG. **3** is a diagram of a structure of the terminal device in FIG. **2** after removal of a display **200**; and FIG. **4** is a diagram of a structure of the terminal device in FIG. **2** in a folded state.

[0097] The terminal device includes a hinge mechanism **100**, a display **200**, and two housings **300**. The housings **300** are configured to carry the display **200**. The hinge mechanism **100** is disposed at a joint of the two housings **300**, so that the two housings **300** may switch between the unfolded state (as shown in FIG. **2**) and the folded state (as shown in FIG. **4**).

[0098] The terminal device is not limited to being provided with two housings **300**, and may alternatively be provided with more than two housings **300**, for example, three or four housings **300**, which may be determined based on an actual situation. The hinge mechanism **100** is disposed at a joint of two adjacent housings **300**.

[0099] As shown in FIG. **2** and FIG. **3**, the housing **300** includes a housing bottom wall **310**, a housing side wall **320** disposed at an edge of the housing bottom wall **310**, and a rear cover **330** (also referred to as a battery cover) fastened on the housing side wall **320**. The housing bottom wall **310**, the housing side wall **320**, and the rear cover **330** jointly enclose disposing space, and components such as a battery and a circuit board are disposed in the disposing space. A display **200** is disposed on a side that is of the housing bottom wall **310** and that is away from the disposing space.

[0100] In some embodiments, as shown in FIG. **2** and FIG. **3**, the display **200** may be disposed on a surface that is of the housing bottom wall **310** and that is away from the disposing space. In some other embodiments, a first accommodating groove is provided on a surface that is of the housing bottom wall **310** and that is away from the disposing space, and the display **200** is disposed in the first accommodating groove provided on the housing bottom wall **310**.

[0101] The display **200** has a bendable performance, and may be bent and deformed after being applied with an external force. As shown in FIG. **3**, when the two housings **300** are in the unfolded state, the display **200** is unfolded, and a display area of the display **200** is exposed to display image information to a user. The display **200** includes a first display area **210**, a second display area **220**, and a third display area **230**. The first display area **210** covers the housing bottom wall **310** of one housing **300**, the second display area **220** covers the housing bottom wall **310** of the other housing **300**, and the third display area **230** covers the hinge mechanism **100**.

[0102] The entire display **200** may be of a flexible display structure. For example, the first display area **210**, the second display area **220**, and the third display area **230** of the display **200** are all of a flexible display structure. Alternatively, the display **200** may be of a flexible display structure in the middle foldable part, and a hard display structure on two sides. For example, the first display area **210** and the second display area **220** of the display **200** are of a hard display structure, and the third display area **230** is of a flexible display structure.

[0103] As shown in FIG. **4**, when the two housings **300** are in the folded state, the two housings **300** are stacked. In this case, the display **200** is folded between the two housings **300**. Therefore, the terminal device can be conveniently carried. The first display area **210** and the second display area **220** of the display **200** are stacked. The “stacked” herein means that the first display area **210** and the second display area **220** are stacked in a thickness direction, and the thickness directions of the first display area **210** and the second display area **220** are parallel or roughly parallel (for example, a deviation is within 10°). The first display area **210** and the second display area **220** that are stacked may be attached together, or there may be a gap between the first display area **210** and the second display area **220**. This is not limited herein.

[0104] As shown in FIG. **5** to FIG. **8**, FIG. **5** is a partially enlarged view of the terminal device in FIG. **3** at A; FIG. **6** is a diagram of a structure of the hinge mechanism **100** according to a first embodiment; FIG. **7** is a sectional view of the hinge mechanism **100** in FIG. **6** at M-M; and FIG. **8** is a diagram of a swing arm of the hinge mechanism **100** in FIG. **7** at a folding position.

[0105] The hinge mechanism **100** includes a base **1**, a swing arm assembly **2**, an elastic piece **3**, and a first cam structure **4**.
[0106] The swing arm assembly **2** includes a pair of swing arms **21** that are rotatably connected to edges of two opposite sides of the base **1**, and an even number of gears **22**. The even number of gears **22** are in transmission connection between the pair of swing arms **21**, so that each swing arm **21** can rotate synchronously relative to the base **1** between a folding position (as shown in FIG. **8**) and an unfolding position (as shown in FIG. **7**).
[0107] When the two housings **300** are in an unfolded state, the pair of swing arms **21** in the swing arm assembly **2** are both at the unfolding position. When the two housings **300** are in a folded state, the two swing arms **21** are both at the folding position. When the two housings **300** are switched to the folded state, the swing arms **21** correspondingly rotate toward the folding position relative to the base **1**. When the two housings **300** are switched to the unfolded state, the swing arms **21** correspondingly rotate toward the unfolding position relative to the base **1**.
[0108] In some embodiments, as shown in FIG. **7** and FIG. **8**, in the swing arm assembly **2**, there are four gears **22**, the four gears **22** are rotatably connected to the base **1**, and two adjacent gears **22** are engaged with each other. Two outermost gears **22** are respectively fastened to the corresponding swing arms **21**, so that the swing arms **21** can rotate relative to the base **1** on the folding position and the unfolding position.
[0109] The four gears **22** are in transmission connection between the pair of swing arms **21**. In this way, when one of the swing arms **21** rotates at an angle relative to the base **1**, the swing arm **21** may transfer power to the other swing arm **21** through the four gears **22**, so that the other swing arm **21** also rotates at a same angle relative to the base **1**, thereby implementing synchronous rotation of the pair of swing arms **21** in the swing arm assembly **2** relative to the base **1**.
[0110] A quantity of gears **22** in the swing arm assembly **2** is not limited to four, and may alternatively be two, six, eight, or the like, which may be determined based on an actual situation. When there are two gears **22**, each gear **22** is fastened to a corresponding swing arm **21**. The gear **22** fastened to the swing arm **21** may be of an integrated structure (as shown in FIG. **7** and FIG. **8**) with the swing arm **21**, or may be disposed separately from the swing arm **21**, which may be determined based on an actual situation.
[0111] The even number of gears **22** in the swing arm assembly **2** may be all incomplete gears **22**, or may be all complete gears **22**, or may be a combination of incomplete gears **22** and complete gears **22**. This is not limited herein. For example, as shown in FIG. **8**, in the four gears **22**, two outermost gears **22** are incomplete gears **22**, and two gears **22** located in the middle are complete gears **22**.
[0112] The incomplete gear **22** means that teeth and tooth grooves are distributed on a part of a circumferential surface of the gear **22** in a circumferential direction. The complete gear **22** means that teeth and tooth grooves are distributed on the entire circumferential surface of the gear **22** in the circumferential direction.
[0113] In some embodiments, as shown in FIG. **5** and FIG. **6**, the swing arm **21** is connected to a corresponding housing **300** through a connection frame **400**, the connection frame **400** is fastened to the housing **300**, and the swing arm **21** is slidably connected to the connection frame **400**. The swing arm **21** and the connection frame **400** are slidably connected, so that a degree of freedom of a mechanism formed by the housing **300**, the base **1**, and the swing arm **21** is 1, to ensure that the two housings **300** can be smoothly unfolded and folded.
[0114] The swing arm **21** and the connection frame **400** may be slidably connected through the following structure: In some embodiments, as shown in FIG. **6** and FIG. **9**, a sliding groove **410** is provided on the connection frame **400**, one end of the sliding groove **410** is disposed close to the base **1**, the other opposite end of the sliding groove **410** is disposed away from the base **1**, and the swing arm **21** slidably fits the sliding groove **410**. In some other embodiments, a sliding shaft may also be disposed on the swing arm **21**, a sliding hole is provided on the connection frame **400**, one

end of the sliding hole is provided close to the base **1**, the other opposite end of the sliding hole is provided away from the base **1**, and the sliding shaft slidably fits the sliding hole.

[0115] The swing arm **21** may be connected to the housing **300** through the connection frame **400** or may be slidably connected to the housing **300** directly. This may be determined based on an actual situation.

[0116] In some embodiments, as shown in FIG. **5**, FIG. **6**, and FIG. **9**, FIG. **9** is an exploded view of the hinge mechanism **100** in FIG. **6**. The base **1** includes a shaft cover **11**, and a base body **12** disposed on the shaft cover **11**. The base body **12** includes a first sub-base **13** and a second sub-base **14** that are spaced from each other, and a plurality of mounting shafts **15** disposed between the first sub-base **13** and the second sub-base **14**. The plurality of mounting shafts **15** are arranged in a width direction Y of the base **1**, and each mounting shaft **15** extends in a length direction X of the base **1**. One end of the mounting shaft **15** is connected to the first sub-base **13**, and the other end of the mounting shaft **15** is connected to the second sub-base **14**. The swing arm assembly **2** is disposed between the first sub-base **13** and the second sub-base **14**, and the gear **22** in the swing arm assembly **2** is rotatably sleeved on a corresponding mounting shaft **15**, to implement a rotatable connection between the gear **22** and the base **1**.

[0117] The length direction X of the base **1** is perpendicular to the width direction Y of the base **1**, and a thickness direction Z of the terminal device in the unfolded state. An axial direction X of the gear **22** in the swing arm assembly **2** is parallel to the length direction X of the base **1**.

[0118] The base body **12** in this embodiment is not limited to the structure including the sub-base **1** and the mounting shaft **15**. The base body **12** may alternatively be designed into a long-bar structure, and both the swing arm **21** and the gear **22** are rotatably connected to the base body **12** of the long-bar structure.

[0119] In some embodiments, as shown in FIG. **3** and FIG. **5**, two pairs of first sub-bases **13** and two pairs of second sub-bases **14** are respectively disposed, the two pairs of first sub-bases **13** and the two pairs of second sub-bases **14** are symmetrically distributed on two sides of a middle surface of the base **1** in the length direction X of the base **1**, and the swing arm assembly **2** is disposed between each pair of first sub-bases **13** and each pair of second sub-bases **14**. In this design, the swing arm assemblies **2** between the two pairs of first sub-bases **13** and the two pairs of second sub-bases **14** may be respectively located on two sides of the middle surface, so that the housing **300** of the terminal device is stressed in a balance manner in the length direction X of the base **1**, and the housing **300** of the terminal device is more stable in a process of switching between the folded state and the unfolded state.

[0120] In some embodiments, as shown in FIG. **3** and FIG. **5**, the shaft cover **11** has accommodating space **110**, the base body **12** is disposed in the accommodating space **110**, and the base body **12** is fastened to the shaft cover **11**. For example, the base body **12** may be fastened to the shaft cover **11** through a fastener like a screw.

[0121] As an appearance part (namely, an externally visible part) of the hinge mechanism **100**, the shaft cover **11** is configured to cover moving parts such as the swing arm **21** and the gear **22** in the hinge mechanism **100**, to avoid external interference to motion of the moving parts in the hinge mechanism **100**.

[0122] As shown in FIG. **3** and FIG. **5**, shielding parts **340** are disposed at a joint of the two housings **300**, and the shielding parts **340** are step-shaped. As shown in FIG. **3** and FIG. **5**, when the two housings **300** are in the unfolded state, the shaft cover **11** is located in a second accommodating groove **350** formed by the two shielding parts **340**. In this case, the shaft cover **11** is shielded by the shielding parts **340**, and the shaft cover **11** cannot be seen from the outside, so that an appearance of the terminal device at the joint of the two housings **300** in the unfolded state is ensured.

[0123] When the two housings **300** move from the unfolded state to the folded state, the two shielding parts **340** are gradually unfolded, and the shaft cover **11** is gradually exposed from the

two shielding parts **340**. As shown in FIG. **4**, when the two housings **300** are in the folded state, the shaft cover **11** is located in a gap formed by the two shielding parts **340**, and covers the gap, to prevent a moving part of the hinge mechanism **100** in the gap from being seen from the outside, so that an appearance of the terminal device at the joint of the two housings **300** in the folded state is ensured.

[0124] A structure of the shaft cover **11** is not unique. In some embodiments, as shown in FIG. **5**, the shaft cover **11** includes a shaft cover wall **111**, and the shaft cover wall **111** encloses accommodating space **110**. For example, as shown in FIG. **5**, the shaft cover wall **111** includes a shaft cover bottom wall **112**, and a shaft cover side wall **113** disposed at a peripheral edge of the shaft cover bottom wall **112**. The shaft cover bottom wall **112** and the shaft cover side wall **113** enclose the accommodating space **110**, and the accommodating space **110** may be a U-shaped groove, however, this is not limited thereto. The accommodating space **110** may alternatively be a trapezoidal groove, a semicircular groove, an arc-shaped groove, or the like.

[0125] In some other embodiments, the shaft cover wall **111** may be the foregoing structure or may be designed into a flat plate structure.

[0126] In some embodiments, as shown in FIG. **5**, an avoidance notch **1131** is provided on a position that is of the shaft cover **11** and that corresponds to the swing arm **21**. For example, the avoidance notch **1131** is provided on a position that is of the shaft cover side wall **113** and that corresponds to the swing arm **21**, and the avoidance notch **1131** is used to avoid the swing arm **21**, so as to avoid structural interference between the shaft cover **11** and the swing arm **21** at an unfolding position.

[0127] In some embodiments, as shown in FIG. **6** and FIG. **9**, the swing arm assembly **2** further includes a bearing member **23**. The bearing member **23** and the gear **22** are arranged in the axial direction X of the gear **22**, and the bearing member **23** is fastened relative to the base **1** in a circumferential direction of the gear **22**. The elastic piece **3** is configured to apply an elastic force F to at least one of the bearing member **23** and the gear **22**, so that the bearing member **23** approaches the gear **22**.

[0128] A structure of the elastic piece **3** is not unique. In some embodiments, as shown in FIG. **6** and FIG. **9**, the elastic piece **3** is a spring, and the spring is in a compressed state, and is sleeved on the mounting shaft **15**. One end of the spring applies the elastic force F to the gear **22**, so that the gear **22** approaches the bearing member **23**.

[0129] There may be one or more springs. As shown in FIG. **6**, each mounting shaft **15** is sleeved with a spring.

[0130] In some other embodiments, the elastic piece **3** may be a spring or another elastic component like an elastic sheet.

[0131] The elastic piece **3** may apply the elastic force F to the gear **22**, or may change a disposing position to apply the elastic force F to the bearing member **23** or apply the elastic force F to both the bearing member **23** and the gear **22** at the same time.

[0132] As shown in FIG. **10**, FIG. **10** is a B-direction view of the hinge mechanism **100** in FIG. **7**. The first cam structure **4** is disposed between the first end face **221** of the gear **22** and the bearing member **23**.

[0133] As shown in FIG. **11** to FIG. **16**, FIG. **11** is a three-dimensional diagram of the swing arm **21** of the hinge mechanism **100** at a folding position according to a first embodiment; FIG. **12** is a partially enlarged view of the hinge mechanism **100** at C in FIG. **11**; FIG. **13** is a three-dimensional diagram of the swing arm **21** of the hinge mechanism **100** at an unfolding position according to the first embodiment; FIG. **14** is a partially enlarged view of the hinge mechanism **100** at D in FIG. **13**; FIG. **15** is a circumferentially expanded view of the first cam structure **4** between each of four gears **22** of the swing arm assembly **2** and the bearing member **23** in a case in which the swing arm **21** is at different positions according to the first embodiment; and FIG. **16** is a circumferentially expanded view of the first cam structure **4** between the rightmost gear **22** and the bearing member

23 in FIG. **15** in a case in which the swing arm **21** is at different positions.

[0134] The first cam structure **4** includes a first protrusion part **41** disposed on the first end face **221** and a second protrusion part **42** disposed on the bearing member **23**, where the first protrusion part **41** includes a first side surface **411**. In some embodiments, as shown in FIG. **15** and FIG. **16**, the first side surface **411** may be an inclined surface, and the inclined surface is inclined relative to the axial direction X of the gear **22**. In some other embodiments, the first side surface **411** may alternatively be a bent curved surface, for example, an arched surface or a parabolic surface.

[0135] As shown in FIG. **12**, FIG. **15**, and FIG. **16**, when the swing arm **21** is at the folding position, the second protrusion part **42** abuts against the first side surface **411**. Under an action of an elastic force of the elastic piece **3**, a component force f**1** generated by an extrusion force between the second protrusion part **42** and the first side surface **411** causes the second protrusion part **42** to move relative to or have a tendency of moving relative to the first side surface **411**, so as to apply, to the gear **22**, an action force that can drive the swing arm **21** to rotate toward the unfolding position.

[0136] First, that two components abut against each other in this embodiment means that there is at least one of point contact, line contact, and surface contact between the two components.

[0137] Second, in this embodiment, a locking structure is disposed on the housing **300** of the terminal device, and the locking structure has a locked state and an unlocked state. When the locking structure is in the locked state, positions of the two housings **300** are locked, so that the two housings **300** are in a folded state. In this case, the second protrusion part **42** and the first side surface **411** are in a relatively static state, but under an action of the component force f**1** generated by the extrusion force between the second protrusion part **42** and the first side surface **411**, the second protrusion part **42** and the first side surface **411** have a tendency of moving relative to each other. For example, as shown in (a) in FIG. **16**, the gear **22** has a tendency of moving leftward relative to the bearing member **23**. When the locking structure is in the unlocked state, as shown in (a) in FIG. **16**, the second protrusion part **42** and the first side surface **411** move relative to each other under the action of the component force f**1**, so that the gear **22** rotates leftward relative to the bearing member **23** (in FIG. **16**, the gear **22** rotates leftward to drive the swing arm **21** to move in an unfolding direction, and the gear **22** rotates rightward to drive the swing arm **21** to move in a folding direction), so that the gear **22** drives the swing arm **21** to rotate toward the unfolding position, and the two housings **300** of the terminal device are ejected at an angle.

[0138] The locking structure may be one of a buckle structure and a magnetic attraction mechanism. The buckle structure includes an elastic buckle disposed on one housing **300** and a buckling hole provided on the other housing **300**. When the buckle structure is in a locked state, the elastic buckle may be separately buckled with the buckling hole, and the elastic buckle may be separated from the buckling hole under an external force, so that the buckle structure is in an unlocked state.

[0139] The magnetic attraction mechanism includes an electromagnet disposed on one housing **300** and a magnetic attraction component disposed on the other housing **300**. When the magnetic attraction mechanism is in a locked state, the electromagnet is powered on to attract the magnetic attraction component. When the magnetic attraction mechanism is in an unlocked state, the electromagnet is powered off to be separated from the magnetic attraction component. The magnetic attraction component may be made of at least one of magnetic materials such as iron, cobalt, and nickel.

[0140] According to the hinge mechanism **100** in this embodiment, the first cam structure **4** is disposed between the bearing member **23** and the gear **22**. When the swing arm **21** is at the folding position, the second protrusion part **42** and the first side surface **411** of the first protrusion part **41** press against each other and move relative to each other through the elastic force of the elastic piece **3**, so that the swing arm **21** is driven to unfold by the gear **22**, to achieve an effect that the housing **300** of the terminal device automatically ejects after the locking structure is switched to the

unlocked state.

[0141] Compared with the hinge mechanism **100** in some technologies, in the hinge mechanism **100** in this embodiment, the elastic piece **3** applies the elastic force F to at least one of the bearing member **23** and the gear **22**, so that the bearing member **23** approaches the gear **22**, to ensure that the second protrusion part **42** can abut against the first side surface **411**. In this way, in a process in which the swing arm **21** rotates from the folding position to the unfolding position, a deformation amplitude of the elastic piece **3** is determined by relative displacements of the first protrusion part **41** and the second protrusion part **42** in the axial direction X of the gear **22**, that is, the deformation amplitude of the elastic piece **3** is determined by a height of the first protrusion part **41**. Because the height of the first protrusion part **41** is smaller than a rotation displacement of the swing arm **21** relative to the base **1**, a problem that the deformation amplitude of the elastic piece **3** is large can be avoided, and a reaction force on the elastic piece **3** can be reduced. This helps prolong a service life of the elastic piece **3**, so that the elastic piece **3** can provide the stable elastic force F to at least one of the bearing member **23** and the gear **22**, to ensure stability of an ejecting angle of housings **300** of the terminal device.

[0142] In addition, according to the hinge mechanism **100** in this embodiment, an ejection force (namely, the component force f**1** generated by the extrusion force between the second protrusion part **42** and the first side surface **411**) generated by the first cam structure **4** in a case in which the swing arm **21** is at the folding position may be synchronously transferred to a pair of swing arms **21** in the swing arm assembly **2** through an even number of gears **22**. In this way, the same ejection force is applied to the pair of swing arms **21**, so that the stability of the pair of swing arms **21** can be improved in the process of ejecting, and the pair of swing arms **21** can be ejected at a same angle.

[0143] In some embodiments, as shown in FIG. **15** and FIG. **16**, there is a plurality of first protrusion parts **41**, the plurality of first protrusion parts **41** is arranged in a circumferential direction of the gear **22**, a first notch **43** is formed between two adjacent first protrusion parts **41**, and when the swing arms **21** are at a folding position and an unfolding position, the second protrusion part **42** extends into a same first notch **43**. In this way, when the swing arm **21** rotates between the folding position and the unfolding position, the second protrusion part **42** can avoid crossing the first protrusion part **41**. In this way, a displacement of the second protrusion part **42** relative to the first protrusion part **41** in the axial direction X of the gear **22** can be reduced, so that a deformation amplitude of the elastic piece **3** can be smaller, to further prolong a service life of the elastic piece **3**.

[0144] It should be understood that: If the second protrusion part **42** extends into a same first notch **43** when the swing arms **21** are at the folding position and the unfolding position, a center angle corresponding to the first notch **43** in a circumferential direction of the gear **22** is greater than or equal to 90 degrees as the swing arm **21** rotates 90 degrees from the folding position to the unfolding position, and the gear **22** in transmission connection to the swing arm **21** also rotates 90 degrees, that is, the gear **22** rotates a quarter circle. In this case, the center angle corresponding to the first notch **43** in the circumferential direction of the gear **22** is greater than or equal to 90 degrees, so that the second protrusion part **42** has sufficient space in the first notch **43**.

[0145] In some embodiments, as shown in FIG. **16** and FIG. **17**, FIG. **17** is a diagram of the first cam structure **4** disposed on the gear **22** connected to the swing arm **21** in the hinge mechanism **100** according to the first embodiment. There are two first protrusion parts **41**.

[0146] A quantity of first protrusion parts **41** is not limited to two, and may also be three, one, or the like, which may be determined based on an actual situation.

[0147] In some embodiments, as shown in FIG. **16** and FIG. **17**, a first bottom surface **431** is disposed in the first notch **43**, the first bottom surface **431** is perpendicular to the axial direction X of the gear **22**, and when the swing arm **21** is at the unfolding position, the second protrusion part **42** abuts against the first bottom surface **431**. Compared with the case in which the first bottom

surface **431** is inclined relative to the axial direction X of the gear **22**, in a case in which the first bottom surface **431** is perpendicular to the axial direction X of the gear **22**, the second protrusion part **42** and the first bottom surface **431** can be prevented from moving relative to each other under an action of an elastic force of the elastic piece **3**, to ensure stability between relative positions of the second protrusion part **42** and the first protrusion part **41**, so that the swing arm **21** is stably at the unfolding position, and stability of the terminal device in the unfolded state can be ensured.

[0148] In some embodiments, as shown in FIG. **16**, the first protrusion part **41** includes a second side surface **412**. In the circumferential direction of the gear **22**, the second side surface **412** is disposed opposite to the first side surface **411**. An inclination angle of the second side surface **412** relative to the axial direction X of the gear **22** is less than an inclination angle of the first side surface **411** relative to the axial direction X of the gear **22**, that is, the second side surface **412** is steeper than the first side surface **411**. The second side surface **412** is connected to a first side surface **411** of an adjacent first protrusion part **41** through the first bottom surface **431**. Compared with a case in which the inclination angle of the second side surface **412** is set to be consistent with that of the first side surface **411**, in a case in which the inclination angle of the second side surface **412** relative to the axial direction X of the gear **22** is less than the inclination angle of the first side surface **411** relative to the axial direction X of the gear **22**, a transverse distance between the first side surface **411** and the second side surface **412** on a same first protrusion part **41** may be increased, thereby reducing abrasion of the first protrusion part **41** in folding and unfolding processes of the swing arm **21**, and helping prolonging a service life of a product.

[0149] In some embodiments, as shown in FIG. **16**, when the swing arm **21** is at the folding position, the second protrusion part **42** is in surface contact with the first side surface **411**. In other words, there is a flat surface in a lateral direction of the second protrusion part **42**. When the swing arm **21** is at the folding position, the flat surface in the lateral direction of the second protrusion part **42** is in surface contact with the first side surface **411**. In this design, pressure of interaction between the second protrusion part **42** and the first side surface **411** can be reduced, thereby reducing a probability of damage between the first protrusion part **41** and the second protrusion part **42**.

[0150] In some embodiments, as shown in FIG. **16**, when the swing arm **21** is at the unfolding position, the second protrusion part **42** is in surface contact with the first bottom surface **431**. In other words, there is a flat surface on a top of the second protrusion part **42**. When the swing arm **21** is at the unfolding position, the flat surface on the top of the second protrusion part **42** is in surface contact with the first bottom surface **431**. In this way, a contact area between the second protrusion part **42** and the first bottom surface **431** may be increased, so that the second protrusion part **42** is unlikely to shake along the first bottom surface **431** when the swing arm **21** is at the unfolding position. This can reduce shake of the swing arm **21** at the unfolding position, and further ensure stability of the terminal device in the unfolded state.

[0151] In some embodiments, as shown in FIG. **16** and FIG. **18**, FIG. **18** is a diagram of the first cam structure **4** disposed on the bearing member **23** in the hinge mechanism **100** according to a first embodiment. There is a plurality of second protrusion parts **42**, the plurality of second protrusion parts **42** is arranged in the circumferential direction of the gear **22**, a third notch **44** for a corresponding first protrusion part **41** to extend into is formed between two adjacent second protrusion parts **42**, and each second protrusion part **42** extends into a corresponding first notch **43**. The plurality of second protrusion parts **42** is disposed so that when the swing arm **21** is at the folding position, the plurality of second protrusion parts **42** may press against the corresponding first protrusion parts **41**, to improve contact stress of the first cam structure **4**. This helps avoid a form change of the first cam structure **4** in a use process.

[0152] A quantity of second protrusion parts **42** is equal to a quantity of first protrusion parts **41**. For example, as shown in FIG. **16**, both the quantity of second protrusion parts **42** and the quantity of first protrusion parts **41** are two.

[0153] In some embodiments, as shown in FIG. **16**, a third bottom surface **441** is disposed in the third notch **44**, the third bottom surface **441** is perpendicular to the axial direction X of the gear **22**, and when the swing arm **21** is at the unfolding position, the first protrusion part **41** is in surface contact with the third bottom surface **441**. In other words, there is a flat surface on a top of the first protrusion part **41**. When the swing arm **21** is at the unfolding position, the flat surface on the top of the first protrusion part **41** is in surface contact with the third bottom surface **441**. In this way, a contact area between the first protrusion part **41** and the third bottom surface **441** may be increased, so that the first protrusion part **41** is unlikely to shake along the third bottom surface **441** when the swing arm **21** is at the unfolding position. This can reduce shake of the swing arm **21** at the unfolding position, and further ensure stability of the terminal device in the unfolded state.
[0154] In this embodiment, a plurality of second protrusion parts **42** or one second protrusion part **42** may be disposed in the first cam structure **4**. Positions of the first protrusion part **41** and the second protrusion part **42** in the first cam structure **4** may also be exchanged, that is, the first protrusion part **41** is disposed on the bearing member **23**, and the second protrusion part **42** is disposed on the first end face **221** of the gear **22**, so that a same effect can also be achieved.
[0155] In some embodiments, as shown in FIG. **14** and FIG. **15**, in the swing arm assembly **2**, the first cam structure **4** is disposed between each gear **22** and the bearing member **23**. In this design, when the swing arm **21** is at the folding position, an action force may be applied by a corresponding first cam structure **4** to each gear **22**. In this way, a large torque can be generated to drive the swing arm **21** to rotate toward the unfolding position, so that the first cam structure **4** can be adapted to a terminal device that needs a large torque to eject.
[0156] In a process of rotating the swing arm **21** from the unfolding position to the folding position, the gear **22** is used as a reference. Because the second protrusion part **42** needs to “climb” along the first side surface **411** of the first protrusion part **41**, the swing arm **21** moves in the axial direction X with the outermost gear **22**. To ensure that the swing arm **21** can smoothly move in the axial direction X of the gear **22**, the swing arm **21** is movably connected to the housing **300** in the axial direction X of the gear **22**. For example, as shown in FIG. **6**, there is a motion gap among the swing arm **21** and groove walls on two sides of the sliding groove **410** of the connection frame **400**, so that the swing arm **21** moves in the axial direction X in the sliding groove **410**.
[0157] In the swing arm assembly **2**, the first cam structure **4** is disposed between each gear **22** and the bearing member **23**, or the first cam structure **4** may be separately disposed between some of the gears **22** and the bearing member **23**. In the swing arm assembly **2**, two outermost gears **22** are fastened to corresponding swing arms **21**, and gears **22** (for example, the two gears **22** located in the middle in FIG. **14**) other than the outermost two gears **22** are slidably connected to the base **1** in the axial direction X of the gears **22**, and the first cam structures **4** are disposed between the gears **22** and the bearing member **23**. In this design, in a process in which the swing arm **21** rotates from the unfolding position to the folding position, the gear **22** connected to the swing arm **21** does not move in the axial direction X due to an action force of the first cam structure **4**. In this way, the swing arm **21** can be more stable in a process of rotating relative to the base **1**.
[0158] In some embodiments, as shown in FIG. **14**, FIG. **19**, and FIG. **20**, FIG. **19** is a circumferentially expanded view of the second cam structure between each of four gears **22** of the swing arm assembly **2** and the bearing member **23** in a case in which the swing arm **21** is at different positions according to the first embodiment. FIG. **20** is a circumferentially expanded view of the second cam structure between the rightmost gear **22** and the bearing member **23** in FIG. **19** in a case in which the swing arm **21** is at different positions.
[0159] The hinge mechanism **100** further includes a second cam structure **5** disposed between the second end face **222** of the gear **22** and the bearing member **23**. The second cam structure **5** includes a third protrusion part **51** disposed on the second end face **222** and a fourth protrusion part **52** disposed on the bearing member **23**. The third protrusion part **51** includes a third side surface **511**, where the third side surface **511** may be an inclined surface, and the inclined surface is

disposed relative to the axial direction X of the gear **22**. The third side surface **511** may be the inclined surface, or may be a bent curved surface, for example, an arched surface or a parabolic surface.

[0160] When the swing arm **21** is at an unfolding position, the fourth protrusion part **52** abuts against the third side surface **511**. Under an action of an elastic force of the elastic piece **3**, a component force f**2** generated by an extrusion force between the fourth protrusion part **52** and the third side surface **511** causes the fourth protrusion part **52** and the third side surface **511** to have a tendency of moving relative to each other, so as to apply, to the gear **22**, an action force that can prevent the swing arm **21** from rotating in a direction close to the folding position, as shown in (b) in FIG. **20**. The action force (namely, an unfolding force) may enable the gear **22** to have a tendency of rotating leftward (in FIG. **20**, the gear **22** rotates leftward to drive the swing arm **21** to move in an unfolding direction, and the gear **22** rotates rightward to drive the swing arm **21** to move in a folding direction), so that shake of the swing arm **21** at the unfolding position is avoided, and the swing arm **21** is stably at the unfolding position. In this way, the terminal device can be stably kept in the unfolded state, thereby improving user experience.

[0161] In some embodiments, as shown in FIG. **20**, the third protrusion part **51** includes a fourth side surface **512**. In a circumferential direction of the gear **22**, the fourth side surface **512** is disposed opposite to the third side surface **511**, and an inclination angle of the fourth side surface **512** relative to the axial direction X of the gear **22** is greater than an inclination angle of the third side surface **511** relative to the axial direction X of the gear **22**.

[0162] In a process in which the swing arm **21** rotates from the folding position to the unfolding position, with reference to the gear **22**, the fourth protrusion part **52** needs to pass through the third protrusion part **51** along the fourth side surface **512**, and then abuts against the third side surface **511** of the third protrusion part **51**. Because the inclination angle of the fourth side surface **512** relative to the axial direction X of the gear **22** is greater than the inclination angle of the third side surface **511** relative to the axial direction X of the gear **22**, that is, the fourth side surface **512** is smoother than the third side surface **511**, difficulty of crossing the third protrusion part **51** by the fourth protrusion part **52** is reduced, and resistance of the fourth protrusion part **52** when "climbing" along the fourth side surface **512** is reduced, so that the swing arm **21** can smoothly rotate from the folding position to the unfolding position. In this way, the terminal device can be ensured to smoothly switch to an unfolded state.

[0163] Positions of the third protrusion part **51** and the fourth protrusion part **52** may also be exchanged, that is, the third protrusion part **51** is disposed on the bearing member **23**, and the fourth protrusion part **52** is disposed on the second end face **222** of the gear **22**. In this way, resistance of the fourth protrusion part **52** when "climbing" along the fourth side surface **512** may also be reduced.

[0164] In some embodiments, as shown in FIG. **20** and FIG. **21**, FIG. **21** is a diagram of the second cam structure **5** disposed on the gear **22** connected to the swing arm **21** in the hinge mechanism **100** according to the first embodiment. There is a plurality of third protrusion parts **51**, the plurality of third protrusion parts **51** is arranged in a circumferential direction of the gear **22**, a second notch **53** is formed between two adjacent third protrusion parts **51**, a first positioning part **531** is disposed in the second notch **53**, and when the swing arm **21** is at the folding position, the first positioning part **531** positions the fourth protrusion part **52**. The first positioning part **531** is disposed to position the fourth protrusion part **52**. In this way, the fourth protrusion part **52** is unlikely to shake when the swing arm **21** is at the folding position, thereby reducing shake of the swing arm **21** at the folding position, and further ensuring stability of the terminal device in a folded state.

[0165] A structure of the first positioning part **531** is not unique. In some embodiments, as shown in FIG. **20**, the first positioning part **531** includes a first positioning surface **5311** that is perpendicular to the axial direction X of the gear **22**. When the swing arm **21** is at the folding position, the fourth protrusion part **52** is in surface contact with the first positioning surface **5311**.

In other words, a top of the fourth protrusion part **52** has a flat surface. When the swing arm **21** is at the folding position, the flat surface on the top of the fourth protrusion part **52** is in surface contact with the first positioning surface **5311**. The first positioning part **531** is disposed as the first positioning surface **5311** and is in surface contact with the fourth protrusion part **52**, so that a positioning structure is simpler. This helps reduce processing difficulty, and helps reduce processing costs.

[0166] The first positioning part **531** may be the first positioning surface **5311** or may be a positioning slot, a magnetic attraction member, or the like. When the first positioning part **531** is the positioning slot, a structure matching the positioning slot is disposed on the top of the fourth protrusion part **52**. When the first positioning part **531** is a magnetic attraction member, a magnetic piece that can be attracted by the magnetic attraction member is disposed on the top of the fourth protrusion part **52**, where both the magnetic attraction member and the magnetic piece may be magnets.

[0167] The first positioning part **531** may not be disposed in the second notch **53**. As shown in FIG. **23**, FIG. **23** is a diagram of another structure of the second cam structure **5** according to an embodiment. In FIG. **23**, the first positioning surface **5311** in FIG. **20** is removed. When the swing arm **21** is at the unfolding position, the fourth protrusion part **52** abuts against the fourth side surface **512**.

[0168] In some embodiments, as shown in FIG. **20** and FIG. **22**, FIG. **22** is a diagram of the second cam structure **5** disposed on the bearing member **23** in the hinge mechanism **100** according to the first embodiment. There is a plurality of fourth protrusion parts **52**, the plurality of fourth protrusion parts **52** is arranged in a circumferential direction of the gear **22**, and a fourth notch **54** for the third protrusion part **51** to extend into is formed between two adjacent fourth protrusion parts **52**. The plurality of fourth protrusion parts **52** are disposed, so that when the swing arm **21** is at an unfolding position, the plurality of fourth protrusion parts **52** may press against the corresponding third protrusion parts **51**, to reduce contact stress, thereby effectively prolonging a service life of the second cam structure **5**.

[0169] A quantity of fourth protrusion parts **52** is equal to a quantity of third protrusion parts **51**. For example, as shown in FIG. **20**, both the quantity of fourth protrusion parts **52** and the quantity of third protrusion parts **51** are three. The quantity of the fourth protrusion parts **52** and the quantity of the third protrusion parts **51** are not limited to three, and may alternatively be four, six, eight, or the like, which may be determined based on an actual situation.

[0170] In some embodiments, as shown in FIG. **20**, a second positioning part **541** is disposed in the fourth notch **54**. When the swing arm **21** is at a folding position, the second positioning part **541** positions the third protrusion part **51**. The second positioning part **541** is disposed to position the third protrusion part **51**. In this way, the third protrusion part **51** is unlikely to shake when the swing arm **21** is at the folding position, thereby reducing shake of the swing arm **21** at the folding position, and further ensuring stability of the terminal device in a folded state.

[0171] A structure of the second positioning part **541** is not unique. In some embodiments, as shown in FIG. **20**, the second positioning part **541** includes a second positioning surface **5411** that is perpendicular to the axial direction X of the gear **22**. When the swing arm **21** is at the folding position, the third protrusion part **51** is in surface contact with the second positioning surface **5411**. In other words, a top of the third protrusion part **51** has a flat surface. When the swing arm **21** is at the folding position, the flat surface on the top of the third protrusion part **51** is in surface contact with the second positioning surface **5411**. The second positioning part **541** is disposed as the second positioning surface **5411** and is in surface contact with the third protrusion part **51**, so that a positioning structure is simpler. This helps reduce processing difficulty, and helps reduce processing costs.

[0172] The second positioning part **541** may be the second positioning surface **5411** or may be a positioning slot, a magnetic attraction member, or the like. When the second positioning part **541** is

the positioning slot, a structure matching the positioning slot is disposed on the top of the third protrusion part **51**. When the second positioning part **541** is a magnetic attraction member, a magnetic piece that can be attracted by the magnetic attraction member is disposed on the top of the third protrusion part **51**, where both the magnetic attraction member and the magnetic piece may be magnets.

[0173] In this embodiment, a plurality of fourth protrusion parts **52** or one fourth protrusion part **52** may be disposed in the second cam structure **5**.

[0174] In some embodiments, as shown in FIG. **14** and FIG. **19**, in the swing arm assembly **2**, the second cam structure **5** is disposed between each gear **22** and the bearing member **23**. In this design, when the swing arm **21** is at an unfolding position, an action force may be applied by a corresponding second cam structure **5** to each gear **22**. In this way, a large unfolding force can be generated to prevent the swing arm **21** from rotating toward a folding position, so that the terminal device can be more stable in an unfolded state.

[0175] In the swing arm assembly **2**, the second cam structure **5** is disposed between each gear **22** and the bearing member **23**, or the second cam structure **5** may be separately disposed between some of the gears **22** and the bearing member **23**. In the swing arm assembly **2**, two outermost gears **22** are fastened to the corresponding swing arms **21**, and gears **22** (for example, the two gears **22** located in the middle in FIG. **14**) other than the outermost two gears **22** are slidably connected to the base **1** in the axial direction X of the gears **22**, and the second cam structures **5** are disposed between the gears **22** and the bearing member **23**. In this design, in a process in which the swing arm **21** rotates from the folding position to the unfolding position, the gear **22** connected to the swing arm **21** does not move in the axial direction X due to an action force of the second cam structure **5**. In this way, the swing arm **21** can be more stable in a process of rotating relative to the base **1**.

[0176] In some embodiments, as shown in FIG. **10** to FIG. **14**, in the swing arm assembly **2**, bearing members **23** are respectively disposed on two sides of the gear **22**, the first end face **221** and the second end face **222** are respectively two end faces that are of the gear **22** and that are disposed opposite to each other, the first cam structure **4** is disposed between the first end face **221** and a bearing member **23** on a corresponding side, and the second cam structure **5** is disposed between the second end face **222** and a bearing member **23** on a corresponding side.

[0177] In this embodiment, the first cam structure **4** and the second cam structure **5** are distributed on two sides of a same gear **22**, and the first cam structure **4** and the second cam structure **5** are arranged in a same swing arm assembly **2**. In this way, the terminal device can implement dual functions of self-ejecting in a folded state and keeping a stable unfolded state through a same swing arm assembly **2**.

[0178] In some embodiments, as shown in FIG. **10**, two swing arm assemblies **2** are disposed between the first sub-base **13** and the second sub-base **14**, which are respectively a swing arm assembly **2***a* and a swing arm assembly **2***b*. The swing arm assembly **2***a* is disposed close to the first sub-base **13**, and the swing arm assembly **2***b* is disposed close to the second sub-base **14**.

[0179] In the swing arm assembly **2***a*, an upper end face of the gear **22** is the first end face **221**, a lower end face of the gear **22** is the second end face **222**, the first cam structure **4** is disposed between the upper end face of the gear **22** and the bearing member **23** located on an upper side of the gear **22**, and the second cam structure **5** is disposed between the lower end face of the gear **22** and the bearing member **23** located on a lower side of the gear **22**.

[0180] In the swing arm assembly **2***b*, an upper end face of the gear **22** is the second end face **222**, a lower end face of the gear **22** is the first end face **221**, the second cam structure **5** is disposed between the upper end face of the gear **22** and the bearing member **23** located on an upper side of the gear **22**, and the first cam structure **4** is disposed between the lower end face of the gear **22** and the bearing member **23** located on a lower side of the gear **22**.

[0181] As shown in FIG. **10**, the elastic piece **3** is a spring, the spring is in a compressed state, and

is sleeved on the mounting shaft **15** between the swing arm assembly **2***a* and the swing arm assembly **2***b*. One end of the elastic piece **3** abuts against the bearing member **23** located on the lower side of the gear **22** in the swing arm assembly **2***a*, and the other end of the elastic piece **3** abuts against the bearing member **23** located on the upper side of the gear **22** in the swing arm assembly **2***b*.

[0182] In some embodiments, as shown in FIG. **10**, in the swing arm assembly **2***a*, the bearing member **23** located on the upper side of the gear **22** is fastened to the first sub-base **13**. For example, the bearing member **23** located on the upper side of the gear **22** and the first sub-base **13** may be of an integrated structure. A plurality of through holes **231** are provided on the bearing member **23** located on the lower side of the gear **22**, and the mounting shaft **15** penetrates each through hole **231**.

[0183] In the swing arm assembly **2***b*, a plurality of through holes **231** is provided on each of the bearing members **23** located on the upper side and the lower side of the gear **22**, and the mounting shaft **15** penetrates each through hole **231**. The bearing member **23** located on the lower side of the gear **22** and the second friction member **62** of the damping mechanism **6** may be of an integrated structure, and the damping mechanism **6** is described in detail in the following.

[0184] FIG. **24** is a diagram of the swing arm **21** in the hinge mechanism **100** at an unfolding position according to a second embodiment. A main difference between the hinge mechanism **100** in the second embodiment and the hinge mechanism **100** in the first embodiment lies in that the first cam structure **4** and the second cam structure **5** are disposed in different manners.

[0185] In some embodiments, as shown in FIG. **24**, in the swing arm assembly **2** (for example, the swing arm assembly **2** located on an upper side in the figure), bearing members **23** are respectively disposed on two sides of the gear **22**, the gear **22** has two first end faces **221** that are disposed opposite to each other, and the first cam structure **4** is disposed between each first end face **221** and a bearing member **23** on a corresponding side, that is, the two sides of the gear **22** are disposed on the first cam structure **4**. In this way, when the swing arm **21** is at a folding position, the first cam structures **4** on the two sides of the gear **22** may generate a large ejection force, so that the hinge mechanism **100** can be adapted to a terminal device that needs a large torque to eject.

[0186] When there is a plurality of swing arm assemblies **2**, the first cam structures **4** may be disposed on two sides of the gear **22** in a part of the swing arm assemblies **2**, or the first cam structures **4** may be disposed on two sides of the gear **22** in each swing arm assembly **2**. This is not limited herein.

[0187] In some embodiments, as shown in FIG. **24**, there is a plurality of swing arm assemblies **2**, and the plurality of swing arm assemblies **2** is arranged in the axial direction X of the gear **22**. In a part of the swing arm assemblies **2**, bearing members **23** are respectively disposed on two sides of the gear **22**, the gear **22** has two second end faces **222** disposed opposite to each other, and the second cam structure **5** is disposed between each second end face **222** and a bearing member **23** on a corresponding side. In the other part of swing arm assemblies **2**, bearing members **23** are respectively disposed on two sides of the gear **22**, the gear **22** has two first end faces **221** disposed opposite to each other, and the first cam structure **4** is disposed between each first end face **221** and a bearing member **23** on a corresponding side.

[0188] In this embodiment, in a same group of swing arm assemblies **2**, the first cam structures **4** or the second cam structures **5** are disposed on two sides of the gear **22**, that is, cam structures of a same type are disposed on the two sides of the gear **22**. In this way, when the gear **22** is mounted reversely, normal rotation of the swing arm **21** can still be ensured, and a positive or negative direction of the gear **22** does not need to be determined during assembling, thereby facilitating assembling of the gear **22**. In addition, in a part of the swing arm assemblies **2**, the second cam structures **5** are disposed on two sides of the gear **22**. In this way, when the swing arm **21** is at an unfolding position, the second cam structures **5** on the two sides of the gear **22** may generate a large unfolding force, to prevent the terminal device from folding, so that the hinge mechanism **100**

can adapt to a terminal device that requires a large torque to maintain an unfolded state.

[0189] For example, as shown in FIG. **24**, the swing arm assembly **2***a* and the swing arm assembly **2***b* are disposed between the first sub-base **13** and the second sub-base **14**. In the swing arm assembly **2***a*, both an upper end face and a lower end face of the gear **22** are the first end faces **221**, and the first cam structure **4** is separately disposed between the upper end face of the gear **22** and the bearing member **23** located on the upper side of the gear **22**, and between the lower end face of the gear **22** and the bearing member **23** located on the lower side of the gear **22**. In the swing arm assembly **2***b*, both an upper end face and a lower end face of the gear **22** are second end faces **222**, and the second cam structure **5** is separately disposed between the upper end face of the gear **22** and the bearing member **23** located on the upper side of the gear **22**, and between the lower end face of the gear **22** and the bearing member **23** located on the lower side of the gear **22**.

[0190] As shown in FIG. **25** to FIG. **31**, FIG. **25** is a diagram of the swing arm **21** in the hinge mechanism **100** at an unfolding position according to a third embodiment; FIG. **26** is a three-dimensional diagram of the swing arm **21** of the hinge mechanism **100** at a folding position according to the third embodiment; FIG. **27** is a partially enlarged view of the hinge mechanism **100** in FIG. **26** at E; FIG. **28** is a three-dimensional diagram of the swing arm **21** of the hinge mechanism **100** at the unfolding position according to the third embodiment; FIG. **29** is a partially enlarged view of the hinge mechanism **100** in FIG. **28** at F; FIG. **30** is a circumferentially expanded view of the first cam structure **4** between each of four gears **22** of the swing arm assembly **2** and the bearing member **23** in a case in which the swing arm **21** is at different positions according to the third embodiment; and FIG. **31** is a circumferentially expanded view of the first cam structure **4** between the rightmost gear **22** and the bearing member **23** in FIG. **30** in a case in which the swing arm **21** is at different positions.

[0191] A main difference between the hinge mechanism **100** in the third embodiment and the hinge mechanism **100** in the first embodiment lies in that a structure of the first cam structure **4** is different.

[0192] There is a plurality of first protrusion parts **41**, and the plurality of first protrusion parts **41** is arranged in a circumferential direction of the gear **22**. As shown in FIG. **31**, when the swing arm **21** is at a folding position, the second protrusion part **42** abuts against a first side surface **411** of one first protrusion part **41**; and when the swing arm **21** is at an unfolding position, the second protrusion part **42** abuts against a first side surface **411** of another first protrusion part **41**.

[0193] When the swing arm **21** is at the folding position and the unfolding position, the second protrusion part **42** separately abuts against first side surfaces **411** of different first protrusion parts **41**. In this way, when the swing arm **21** is at the unfolding position and the folding position, under an action of an elastic force of the elastic piece **3**, both the second protrusion part **42** and the first side surface **411** may press against each other to apply an unfolding force to the swing arm **21** through the gear **22**. In this case, the terminal device may have dual functions of self-ejecting in a folded state and keeping a stable unfolded state through the first cam structure **4**, that is, the first cam structure **4** in this embodiment has effects of both the first cam structure **4** and the second cam structure **5**. In this way, a layout of the cam structure is more compact, and a size of the swing arm assembly **2** is reduced when a same function is implemented.

[0194] In some embodiments, as shown in FIG. **30** and FIG. **31**, an inclined angle of the second side surface **412** of the first protrusion part **41** relative to an axial direction X of the gear **22** is greater than an inclined angle of the first side surface **411** relative to the axial direction X of the gear **22**.

[0195] In a process in which the swing arm **21** rotates from the folding position to the unfolding position, with reference to the gear **22**, the second protrusion part **42** needs to cross the first protrusion part **41** along the second side surface **412**, and then abuts against the first side surface **411** of the first protrusion part **41**. Because the inclination angle of the second side surface **412** relative to the axial direction X of the gear **22** is greater than the inclination angle of the first side

surface **411** relative to the axial direction X of the gear **22**, that is, the second side surface **412** is smoother than the first side surface **411**, difficulty of crossing the first protrusion part **41** by the second protrusion part **42** is reduced, and resistance of the second protrusion part **42** when "climbing" along the second side surface **412** is reduced, so that the swing arm **21** can smoothly rotate from the folding position to the unfolding position. In this way, the terminal device can be ensured to smoothly switch to an unfolded state.

[0196] In some embodiments, as shown in FIG. **31**, in the circumferential direction of the gear **22**, a center angle corresponding to a distance between first side surfaces **411** of two adjacent first protrusion parts **41** is 90 degrees.

[0197] In a process in which the swing arm **21** rotates by 90 degrees from the folding position to the unfolding position, the gear **22** in transmission connection to the swing arm **21** also rotates by 90 degrees, that is, the gear **22** rotates by a quarter circle. A center angle corresponding to a distance between first side surfaces **411** of two adjacent first protrusion parts **41** is set to 90 degrees, so that the second protrusion part **42** may move from a first side surface **411** of one first protrusion part **41** to a first side surface **411** of an adjacent first protrusion part **41**. In this way, a quantity of first protrusion parts **41** crossed by the second protrusion parts **42** can be reduced, to reduce rotation resistance of the swing arm **21**, so that a process of switching the terminal device to the unfolded state is smoother.

[0198] The distance between the first side surfaces **411** of the two adjacent first protrusion parts **41** refers to: a distance between same positions on the first side surfaces **411** of the two adjacent first protrusion parts **41**. For example, a point **01** is located on a top of one first side surface **411**, and a point **02** is located on a top of an adjacent first side surface **411**. In this case, in the circumferential direction of the gear **22**, a distance between the point **01** and the point **02** is a distance between the first side surfaces **411** of the two adjacent first protrusion parts **41**.

[0199] In some embodiments, as shown in FIG. **31**, there are four first protrusion parts **41**, and the four first protrusion parts **41** are continuously arranged.

[0200] "Continuous arrangement" means that in two adjacent first protrusion parts **41**, a first side surface **411** of one first protrusion part **41** is connected to a second side surface **412** of the other first protrusion part **41**.

[0201] In some embodiments, as shown in FIG. **31** and FIG. **32**, FIG. **32** is a diagram of the first cam structure **4** disposed on the bearing member **23** in the hinge mechanism **100** according to the third embodiment. There is a plurality of second protrusion parts **42**, the plurality of second protrusion parts **42** is arranged in a circumferential direction of the gear **22**, and each second protrusion part **42** may extend into a corresponding first notch **43**.

[0202] The plurality of second protrusion parts **42** is disposed, so that when the swing arm **21** is at a folding position and an unfolding position, the plurality of second protrusion parts **42** separately abut against corresponding first protrusion parts **41**, to improve contact stress between the protrusion parts. This helps ensure that the first cam structure **4** works normally and stably, and effectively prolongs a service life of the first cam structure **4**.

[0203] A quantity of second protrusion parts **42** is equal to a quantity of first protrusion parts **41**. For example, as shown in FIG. **31**, both the quantity of second protrusion parts **42** and the quantity of first protrusion parts **41** are four.

[0204] In some embodiments, as shown in FIG. **31**, when the swing arm **21** is at the folding position and the unfolding position, the second protrusion part **42** is in surface contact with the first side surface **411**. In other words, there is a flat surface in a lateral direction of the second protrusion part **42**. When the swing arm **21** is at the folding position and the unfolding position, the flat surface in the lateral direction of the second protrusion part **42** is in surface contact with the first side surface **411**. In this design, pressure of interaction between the second protrusion part **42** and the first side surface **411** can be reduced, thereby reducing a probability of damage between the first protrusion part **41** and the second protrusion part **42**.

[0205] In some embodiments, as shown in FIG. **25** to FIG. **29**, there is a plurality of swing arm assemblies **2**, and the plurality of swing arm assemblies **2** is arranged in the axial direction X of the gear **22**. In a part of the swing arm assemblies **2**, bearing members **23** are respectively disposed on two sides of the gear **22**, the gear **22** has the first end face **221** and the second end face **222** disposed opposite to each other, the first cam structure **4** is disposed between the first end face **221** and a bearing member **23** on a corresponding side, and the second cam structure **5** is disposed between the second end face **222** and a bearing member **23** on a corresponding side. In the other part of swing arm assemblies **2**, bearing members **23** are respectively disposed on two sides of the gear **22**, the gear **22** has two first end faces **221** disposed opposite to each other, and the first cam structure **4** is disposed between each first end face **221** and a bearing member **23** on a corresponding side.

[0206] In some embodiments, as shown in FIG. **25**, in the swing arm assembly **2** in which the first cam structure **4** is disposed, a first cam structure **4***a* is disposed between one first end face **221** of the gear **22** and a bearing member **23** on a corresponding side, and a first cam structure **4***b* is disposed between the other first end face **221** of the gear **22** and a bearing member **23** on a corresponding side.

[0207] It should be noted that, for differentiation, a first cam structure **4** (for example, the first cam structure **4** shown in FIG. **10** to FIG. **18**) that meets a condition that "when the swing arms **21** are at the folding position and the unfolding position, the second protrusion part **42** extends into a same first notch **43**" is referred to as the first cam structure **4***a*. A first cam structure **4** (for example, the first cam structure **4** shown in FIG. **25** to FIG. **32**) that meets a condition that "when the swing arm **21** is at the folding position, the second protrusion part **42** abuts against a first side surface **411** of one first protrusion part **41**; and when the swing arm **21** is at the unfolding position, the second protrusion part **42** abuts against a first side surface **411** of the other first protrusion part **41**" is referred to as the first cam structure **4***b*.

[0208] For example, as shown in FIG. **25**, the swing arm assembly **2***a* and the swing arm assembly **2***b* are disposed between the first sub-base **13** and the second sub-base **14**. In the swing arm assembly **2***a*, an upper end face of the gear **22** is the first end face **221**, a lower end face of the gear **22** is the second end face **222**, the first cam structure **4***a* is disposed between the upper end face of the gear **22** and a bearing member **23** located on an upper side of the gear **22**, and the second cam structure **5** is disposed between the lower end face of the gear **22** and a bearing member **23** located on the lower side of the gear **22**. In the swing arm assembly **2***b*, both an upper end face and a lower end face of the gear **22** are first end faces **221**, the first cam structure **4***b* is disposed between the upper end face of the gear **22** and a bearing member **23** located on an upper side of the gear **22**, and the first cam structure **4***a* is disposed between the lower end face of the gear **22** and a bearing member **23** located on a lower side of the gear **22**.

[0209] In some embodiments, as shown in FIG. **28** and FIG. **33** to FIG. **35**, FIG. **33** is an exploded view of the damping mechanism **6** of the hinge mechanism **100** shown in FIG. **28**; FIG. **34** is a sectional view of a first friction member after removal of the connection frame **400** from the hinge mechanism **100** shown in FIG. **28**; and FIG. **35** is a sectional view of a first friction member after removal of the connection frame **400** from the hinge mechanism **100** shown in FIG. **26**. The hinge mechanism **100** in this embodiment further includes a damping mechanism **6**. The damping mechanism **6** includes a first friction member **61** and a second friction member **62**. The first friction member **61** is rotatably connected to the base **1**, and the first friction member **61** is connected to the swing arm **21** through the connector **63**, so that the first friction member **61** and the swing arm **21** can rotate synchronously relative to the base **1**. The second friction member **62** is disposed on the base **1**, and is in contact with the first friction member **61**. When the swing arm **21** rotates between a folding position and an unfolding position, the second friction member **62** may rub against the first friction member **61**, to apply a rotation damping force to the swing arm **21**.

[0210] The damping mechanism **6** is disposed. When the swing arm **21** rotates between the folding

position and the unfolding position, the damping mechanism **6** may provide a rotation damping force in a direction opposite to a movement direction of the swing arm **21**. In this way, the housing **300** connected to the swing arm **21** can be suspended at a middle position between an unfolded state and a folded state, so that the terminal device can be unfolded at a proper angle to facilitate use by a user. In addition, the damping mechanism **6** provides a rotation damping force through contact friction between the first friction member **61** and the second friction member **62**. In this way, a structure of the damping mechanism **6** is simple. When one of the first friction member **61** and the second friction member **62** is damaged, the first friction member **61** or the second friction member **62** may be replaced, and the entire damping mechanism **6** does not need to be replaced. This helps reduce maintenance costs.

[0211] The first friction member **61** and the second friction member **62** are not disposed uniquely. FIG. **33** to FIG. **35** show an embodiment in which the first friction member **61** and the second friction member **62** are disposed in a first manner. In this embodiment, there are a plurality of first friction members **61** and a plurality of second friction members **62**, the plurality of first friction members **61** and the plurality of second friction members **62** are arranged in the axial direction X of the gear **22**, a first gap **60** is formed between two adjacent second friction members **62**, each first friction member **61** is inserted into a corresponding first gap **60**, and is in contact with an adjacent second friction member **62**.

[0212] In this design, the first friction member **61** and the adjacent second friction member **62** rub against each other, so that a rotation damping force can be provided for the swing arm **21** in an entire process of rotating the swing arm **21** between the folding position and the unfolding position, the housing **300** connected to the swing arm **21** can be suspended at the middle position between the unfolded state and the folded state, and a large ejection speed, due to an ejection force provided by the first cam structure **4**, of the housing **300** of the terminal device can be avoided. In this way, the housing **300** of the terminal device moves more smoothly. In addition, a friction force generated between friction members is changed by adjusting a quantity of first friction members **61** and second friction members **62** (for example, the generated friction force is increased by increasing the quantity of friction members). A magnitude of the rotation damping force can be conveniently adjusted, so that the damping mechanism **6** can be rotated to adapt to terminal devices that require different rotation damping forces. This helps improve universality of the damping mechanism **6**.

[0213] In some embodiments, as shown in FIG. **28** and FIG. **33**, the swing arm **21** includes two swing sub-arms **211** that are both rotatably connected to the base **1**, the two swing sub-arms **211** are spaced from each other in the axial direction X of the gear **22**, and the two swing sub-arms **211** are connected through a connector **63**, so that the two swing sub-arms **211** can rotate synchronously relative to the base **1**, and one swing sub-arm **211** is in transmission connection to the gear **22**. The first friction member **61** is disposed between the two swing sub-arms **211** and is connected to the connector **63**, and the second friction member **62** is disposed between the gear **22** and a limiting part on the base **1**.

[0214] The first friction member **61** is disposed between the two swing sub-arms **211**, and the second friction member **62** is disposed between the gear **22** and the limiting part on the base **1**. In this way, the two swing sub-arms **211** can limit the first friction member **61**, to prevent the first friction member **61** from fluttering in the axial direction X of the gear **22**. The limiting part on the gear **22** and the base **1** can limit the second friction member **62**, so that there is contact pressure between the first friction member **61** and the second friction member **62**, to ensure a magnitude of a friction force between the first friction member **61** and the second friction member **62**.

[0215] The connector **63** may be connected between the two swing sub-arms **211** through clamping, inserting, hinging, or screwing. The connector **63** may be rod-shaped, or may be in another shape, which is not limited herein.

[0216] For example, as shown in FIG. **28**, FIG. **33**, and FIG. **34**, the connector **63** is rod-shaped, one end of the connector **63** is inserted into a hole on one swing sub-arm **211**, and the other end of

the connector **63** is inserted into a hole on the other swing sub-arm **211**.
[0217] The first friction member **61** may be mounted in the following way: A first assembling hole **611** is separately provided at two ends of the first friction member **61**, and a first mounting hole at one end of the first friction member **61** fits the connector **63**. A first assembling hole **611** at the other end of the first friction member **61** rotatably fits the mounting shaft **15**, so that the first friction member **61** is rotatably connected to the base **1**.
[0218] The second friction member **62** may be mounted in the following way: A plurality of third assembling holes **621** is provided on the second friction member **62** in a width direction Y of the base **1**, each third assembling hole **621** fits a corresponding mounting shaft **15**, and the second friction member **62** is located between the gear **22** and the second sub-base **14**, where the second sub-base **14** is a limiting part of the base **1**.
[0219] In some embodiments, as shown in FIG. **28** and FIG. **33**, both the first friction member **61** and the second friction member **62** are friction plates, and parts that are of the plurality of first friction members **61** and that are close to the base **1** and the plurality of second friction members **62** are staggered and stacked. In this way, the first friction member **61** is in surface contact with an adjacent first friction member **61**, so that a large rotation damping force can be provided.
[0220] The first friction member **61** and the second friction member **62** are not limited to being sheet-shaped, and the first friction member **61** and the second friction member **62** may alternatively be set in another shape, for example, a rod shape, which may be determined based on an actual situation.
[0221] FIG. **36** to FIG. **39** show an embodiment in which the first friction member **61** and the second friction member **62** are disposed in a second manner. FIG. **36** is a diagram of another structure of the damping mechanism **6** in the hinge mechanism **100** according to an embodiment; FIG. **37** is a diagram of a position relationship between the first friction member **61** and the second friction member **62** in a rotation process in FIG. **36**; FIG. **38** is a partially enlarged view of a joint between the first friction member **61** and the second friction member **62** in FIG. **37**; and FIG. **39** is a diagram of a third structure of the damping mechanism **6** in the hinge mechanism **100** according to an embodiment.
[0222] In this embodiment, the first friction member **61** includes an elastic part **612**, a flat hole **613** is provided on the elastic part **612**, and a hole wall of the flat hole **613** has a first flat surface **6131** in a circumferential direction of the flat hole **613**. The second friction member **62** is a flat shaft disposed on the base **1**, and in a circumferential direction of the flat shaft, the flat shaft is fastened relative to the base **1**, the flat shaft has a second flat surface **622** and a third flat surface **623** that are spaced from each other, and the flat shaft penetrates the flat hole **613**. As shown in FIG. **37** and FIG. **38**, when the swing arm **21** is at a folding position, the first flat surface **6131** is disposed opposite to the second flat surface **622**. When the swing arm **21** is at an unfolding position, the first flat surface **6131** is disposed opposite to the third flat surface **623**.
[0223] That the first flat surface **6131** is disposed opposite to the second flat surface **622** means that the first flat surface **6131** is parallel to or approximately parallel to the second flat surface **622** (for example, a deviation is within 5 degrees). That the first flat surface **6131** is disposed opposite to the third flat surface **623** means that the first flat surface **6131** is parallel to or approximately parallel to the third flat surface **623** (for example, a deviation is within 5 degrees).
[0224] Because the flat shaft is fastened relative to the base **1** in the circumferential direction of the flat shaft, and the flat shaft penetrates the flat hole **613**. As shown in FIG. **37** and FIG. **38**, when the swing arm **21** rotates between the folding position and the unfolding position, the first friction member **61** rotates relative to the flat shaft. As the first flat surface **6131** of the flat hole **613** moves relative to the second flat surface **622** on the flat shaft, a corner part ml that is located at an edge of the second flat surface **622** and that is on the flat shaft presses against a hole wall of the flat hole **613**. In this way, the flat shaft and the hole wall of the flat hole **613** rub against each other, to provide a rotation damping force to the swing arm **21**.

[0225] In this embodiment, when the swing arm **21** is at the folding position, the first flat surface **6131** is disposed opposite to the second flat surface **622**. When the swing arm **21** is at the unfolding position, the first flat surface **6131** is disposed opposite to the third flat surface **623**. In this way, when the swing arm **21** is at the folding position and the unfolding position, the second friction member **62** (the flat shaft) and the flat hole **613** can be in a stable-fit state. In this case, the first friction member **61** can be stably kept at the folding position and the unfolding position, so that the swing arm **21** can be stably kept at the folding position and the unfolding position, and stability of the terminal device in a folded state and an unfolded state can be ensured. In addition, in this embodiment, a rotation damping force is provided to the swing arm **21** through friction generated when the first friction member **61** rotates relative to the second friction member **62**. Because the second friction member **62** is a flat shaft disposed on the base **1**, the elastic part **612** of the first friction member **61** is sleeved on the second friction member **62**. In this way, the first friction member **61** and the second friction member **62** are more compact and occupy less space.
[0226] In some embodiments, as shown in FIG. **37** and FIG. **38**, when the swing arm **21** is at the folding position, there is a second gap **64** between the first flat surface **6131** and the second flat surface **622**. In this way, when the swing arm **21** rotates to a position near the folding position (for example, deviates from the folding position within a preset angle), there is sufficient space for the second flat surface **622** to avoid the corner part ml at the edge of the second flat surface **622**, to avoid extrusion between the corner part ml and the hole wall of the flat hole **613**. Therefore, when the swing arm **21** rotates to a position near the folding position, no friction occurs between the first friction member **61** and the second friction member **62**, that is, no rotation damping force is provided to the swing arm **21**, so that the first cam structure **4** can conveniently eject the housing **300** of the terminal device. This embodiment is applicable to a case in which an ejection force provided by the first cam structure **4** is small.
[0227] In some embodiments, as shown in FIG. **37** and FIG. **38**, when the swing arm **21** is at the unfolding position, there is a third gap **65** between the first flat surface **6131** and the third flat surface **623**. In this way, when the swing arm **21** rotates to a position near the unfolding position (for example, deviates from the unfolding position within a preset angle), there is sufficient space for the third flat surface **623** to avoid the corner part ml at the edge of the second flat surface **622**, so as to avoid extrusion between the corner part ml and the hole wall of the flat hole **613**. Therefore, when the swing arm **21** rotates to a position near the folding position, no friction occurs between the first friction member **61** and the second friction member **62**, that is, no rotation damping force is provided to the swing arm **21**, so that the second cam structure **5** can conveniently keep the terminal device at the unfolded state. This embodiment is applicable to a case in which an unfolding force provided by the second cam structure **5** is small.
[0228] The preset angle may be 10 degrees, but is not limited thereto. The preset angle may alternatively be 5 degrees, 8 degrees, or the like, which may be determined based on an actual situation. When the preset angle is 10 degrees, and unfolding and folding angles (the included angle between the first display area **210** and the second display area **220** in FIG. **2**) of the two housings **300** of the terminal device are between 20° and 160°, the corner part ml presses against the hole wall of the flat hole **613**, and an extrusion force between the corner part ml and the hole wall of the flat hole **613** is increasingly large in a range of 20° to 90°, and is increasingly small in a range of 900 to 160°. When the unfolding and folding angles of the two housings **300** of the terminal device are 90°, the extrusion force between the corner part ml and the hole wall of the flat hole **613** is the greatest, and the rotation damping force provided is the greatest.
[0229] In some other embodiments, when the swing arm **21** is at the folding position, the first flat surface **6131** is attached to the second flat surface **622**; or when the swing arm **21** is at the unfolding position, the first flat surface **6131** is attached to the third flat surface **623**. In this way, in an entire process in which the swing arm **21** rotates from the folding position to the unfolding position, the corner part ml presses against the hole wall of the flat hole **613**, to provide a rotation

damping force to the swing arm **21**, so as to avoid an excessively high speed at which the terminal device is ejected under an action of the first cam structure **4** and an excessively high speed at which the terminal device is unfolded under an action of the second cam structure **5**. This embodiment is applicable to a case in which the first cam structure **4** provides a large ejection force and the second cam structure **5** provides a large unfolding force.

[0230] In some embodiments, as shown in FIG. **36**, the elastic part **612** is formed by the first friction member **61** through an edge rolling process. Compared with a case in which the elastic part **612** and a body of the first friction member **61** are disposed separately, in the case in which the elastic part **612** is formed through the edge rolling process, a process of assembling the elastic part **612** is reduced. This not only helps improve assembling efficiency of the damping mechanism **6**, but also improves reliability of a connection between the elastic part **612** and the body of the first friction member **61**.

[0231] In some embodiments, as shown in FIG. **39**, the first friction member **61** is of a sheet-like structure, there is a plurality of first friction members **61**, the plurality of first friction members **61** is stacked, each first friction member **61** is provided with a notch **614** at the flat hole **613** for breaking the hole wall of the flat hole **613**, and notches **614** of the plurality of first friction members **61** form a slot **615** that extends in an axial direction X of the flat shaft. Compared with the case in which the elastic part **612** is formed through the edge rolling process, in the solution in this embodiment, the elastic part **612** (namely, an edge rolling structure) shown in FIG. **36** is split into a plurality of sheet-like structures that are stacked. In this way, the flat hole **613** of the sheet-like elastic part **612** may be formed through a stamping process, and does not need to be manufactured through the edge rolling process. This helps reduce the processing difficulty and costs of the flat hole **613** of the elastic part **612**.

[0232] In some embodiments, as shown in FIG. **36** and FIG. **39**, the second friction member **62** and the mounting shaft **15** are of an integrated structure. The second friction member **62** and the mounting shaft **15** may alternatively be disposed, which may be determined based on an actual situation.

[0233] For an example of a connection relationship between the first friction member **61** and the swing arm **21**, refer to the connection relationship between the first friction member **61** and the swing arm **21** in the embodiments shown in FIG. **33** to FIG. **35**. Details are not described herein again.

[0234] In some embodiments, as shown in FIG. **40** to FIG. **43**, FIG. **40** is a diagram of a structure of the hinge mechanism **100** according to some embodiments; FIG. **41** is a partially enlarged view of a position of a torsion spring in the hinge mechanism **100** shown in FIG. **40**; FIG. **42** is a sectional view of the hinge mechanism **100** in FIG. **40** at H-H; and FIG. **43** is a status diagram of a torsion spring in a rotation process of the swing arm **21** according to an embodiment. The swing arm **21** is rotatably connected to the base **1** through the rotating shaft **24**, a torsion spring **7** is sleeved on the rotating shaft **24**, and the first connection arm **71** of the torsion spring **7** is connected to the swing arm **21**.

[0235] As shown in FIG. **41**, the first connection arm **71** is inserted into a hole provided on the swing arm **21**, to connect the first connection arm **71** to the swing arm **21**. However, this is not limited thereto. The first connection arm **71** may alternatively be connected to the swing arm **21** through clamping, or the like, which may be determined based on an actual situation. The rotating shaft **24** and the mounting shaft **15** of the base **1** may be of an integrated structure, or may be designed separately. This is not limited herein.

[0236] A stop part **16** is disposed on the base **1**. As shown in FIG. **43**, when the swing arm **21** is at an unfolding position, the second connection arm **72** is separated from the stop part **16**, so that the torsion spring **7** is in a natural state. When the swing arm **21** rotates between a middle position and a folding position, the second connection arm **72** of the torsion spring **7** presses against the stop part **16**, so that the torsion spring **7** is in a force-storage state, to apply, to the swing arm **21**, an

action force that can drive the swing arm **21** to rotate toward the unfolding position, where the middle position is a position between the folding position and the unfolding position in a rotation direction of the swing arm **21**.

[0237] The torsion spring **7** is disposed, so that when the swing arm **21** is in a folded state, the torsion spring **7** may apply, to the swing arm **21**, an action force that can drive the swing arm **21** to rotate toward the unfolding position, to assist the housing **300** of the terminal device in unfolding. The torsion spring **7** and the first cam structure **4** may be combined to provide a large unfolding force, so that the hinge mechanism **100** is applicable to a terminal device that requires a large unfolding force.

[0238] In addition, when the swing arm **21** rotates between the middle position and the folding position, the torsion spring **7** abuts against the stop part **16**. That is, the torsion spring **7** abuts against the stop part **16** in a part of a range in which the swing arm **21** rotates toward the folding position, so that a deformation amount of the torsion spring **7** in a case in which the swing arm **21** is at the folding position can be reduced. In this way, a magnitude of a reaction force, to which the torsion spring **7** is subjected, of the swing arm **21** and the stop part **16** can be reduced, so that the torsion spring **7** is not easily damaged due to an excessively large reaction force, and a service life of the torsion spring **7** can be prolonged.

[0239] A structure of the stop part **16** is not unique. In some embodiments, as shown in FIG. **41**, FIG. **42**, and FIG. **43**, the stop part **16** is a stop surface disposed on the base **1**, and motion space **17** for the second connection arm **72** to swing is disposed between the stop surface and the torsion spring **7**. In a process of rotating the swing arm **21**, the second connection arm **72** may move in the motion space **17**.

[0240] As shown in FIG. **43**, when the swing arm **21** is at the unfolding position, the second connection arm **72** is located in the motion space **17**, and there is a distance between the second connection arm **72** and the stop surface. In this case, the torsion spring **7** does not deform and is in a natural state. When the swing arm **21** rotates between the middle position and the folding position, the second connection arm **72** presses against the stop surface, and the torsion spring **7** deforms to be in a force-storage state, so as to apply, to the swing arm **21**, an action force that can drive the swing arm **21** to rotate toward the unfolding position.

[0241] The stop surface on the base **1** is set as the stop part **16**, so that a structure on the base **1** can be fully used, the structure of the stop part **16** is simple, and other components do not need to be mounted on the base **1**. This helps reduce costs.

[0242] The motion space **17** is space located between the stop surface and the torsion spring **7**. For example, as shown in FIG. **41** and FIG. **42**, the motion space **17** may be a cavity on the base **1**, the stop part **16** is a cavity wall of the cavity, and a side that is of the cavity and that is close to the torsion spring **7** has an extension hole for the second connection arm **72** to extend into.

[0243] In some other embodiments, as shown in FIG. **44** and FIG. **45**, FIG. **44** is a sectional view of the base **1** of the hinge mechanism **100** at a position close to the torsion spring **7** according to some embodiments; and FIG. **45** is a position status diagram of the second connection arm **72** of the torsion spring **7** in a rotation process of the swing arm **21** according to an embodiment. The base **1** is provided with an arc-shaped groove **18** for the second connection arm **72** to extend into, the arc-shaped groove **18** extends in a circumferential direction of the gear **22**, and a groove wall at an end of the arc-shaped groove **18** is the stop part **16**.

[0244] As shown in FIG. **45**, when the swing arm **21** is at an unfolding position, the second connection arm **72** is located at a lower end of the arc-shaped groove **18**. In this case, the torsion spring **7** does not deform and is in a natural state. When the swing arm **21** rotates between a middle position and the folding position, the second connection arm **72** presses against a groove arm at an upper end of the arc-shaped groove **18**, and the torsion spring **7** deforms to be in a force-storage state, so as to apply, to the swing arm **21**, an action force that can drive the swing arm **21** to rotate toward the unfolding position.

[0245] The groove wall of the arc-shaped groove **18** on the base **1** is set as the stop part **16**, so that a structure on the base **1** can be fully used, the structure of the stop part **16** is simple, and other components do not need to be mounted on the base **1**. This helps reduce costs. In addition, the arc-shaped groove **18** may also be configured to guide motion of the second connection arm **72**, so that shake of the second connection arm **72** in a motion process can be reduced, and the second connection arm **72** moves more smoothly.

[0246] In some embodiments, as shown in FIG. **44**, the swing arm **21** includes two swing sub-arms **211**, the two swing sub-arms **211** are spaced from each other in an axial direction X of the gear **22**, and the two swing sub-arms **211** are connected through the connector **63**, so that the two swing sub-arms **211** can rotate synchronously relative to the base **1**. The two swing sub-arms **211** are a first swing sub-arm **211***a* and a second swing sub-arm **211***b*, and the first swing sub-arm **211***a* is in transmission connection to the gear **22**. The torsion spring **7** is located on a side that is of the second swing sub-arm **211***b* and that is away from the first swing sub-arm **211***a*, and the second connection arm **72** of the torsion spring **7** is connected to the second swing sub-arm **211***b*. The torsion spring **7** is disposed on the side that is of the second swing sub-arm **211***b* and that is away from the first swing sub-arm **211***a*. In this way, the torsion spring **7** may be disposed away from the gear **22**, to avoid structural interference among the torsion spring **7**, the gear **22**, the bearing member **23**, and the like.

[0247] The connector **63** may be connected between the two swing sub-arms **211** through clamping, inserting, hinging, or screwing. The connector **63** may be rod-shaped, or may be in another shape, which is not limited herein.

[0248] For example, as shown in FIG. **44**, the connector **63** is rod-shaped, one end of the connector **63** is inserted into a hole on one swing sub-arm **211**, and the other end of the connector **63** is inserted into a hole on the other swing sub-arm **211**.

[0249] In the descriptions of this specification, the described features, structures, materials, or characteristics may be combined in a proper manner in any one or more of embodiments or examples.

[0250] The hinge mechanism **100** in embodiments is not limited to being used in a terminal device, and may be further used in a product that needs to be unfolded and folded in the field of automobiles, aircrafts, home appliances, and consumer electronics.

[0251] The foregoing embodiments are merely intended to describe the technical solutions of this disclosure, but not intended to limit this disclosure. Although this disclosure is described in detail with reference to the foregoing embodiments, persons of ordinary skill in the art should understand that they may still make modifications to the technical solutions described in the foregoing embodiments or make equivalent replacements to some technical features thereof, without departing from the spirit and scope of the technical solutions of the this disclosure.

Claims

1. A hinge mechanism, comprising: a base; a swing arm assembly comprising: a first bearing member fastened to the base; a pair of swing arms rotatably connected to two opposite edges of the base; and an even number of gears disposed in a direction axial to the first bearing member, wherein the gears are in transmission connection between the pair of swing arms and configured so that each of the pair of swing arms is synchronously rotatable between a folding position and an unfolding position relative to the base; a plurality of elastic pieces, wherein each of the plurality of elastic pieces is aligned with a corresponding gear of the gears and is configured to apply an elastic force to press the first bearing member to contact the corresponding gear; and a first cam structure disposed between first end faces of the gears and the first bearing member and comprising; a plurality of first protrusion parts disposed on the first bearing member or on the first end face of each of the gears, wherein the first protrusion parts comprise a first side surface; and a plurality of

second protrusion parts disposed on the first bearing member or on the first end face of each of the gears and configured to abut, due to the elastic force, against the first side surface when the swing arm assembly is in the folding position, wherein the second protrusion parts and the first side surface are biased to move toward each other to apply to the gears a force for driving the swing arm assembly to rotate toward the unfolding position.

2. The hinge mechanism of claim 1, wherein the first protrusion parts are disposed in a circumferential direction on the first end face of each of the gears, wherein a first notch is defined between two adjacent first protrusion parts, and wherein each of second protrusion parts is configured to extend into a corresponding first notch when the swing arm assembly is in the folding position and in the unfolding position.

3. The hinge mechanism of claim 2, wherein the first notch comprises a first bottom surface perpendicular to an axial direction relative to the gears, and wherein the second protrusion parts are configured to abut against the first bottom surface when the swing arm assembly is in the unfolding position.

4. The hinge mechanism of claim 3, wherein each of the first protrusion parts comprises a second side surface disposed in the circumferential direction and opposite to the first side surface, wherein an inclination angle of the second side surface relative to the axial direction is less than an inclination angle of the first side surface relative to the axial direction, and wherein the second side surface is connected to a first side surface of an adjacent first protrusion part through the first bottom surface.

5. The hinge mechanism of claim 3, wherein when the swing arm assembly is in the folding position, the second protrusion part is configured to be in surface contact with the first side surface, and when the swing arm assembly is in the unfolding position, each of the second protrusion parts is configured to be in surface contact with the first bottom surface.

6. The hinge mechanism of claim 1, wherein the first protrusion parts are disposed in a circumferential direction relative to the gears and wherein each of the second protrusion parts is configured to abut against a first side surface of a first protrusion part when the swing arm assembly is in the folding position, and to abut against a second side surface of a second first protrusion part when the swing arm assembly is in the unfolding position.

7. The hinge mechanism of claim 6, wherein each of the first protrusion parts comprises a second side surface disposed opposite to the first side surface in the circumferential direction, and wherein an inclination angle of the second side surface relative to the axial direction is greater than an inclination angle of the first side surface relative to the axial direction, and/or in the circumferential direction, a center angle corresponding to a distance between first side surfaces of two adjacent first protrusion parts is 90 degrees.

8. The hinge mechanism of claim 1, wherein either: the first cam structure is disposed between each of the gears and the first bearing member; or two outermost gears of the gears are fastened to corresponding swing arms, a gear disposed between the two outermost gears is slidably connected to the base in the axial direction and the first cam structure is disposed between the gear and the first bearing member, wherein a second bearing member is disposed on second end faces opposite the first end face of each of the gears, and wherein the first cam structure is disposed between each of the first end faces and the first bearing member.

9. The hinge mechanism of claim 1, further comprising a second cam structure disposed between second end faces of the gears and the second bearing member, wherein the second cam structure comprises: a plurality of third protrusion parts disposed on the second bearing member or on the second end face of each of the gears, wherein the third protrusion parts comprise a third side surface; and a plurality of fourth protrusion parts disposed on the second bearing member or on the second end face of each of the gears and configured to abut against the third side surface due to the elastic force when the swing arm assembly is in the unfolding position, wherein the fourth protrusion parts and the third side surface are biased to move toward each other to apply to the

gears, a force to prevent the swing arm assembly from rotating in a direction toward the folding position.

10. The hinge mechanism of claim 9, wherein the third protrusion parts further comprise a fourth side surface oriented in a circumferential direction relative to the gears, wherein the fourth side surface is disposed opposite the third side surface, and wherein an inclination angle of the fourth side surface relative to the axial direction is greater than an inclination angle of the third side surface relative to the axial direction.

11. The hinge mechanism of claim 9, wherein the plurality of third protrusion parts is arranged in a circumferential direction relative to the gears, wherein a second notch is defined between two adjacent third protrusion parts, wherein a first positioning part is disposed in the second notch and is configured to position the fourth protrusion parts when the swing arm assembly is in the folding position, and wherein the first positioning part comprises a first positioning surface perpendicular to the axial direction and is configured to be in surface contact with the first positioning surface when the swing arm assembly is in the folding position.

12. The hinge mechanism of claim 9, wherein either: the first cam structure is disposed between the first end faces and the first bearing member, and the second cam structure is disposed between the second end faces and the second bearing member; or further comprising: a first plurality of swing arm assemblies disposed in the axial direction, wherein in the first plurality of swing arm assemblies, the first and second bearing members are respectively disposed on two sides of the gears, wherein the second cam structure is disposed between each second end face and a corresponding bearing member; a second plurality of swing arm assemblies disposed in the axial direction, wherein in the second plurality of swing arm assemblies, the first and second bearing members are respectively disposed on two sides of the gears, and wherein the first cam structure is disposed between each first end face and a corresponding bearing member.

13. The hinge mechanism of claim 9, wherein in the swing arm assembly, either; the second cam structure is disposed between each of the gears and the first bearing member; or two outermost gears are fastened to corresponding swing arms, wherein gears between two outermost gears are slidably connected to the base in the axial direction, and wherein the second cam structure is disposed between the gears and the first bearing member.

14. The hinge mechanism of claim 1, further comprising a damping mechanism comprising: a first friction member rotatably connected to the base, wherein the first friction member is connected to the swing arm assembly via a connector configured for synchronous rotation of the first friction member and the swing arm assembly relative to the base; and a second friction member disposed on the base and in contact with the first friction member, and configured to apply a rotation damping force to the swing arm assembly when the swing arm assembly rotates between the folding position and the unfolding position.

15. The hinge mechanism of claim 14, further comprising a plurality of first friction members and a plurality of second friction members arranged in the axial direction, wherein a first gap is defined between two adjacent second friction members, and wherein each first friction member is configured to be inserted into a corresponding first gap and in contact with an adjacent second friction member.

16. The hinge mechanism of claim 15, wherein the first friction members comprise an elastic part, wherein a flat hole is provided on the elastic part, and wherein a hole wall of the flat hole has a first flat surface in a circumferential direction of the flat hole, wherein the second friction members comprise a flat shaft disposed on the base, wherein the flat shaft is fastened to the base in a circumferential direction of the flat shaft, the flat shaft has a second flat surface and a third flat surface, and wherein the flat shaft penetrates the flat hole, whereby when the swing arm assembly is in the folding position the first flat surface is disposed opposite the second flat surface, and when the swing arm assembly is in the unfolding position the first flat surface is disposed opposite the third flat surface.

17. The hinge mechanism of claim 16, wherein when the swing arm assembly is in the folding position, a first gap is provided between the first flat surface and the second flat surface, wherein when the swing arm assembly is in the unfolding position, a second gap is provided between the first flat surface and the third flat surface, and wherein the elastic part comprises either: a plurality of stacked first friction members, wherein the first friction members comprise edge rolled structures; or the plurality of stacked first friction members, wherein the first friction members comprise sheet-like structures, and wherein each first friction member comprises a notch in the hole wall of the flat hole, and wherein the notches form a slot extending in an axial direction of the flat shaft.

18. The hinge mechanism of claim 1, further comprising: a rotatable shaft connecting the swing arm assembly to the base; a torsion spring sleeved on the rotating shaft comprising: a first connection arm connected to the swing arm assembly; and a second connection arm connected to the swing arm assembly; and a stop part disposed on the base and configured to separate the second connection arm from the stop part when the swing arm assembly is in the unfolding position to place the torsion spring in a relaxed state, wherein when the swing arm assembly rotates between a middle position and the folding position, the second connection arm abuts against the stop part to place the torsion spring in a compressed state, to apply, to the swing arm assembly, a force for driving the swing arm assembly to rotate toward the unfolding position, and wherein the middle position is a position between the folding position and the unfolding position in a rotation direction of the swing arm assembly.

19. The hinge mechanism of claim 18, wherein the base further comprises: an arc-shaped groove extending in a circumferential direction of the rotating shaft, and configured to receive the second connection arm, and comprising: a wall at an end defining the stop part; or a stop surface disposed on the base configured to provide space for the second connection arm to swing between the stop surface and the torsion spring.

20. A terminal device, comprising: a display; at least two housings configured to confine the display; and a hinge mechanism defining a joint of the housings, and comprising: a base; a swing arm assembly comprising: a bearing member fastened to the base; a pair of swing arms rotatably connected to two opposite edges of the base; an even number of gears, disposed in a direction axial to the bearing member, wherein the gears are in transmission connection between the pair of swing arms and configured so that each of the pair of swing arms is synchronously rotatable between a folding position and an unfolding position relative to the base; a plurality of elastic pieces, wherein each of the plurality of elastic pieces is aligned with a corresponding gear of the gears and is configured to apply an elastic force to press the bearing member to contact the corresponding gear; and a first cam structure disposed between first end faces of the gears and the bearing member and comprising; a plurality of first protrusion parts disposed on the bearing member or on the first end face of each of the gears, wherein the first protrusion parts comprise a first side surface; and a plurality of second protrusion parts disposed on the bearing member or on the first end face of each of the gears, and configured to abut, due to the elastic force, against the first side surface when the swing arm assembly is in the folding position, wherein the second protrusion parts and the first side surface are biased to move toward each other, to apply, to the gears, a force for driving the swing arm assembly to rotate toward the unfolding position.