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Fan blade installation mechanism

Abstract

A fan blade installation mechanism includes a slot and an elastic member. The elastic member is fixedly connected to a groove above the slot. The elastic member is elastically moved between the slot and the groove for a blade to be inserted into the slot. A blade hole of the blade is guided and secured by bevels of a protrusion of an elastic portion in the slot and the elastic member. The elastic member has an operation portion. The fan blade installation mechanism has the advantages of rapid installation and removal of blades, stability without wobbling, ease of assembly, high assembly safety, and reducing the tolerance and gap between the blade and the fan blade installation mechanism in the manufacturing process.

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
6059531	12/1999	Tai	416/207	F04D 29/34
6378824	12/2001	Tseng	248/220.21	F04D 29/34
12180973	12/2023	Chen	N/A	F04D 25/088
12203478	12/2024	Guo	N/A	F04D 29/34
12264686	12/2024	Botkin	N/A	F04D 29/34
2023/0111026	12/2022	Wang	416/210R	F04D 29/34

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Background/Summary

FIELD OF THE INVENTION

(1) The present invention relates to a ceiling fan, and more particularly to a fan blade installation mechanism.

BACKGROUND OF THE INVENTION

(2) A conventional ceiling fan blade installation structure comprises a slot, a fan blade, and an elastic locking member. The fan blade has a circular positioning hole. The elastic locking member is located in the slot. An elastic end of the elastic locking member has an arc-shaped protrusion corresponding to the circular positioning hole of the fan blade. The arc-shaped protrusion has a bevel facing outward and corresponding to the fan blade. When the bevel is pushed by the fan blade, the arc-shaped protrusion is elastically displaced, allowing the fan blade to be inserted in the slot. When the fan blade is inserted to an appropriate position, the arc-shaped protrusion is engaged in the circular positioning hole of the fan blade to complete the assembly of the fan blade.

(3) In the foregoing conventional ceiling fan blade installation structure, there is a tolerance and gap between the arc-shaped protrusion of the elastic locking member and the blade hole in the manufacturing process, and there is a large gap between the slot and the fan blade because the elastic locking member is disposed in the slot, which has the disadvantage of being easy to wobble. Accordingly, the inventor of the present invention has devoted himself based on his many years of practical experiences to solve these problems.

SUMMARY OF THE INVENTION

(4) The primary object of the present invention is to provide a fan blade installation mechanism, which has the advantages of rapid installation and removal of blades, good tightness, stability without wobbling, ease of assembly, and high assembly safety.

(5) In order to achieve the above object, the present invention provides a fan blade installation mechanism, applied to a ceiling fan motor and a blade. The ceiling fan motor includes a rotating portion. The blade has a coupling end and a coupling portion. The coupling portion is adjacent to the coupling end. The coupling portion is gradually enlarged from the coupling end in a direction away from the coupling end. The coupling portion of the blade has a blade hole longitudinally passing through the coupling portion. The blade hole is a polygonal hole. A bottom of the blade hole has a plurality of bottom edges. The coupling portion further has a fastening portion between the blade hole and the coupling end. The fan blade installation mechanism comprises an upper part,

a lower part, and an elastic member. One of the upper part and the lower part is fixedly connected to the rotating portion. The upper part is fixedly connected to the lower part to form a slot between the upper part and the lower part. The slot forms a slot space therein. The slot space has a height corresponding to a thickness of the blade. A front opening is formed on an outer side of the slot for insertion of the coupling portion of the blade, so that the blade can be moved along a displacement path within the slot space. The upper part is fixed to an underside of the rotating portion of the ceiling fan motor. One side of the upper part, adjacent to the slot space, is recessed upward to form a groove. The groove communicates with the slot space. The groove is formed with at least one screw hole. The lower part is fixed to an underside the upper part. The lower part has a blocking wall corresponding to the coupling portion of the blade. The lower part further has an elastic portion. One end of the elastic portion is connected to the lower part. Another end of the elastic portion is adjacent to the slot space and has a protrusion corresponding to the blade hole. The protrusion has a plurality of bevels corresponding to the bottom edges of the blade hole. The bevels each slope outwardly from top to bottom. The protrusion is gradually enlarged from top to bottom, allowing the protrusion to lean against the bottom edges of the blade hole. Two of the bevels are defined as a front bevel and a rear bevel. The front bevel corresponds to the front opening and the coupling end of the blade. A rear opening is formed between the upper part and the lower part opposite the front opening. The elastic member has a closed end and a free end. The closed end of the elastic member is formed with at least one through hole. At least one screw passes through the through hole of the closed end of the elastic member and is screwed to the screw hole of the groove of the upper part. The closed end of the elastic member is fixedly connected to the groove of the upper part through at least one screw. The at least one screw is not beyond the groove. The free end of the elastic member extends toward the slot space and the displacement path. The free end of the elastic member has a pushing portion, a first blocking portion, a second blocking portion, and an operating portion. The pushing portion corresponds to the front opening of the slot and the coupling end of the blade. The pushing portion slopes downwardly a direction away from the front opening. The first blocking portion extends upwardly from one end of the pushing portion opposite the front opening. The second blocking portion extends transversely from the first blocking portion in the direction away from the front opening. The first blocking portion and the second blocking portion correspond to the fastening portion of the blade. The operating portion extends outwardly from the second blocking portion toward the rear opening.

(6) In a normal state, the pushing portion and the first blocking portion of the elastic member and the protrusion of the elastic portion of the lower part are located in the displacement path. When the coupling end and the coupling portion of the blade apply force to the pushing portion of the elastic member and the front bevel of the protrusion of the lower part, the protrusion of the elastic portion of the lower part is elastically moved away from the displacement path, and the pushing portion, the first blocking portion and the second blocking portion of the elastic member are elastically moved toward the groove and away from the displacement path. When the coupling portion of the blade is fully inserted into the slot, the blocking wall of the lower part engages the coupling portion of the blade, the slot restricts longitudinal displacement of the coupling portion of the blade, and the elastic member and the protrusion of the elastic portion of the lower part are elastically displaced to a position in the normal state, so that the first blocking portion and the second blocking portion of the elastic member and the blocking wall of the lower part and the rear bevel of the protrusion of the lower part guide and secure the tightening portion of the blade. The rear bevel leans against a corresponding one of the bottom edges of the blade hole, so that the coupling portion of the blade is tightly against the blocking wall of the lower part for restricting longitudinal, transverse and circumferential displacement of the coupling portion of the blade to complete installation of the blade. When a user applies force to the operating portion in an upward direction, the pushing portion, the first blocking portion and the second blocking portion of the elastic member are elastically moved toward the groove and away from the displacement path for the user

to remove the blade.
(7) The fan blade installation mechanism provided by the present invention has the advantages of rapid installation and removal of blades, stability without wobbling, and reducing the tolerance and gap between the blade and the fan blade installation mechanism in the manufacturing process. Through the configuration of the operating portion, the user can work underneath the blade, thereby enhancing the convenience and safety of assembling the blade.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is an exploded view according to a preferred embodiment of the present invention;
(2) FIG. **2** is a perspective view of the lower part according to the preferred embodiment of the present invention;
(3) FIG. **3** is a schematic view according to the preferred embodiment of the present invention when in use, illustrating the assembly of the upper part, the lower part and the elastic member;
(4) FIG. **4** is a schematic view according to the preferred embodiment of the present invention when in use, illustrating that the blade is not inserted into the slot;
(5) FIG. **5** is a schematic view according to the preferred embodiment of the present invention when in use, illustrating that the blade applies force to the elastic member;
(6) FIG. **6** is a schematic view according to the preferred embodiment of the present invention when in use, illustrating that the coupling portion of the blade is fully inserted into the slot;
(7) FIG. **7** is a schematic view according to the preferred embodiment of the present invention when in use, illustrating the configuration of the blade hole, the rear bevel and the side bevels when the coupling portion of the blade is fully inserted into the slot;
(8) FIG. **8** is a schematic view according to the preferred embodiment of the present invention when in use, illustrating the configuration of the groove and the screw when the coupling portion of the blade is fully inserted into the slot; and
(9) FIG. **9** is a schematic view according to the preferred embodiment of the present invention when in use, illustrating that the user applies force to the operating portion to remove the blade.
DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS
(10) Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings.
(11) As shown in FIG. **1** through FIG. **9**, the present invention discloses a fan blade installation mechanism **100**, applied to a ceiling fan motor **101** and a blade **102**. The ceiling fan motor **101** is an external rotor motor. The ceiling fan motor **101** includes a rotor **101***a* and a rotating portion **101***b*. The rotor **101***a* drives the rotating portion **101***b* to rotate. The blade **102** has a coupling end **102***a* and a coupling portion **102***b*. The coupling portion **102***b* is adjacent to the coupling end **102***a*. The coupling portion **102***b* is gradually enlarged from the coupling end **102***a* in a direction away from the coupling end **102***a*. The coupling portion **102***b* of the blade **102** has a blade hole **102***c* longitudinally passing through the coupling portion **102***b*. The blade hole **102***c* is a polygonal hole. In this embodiment, the blade hole **102***c* is a square hole. The bottom of the blade hole **102***c* has a plurality of bottom edges **102***d*. The coupling portion **102***b* further has a fastening portion **102***e* between the blade hole **102***c* and the coupling end **102***a*. The fan blade installation mechanism **100** includes an upper part **10**, a lower part **20**, and an elastic member **30**. One of the upper part **10** and the lower part **20** is fixedly connected to the rotating portion **101***b*. The upper part **10** is fixedly connected to the lower part **20** to form a slot **21** between the upper part **10** and the lower part **20**. The slot **21** forms a slot space **21***a* therein. The height of the slot space **21***a* corresponds to the thickness of the blade **102**. A front opening **21***b* is formed on the outer side of the slot **21** for insertion of the coupling portion **102***b* of the blade **102**, so that the blade **102** can be moved along a

displacement path **21***c* within the slot space **21***a*.
(12) The upper part **10** is fixed to the underside of the rotating portion **101***b* of the ceiling fan motor **101**. One side of the upper part **10**, adjacent to the slot space **21***a*, is recessed upward to form a groove **11**. The groove **11** communicates with the slot space **21***a*. The groove **11** is formed with at least one screw hole **12**.
(13) The lower part **20** is fixed to the underside the upper part **10**. The lower part **20** has a longitudinal blocking wall **22** corresponding to the coupling portion **102***b* of the blade **102**. The lower part **20** further has an elastic portion **23**. The elastic portion **23** is located at a middle position of the lower part **20**. One end of the elastic portion **23** is connected to the lower part **20**. The elastic portion **23** is integrally formed with the lower part **20**. The other end of the elastic portion **23** is adjacent to the slot space **21***a* and has a protrusion **23***a* corresponding to the blade hole **102***c*. The protrusion **23***a* has a plurality of bevels **23***b* corresponding to the bottom edges **102***d* of the blade hole **102***c*. The bevels **23***b* each slope outwardly from top to bottom. The protrusion **23***a* is gradually enlarged from top to bottom, allowing the protrusion **23***a* to lean against the bottom edges **102***d* of the blade hole **102***c*. At least one of the bevels **23***b* leans against a corresponding one of the bottom edges **102***d* of the blade hole **102***c*. Two of the bevels **23***b* are defined as a front bevel **23***c* and a rear bevel **23***d*. The front bevel **23***c* corresponds to the front opening **21***b* and the coupling end **102***a* of the blade **102**. The bevels **23***b* further define a plurality of side bevels **23***e*. The rear bevel **23***d* and the side bevels **23***e* lean against the corresponding bottom edges **102***d* of the blade hole **102***c*. A rear opening **21***d* is formed between the upper part **10** and the lower part **20** opposite the front opening **21***b*. The groove **11** of the upper part **10** communicates with the rear opening **21***d*.
(14) Furthermore, one side of the lower part **20**, adjacent to the slot space **21***a*, has two protruding ribs **24** corresponding to the underside of the coupling portion **102***b* of the blade **102**. The protruding ribs **24** are spaced apart from each other and located at two sides of the protrusion **23***a* of the elastic portion **23** for reducing friction when the coupling portion **102***b* of the blade **102** is inserted into the slot **21**.
(15) The elastic member **30** has a closed end **31** and a free end **32**. The closed end **31** of the elastic member **30** is formed with at least one through hole **31***a*. The width of the elastic member **30** corresponds to the width of the groove **11**. At least one screw **33** passes through the through hole **31***a* of the closed end **31** of the elastic member **30** and is screwed to the screw hole **12** of the groove **11** of the upper part **10**. The at least one screw **33** is not beyond the groove **11**. The free end **32** of the elastic member **30** extends toward the slot space **21***a* and the displacement path **21***c*. The free end **32** of the elastic member **30** has a pushing portion **34**, a first blocking portion **35**, a second blocking portion **37**, and an operating portion **38**. The pushing portion **34** corresponds to the front opening **21***b* of the slot **21** and the coupling end **102***a* of the blade **102**. The pushing portion **34** slopes downwardly in a direction away from the front opening **21***b*. The first blocking portion **35** extends upwardly from one end of the pushing portion **34** opposite the front opening **21***b*. An included angle **36** is defined between the pushing portion **34** and the first blocking portion **35** of the elastic member **30** to enhance the structural strength of the first blocking portion. The second blocking portion **37** extends transversely from the first blocking portion **35** in a direction away from the front opening **21***b*. The first blocking portion **35** and the second blocking portion **37** correspond to the fastening portion **102***e* of the blade **102**. The operating portion **38** extends outwardly from the second blocking portion **37** toward the rear opening **21***d*. The rear bevel **23***d* of the protrusion **23***a* of the lower part **20** corresponds to the first blocking portion **35**.
(16) Referring to FIG. **4**, in a normal state, the pushing portion **34** and the first blocking portion **35** of the elastic member **30** and the protrusion **23***a* of the elastic portion **23** of the lower part **20** are located in the displacement path **21** *c*.
(17) Referring to FIG. **5**, when the coupling end **102***a* and the coupling portion **102***b* of the blade **102** apply force to the pushing portion **34** of the elastic member **30** and the front bevel **23***c* of the

protrusion **23***a* of the lower part **20**, the protrusion **23***a* of the elastic portion **23** of the lower part **20** is elastically moved away from the displacement path **21***c*, and the pushing portion **34**, the first blocking portion **35** and the second blocking portion **37** of the elastic member **30** are elastically moved toward the groove **11** and away from the displacement path **21**.

(18) Referring to FIG. **6**, when the coupling portion **102***b* of the blade **102** is fully inserted into the slot **21**, the blocking wall **22** of the lower part **20** engages the coupling portion **102***b* of the blade **102**. The slot **21** restricts the longitudinal displacement of the coupling portion **102***b* of the blade **102**. The elastic member **30** and the protrusion **23***a* of the elastic portion **23** of the lower part **20** are elastically displaced to the position in the normal state, so that the first blocking portion **35** and the second blocking portion **37** of the elastic member **30** and the blocking wall **22** of the lower part **20** and the rear bevel **23***d* of the protrusion **23***a* of the lower part **20** guide and secure the tightening portion **102***e* of the blade **102**. The protrusion **23***a* of the elastic portion **23** of the lower part **20** has the feature that it is gradually enlarged from top to bottom. The rear bevel **23***d* leans against the corresponding bottom edge **102***d* of the blade hole **102***c*, so that the coupling portion **102***b* of the blade **102** is tightly against the blocking wall **22** of the lower part **20** for restricting the longitudinal, transverse and circumferential displacement of the coupling portion **102***b* of the blade **102** to complete the installation of the blade **102**, thereby reducing the tolerance and gap between the coupling portion **102***b* of the blade and the slot **21** in the manufacturing process and improving the wobbling of the blade.

(19) Referring to FIG. **1**, FIG. **2**, FIG. **6** and FIG. **7**, within a certain tolerance range of the blade hole **102***c*, the rear bevel **23***d* and the side bevels **23***e* lean against the corresponding bottom edges **102***d* of the blade hole **102***c* effectively, thereby reducing the tolerance and gap between the blade hole **102***c* and the protrusion **23***a* of the elastic member **30** in the manufacturing process and improving the wobbling of the blade.

(20) Referring to FIG. **8**, the height of the slot space **21***a* corresponds to the thickness of the blade **102**. One side of the upper part **10**, adjacent to the slot space **21***a*, is recessed upward to form the groove **11**. The screw **33** used in the elastic member **30** is not beyond the groove **11**, so that the gap among the upper part **10**, the lower part **20** and the blade **102** is extremely small. When the ceiling fan is rotating, it is less likely to cause the blade **102** to wobble.

(21) Referring to FIG. **9**, when the user applies force to the operating portion **38** in an upward direction, the pushing portion **34**, the first blocking portion **35** and the second blocking portion **37** of the elastic member **30** are elastically moved toward the groove **11** and away from the displacement path **21***c* for the user to remove the blade **102**.

(22) Although particular embodiments of the present invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the present invention. Accordingly, the present invention is not to be limited except as by the appended claims.

Claims

1. A fan blade installation mechanism, applied to a ceiling fan motor and a blade, the ceiling fan motor including a rotating portion, the blade having a coupling end and a coupling portion, the coupling portion being adjacent to the coupling end, the coupling portion being gradually enlarged from the coupling end in a direction away from the coupling end, the coupling portion of the blade having a blade hole longitudinally passing through the coupling portion, the blade hole being a polygonal hole, a bottom of the blade hole having a plurality of bottom edges, the coupling portion further having a fastening portion between the blade hole and the coupling end, the fan blade installation mechanism comprising an upper part, a lower part and an elastic member, one of the upper part and the lower part being fixedly connected to the rotating portion, the upper part being fixedly connected to the lower part to form a slot between the upper part and the lower part, the slot

forming a slot space therein, the slot space having a height corresponding to a thickness of the blade, a front opening being formed on an outer side of the slot for insertion of the coupling portion of the blade so that the blade can be moved along a displacement path within the slot space, characterized in that: the upper part is fixed to an underside of the rotating portion of the ceiling fan motor, one side of the upper part, adjacent to the slot space, is recessed upward to form a groove, the groove communicates with the slot space, the groove is formed with at least one screw hole; the lower part is fixed to an underside of the upper part, the lower part has a blocking wall corresponding to the coupling portion of the blade, the lower part further has an elastic portion, one end of the elastic portion is connected to the lower part, another end of the elastic portion is adjacent to the slot space and has a protrusion corresponding to the blade hole, the protrusion has a plurality of bevels corresponding to the bottom edges of the blade hole, the bevels each slope outwardly from top to bottom, the protrusion is gradually enlarged from top to bottom, allowing the protrusion to lean against the bottom edges of the blade hole, two of the bevels are defined as a front bevel and a rear bevel, the front bevel corresponds to the front opening and the coupling end of the blade, a rear opening is formed between the upper part and the lower part opposite the front opening; the elastic member has a closed end and a free end, the closed end of the elastic member is formed with at least one through hole, at least one screw passes through the through hole of the closed end of the elastic member and is screwed to the screw hole of the groove of the upper part, the at least one screw is not beyond the groove, the free end of the elastic member extends toward the slot space and the displacement path, the free end of the elastic member has a pushing portion, a first blocking portion, a second blocking portion and an operating portion, the pushing portion corresponds to the front opening of the slot and the coupling end of the blade, the pushing portion slopes downwardly in a direction away from the front opening, the first blocking portion extends upwardly from one end of the pushing portion opposite the front opening, the second blocking portion extends transversely from the first blocking portion in the direction away from the front opening, the first blocking portion and the second blocking portion correspond to the fastening portion of the blade, the operating portion extends outwardly from the second blocking portion toward the rear opening; wherein, in a normal state, the pushing portion and the first blocking portion of the elastic member and the protrusion of the elastic portion of the lower part are located in the displacement path; wherein when the coupling end and the coupling portion of the blade apply force to the pushing portion of the elastic member and the front bevel of the protrusion of the lower part, the protrusion of the elastic portion of the lower part is elastically moved away from the displacement path, and the pushing portion, the first blocking portion and the second blocking portion of the elastic member are elastically moved toward the groove and away from the displacement path; wherein when the coupling portion of the blade is fully inserted into the slot, the blocking wall of the lower part engages the coupling portion of the blade, the slot restricts longitudinal displacement of the coupling portion of the blade, and the elastic member and the protrusion of the elastic portion of the lower part are elastically displaced to a position in the normal state so that the first blocking portion and the second blocking portion of the elastic member and the blocking wall of the lower part and the rear bevel of the protrusion of the lower part guide and secure a tightening portion of the blade, wherein the rear bevel leans against a corresponding one of the bottom edges of the blade hole so that the coupling portion of the blade is tightly against the blocking wall of the lower part for restricting longitudinal, transverse and circumferential displacement of the coupling portion of the blade to complete installation of the blade; wherein when a user applies force to the operating portion in an upward direction, the pushing portion, the first blocking portion and the second blocking portion of the elastic member are elastically moved toward the groove and away from the displacement path for the user to remove the blade.

2. The fan blade installation mechanism as claimed in claim 1, wherein the groove of the upper part communicates with the rear opening.

3. The fan blade installation mechanism as claimed in claim 1, wherein the rear bevel of the protrusion of the lower part corresponds to the first blocking portion.
4. The fan blade installation mechanism as claimed in claim 1, wherein one side of the lower part, adjacent to the slot space, has two protruding ribs corresponding to an underside of the coupling portion of the blade, and the protruding ribs are spaced apart from each other and located at two sides of the protrusion of the elastic portion.
5. The fan blade installation mechanism as claimed in claim 1, wherein at least one of the bevels leans against a corresponding one of the bottom edges of the blade hole.
6. The fan blade installation mechanism as claimed in claim 5, wherein the bevels further define a plurality of side bevels, and the rear bevel and the side bevels lean against the corresponding bottom edges of the blade hole.
7. The fan blade installation mechanism as claimed in claim 1, wherein the elastic portion is located at a middle position of the lower part, and the elastic portion is integrally formed with the lower part.
8. The fan blade installation mechanism as claimed in claim 1, wherein the elastic member has a width corresponding to that of the groove.
9. The fan blade installation mechanism as claimed in claim 1, wherein an included angle is defined between the pushing portion and the first blocking portion of the elastic member.