

One-touch Fitting Device for Fan

Technical Field

[0001]

The present invention relates to a fitting device used for one-touch mounting and unmounting a fan, such as the one used in a cooking-range hood, to and from the fan motor shaft.

Background Art

[0002]

Generally, in order to attach the fan of a cooking-range hood to a fan motor, the threaded portion of the fan motor shaft is passed through the top plate of the fan, and a nut with a left-hand screw is fastened onto the end of the shaft's threaded portion that has passed through the top plate. This requires that (1) the person who is attaching the fan must hold the fan in one hand and use his/her other hand to rotate the nut; and (2) the person installing the fan must work in a way that is limited by the small space under the range hood and above the kitchen counter or range below the range hood, which causes a problem in that it is not easy for the person to mount the fan to the fan motor or to replace the fan.

In view of such a problem, JP-A 2009-270550 discloses a conventional fitting device for a fan that is able to mount a fan with one touch.

[0003]

This conventional fitting device for a fan provides to the fan motor shaft (1) engaging pins that can be used to prevent the shaft from rotating, (2) a circular locking groove, (3) engaging recesses that engage with the engaging pins of the motor shaft in the boss portion of the fan through which the motor shaft is passed; (4) a holding section that is locked to the locking groove due to the biasing force of a spring, so as to keep the fan attached to the fan motor shaft; and (5) a release member that releases the locking of the holding section to the locking groove by moving the holding section against the biasing force of the spring.

[0004]

In this conventional fitting device for a fan, the fan is mounted to the fan motor shaft by inserting the fan motor shaft into the boss portion of the fan, and allowing the locking groove of the motor shaft to be locked to the holding section of the fan.

The holding section is moved by operating the release member so as to release the holding section from the locking groove.

Thus, the fan can be mounted to, and unmounted from, the fan motor shaft with one touch, so that the mounting or replacing of the fan is made easy.

[0005]

Patent Document 1: JP-A 2009-270550

Summary of the Invention

Technical Problem

[0006]

However, the conventional fitting device for a fan has problems in that (1) the device is not able to stably retain the fan as noted above, because the locking groove is held by one side of the holding section; and (2) the operability of the device is not good, in that the device requires a strong spring so as not to easily cancel the holding of the fan, because (a) the spring for biasing the holding section, (b) the holding section, and (c) the release member are arranged linearly in the direction of the motor shaft, and therefore much power is needed to release the holding.

[0007]

One objective of the present invention is to overcome such prior-art problems. The present invention provides a one-touch fitting device for a fan, which is able to mount a fan to a motor shaft with one touch, stabilizing and retaining the fan, and exhibiting good operability.

Solution to Problem

[0008]

The present invention provides a one-touch fitting device for a fan, into which the motor shaft of the fan motor that rotates the fan is inserted, and which can freely be mounted to or unmounted from the motor shaft, so as to connect the fan to the motor shaft.

The one-touch fitting device includes the following:

- (1) a base that (a) is fixed to the inside of the housing that is fixed to the fan, and (b) has a motor-shaft-inserting hole, with the motor shaft being inserted into the motor-shaft-inserting hole;
 - (2) an operating member that is movably mounted to the base and that has a guide portion and an operating portion;
 - (3) an engaging part on which is formed an engagement portion that is able to engage with the engagement-target portion that is on the outer peripheral surface of the motor shaft, and with the engaging part provided to the base in such a manner that the engaging part sandwiches the guide portion, so as to be able to move back and forth in the direction of the motor shaft;
 - (4) a return spring that returns the operating member moved by the operation of the operating portion to the operating member's original position;
- and
- (5) an engaging mechanism that (a) is provided at the position of the engaging part that sandwich the guide portion, with the position of the guide portion corresponding to the position of the engaging part, and (b) causes the engaging part to move back and forth in the direction of the motor shaft due to the contacting and moving away from each other of the

engaging mechanism caused by the move of the guide portion.

The device further includes a feature that, due to said action of the engaging mechanism, the engaging part moves forward and backward in the direction of the motor shaft, whereby the engagement portion of the engaging part engages with and disengages from the engagement-target portion of the motor shaft.

[0009]

In the present invention, moving the guide portion of the operating member causes the engaging part to withdraw from the motor-shaft-inserting hole of the base via the engaging mechanism. In this condition, the fan motor shaft is inserted into the motor-shaft-inserting hole, and then the operating member is operated so as to release the operation, which causes the return spring to return the operating member to its original position.

This returning of the operating member to its original position causes the engaging part to advance toward the motor shaft via the engaging mechanism, which allows the engagement portion of the engaging part to engage with the engagement-target portion of the motor shaft and to mount the one-touch fitting device to the motor shaft.

[0010]

When the fan is mounted to the motor shaft, moving the operating member in the reverse direction causes the engaging part to withdraw from the motor shaft via the engaging mechanism, so that the engagement between the engagement portion of the engaging part and the engagement-target portion of the motor shaft is released. This allows the fan to be unmounted from the motor shaft. Thus, mounting and unmounting of the one-touch fitting device about the motor shaft can be made with one touch, and the fan is stably retained on the motor shaft, exhibiting good mounting and unmounting operability.

[0011]

In the present invention, it is preferred that the engaging mechanism is formed by the following elements:

- (1) an inside-diameter-changing portion in which the inside diameter of the guide portion is changed in the direction of the movement of the guide portion;
- (2) an supporting projecting portion that is formed on the external surface of the guide portion;
- (3) a first engaging projecting portion that is provided to one side of the engaging part, with the engaging part sandwiching the guide portion, and that is capable of making contact with the inside-diameter-changing portion; and
- (4) a second engaging projecting portion that is provided to the other side of the engaging part, with the engaging part sandwiching the guide portion, and that is capable of making contact with the supporting projecting portion.

[0012]

Also, the engaging part advances into the motor-shaft-inserting hole so as to engage with the

engagement-target portion of the motor shaft. It is preferred that the base of the fan housing be provided with a holding mechanism that prevents the engaging part from advancing into the motor-shaft-inserting hole and cancels the prevention of the advancement of the engaging part by inserting the motor shaft into the motor-shaft-inserting hole.

Because providing the holding mechanism as above prevents the engaging part from advancing into the motor-shaft-inserting hole, the motor shaft can be smoothly inserted into the motor-shaft-inserting hole without handling the operating member.

[0013]

Also, it is preferred that the guide portion of the operating member is rotatable or linearly movable relative to the base.

This structure improves the operability of the operating member.

[0014]

Also, the engaging part is formed by (1) an operating piece that contacts the guide portion while sandwiching the guide portion, and by (2) a locking piece, which has an engagement portion that is able to engage with the engagement-target portion of the motor shaft. The operating piece and lock piece contact each other via their respective surfaces, which are tapered. It is preferred that the tapered surfaces of the lock piece and the operating piece be inclined in the direction of preventing the lock piece from moving off the motor shaft.

In this configuration, even if a force is applied to the fan in the direction of causing the fan to move off from the motor shaft, the fan is prevented from moving off from the shaft, and is stably retained on the motor shaft.

[0015]

Also, it is preferred that the engaging part is provided to at least one side of the two sides that sandwich the motor-shaft-inserting hole.

The engaging part engages with at least one of the two sides of the motor shaft as above, so that the fan can be stably retained on the motor shaft.

[0016]

Also, it is preferred that the engagement portion of the engaging part and the engagement-target portion of the motor shaft are threaded portions that engage with each other.

This feature can be applied to a conventional motor shaft by using a left-hand screw without modification, and therefore the device involves versatility because it is not necessary for the motor shaft to be structured so as to be dedicated only for use with this device.

[0017]

Also, it is preferred that the lock piece is provided to the base via an elastic body that allows the lock piece to be movable along the axis of the motor shaft so as to cause the threaded portion of the lock piece to engage with the threaded portion of the motor shaft.

Because the elastic body allows the lock piece to be movable along the axis of the motor shaft as above, the threads of the threaded portion of the lock piece can automatically mate with the threads of the threaded portion of the motor shaft. Therefore, firm engagement between the lock piece and the motor shaft is obtained.

Advantageous Effects of Invention

[0018]

The present invention can provide a one-touch fitting device for a fan, with the one-touch fitting device able to mount a fan to a motor shaft with one touch, able to stabilize and retain the fan on the motor shaft, and offering good operability.

Brief Description of the Drawings

[0019]

Fig. 1 is a perspective view of an embodiment of the present invention that shows how the one-touch fitting device for a fan is mounted to a fan.

Fig. 2 is a bottom view of an embodiment of the present invention.

Fig. 3 is a side view of the first embodiment of the present invention.

Fig. 4 is a view taken in the direction of the arrow A of Fig. 3.

Fig. 5 is a cross-sectional view, taken along the line C-C of Fig. 6, that shows the lock-release state of the first embodiment of the present invention,.

Fig. 6 is a cross-sectional view, taken along the line B-B of Fig. 2, that shows the lock-release state of the first embodiment of the present invention.

Fig. 7 is a cross-sectional view that shows the locked state of the first embodiment of the present invention, and that corresponds to Fig. 5.

Fig. 8 is a cross-sectional view that shows the locked state of the first embodiment of the present invention, and that corresponds to Fig. 6.

Fig. 9 is a cross-sectional view that shows the state before the lock piece is engaged with the motor shaft in the first embodiment of the present invention.

Fig. 10 is a cross-sectional view that shows the lock piece engaged with the motor shaft in the first embodiment of the present invention.

Fig. 11 is a cross-sectional view of the second embodiment of the present invention (in the locked state), showing a flat surface that includes the axis of the motor shaft.

Fig. 12 is a cross-sectional view along the line D-D of Fig. 11.

Fig. 13 is a cross-sectional view of the second embodiment of the present invention (in the lock-release state), showing a flat surface that includes the axis of the motor shaft.

Fig. 14 is a cross-sectional view along the line E-E of Fig. 13.

Fig. 15 is a cross-sectional view that shows the state before the one-touch fitting device for a fan is mounted to the motor shaft in the third embodiment of the present invention, and that corresponds to the cross-sectional view along the line B-B of Fig. 2.

Fig. 16 is a cross-sectional view that shows the motor shaft initially inserted into the motor-shaft-inserting hole in the third embodiment of the present invention.

Fig. 17 is a cross-sectional view that shows the motor shaft fully inserted into the motor-shaft-inserting hole in the third embodiment of the present invention.

Fig. 18 is a cross-sectional view that shows the state in which the device is mounted to the motor shaft in the third embodiment of the present invention.

Fig. 19 is a cross-sectional view that shows the state in which the device is incompletely mounted to the motor shaft in the third embodiment of the present invention.

Fig. 20 is a plan view that shows the one-touch fitting device for a fan in the fourth embodiment of the present invention.

Fig. 21 is a cross-sectional view taken along the line F-F of Fig. 20.

Fig. 22 is a cross-sectional view, taken along the line G-G of Fig. 21, that shows the state before the one-touch fitting device for a fan is mounted to the motor shaft in the fourth embodiment of the present invention.

Fig. 23 is a cross-sectional view taken along the line G-G of Fig. 21 that shows the state in which the device is mounted to the motor shaft in the fourth embodiment of the present invention.

Fig. 24 is a plan view that shows the one-touch fitting device for a fan in the fifth embodiment of the present invention.

Fig. 25 is a cross-sectional view taken along the line H-H of Fig. 25.

Fig. 26 is a cross-sectional view, taken along the line I-I of Fig. 25, that shows the state before the one-touch fitting device for a fan is mounted to the motor shaft in the fifth embodiment of the present invention.

Fig. 27 is a cross-sectional view, taken along the line I-I of Fig. 25, that shows the state in which the device is mounted to the motor shaft in the fifth embodiment of the present invention.

Fig. 28 is a plan view that shows the one-touch fitting device for a fan in the sixth embodiment of the present invention.

Fig. 29 is a cross-sectional view taken along the line J-J of Fig. 28.

Fig. 30 is a cross-sectional view, taken along the line K-K of Fig. 29, that shows the state before the one-touch fitting device for a fan is mounted to the motor shaft in the sixth embodiment of the present invention.

Fig. 31 is a cross-sectional view, taken along the line K-K of Fig. 29, that shows the state in which the device is mounted to the motor shaft in the sixth embodiment of the present invention.

Fig. 32 is a cross-sectional view that shows the one-touch fitting device for a fan of the seventh embodiment of the present invention when the motor shaft is initially inserted into the motor-shaft-inserting hole, and that corresponds to the cross-sectional view taken along the line B-B of Fig. 2.

Fig. 33 is a cross-sectional view that shows the one-touch fitting device for a fan of the seventh embodiment of the present invention when the motor shaft is fully inserted into the motor-shaft-inserting hole.

Fig. 34 is a cross-sectional view that shows the one-touch fitting device for a fan of the eighth embodiment of the present invention, and that corresponds to Fig. 15.

Fig. 35 is a cross-sectional view that shows the one-touch fitting device for a fan of the ninth embodiment of the present invention, and that corresponds to Fig. 30.

Descriptions of Embodiments

[0020]

First Embodiment

Fig. 1 shows the state in which the one-touch fitting device for a fan 1 of an embodiment of the present invention is about to be mounted to the fan 2, and Figs. 2–10 show the one-touch fitting device for a fan 1 of the first embodiment.

[0021]

The fan 2 is, for example, for a cooking-range hood, to be mounted to a fan motor 3 so as to be rotated by the fan motor. As shown in Fig. 1, a motor shaft 4 hangs down from the fan motor 3. This motor shaft 4 is inserted into the one-touch fitting device 1, so that a threaded portion 4a on the outer peripheral surface of the motor shaft 4 engages with the one-touch fitting device 1. The motor shaft 4 is provided with a rotation-prevention pin 4b that protrudes from the motor shaft 4 in the direction such that the pin lies at a right angle to the shaft. The rotation-prevention pin 4b fits into an engaging recess (not shown) that is provided on the top board portion 2a of the fan 2, so that the fan 2 engages with the rotation-prevention pin 4b and is rotated by the fan motor 3.

[0022]

The fan 2 is a sirocco-fan type in which multiple blades 2c are provided between the circular top-board portion 2a and the ring portion 2b beneath the top board portion 2a. The one-touch fitting device 1 of this embodiment is mounted to the underside of the top board portion 2a of the fan 2, so that the fan 2 can be mounted to and unmounted from the motor shaft 4 of the fan motor 3.

[0023]

Fig. 2 is a bottom view, Fig. 3 is a side view, Fig. 4 is a view taken in the direction of the arrow A of Fig. 3, Fig. 5 is a cross-sectional view taken along the line C-C of Fig. 6, and Fig. 6 is a cross-sectional view taken along the line B-B of Fig. 2, respectively, of the one-touch fitting device 1. Fig. 5 and Fig. 6 are cross-sectional views that show a lock-release state; Fig. 7 and Fig. 8 are cross-sectional views that show a locked state; Fig. 9 and Fig. 10 are cross-sectional views that show the device engaged with the motor shaft 4.

[0024]

As shown in Figs. 1-6, the one-touch fitting device 1 includes the housing 5, the base 10, the operating member 6, the return spring 8, the elastic body 14, and the engaging part 41 having lock pieces 12, 13 and operating pieces 15, 16.

[0025]

The housing 5 has a dish shape and is formed from a thin plate so as to have a receiving portion 5a and a flange portion 5b that surrounds the receiving portion 5a. While the flange portion 5b abuts the top board portion 2a of the fan 2, screws are screwed into multiple mounting holes 5c formed on the flange portion 5b, so that present device is fixed to the fan 2. The receiving portion 5a receives the above base 10, operating member 6, return spring 8, elastic body 14, and engaging part 41 having the lock pieces 12, 13 and the operating pieces 15, 16.

[0026]

The base 10 is fixed to the bottom of the receiving portion 5a of the housing 5 by rivets or other fastening pieces. In the base 10, a motor-shaft-inserting hole 10a into which the motor shaft 4 is to be inserted is provided approximately at the center of the base 10. As shown in Fig. 5, the motor-shaft-inserting hole 10a is to be formed on the round shaft 10b of the base 10, to which the operating member 6 is mounted so as to be able to be displaced (rotated).

[0027]

The operating member 6 has a guide portion 22 and an operating portion 23 that outwardly protrudes from the guide portion 22. As shown in Fig. 5, the guide portion 22 is ring-shaped, surrounding the round shaft 10b of the base 10, and is movably mounted to the base 10, at the center of which the round shaft 10b is placed. In this embodiment, the guide portion 22 is mounted to the base 10 so as to be rotatable forward or backward at the center of which the round shaft 10b is placed, and the guide portion 22 moves either forward or backward, depending on the direction of its rotation. The forward rotation of the guide portion 22 (operating member 6) is the lock-release direction; in this embodiment, the direction of this rotation is counterclockwise. The rotation in the reverse direction of the guide portion 22 (operating member 6) is the locking direction; and in this embodiment, the direction of this rotation is clockwise.

[0028]

The operating portion 23 of the operating member 6 protrudes outwardly from the guide portion 22 the outer direction, is exposed to the outside of the receiving portion 5a of the housing 5, and is used for rotating operation in the forward direction. A grip portion 25 covers the operating portion 23, making the ejection length from the housing 5 longer, whereby the operating portion 23 is made easier to operate. A knob 7 is formed on the housing 5 in such a way that a user can put his/her fingers on both the knob 7 and the operating portion 23 (grip portion 25), which makes it easier to effect the rotational operation of the operating portion 23.

[0029]

The round shaft 10b of the base 10 accommodates a pair of lock pieces 12, 13 and a pair of operating pieces 15, 16; those pieces form two engaging parts 41. One operating piece 15 is provided on the round shaft 10b so as to correspond to the lock piece 12, and one operating piece 16 is provided on the round shaft 10b so as to correspond to the lock piece 13. Wide connections 12b, 13b are formed at the rear ends of their respective lock pieces 12, 13 so that the wide connections 12b, 13b can be inserted into the operating pieces 15, 16. The connections 12b, 13b are inserted into the operating pieces 15, 16 so that the lock pieces 12, 13 are engaged with their corresponding operating pieces 15, 16.

[0030]

The pair of operating pieces 15, 16 are received in the round shaft 10b on diametrically opposite sides so as to sandwich the motor-shaft-inserting hole 10a. Threaded portions 12a, 13a are formed on the apical surfaces of the lock pieces 12, 13 that face the motor-shaft-inserting hole 10a, in which the threaded portions 12a, 13a are screwed to, and engaged with, the threaded portion 4a of the motor shaft 4. Also, the operating pieces 15, 16 are mounted to the round shaft 10b of the base 10 so as to be able to move back and forth only linearly in the direction of the motor shaft 4. Accordingly, when the lock pieces 12, 13 advance towards the motor shaft 4, the threaded portions 12a, 13a engage with the threaded portion 4a of the motor shaft 4. When the lock pieces 12, 13 withdraw from the motor shaft 4, the engagement between the threaded portions 12a, 13a and the threaded portion 4a of the motor shaft 4 is released.

[0031]

In this embodiment, the lock pieces 12, 13 and the operating pieces 15, 16 are provided to both sides of the motor-shaft-inserting hole 10a of the base 10 so as to sandwich the motor-shaft-inserting hole 10a. Arranging the lock pieces 12, 13 and the operating pieces 15, 16 on both sides of the motor-shaft-inserting hole 10a allows those pieces to lock from the both sides the threaded portion 4a of the motor shaft 4 that is inserted into the motor-shaft-inserting hole 10a, so that the fan is locked stably to the motor shaft.

[0032]

As shown in Fig. 6, the operating pieces 15, 16 have inverted U-shaped holes into which the ring-shaped guide portion 22 of the operating member 6 is inserted. Thus, the operating pieces

15, 16 sandwich the guide portion 22 of the operating member 6. Because the guide portion 22 is sandwiched in this manner, engaging mechanisms 31, 32 are formed between the operating pieces 15, 16 and the sandwiched portions of the guide portion 22.

[0033]

The engaging mechanisms 31, 32 have first engaging projecting portions 33, 34 that are formed on the sides (the inner parts) of the operating pieces 15, 16 that are sandwiching the guide portion 22, and second engaging projecting portions 35, 36 that are formed on the other sides (the outer parts) of the operating pieces 15, 16 and also sandwiching the guide portion 22. In addition, the engaging mechanisms 31, 32 have inside-diameter-changing portions 37, 38 that are formed on the inner side of the guide portion 22 so as to correspond to the first engaging projecting portions 33, 34, and the supporting projecting portions 39, 40 that are formed on the outside surfaces of the guide portion 22 so as to correspond to the second engaging projecting portions 35, 36. The supporting projecting portions 39, 40 protrude from the outside surfaces of the guide portion 22 in the radial direction, and their protruding ends are formed so that each end has a flat surface. The inside-diameter-changing portions 37, 38 are formed by large-diameter recesses 37a, 38a and curved portions 37b, 38b whose diameter gradually decreases from the two sides of each of the large-diameter recesses 37a, 38a.

[0034]

In the engaging mechanisms 31, 32, the supporting projecting portions 39, 40 contact the second engaging projecting portions 35, 36 of the operating pieces 15, 16, so that the operating pieces 15, 16 move linearly away from the motor shaft 4, which causes the lock pieces 12, 13 to move away from the motor shaft 4. Thus, as shown in Fig. 5 and Fig. 6, the engagement between the threaded portions 12a, 13a of the lock pieces 12, 13 and the threaded portion 4a of the motor shaft 4 is released to a lock-release state. In contrast, if the operating member 6 rotates in the reverse direction (clockwise direction), the contact between the supporting projecting portions 39, 40 and the second engaging projecting portions 35, 36 is released. At the same time, inside-diameter-changing portions 37, 38 of the guide portion 22, the curved portions 37b, 38b continuing to the large-diameter recesses 37a, 38a contact the first engaging projecting portions 33, 34. Because the diameter of the curved portions 37b, 38b is smaller than that of the large-diameter recesses 37a, 38a, the contact of the curved portions 37b, 38b with the first engaging projecting portions 33, 34 causes the operating pieces 15, 16 to move linearly toward the motor shaft 4. In accordance with this movement, the lock pieces 12, 13 also move linearly toward the motor shaft 4. Thus, as shown in Fig. 7 and Fig. 8, the threaded portions 12a, 13a of the lock pieces 12, 13 are screwed to and engaged with the threaded portion 4a of the motor shaft 4. Also, because the diameter of the curved portions 37b, 38b gradually decreases, despite the variations in the diameter of the threaded portion 4a of the motor shaft 4, the lock pieces 12, 13 are able to smoothly move to the point that the threaded portions 12a, 13a closely contact the threaded portion 4a of the motor shaft 4. The one-touch

fitting device 1 is mounted to the motor shaft 4 through these engagement operations.

[0035]

In the above structure, the lock pieces 12, 13 contact the operating pieces 15, 16 on their tapered surfaces. That is, as shown in Figs. 6 and 8, tapered surfaces 12c, 13c are formed on the outside of the lock pieces 12, 13, respectively, and also tapered surfaces 15c, 16c, corresponding to the tapered surfaces 12c, 13c, are formed on the operating pieces 15, 16, respectively. These tapered surfaces 12c, 13c, 15c, 16c have inclined planes in which the distance between the plane and the motor shaft 4 gradually becomes larger in the direction in which the motor shaft 4 is inserted (i.e., downward). Due to these inclined planes being provided, the lock pieces 12, 13 do not come off from the motor shaft 4, even if downward forces (the direction in which the forces cause the device to be detached from the motor shaft 4) are applied to the one-touch fitting device 1. Thus, the one-touch fitting device 1 does not move in the direction in which the device comes off from the motor shaft 4, and therefore the one-touch fitting device 1 is kept stably mounted to the motor shaft 4 so as to prevent the device from shaking.

[0036]

That is, if downward forces (the direction in which forces cause the device to be detached from the motor shaft 4) are applied to the one-touch fitting device 1, the lock pieces 12, 13 receive upward forces (upward in the drawings of Figs. 6 and 8) from the threaded portion 4a of the motor shaft 4 and are pushed to move upward, because the threaded portions 12a, 13a of the lock pieces 12, 13 engage with the threaded portion 4a of the motor shaft 4. However, the distance between the tapered surfaces that contact the operating pieces 15, 16 is narrower in the upward direction, and therefore the lock pieces receive the forces toward the center of the motor shaft 4, which prevents the lock pieces 12, 13 from moving off the motor shaft 4.

[0037]

Also, in the mounted state, the lock pieces 12, 13 are pushed by the operating pieces 15, 16, and receive forces toward the center of the motor shaft 4. Because the distance of the tapered surfaces from the motor shaft 4 tends to be narrowed in the direction in which the motor shaft 4 is inserted (downward), the forces that the lock pieces 12, 13 receive toward the center of the motor shaft 4 are transformed into downward forces (downward in the drawings of Figs. 6 and 8). Accordingly, the threaded portions 12a, 13a of the lock pieces 12, 13 engage with the threaded portion 4a of the motor shaft 4 so as to press the threaded portion 4a of the motor shaft 4 downward. That is, the lock pieces 12, 13 receive upward reaction forces from the motor shaft 4, and therefore the fan 2 receives upward forces that immobilize the fan 2. At this time, the fan 2 engages with the motor shaft 4 such that the rotation-prevention pin protruding from the motor shaft 4 fits into engaging recesses that are provided at the top-board portion 2a of the fan 2 so that the fan 2 engages with the rotation-prevention pin 4b. Therefore, the fan is restricted from moving upward (upward in the drawings of Figs. 6 and 8). Accordingly, the

upward reaction forces that the fan 2 receives from the motor shaft 4 effectively serve to immobilize the fan 2 in the upward direction, and therefore shaking of the fan in the mounted state is effectively prevented.

[0038]

As shown in Figs. 6 and 8, elastic bodies 14 are disposed between the lock pieces 12, 13 and the base 10 so as to sandwich the lock pieces 12, 13 on the upper side and underside of those two pieces. This embodiment uses a coil spring as an elastic body 14. However, a disc spring or leaf spring can be used appropriately as an elastic body 14. Because the elastic bodies 14 are disposed so as to sandwich the lock pieces 12, 13 on the upper sides and undersides of those two pieces as mentioned above, the lock pieces 12, 13 are held elastically so as to be able to move upward and downward (along the axis of the motor shaft 4). This allows the lock pieces 12, 13 to move so that the threads of the threaded portions 12a, 13a engage with the threads of the threaded portion 4a of the motor shaft 4, whereby the threaded portions 12a, 13a can engage firmly and easily with the threaded portion 4a of the motor shaft 4.

[0039]

Fig. 9 shows a state such that the threads of the threaded portions 12a, 13a of the lock pieces 12, 13 do not mate with the threads of the threaded portion 4a of the motor shaft 4. In this state, because the elastic bodies 14 elastically hold the lock pieces 12, 13 so as to be able to move upward and downward, the lock pieces 12, 13 move so that the aforementioned threads mate with each other. Thus, as shown in Fig. 10, the threaded portions 12a, 13a of the lock pieces 12, 13 mate with the threads of the threaded portion 4a of the motor shaft 4, so that the threaded portions 12a, 13a can screw and engage with the threaded portion 4a of the motor shaft 4. According to this engagement, the lock pieces 12, 13 connect with the motor shaft 4, and the one-touch fitting device for a fan 1 is mounted to the motor shaft 4.

[0040]

While the return spring 8 is wound around the base 10, one end of the return spring 8, the hook portion 8a, is locked to the base 10, and the other end, the hook portion 8b, is locked to the operating member 6. Thus, the return spring 8 biases the operating member 6 so that the operating member 6 rotates in the locking direction (clockwise direction). Accordingly, if the operation of the operating member 6 to release the locking is canceled, the operating member 6 automatically rotates in the locking direction due to the biasing force of the return spring 8.

[0041]

Next, the operation in the first embodiment will be explained with reference to Figs. 5–8.

[0042]

Figs. 5 and 6 show the state after the operating portion 23 (grip portion 25) of the operating member 6 has been rotated forward (counterclockwise). The forward rotation of the operating portion 23 causes the supporting projecting portions 39, 40 of the guide portion 22 of the operating member 6 to contact the second engaging projecting portions 35, 36 of the operating

pieces 15, 16, so that the operating pieces 15, 16 move linearly away from the motor shaft 4. In this state, the first engaging projecting portions 33, 34 of the operating pieces 15, 16 are adjacent to the large-diameter recesses 37a, 38a of the guide portion 22, but separated from them by gaps, and therefore these first engaging projecting portions 33, 34 do not contact the guide portion 22. Due to this movement of the operating pieces 15, 16, the lock pieces 12, 13 move in the same direction as that of the operating pieces 15, 16, and therefore the threaded portions 12a, 13a of the lock pieces 12, 13 withdraw from the motor-shaft-inserting hole 10a of the base 10.

[0043]

Accordingly, in this state, the motor shaft 4 can be inserted into the motor-shaft-inserting hole 10a. After the motor shaft 4 is inserted, the operation on the operating portion 23 of the operating member 6 is canceled. Canceling the operation on the operating portion 23 causes the operating member 6 to rotate in the reverse direction (clockwise) due to the biasing force of the return spring 8. Due to this rotation, the supporting projecting portions 39, 40 of the guide portion 22 of the operating member 6 cease making contact with the second engaging projecting portions 35, 36 of the operating pieces 15, 16.

[0044]

When the operating member 6 (guide portion 22) further rotates in the reverse direction (clockwise) due to the biasing force of the return spring 8, the curved portions 37b, 38b of the inside-diameter-changing portions 37 of the guide portion 22 contact the first engaging projecting portions 33, 34 of the operating pieces 15, 16. Because the diameter of the curved portions 37b, 38b is smaller than that of the large-diameter recesses 37a, 38a, the curved portions 37b, 38b contact the first engaging projecting portions 33, 34, whereby the operating pieces 15, 16 are pushed, so that the operating pieces 15, 16 move linearly toward the motor shaft 4. In accordance with this movement, the lock pieces 12, 13 move linearly toward the motor shaft 4, and therefore, as shown in Fig. 7 and Fig. 8, the threaded portions 12a, 13a of the lock pieces 12, 13 are screwed to and engaged with the threaded portion 4a of the motor shaft 4. In this engagement of the threaded portions 12a, 13a with the threaded portion 4a, because the elastic bodies 14 elastically hold the lock pieces 12, 13 so as to be able to move upward and downward, as is explained with reference to Fig. 9 and Fig. 10, the threads of the threaded portions 12a, 13a mate with the threads of the threaded portion 4a of the motor shaft 4, so that both sets threads can be engaged with each other. The threaded portions 12a, 13a of the lock pieces 12, 13 engage with the threaded portion 4a of the motor shaft 4, so that the one-touch fitting device 1 is mounted to the fan 2.

[0045]

In a state such that the fan 2 is mounted to the device, the counterclockwise rotational operation of the operating portion 23 (grip portion 25) of the operating member 6 results in the states shown in Fig. 5 and Fig. 6, in which the lock pieces 12, 13 have moved linearly away

from the motor shaft 4, and the threaded portions 12a, 13a have been disengaged from the threaded portion 4a of the motor shaft 4. Thus, the one-touch fitting device 1 can be unmounted from the fan 2.

[0046]

In this first embodiment, rotating the operating member 6 forward allows the operating pieces 15, 16 to cause the lock pieces 12, 13 to withdraw from the motor-shaft-inserting hole 10a of the base 10, so that the motor shaft 4 can be inserted into the motor-shaft-inserting hole 10a. Then, canceling the operation on the operating member 6 allows the return spring 8 to return the operating member 6 to its original position. Then, the operating pieces 15, 16 cause the lock pieces 12, 13 to advance toward the motor shaft 4, and the threaded portions 12a, 13a of the lock pieces 12, 13 engage with the threaded portion 4a of the motor shaft 4, and can be mounted to the motor shaft 4. Moreover, by rotating the operating member 6 forward, the operating pieces 15, 16 cause the lock pieces 12, 13 to withdraw from the motor shaft 4, so that the engagement between the threaded portions 12a, 13a of the lock pieces 12, 13 and the threaded portion 4a of the motor shaft 4 is released. And therefore the one-touch fitting device can be unmounted from the motor shaft 4. Thus, the mounting and unmounting of the fan about the motor shaft 4 can be made with one touch. Moreover, because there is no need to add further manufacturing to the motor shaft 4 for the fan to be mounted or unmounted, the present device can be applied as is to a conventional motor shaft provided with a left-hand screw. Thus, it is not necessary for the motor shaft to be structured so as to be dedicated to the present device, and therefore the present device offers versatility of use. Also, in the retained state, because the engaging part 41 formed by the operating pieces 15, 16 and the lock pieces 12, 13 is fixed by the inside-diameter-changing portions 37, 38 of the guide portion 22, the device of the present invention is able to more stably retain the fan compared to the prior-art devices that adopt the method of immobilizing the fan by using elastic forces of a spring and other means. That is, because the prior-art devices retain the fan by immobilizing the fan by biasing and pushing a holding section to a motor shaft's locking groove by using the elastic forces of a spring and other means, the retention of the fan is maintained by the elastic forces of a spring or other means. However, in the present invention, the movement of the engaging part 41 is restricted by the inside-diameter-changing portions 37, 38 of the guide portion 22, and therefore the present device is capable of more stably retaining the fan.

[0047]

In the above first embodiment, the elastic bodies 14 are disposed on the upper side and the underside of the lock pieces 12, 13, respectively. However, the device can be structured such that an elastic body 14 can be disposed so as to pass through the lock pieces 12, 13. In this structure, the following modifications can be made: (1) projecting portions that engage with the elastic body 14 are formed on the lock pieces 12, 13; (2) the parts of the elastic body 14 that pass through the lock pieces 12, 13 are glued to the corresponding parts of the lock pieces

12, 13; or (3) the parts of the elastic body 14 that pass through the lock pieces 12, 13 are made to have large diameters so that the elastic body 14 engages with the lock pieces 12, 13. Also, the lock piece and the operating piece can be provided singularly on just one side of the motor-shaft-inserting hole 10a, instead of providing them on both sides of the motor-shaft-inserting hole 10a. More than three lock pieces and operating pieces can be provided.

[0048]

Second Embodiment

In contrast to the configuration of the first embodiment, the one-touch fitting device for a fan of the second embodiment of the present invention is configured, as shown in Figs. 11–14, as follows so as to retain the fan:

(1) instead of, as in the first embodiment, the engaging part 41 is formed by two components, i.e. the lock piece and the operating piece, the engaging part 41 is formed integrally by one component;

(2) instead of, as in the first embodiment, threaded portions being used at the engagement-target portion of the motor shaft 4 and at the engagement portion of the engaging part, a narrowed portion 44 is provided to the part of the motor shaft 4 where the diameter of the motor shaft 4 is small, so that the narrowed portion 44 operates as the engagement-target portion 42; and

(3) the engagement portion 43 of the engaging part 41 is coupled into the narrowed portion 44. Other component parts of the second embodiment are basically the same as those of the first embodiment, and therefore like component parts are represented by the same reference numbers.

[0049]

Fig. 11 is a cross-sectional view (in the locked state) — along a flat plane that includes the axis of the motor shaft — of the second embodiment of the one-touch fitting device for a fan; Fig. 12 is a cross-sectional view taken along the line D–D of Fig. 11; Fig. 13 is a cross-sectional view (in the lock-release state) of the one-touch fitting device for a fan of the second embodiment — along a flat plane that includes the axis of the motor shaft; and Fig. 14 is a cross-sectional view taken along the line E–E of Fig. 13.

[0050]

As shown in Figs. 11 and 13, the engagement-target portion 42 of the motor shaft 4 is formed by the narrowed portion 44, in which the diameter of a part of the motor shaft is reduced. The engagement portion 43 of the engaging part 41 is coupled into the narrowed portion 44, so as to realize the engagement.

[0051]

The round shaft 10b of the base 10 receives a pair of engaging parts 41 along the direction of

the diameter of the round shaft 10b in such a manner that the engaging parts 41 sandwich the motor-shaft-inserting hole 10a. Engagement portions 43 are formed at the tip ends of the engaging parts 41 facing the motor-shaft-inserting hole 10a, with the engagement portions 43 coupled into and engaging with the narrowed portion 44, which is the engagement-target portion 42. Also, the engaging parts 41 are mounted to the round shaft 10b of the base 10 so as to be able to move only back and forth —linearly in the direction of the motor shaft 4. Accordingly, the engaging parts 41 advance toward the motor shaft 4, so that the engagement portion 43 engages with the narrowed portion 44 of the motor shaft 4, and the engaging parts 41 withdraw the motor shaft 4, so that the motor shaft 4 is released from engagement with the narrowed portion 44.

[0052]

As shown in Fig. 14, in the engagement portion 43 formed on the tip ends of the engaging parts 41 facing the motor-shaft-inserting hole 10a, the apical surface that contacts the narrowed portion 44 of the motor shaft 4 has a surface that is curved in accordance with the shape of the narrowed portion 44. Configuring in this manner allows the present device to secure enough contact surfaces, so that stable engagement is obtained.

[0053]

In this embodiment, an engaging part 41 is provided to both sides of the motor-shaft-inserting hole 10a of the base 10, sandwiching the hole. Because an the engaging part 41 is thus disposed on both sides of the motor-shaft-inserting hole 10a, the engaging parts 41 are able to lock on both sides the engagement-target portion 42 of the motor shaft 4 that is inserted into the motor-shaft-inserting hole 10a, whereby a stable locked state is obtained.

[0054]

As shown in Figs. 11 and 13, the respective engaging parts 41 have holes that are inverted U-shaped on the rearward side thereof (the side distant from the motor shaft), and the ring-shaped guide portion 22 of the operating member 6 is inserted into the holes. This allows the respective engaging parts 41 to sandwich the guide portion 22 of the operating member 6. Because the guide portion 22 is sandwiched in this manner, engaging mechanisms 31, 32 are formed between the engaging parts 41 and the sandwiched portions of the guide portion 22.

[0055]

The engaging mechanisms 31, 32 have first engaging projecting portions 33, 34 that are formed on the sides (inner parts) (inner sides as seen from the guide portion 22) of the respective engaging parts 41 across the guide portion 22, and second engaging projecting portions 35, 36 that are formed on the other sides (outer parts) of the engaging parts 41 that are on the other sides (outer parts) (outer sides as seen from the guide portion 22) — of their respective engaging parts 41 across the guide portion 22. Also, the engaging mechanisms 31, 32 have inside-diameter-changing portions 37, 38 that are formed on the inner sides of the guide portion 22 so as to correspond to the first engaging projecting portions 33, 34, and

supporting projecting portions 39, 40 that are formed on the outside surfaces of the guide portion 22 so as to correspond to the second engaging projecting portions 35, 36.

The supporting projecting portions 39, 40 protrude radially from the outside surfaces of the guide portion 22, and the protruded ends are formed so as to be flat.

The inside-diameter-changing portions 37, 38 are formed by large-diameter recesses 37a, 38a and curved portions 37b, 38b in which the diameter is gradually reduced from the two sides of each of the large-diameter recesses 37a, 38a.

[0056]

In the engaging mechanisms 31, 32, the supporting projecting portions 39, 40 contact the second engaging projecting portions 35, 36 of the engaging parts 41, so that the engaging parts 41 move linearly away from the motor shaft 4. Thus, as shown in Figs. 13 and 14, the engagement between the engagement portion 43 of the engaging part 41 and the narrowed portion 44, which is the engagement-target portion 42, of the motor shaft 4 is released so as to become a lock-release state. In contrast, if the operating member 6 rotates in the reverse direction (clockwise), the contact between the supporting projecting portions 39, 40 and the second engaging projecting portions 35, 36 ceases. At the same time, inside-diameter-changing portions 37, 38 of the guide portion 22, the curved portions 37b, 38b continuing to the large-diameter recesses 37a, 38a contact the first engaging projecting portions 33, 34. Because the diameter of the curved portions 37b, 38b is smaller than that of the large-diameter recesses 37a, 38a, the contact of curved portions 37b, 38b with the first engaging projecting portions 33, 34 causes the engaging parts 41 to be pushed linearly toward the motor shaft 4. Thus, as shown in Figs. 11 and 12, the engagement portion 43 of the engaging part 41 is coupled into and engages with the narrowed portion 44, which is the engagement-target portion 42, of the motor shaft 4. In this manner, due to the engagement operation the one-touch fitting device is mounted to the motor shaft 4. Therefore, in the regained state, because the engaging part 41 is fixed by the inside-diameter-changing portions 37, 38 of the guide portion 22, the device of the present invention is capable of retaining the fan more stably compared to the prior-art devices that immobilize the fan by using elastic forces of a spring or similar object. That is, because the prior-art uses elastic forces of a spring or other similar object to retain the fan by immobilizing the fan by biasing and pushing a holding section to a locking groove provided to a motor shaft, the retention of the fan is maintained by the elastic forces of a spring or other similar object. However, in the present invention, the movement of the engaging part 41 is restricted by the inside-diameter-changing portions 37, 38 of the guide portion 22, and therefore the present device is capable of retaining the fan more stably.

[0057]

Third Embodiment

Figs. 15–19 shows the third embodiment of the present invention's one-touch fitting device for

a fan, showing the cross-sectional view taken along the line B-B of Fig. 2. The one-touch fitting device of this embodiment has the same configuration as that of the first embodiment, except that a holding mechanism 51 is provided on the base 10.

[0058]

That is, the one-touch fitting device of this embodiment has the housing 5 fixed to the fan 2, the base 10 fixed to the bottom of the receiving portion 5a of the housing 5, and the operating member 6 displaceably fixed to the base 10, as is in the first embodiment. The motor-shaft-inserting hole 10a into which the motor shaft 4 is to be inserted passes through the approximately central part of the base 10, and the operating member 6 is mounted to the round shaft 10b, on which the motor-shaft-inserting hole 10a is formed.

[0059]

As is shown in Fig. 5, the operating member 6 has (1) a ring-shaped guide portion 22 that is rotatable forward and backward relative to the round shaft 10b of the base 10, and (2) an operating portion 23 that protrudes outwardly from the guide portion 22.

[0060]

As is shown in Fig. 5, the round shaft 10b of the base 10 is provided with two engaging parts 41 that are formed of the lock pieces 12, 13 and operating pieces 15, 16 that are respectively connected to the lock pieces 12, 13 on both sides across the motor-shaft-inserting hole 10a. Threaded portions 12a, 13a, which are screwed to and engaged with the threaded portion 4a of the motor shaft 4, are formed on the apical surfaces of the lock pieces 12, 13. First engaging projecting portions 33, 34 are formed on the inner sides of the operating pieces 15, 16 sandwiching the guide portion 22, and the second engaging projecting portions 35, 36 are formed on the outsides of the operating pieces 15, 16 sandwiching the guide portion 22. Inside-diameter-changing portions 37, 38 corresponding to the first engaging projecting portions 33, 34 are formed on the inside of the guide portion 22, and supporting projecting portions 38, 39 corresponding to the second engaging projecting portions 35, 36 are formed on the outside of the guide portion 22. As in the first embodiment, the first engaging projecting portions 33, 34, second engaging projecting portions 35, 36, inside-diameter-changing portions 37, 38, and supporting projecting portions 39, 40 form the engaging mechanisms 31, 32, by which the lock pieces 12, 13 engage with, and are disengaged from, the threaded portion 4a of the motor shaft 4. Also, the lock pieces 12, 13 and the operating pieces 15, 16 contact each other via their respective tapered surfaces 12c, 15c, 13c, 16c; the distance between each of the tapered surfaces 12c, 15c, 13c, 16c and the motor shaft 4 gradually increases in the direction in which the motor shaft 4 is inserted. The elastic bodies 14 are disposed between the lock pieces 12, 13 and the base 10 so as to sandwich the lock pieces 12, 13 on the upper side and underside of those two pieces. The base 10 is provided with the return spring 8 that returns the operating member 6 to its original position after the operating member 6 is displaced due to rotation. The above configuration is the same as that of the first embodiment.

[0061]

The holding mechanism 51 of this embodiment is formed by a hold cap 52 and a compression spring 53 that presses the hold cap 52. The hold cap 52 is inserted into the motor-shaft-inserting hole 10a of the base 10 so as to be movable upward and downward, by which the hold cap 52 is provided so that its direction corresponds to the direction of the axis along which the motor shaft 4 is inserted. The hold cap 52 is formed in a tubular shape with the upper surface 52a is closed, the lower surface is opened. Also, the diameter of the hold cap 52 is to some extent larger than that of the threaded portion 4a of the motor shaft 4. Therefore, when the hold cap 52 is positioned inside the motor-shaft-inserting hole 10a, the lock pieces 12, 13 are in the withdrawal state in which the lock pieces 12, 13 are prevented from advancing into the motor-shaft-inserting hole 10a. A flanged stopper part 52b that contacts the base 10 is formed on the bottom end of the hold cap 52, and the contact of the stopper part 52b with the base 10 prevents the hold cap 52 from moving upwardly inside the motor-shaft-inserting hole 10a.

[0062]

The compression spring 53 is arranged between the upper surface 52a of the hold cap 52 and the housing 5, and the compression spring 53 biases the hold cap 52 so that the hold cap 52 moves upward. Thus, the hold cap 52 is biased so as to be inserted into the motor-shaft-inserting hole 10a of the base 10.

[0063]

In the one-touch fitting device of this embodiment, the counterclockwise rotational operation of the operating member 6 causes the lock pieces 12, 13 to withdraw from the motor-shaft-inserting hole 10a of the base 10 via the operating pieces 15, 16. This causes the hold cap 52, which is biased by the compression spring 53, to advance upward into the motor-shaft-inserting hole 10a. Because this advancement of the hold cap 52 pushes the threaded portions 12a, 13a of the lock pieces 12, 13, as shown in Fig. 15, the lock pieces 12, 13 are maintained withdrawn from the motor-shaft-inserting hole 10a. Accordingly, even if operation of the operating member 6 is cancelled, the lock pieces 12, 13 will not advance into the motor-shaft-inserting hole 10a. If operation of the operating member 6 is cancelled, the operating member 6 is biased by the return spring 8 so as to rotate in the reverse direction (clockwise).

[0064]

In this state, the one-touch fitting device moves closer to the motor shaft 4, and the threaded portion 4a of the motor shaft 4 is inserted into the motor-shaft-inserting hole 10a. Fig. 16 shows this state, in which the tip end of the threaded portion 4a of the motor shaft 4 advances into the motor-shaft-inserting hole 10a while the tip end of the threaded portion 4a of the motor shaft 4 pushes downward the upper surface 52a of the hold cap 52. Accordingly, the hold cap 52 moves toward the bottom inside the motor-shaft-inserting hole 10a while pressing

the compression spring 53. In this state, by the hold cap 52, the lock pieces 12, 13 are maintained withdrawn from the motor-shaft-inserting hole 10a, and therefore the lock pieces 12, 13 do not either interfere with or screw into the threaded portion 4a of the motor shaft 4, so that the insertion of motor shaft 4 into the motor-shaft-inserting hole 10a can be smoothly implemented without operating the operating member 6.

[0065]

Fig. 17 shows the state where the threaded portion 4a of the motor shaft 4 is completely inserted into the motor-shaft-inserting hole 10a of the base 10, in which the hold cap 52 moves downward and out of a position between the lock pieces 12, 13. At this time, because the operating member 6 is biased by the return spring 8 so as to rotate in the returning direction, the lock pieces 12, 13 advance into the motor-shaft-inserting hole 4a via the engaging mechanisms 31, 32. Also, at this time, because the elastic bodies 14 elastically hold the lock pieces 12, 13 so that they can move upward and downward, the threads of the threaded portions 12a, 13a of the lock pieces 12, 13 smoothly mesh with the threads of the threaded portion 4a of the motor shaft 4.

Thus, the lock pieces 12, 13 instantaneously move toward the motor shaft 4, and, as shown in Fig. 18, the threaded portions 12a, 13a of the lock pieces 12, 13 are screwed to and engaged with the threaded portion 4a of the motor shaft 4, so that the one-touch fitting device can be mounted to the motor shaft 4. Because a collision-like sound is generated when the lock pieces 12, 13 are screwed to the threaded portion 4a of the motor shaft 4, the person operating the present device is informed that the one-touch fitting device is being mounted to the motor shaft 4.

[0066]

The unmounting of the one-touch fitting device from the motor shaft 4 is made by counterclockwise rotational operation of the operating member 6. This rotational operation allows the lock pieces 12, 13 to move linearly from the motor shaft 4 perpendicular to the axis of the motor shaft 4, so that the threaded portions 12a, 13a are disengaged from the threaded portion 4a of the motor shaft 4, whereby the one-touch fitting device can be unmounted from the motor shaft 4. After the one-touch fitting device has been unmounted, the hold cap 52 advances to a position between the lock pieces 12, 13, due to the biasing force of the compression spring 53, which causes the hold cap 52 to return to the state of Fig. 15.

[0067]

Fig. 19 shows the state where the motor shaft 4 has been inserted into the motor-shaft-inserting hole 10a and has stopped advancing into the hole. In this state, the hold cap 52 stops between the lock pieces 12, 13, and therefore the lock pieces 12, 13 will not advance toward the motor-shaft-inserting hole 10a, so that the threaded portions 12a, 13a do not engage with the threaded portion 4a of the motor shaft 4. Accordingly, the one-touch fitting device is not mounted to the motor shaft 4 in an incomplete state, and therefore the one-touch fitting device

is prevented from falling out of the motor shaft 4 due to an incomplete mounting.

[0068]

Fourth Embodiment

Figs. 20–23 show the one-touch fitting device for a fan of the fourth embodiment of the present invention. Fig. 20 presents a plan view; Fig. 21 presents a cross-sectional view taken along the line F–F of Fig. 20; and Figs. 22 and 23 present cross-sectional views taken along the line G–G of Fig. 21.

[0069]

The one-touch fitting device for a fan of this embodiment is obtained by modifying the operating member 6 and return spring 8 of the first embodiment; other component parts are the same as those of the first embodiment. Also, the holding mechanism 51 of the third embodiment is provided to this embodiment. The holding mechanism 51 is formed by the hold cap 52, which can move upward and downward and advances into the motor-shaft-inserting hole 10a as shown in Fig. 21, and the compression spring 53 that biases the hold cap 52 so that the hold cap 52 advances into the motor-shaft-inserting hole 10a.

[0070]

As in the first and third embodiments, the base 10 is provided with a pair of lock pieces 12, 13 and a pair of operating pieces 15, 16; those pieces form two engaging parts 41. The pair of operating pieces 15, 16 respectively connected to the pair of lock pieces 12, 13 on the two sides of the motor-shaft-inserting hole 10a, sandwiching that hole. Threaded portions 12a, 13a, which are screwed to and engaged with the threaded portion 4a of the motor shaft 4, are formed on the apical surfaces of the lock pieces 12, 13. As is shown in Fig. 21, the lock pieces 12, 13 and the operating pieces 15, 16 contact each other via their respective tapered surfaces 12c, 15c, 13c, 16c, the distance between which becomes gradually larger in the direction in which the motor shaft 4 is inserted. Moreover, the elastic bodies 14 are disposed between the lock pieces 12, 13 and the base 10 so as to elastically hold the lock pieces 12, 13 on the upper side and underside of those two pieces.

[0071]

As shown in Figs. 22 and 23, the operating member 6 has a guide portion 22 and operating portion 23. The operating member 6 of this embodiment moves linearly relative to the base 10. The operating portion 23 protrudes from the receiving portion 5a of the housing 5, and pressing the operating portion 23 causes the operating portion 23 to be pressed in the housing 5 and to move linearly.

[0072]

The guide portion 22 is formed in a roughly semicircular arm-like shape when seen in a plan view. An operating portion 23 is provided at the central part thereof. Thus, the guide portion 22 branches into left and right sides from the operating portion 23. The operating portion 23 is

arranged perpendicular to the line that connects the lock pieces 12, 13 and the operating pieces 15, 16. Pressing the operating portion 23 causes the guide portion 22, which is an arm having a roughly semicircular shape, to move and be displaced perpendicular to the line that connects the lock pieces 12, 13 and the operating pieces 15, 16.

[0073]

Guide surfaces 55 are formed on the tip ends of the two branches of the guide portion 22, in which the guide surfaces 55 extend in the direction in which the guide portion 22 moves linearly. Also, receiving surfaces 56 on which the guide surfaces 55 are capable of sliding are linearly formed at the positions that correspond to the guide surfaces 55 of the base 10. Due to these guide surfaces 55 and receiving surfaces 56, the operating member 6 is able to move stably and linearly as stated above. Furthermore, stopper surfaces 58, which extend perpendicular to the receiving surfaces 56, are formed on the base 10. The contact (collision) of the guide portion 22 with the stopper surfaces 58 restricts the linear movement of the guide portion 22.

[0074]

The operating pieces 15, 16 sandwich the branches of the guide portion 22, in which the engaging mechanisms 31, 32 are formed between the operating pieces 15, 16 and the sandwiched portions of the guide portion 22. As in the first embodiment, the engaging mechanisms 31, 32 have first engaging projecting portions 33, 34 that are formed on the inner parts (inner sides as seen from the guide portion 22) of the operating pieces 15, 16 across the guide portion 22, and the second engaging projecting portions 35, 36 that are formed on the outer parts (outer sides as seen from the guide portion 22) of the operating pieces 15, 16 across the guide portion 22. Also, the engaging mechanisms 31, 32 have inside-diameter-changing portions 37, 38 that are formed on the inner sides of the guide portion 22 so as to correspond to the first engaging projecting portions 33, 34, and the supporting projecting portions 39, 40 that are formed on the outside surfaces of the guide portion 22 so as to correspond to the second engaging projecting portions 35, 36. The supporting projecting portions 39, 40 protrude with sloping surface from the outside surfaces of the guide portion 22. The inside-diameter-changing portions 37, 38 are formed by large-diameter recesses 37a, 38a, and curved portions 37b, 38b, whose diameter gradually decreases and which connect with the large-diameter recesses 37a, 38a.

[0075]

A return spring 8, which is made of a coil spring, is disposed between the base 10 and the operating member 6. One end of the return spring 8 contacts the back side of the operating portion 23 of the operating member 6, and the other end contacts the bottom of the spring hole 57 formed on the base 10, whereby the return spring 8 biases the operating member 6 so that operating member 6 protrudes from the housing 5.

[0076]

Fig. 22 shows the state where the threaded portions 12a, 13a of lock pieces 12, 13 withdraw from the motor-shaft-inserting hole 10a of the base 10, and the threaded portions 12a, 13a do not engage with the threaded portion 4a of the motor shaft 4, in which the hold cap 52 is located inside the motor-shaft-inserting hole 10a. Fig. 23 shows the state where the threaded portions 12a, 13a of lock pieces 12, 13 advance into the motor-shaft-inserting hole 10a so as to engage with the threaded portion 4a of the motor shaft 4, by which the one-touch fitting device is mounted to the motor shaft 4.

[0077]

In the one-touch fitting device of this embodiment, as shown in Fig. 22, the operating portion 23 is pushed into the housing 5. This causes the entire operating member 6 to move linearly in the pushed direction, so that the guide portion 22 moves linearly in the same direction. This linear movement of the guide portion 22 causes the supporting projecting portions 39, 40 of the guide portion 22 to contact the second engaging projecting portions 35, 36 of the operating pieces 15, 16, so as to move the operating pieces 15, 16 away from the motor-shaft-inserting hole 10a. At this time, the first engaging projecting portions 33, 34 of the operating pieces 15, 16 are adjacent to the large-diameter recesses 37a, 38a of the guide portion 22, but are separated from them by gaps, and therefore the first engaging projecting portions 33, 34 do not contact the guide portion 22. Due to this movement of the operating pieces 15, 16, the lock pieces 12, 13 move in the same direction as that of the operating pieces 15, 16, and therefore the threaded portions 12a, 13a of the lock pieces 12, 13 withdraw from the motor-shaft-inserting hole 10a of the base 10. Thus, as is in the third embodiment, the hold cap 52 advances into the motor-shaft-inserting hole 10a, so that the lock pieces 12, 13 are maintained withdrawn. Also, at this time, the return spring 8 is compressed due to the pushing of the operating member 6, so that the biasing force in the opposite direction is stored.

[0078]

In such a state as shown in Fig. 22, the motor shaft 4 can be inserted into the motor-shaft-inserting hole 10a. Due to the insertion of the motor shaft 4, the hold cap 52 is pushed by the motor shaft 4 and moves downward inside of the motor-shaft-inserting hole 10a, so that the hold cap 52 moves out of its position between the lock pieces 12, 13. At this time, the return spring 8 biases the operating member 6 so that the operating member 6 linearly moves in the returning direction, by which the lock pieces 12, 13 advance into the motor-shaft-inserting hole 4a via the engaging mechanisms 31, 32. Due to the linear returning movement of the operating member 6, the supporting projecting portions 39, 40 of the guide portion 22 of the operating member 6 cease contact with the second engaging projecting portions 35, 36 of the operating pieces 15, 16. Then, as shown in Fig. 23, the curved portions 37b, 38b of the inside-diameter-changing portions 37, 38 of the guide portion 22 contact the first engaging projecting portions 33, 34 of the operating pieces 15, 16, so that the operating pieces 15, 16 move linearly toward the motor shaft 4, and in accordance with this movement,

the lock pieces 12, 13 move linearly toward the motor shaft 4. Thus, the threaded portions 12a, 13a of the lock pieces 12, 13 are screwed to and engaged with the threaded portion 4a of the motor shaft 4. At this time, because the elastic bodies 14 elastically hold the lock pieces 12, 13 so that the lock pieces 12, 13 are able to move upward and downward, the threads of the threaded portions 12a, 13a mate with the threads of the threaded portion 4a of the motor shaft 4, so that these two sets of threads can engage with each other. Because this screwing operation generates a collision-like sound, the person who is operating the device is informed that the one-touch fitting device is being mounted to the motor shaft 4.

[0079]

As explained above, because the threaded portions 12a, 13a of the lock pieces 12, 13 engage with the threaded portion 4a of the motor shaft 4, the one-touch fitting device 1 is mounted to the fan 2 without operating the operating member 6. Also, in this embodiment, the linear pushing of the operating member 6 allows the device to be mounted to and unmounted from the motor shaft 4, and therefore the operability of the device is remarkably improved compared to the rotational operation to the operating member 6.

[0080]

Fifth Embodiment

Figs. 24–27 show the one-touch fitting device for a fan in a fifth embodiment of the present invention. Fig. 24 presents a plan view, Fig. 25 presents a cross-sectional view taken along the line H–H of Fig. 24, and Figs. 26 and 27 present cross-sectional views taken along the line I–I of Fig. 25, respectively, of the one-touch fitting device for a fan in the fifth embodiment.

[0081]

This embodiment is achieved by modifying the operating member 6, return spring 8, and engaging part 41 of the first embodiment; other component parts of this embodiment are the same as those of the first embodiment. Also, the holding mechanism 51 of the third embodiment is provided to this embodiment. The holding mechanism 51 is formed by the hold cap 52, which advances into the motor-shaft-inserting hole 10a, and the compression spring 53 that biases the hold cap 52 so that the hold cap 52 advances into the motor-shaft-inserting hole 10a, as shown in Fig. 25.

[0082]

As shown in Figs. 25–27, an engaging part 41 of this embodiment is to be provided to one side of the two sides of the base 10, across the motor-shaft-inserting hole 10a. That is, the engaging part 41 includes (1) a lock piece 12 that is provided to one side (left side) of the motor-shaft-inserting hole 10a, and (2) an operating piece 15 that is connected to the lock piece 12. A threaded portion 12a, which is screwed to and engaged with the threaded portion 4a of the motor shaft 4, is formed on the apical surface of the lock piece 12. As shown in Fig. 25, the lock piece 12 and the operating piece 15 contact each other via their respective tapered surfaces 12c, 15c, the distance between which gradually becomes larger in the direction in

which the motor shaft 4 is inserted. Moreover, the elastic bodies 14 are disposed between the lock piece 12 and the base 10 so as to elastically hold the lock piece 12 on the upper side and underside of the piece.

[0083]

As shown in Figs. 26 and 27, the operating member 6 has a guide portion 22 that has a C-shape when seen in a plan view, and an operating portion 23 that is integrally formed with the guide portion 22. A round supporting point 61 is formed on one side of the guide portion 22 (right-side end in Figs. 26 and 27), and an axle pin 62 is inserted into the round supporting point 61. Thus, the guide portion 22 is able to rotate on the supporting point 61. An operating portion 23 is formed at the middle portion of the guide portion 22 so as to protrude outward from the receiving portion 5a of the housing 5. Pushing this operating portion 23 linearly causes the guide portion 22 to rotate on the axle pin 62.

[0084]

The operating piece 15 sandwiches the other side of the guide portion 22 (the left-side end in Figs. 26 and 27), in which the engaging mechanism 31 is formed between the operating piece 15 and the sandwiched portions of the guide portion 22. The engaging mechanism 31 is provided so as to correspond to the engaging part 41, and therefore the engaging mechanism 31 is provided to only one side of the two sides of the base 10, across the motor-shaft-inserting hole 10a. The engaging mechanism 31 has (1) a first engaging projecting portions 33 that is formed on the inner part of the operating piece 15 that sandwiches the guide portion 22, (2) a second engaging projecting portion 35 that is formed on the outer part sandwiching the guide portion 22, (3) an inside-diameter-changing portion 37 that is formed on the inner side of the guide portion 22 so as to correspond to the first engaging projecting portion 33, and (4) a supporting projecting portion 39 that is formed on the external surface of the guide portion 22 so as to correspond to the second engaging projecting portion 35. The supporting projecting portion 39 is formed so as to have a flat surface. Also, the inside-diameter-changing portion 37 is formed by a large-diameter recess 37a and a curved portion 37b whose diameter gradually decreases and which connects with the large-diameter recess 37a.

[0085]

A return spring 8, which is made of a coil spring, is disposed between the base 10 and the operating member 6. One end of the return spring 8 contacts the back side of the operating portion 23 of the operating member 6, and the other end contacts the bottom of the spring hole 57 formed on the base 10, whereby the return spring 8 biases the operating member 6 so that the operating member 6 rotates to protrude from the housing 5.

[0086]

Fig. 26 shows the state where the threaded portion 12a of lock piece 12 is withdrawn from the motor-shaft-inserting hole 10a of the base 10, and the threaded portion 12a is not engaged with the threaded portion 4a of the motor shaft 4, in which the hold cap 52 is located inside the

motor-shaft-inserting hole 10a. Fig. 27 shows the state where the threaded portion 12a of the lock piece 12 has advanced into the motor-shaft-inserting hole 10a so as to engage with the threaded portion 4a of the motor shaft 4, by which the one-touch fitting device is mounted to the motor shaft 4.

[0087]

In the one-touch fitting device of this embodiment, as shown in Fig. 26, the operating portion 23 is pushed linearly into the housing 5. This causes the entire operating member 6 to rotate counterclockwise on the axle pin 62, so that the guide portion 22 rotates in the same direction. The rotation of the guide portion 22 causes the supporting projecting portion 39 of the guide portion 22 of the operating member 6 to contact the second engaging projecting portions 35 of the operating piece 15 so that the operating piece 15 moves linearly away from the motor-shaft-inserting hole 10a. In this state, the first engaging projecting portion 33 of the operating piece 15 is adjacent to, but separated from by a gap, the large-diameter recess 37a of the guide portion 22, and therefore the first engaging projecting portion 33 does not contact the guide portion 22. Due to this movement of the operating piece 15, the lock piece 12 moves in the same direction as the operating piece 15, and therefore the threaded portion 12a of the lock piece 12 withdraws from the motor-shaft-inserting hole 10a of the base 10. Thus, the hold cap 52 advances into the motor-shaft-inserting hole 10a, so that the lock piece 12 is maintained withdrawn. Also, at this time, the return spring 8 is compressed due to the pushing of the operating member 6, so that a biasing force in the opposite direction is stored.

[0088]

In such a state as shown by Fig. 26, the motor shaft 4 can be inserted into the motor-shaft-inserting hole 10a, by which the hold cap 52 is pushed by the motor shaft 4 and moves downward inside of the motor-shaft-inserting hole 10a, so that the hold cap 52 moves out of the motor-shaft-inserting hole 10a. At this time, the return spring 8 biases the operating member 6 so that the operating member 6 rotates in the returning direction, by which the lock piece 12 advances into the motor-shaft-inserting hole 4a via the engaging mechanism 31. Due to the rotation of the operating member 6, the supporting projecting portion 39 of the guide portion 22 of the operating member 6 ceases making contact with the second engaging projecting portion 35 of the operating piece 15. Then, as shown in Fig. 27, the curved portion 37b of the inside-diameter-changing portion 37 of the guide portion 22 contacts the first engaging projecting portion 33 of the operating piece 15 so that the operating piece 15 moves linearly in the direction of the motor shaft 4, and in accordance with this movement, the lock piece 12 moves linearly in the direction of the motor shaft 4. Thus, the threaded portion 12a of the lock piece 12 is screwed to and engaged with the threaded portion 4a of the motor shaft 4. At this time, because the elastic bodies 14 elastically hold the lock piece 12 so as to be able to move upward and downward, the threads of the threaded portion 12a mate with the threads of the threaded portion 4a of the motor shaft 4, so that the two sets of threads can be engaged

with each other.

[0089]

As stated above, the threaded portion 12a of the lock piece 12 is screwed to and engaged with the threaded portion 4a of the motor shaft 4, so that the one-touch fitting device can be mounted to the motor shaft 4. Because a collision-like sound is generated when the lock piece 12 is screwed to the threaded portion 4a of the motor shaft 4, the person operating the device is informed that the one-touch fitting device is being mounted to the motor shaft 4. In this embodiment, the engaging part 41 which has the lock piece 12 to be screwed with the threaded portion 4a of the motor shaft 4, and the engaging mechanism 31 that causes the lock piece 12 to move forward and backward, are provided on only one side of the motor-shaft-inserting hole 10a of the base 10, and therefore the number of the device's parts is reduced, resulting in the device's simple structure, which allows easy maintenance of the device. Also, because the rotation of the operating member 6 is made by linear pushing of the operating portion 23, the operability of the device is remarkably improved compared to when the operating portion 23 is rotated.

[0090]

Sixth Embodiment

Fig. 28 through Fig. 31 show the one-touch fitting device for a fan in the sixth embodiment of the present invention. Fig. 28 presents a plan view; Fig. 29 presents a cross-sectional view taken along the line J-J of Fig. 28; and Figs. 30 and 31 present cross-sectional views taken along the line K-K of Fig. 29, respectively showing the condition before and after device is mounted to the motor shaft.

[0091]

This embodiment is achieved by modifying the operating member 6, return spring 8, and engaging part 41 of the first embodiment, while other component parts of this embodiment are the same as those of the first embodiment. Also, the holding mechanism 51 of the third embodiment is provided to this embodiment. The holding mechanism 51 is formed by the hold cap 52, which advances into the motor-shaft-inserting hole 10a, and the compression spring 53 that biases the hold cap 52 so that the hold cap 52 advances into the motor-shaft-inserting hole 10a, as shown in Fig. 29.

[0092]

As shown in Fig. 29 through Fig. 31, the engaging part 41 of this embodiment is provided to only one side of the two sides that sandwich the motor-shaft-inserting hole 10a of the base 10. That is, the engaging part 41 is formed by (1) a lock piece 12 that is provided on one side (the left side) of the motor-shaft-inserting hole 10a, and (2) an operating piece 15 that is connected to the lock piece 12. The threaded portion 12a, which is screwed to and engaged with the threaded portion 4a of the motor shaft 4, is formed on the apical surface of the lock piece 12.

As shown in Fig. 29, the lock piece 12 and the operating piece 15 contact each other via their respective tapered surfaces 12c, 15c, the distance between which gradually increases in the direction in which the motor shaft 4 is inserted. Moreover, the elastic bodies 14 are disposed between the lock piece 12 and the base 10 so as to elastically hold the lock piece 12 on the upper side and underside of the piece.

[0093]

As shown in Fig. 30 and Fig. 31, the operating member 6 has (1) a guide portion 22 that has an inverted U-shape when seen in a plan view, and (2) an operating portion 23 that is integrally formed with the guide portion 22. The guide portion 22 is provided so as to encircle the motor-shaft-inserting hole 10a of the base 10. The one side (left side) of the guide portion 22 across the motor-shaft-inserting is an engaging-mechanisms-forming portion 64 (as described below), and the another side (right side) of the guide portion 22 is a guide arm portion 63. The operating portion 23 is provided to the middle portion of the guide portion 22 so as to protrude outward from the receiving portion 5a of the housing 5. Pushing this operating portion 23 linearly causes the entire operating member 6 to move and be displaced linearly relative to the base 10. This linear displacement is perpendicular to the line showing the connection between the lock piece 12 and the operating piece 15.

[0094]

The guide arm portion 63 of the operating member 6 extends linearly in the direction of the movement of the operating member 6. A linear guide groove 65 is formed on the base 10, and the guide arm portion 63 is inserted into the guide groove 65, so that the guide arm portion 63 is disposed inside the base 10. Movement of the operating member 6 is effected by the guide arm portion 63 sliding inside the guide groove 65, and therefore the operating member 6 is able to move linearly and stably.

[0095]

Guide surface 55 is formed on the end of the engaging-mechanisms-forming portion 64 of the guide portion 22, in which the guide surface 55 extends linearly in the direction in which the guide portion 22 moves. Also, receiving surface 56 on which the guide surface 55 is capable of sliding is formed at location that corresponds to the guide surface 55 of the base 10. In this embodiment, the operating member 6 is able to move linearly and stably because the guide surface 55 and receiving surface 56, in addition to the above-stated guide arm portion 63, are formed on the operating member 6. Moreover, stopper surface 58, which extends perpendicular to the receiving surface 56, is formed on the base 10. The contact of the guide portion 22 with the stopper surface 58 stops the linear movement of the guide portion 22.

[0096]

The operating piece 15 sandwiches the engaging-mechanisms-forming portion 64 of the guide portion 22 (the left side in Fig. 30 and Fig. 31), in which the engaging mechanism 31 is formed of the operating piece 15 and the engaging-mechanisms-forming portion 64. The engaging

mechanism 31 is provided so as to correspond to the engaging part 41, and therefore the engaging mechanism 31 is provided on only one side across the motor-shaft-inserting hole 10a of the base 10. The engaging mechanism 31 has (1) a first engaging projecting portion 33 that is formed on the inner part of the operating piece 15 that sandwiches the engaging-mechanisms-forming portion 64 of the guide portion 22, and (2) a second engaging projecting portion 35 that is formed on the outer part of the operating piece 15 that sandwiches the engaging-mechanisms-forming portion 64, (3) an inside-diameter-changing portion 37 that is formed on the inside surface of the engaging-mechanisms-forming portion 64 so as to correspond to the first engaging projecting portion 33, and (4) a supporting projecting portion 39 that is formed on the outside surface of the engaging-mechanisms-forming portion 64 so as to correspond to the second engaging projecting portion 35. The supporting projecting portion 39 is formed so as to have a flat surface. Also, the inside-diameter-changing portion 37 is formed by the large-diameter recess 37a and the curved portion 37b whose diameter gradually decreases and which connects to the large-diameter recess 37a.

[0097]

A return spring 8, which is made of a coil spring, is disposed between the base 10 and the operating member 6. One end of the return spring 8 contacts the back side of the operating portion 23 of the operating member 6, and the other end contacts the bottom of the spring hole 57 formed on the base 10, whereby the return spring 8 biases the operating member 6 so that operating member 6 protrudes from the housing 5.

[0098]

Fig. 30 shows the state where the threaded portion 12a of the lock piece 12 has been withdrawn from the motor-shaft-inserting hole 10a (not shown) of the base 10, and the threaded portion 12a is not engaged with the threaded portion 4a of the motor shaft 4, in which the hold cap 52 has advanced into the motor-shaft-inserting hole 10a. Fig. 31 shows the state where the threaded portion 12a of the lock piece 12 has advanced into the motor-shaft-inserting hole 10a so as to engage with the threaded portion 4a of the motor shaft 4, by which the one-touch fitting device is mounted to the motor shaft 4.

[0099]

In the one-touch fitting device of this embodiment, as shown in Fig. 30, the operating portion 23 is pushed into the housing 5. This causes the entire operating member 6 to linearly move in the pushed direction, so that the guide portion 22 moves in the same direction. The linear movement of the guide portion 22 causes the supporting projecting portion 39 of the guide portion 22 to contact the second engaging projecting portion 35 of the operating piece 15, so as to move linearly the operating piece 15 away from the motor-shaft-inserting hole 10a. At this time, the first engaging projecting portion 33 of the operating piece 15 is adjacent to the large-diameter recess 37a of the guide portion 22, but separated from it by a gap, and therefore the first engaging projecting portion 33 does not contact the guide portion 22. Due to this

movement of the operating piece 15, the lock piece 12 moves in the same direction as the operating piece 15, and therefore the threaded portion 12a of the lock piece 12 is withdrawn from the motor-shaft-inserting hole 10a of the base 10. Thus, the hold cap 52 advances into the motor-shaft-inserting hole 10a, so that the lock piece 12 is maintained withdrawn. Therefore, the lock piece 12 does not either interfere with or screw into the threaded portion 4a of the motor shaft 4, whereby it is not necessary to continue the operation of the operating member 6 in order to prevent such interference or screwing. Also, at this time, the return spring 8 is compressed due to the pushing of the operating member 6, so that biasing force in the opposite direction is stored.

[0100]

In the state shown by Fig. 30, the motor shaft 4 can be inserted into the motor-shaft-inserting hole 10a. Due to that insertion of the motor shaft 4, the hold cap 52 is pushed by the motor shaft 4 and moves downward inside the motor-shaft-inserting hole 10a, so that the hold cap 52 goes out of the motor-shaft-inserting hole 10a. At this time, the return spring 8 biases the operating member 6 so that the operating member 6 linearly moves in the returning direction, by which the lock piece 12 advances into the motor-shaft-inserting hole 4a via the engaging mechanism 31. Due to the linear returning movement of the operating member 6, the supporting projecting portion 39 of the guide portion 22 of the operating member 6 ceases its contact with the second engaging projecting portion 35 of the operating piece 15. Then, as shown in Fig. 31, the curved portion 37b of the inside-diameter-changing portions 37 of the guide portion 22 contacts the first engaging projecting portions 33 of the operating piece 15, so that the operating piece 15 moves linearly in the direction of the motor shaft 4, and in accordance with this movement, the lock piece 12 moves linearly in the direction of the motor shaft 4. Thus, the threaded portion 12a of the lock piece 12 is screwed to and engaged with the threaded portion 4a of the motor shaft 4. At this time, because the elastic bodies 14 elastically hold the lock piece 12 so as to be able to move upward and downward, the threads of the threaded portion 12 mate with the threads of the threaded portion 4a of the motor shaft 4, so that the two sets of threads can be engaged with each other.

[0101]

As explained above, the threaded portion 12a of the lock piece 12 is screwed to and engaged with the threaded portion 4a of the motor shaft 4, so that the one-touch fitting device can be mounted to the motor shaft 4. Because a collision-like sound is generated when the lock piece 12 is screwed to the threaded portion 4a of the motor shaft 4, the person operating the device is informed that the one-touch fitting device is being mounted to the motor shaft 4.

[0102]

In this embodiment, the linear pushing of the operating member 6 allows the device to be mounted to and unmounted from the motor shaft 4, and therefore the operability of the device is remarkably improved compared to the rotational operation of the operating member 6. Also,

an engaging part 41 that has a lock piece 12 to be screwed with the threaded portion 4a of the motor shaft 4, and an engaging mechanism 31 that causes the lock piece 12 to move forward and backward are provided to only one side of motor-shaft-inserting hole 10a of the base 10, and therefore the number of the device's parts is reduced, resulting in the device's simple structure, which allows easy maintenance of the device.

[0103]

Seventh Embodiment

Figs. 32 and 33 show the one-touch fitting device for a fan in a seventh embodiment of the present invention. Fig. 32 and Fig. 33 are cross-sectional views that respectively show the condition before and after the motor shaft has been inserted.

[0104]

The one-touch fitting device of this embodiment has the same configuration as that of the third embodiment shown in Fig. 15 through Fig. 19, but in which a sound-production member 67 is further added to the third embodiment. The other component parts of the present embodiment are basically the same as those of the third embodiment, and therefore like component parts are represented by the same reference numbers, and explanations of the same component parts are omitted.

[0105]

The sound-production member 67 is provided to correspond to the hold cap 52 of the holding mechanism 51, in which a recessed part 68 to dispose the sound-production member 67 is formed on the base 10. The recessed part 68 has a larger diameter than that of the recessed part for insertion 70, into which the hold cap 52 of the holding mechanism 51 is inserted, and is formed **on** the bottom of the base 10 so as to surround the recessed part for insertion 70. The sound-production member 67 is disposed between the recessed part 68 and the base 69 of the housing 5.

[0106]

The sound-production member 67 is disposed inside the recessed part 68 so as to contact the flanged stopper part 52b that is formed on the bottom of the hold cap 52. The material used for the sound-production member 67 is one that produces sounds by being deformed when the stopper part 52b of the hold cap 52 contacts the sound-production member 67. In this embodiment is used a disc spring that flips up and down when contacted by the stopper part 52b of the hold cap 52.

[0107]

In this embodiment, as shown in Fig. 32, at the initial state, before the motor shaft 4 is inserted into the motor-shaft-inserting hole 10a, the sound-production member 67, which is made of a disc spring, is convex-shaped upwardly with its periphery in contact with the bottom 69 of the housing 5. In contrast, as shown in Fig. 33, at the ending state, after the motor shaft 4 has been

inserted into the motor-shaft-inserting hole 10a, the hold cap 52 has been pushed downward by the motor shaft 4, whereby the stopper part 52b of the bottom end of the hold cap 52 contacts the sound-production member 67. Thus, the periphery of the sound-production member 67 contacts the recessed part 68 of the base 10, so that the disc spring flips up and down so as to be recess-shaped. A sound is produced when the disc spring flips up and down. In this state, the hold cap 52 moves out of its position between the lock pieces 12, 13, and the threaded portions 12a, 13a are screwed to the threaded portion 4a of the motor shaft 4, so that the one-touch fitting device is mounted to the motor shaft 4. Because a sound is generated when the device is mounted to the motor shaft 4, the person operating the device is informed that the device is being mounted to the motor shaft 4. When the motor shaft 4 moves out of the motor-shaft-inserting hole 10a to unmount the one-touch fitting device 1 from the motor shaft 4, the hold cap 52 moves upward due to the biasing force of the compression spring 53. Due to this upward movement, the stopper part 52b ceases making contact with the sound-production member 67, so that the sound-production member 67 flips up and down and changes from being recess-shaped to being convex-shaped. Because a sound is generated when the sound-production member 67 flips up and down, the person operating the device is informed that the device is being unmounted from the motor shaft 4.

[0108]

Eighth Embodiment

Fig. 34 is a cross-sectional view that shows the one-touch fitting device for a fan of an eighth embodiment of the present invention. The one-touch fitting device of this embodiment is achieved by modifying the holding mechanism 51 of the third through the seventh embodiments, although other component parts of this embodiment are the same as those of the first through the third embodiments. Accordingly, other component parts of the present embodiment are basically the same as those of the first through the third embodiments, and therefore like component parts are represented by the same reference numbers, and explanations of the same respective parts are omitted.

[0109]

The holding mechanism 51 of this embodiment is formed of a holding spring 71 made of a coil spring. The holding spring 71 is formed of a loosely-wound biasing coil 71a to be mounted to the inside of the base 10, and a closely-wound holding coil 71b that is consecutively connected to the biasing coil 71a. The holding spring 71 is inserted into the motor-shaft-inserting hole 10a so that the holding coil 71b is placed between the lock pieces 12, 13, working in a way similar to the already-described hold cap 52. Also, when the motor shaft 4 is inserted into the motor-shaft-inserting hole 10a, the threaded portion 4a of the motor shaft 4 contacts the holding coil 71b, so that the holding coil 71b is pressed by the motor shaft 4.

[0110]

In this embodiment, under the condition that the motor shaft 4 is not inserted into the

motor-shaft-inserting hole 10a, the holding coil 71b is biased by the biasing coil 71a, so that the holding coil 71b is located between the lock pieces 12, 13 due to that biasing. Therefore, the lock pieces 12, 13 are prevented from advancing into the motor-shaft-inserting hole 10a. In contrast, if the motor shaft 4 is inserted into the motor-shaft-inserting hole 10a, the holding coil 71b is pressed by the motor shaft 4, the holding coil 71b withdraws from its position between the lock pieces 12, 13. Thus, the lock pieces 12, 13 advance into the motor-shaft-inserting hole 10a so as to engage with the threaded portion 4a of the motor shaft 4, by which the one-touch fitting device is mounted to the motor shaft 4. In this embodiment, the holding mechanism 51 is formed of a single coil spring, and therefore the number of the device's parts of is reduced, resulting in a simple structure for the device

[0111]

Ninth Embodiment

Fig. 35 is a cross-sectional view that shows the one-touch fitting device for a fan of the ninth embodiment of the present invention. The one-touch fitting device of this embodiment is achieved by modifying the holding mechanism 51 of the sixth embodiment, although other component parts of this embodiment are basically the same as those of the sixth embodiment. Accordingly, the same component parts are represented by the same reference numbers, and explanations of those respective parts are omitted.

[0112]

In this embodiment the hold cap 52 of the holding mechanism 51 of the sixth embodiment is modified. As is the same in the third through seventh embodiments, the hold cap 52 has a tubular portion 73 whose upper surface is closed and whose under surface is opened so as to form a tubular shape, and contacting arms 72 are integrally formed on the tubular portion 73. Inserting the motor shaft 4 into the motor-shaft-inserting hole 10a causes the tubular portion 73 to be pressed to the threaded portion 4a of the motor shaft 4. The contacting arms 72 are extended toward the operating piece 15 from the tubular portion 73. The operating piece 15 is a component part of the engaging part 41, as is the lock piece 12, and in this embodiment is disposed only on one side of the motor-shaft-inserting hole 12a.

[0113]

The contacting arms 72 extend towards the operating piece 15 so as to contact the end faces (right-end faces) of the operating piece 15 over the lock piece 12 that engages with the operating piece 15. Thus, in the condition that the motor shaft 4 is not inserted into the motor-shaft-inserting hole 10a, and the hold cap 52 is located inside of the motor-shaft-inserting hole 10a, the contacting arms 72 press the operating piece 15 away from the motor-shaft-inserting hole 10a. Accordingly, in this condition, the contacting arms 72 prevent the lock piece 12 that engages with the operating piece 15 from advancing into the motor-shaft-inserting hole 10a. In contrast, if the motor shaft 4 is inserted into the motor-shaft-inserting hole 10a, and the hold cap 52 withdraws from the motor-shaft-inserting

hole 10a, the contacting arms 72 cease making contact with the operating piece 15. Therefore, the lock piece 12 becomes able to advance into the motor-shaft-inserting hole 10a, so that the threaded portion 12a of the lock piece 12 can engage with the threaded portion 4a of the motor shaft 4, by which the one-touch fitting device is mounted to the motor shaft 4. In this structure, the holding mechanism 51 does not prevent the lock piece 12 from moving upward and downward, and therefore the threaded portion 12a of the lock piece 12 can further smoothly engage with the threaded portion 4a of the motor shaft 4.

Reference Signs List

[0114]

1	one-touch fitting device
2	fan
3	fan motor
4	motor shaft
4a	threaded portion
5	housing
6	operating member
8	return spring
10	base
10a	motor-shaft-inserting hole
10b	round shaft
12, 13	lock piece
12a, 12b	connection
12c, 13c	tapered surface
14	elastic body
15, 16	operating piece
15c, 16c	tapered surface
22	guide portion
23	operating portion
31, 32	engaging mechanism
33, 34	first engaging projecting portion
35, 36	second engaging projecting portion
37, 38	inside-diameter-changing portion
39, 40	supporting projecting portion
41	engaging part
42	engagement-target portion

43	engagement portion
44	narrowed portion
51	holding mechanism
52	hold cap
53	compression spring

Claims

1. A one-touch fitting device for a fan, into which is inserted a fan motor shaft that rotates the fan, and that can freely be mounted to or unmounted from the motor shaft, so as to connect the fan to, or disconnect the fan from, the motor shaft, with said device comprising:

a base that is fixed to the inside of a housing that is fixed to the fan, and that includes a motor-shaft-inserting hole into which the fan motor shaft is inserted;

an operating member that is movably mounted to the base and that has a guide portion and an operating portion;

an engaging part on which is formed an engagement portion that is able to engage with an engagement-target portion that is on the outer peripheral surface of the fan motor shaft, with the engaging part being provided to the base such that the engaging part sandwiches the guide portion so that the engaging part is able to move back and forth in the direction of the motor shaft;

a return spring that returns the operating member that has been moved by the operating portion to its original position;

an engaging mechanism that is provided at the position of the engaging part that sandwiches the guide portion and at the position of the guide portion corresponding to the position of the engaging part,

with the engaging mechanism causing the engaging part to move back and forth in the direction of the motor shaft

due to the contacting and moving away from each other of the engaging mechanism caused by the move of the guide portion;

wherein, due to the contacting and moving away from each other of the engaging mechanism, the engaging part moves forward and backward along the motor shaft, whereby the engagement portion of the engaging part engages with and disengages from the engagement-target portion of the motor shaft.

2. A one-touch fitting device for a fan according to Claim 1,

wherein the engaging mechanism is formed of

an inside-diameter-changing portion in which the inside diameter of the guide portion is changed in the direction in which the guide portion moves;

a supporting projecting portion that is formed on the external surface of the guide portion;

a first engaging projecting portion that is provided to one side of the engaging part, which sandwiches the guide portion, and that is able to contact the inside-diameter-changing portion; and

a second engaging projecting portion that is provided to the other side of the engaging part,

which sandwiches the guide portion, and that is able to contact the supporting projecting portion.

3. A one-touch fitting device for a fan according to either Claim 1 or Claim 2, wherein the engaging part advances into the motor-shaft-inserting hole so as to engage with the engagement-target portion of the motor shaft, and a holding mechanism is provided to the base, in which the holding mechanism prevents the engaging part from advancing into the motor-shaft-inserting hole, and by inserting the motor shaft into the motor-shaft-inserting hole, allows the engaging part to advance.

4. A one-touch fitting device for a fan according to any of the preceding claims, wherein the guide portion of the operating member is rotatable or linearly movable relative to the base.

5. A one-touch fitting device for a fan according to any of the preceding claims, wherein the engaging part is formed by an operating piece that contacts the guide portion while sandwiching the guide portion, and by an lock piece having an engagement portion that is able to engage with the engagement-target portion of the motor shaft, and in which the operating piece and lock piece contact each other via their respective surfaces, which are tapered and incline in the direction of preventing the lock piece from coming off the motor shaft.

6. A one-touch fitting device for a fan according to any of the preceding claims, wherein the engaging part is provided to at least one of the two sides that sandwich the motor-shaft-inserting hole.

7. A one-touch fitting device for a fan according to any of the preceding claims, wherein the engagement portion of the engaging part and the engagement-target portion of the motor shaft are threaded portions that engage with each other.

8. A one-touch fitting device for a fan according to Claim 7, wherein the lock piece is provided to the base via an elastic body that allows the lock piece to move toward the motor shaft so as to cause the threaded portion of the lock piece to engage with the threaded portion of the motor shaft.