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(54) Title: A FAN ASSEMBLY, TOOL FOR DETACHABLY COUPLING BLADE PANEL OF FAN ASSEMBLY AND METHOD THEREOF

(57) Abstract: The present disclosure relates to a fan assembly (100). The fan assembly (100) may include a housing (101), a blade panel (102) comprising two or more blades (102a) and a locking unit (103) attached to the housing (101). The locking unit (103) is configured to detachably couple the blade panel (102) to the housing (101). The locking unit (103) may include a plurality of locking arms (103a) connected to a first flange (103b), and each locking arm of the plurality of locking arms (103a) is movably connected to the first flange (103b) by at least one link (103c). The plurality of locking arms (103a) facilitates detachably coupling of the blade panel (102) with the housing (101) of the fan assembly (100).

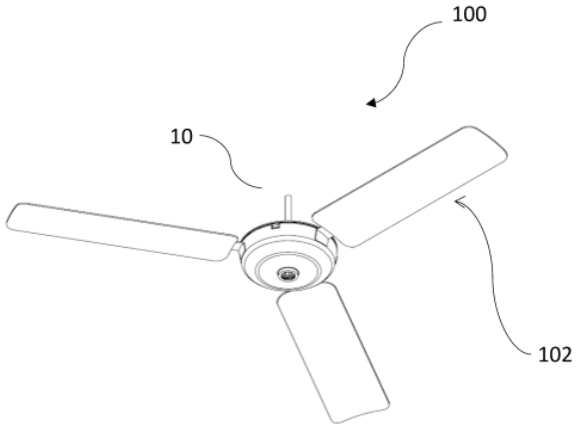

FIG. 1A

FORM 2

THE PATENTS ACT 1970
(39 OF 1970)
&
The Patent Rules, 2003

Complete Specification
(See Section 10 and Rule 13)

1. TITLE OF THE INVENTION

A FAN ASSEMBLY, TOOL FOR DETACHABLY COUPLING BLADE PANEL OF FAN ASSEMBLY AND METHOD THEREOF

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3. PREAMBLE TO THE DESCRIPTION

COMPLETE

The following specification describes the invention and the manner in which it is to be performed

DESCRIPTION

Technical Field

[001] This disclosure relates generally to a fan assembly, and more particularly to a locking unit to detachably couple a blade panel of the fan assembly.

BACKGROUND

[002] Conventionally, the ceiling fans are assembled on a ground/floor and then the assembled ceiling fan is configured to be mounted or attached to the ceiling of the room by means of rods and fasteners. Alternately, in the modular ceiling fan, the centre hub is initially attached to the ceiling then the blades of the modular ceiling fan are connected to the centre hub by means of fasteners. The process of attaching and/or detaching the ceiling fan from the ceiling is cumbersome process and consumes more time. In order to maintain efficiency and enhance décor of the room, the ceiling fans and their respective blades are required with a continuous and timely maintenance, for example –cleaning of the blade panels and the centre hub to improve flow of air within the room and likewise. The maintenance process of existing fans requires removal/detaching of the fan from the ceiling of the room. The dust layer formed on blades, prevent effective flow of air inside the room. Therefore, it is required to regularly clean the blades to improve the air flow as well as to enhance décor of the room. Cleaning of the blades of the fan generally require removal of the fan from the ceiling, which in turn may cause accidents due to heavy weight of the centre hub comprising the rotor. Also, during attaching and detaching of the fan and/or blades of the fan may result in bending of the blades and also compromises safety of the user or operator performing the maintenance work.

[003] The present disclosure is directed to overcome one or more limitations stated above or any other limitation associated with the prior arts.

SUMMARY OF THE INVENTION

[004] One or more shortcomings of the prior art are overcome by a fan assembly as disclosed and additional advantages are provided through the fan assembly as described in the present disclosure.

[005] Additional features and advantages are realized through the techniques of the present disclosure. Other embodiments and aspects of the disclosure are described in detail herein and are considered a part of the claimed disclosure.

[006] In one non-limiting embodiment of the present disclosure, a fan assembly is disclosed. The fan assembly may include a housing configured to house a plurality of

components of the fan assembly, a blade panel comprising two or more blades and a locking unit attached to the housing. The locking unit is configured to detachably couple the blade panel to the housing.

[007] In an embodiment, the locking unit may comprise a plurality of locking arms connected to a first flange, and each locking arm of the plurality of locking arms is movably connected to the first flange by at least one link.

[008] In an embodiment, each locking arm of the plurality of locking arms may comprise a first biasing element configured to bias each locking arm in a radially outward direction to detachably couple the blade panel to the housing.

[009] In an embodiment, the locking unit may comprise an intermediate flange disposed between the first flange and a second flange.

[010] In an embodiment, the locking unit may comprise a second biasing element disposed between the intermediate flange and the second flange, such that the second biasing element is configured to bias the second flange along a vertical direction

[011] In an embodiment, the second flange may comprise a plurality of slots defined in the second flange, such that each slot of the plurality of slots is adapted to receive a first end of respective locking arm of the plurality of locking arms to detach the blade panel from the housing.

[012] In an embodiment, one end of the at least one link is pivotably connected to the first flange and another end of the at least one link is pivotably connected to the locking arm of the plurality of locking arms, such that rotation of the first flange in one direction facilitates movement of each locking arm of the plurality of locking arms to detach the blade panel from the housing.

[013] In an embodiment, the first flange is engageable with a tool for providing rotation to the first flange.

[014] In an embodiment, the blade panel may comprise a cover member having a plurality of locking slots defined in a circumferential wall of the cover member, such that each slot is adapted to receive respective locking arm of the plurality of locking arms to detachably couple the blade panel to the housing.

[015] In an embodiment, the first flange and the second flange are rotatably mounted on the housing of the fan assembly and the intermediate flange is secured to the housing by fasteners.

[016] In another embodiment, a tool for detachably coupling a blade panel to a housing of a fan assembly is disclosed. The tool may include an inner shaft rotatably received

in a hollow shaft and a sleeve slidably mounted on the hollow shaft. The inner shaft is configured to rotatably engage with at least one flange of a locking unit of the fan assembly. The hollow shaft may include a base plate and the sleeve may include a plurality of clamps to secure the blade panel of the fan assembly.

[017] In an embodiment, each clamp of the plurality of clamps may include a proximal end, a distal end and an intermediate portion defined between the proximal end and the distal end. The proximal end is pivotably connected to the sleeve and the intermediate portion is pivotably connected to the base plate of the hollow shaft.

[018] In an embodiment, the tool may include a third biasing element disposed between a first upper end of the sleeve and the base plate to bias the plurality of clamps in a radially inward direction.

[019] In an embodiment, the distal end of each clamp of the plurality of clamps is configured to engage with corresponding groove defined on a circumferential wall of a cover member of the blade panel to secure the blade panel.

[020] In an embodiment, the hollow shaft may include a lever configured to provide a sliding movement to the sleeve along a vertical direction.

[021] In an embodiment, the lever is pivotably connected to a primary bracket mounted on the sleeve at a first lower end, such that pivotal movement of the lever towards the hollow shaft provides sliding movement to the sleeve in a vertically upward direction to facilitate radially outward movement of the plurality of clamps.

[022] In yet another embodiment, a method for detachably coupling a blade panel with a housing of a fan assembly by a tool is disclosed. The method may include actuating a lever of the tool to facilitate radially outward movement of plurality of clamps and placing a cover member of the blade panel on a base plate of the tool. Then, releasing the lever to facilitate radially inward movement of the plurality of clamps to secure the tool with the blade panel. Then the method step may include positioning the blade panel below the housing of the fan assembly. After position of the blade panel, sliding operation of an inner shaft with respect to a hollow shaft of the tool is initiated to engage the inner shaft with a second flange of a locking unit of the fan assembly and further sliding the inner shaft to move the second flange such that each slot defined in the second flange aligns with respective locking arm of plurality of locking arms of the locking unit. The method may further include pushing the tool in a vertically upward direction to receive the plurality of locking arms in corresponding locking slot of plurality of locking slots defined in a circumferential wall of the cover member to facilitate detachably coupling of the blade panel with the housing of the fan assembly.

[023] In an embodiment, the method may include rotating the inner shaft in one direction to facilitate movement of each locking arm of the plurality of locking arms in a radially inward direction to detach the blade panel from the housing.

[024] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[025] The accompanying drawings, which are incorporated in and constitute a part of this disclosure, illustrate exemplary embodiments and, together with the description, serve to explain the disclosed principles.

[026] The novel features and characteristics of the disclosure are set forth in the appended description. The disclosure itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying figures. One or more embodiments are now described, by way of example only, with reference to the accompanying figures wherein like reference numerals represent like elements and in which:

[027] **FIGS. 1A-1B** illustrate a perspective view and a front view, respectively of a fan assembly, in accordance with an embodiment of the present disclosure;

[028] **FIG. 2** illustrates a sectional front view (along a axis X-X) of the fan assembly of FIG. 1B, in accordance with an embodiment of the present disclosure ;

[029] **FIG. 3** illustrates a magnified view of a section of the fan assembly of FIG. 2, in accordance with an embodiment of the present disclosure;

[030] **FIG. 4** illustrates an exploded sectional view of the fan assembly of FIG. 1B, in accordance with an embodiment of the present disclosure;

[031] **FIG. 5** illustrates a perspective view of a housing of the fan assembly of FIG. 4, in accordance with an embodiment of the present disclosure;

[032] **FIG. 6** illustrates a an exploded view of the housing of FIG. 5, in accordance with an embodiment of the present disclosure;

[033] **FIG. 7** illustrates a front view of the housing of FIG. 5, in accordance with an embodiment of the present disclosure;

[034] **FIG. 8** illustrates a front sectional view (along axis Y-Y) of housing of FIG. 7, in accordance with an embodiment of the present disclosure;

[035] **FIG. 9** illustrates a top perspective view of a blade panel of the fan assembly of FIG. 1A, in accordance with an embodiment of the present disclosure;

[036] **FIG. 10** illustrates a front view of a tool for detachably coupling the blade panel to a housing of the fan assembly of FIG. 1A, in accordance with an another embodiment of the present disclosure;

[037] **FIG. 11** illustrates a front section view (along axis Z-Z) of the tool of FIG. 10, in accordance with an embodiment of the present disclosure;

[038] **FIG. 12** illustrates an exploded view of the tool of FIG. 10, in accordance with an embodiment of the present disclosure;

[039] **FIGS. 13A-13D** illustrate sectional views of the fan assembly and tool for detachably coupling the blade panel to the housing of the fan assembly, in accordance with an embodiment of the present disclosure;

[040] **FIGS. 14A-14D** illustrate sectional views of the fan assembly and tool for detaching the blade panel from the housing of the fan assembly, in accordance with an another embodiment of the present disclosure

[041] The figures depict embodiments of the disclosure for purposes of illustration only. One skilled in the art will readily recognize from the following description that alternative embodiments of the assembly illustrated herein may be employed without departing from the principles of the disclosure described herein.

DETAILED DESCRIPTION OF THE DRAWINGS

[042] Exemplary embodiments are described with reference to the accompanying drawings. Wherever convenient, the same reference numbers are used throughout the drawings to refer to the same or like parts. While examples and features of disclosed principles are described herein, modifications, adaptations, and other implementations are possible without departing from the spirit and scope of the disclosed embodiments. It is intended that the following detailed description be considered as exemplary only, with the true scope and spirit being indicated by the following claims. Additional illustrative embodiments are listed.

[043] In the present document, the word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any embodiment or implementation of the present subject matter described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments.

[044] While the disclosure is susceptible to various modifications and alternative forms, specific embodiment thereof has been shown by way of example in the drawings and

will be described in detail below. It should be understood, however that it is not intended to limit the disclosure to the particular forms disclosed, but on the contrary, the disclosure is to cover all modifications, equivalents, and alternatives falling within the spirit and the scope of the disclosure.

[045] The terms “comprises”, “comprising”, or any other variations thereof, are intended to cover a non-exclusive inclusion, such that a system that comprises a list of components does not include only those components but may include other components not expressly listed or inherent to such assembly or system. In other words, one or more components in a system proceeded by “comprises… a” does not, without more constraints, preclude the existence of other acts or additional acts in the method.

[046] In an embodiment, a fan assembly is disclosed. The fan assembly is configured to provide flow or circulation of air inside a room or in any surrounding space. The fan assembly may include a housing, a blade panel and a locking unit. The housing is configured to enclose a plurality of components for example – a rotor, capacitor, wires and likewise configured to facilitate rotation of the blade panel. The blade panel may include two or more blades configured to allow flow of air in a predefined direction. The number of blades of the blade panel may vary depending on type of application of the fan assembly and also the number of blades depend on an area to be covered by the fan assembly. The blades are generally defined having a rectangular profile, but not limited to the same. Alternatively, the blades may have a curved profile to vary speed and direction of flow of air into the surrounding space. The fan assembly may be utilized in different field of applications, for example – as an home appliance, industries, working sites and likewise.

[047] In an embodiment, the fan assembly may be defined as a ceiling fan assembly, but not limited to the same. The locking unit is attached to the housing of the fan assembly. The locking unit is configured to easy coupling/detaching of the blade panel from the housing of the fan assembly. The blade panel may further include a cover member to which one end of the two or more blades are attached. In an exemplary embodiment, the two or more blades are integrally formed with the cover member of the blade panel, defining a unitary structure of the blade panel. The unitary structure of the blade panel facilitates easy and quick removal of all the blades attached to the cover member and thereby saving additional cost as well as time of the user, while performing maintenance and/or cleaning operations. Alternatively, the two or more blades of the blade panels may be fastened to the cover member of the blade panel, thereby making packaging and transportation of the fan assembly easy.

[048] The locking unit may be provided with provisions to facilitate locking of the blade panel with the housing of the fan assembly. The blade panel is configured to be locked or secured with the housing, such that the blade panel provides safety during operation of the fan assembly or rotation of the blade panel. The locking unit may include a plurality of locking arms connected to a first flange, such that each locking arm of the plurality of locking arms is movably connected to the first flange by at least one link. Each locking arm of the plurality of locking arms may comprise a first biasing element configured to bias each locking arm in a radially outward direction to facilitate detachably coupling of the blade panel to the housing of the fan assembly. The plurality of locking arms may also be defined as plurality of finger or bars, configured to engage with the cover member of the blade panel, when the blade panel is locked or secured with the housing.

[049] In an exemplary embodiment, the locking unit may further comprise an intermediate flange and a second flange. The intermediate flange is disposed between the first flange and the second flange. The locking unit may comprise a second biasing element disposed between the intermediate flange and the second flange, such that the second biasing element is configured to bias the second flange along a vertical direction, preferably along a vertically downward direction along an axis X-X. the second flange comprises a plurality of slots defined in the second flange, such that each slot of the plurality of slots is adapted to receive a first end of respective locking arm of the plurality of locking arms to detach the blade panel from the housing. One end of the at least one link may be pivotably connected to the first flange and another end of the at least one link may be pivotably connected to the locking arm of the plurality of locking arms, such that rotation of the first flange in one direction facilitates movement of each locking arm of the plurality of locking arms to detach the blade panel from the housing. The first flange is engageable with a tool for providing rotation to the first flange.

[050] In an embodiment, the tool is provided to facilitate detaching and coupling of the blade panel with the housing of the fan assembly. The tool consists of less number of components to facilitate detaching and/or attaching of the blade panel and thereby reduces human effort and time. The tool may include an inner shaft rotatably received in a hollow shaft, such that the inner shaft is configured to rotatably engage with at least one flange of the locking unit of the fan assembly. The hollow shaft may include a base plate providing support to the cover member of the blade panel. The tool may include a sleeve slidably mounted on the hollow shaft, such that the sleeve comprises a plurality of clamps to secure the blade panel. The plurality of clamps are configured to lock with the cover member of the blade panel during detaching/coupling of the blade panel with the housing. The plurality of clamps are pivotably

connected to the sleeve at one end and pivotably connected to the base plate at an intermediate portion. Alternatively, the plurality of clamp may be connected in a different manner, such that the plurality of clamps grip or secure the cover member of the blade panel.

[051] In another embodiment, a method for detachably coupling the blade panel with the housing of the fan assembly by using the tool is disclosed. The method may include actuating a lever of the tool to facilitate radially outward movement of the plurality of clamps and placing the cover member of the blade panel on the base plate of the tool. Then, releasing the lever to facilitate radially inward movement of the plurality of clamps to secure the tool with the blade panel and positioning the blade panel below the housing of the fan assembly. In the next step, sliding an inner shaft with respect to the hollow shaft of the tool to engage the inner shaft with the second flange of the locking unit of the fan assembly and further sliding the inner shaft to move the second flange such that each slot defined in the second flange aligns with respective locking arm of plurality of locking arms of the locking unit. Then, pushing the tool in a vertically upward direction to receive the plurality of locking arms in corresponding slot of plurality of locking slots defined in a circumferential wall of the cover member to facilitate detachably coupling of the blade panel with the housing of the fan assembly.

[052] Referring now to **FIGS. 1A-1B**, a perspective view and a front view, respectively, of a fan assembly (100) are illustrated, in accordance with an embodiment of the present disclosure. As will be understood, the fan assembly (100) may be meant for a ceiling fan assembly (but not limited to the same) which may be used for allowing flow of air inside a room, hall or a closed space. In an embodiment, the fan assembly (100) [hereinafter may be referred to as "assembly"] may include a housing (101), a blade panel (102) and a locking unit (103). The housing (101) is configured to enclose or house a plurality of components and sub-components of the fan assembly (100). The fan assembly (100) may be utilized for different kind of fans or air flow generating equipment. In an exemplary embodiment, the fan assembly (100) may be defined as a ceiling fan assembly such that, the fan assembly (100) is attached to a ceiling (not shown in FIGS.) of the room through a rod (10), as shown in FIG. 1B. One end of the rod (10) is fixed to the ceiling by hook/latch mechanism and other end may removably connected to the housing (101) by fasteners (not shown in FIGS.). During operation of the fan assembly (100), the blade panel (102) is configured rotate about a vertical axis X-X. The vertical axis X-X may be defined as an axis passing through centre of the rod (10).

[053] The fan assembly (100) may further include a sub-housing (101a) adapted to receive a plurality of rotating and stationary components to govern rotation of the blade panel (102), as shown in FIG. 2. The housing (101) is removably connected to the sub-housing (101a)

by a plurality of fasteners. The sub-housing (101a) is rotatably connected to the rod (10) by a set of bearing (20), as shown in FIG. 3. The sub-housing (101a) provides provisions for mounting of a rotor (30). The rotor (30) is connected to a capacitor (not shown in FIGS.). The capacitor is configured to start single phase in an induction motor of the fan assembly (100) by splitting the phase and energize starting winding to facilitate rotation of the sub-housing (101a). Alternatively, the fan assembly (100) may comprise a Brushless Direct Current (BLDC) to facilitate rotation of the sub-housing (101a) of the fan assembly (100), but not limited to the same and may utilize other principles as well for rotation of the sub-housing (101a). The sub-housing (101a) being connected to the housing (101) and the blade panel (102) being detachably coupled to the housing (101) may result in rotation of the blade panel (102) in a particular direction. The rotation of the blade panel (102) facilitate flow of air inside the room or a surrounding space. The fan assembly (100) may also be mounted with a variety of electronic components for example – micro-controllers, sensors, and likewise to detect temperature of the room and vary rotation speed of the blade panel (102) accordingly. Also, the fan assembly (100) may be mounted with safety sensors to detect locking of the blade panel (102) with the housing (101) of the fan assembly (100). The safety sensors may be configured to provide real-time information to a user, regarding the locked condition of the blade panel (102). The detachable connections of the sub-housing (101a) with the housing (101) and the blade panel (102) with the housing (101) may define the fan assembly (100) as a modular fan assembly.

[054] In an embodiment, the locking unit (103) may be attached to the housing (101) by existing attaching means, for example – by fasteners, but not limited to the same. The locking unit (103) is configured to detachably couple the blade panel (102) to the housing (101). Alternatively, the locking unit (103) may also be attached to the sub-housing (101a) by increasing the space provided in the sub-housing (101a) and providing partition between the rotor (30) and the locking unit (103).

[055] The housing (101) may be defined having a dome-shaped structure, but not limited to the same, as shown in FIG. 4. Alternatively, the housing (101) may be defined having a square, rectangular, or polygonal shaped structure to enhance aesthetic of the fan assembly (100). Referring to FIG. 5, the housing (101) may be defined having a plurality of circumferential cutouts (101b), preferably the housing is defined having at least three circumferential cutouts (101b) to facilitate coupling or mounting and self-aligning of the blade panel (102) with respect to the housing (101). The housing (101) may comprise a bottom panel

(101c) and circumferential panel (101d). The bottom panel (101c) may be defined having a centre hole (101e), as shown in FIG. 6.

[056] The bottom panel (101c) and the circumferential panel (101d) are integrally formed to have a unitary structure of the housing (101). The plurality of circumferential cutouts (101b) are defined in the circumferential panel (101d) of the housing (101), as shown in FIG. 5. Each circumferential cutout of the plurality of circumferential cutouts (101b) is defined having an opening (101g). The bottom panel (101c) may be defined having a plurality of protrusions (101h) defined on an upper surface of the bottom panel (101c), such that each protrusion of the plurality of protrusions (101h) are formed at equally distance from each other and extend in a vertically upward direction. The bottom panel (101c) may be further defined having a plurality of mounting provisions (101i) extending from the upper surface of the bottom panel (101c) in a vertically upward direction. Each mounting provision of the plurality of mounting provisions (101i) is configured to attach or mount the locking unit (103) with the housing (101) by fasteners, preferably screws.

[057] Referring to FIGS. 5-8 and according to an embodiment, the locking unit (103) attached to the housing (101) is illustrated. The locking unit (103) may include a plurality of locking arms (103a) connected to a first flange (103b). Each locking arm of the plurality of locking arms (103a) is movably connected to the first flange (103b) by an at least one link (103c). The plurality of locking arms (103a) are configured to lock or secure the blade panel (102) with the housing (101). Alternatively, the locking unit (103) may comprise other mechanism to facilitate locking or detachably coupling of the blade panel (102 103) to the housing (101). The locking unit (103) may comprise an actuator configured to utilize the power or electrical energy supplied to the fan assembly (100). The actuator may be configured to actuate the plurality of locking arms (103a) to detachably couple the blade panel (102) to the housing (101). The actuator may be defined as motor, preferably a stepper motor which rotates in a predefined direction depending on the input transmitted by the user through a remote control device or a switch disposed inside the housing (101) of the fan assembly (100).

[058] In an exemplary embodiment, the locking unit (103) may contain three locking arms (103a). Each locking arm of the plurality of locking arms (103a) is positioned on the upper surface of the bottom panel (101c) of the housing (101). Each locking arm (103a) may be defined having a first end, a second end, and an intermediate portion defined between the first end and the second end. One end of the at least one link (103c) is pivotably connected to the first flange (103b) and other end of the at least one link (103c) is pivotably connected to the locking arm of the plurality of locking arms (103a), preferably the other end is pivotably

connected to the locking arm (103a) at the intermediate portion. The pivotal connection of each locking arm (103a) with the first flange (103b) facilitates movement of each locking arm of the plurality of locking arms (103a) to detach the blade panel (102) from the housing (101), during rotation of the first flange (103b) in one direction. Each locking arm of the plurality of locking arms (103a) may comprise a first biasing element (103d) configured to bias each locking arm in a radially outward direction to detachably couple the blade panel (102) to the housing (101). The first biasing element (103d) is disposed between a wall of the intermediate portion of each locking arm and the respective protrusion (101h) formed on the bottom panel (101c) of the housing (101), as shown in FIG. 5 and FIG. 8. The protrusion (101h) also provides support to the respective locking arm of the plurality of locking arms (103a) of the locking unit (103).

[059] The locking unit (103) may include a second flange (103f) and an intermediate flange (103g) disposed between the first flange (103b) and the second flange (103f). Once again referring to FIG. 6, the first flange (103b) may be defined with a plurality of guide slots (103h) adapted to receive respective guide rod of the plurality of guide rods (103j) provided on the intermediate flange (103g). The plurality of guide rods (103j) received in the respective guide slots (103h) of the first flange (103b) facilitate uniform and/or smooth rotating movement of the first flange (103b) with respect to the intermediate flange (103g). The first flange (103b) may comprise a first cylindrical portion (103n) extending in a vertical downward direction. The first cylindrical portion (103n) is adapted to be received in a cutout (103k) defined at centre of the intermediate flange (103g).

[060] The second flange (103f) may comprise a plurality of slots (103i) defined in the second flange (103f), such that each slot of the plurality of slots (103i) is adapted to receive the first end of respective locking arm of the plurality of locking arms (103a) to detach the blade panel (102) from the housing (101). The peripheral portion of respective slots of the plurality of slots (103i) prevent unintentional movement of the respective locking arm of the plurality of locking arms (103a) towards a radially inward direction. The locking unit (103) may further comprise a second biasing element (103e) disposed between the intermediate flange (103g) and the second flange (103f), such that the second biasing element (103e) is configured to bias the second flange (103f) along a vertical direction, preferably in a vertically downward direction. The intermediate flange (103g) may include a first seat and the second flange (103f) may comprise a second seat, such that an upper end of the second biasing element (103e) abuts with the first seat and a lower end of the second biasing element (103e) abuts with the second seat.

[061] The first flange (103b), the intermediate flange (103g) and the second flange (103f) are arranged in such a manner that, the first flange (103b) is positioned above the intermediate flange (103g) and the second flange (103f) is positioned below the intermediate flange (103g). The second flange (103f) may include a second cylindrical portion (103o) adapted to be received in the centre hole (101e) defined in the housing (101). In an embodiment, the first flange (103b) and the second flange (103f) are rotatably mounted on the housing (101) of the fan assembly (100) and the intermediate flange (103g) is secured to the housing (101) by fasteners. The first flange (103b) is engageable with a tool (200) for providing rotation to the first flange (103b). The first cylindrical portion (103n) of the first flange (103b) may be defined with a first cutout (103m), as shown in FIG. 8. The first cutout (103m) is adapted to receive the tool (200) to provide rotating movement to the first flange (103b), which in turn facilitates radially inward movement of the plurality of locking arms (103a) to detach the blade panel (102) from the housing (101).

[062] Referring to FIG. 9, the blade panel (102) may comprise two or more blades (102a) and a cover member (102b). The two or more blades (102a) are configured to allow flow of air in a particular direction inside the room or in the surrounding space. The two or more blades (102a) may also be defined as leaves, preferably fan leaves but not limited to the same. The two or more blades (102a) are mounted on the cover member (102b) by existing mounting mechanism. In an embodiment, the two or more blades (102a) and the cover member (102b) are integrally formed to have a unitary structure of the blade panel (102). The shape and size of the two or more blades (102a) and the cover member (102b) may vary depending on the type of application of the fan assembly (100) or other parameters, for example – area to be covered by the fan assembly (100) or likewise.

[063] The cover member (102b) may have a plurality of locking slots (102c) defined in a circumferential wall (102f) of the cover member (102b), such that each slot is adapted to receive respective locking arm of the plurality of locking arms (103a) to detachably couple the blade panel (102) to the housing (101). Each locking slot may be defined having a wedge shape profile to guide the respective locking arm of the plurality of locking arms (103a) to receive in the corresponding locking slot. Each locking arm of the plurality of locking arms (103a) may also be defined having a wedge-shape profile corresponding to the wedge shape profile of the corresponding locking slot to facilitate smooth guiding movement of the respective locking arm into the corresponding locking slot. The cover member (102b) may be defined as a hollow structure having a lower end closed by a bottom plate (102d). The bottom plate (102d) may be defined having a centre hole (102e) coinciding with the centre hole (101e) defined in the bottom

panel (101c) of the housing (101). The second cylindrical portion (103o) of the second flange (103f) is allowed to pass through the centre hole (101e) of the housing (101) and then through the centre hole (102e) of the cover member (102b) of the blade panel (102), when the blade panel (102) is coupled to the housing (101) of the fan assembly (100). The cover member (102b) may further include provisions to receive grabbing means of the tool (200). In an embodiment, the cover member (102b) may include a plurality of grooves (102g) disposed at equidistance from each other to receive the grabbing means of the tool (200) to improve safety to the user during detaching and/or coupling of the blade panel (102) with respect to the housing (101) of the fan assembly (100). In an embodiment, the tool (200) is configured to detach and/or couple the blade panel (102) in one go. In other words, the user is not required to detach or couple the two or more blades (102a) of the blade panel (102) during detaching or coupling of the blade panel (102) on the housing (101).

[064] In an embodiment, the tool (200) for detachably coupling the blade panel (102) to the housing (101) of the fan assembly (100) is disclosed. Referring to FIGS. 10-12, the tool (200) may comprise an inner shaft (200a) movably received in a hollow shaft (200b). The inner shaft (200a) is configured to slide along a vertical axis Z-Z and simultaneously may rotate about the vertical axis Z-Z during operation. The vertical axis Z-Z may be defined as an axis vertically passing though the centre of the tool (200). The inner shaft (200a) is configured to rotatably engage with at least one flange (103b, 103g, 103f) of the locking unit (103) of the fan assembly (100). The hollow shaft (200b) may comprise a base plate (200d), such that the base plate (200d) provides support to the cover member (102b) of the blade panel (102), during detaching and/or coupling of the blade panel (102) to the housing (101). The base plate (200d) is mounted on a top end of the hollow shaft (200b). The tool (200) may further include a sleeve (200c) slidably mounted on the hollow shaft (200b) and the sleeve (200c) may comprise a plurality of clamps (200e) to secure or grab or grip the blade panel (102).

[065] The inner shaft (200a) may comprise an extended member (21) defined at a top end of the inner shaft (200a). The extended member (21) may also be referred as a tool bit. The extended member (21) may be defined having a shape and size corresponding to the shape and size of the first cutout (103m) defined in the first cylindrical portion (103n) of the first flange (103b). Once the extended member (21) is received in the first cutout (103m), the rotating movement provided to the inner shaft (200a) facilitates rotary movement of the extended member (21), which in turn governs rotating movement of the first flange (103b) about a vertical axis Y-Y. The vertical axis Y-Y may be defined as an axis passing through centre of the housing (101).

[066] Referring to FIG. 11 and FIG. 12, the inner shaft (200a) may comprise a first handle (22) configured to provide a grip to the user while operating the tool (200). The user may grip the first handle (22) to push the inner shaft (200a) in a vertically upward direction and then to rotate the inner shaft (200a) in one direction to detach the blade panel (102) from the housing (101). The hollow shaft (200b) may include a second handle (23) provided at a lower end of the hollow shaft (200b), as shown in FIG. 12. The hollow shaft (200b) may further include a secondary bracket (24) and a lever (200f) configured to provide a sliding movement to the sleeve (200c) along a vertical direction. The lever (200f) is pivotably connected to the secondary bracket (24) at one end. The lever (200f) is pivotably connected to a primary bracket (25) mounted on the sleeve (200c) at a first lower end, such that pivotal movement of the lever (200f) towards the hollow shaft (200b) provides sliding movement to the sleeve (200c) in a vertically upward direction to facilitate radially outward movement of the plurality of clamps (200e). In an exemplary embodiment, the lever (200f) is pivotably connected to the primary bracket (25) and the secondary bracket (24) through a two-bar linkage (200g), such that first bar of the two-bar linkage (200g) is pivotably connected to the one end of the lever (200f) and the primary bracket (25) and a second bar of the two-bar linkage (200g) is pivotably connected to the first bar and the secondary bracket (24). The two-bar linkage (200g) transmits pivotal movement of the lever (200f) into the sliding movement of the sleeve (200c) in a vertically upward/downward direction.

[067] Alternatively, the tool (200) may be comprise different and components to facilitate detaching or coupling of the blade panel (102) with the housing (101) of the fan assembly (100). The tool (200) may directly rest on a floor and may comprise telescopic arrangements to facilitate telescopic movement of the tool to vary length and thereby to increase ease of operation. The telescopic movement may be achieved by an internal rack and pinion or lead screw nut coupled to a hand wheel to rotate the lead screw nut or may comprise gas spring or by electromagnetic actuations. Further, the radially outward movement of the plurality of clamps (200e) may be achieved by an electric actuator positioned inside the hollow shaft (200b). The hollow shaft (200b) may be provided with a switch to actuate the electric actuator which is connected to the plurality of clamps through linkages for example - rack and pinion arrangement or likewise. This may further reduce the human efforts during detaching and/or coupling of the blade panel (102) with the housing (101).

[068] Each clamp of the plurality of clamps (200e) may comprise a proximal end (20p), a distal end (20d) and an intermediate portion (20i) defined between the proximal end (20p) and the distal end (20d). The proximal end (20p) is pivotably connected to the sleeve

(200c) and the intermediate portion (20i) is pivotably connected to the base plate (200d) of the hollow shaft (200b). The distal end (20d) of each clamp of the plurality of clamps (200e) is configured to engage with corresponding groove of the plurality of grooves (102g) defined in the circumferential wall (102f 102d) of the cover member (102b) of the blade panel (102) to secure the blade panel (102). The tool (200) may further include a third biasing element (200h) disposed between a first upper end of the sleeve (200c) and the base plate (200d) to bias the plurality of clamps (200e) in a radially inward direction or in a locked position. The third biasing element (200h) is received inside a hollow cylinder (200i) to enhance aesthetic of the tool (200). The proximal end (20p) of each clamp of the plurality of clamps (200e) is pivotably connected to the hollow cylinder (200i) mounted on the first upper end of the sleeve (200c).

[069] According to an embodiment and referring to FIGS. 13A-13D, a method for detachably coupling the blade panel (102) with the housing (101) of the fan assembly (100) using the tool (200) is disclosed and depicted. The method comprises steps of: actuating the lever (200f) of the tool (200) to facilitate radially outward movement of the plurality of clamps (200e) and then placing the cover member (102b) of the blade panel (102) on the base plate (200d) of the tool (200). Then, releasing the lever (200f) to facilitate radially inward movement of the plurality of clamps (200e) to secure the tool (200) with the blade panel (102) and simultaneously positioning the blade panel (102) below the housing (101) of the fan assembly (100). The next method step is of sliding the inner shaft (200a) with respect to the hollow shaft (200b) of the tool (200) to engage the inner shaft (200a) with the second flange (103f) of the locking unit (103) of the fan assembly (100) and further sliding the inner shaft (200a) to move the second flange (103f) such that each slot defined in the second flange (103f) aligns with respective locking arm of the plurality of locking arms (103a) of the locking unit (103). Then, pushing the tool (200) in a vertically upward direction to slidably receive the plurality of locking arms (103a) in corresponding locking slot of the plurality of locking slots (102c) defined in the circumferential wall (102f) of the cover member (102b) to facilitate detachably coupling of the blade panel (102) with the housing (101) of the fan assembly (100). A buzzer or an LED indicator may be electrically connected to the locking slot through sensor to detect and transmit signals to the user to confirm locking of the blade panel (102) with the housing (101) of the fan assembly (100).

[070] In yet another embodiment, a method for detaching the blade panel (102) from the housing (101) of the fan assembly (100) using the tool (200) is disclosed and shown in FIGS. 14A-14D. The method comprises steps of: positioning the base plate (200d) of the tool (200) below a cover member (102b) of the blade panel (102). Then, actuating the lever (200f)

of the tool (200) to facilitate radially outward movement of the plurality of clamps (200e) and positioning the base plate (200d) to abut with the cover member (102b). The next step is of releasing the lever (200f) to facilitate radially inward movement of the plurality of clamps (200e) to secure the tool (200) with the blade panel (102), preferably with the cover member (102b). By releasing the lever (200f) the biasing force of the third biasing element (200h) pushes the sleeve (200c) in vertically downward direction which in turn governs radially inward movement of the plurality of clamps (200e). The radially inward movement of the plurality of clamps (200e) facilitates receiving of the distal end (20d) of each clamp in corresponding groove of the plurality of grooves (102g) defined in the cover member (102b), thereby securing the tool (200) with the cover member (102b) of the blade panel (102). Then, sliding the inner shaft (200a) with respect to the hollow shaft (200b) of the tool (200) to rotatably engage the inner shaft (200a) with an the least one flange (103b, 103g, 103f) of the locking unit (103) of the fan assembly (100). Then further sliding the inner shaft (200a) against the biasing force of the third biasing element (200h), which in turn facilitates vertical movement of the second flange (103f) so that the one end of each locking arm of the plurality of locking arms (103a) is aligned with the respective slot (103i) defined in the second flange (103f). In an embodiment, sliding of the inner shaft (200a) facilitates engaging of the extended member (21) with the first cutout (103m) of the first flange (103b). Then, rotating the inner shaft (200a) in one direction to facilitate movement of each locking arm of the plurality of locking arms (103a) in a radially inward direction to detach the blade panel (102) from the housing (101). The rotation of the inner shaft (200a) facilitates rotation of the extended member (21) and the extended member (21) being engaged with the first flange (103b) possess the same rotating movement. The rotation of the first flange (103b) governs radially inward movement of each locking arm of the plurality of locking arms (103a), such that the one end of each locking arm is received within the respective slot (103i) defined in the second flange (103f). The radially inward movement of the plurality of locking arms (103a) releases the other end of the locking arm from the corresponding locking slot (102c) defined in the cover member (102b) of the blade panel (102) and thereby detaching the blade panel (102) from the housing (101).

[071] In alternative embodiments, the radially inward/outward movement of the plurality of clamps (200e) may be achieved through electromagnetic actuations with the help of external power source or a rechargeable battery disposed inside the tool (200). The radial movement of the plurality of clamps (200e) may be transformed to other mechanical movements, for example – linear movement of the clamps to secure the cover member (102b) of the blade panel (102) to further reduce the operational time and effort of the user. The

connection of the lever (200f) with the sleeve (200c) and the hollow shaft (200b) may be modified by changing the two-bar linkage (200g) with the helix gear and lead nut or likewise. Also, the size of the first handle (22) may be varied depending on the twisting or rotating force required to rotate the inner shaft (200a) of the tool (200). For example – if the operator or user feels that twisting effort needs to be reduced diameter of the first handle (22) may be increased by utilizing a collapsible or variable size first handle (22).

[072] In alternative embodiments, the locking unit (103) and its internal components may be modified to provide further ease to the user during detaching/coupling of the blade panel (102) from the housing (101) of the fan assembly (100). All such modifications shall be considered within the scope of the present disclosure. Such modifications may include, for example – three individual or single electromagnetic actuator with fail safe to govern mechanical rotary movement to the first flange (103b) and thereby to facilitate radially inward movement of the plurality of locking arms (103a). The power to actuate the electromagnetic actuator may be taken from the same source of the fan assembly (100) for rotation of the blade panel (102). The electromagnetic actuator may only utilize power during detaching of the blade panel (102) from the housing (101). In case of electromagnetic actuator, a rotatable inner shaft arrangement in the tool for providing rotary movement may not be required to detach the blade panel (102). However, the tool having the electromagnetic actuator is still required to hold or provide support to the blade panel (102) during detaching/coupling of the blade panel (102) from the housing (101). Also, the tool may also be configured to operate a switch associated with the electromagnetic actuator.

[073] The above subject matter discloses a fan assembly comprising a blade panel which is easily detached or coupled to the housing using the tool. Further, the tool provides a portable solution which may be easily accommodated in a limited space inside the room and may readily be used to detach and/or couple the blade panel with the housing of the fan assembly. Moreover, by employing the locking unit inside the housing, the construction and therefore the detaching and coupling process of the blade panel is simplified. Further, the fan assembly comprising the blade panel facilitates easy and regular cleaning of the blades/leaves and thereby increasing the air flow quality.

[074] It is intended that the disclosure and examples be considered as exemplary only, with a true scope and spirit of disclosed embodiments being indicated by the following claims.

WE CLAIM:

1. A fan assembly (100), comprising:

a housing (101);

a blade panel (102) comprising two or more blades (102a); and

a locking unit (103) attached to the housing (101) and configured to detachably couple the blade panel (102) to the housing (101).

2. The fan assembly (100) as claimed in claim 1, wherein the locking unit (103) comprises a plurality of locking arms (103a) connected to a first flange (103b), and each locking arm of the plurality of locking arms (103a) is movably connected to the first flange (103b) by at least one link (103c).

3. The fan assembly (100) as claimed in claim 2, wherein each locking arm of the plurality of locking arms (103a) comprises a first biasing element (103d) configured to bias each locking arm in a radially outward direction to detachably couple the blade panel (102) to the housing (101).

4. The fan assembly (100) as claimed in claim 2, wherein the locking unit (103) comprises an intermediate flange (103g) disposed between the first flange (103b) and a second flange (103f).

5. The fan assembly (100) as claimed in claim 4, wherein the locking unit (103) comprises a second biasing element (103e) disposed between the intermediate flange (103g) and the second flange (103f), such that the second biasing element (103e) is configured to bias the second flange (103f) along a vertical direction.

6. The fan assembly (100) as claimed in claim 4, wherein the second flange (103f) comprises a plurality of slots (103i) defined in the second flange (103f), such that each slot of the plurality of slots (103i) is adapted to receive a first end of respective locking arm of the plurality of locking arms (103a) to detach the blade panel (102) from the housing (101).

7. The fan assembly (100) as claimed in claim 5, wherein one end of the at least one link (103c) is pivotably connected to the first flange (103b) and another end of the at least one link (103c) is pivotably connected to the locking arm of the plurality of locking arms (103a), such that

rotation of the first flange (103b) in one direction facilitates movement of each locking arm of the plurality of locking arms (103a) to detach the blade panel (102) from the housing (101).

8. The fan assembly (100) as claimed in claim 7, wherein the first flange (103b) is engageable with a tool (200) for providing rotation to the first flange (103b).

9. The fan assembly (100) as claimed in claim 1, wherein the blade panel (102) comprises a cover member (102b) having a plurality of locking slots (102c) defined in a circumferential wall (102f) of the cover member (102b), such that each slot is adapted to receive respective locking arm of the plurality of locking arms (103a) to detachably couple the blade panel (102) to the housing (101).

10. The fan assembly (100) as claimed in claim 4, wherein the first flange (103b) and the second flange (103f) are rotatably mounted on the housing (101) of the fan assembly (100) and the intermediate flange (103g) is secured to the housing (101) by fasteners.

11. A tool (200) for detachably coupling a blade panel (102) to a housing (101) of a fan assembly (100), the tool (200) comprising:

an inner shaft (200a) rotatably received in a hollow shaft (200b), wherein the inner shaft (200a) is configured to rotatably engage with at least one flange (103b, 103g, 103f) of a locking unit (103) of the fan assembly (100);

the hollow shaft (200b) comprises a base plate (200d); and

a sleeve (200c) slidably mounted on the hollow shaft (200b), wherein the sleeve (200c) comprises a plurality of clamps (200e) to secure the blade panel (102).

12. The tool (200) as claimed in claim 11, wherein each clamp of the plurality of clamps (200e) comprises:

a proximal end (20p), a distal end (20d) and an intermediate portion (20i) defined between the proximal end (20p) and the distal end (20d); wherein

the proximal end (20p) is pivotably connected to the sleeve (200c) and the intermediate portion (20i) is pivotably connected to the base plate (200d) of the hollow shaft (200b).

13. The tool (200) as claimed in claim 11, comprises a third biasing element (200h) disposed between a first upper end of the sleeve (200c) and the base plate (200d) to bias the plurality of clamps (200e) in a radially inward direction.

14. The tool (200) as claimed in claim 12, wherein the distal end (20d) of each clamp of the plurality of clamps (200e) is configured to engage with corresponding groove (102g) defined in a circumferential wall (102f) of a cover member (102b) of the blade panel (102) to secure the blade panel (102).

15. The tool (200) as claimed in claim 11, wherein the hollow shaft (200b) comprises a lever (200f) configured to provide a sliding movement to the sleeve (200c) along a vertical direction.

16. The tool (200) as claimed in claim 15, wherein the lever (200f) is pivotably connected to a primary bracket (25) mounted on the sleeve (200c) at a first lower end, such that pivotal movement of the lever (200f) towards the hollow shaft (200b) provides sliding movement to the sleeve (200c) in a vertically upward direction to facilitate radially outward movement of the plurality of clamps (200e).

17. A method for detachably coupling a blade panel (102) with a housing (101) of a fan assembly (100) by a tool (200), the method comprises:

actuating a lever (200f) of the tool (200) to facilitate radially outward movement of plurality of clamps (200e) and placing a cover member (102b) of the blade panel (102) on a base plate (200d) of the tool (200);

releasing the lever (200f) to facilitate radially inward movement of the plurality of clamps (200e) to secure the tool (200) with the blade panel (102);

positioning the blade panel (102) below the housing (101) of the fan assembly (100);

sliding an inner shaft (200a) with respect to a hollow shaft (200b) of the tool (200) to engage the inner shaft (200a) with a second flange (103f) of a locking unit (103) of the fan assembly (100) and further sliding the inner shaft (200a) to move the second flange (103f) such that each slot defined in the second flange (103f) aligns with respective locking arm of plurality of locking arms (103a) of the locking unit (103); and

pushing the tool (200) in a vertically upward direction to receive the plurality of locking arms (103a) in corresponding locking slot of plurality of locking slots (102c) defined in a

circumferential wall (102f) of the cover member (102b) to facilitate detachably coupling of the blade panel (102) with the housing (101) of the fan assembly (100).

18. The method for detachably coupling the blade panel (102) with the housing (101) of the fan assembly (100) by the tool (200) as claimed in claim 17, the method comprises:

rotating the inner shaft (200a) in one direction to facilitate movement of each locking arm of the plurality of locking arms (103a) in a radially inward direction to detach the blade panel (102) from the housing (101).

. Dated this 09th day of November 2022

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ABSTRACT

A FAN ASSEMBLY, TOOL FOR DETACHABLY COUPLING BLADE PANEL OF FAN ASSEMBLY AND METHOD THEREOF

The present disclosure relates to a fan assembly (100). The fan assembly (100) may include a housing (101), a blade panel (102) comprising two or more blades (102a) and a locking unit (103) attached to the housing (101). The locking unit (103) is configured to detachably couple the blade panel (102) to the housing (101). The locking unit (103) may include a plurality of locking arms (103a) connected to a first flange (103b), and each locking arm of the plurality of locking arms (103a) is movably connected to the first flange (103b) by at least one link (103c). The plurality of locking arms (103a) facilitates detachably coupling of the blade panel (102) with the housing (101) of the fan assembly (100).

[FIG. 1A]

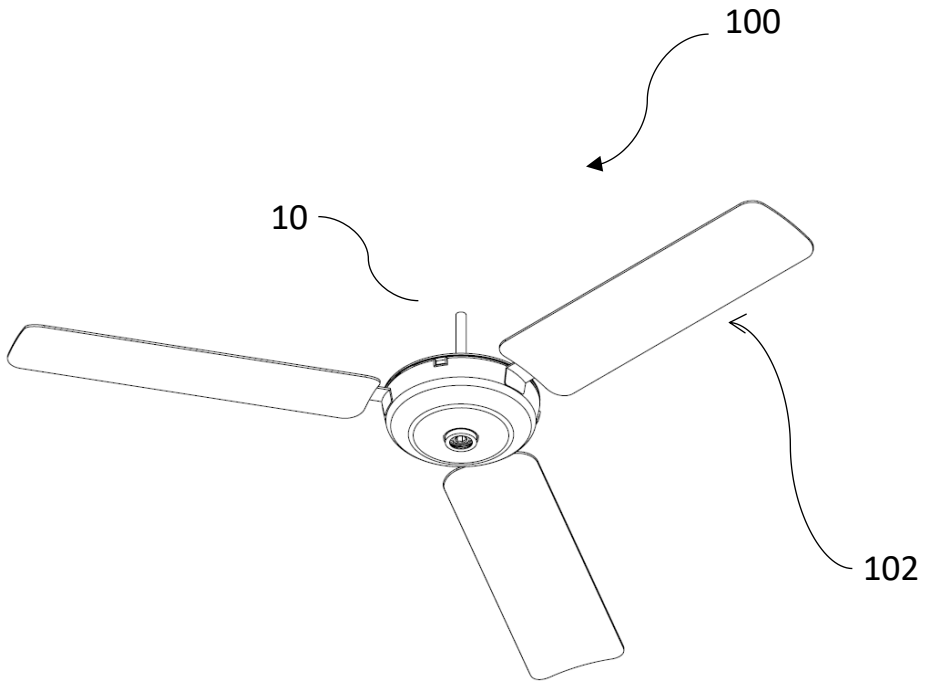

FIG. 1A

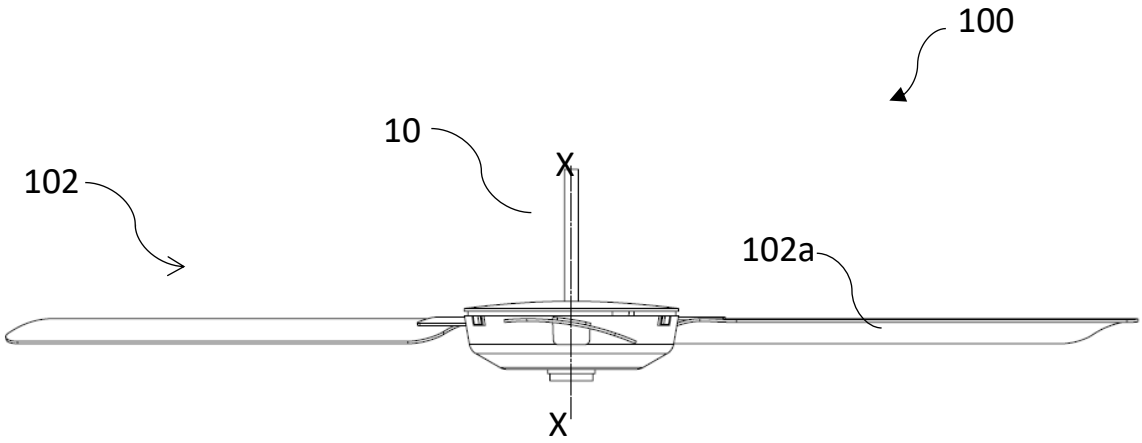

FIG. 1B

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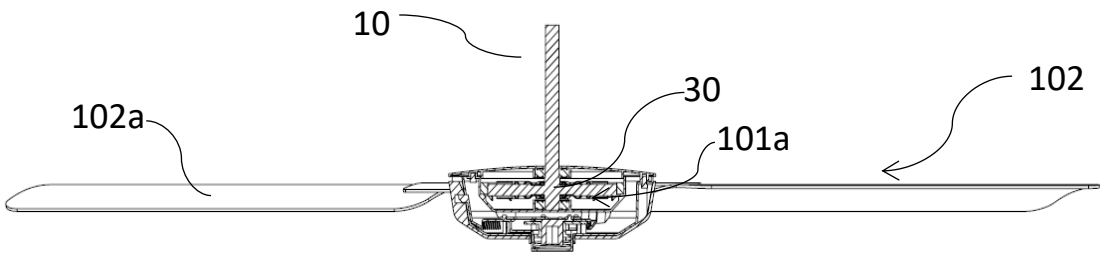

FIG. 2

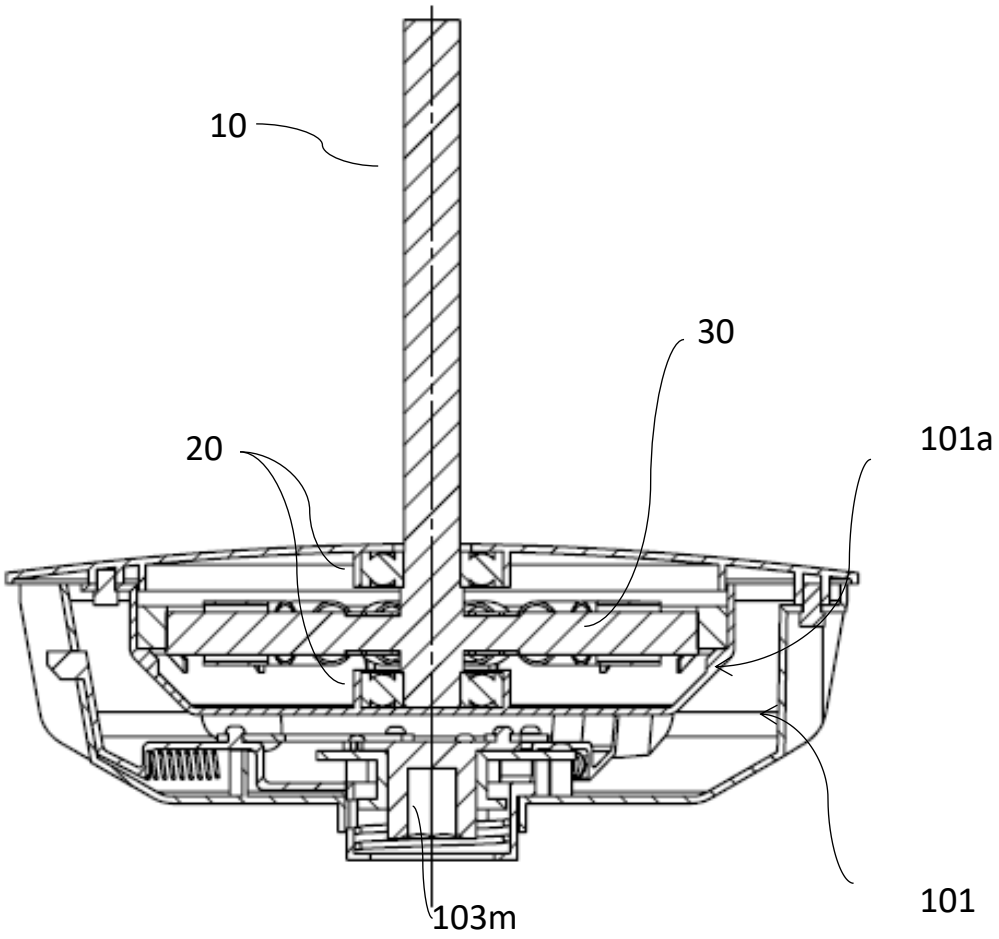

FIG. 3

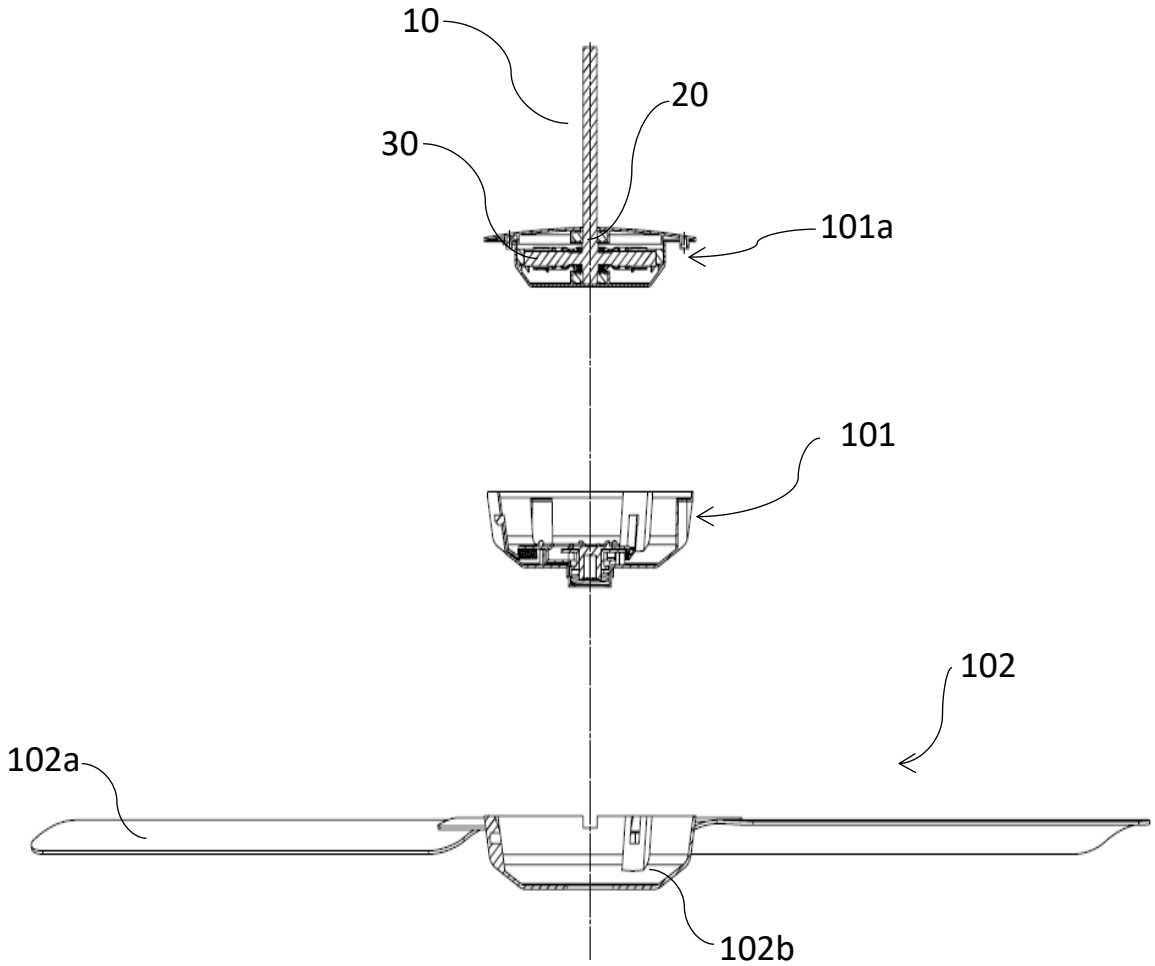

FIG. 4

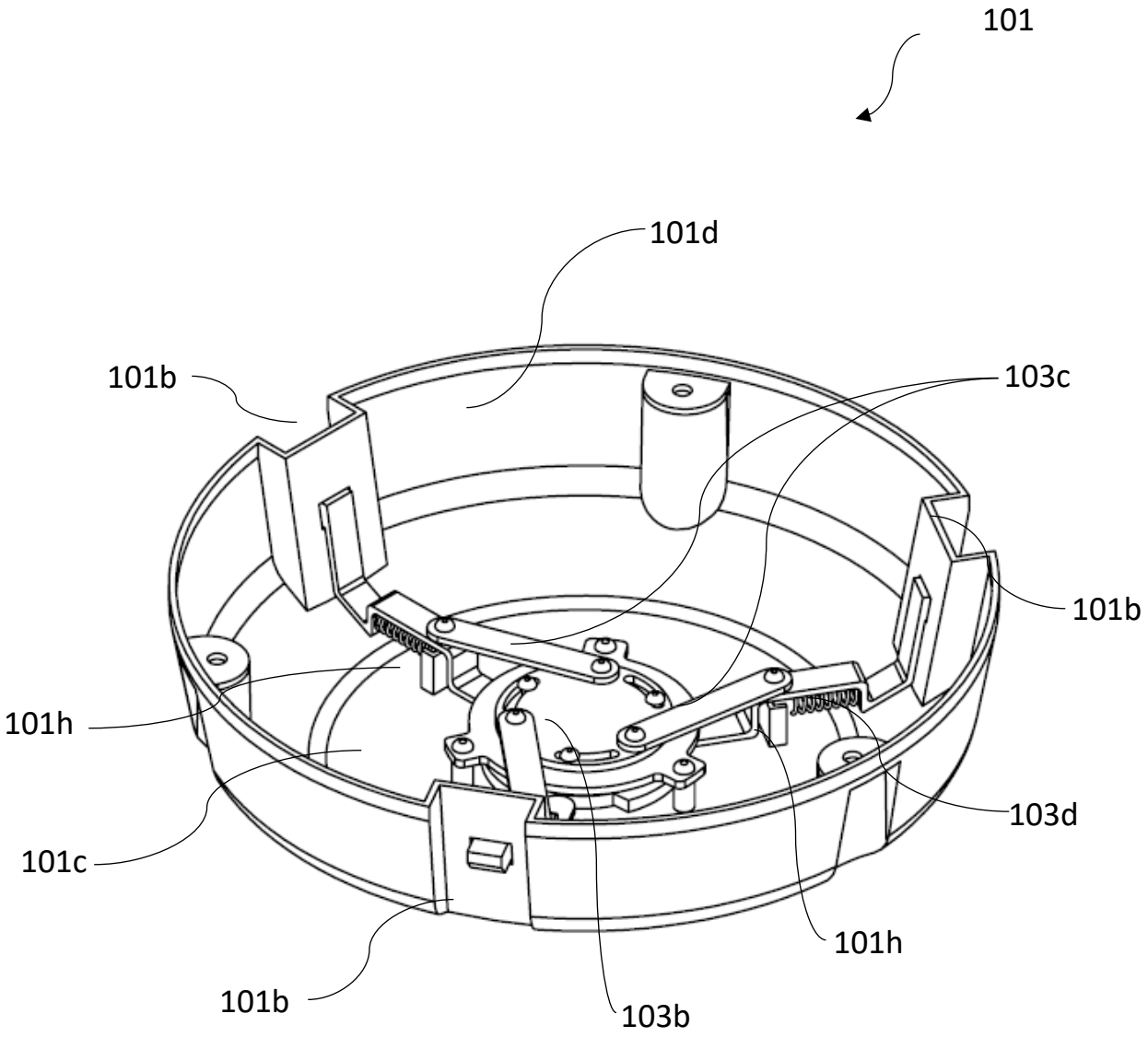

FIG. 5

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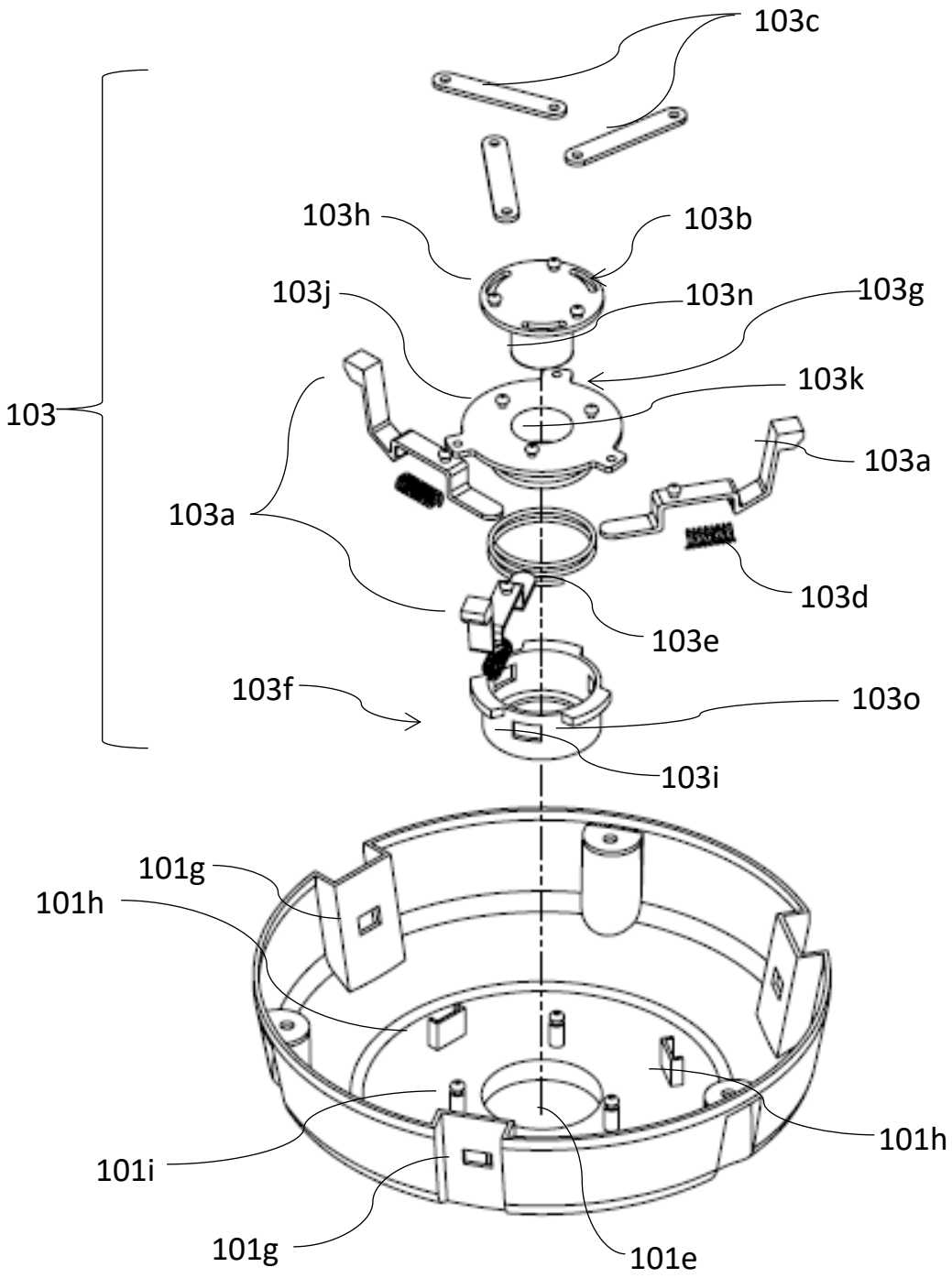

FIG. 6

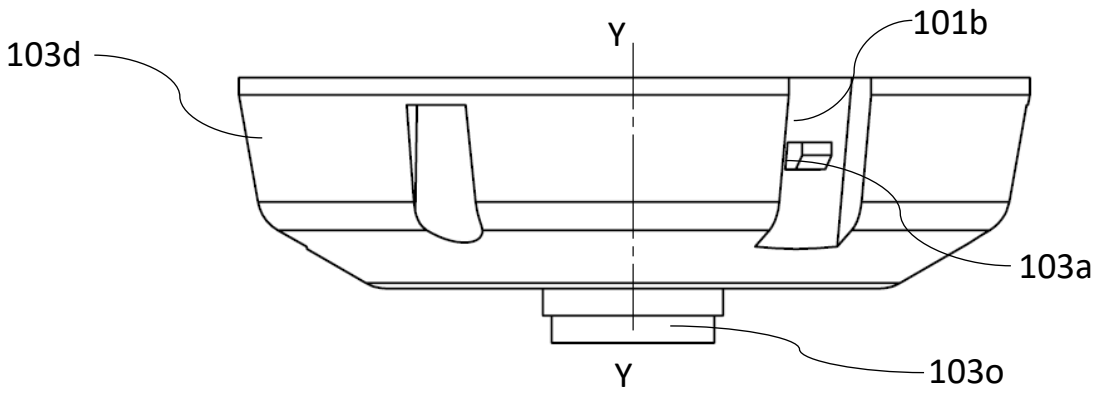

FIG. 7

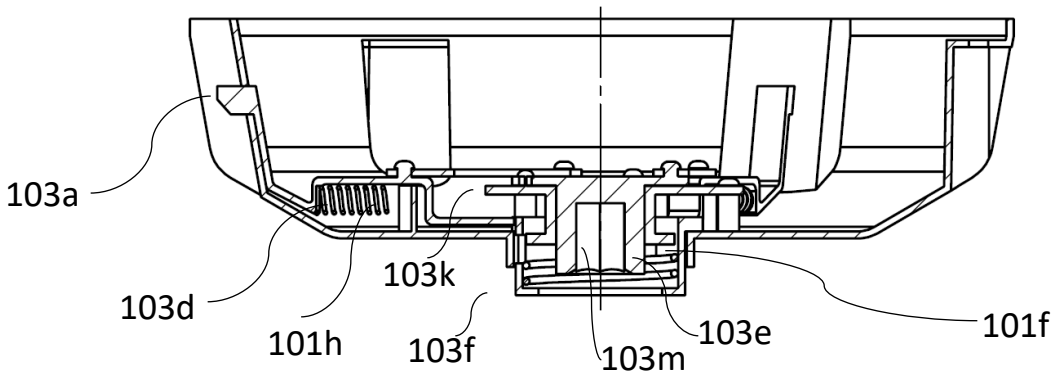

FIG. 8

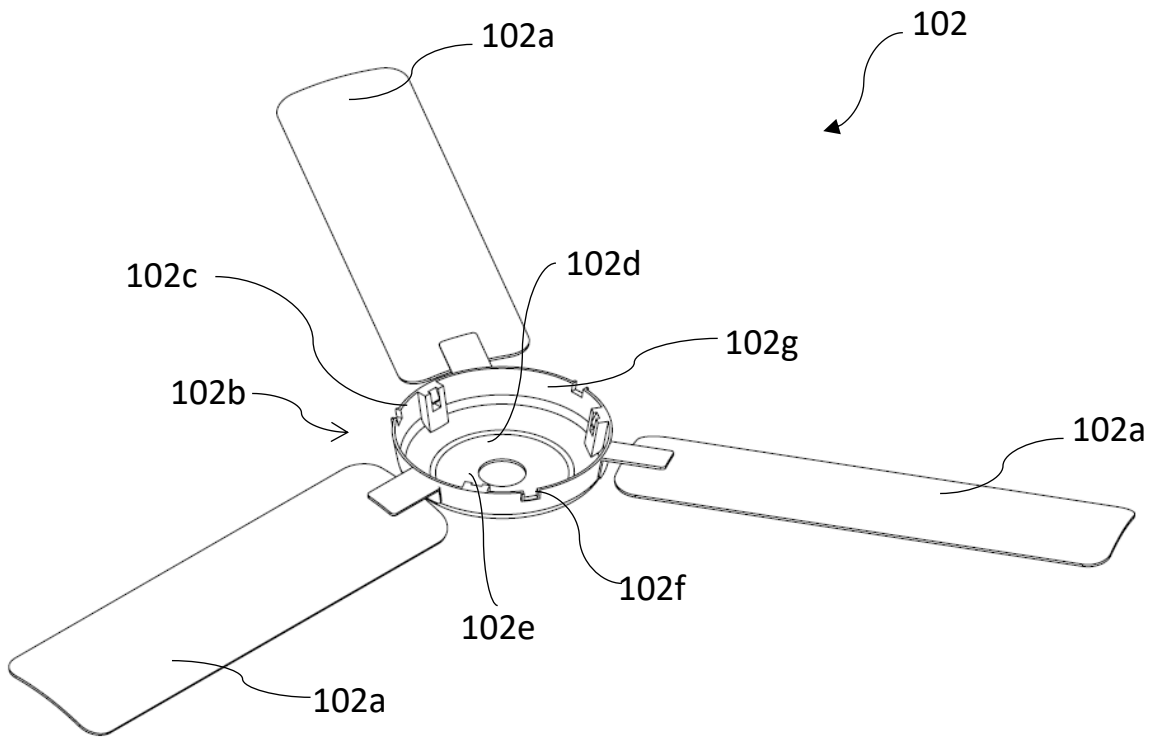

FIG. 9

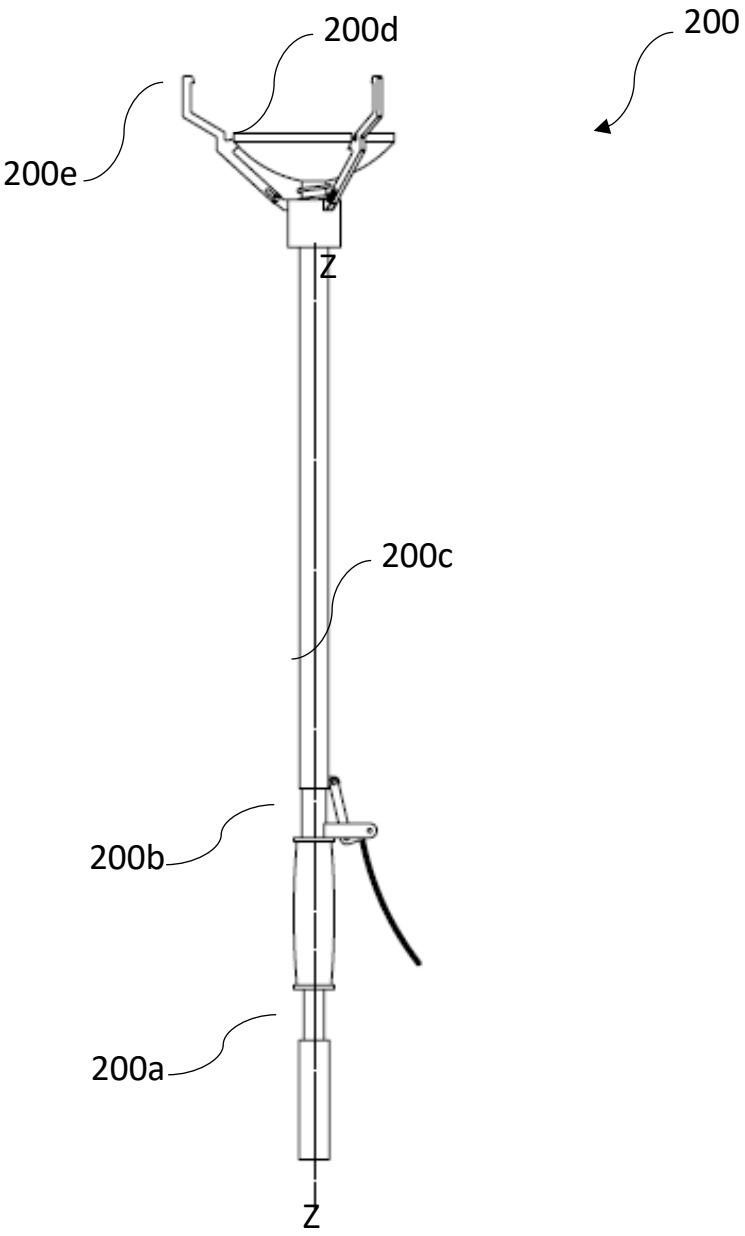

FIG. 10

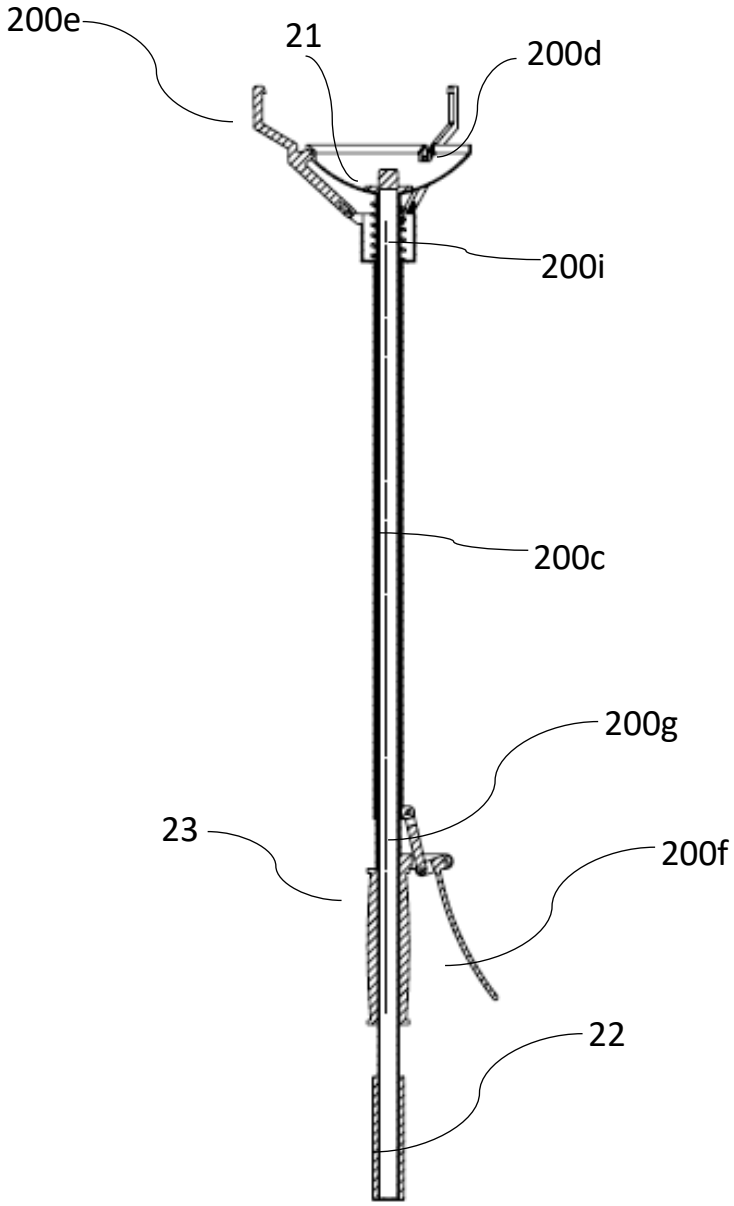

FIG. 11

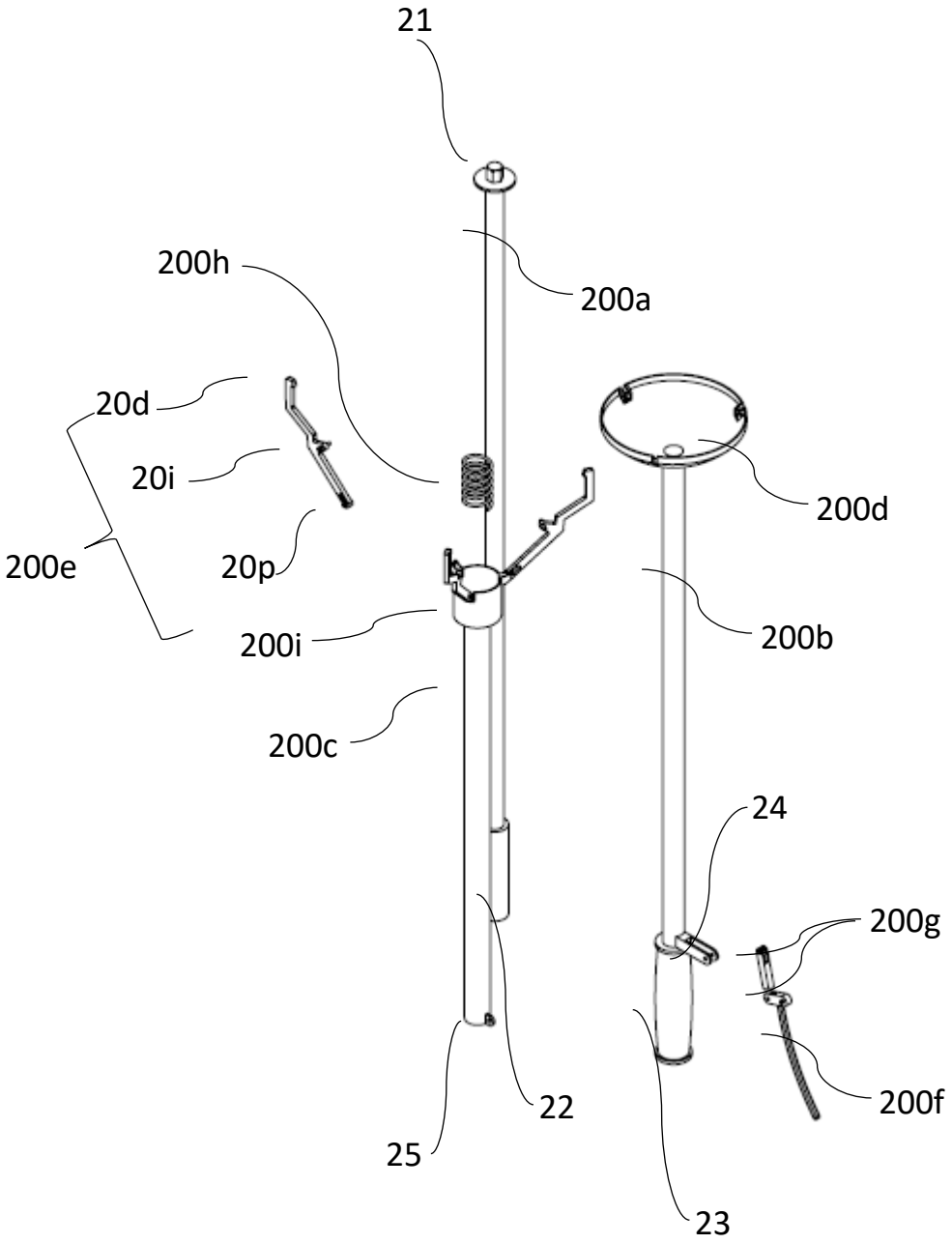

FIG. 12

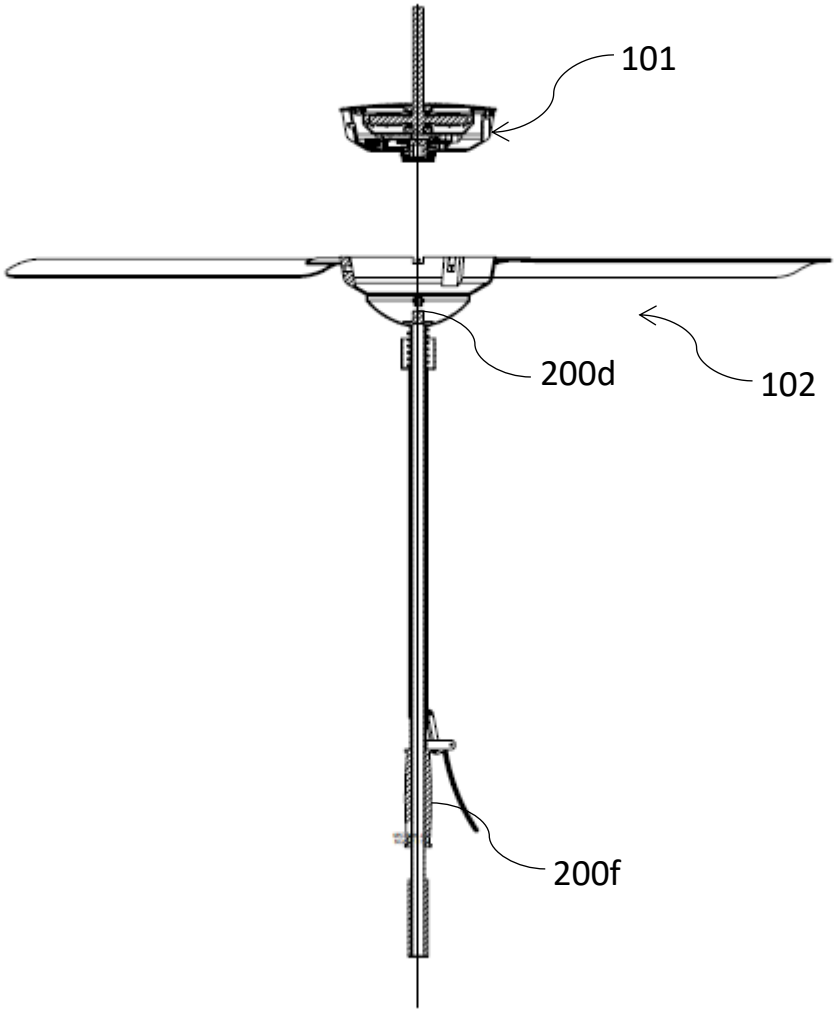

FIG. 13A

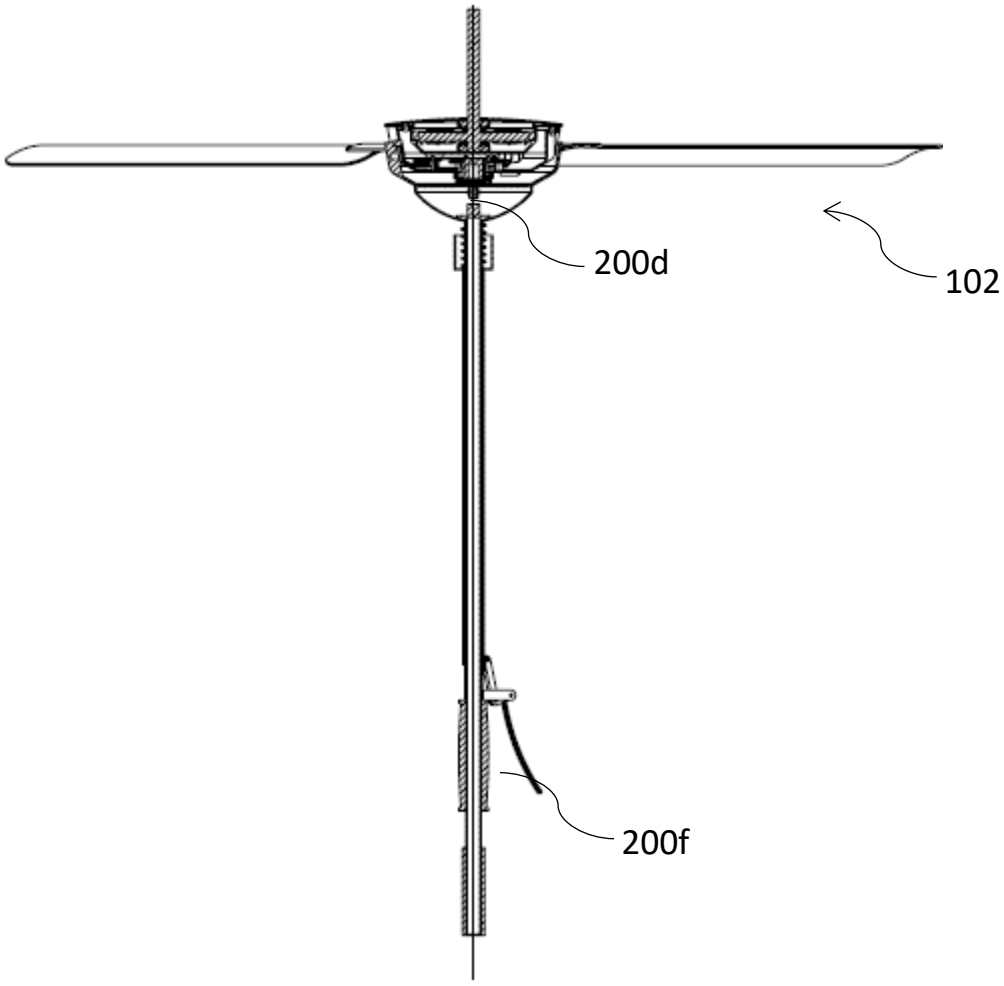

FIG. 13B

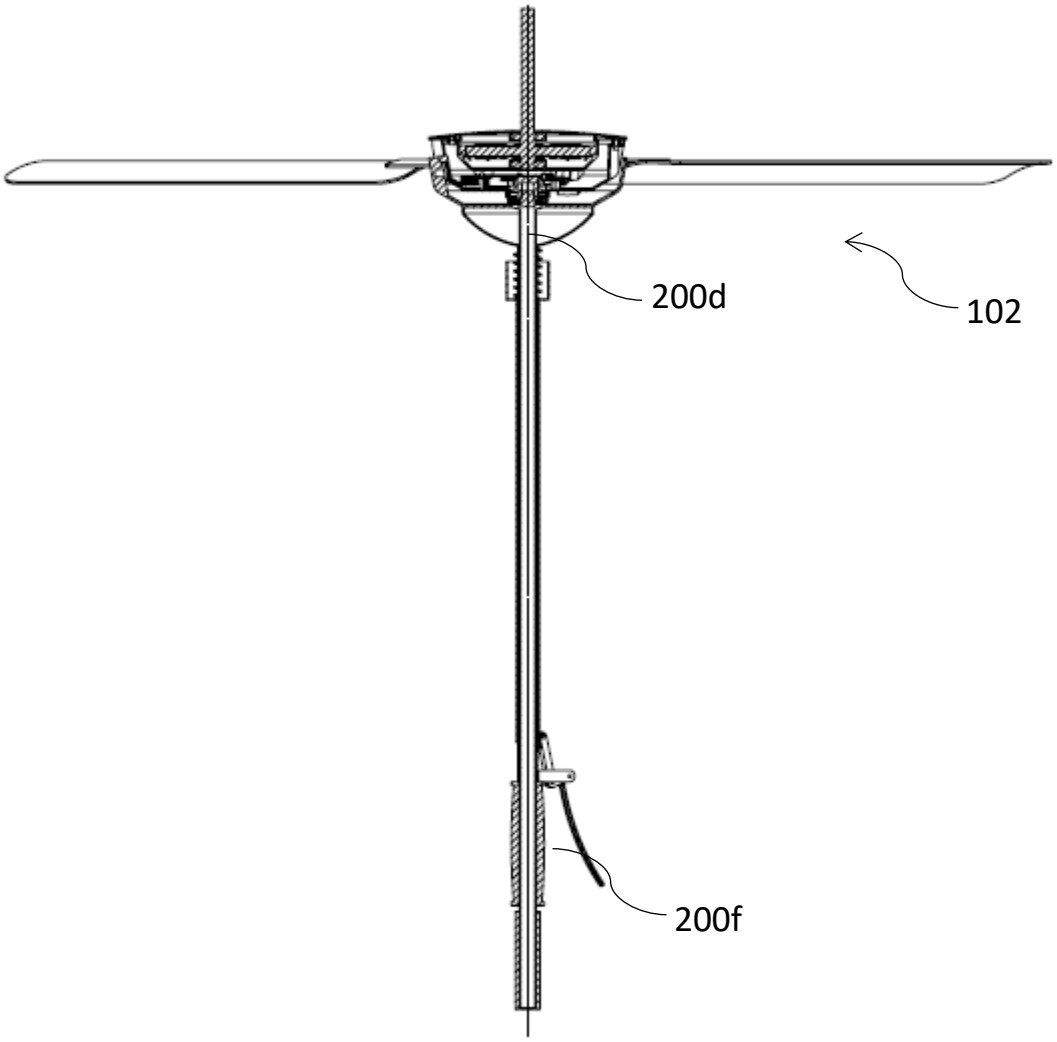

FIG. 13C

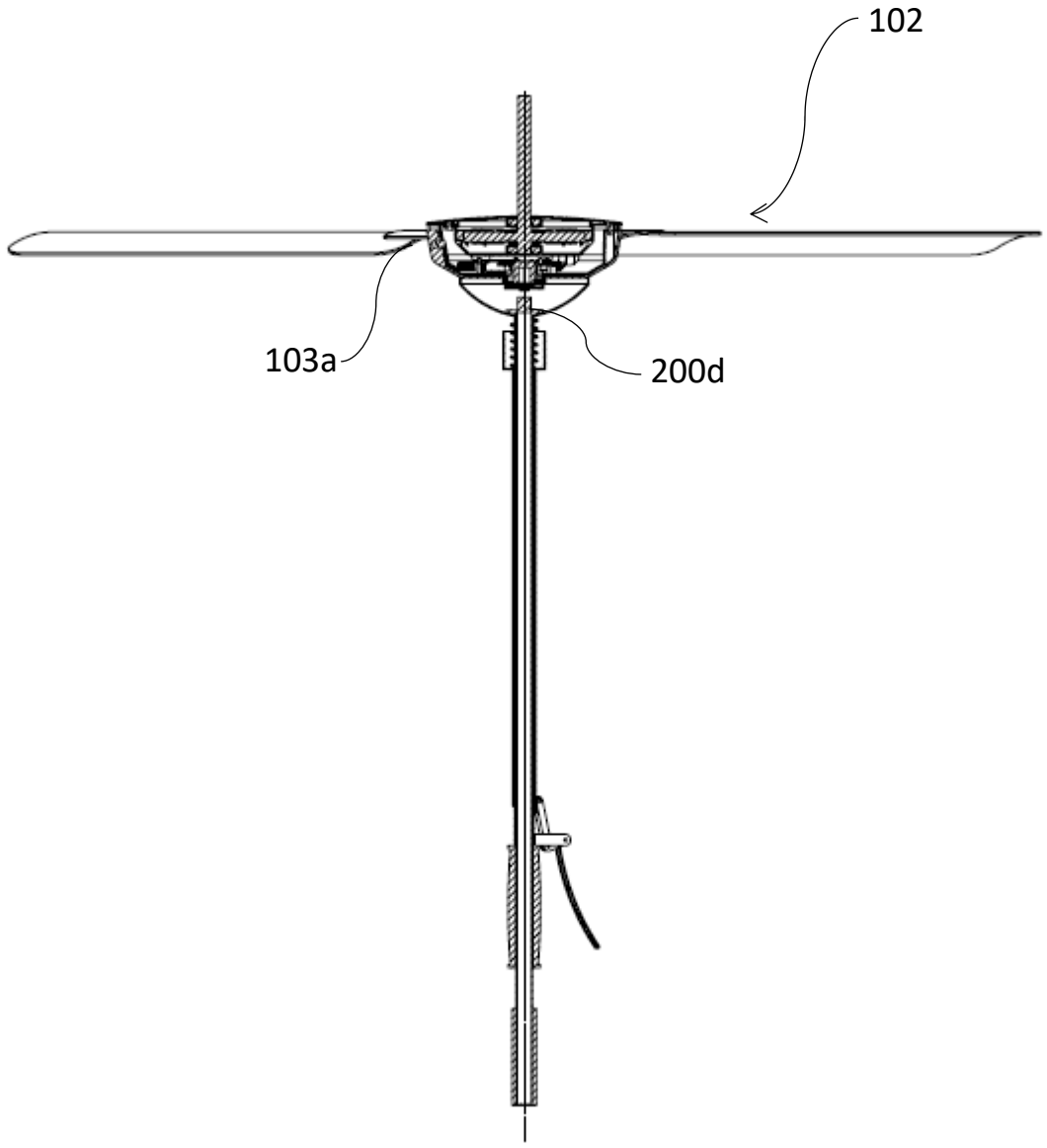

FIG. 13D

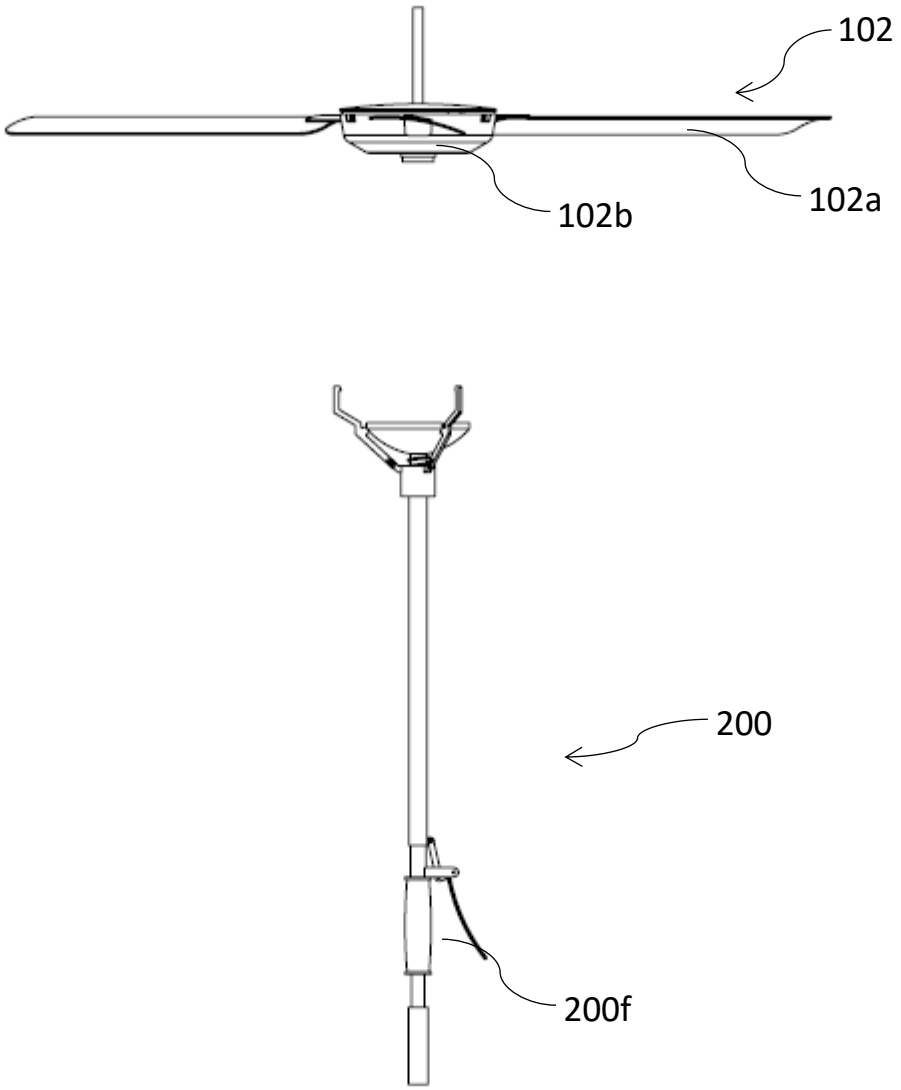

FIG. 14A

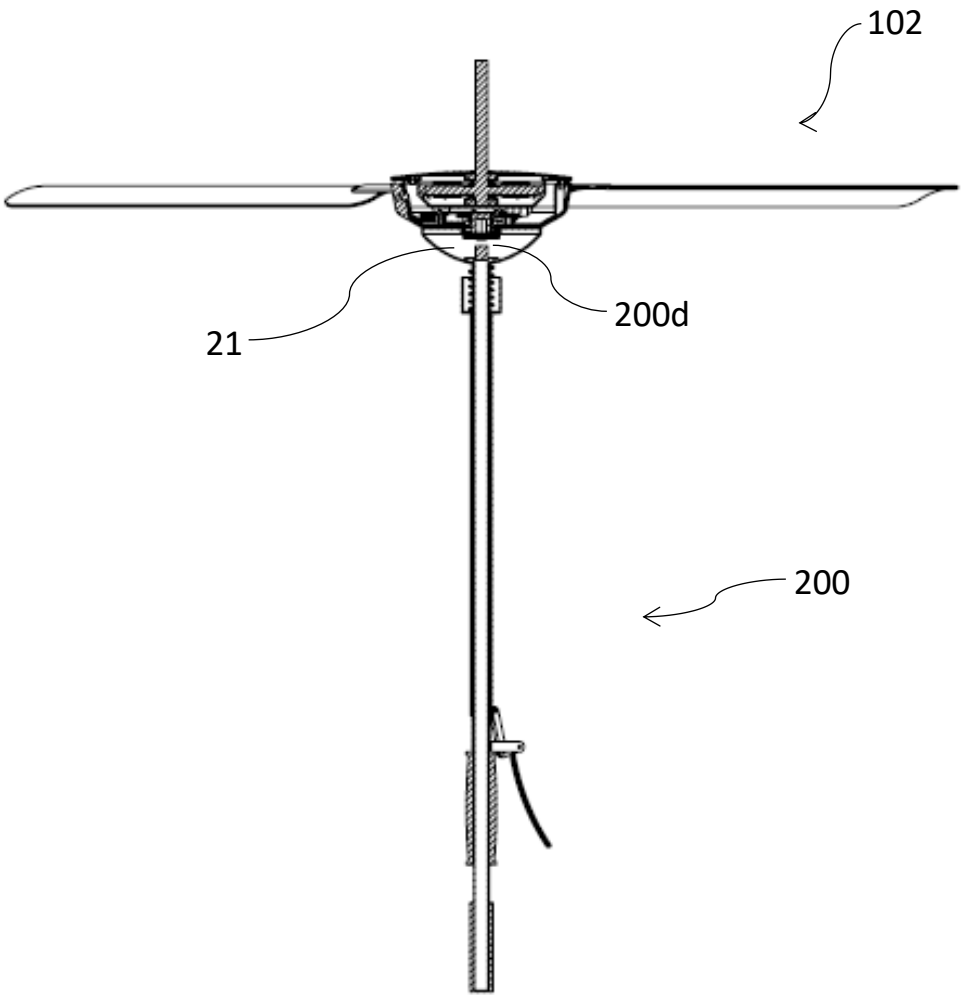

FIG. 14B

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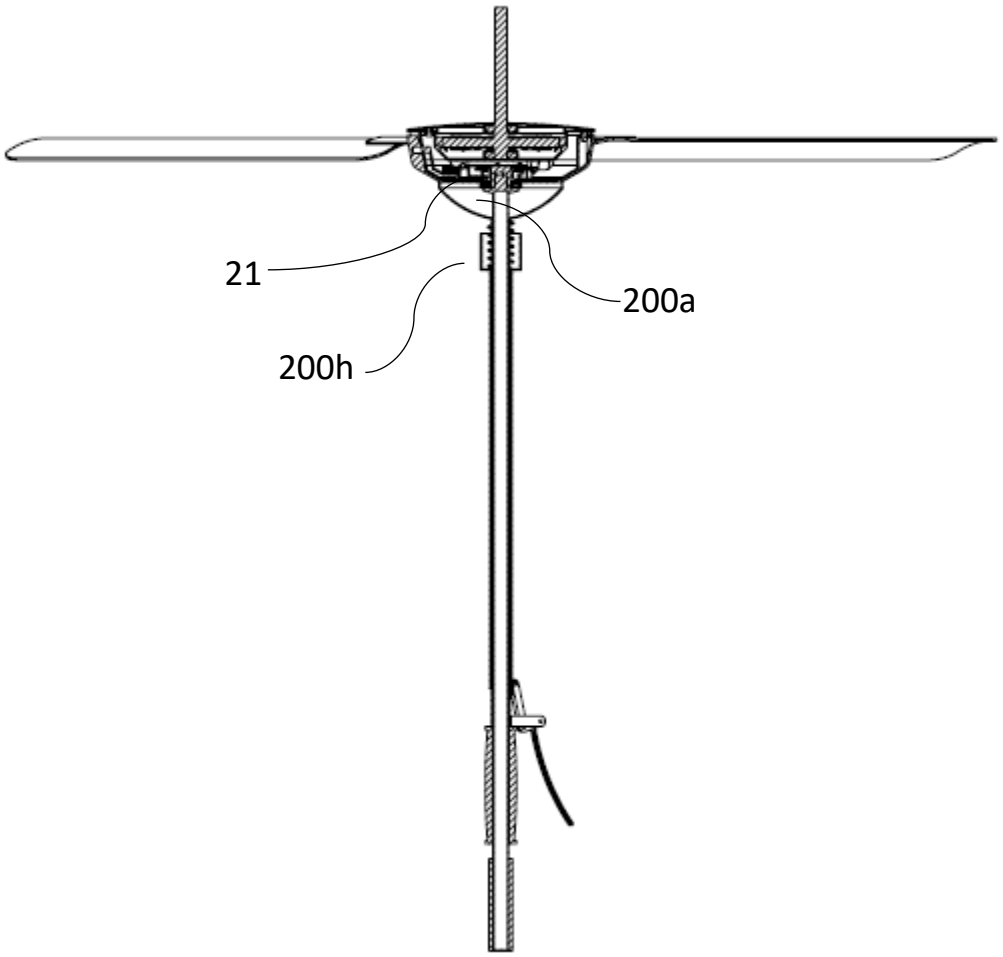

FIG. 14C

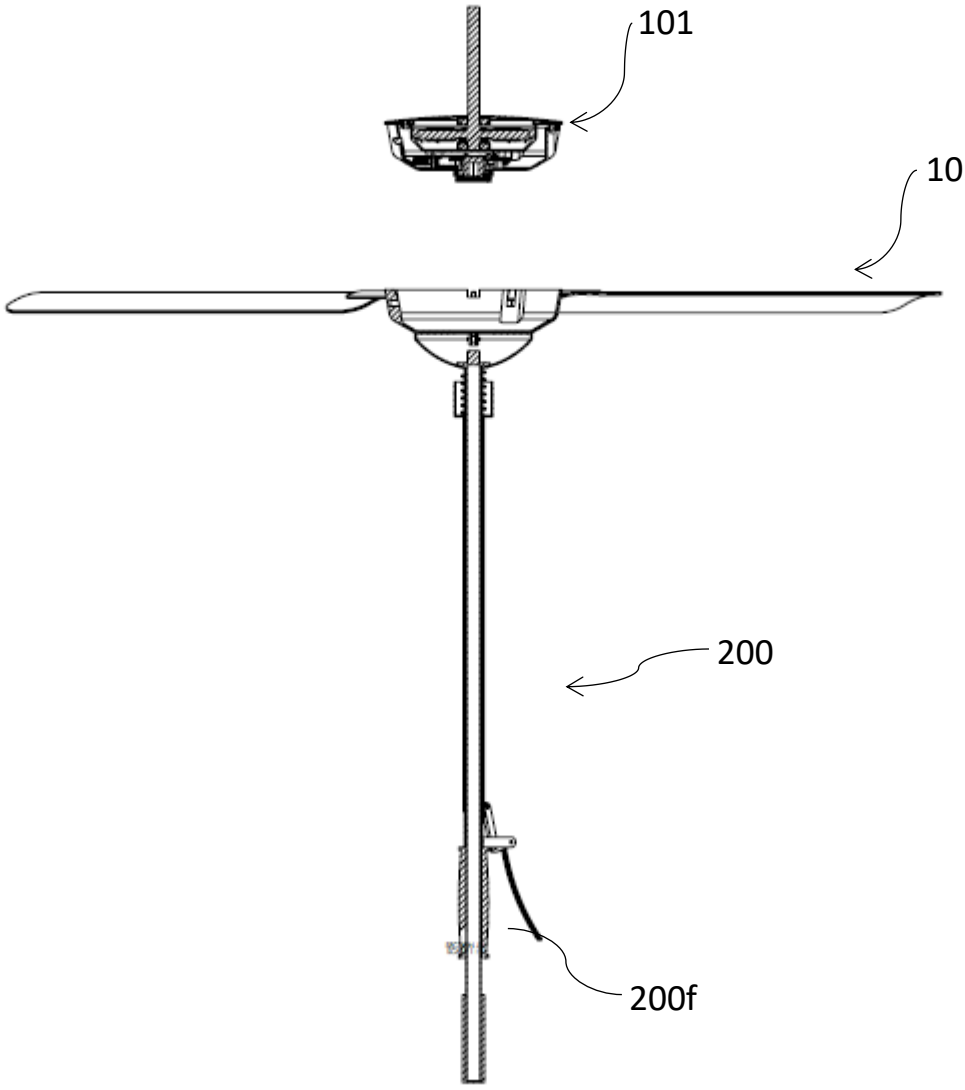

FIG. 14D