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FAN BLADE RETENTION SYSTEM FOR OVERHEAD FAN**CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] This patent application claims the benefit of U.S. Provisional Patent Application
10 No. 63/538,050, filed September 12, 2023, and U.S. Provisional Patent Application No. 63/560,167, filed March 1, 2024, the disclosures of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] This document relates generally to the fan arts and, more particularly, to an
15 overhead fan, such as a ceiling-mounted fan, including a fan blade retention system.

BACKGROUND

[0003] Overhead fans such as ceiling-mounted fans are in widespread use. Such fans are
often designed with certain features to retain associated fan blades and prevent inadvertent
20 detachment during operation. For example, the fan blades may be attached to a rotatable hub via various retainers, such as removable fasteners.

[0004] In addition to attaching the fan blades to the hub in this manner, enhancements may
be used to act as an additional safeguard in the event of failure or fatigue. For example, it is
further known to provide systems for the retention of fan blades in the event of a failure of the fan
25 blade or other modes of attachment. Merely exemplary systems are described in U.S. Pat. No. 9,347,462 for “Fan Blade Retention System,” issued May 24, 2016, and U.S. Pat. No. 8,770,937 for “Fan Blade Retention System,” issued July 8, 2014.

[0005] Thus, while fan blade retention systems are known, different types of retentions
systems may offer various advantages from a manufacturing, safety and security, or assembly
30 perspective.

[0006] For example, in one aspect, a need exists for a more efficient version of a retention
system that is simple to implement, yet highly effective in use, especially for a residential fan,
which typically includes solid fan blades made of thin material lacking hollow passages or the
like for receiving a retainer, as well as a winglet to serve as a connection point at the radially

outward end of the blade. Such blades may also bend in plane or have unusual contours to improve airflow generation, which requires a unique solution for a means of connection to accommodate such variably shaped blades in a universal fashion, if desired.

5 [0007] In other aspects, alternative blade retention systems that may be positioned inside or outside of a blade may be advantageous, either from an ease of assembly or to provide additional or different structural integrity to an assembled fan.

SUMMARY

10 [0008] According to an aspect of the disclosure, an overhead fan is provided. The fan includes (a) a motor, (b) a rotatable hub coupled to the motor, (c) at least one fan blade having a solid body including a first end coupled to the rotatable hub and a second end radially outward of the first end, and (d) at least one connector extending externally along the at least one fan blade between the first end and the second end, the at least one connector connecting the at least one fan blade to the rotatable hub.

15 [0009] In one aspect, the connector may be elongated and flexible.

[0010] In one aspect, the overhead fan may further include a first anchor for anchoring the at least one connector to the rotatable hub and a second anchor for anchoring the at least one connector to the at least one fan blade. The first anchor may be formed in a housing associated with the rotatable hub and the second anchor is are formed in an upper surface of the at least one fan blade. The first and second anchors may comprise injection molded inserts adapted for receiving a threaded fastener. The second anchor may be located closer to the second end of the at least one fan blade than the first end of the at least one fan blade. The first and second anchors may be radially aligned.

25 [0011] In one aspect, the at least one fan blade may comprise a plurality of fan blades, and the at least one connector comprises a plurality of connectors, each of the plurality of connectors extending externally along at least one of the plurality of fan blades.

[0012] In one aspect, the at least one fan blade is attached to the rotatable hub by one or more fasteners.

30 [0013] In one aspect, the at least one connector is connected to a housing of the rotatable hub.

[0014] In one aspect, the at least one fan blade is bent relative to a horizontal plane.

[0015] In another aspect, an overhead fan is provided. The fan includes (a) a motor, (b) a rotatable hub coupled to the motor, (c) at least one fan blade including a first end coupled to the rotatable hub and a second end radially outward of the first end, and (d) at least one elongated

flexible connector extending externally along the at least one fan blade between the first end and the second end, the at least one connector connecting the at least one fan blade to the rotatable hub.

5 [0016] In one aspect, the overhead fan may further include a first anchor for anchoring the at least one connector to the rotatable hub and a second anchor for anchoring the at least one connector to the at least one fan blade. The first anchor may be formed in a housing associated with the rotatable hub and the second anchor is are formed in an upper surface of the at least one fan blade. The first and second anchors may comprise injection molded inserts adapted for receiving a threaded fastener. The second anchor may be located closer to the second end of the
10 at least one fan blade than the first end of the at least one fan blade. The first and second anchors may be radially aligned.

[0017] In one aspect, the at least one fan blade comprises a plurality of fan blades, and the at least one connector comprises a plurality of connectors, each of the plurality of connectors extending externally along at least one of the plurality of fan blades.

15 [0018] In one aspect, the at least one fan blade is attached to the rotatable hub by one or more fasteners.

[0019] In one aspect, the at least one connector is connected to a housing of the rotatable hub.

[0020] In one aspect, the at least one fan blade is bent relative to a horizontal plane.

20 [0021] In another aspect, a fan blade assembly for an overhead fan is provided, which includes a fan hub having a plurality of fan blades attached thereto, each of the plurality of fan blades including a solid body having a first end coupled to the fan hub and a second end radially outward of the first end, and at least one elongated flexible connector extending externally along at least one fan blade of the plurality of fan blades between the first end and the second end thereof,
25 the at least one connector connecting the at least one fan blade to the rotatable hub.

[0022] In one aspect, the fan blade may comprise a first end portion adapted for connecting to a rotatable hub and a second end portion including at least one injection molded insert adapted for receiving a threaded fastener.

30 [0023] In another aspect, an upper housing for a rotatable hub of an overhead fan is provided, comprising at least one injection molded insert adapted for receiving a threaded fastener for connecting the rotatable hub to at least one fan blade connected thereto.

[0024] In one aspect, an overhead fan is provided which includes a fan blade as described herein or an upper housing as described herein.

[0025] In one aspect, an overhead fan is provided which includes a fan blade as described herein and an upper housing as described herein, along with at least one connector for connecting the fan blade to the upper housing.

[0026] In another aspect, an overhead fan is provided. The overhead fan includes (a) a motor, (b) a rotatable hub coupled to the motor, (c) at least one fan blade including a first end coupled to the rotatable hub and a second end radially outward of the first end, and (d) at least one connector extending externally from the at least one fan blade, the at least one connector connecting to a portion of the overhead fan other than the rotatable hub at a first end of the connector, the connector further adapted to attach to at a second end to the at least one fan blade.

[0027] In one aspect the overhead fan includes a retainer adapted to attach to the first end of the at least one connector. The overhead fan may include a first anchor connecting the first end of the connector to the retainer and a second anchor connecting the second end of the connector to the at least one fan blade. The retainer may comprise a ring, raceway, or track. The first anchor may comprise a moveable base adapted to movably attach to the retainer. The retainer may be integral with a downrod of the fan.

[0028] In another aspect, an overhead fan is provided which includes (a) a motor, (b) a rotatable hub coupled to the motor, (c) at least one fan blade including a first end coupled to the rotatable hub and a second end radially outward of the first end, and (d) at least one connector attached to an outer surface of the at least one fan blade and the rotatable hub, the at least one connector comprising a film, a sheet, or another bonded or bondable material.

[0029] In one aspect, the connector is positioned only on a top portion of the at least one fan blade and a top portion of the rotatable hub.

[0030] In one aspect, the connector is wrapped around a portion of a joint connecting the at least one fan blade to the rotatable hub.

[0031] In one aspect, the connector is wrapped around an entirety of a joint connecting the at least one fan blade to the rotatable hub.

[0032] In one aspect, the connector is positioned on at least a portion of the rotatable hub.

[0033] In another aspect, an overhead fan is provided, which includes (a) a motor, (b) a rotatable hub coupled to the motor, (c) at least two fan blades, each of the at least two fan blades including a first end coupled to the rotatable hub and a second end radially outward of the first end, and (d) at least one connector extending between the at least two fan blades.

[0034] In one aspect, the at least one connector comprises a strap, bar, beam, rod, or plate.

[0035] In one aspect, the overhead fan may further include a first anchor on a respective at least one of the at least two fan blades, said first anchor adapted to attach a first end of the at

least one connector to the respective at least one of the at least two fan blades. The overhead fan may further include a second anchor on an adjacent blade of the at least two fan blades, said second anchor adapted to attach a second end of the at least one connector to the adjacent blade.

[0036] In another aspect, a fan is provided which includes (a) a motor, (b) a rotatable hub coupled to the motor, (c) at least one fan blade comprising i. a first end securably coupled to the rotatable hub assembly, ii. a second end, and iii. a channel extending from the first end to the second end, and (d) at least one rigid connector extending through the channel and adapted to connect the at least one fan blade to the rotatable hub.

[0037] In one aspect, the rigid connector connects to the at least one fan blade at the second end.

[0038] In one aspect, the fan further includes a winglet attached to the second end of the blade. The rigid connector may be attached to the winglet.

[0039] In one aspect, the rigid connector is attached to the at least one fan blade at a position between the first end and the second end.

[0040] In another aspect, a fan is provided which includes (a) a motor, (b) a rotatable hub coupled to the motor, (c) at least one fan blade comprising i. a blade first end coupled to the rotatable hub, ii. a blade second end, and iii. a passage extending from the blade first end to the blade second end, and (d) at least one flexible connector extending through the passage of the at least one fan blade, and wherein the at least one flexible strap is coupled at a strap first end to the rotatable hub and coupled at a strap second end to a position on the at least one fan blade intermediate the blade first end and the blade second end.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] The above and further advantages of the disclosed inventions may be better understood by referring to the following description in conjunction with the accompanying drawings in which:

[0042] Figure 1 is a perspective view of a fan according to a first aspect of the disclosure;

[0043] Figure 1A is an exploded view of a portion of a hub of the fan of Figure 1;

[0044] Figure 2 is an overhead view of a fan according to another aspect of the disclosure;

[0045] Figure 3 is a top perspective view of a portion of the fan of Figure 2;

[0046] Figure 4 is an exploded view of a portion of the fan of Figure 2;

[0047] Figure 5 is a perspective view of a blade of the fan of Figure 2;

[0048] Figure 6 is a perspective view of a portion of the hub of the fan of Figure 2;

[0049] Figure 7 is a top perspective view of a fan according to another aspect of the disclosure;

[0050] Figures 8A and 8B are top perspective views of a fan according to another aspect of the disclosure;

5 [0051] Figure 9 is a top perspective view of a fan according to a further aspect of the disclosure;

[0052] Figure 10 is a bottom perspective view of a fan according to a further aspect of the disclosure;

[0053] Figure 11 is a fan blade according to one aspect of the disclosure;

10 [0054] Figure 12 is a partial perspective view of a fan blade according to one aspect of this disclosure;

[0055] Figure 13 is a partial perspective view of a winglet attached to a fan blade with the fan blade being transparent according to one aspect of this disclosure;

[0056] Figure 14 is a partial top view of a winglet attached to a fan blade according to one aspect of the disclosure;

[0057] Figure 15 is a partial view of a connector connecting a blade to a hub of a fan according to one aspect of the disclosure;

[0058] Figure 16 is a partial bottom perspective view of a fan according to an aspect of the disclosure; and

20 [0059] Figure 17 is a partial perspective view of a winglet attached to a fan blade with the fan blade being partially cut away according to one aspect of the disclosure.

DETAILED DESCRIPTION

[0060] In the following detailed description, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration, specific embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the embodiments and like numerals represent like details in the various figures. Also, it is to be understood that other embodiments may be utilized and that process or other changes may be made without departing from the scope of the disclosure. The following detailed description is not to be taken in a limiting sense, and the scope of the invention is defined only by the appended claims and their equivalents. In accordance with the disclosure, a blade retention system for a fan is provided.

[0061] Reference is now made to FIGS. 1 and 1A, which depict an exemplary fan 10 having a housing 20 containing a motor, a rotatable hub 30 coupled to motor, and a plurality of

fan blades 40 coupled to hub 30. In the present example, fan 10 (including hub 30 and fan blades 40) has a diameter of approximately 5 feet. In some versions, fan 10 has a diameter of approximately 7 feet. In other variations, fan 10 has a diameter between approximately 6 feet, inclusive, and approximately 24 feet, inclusive. Further still, fan 10 may have any other suitable dimensions, such as 3 feet, inclusive, to 30 feet, inclusive.

5 [0062] Except as otherwise described herein, fan 10 may be constructed and operable in accordance with at least some of the teachings of any of the references that are cited herein; and/or in any other suitable fashion. By way of example only, motor may be constructed in accordance with at least some of the teachings of U.S. Pat. Pub. No. 2009/0208333, entitled "Ceiling Fan
10 System with Brushless Motor," published August 20, 2009, or U.S. Pat. Pub. No. 2020/0158121, the disclosures of which are incorporated by reference herein. In some versions, motor may be remote from hub 30 and may be coupled via an axle or other component that is operable to transmit rotational movement from motor to hub assembly 30, which may also include an optional
15 downlight 50, which may be concentric with the hub 30. Furthermore, fan 10 may include control electronics that are configured in accordance with at least some of the teachings of U.S. Pat. Pub. No. 2010/0278637, entitled "Ceiling Fan with Variable Blade Pitch and Variable Speed Control," published November 4, 2010, the disclosure of which is incorporated by reference herein. Alternatively, motor may have any other suitable components, configurations, functionalities, and operability, as will be apparent to those of ordinary skill in the art in view of the teachings herein.

20 [0063] In the present example, fan 10 includes a support 12 adapted to couple the fan to a ceiling or other support structure. By way of example only, support 12 may include features of or be constructed in accordance with at least some of the teachings of U.S. Pat. Pub. No. 2009/0072108, entitled "Ceiling Fan with Angled Mounting," published March 19, 2009, and issued April 10, 2012 as U.S. Pat. No. 8,152,453, the disclosure of which is incorporated by
25 reference herein. Alternatively, the support 12 may have any other suitable components, configurations, functionalities, and operability, as will be apparent to those of ordinary skill in the art in view of the teachings herein.

[0064] The fan blades 40 of the present embodiment are shown mounted directly to the hub 30. This may be done by way of a primary connection at the radially inward end of the fan
30 blades 40 using fasteners, such as bolts or screws 42 (see FIG. 1A) passing through apertures A in an extension 30a of the hub 30 into threaded portions or inserts 41 formed in an adjacent root end of the blade 40. Alternatively, external fasteners may be used to achieve the primary connection between the hub 30 and blade 40. It should be further understood that alternative mounting arrangements may be employed. For example, fan blades 40 may be mounted by

adhesives, by friction fit, and/or by any combination of suitable mountings as will be apparent to one of ordinary skill in the art in light of the teachings herein. It should also be understood that an interface component (not shown) may be provided at the interface of each fan blade 40 and hub 30. By way of example only, such an interface component may be configured in accordance with the teachings of U.S. Pat. Pub. No. 2009/0081045, entitled "Aerodynamic Interface Component for Fan Blade," published Mar. 26, 2009, the disclosure of which is incorporated by reference herein.

[0065] As shown in FIGS. 2 and 3, the fan blade(s) 40 include a first or proximal end 40a closest to the hub 30, and a second or distal or free end 40b. Each fan blade 40 is coupled to the hub 30 (as seen in FIG. 1) at the first end 40a and each fan blade 40 extends radially outwardly from hub 30 to the second end 40b. Fan blades 40 may further be constructed in accordance with some or all of the teachings of any of the patents, patent publications, or patent applications cited herein, and when used in smaller diameter or residential fans, typically include a body formed of a solid piece of material (such as polymer, metal or wood), without any form of internal passage extending between the first end and the second end of the fan blade.

[0066] To prevent inadvertent separation of one or more of the fan blades 40 from hub 30, a fan blade attachment may be provided in the form of a connector that interconnect the two structures independent of the primary fastening arrangement noted above. In the illustrated example, the attachment may comprise an elongated connector, such as in the form of a cable 60. The cable 60 may comprise a thin or small diameter piece of a flexible material, such as metal, the ends of which are attached to the hub 30 and fan blade 40, respectively.

[0067] More specifically, and as shown in FIGS. 4 and 6, at one end of the arrangement, the cable 60 is fastened to the hub 30. This may be achieved using a first anchor, which may be the combination of a fastener F and a threaded insert 62, which may be formed in the housing 20. The fastener F may be passed through a loop or eyelet 60a in the corresponding end of the cable 60 and threaded into the insert 62, thereby forming a secure, but releasable connection. Alternatively, the first anchor 62 may be connected to any other portion of the hub 30, and may also connect with the extension thereof 30a for connecting to the fan blade 40 (which extension may include a threaded insert 30b for receiving the fastener for securing the first end of the connector or cable 60 in place, as shown in FIG. 1A).

[0068] As shown in FIG. 5, the opposite end of the cable 60 may be secured to the blade 40 closer to the radially outward second end 40b, such as at a point that is at least half the length of the blade. This securement may be achieved using a second anchor, which may also be the combination of a fastener F for insertion into a threaded insert 64 formed into the fan blade 40,

after passing through a loop or eyelet 60b in the opposite end of the cable 60. Hence, in this version, the connector, such as cable 60, extends from or along an upper surface of the housing 20 of hub 30 and along the corresponding surface of the fan blade 40, but could alternatively extend along the lower or lateral surfaces.

5 [0069] As can be understood from FIG. 2, the first and second anchors, such as inserts 62, 64 may be radially aligned, and be located along a central radial axis of the corresponding fan blade 40. As can be further understood from FIG. 3, the second insert 64 may be upstanding relative to an upper surface of the fan blade 40, while the first insert may be located at a corresponding point where the plane parallel with the upper end of the insert 64 intersects the
10 housing 20. This places the connector 60 in a generally horizontal orientation, which may be desirable, but is considered optional. Alternatively, one or both of the inserts 62, 64 could also extend laterally along a surface of the hub 30 or blade 40, or the inserts could be omitted and the fasteners secured directly to the fan blade 40 (which may be made of metal, polymer, or wood, with the use of a polymer allowing for the second insert 64 to be formed during an injection
15 molding process). In any case, such a secondary connection or means of backup attachment may be provided on each blade 40 present, which is three blades in the illustrated example, or may be provided on fewer of the blades.

[0070] As can be appreciated, these connectors, such as cables 60, provide for the retention of fan blade(s) 40 by the hub 30 in the event of an unanticipated event, such as a compromise in
20 material, failure of the primary fastener (such as due to faulty installation or improper maintenance), due to misuse of fan 10 by an operator, or other factors. The external positioning above the blades 40 in the illustrated embodiment conceals the view of the connectors 60 from below. If the connector is flexible, such as in the case of cable 60, it can readily accommodate any changes in contour of the corresponding surface of the fan blade 40. The arrangement also
25 allows for a simple retrofit application to existing fans without significant or costly modification, such as by either replacing the housing 20 and blade(s) 40 with those including inserts 62, 64, or else attaching fasteners for securement of the connector to the existing fan blade and hub.

[0071] Turning to FIG. 7, a fan 100 is illustrated, including a plurality of blades 140 connected to a hub 130 via one or more primary fasteners (not illustrated), such as those described
30 herein. In addition to the primary fasteners, the fan 100 may include a connector 160 adapted to interconnect one or more blades 140 to the fan 100, independent of the primary fasteners, via an element of the fan other than the hub 130. As illustrated, the fan 100 may include a retainer 170, such as a ring, raceway, or track. This retainer 170 may be integral with or attached to a downrod 172, or any other generally central portion of the fan 100, other than the hub 130. The retainer

170 may be stationary with respect to the fan 100, such that the retainer does not rotate as the fan rotates. In one aspect, the retainer 170 may be rigid. In another aspect, the retainer 170 may be flexible.

5 [0072] The connector 160 may be attached to the retainer 170 via a first anchor 162, and may further be attached to the blade 140 via a second anchor 164. The first anchor 162 may be adapted to be restrained within, around, or otherwise attached to the retainer 170. For example, the first anchor may comprise a moveable base, such as a rolling or sliding bearing or bushing material inside a raceway of the retainer 170. In other embodiments, the first anchor 162 may be a ring, hook, or arc shaped member adapted to at least partially encircle the retainer 170.

10 [0073] The connector 160 may be attached to the blade 140 via a second anchor 164. The second anchor 164 may be a fastener such as a bolt or screw, a post, a threaded insert, or any other type of anchor described herein.

[0074] In practice, the fan 100 may be adapted to rotate, with blades 140 connected to the rotating hub 130 via the primary fasteners, and also connected to the fan at a location other than the rotating hub via the connector 160. If any of the primary fasteners should fail or become compromised, the blade 140 may be prevented from fully separating from the fan 100 by the one or more connectors 160.

15 [0075] In a further embodiment, as illustrated in FIGs 8A and 8B, a fan 200 is illustrated, including a hub 230 and a plurality of blades 240. In addition to the primary fasteners (not illustrated), such as those described herein, a connector 260 is provided to further retain the blades 240 to the hub 230 independent of the primary fasteners. The connector 260 may comprise a film, a sheet, or another bonded or bondable material. This connector 260 may comprise a polymer sheet and/or a woven or otherwise interconnected polymer or metal mesh that may be applied to an outer surface of at least a portion of the fan 200. As illustrated, the connector 260 may be applied to at least a portion of the blade 240 and at least a portion of the hub 230, so as to interconnect these two structures in case of failure or compromise of any of the primary fasteners. The connector 260 may be applied only to a top portion of the blade 240 so as to be less visible to a user below the fan 200. In other embodiments, the connector 260 may be wrapped around a portion of or an entirety of the joint connecting the blade 240 to the hub 230. In some embodiments, a single connector 260 may span at least a portion of the hub 230 and at least a portion of a plurality of the blades 240.

25 [0076] Turning to FIG. 9, a fan 300 is illustrated with a central hub 330 and a plurality of blades 340. At least one connector 360 is provided for directly interconnecting at least two blades

340 independent of the hub 330. As illustrated, a plurality of connectors 360 may be provided, with each connector 360 adapted to connect two adjacent blades 340.

[0077] The connectors 360 may comprise straps, bar, beams, rods, plates, or any other material that may affix one blade 340 to another. Each interconnected blade 340 may include one or more anchors 364 to which the connectors 360 may be affixed or attached. As illustrated, each blade 340 includes an independent anchor 364 adapted to attach to an end of a respective connector 360. In other embodiments, one or more blades 340 may include a single anchor 364 adapted to affix to a plurality of connectors 360. For example, a blade may have a single anchor 364 adapted to connect to a first connector 360 attached to a first adjacent blade and to also connect to a second connector 360 attached to a second adjacent blade.

[0078] In practice, if any primary fastener connecting a blade 340 to the hub 330 should fail or become compromised, the connector(s) 360 is/are adapted to retain the blade 340 to one or more adjacent blades 340 in order to prevent the blade 340 from becoming detached from the fan 300.

[0079] Referring to FIGS. 10-17, a fan 400 is illustrated, which includes a motor M, a hub 430, and a plurality of fan blades 440. With reference to FIG 11, an exemplary fan blade 440 comprises a first end 442 and a second end 444. The first end 442 is the radially inner end, and the second end 444 is the radially outer end. The blade 440 may include hollow channel 448 through the blade.

[0080] As can be seen in FIGS 12 and 16, each blade 440 may be coupled to the hub 430 at the first end 442 by one or more primary fasteners, such as tab 470, which may be fastened to the blade 440 and the hub 430, such as by bolts 472. These bolts 472 may pass through one or more apertures 474 in the tab 470 as well as at least a portion of the hub 430 or the blade 440.

[0081] Independent of the primary fasteners, the fan 400 may include at least one connector 460 adapted to maintain connection between the blade 440 and the fan 400 in the event of failure or compromise of the primary fasteners. The connector 460 may pass through the hollow channel 448 of the blade 440.

[0082] As illustrated in FIGS. 12-13, the connector 460a may be in the form of a rigid strap, bar, or plate. The connector 460a may be flat as illustrated, or may be more cylindrical in nature. The connector 460a may be connected to the hub 430 by a first anchor 462a, and to the blade 440 by a second anchor 464a. The first anchor 462a may connect to the hub via a fastener (not shown) such as a bolt, screw, welding, or any other fastener.

[0083] FIG 13 illustrates the second anchor 464a connecting the second end of the connector 460a to the blade 440. In one aspect, the second anchor 464a may connect the connector

460a directly to the winglet 446, such as via a bracket on the winglet internal to the hollow channel 448. In another aspect, the second anchor 464a may connect the connector 460a directly to the blade 440, such as through an aperture in the blade 440. In some embodiments, this connection at the second anchor 464a may be a keyhole connection, a threaded connection, or any other locking or fixing arrangement between the connector 460a and the blade 440. The location of this connection between the second anchor 464a and the blade 440 may be located at the radially outer end of the blade 440, as is shown in FIG. 13.

[0084] In another aspect, as shown in FIGS. 14-16, the connector 460b may take the form of a rigid bar, cable, or other elongated element. The connector 460b may extend through an aperture 466 in the winglet 446 such that a second anchor 464b is sized larger than the aperture 466 holds the connector 460b from passing back through the winglet. In some aspects, a support plate 468 may be present to reinforce the connection between the second anchor 464b and the winglet.

[0085] FIG. 15 illustrates an embodiment of the first anchor 462b, which may be used to retain a first end of the connector 460b to the hub. The connector 460b may pass through the channel of the fan blade 440, and to the first anchor 462b on the hub 430. The inner end of the connector 460b may include a threaded shaft 474 to permit attachment and adjustment of the connector 460b. Threaded shaft 474 is passed through a hole 476 in the corresponding rear anchor portion 478 or fore anchor portion 480 of the first anchor 462b. Threaded shaft 474 is then passed through a coil compression spring 482 and finally a threaded nut 484. By means of the combination of nut 484 and spring 482, and the selection of a spring 482 of appropriate length and spring rate, it is possible to bring each connector 460b to a precise specified tension, such that connector 460b is adapted to perform the function of retaining each fan blade 440 in the event of a structural failure elsewhere in fan 400, without being so tight as to impose an undesirable compressive load on fan blade 440 or other components or to impose an undesirable excessive tensile load on connector 460b itself. In one merely exemplary alternative, coil compression spring 482 and nut 484 may be replaced with a turnbuckle or other component suitable for selective tightening as will be apparent to one of ordinary skill in the art in view of the teachings herein.

[0086] With reference to FIG. 16, the hub 430 is shown with a plurality of connectors 460b, each attached to an inner anchor assembly 490 comprising a plate 492 secured to the hub 430. Each of the first anchors 462b may be attached to the plate 492, such as by welding or any other suitable method known to one of ordinary skill in the art. The connectors 460b can be seen passing through the channel of the blade 440, outward to the radially outer end of the blade 440.

[0087] In a further embodiment, as illustrated in FIG. 17, the second anchor 464c may be placed at an intermediate portion of the blade 440. Thus, the connector 460b may terminate at a position radially inward from the outer end 444 of the blade 440 and the winglet 446. The second anchor 464c may be any of the types of anchors described herein.

- 5 [0088] In one aspect, the position of the second anchor 464c may be within the outermost 5%, 10%, 25%, or 50% of the length of the blade 440. In other aspects, the position of the second anchor 464c may be within the innermost 5%, 10%, 25%, or 50% of the length of the blade 440.

[0089] This disclosure may be considered to relate to the following items:

1. An overhead fan, comprising:
 - 10 (a) a motor;
 - (b) a rotatable hub coupled to the motor;
 - (c) at least one fan blade having a solid body including a first end coupled to the rotatable hub and a second end radially outward of the first end;
 - (d) at least one connector extending externally along the at least one fan blade
- 15 between the first end and the second end, the at least one connector connecting the at least one fan blade to the rotatable hub.
2. The overhead fan of item 1, wherein the connector is elongated and flexible.
3. The overhead fan of item 1, further including a first anchor for anchoring the at least one connector to the rotatable hub and a second anchor for anchoring the at least one
- 20 connector to the at least one fan blade.
4. The overhead fan of item 3, wherein the first anchor is formed in a housing associated with the rotatable hub and the second anchor is are formed in an upper surface of the at least one fan blade.
5. The overhead fan of item 4, wherein the first and second anchors comprise injection
- 25 molded inserts adapted for receiving a threaded fastener.
6. The overhead fan of item 3, wherein the second anchor is located closer to the second end of the at least one fan blade than the first end of the at least one fan blade.
7. The overhead fan of item 3, wherein the first and second anchors are radially aligned.
- 30 8. The overhead fan of item 1, wherein the at least one fan blade comprises a plurality of fan blades, and the at least one connector comprises a plurality of connectors, each of the plurality of connectors extending externally along at least one of the plurality of fan blades.

9. The overhead fan of item 1, wherein the at least one fan blade is attached to the rotatable hub by one or more fasteners.
10. The overhead fan of item 1, wherein the at least one connector is connected to a housing of the rotatable hub.
- 5 11. The overhead fan of item 1, wherein the at least one fan blade is bent relative to a horizontal plane.
12. An overhead fan, comprising:
- (a) a motor;
- (b) a rotatable hub coupled to the motor;
- 10 (c) at least one fan blade including a first end coupled to the rotatable hub and a second end radially outward of the first end;
- (d) at least one elongated flexible connector extending externally along the at least one fan blade between the first end and the second end, the at least one connector connecting the at least one fan blade to the rotatable hub.
- 15 13. The overhead fan of item 11, further including a first anchor for anchoring the at least one connector to the rotatable hub and a second anchor for anchoring the at least one connector to the at least one fan blade.
14. The overhead fan of item 13, wherein the first anchor is formed in a housing associated with the rotatable hub and the second anchor is are formed in an upper surface
- 20 of the at least one fan blade.
15. The overhead fan of item 14, wherein the first and second anchors comprise injection molded inserts adapted for receiving a threaded fastener.
16. The overhead fan of item 13, wherein the second anchor is located closer to the second end of the at least one fan blade than the first end of the at least one fan blade.
- 25 17. The overhead fan of item 13, wherein the first and second anchors are radially aligned.
18. The overhead fan of item 11, wherein the at least one fan blade comprises a plurality of fan blades, and the at least one connector comprises a plurality of connectors, each of the plurality of connectors extending externally along at least one of the plurality of fan
- 30 blades.
19. The overhead fan of item 11, wherein the at least one fan blade is attached to the rotatable hub by one or more fasteners.
20. The overhead fan of item 1, wherein the at least one connector is connected to a housing of the rotatable hub.

21. The overhead fan of item 1, wherein the at least one fan blade is bent relative to a horizontal plane.
22. A fan blade assembly for an overhead fan, comprising:
a fan hub having a plurality of fan blades attached thereto, each of the plurality of fan blades including a solid body having a first end coupled to the fan hub and a second end radially outward of the first end; and
at least one elongated flexible connector extending externally along at least one fan blade of the plurality of fan blades between the first end and the second end thereof, the at least one connector connecting the at least one fan blade to the rotatable hub.
23. A fan blade comprising a first end portion adapted for connecting to a rotatable hub and a second end portion including at least one injection molded insert adapted for receiving a threaded fastener.
24. An upper housing for a rotatable hub of an overhead fan comprising at least one injection molded insert adapted for receiving a threaded fastener for connecting the rotatable hub to at least one fan blade connected thereto.
25. An overhead fan including the fan blade of item 23 or the upper housing of item 24.
26. An overhead fan including the fan blade of item 23 and the upper housing of item 24, along with at least one connector for connecting the fan blade to the upper housing.
27. An overhead fan, comprising:
(a) a motor;
(b) a rotatable hub coupled to the motor;
(c) at least one fan blade including a first end coupled to the rotatable hub and a second end radially outward of the first end;
(d) at least one connector extending externally from the at least one fan blade, the at least one connector connecting to a portion of the overhead fan other than the rotatable hub at a first end of the connector, the connector further adapted to attach to at a second end to the at least one fan blade.
28. The overhead fan of item 27, further including a retainer adapted to attach to the first end of the at least one connector.
29. The overhead fan of item 28, further including a first anchor connecting the first end of the connector to the retainer and a second anchor connecting the second end of the connector to the at least one fan blade.

30. The overhead fan of item 28, wherein the retainer comprises a ring, raceway, or track.
31. The overhead fan of item 30, wherein the first anchor comprises a moveable base adapted to movably attach to the retainer.
- 5 32. The overhead fan of item 28, wherein the retainer is integral with a downrod of the fan.
33. An overhead fan, comprising:
- (a) a motor;
 - (b) a rotatable hub coupled to the motor;
 - 10 (c) at least one fan blade including a first end coupled to the rotatable hub and a second end radially outward of the first end;
 - (d) at least one connector attached to an outer surface of the at least one fan blade and the rotatable hub, the at least one connector comprising a film, a sheet, or another bonded or bondable material.
- 15 34. The overhead fan of item 27, wherein the connector is positioned only on a top portion of the at least one fan blade and a top portion of the rotatable hub.
35. The overhead fan of item 27, wherein the connector is wrapped around a portion of a joint connecting the at least one fan blade to the rotatable hub.
36. The overhead fan of item 27, wherein the connector is wrapped around an entirety
- 20 of a joint connecting the at least one fan blade to the rotatable hub.
37. The overhead fan of item 27, wherein the connector is positioned on at least a portion of the rotatable hub.
38. An overhead fan, comprising:
- (a) a motor;
 - 25 (b) a rotatable hub coupled to the motor;
 - (c) at least two fan blades, each of the at least two fan blades including a first end coupled to the rotatable hub and a second end radially outward of the first end;
 - (d) at least one connector extending between the at least two fan blades.
39. The overhead fan of item 38, wherein the at least one connector comprises a strap,
- 30 bar, beam, rod, or plate.
40. The overhead fan of item 38, further including a first anchor on a respective at least one of the at least two fan blades, said first anchor adapted to attach a first end of the at least one connector to the respective at least one of the at least two fan blades.

41. The overhead fan of item 40, further includes a second anchor on an adjacent blade of the at least two fan blades, said second anchor adapted to attach a second end of the at least one connector to the adjacent blade.

42. A fan, comprising:

(a) a motor;

(b) a rotatable hub coupled to the motor;

(c) at least one fan blade comprising:

i. a first end securably coupled to the rotatable hub assembly,

ii. a second end, and

iii. a channel extending from the first end to the second end; and

(d) at least one rigid connector extending through the channel and adapted to connect the at least one fan blade to the rotatable hub.

43. The fan of item 42, wherein the rigid connector connects to the at least one fan blade at the second end.

44. The fan of item 42, further including a winglet attached to the second end of the blade.

45. The fan of item 44, wherein the rigid connector is attached to the winglet.

46. The fan of item 42, wherein the rigid connector is attached to the at least one fan blade at a position between the first end and the second end.

47. A fan, comprising:

(a) a motor;

(b) a rotatable hub coupled to the motor;

(c) at least one fan blade comprising:

i. a blade first end coupled to the rotatable hub,

ii. a blade second end, and

iii. a passage extending from the blade first end to the blade second end;

and

(d) at least one flexible connector extending through the passage of the at least one fan blade, and wherein the at least one flexible strap is coupled at a strap first end to the rotatable hub and coupled at a strap second end to a position on the at least one fan blade intermediate the blade first end and the blade second end.

[0090] Each of the following terms written in singular grammatical form: “a”, “an”, and “the”, as used herein, means “at least one”, or “one or more”. Use of the phrase “One or more” herein does not alter this intended meaning of “a”, “an”, or “the”. Accordingly, the terms “a”,

“an”, and “the”, as used herein, may also refer to, and encompass, a plurality of the stated entity or object, unless otherwise specifically defined or stated herein, or the context clearly dictates otherwise. For example, the phrases: “a unit”, “a device”, “an assembly”, “a mechanism”, “a component”, “an element”, and “a step or procedure”, as used herein, may also refer to, and encompass, a plurality of units, a plurality of devices, a plurality of assemblies, a plurality of mechanisms, a plurality of components, a plurality of elements, and, a plurality of steps or procedures, respectively.

[0091] Each of the following terms: “includes”, “including”, “has”, “having”, “comprises”, and “comprising”, and, their linguistic/grammatical variants, derivatives, or/and conjugates, as used herein, means “including, but not limited to”, and is to be taken as specifying the stated components), feature(s), characteristic(s), parameter(s), integer(s), or step(s), and does not preclude addition of one or more additional component(s), feature(s), characteristic(s), parameter(s), integer(s), step(s), or groups thereof. Each of these terms is considered equivalent in meaning to the phrase “consisting essentially of.” Each of the phrases “consisting of” and “consists of, as used herein, means “including and limited to”. The phrase “consisting essentially of” means that the stated entity or item (system, system unit, system sub-unit device, assembly, sub-assembly, mechanism, structure, component element or, peripheral equipment utility, accessory, or material, method or process, step or procedure, sub-step or sub-procedure), which is an entirety or part of an exemplary embodiment of the disclosed invention, or/and which is used for implementing an exemplary embodiment of the disclosed invention, may include at least one additional feature or characteristic” being a system unit system sub-unit device, assembly, sub-assembly, mechanism, structure, component or element or, peripheral equipment utility, accessory, or material, step or procedure, sub-step or sub-procedure), but only if each such additional feature or characteristic” does not materially alter the basic novel and inventive characteristics or special technical features, of the claimed item.

[0092] Terms of approximation, such as the terms about, substantially, approximately, generally, etc., as used herein, refer to $\pm 10\%$ of the stated numerical value or as close as possible to a stated condition.

[0093] It is to be fully understood that certain aspects, characteristics, and features, of the invention, which are, for clarity, illustratively described and presented in the context or format of a plurality of separate embodiments, may also be illustratively described and presented in any suitable combination or sub-combination in the context or format of a single embodiment. Conversely, various aspects, characteristics, and features, of the invention which are illustratively described and presented in combination or sub-combination in the context or format of a single

embodiment may also be illustratively described and presented in the context or format of a plurality of separate embodiments.

[0094] Although the invention has been illustratively described and presented by way of specific exemplary embodiments, and examples thereof, it is evident that many alternatives, modifications, or/and variations, thereof, will be apparent to those skilled in the art. Accordingly, 5 it is intended that all such alternatives, modifications, or/and variations, fall within the spirit of, and are encompassed by, the broad scope of the appended claims. As a non-limiting example, any of the embodiments of connectors, anchors, and blades described herein can be used interchangeably with other embodiments of connectors, anchors, or blades.

10

In the Claims

1. An overhead fan, comprising:
 - (a) a motor;
 - (b) a rotatable hub coupled to the motor;
 - (c) at least one fan blade having a solid body including a first end coupled to the rotatable hub and a second end radially outward of the first end;
 - (d) at least one connector extending externally along the at least one fan blade between the first end and the second end, the at least one connector connecting the at least one fan blade to the rotatable hub.
2. The overhead fan of claim 1, wherein the connector is elongated and flexible.
3. The overhead fan of claim 1, further including a first anchor for anchoring the at least one connector to the rotatable hub and a second anchor for anchoring the at least one connector to the at least one fan blade.
4. The overhead fan of claim 3, wherein the first anchor is formed in a housing associated with the rotatable hub and the second anchor is formed in an upper surface of the at least one fan blade.
5. The overhead fan of claim 4, wherein the first and second anchors comprise injection molded inserts adapted for receiving a threaded fastener.
6. The overhead fan of claim 3, wherein the second anchor is located closer to the second end of the at least one fan blade than the first end of the at least one fan blade.
7. The overhead fan of claim 3, wherein the first and second anchors are radially aligned.
8. The overhead fan of claim 1, wherein the at least one fan blade comprises a plurality of fan blades, and the at least one connector comprises a plurality of connectors, each of the plurality of connectors extending externally along at least one of the plurality of fan blades.
9. The overhead fan of claim 1, wherein the at least one fan blade is attached to the rotatable hub by one or more fasteners.

10. The overhead fan of claim 1, wherein the at least one connector is connected to a housing of the rotatable hub.
11. The overhead fan of claim 1, wherein the at least one fan blade is bent relative to a horizontal plane.
12. An overhead fan, comprising:
 - (a) a motor;
 - (b) a rotatable hub coupled to the motor;
 - (c) at least one fan blade including a first end coupled to the rotatable hub and a second end radially outward of the first end;
 - (d) at least one elongated flexible connector extending externally along the at least one fan blade between the first end and the second end, the at least one connector connecting the at least one fan blade to the rotatable hub.
13. The overhead fan of claim 11, further including a first anchor for anchoring the at least one connector to the rotatable hub and a second anchor for anchoring the at least one connector to the at least one fan blade.
14. The overhead fan of claim 13, wherein the first anchor is formed in a housing associated with the rotatable hub and the second anchor is are formed in an upper surface of the at least one fan blade.
15. The overhead fan of claim 14, wherein the first and second anchors comprise injection molded inserts adapted for receiving a threaded fastener.
16. The overhead fan of claim 13, wherein the second anchor is located closer to the second end of the at least one fan blade than the first end of the at least one fan blade.
17. The overhead fan of claim 13, wherein the first and second anchors are radially aligned.

18. The overhead fan of claim 11, wherein the at least one fan blade comprises a plurality of fan blades, and the at least one connector comprises a plurality of connectors, each of the plurality of connectors extending externally along at least one of the plurality of fan blades.
19. The overhead fan of claim 11, wherein the at least one fan blade is attached to the rotatable hub by one or more fasteners.
20. The overhead fan of claim 1, wherein the at least one connector is connected to a housing of the rotatable hub.
21. The overhead fan of claim 1, wherein the at least one fan blade is bent relative to a horizontal plane.
22. A fan blade assembly for an overhead fan, comprising:
a fan hub having a plurality of fan blades attached thereto, each of the plurality of fan blades including a solid body having a first end coupled to the fan hub and a second end radially outward of the first end; and
at least one elongated flexible connector extending externally along at least one fan blade of the plurality of fan blades between the first end and the second end thereof, the at least one connector connecting the at least one fan blade to the rotatable hub.
23. A fan blade comprising a first end portion adapted for connecting to a rotatable hub and a second end portion including at least one injection molded insert adapted for receiving a threaded fastener.
24. An upper housing for a rotatable hub of an overhead fan comprising at least one injection molded insert adapted for receiving a threaded fastener for connecting the rotatable hub to at least one fan blade connected thereto.
25. An overhead fan including the fan blade of claim 23 or the upper housing of claim 24.
26. An overhead fan including the fan blade of claim 23 and the upper housing of claim 24, along with at least one connector for connecting the fan blade to the upper housing.

27. An overhead fan, comprising:
- (a) a motor;
 - (b) a rotatable hub coupled to the motor;
 - (c) at least one fan blade including a first end coupled to the rotatable hub and a second end radially outward of the first end;
 - (d) at least one connector extending externally from the at least one fan blade, the at least one connector connecting to a portion of the overhead fan other than the rotatable hub at a first end of the connector, the connector further adapted to attach to at a second end to the at least one fan blade.
28. The overhead fan of claim 27, further including a retainer adapted to attach to the first end of the at least one connector.
29. The overhead fan of claim 28, further including a first anchor connecting the first end of the connector to the retainer and a second anchor connecting the second end of the connector to the at least one fan blade.
30. The overhead fan of claim 28, wherein the retainer comprises a ring, raceway, or track.
31. The overhead fan of claim 30, wherein the first anchor comprises a moveable base adapted to movably attach to the retainer.
32. The overhead fan of claim 28, wherein the retainer is integral with a downrod of the fan.
33. An overhead fan, comprising:
- (a) a motor;
 - (b) a rotatable hub coupled to the motor;
 - (c) at least one fan blade including a first end coupled to the rotatable hub and a second end radially outward of the first end;
 - (d) at least one connector attached to an outer surface of the at least one fan blade and the rotatable hub, the at least one connector comprising a film, a sheet, or another bonded or bondable material.

34. The overhead fan of claim 27, wherein the connector is positioned only on a top portion of the at least one fan blade and a top portion of the rotatable hub.
35. The overhead fan of claim 27, wherein the connector is wrapped around a portion of a joint connecting the at least one fan blade to the rotatable hub.
36. The overhead fan of claim 27, wherein the connector is wrapped around an entirety of a joint connecting the at least one fan blade to the rotatable hub.
37. The overhead fan of claim 27, wherein the connector is positioned on at least a portion of the rotatable hub.
38. An overhead fan, comprising:
- (a) a motor;
 - (b) a rotatable hub coupled to the motor;
 - (c) at least two fan blades, each of the at least two fan blades including a first end coupled to the rotatable hub and a second end radially outward of the first end;
 - (d) at least one connector extending between the at least two fan blades.
39. The overhead fan of claim 38, wherein the at least one connector comprises a strap, bar, beam, rod, or plate.
40. The overhead fan of claim 38, further including a first anchor on a respective at least one of the at least two fan blades, said first anchor adapted to attach a first end of the at least one connector to the respective at least one of the at least two fan blades.
41. The overhead fan of claim 40, further includes a second anchor on an adjacent blade of the at least two fan blades, said second anchor adapted to attach a second end of the at least one connector to the adjacent blade.

42. A fan, comprising:
- (a) a motor;
 - (b) a rotatable hub coupled to the motor;
 - (c) at least one fan blade comprising:
 - i. a first end securably coupled to the rotatable hub assembly,
 - ii. a second end, and
 - iii. a channel extending from the first end to the second end; and
 - (d) at least one rigid connector extending through the channel and adapted to connect the at least one fan blade to the rotatable hub.
43. The fan of claim 42, wherein the rigid connector connects to the at least one fan blade at the second end.
44. The fan of claim 42, further including a winglet attached to the second end of the blade.
45. The fan of claim 44, wherein the rigid connector is attached to the winglet.
46. The fan of claim 42, wherein the rigid connector is attached to the at least one fan blade at a position between the first end and the second end.
47. A fan, comprising:
- (a) a motor;
 - (b) a rotatable hub coupled to the motor;
 - (c) at least one fan blade comprising:
 - i. a blade first end coupled to the rotatable hub,
 - ii. a blade second end, and
 - iii. a passage extending from the blade first end to the blade second end; and
 - (d) at least one flexible connector extending through the passage of the at least one fan blade, and wherein the at least one flexible strap is coupled at a strap first end to the rotatable hub and coupled at a strap second end to a position on the at least one fan blade intermediate the blade first end and the blade second end.