

# High Efficiency Ceiling Fan Blades

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**Parker et al.**

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- (54) **HIGH EFFICIENCY CEILING FAN BLADES**
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- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 88 days.

4,730,985 A	3/1988	Rothman et al. ....	416/223
4,782,213 A	11/1988	Teal	
4,844,698 A	7/1989	Gornstein et al. ....	416/223
4,892,460 A	1/1990	Volk	
4,974,633 A	12/1990	Hickey .....	137/561
5,033,113 A	7/1991	Wang	
5,114,313 A	5/1992	Vorus	
5,244,349 A	9/1993	Wang .....	416/5
5,253,979 A	10/1993	Fradenburgh	
D355,027 S	1/1995	Young	
5,554,006 A *	9/1996	Liao .....	416/235
D382,636 S	8/1997	Yang	
5,951,162 A	9/1999	Westman et al. ....	416/223
6,045,327 A *	4/2000	Amr .....	415/210.1
6,116,856 A *	9/2000	Karadgy et al. ....	416/223 R
6,206,641 B1 *	3/2001	Park et al. ....	416/223 R
6,250,886 B1 *	6/2001	Immell et al. ....	416/219 A
6,378,322 B1 *	4/2002	Calvert .....	415/223
6,471,473 B1 *	10/2002	Wilkinson et al. ....	415/220

This patent is subject to a terminal disclaimer.

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- (22) Filed: **Oct. 12, 2001**

**Related U.S. Application Data**

- (63) Continuation-in-part of application No. 09/711,599, filed on Nov. 13, 2000, which is a division of application No. 09/415,883, filed on Oct. 8, 1999, now Pat. No. 6,189,799, which is a division of application No. 09/067,236, filed on Apr. 27, 1998, now Pat. No. 5,996,898, which is a continuation-in-part of application No. 09/056,428, filed on Apr. 7, 1998, now Pat. No. 6,039,541.
- (60) Provisional application No. 60/265,241, filed on Jan. 31, 2001.
- (51) **Int. Cl.<sup>7</sup>** ..... **F04D 29/38**
- (52) **U.S. Cl.** ..... **416/5; 416/223 R**
- (58) **Field of Search** ..... **416/5, 223 R, 416/243, 210 R**

**References Cited**

**U.S. PATENT DOCUMENTS**

1,506,937 A	9/1924	Miller .....	416/223
1,903,823 A	4/1933	Lougheed .....	416/223
1,942,688 A	1/1934	Davis .....	416/223
2,283,956 A	5/1942	Smith .....	416/223
2,345,047 A	3/1944	Houghton .....	416/223
2,450,440 A	10/1948	Mill .....	416/223
2,682,925 A	7/1954	Wosika .....	416/226
4,197,057 A	4/1980	Hayashi .....	416/242
4,325,675 A	4/1982	Gallot et al. ....	416/223
4,411,598 A	10/1983	Okada .....	416/223
4,416,434 A	11/1983	Thibert et al. ....	416/223

**FOREIGN PATENT DOCUMENTS**

AU	19987	1/1930 .....	416/223
FR	1050902	1/1954 .....	416/223
GB	676406	7/1952 .....	416/223
GB	925931	5/1963 .....	416/223

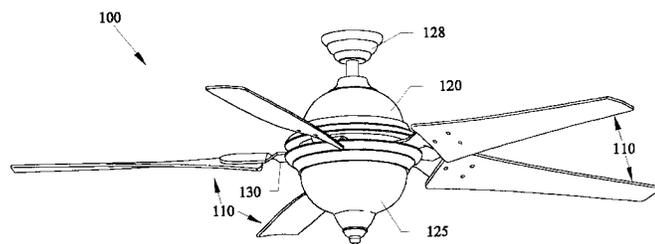
\* cited by examiner

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(57) **ABSTRACT**

Ceiling fan blades for maximizing air flow at operational speeds of up to approximately 200 revolutions per minute (rpm). The blades have a positive twist at the tip ends of approximately 5 degrees to approximately 10 degrees parallel to the ceiling. The root end of the blades closest to the motor can have a positive twist exceeding that of the tip end and can be approximately 20 to approximately 35 degrees parallel to the ceiling. The ceiling fans can have individual blade lengths of approximately 20 inches and overall spans of up to approximately 52 inches and up to approximately 54 inches. Each embodiment can use three, four, and five blades, with the blades being made of injection molded plastic, and the like. The embodiments can include built in light kit domes.

**20 Claims, 16 Drawing Sheets**



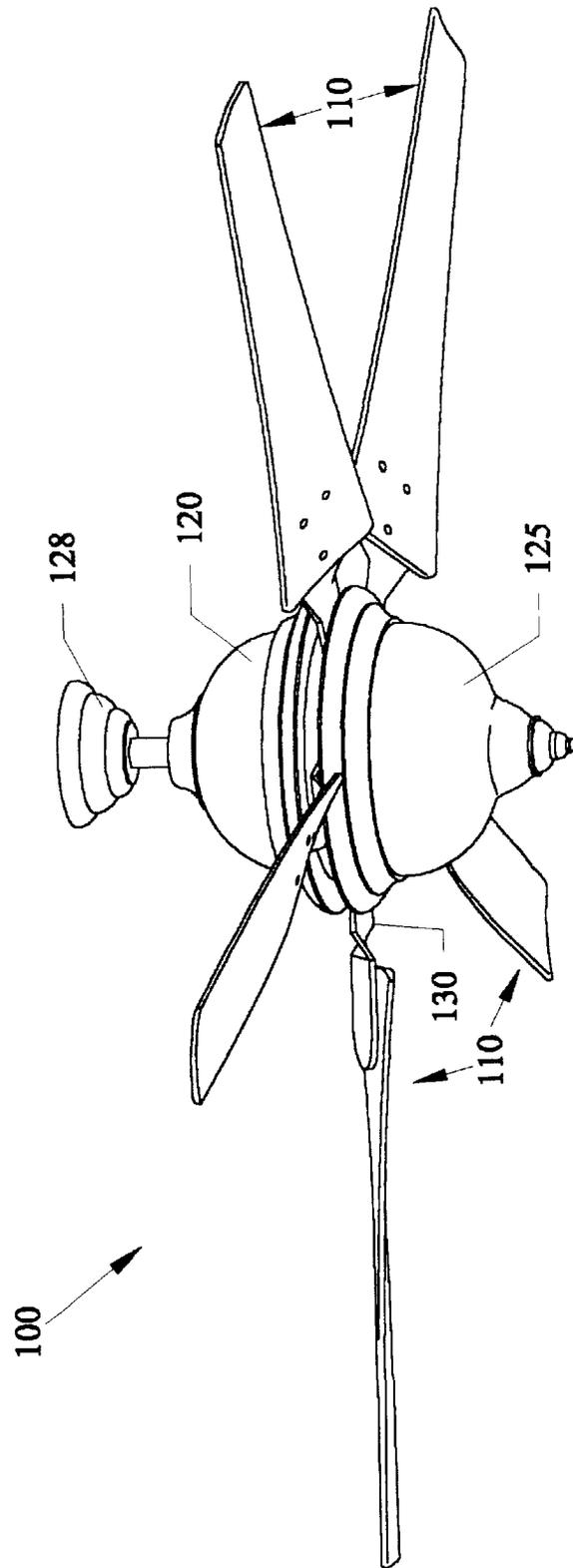


Fig. 1

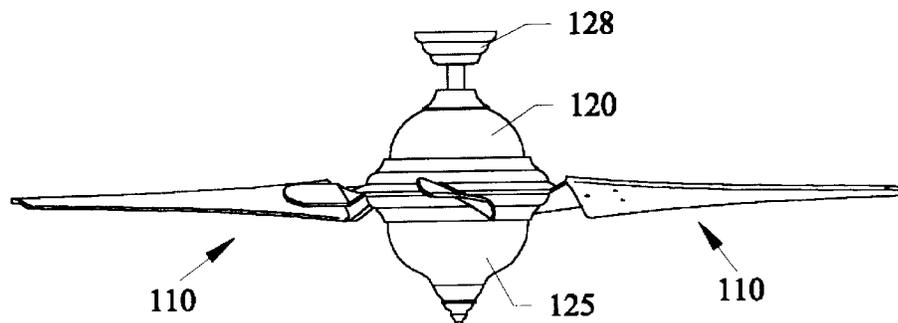


Fig. 2

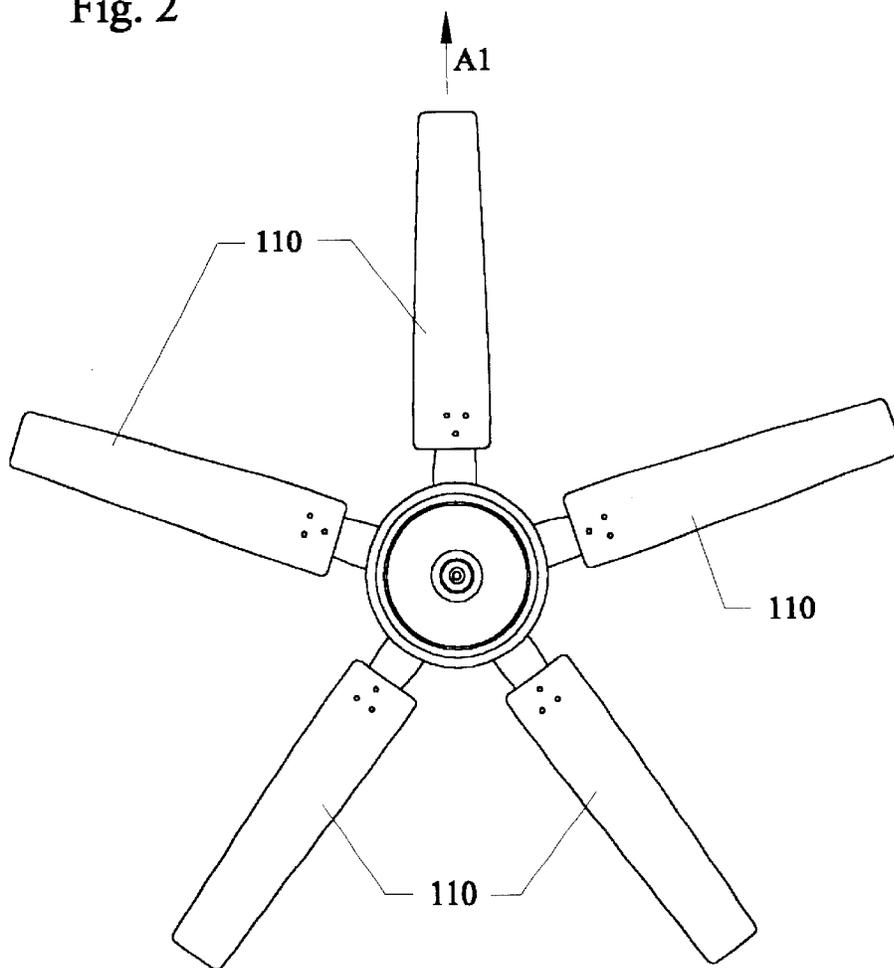


Fig. 3

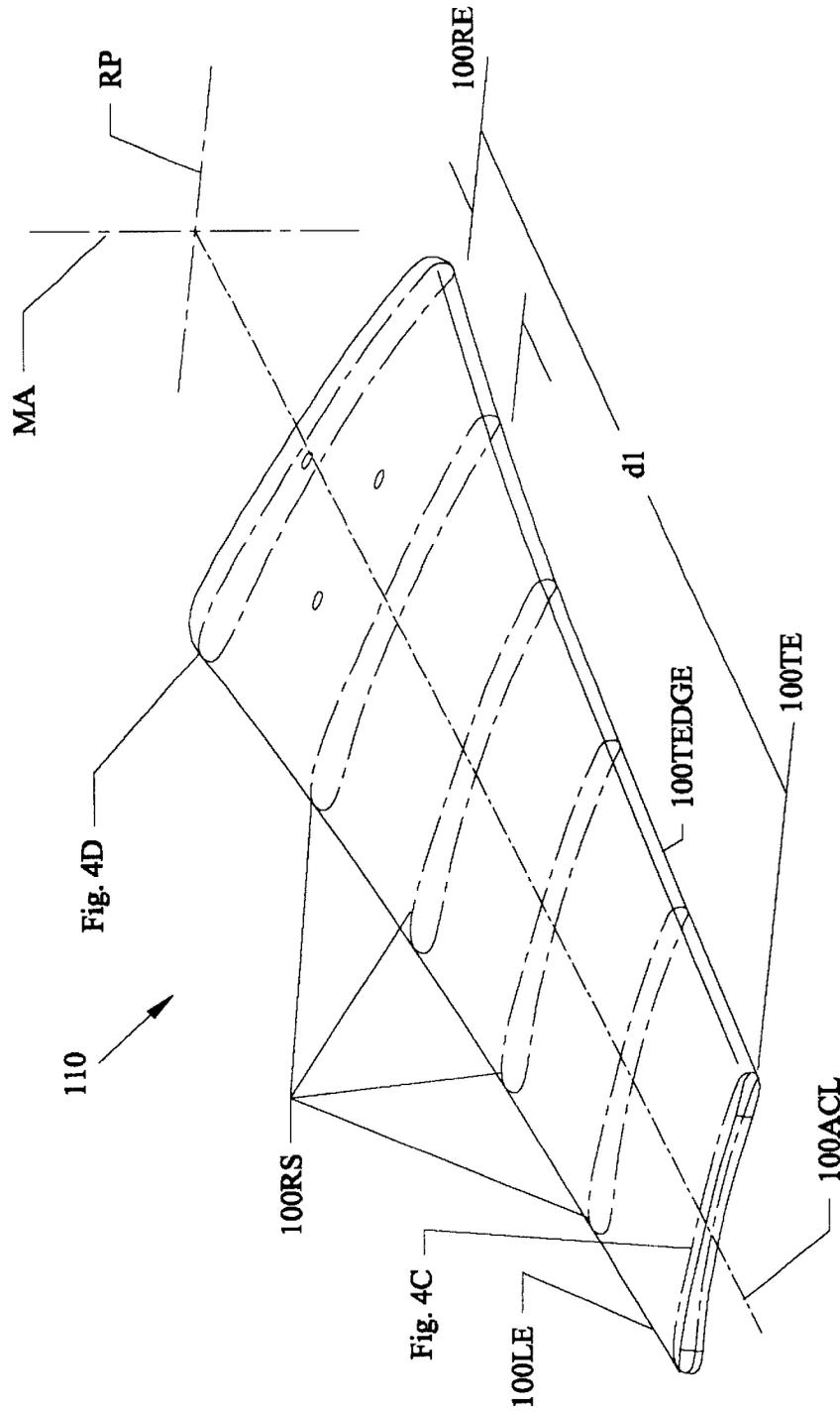
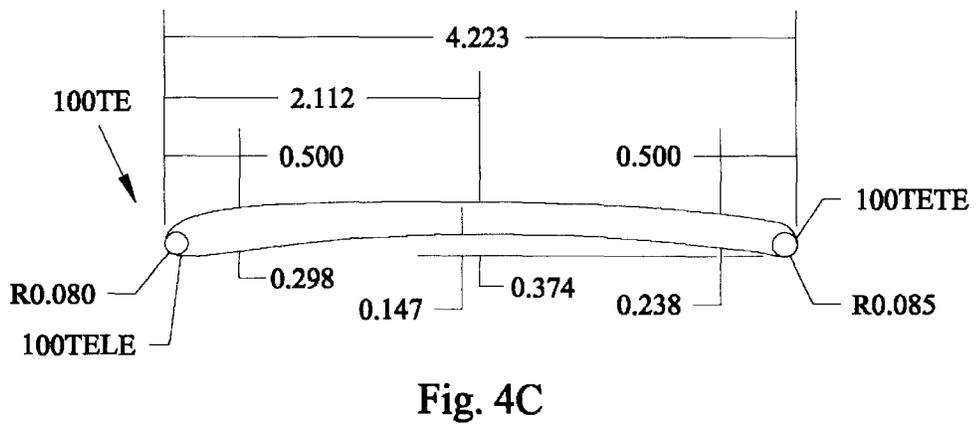
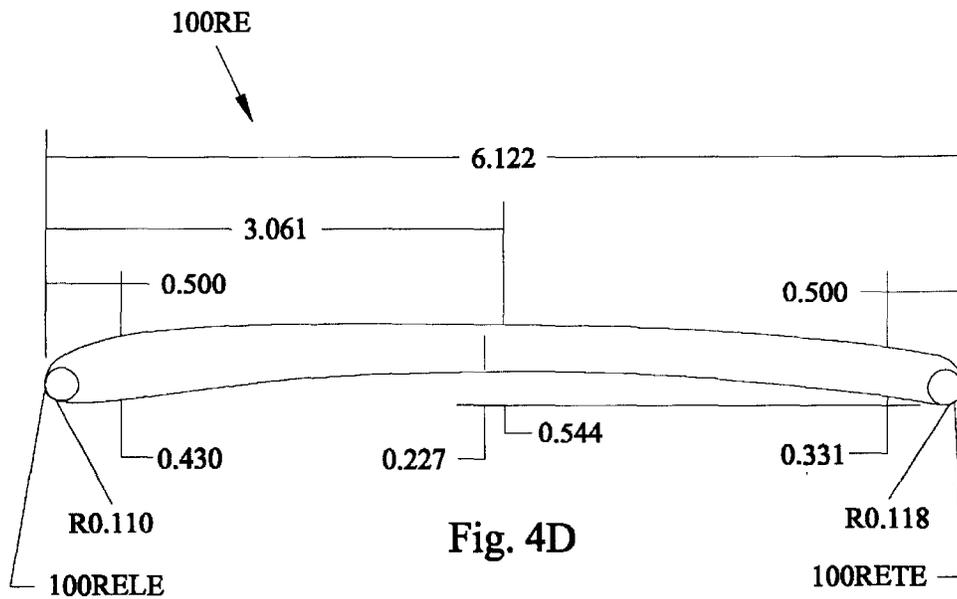


Fig. 4A





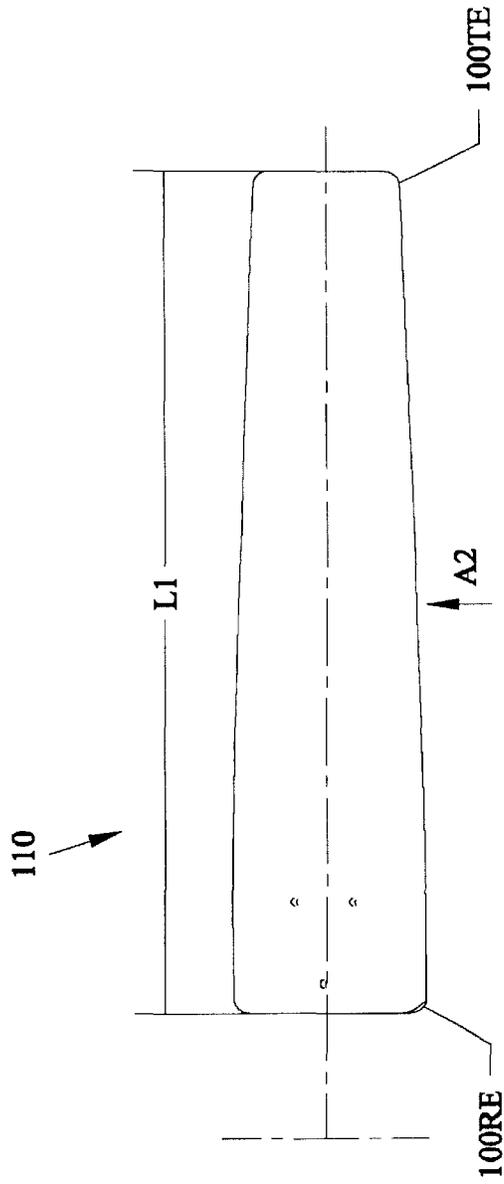


Fig. 5

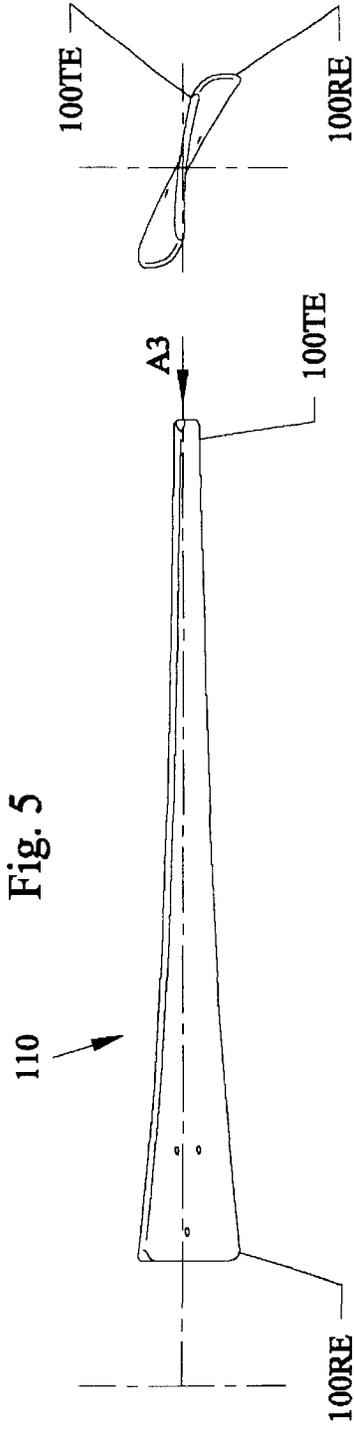


Fig. 6

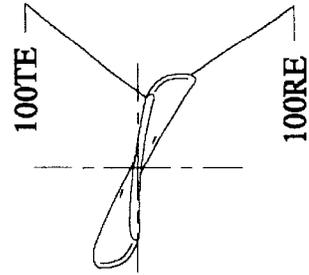


Fig. 7

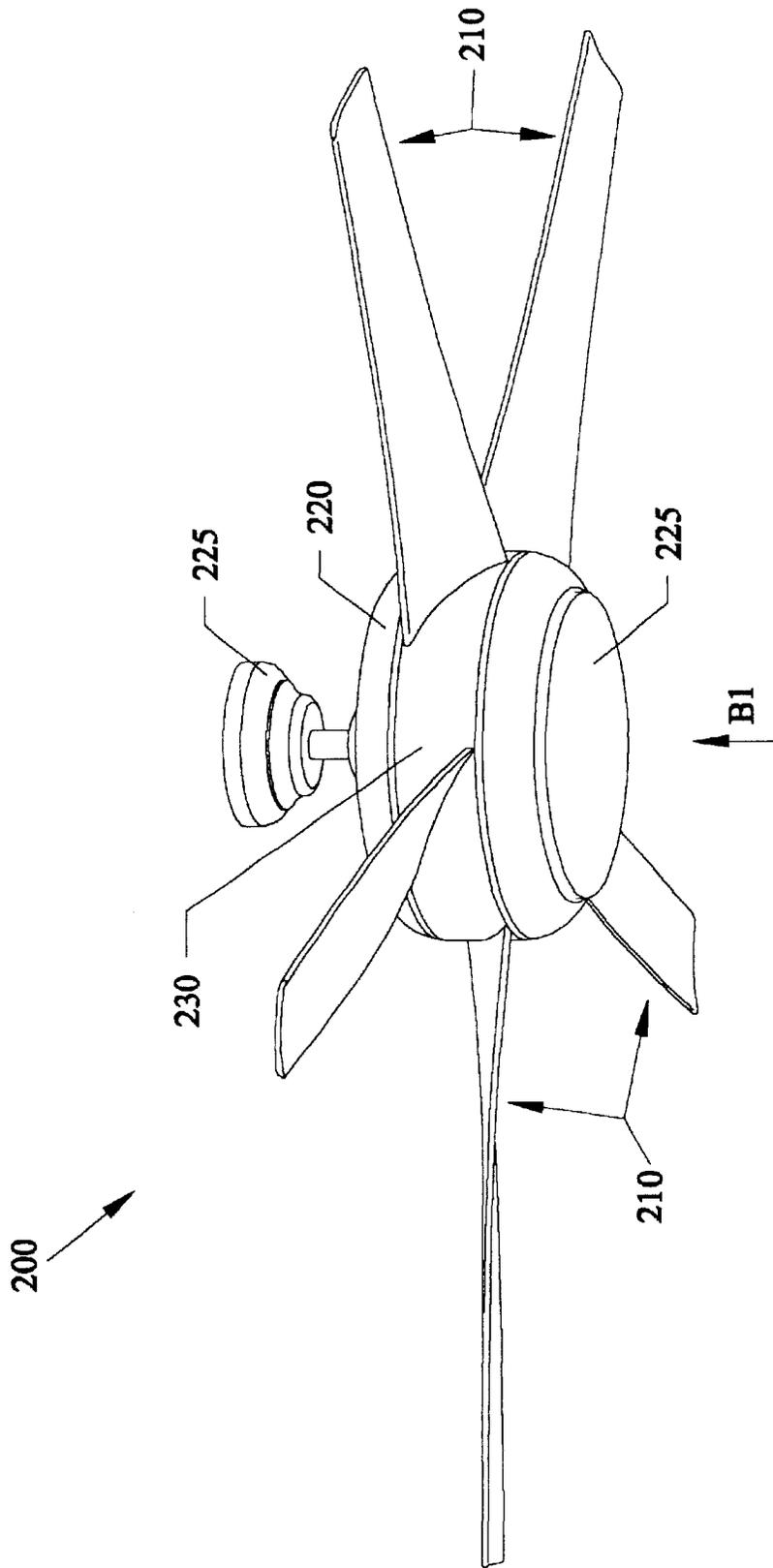
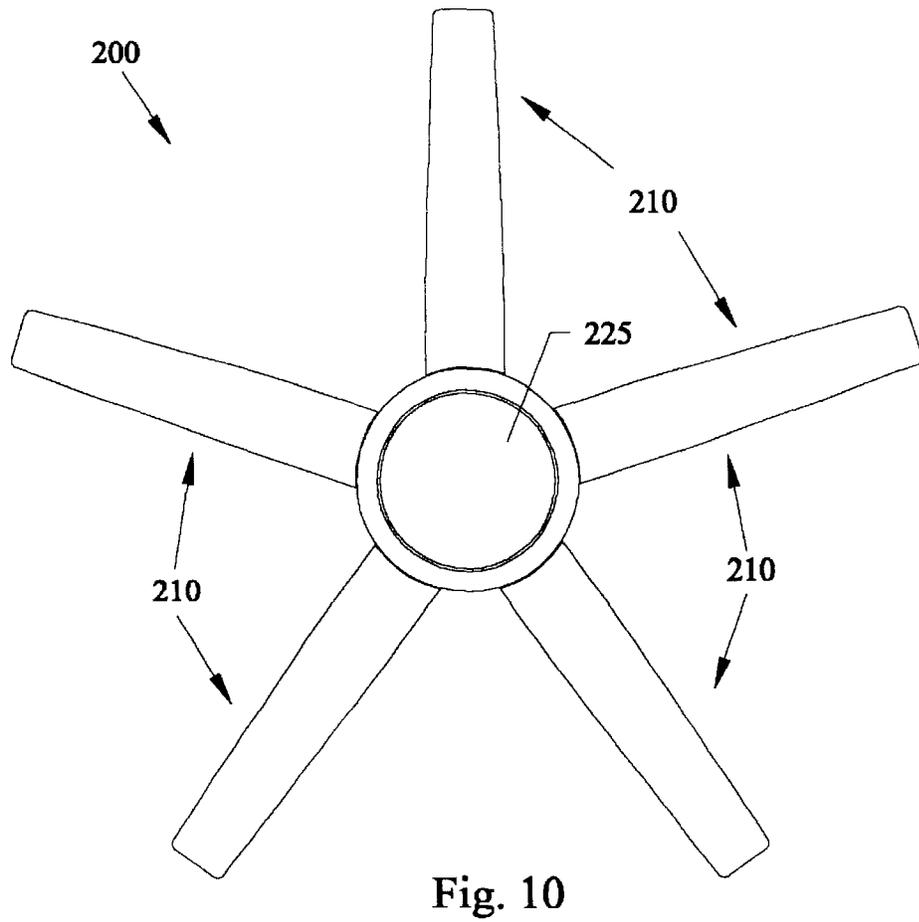
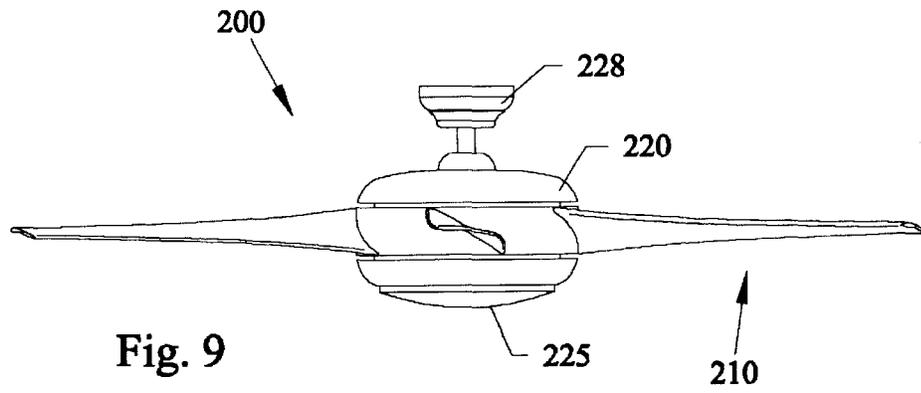


Fig. 8



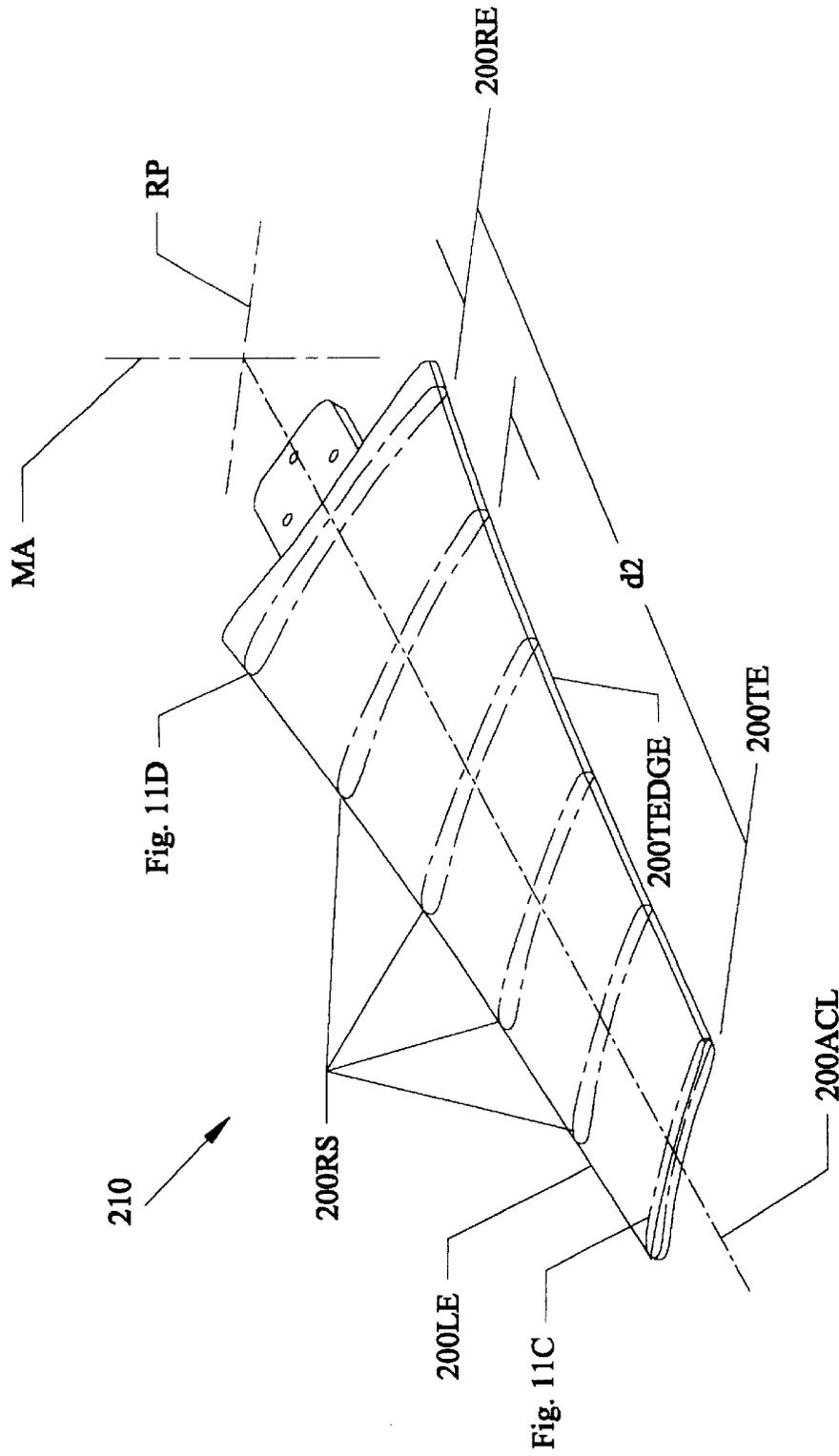


Fig. 11A

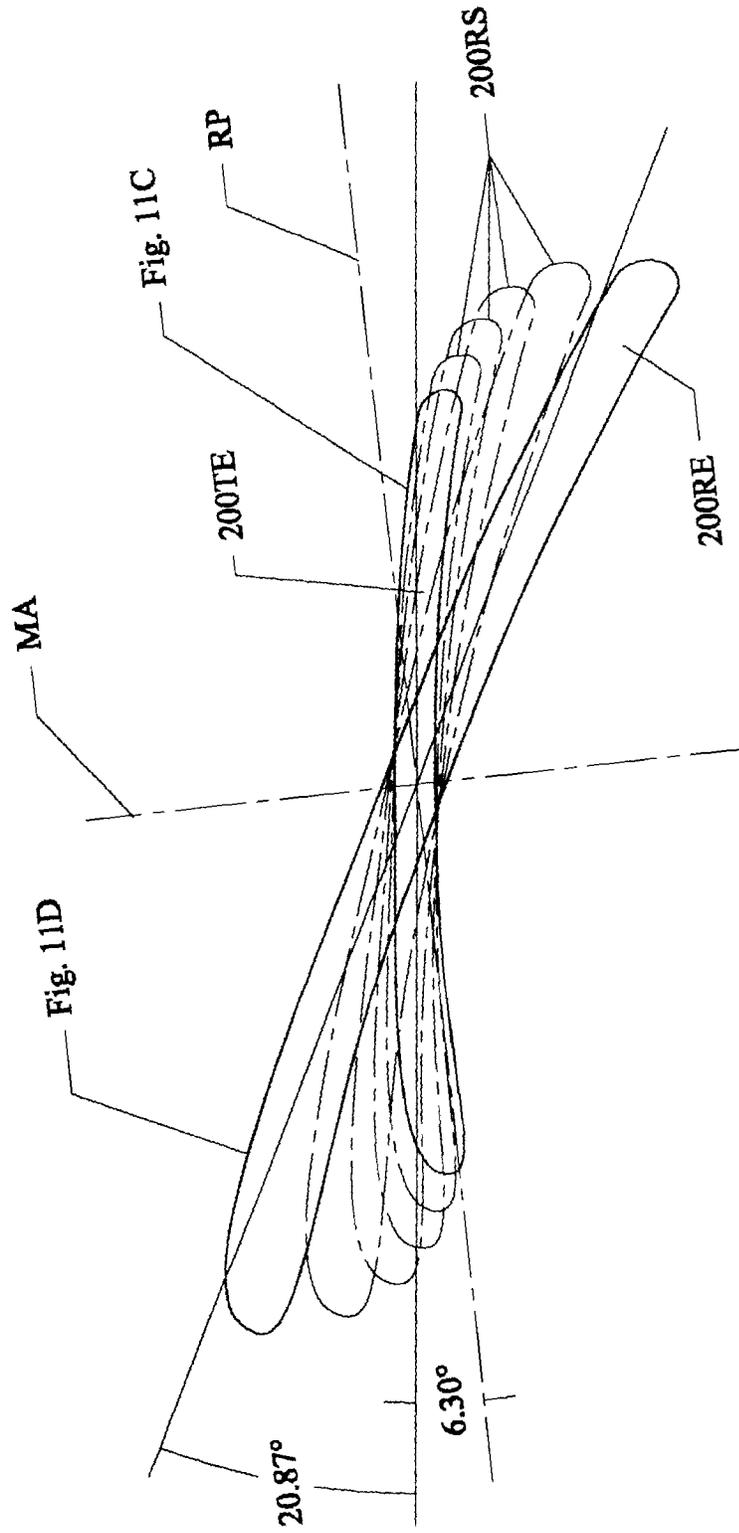


Fig. 11B

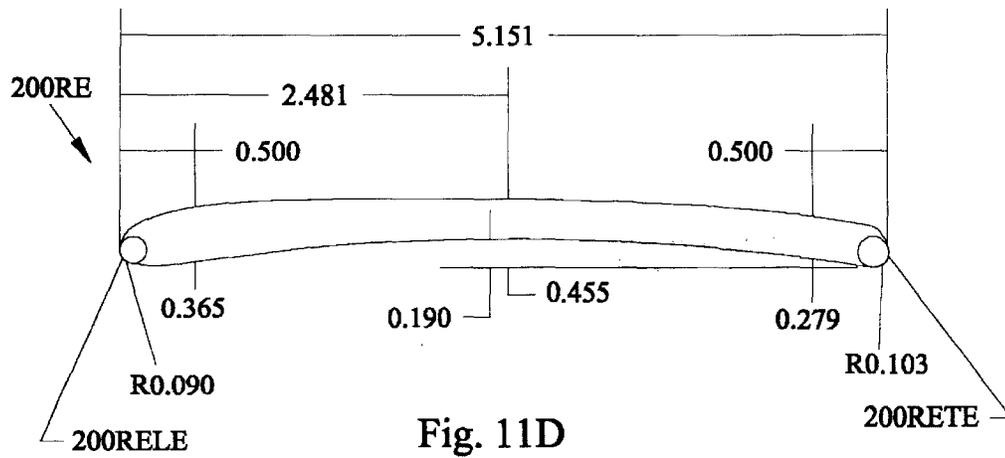


Fig. 11D

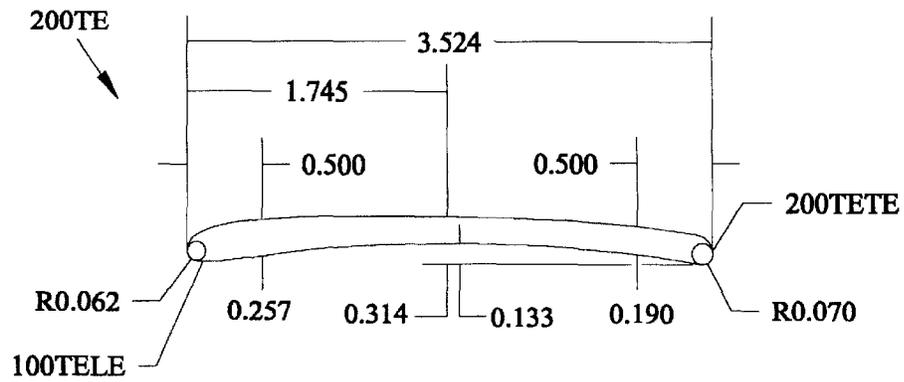


Fig. 11C

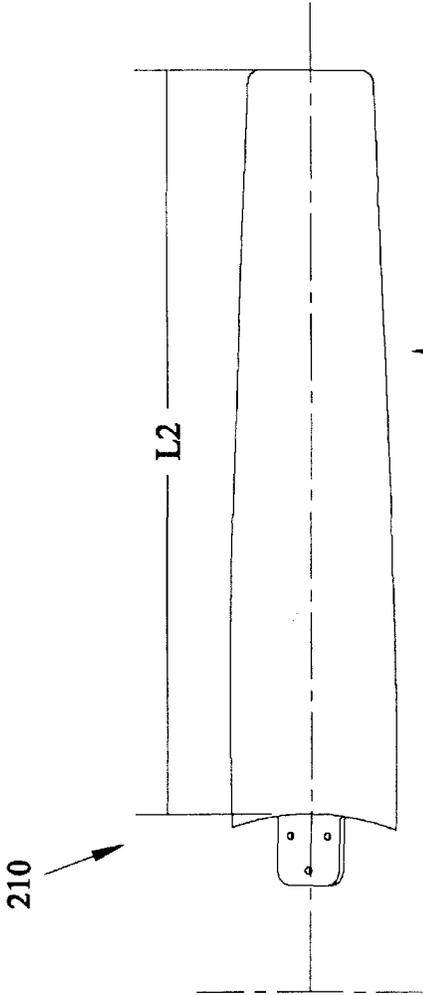


Fig. 12

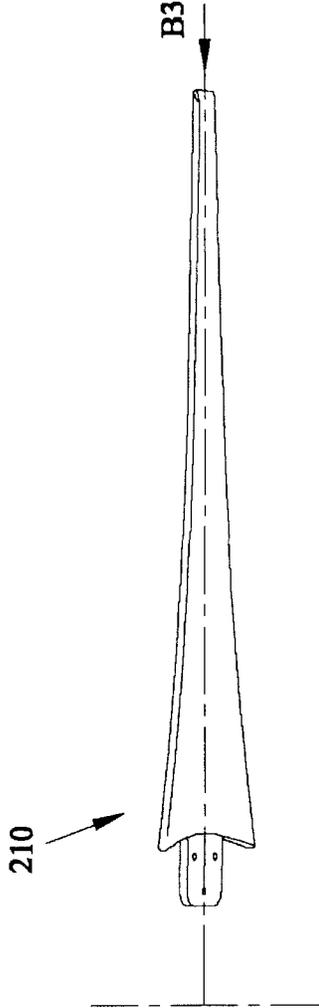


Fig. 13

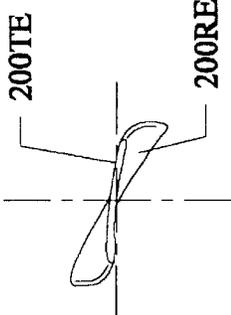


Fig. 14

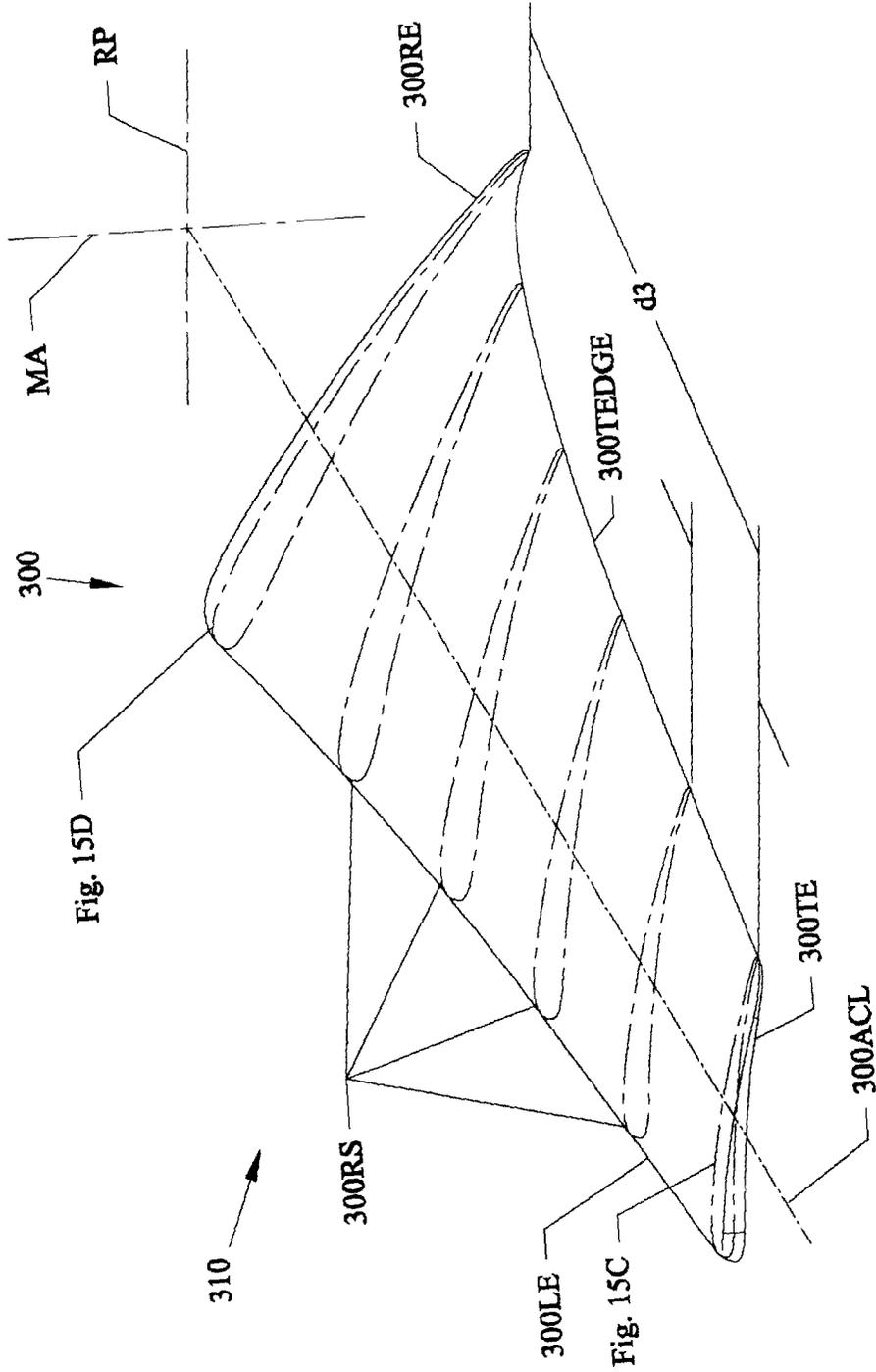


Fig. 15A

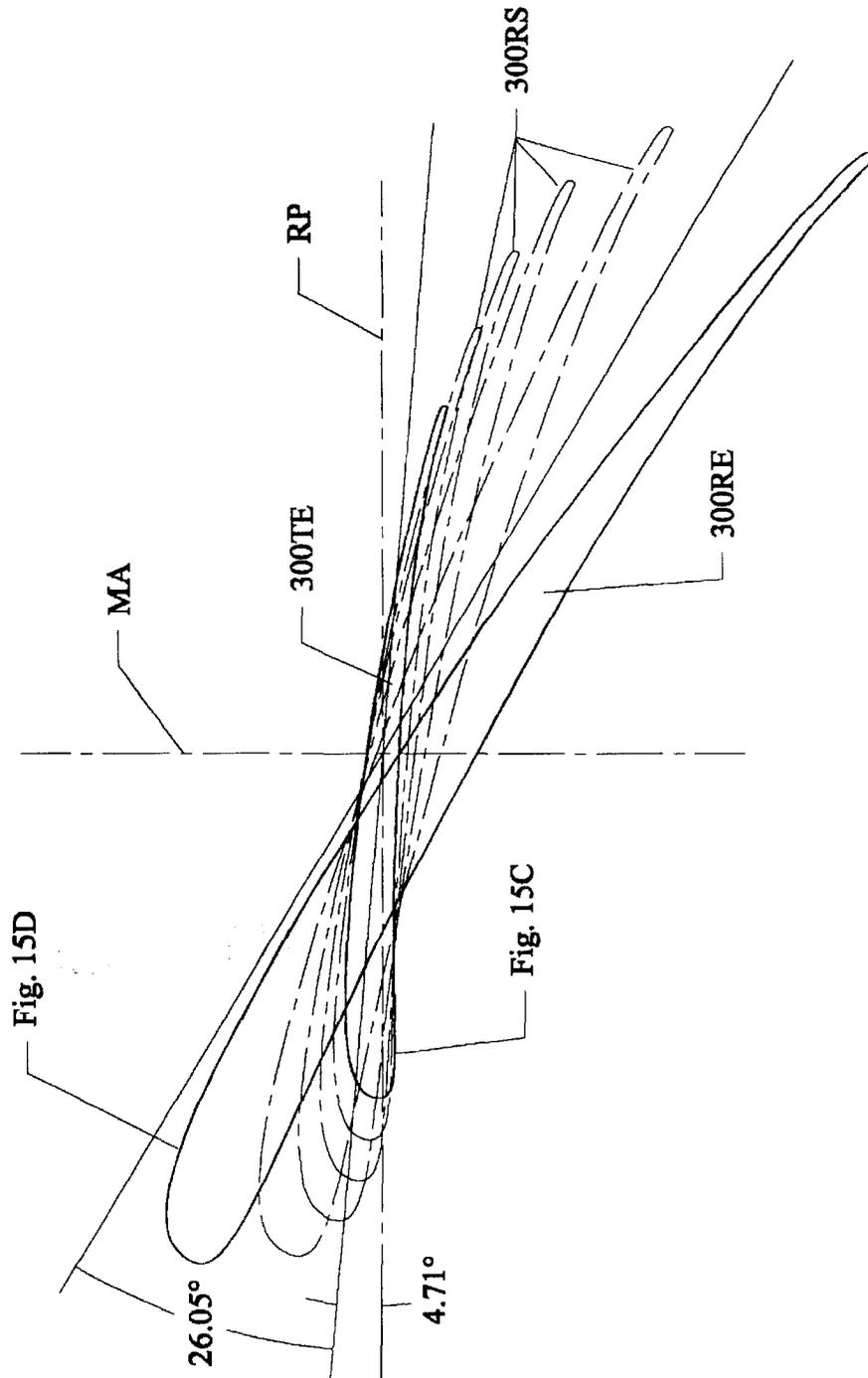
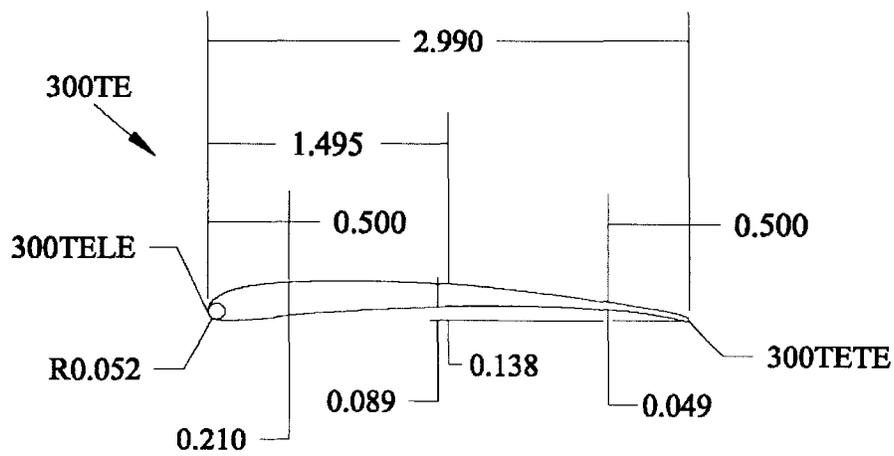
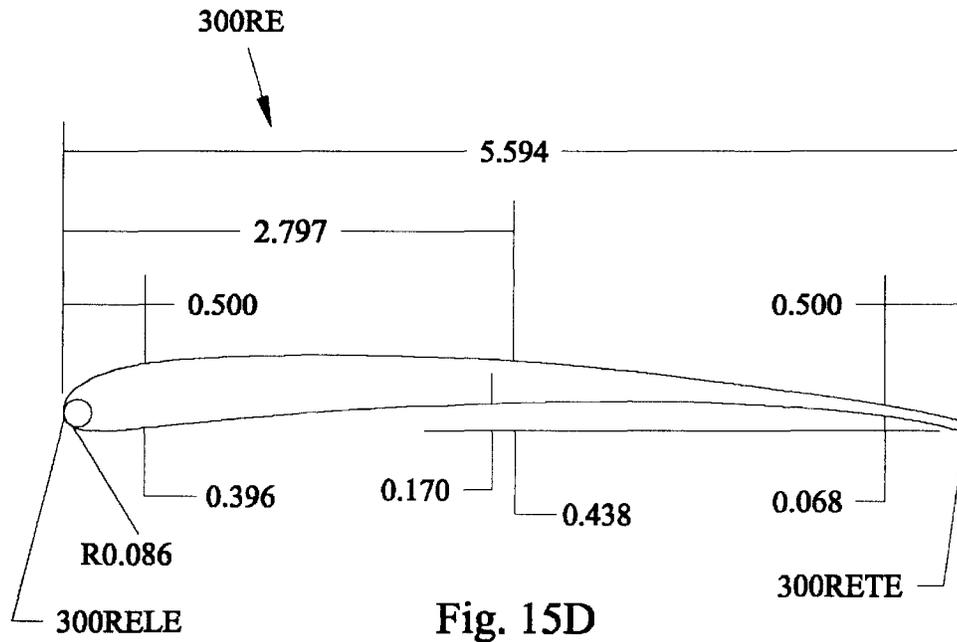


Fig. 15B



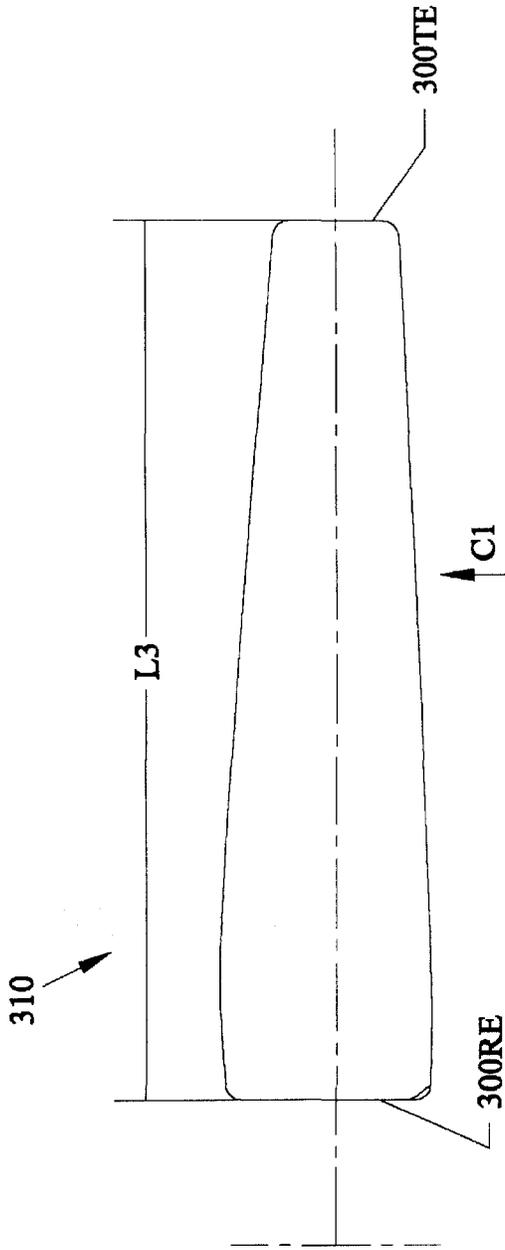


Fig. 16

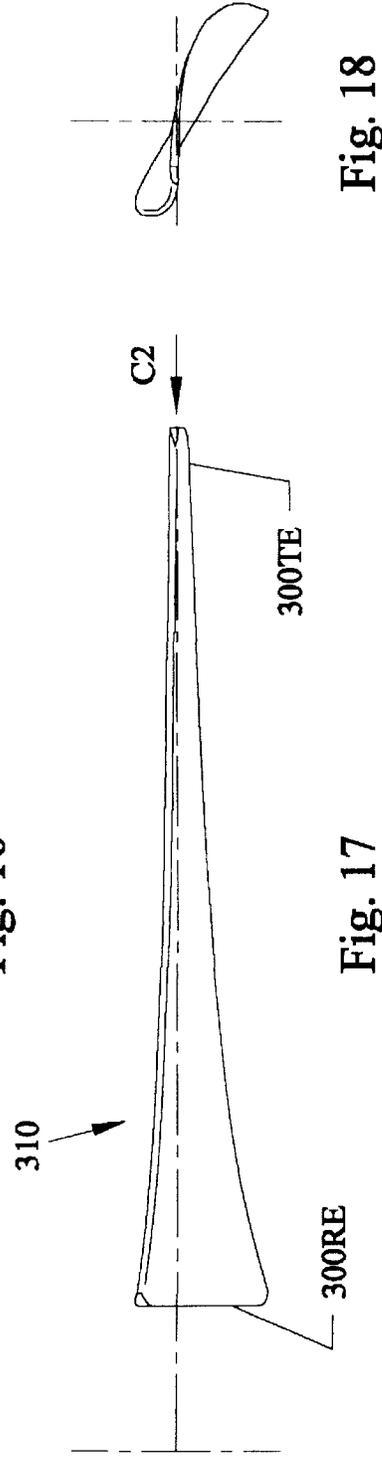


Fig. 17

Fig. 18

**HIGH EFFICIENCY CEILING FAN BLADES**

This invention relates to ceiling fans, and in particular to ceiling fan blades with twisted bodies for providing increased airflow at low rotational speeds with low energy consumption, and claims the benefit of Provisional Application No. 60/265,241 filed Jan. 31, 2001 and is a continuation-in-part of U.S. Ser. No. 09/711,599 filed Nov. 13, 2000, which is a divisional application of U.S. Ser. No. 09/415,883 filed Oct. 8, 1999 now U.S. Pat. No. 6,189,799, which is a divisional application of U.S. Ser. No. 09/067,236 filed Apr. 27, 1998 now U.S. Pat. No. 5,996,898 which is incorporated by reference, which is a continuation-in-part of U.S. Ser. No. 09/056,428 filed Apr. 7, 1998 now U.S. Pat. No. 6,039,541 which is incorporated by reference.

**BACKGROUND AND PRIOR ART**

Ceiling fans have been around for many years as a useful air circulator. The popular blade style over the years is a flat planar rectangular blade that can have a slight tilt, as shown for example in U.S. Pat. No. Des. 355,027 to Young and U.S. Pat. No. Des. 382,636 to Yang. These patents while moving air are not concerned with maximizing optimum downward airflow. Furthermore, many of the flat ceiling fan blades have problems such as vibrations and wobbling during use, and excessive noise that is noticeable to persons in the vicinity of the fan blades.

Aircraft, marine and automobile engine propeller type blades have been altered over the years to shapes other than flat rectangular. See for example, U.S. Pat. No. 1,903,823 to Lougheed; U.S. Pat. No. 1,942,688 to Davis; U.S. Pat. No. 2,283,956 to Smith; U.S. Pat. No. 2,345,047 to Houghton; U.S. Pat. No. 2,450,440 to Mills; U.S. Pat. No. 4,197,057 to Hayashi; U.S. Pat. No. 4,325,675 to Gallot et al.; U.S. Pat. No. 4,411,598 to Okada; U.S. Pat. No. 4,416,434 to Thibert; U.S. Pat. No. 4,730,985 to Rothman et al. U.S. Pat. No. 4,794,633 to Hickey; 4,844,698 to Gornstein; U.S. Pat. No. 5,114,313 to Vorus; and U.S. Pat. No. 5,253,979 to Fradenburgh et al.; Australian Patent 19,987 to Eather. However, these patents are describing devices that are generally used for high speed water, aircraft, and automobile applications where the propellers are run at high revolutions per minute (rpm) generally in excess of 500 rpm. None of these propellers are designed for optimum airflow at low speeds of less than approximately 200 rpm which is the desired speeds used in overhead ceiling fan systems.

Some alternative blade shapes have been proposed for other types of fans. See for example, U.S. Pat. No. 1,506,937 to Miller; U.S. Pat. No. 2,682,925 to Wosik; U.S. Pat. No. 4,892,460 to Volk; U.S. Pat. No. 5,244,349 to Wang; Great Britain Patent 676,406 to Spencer; and PCT Application No. WO 92/07192.

Miller '937 requires that their blades have root "lips 26" FIG. 1 that overlap one another, and would not be practical nor useable for three or more fan blade operation for a ceiling fan. Wosik '925 describes "fan blades . . . particularly adapted to fan blades on top of cooling towers such for example as are used in oil refineries and in other industries", column 1, lines 1-5, and does not describe any use for ceiling fan applications. The Volk '460 patent by claiming to be "aerodynamically designed" requires one curved piece to be attached at one end to a conventional planar rectangular blade. Using two pieces for each blade adds extreme costs in both the manufacturing and assembly of the ceiling itself. Furthermore, the grooved connection point in the Volk devices would appear to be susceptible to separating and

causing a hazard to anyone or any property beneath the ceiling fan itself. Such an added device also has necessarily less than optimal aerodynamic properties.

Wang '349 requires each of their blades be "drilled with a plurality of perforations . . . for reducing weight . . . (and) may be reinforced by at least one rib . . .", abstract. Clearly, such a blades would not be aesthetically pleasing to the user to have various holes and ribs visible on the blades, and there is no description for increasing airflow with such an arrangement. Great Britain Patent '406 describes "fan impellers" that require an "a unitary structure . . . constituted by a boss and four blades" page 1, lines 38+, and does not describe any single blades that can be used without any central boss type hub arrangement nor any use for less than three or more than four blade operation that will allow versatility for mounting separate numbers of blades on a ceiling fan motor. PCT '192 is for use "in an electric fan . . . to convert axially existing ambient air into a radially outward current of air", abstract, and is shown in FIGS. 5-12 as being used for being mounted on "post(s)", and the like, and is not directed toward a ceiling fan operation, which would direct air primarily downward. Additionally, PCT '192 generally requires an elaborate arrangement of using plural blades angled both upward and downward for operation.

Thus, the need exists for solutions to the above described problems in the prior art.

**SUMMARY OF THE INVENTION**

The first objective of the subject invention is to provide ceiling fan blades that are aerodynamically optimized to move up to approximately 40% or more air than traditional flat planar ceiling fan blades.

The second objective of the subject invention is to provide ceiling fan blades that are quieter and provide greater comfort than traditional flat planar ceiling fan blades.

The third objective of the subject invention is to provide ceiling fan blades that are less prone to wobble than traditional flat planar ceiling fan blades.

The fourth objective of the subject invention is to provide ceiling fan blades that reduce electrical power consumption and are more energy efficient over traditional flat planar ceiling fan blades.

The fifth objective of the subject invention is to provide ceiling fan blades designed for superior airflow at up to approximately 200 revolutions per minute(rpm).

The sixth objective of the subject invention is to provide ceiling fan blades being more aesthetically appealing than traditional flat planar ceiling fan blades.

Three embodiments of a novel ceiling fan blade are described where each blade can include a tip end having a twist of approximately 5 degrees to approximately 10 degrees, and a root end attached to a ceiling fan motor, wherein the positive twist provides increased air flow over other ceiling fan blades. The root end can include a twist of approximately 20 to approximately 35 degrees. The blades generally include a concave raised bottom and a convex shaped upper surface. The blades are mounted to motor assemblies in a twisted configuration. The blades can be mounted to a ceiling fan motor and provide enhanced airflow at speeds of up to approximately 200 revolutions per minute(rpm). The novel ceiling fan system includes wing-spans of up to approximately 52 inches and up to approximately 54 inches.

Further objects and advantages of this invention will be apparent from the following detailed description of a pres-

ently preferred embodiment which is illustrated schematically in the accompanying drawings.

#### BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a perspective view of a first embodiment of the novel blades with motor assembly.

FIG. 2 is a side view of the first embodiment of FIG. 1.

FIG. 3 is a top view of the first embodiment of FIG. 2 along arrow A1.

FIG. 4A is a perspective view of a single fan blade of the first embodiment of FIGS. 1-3.

FIG. 4B is an end view of the single fan blade of FIG. 4A representing degrees of twist between from the root end to the tip end.

FIG. 4C is a cross-sectional view of the tip end of the first embodiment of FIGS. 4A-4B.

FIG. 4D is a cross-sectional view of the root end of the first embodiment of FIGS. 4A-4B.

FIG. 5 is a top view of a ceiling fan blade of the first embodiment of FIGS. 1-4D.

FIG. 6 is a side view of the ceiling fan blade of FIG. 5 along arrow A2.

FIG. 7 is an end view of the ceiling fan blade of FIG. 6 along arrow A3.

FIG. 8 is a perspective view of a second embodiment of the novel blades with motor assembly.

FIG. 9 is a side view of the second embodiment of FIG. 8.

FIG. 10 is a top view of the second embodiment of FIG. 9 along arrow B1.

FIG. 11A is a perspective view of a single fan blade of the second embodiment of FIGS. 8-10.

FIG. 11B is an end view of the single fan blade of FIG. 11A representing degrees of twist between from the root end to the tip end.

FIG. 11C is cross-sectional view of the tip end of the second embodiment of FIGS. 11A-11B.

FIG. 11D is a cross-sectional view of the root end of the second embodiment of FIGS. 11A-11B.

FIG. 12 is a top view of a ceiling fan blade of the second embodiment of FIGS. 11A-11D.

FIG. 13 is a side view of the ceiling fan blade of FIG. 12 along arrow B2.

FIG. 14 is an end view of the ceiling fan blade of FIG. 13 along arrow B3.

FIG. 15A is a perspective view of a single fan blade of a third embodiment of invention.

FIG. 15B is an end view of the single fan blade of FIG. 15A representing degrees of twist between from the root end to the tip end.

FIG. 15C is cross-sectional view of the tip end of the third embodiment of FIGS. 15A-15B.

FIG. 15D is a cross-sectional view of the root end of the third embodiment of FIGS. 15A-15B.

FIG. 16 is a top view of a ceiling fan blade of the third embodiment of FIGS. 15A-15D.

FIG. 17 is a side view of the ceiling fan blade of FIG. 16 along arrow C1.

FIG. 18 is an end view of the ceiling fan blade of FIG. 17 along arrow C2.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Before explaining the disclosed embodiments of the present invention in detail it is to be understood that the

invention is not limited in its application to the details of the particular arrangement shown since the invention is capable of other embodiments. Also, the terminology used herein is for the purpose of description and not of limitation.

Testing of novel ceiling fan blades in the parent patent application to the subject invention, namely U.S. Pat. Ser. No. 09/056,428 filed Apr. 7, 1998, now U.S. Pat. No. 6,039,541, and incorporated by reference, were tested between May and June, 1997 at the Florida Solar Energy Center® in Cocoa, Florida, and included three parameters of measurement data: airflow(meters per second(m/s)), power (in watts) and speed(revolutions per minute(rpm)). Those novel ceiling fan blades far surpassed the operating parameters of various conventional ceiling fans in operation, and the subject fan blades have similar attributes.

#### FIRST EMBODIMENT

FIG. 1 is a perspective view of a first embodiment 100 of a first embodiment of the novel twisted blades 110. twisted mounting arm 130 conventionally mounted to motor assembly 120, light kit dome 125, such as a incandescent bulb, and the like, and ceiling mount 128. FIG. 2 is a side view of the first embodiment 100 of FIG. 1. FIG. 3 is a top view of the first embodiment 100 of FIG. 2 along arrow A1.

FIG. 4A is a perspective view of a single fan blade 110 of the first embodiment 100 of FIGS. 1-3, showing the single fan blade 110 having an overall length D1, between tip end 100TE and root end 100RE being approximately 19.50 inches, and various reference cross-sections(100TE, 100RS (4), 100RE) being approximately 3.90 inches from one another along the airfoil center line 100ACL, and blade 110 having leading edge 100LE and trailing edge 100TEDGE oriented along the blade rotational plane RP. FIG. 4B is an end view of the single fan blade 110 of FIG. 4A representing degrees of twist between from the root end 100RE to the tip end 100TE, when the blade 110 is positioned in a selected position shown in FIGS. 1-3(Note the twisted mounting arm 130 of FIG. 1 is used to hold the twist position shown in FIG. 4B). The tip end 100TE has an angle of approximately 6.22 degrees from a horizontal plane that is parallel to a ceiling. In other words, the angle would be approximately 6.22 degrees from the motor axis(MA)(being the rotational axis of the blades. The root end 100RE would have an angle of twist of approximately 25.63 degrees(19.41+6.22). The mid cross-sectional areas noted as 100RS have varying angles of twist between the tip end 100TE and the root end 200RE.

FIG. 4C is a cross-sectional view of the tip end 100 TE of the first embodiment 100 of FIGS. 4A-4B. Referring to FIG. 4C, tip end 100TE has a width span of approximately 4.223 inches. The rounded leading edge 100TELE has a diameter of approximately 0.080 degrees being approximately 0.298 inches thick and approximately 0.5 inches from rounded leading edge 100TELE. The middle of tip end 100 TE has a thickness of approximately 0.227 inches (0.374-0.147), with a generally concave shaped elongated bottom section raised approximately 0.147 inches and upper surface being generally convex shaped. Rounded tip end trailing edge 100TETE has a diameter of approximately 0.085 degrees with a thickness of approximately 0.238 inches approximately 0.5 inches from the rounded trailing edge 100TETE.

FIG. 4D is a cross-sectional view of the root end 100 RE of the first embodiment 100 of FIGS. 4A-4B. Referring to FIG. 4D, root end 100RE has a width span of approximately 6.122 inches. The rounded leading edge 100RELE has a diameter of approximately 0.110 degrees being approximately 0.430 inches thick approximately 0.5 inches from

rounded leading edge **100RELE**. The middle of root end **100RE** has a thickness of approximately 0.317(0.544–0.227) inches, with a generally concave shaped elongated bottom section raised midway approximately 0.227 inches and upper surface being generally convex shaped. Rounded tip end trailing edge **100RETE** has a diameter of approximately 0.118 degrees with a thickness of approximately 0.331 inches approximately 0.5 inches from the rounded trailing edge **100RETE**.

FIG. 5 is a top view of a ceiling fan blade **110** of the first embodiment **100** of FIGS. 1–4D, where the length, **L1** can be approximately 19.5 inches to approximately 20.228 inches from tip end **100TE** to root end **200RE**. FIG. 6 is a side view of the ceiling fan blade **110** of FIG. 5 along arrow **A2**. FIG. 7 is an end view of the ceiling fan blade **110** of FIG. 6 along arrow **A3**.

SECOND EMBODIMENT

FIG. 8 is a perspective view of a second embodiment **200** of the novel blades **210** attached to a mounting ring **230** which rotates relative to conventional motor assembly **220**. A dome shaped light **225** can also be used.

FIG. 9 is a side view of the second embodiment **200** of FIG. 8. FIG. 10 is a top view of the second embodiment **200** of FIG. 9 along arrow **B1**.

FIG. 11A is a perspective view of a single fan blade **210** of the second embodiment **200** of FIGS. 8–10 showing the single fan blade **210** having an overall length **D2** between tip end **200TE** and root end **200RE** being approximately 20 inches, and various reference cross-sections(**200TE**, **200RS (4)**, **200RE**) being approximately 4 inches from one another along air foil center line **200ACL**, and blade **210** having leading edge **200LE** and trailing edge **200TEDGE** oriented along the blade rotational plane **RP**. FIG. 11B is an end view of the single fan blade **210** of FIG. 11A representing degrees of twist between from the root end **200RE** to the tip end **200TE** when the blade **210** is positioned in a selected position shown in FIGS. 8–10. The tip end **200TE** has an angle of approximately 6.30 degrees from a horizontal plane that is parallel to the ceiling. In other words, the angle would be approximately 6.3 degrees from a motor axis(**MA**). The root end **200RE** would have an angle of twist of approximately 27.17 degrees(6.3+20.87). The mid cross-sectional areas noted as **200RS** have varying angles of twist between the tip end **200TE** and the root end **200RE**.

FIG. 11C is cross-sectional view of the tip end **200TE** of the second embodiment **200** of FIGS. 11A–11B. Referring to FIG. 11C, tip end **200TE** has a width span of approximately 3.524 inches. The rounded leading edge **200TELE** has a diameter of approximately 0.062 degrees being approximately 0.257 inches thick approximately 0.5 inches from leading edge **200TELE**. The middle of tip end **200TE** has a thickness of approximately 0.181 inches(0.314–0.133), with a generally concave shaped elongated bottom section raised approximately 0.133 inches and an upper surface being generally convex shaped. Rounded tip end trailing edge **200TETE** has a diameter of approximately 0.070 inches with a thickness of approximately 0.190 inches approximately 0.5 inches from the rounded trailing edge **200TETE**.

FIG. 11D is a cross-sectional view of the root end **200RE** of the second embodiment **200** of FIGS. 11A–11B. Referring to FIG. 11D, root end **200RE** has a width span of approximately 5.151 inches. The rounded leading edge **200RELE** has a diameter of approximately 0.090 degrees being approximately 0.365 inches thick approximately 0.5 inches from rounded leading edge **200RELE**. The middle of

root end **200RE** has a thickness of approximately 0.265 inches(0.455–0.190), with a generally concave shaped elongated bottom section raised midway approximately 0.190 inches and an upper surface being generally convex shaped. Rounded tip end trailing edge **200RETE** has a diameter of approximately 0.103 degrees with a thickness of approximately 0.279 inches approximately 0.5 inches from rounded trailing edge **200RETE**.

FIG. 12 is a top view of a ceiling fan blade **210** of the second embodiment **200** of FIGS. 11A–11D, where the length **L2** can be approximately 20 inches to approximately 20.819 inches long from tip end **200TE** to root end **200RE**. FIG. 13 is a side view of the ceiling fan blade **210** of FIG. 12 along arrow **B2**. FIG. 14 is an end view of the ceiling fan blade **210** of FIG. 13 along arrow **B3**.

Subject invention second embodiment had an overall wing span of approximately 52", and used fan blades each being made of injection molded plastic.

Table 1 shows running the second embodiment of the subject invention at low speed operations, with the Power Drawer is the instantaneous electric power requirement in Watts. The parameters include power(in watts) and speed (revolutions per minute(rpm)).

TABLE 1

<u>FAN (LOW SPEED OPERATION)</u>		
	Power Draw	Revolutions Per Minute
Invention 2 <sup>nd</sup> Embodiment	17.9 Watts	81 rpm

Table 2 shows running the second embodiment of the subject invention at medium speed operations, with the Power Drawer is the instantaneous electric power requirement in Watts.

TABLE 2

<u>FAN (MEDIUM SPEED OPERATION)</u>		
	Power Draw	Revolutions Per Minute
Invention 2 <sup>nd</sup> Embodiment	38.6 Watts	135 rpm

Table 3 shows running the second embodiment of the subject invention at high speed operations, with the Power Drawer is the instantaneous electric power requirement in Watts.

TABLE 3

<u>FAN (HIGH SPEED OPERATION)</u>		
	Power Draw	Revolutions Per Minute
Invention 2 <sup>nd</sup> Embodiment	62.3 Watts	176 rpm

THIRD EMBODIMENT

FIG. 15A is a perspective view of a single fan blade **310** of a third embodiment **300** of invention showing the single fan blade **310** having an overall length **D3** between tip end **300TE** and root end **300RE** being approximately 23.5 inches, and various reference cross-sections(**300RS(4)**, **300RE**) being approximately 4.70 inches from one another

along air foil center line **300ACL**, and blade **310** having leading edge **300LE** and trailing edge **300TEDGE** oriented along the blade rotational plane RP. FIG. **15B** is an end view of the single fan blade **310** of FIG. **15A** representing degrees of twist between from the root end **300RE** to the tip end **300TE**, when the blade is positioned in a selected position on a ceiling fan motor assembly like those shown in the previous embodiments. The tip end **300TE** has an angle of approximately 4.71 degrees from a horizontal plane that is parallel to the ceiling. In other words, the angle would be approximately 4.71 degrees from a motor axis(MA). The root end **200RE** would have an angle of twist of approximately 30.76 degrees(4.71+26.05). The mid cross-sectional areas noted as **300RS** have varying degrees of twist between the tip end **300TE** and the root end **300RE**.

FIG. **15C** is cross-sectional view of the tip end **300TE** of the third embodiment **300** of FIGS. **15A–15B**. Referring to FIG. **15C**, tip end **300TE** has a width span of approximately 2.990 inches. The rounded leading edge **300TELE** has a diameter of approximately 0.052 inches being approximately 0.210 inches thick approximately 0.5 inches from the leading edge **300TELE**. The middle of tip end **300TE** has a thickness of approximately 0.049 inches(0.138–0.089), with a generally concave shaped elongated bottom section raised approximately 0.089 inches and upper surface being generally convex shaped. Rounded tip end trailing edge **300TETE** has a diameter of approximately 0.049 inches approximately 0.5 inches from rounded trailing edge **300TETE**.

FIG. **15D** is a cross-sectional view of the root end **300RE** of the third embodiment **300** of FIGS. **15A–15B**. Referring to FIG. **15D**, root end **300RE** has a width span of approximately 5.594 inches. The rounded leading edge **300RELE** has a diameter of approximately 0.086 inches being approximately 0.396 inches thick approximately 0.5 inches from leading edge **300RELE**. The middle of root end **300RE** has a thickness of approximately 0.268 inches(0.438–0.170), with a generally concave shaped elongated bottom section raised midway approximately 0.170 inches, and an upper surface being generally convex shaped. Rounded tip end trailing edge **300RETE** can have a blunt, and/or rounded tip with a thickness of approximately 0.068 inches approximately 0.5 inches from the trailing edge **300RETE**.

FIG. **16** is a top view of a ceiling fan blade **310** of the third embodiment **300** of FIGS. **15A–15D**, having a length **L3** of approximately 23.5 inches to approximately 24.5 inches between the root end **300RE** and the tip end **300TE**. FIG. **17** is a side view of the ceiling fan blade **310** of FIG. **16** along arrow **C1**. FIG. **18** is an end view of the ceiling fan blade **310** of FIG. **17** along arrow **C2**.

The subject invention allows for maximizing air flow for ceiling fans having wing spans of up to approximately 52 and approximately 54 inches, with the blades shaped to maximize downward air flow at RPMs of up to approximately 200RPM.

While the invention has been described, disclosed, illustrated and shown in various terms of certain embodiments or modifications which it has presumed in practice, the scope of the invention is not intended to be, nor should it be deemed to be, limited thereby and such other modifications or embodiments as may be suggested by the teachings herein are particularly reserved especially as they fall within the breadth and scope of the claims here appended.

We claim:

1. A ceiling fan blade for use in overhead ceiling fans, the blade comprising:

a tip end having a twist of approximately 5 degrees to approximately 10 degrees; and

a root end attached to a ceiling fan motor, wherein the positive twist provides increased air flow over other ceiling fan blades.

2. The ceiling fan blade of claim 1, wherein the twist on the tip end is:

approximately 6 to approximately 9 degrees.

3. The ceiling fan blade of claim 1, wherein the root end includes:

a twist of approximately 20 to approximately 35 degrees.

4. The ceiling fan blade of claim 1, wherein the root end includes:

a twist of approximately 25 to approximately 30 degrees.

5. The ceiling fan blade of claim 1, wherein the blade further includes:

means for operating the motor for rotating the blade up to approximately 200 revolutions per minute(rpm).

6. The ceiling fan blade of claim 1, wherein the blade includes:

a longitudinal length between the tip end and the root end, the tip end extending outward and facing away from the motor, the root end having a width being adjacent to the motor, the longitudinal length between the tip end and the root end being substantially greater than the width of the root end adjacent to the motor.

7. A ceiling fan system, comprising:

a first blade having a twist between a root end and a tip end;

a second blade having a twist between a root end and a tip end; and

a ceiling fan motor attached to the root ends of the first blade and the root end of the second blade for rotating the first blade and the second blade, wherein the first blade and the second blade provide increased airflow over other blades.

8. The ceiling fan system of claim 7, wherein the tip end of each of the first blade and the second blade include: a twist of approximately 5 to approximately 10 degrees.

9. The ceiling fan system of claim 8, wherein the root end of each of the first blade and the second blade include: a twist of approximately 20 to approximately 35 degrees.

10. The ceiling fan system of claim 8, wherein the root end of each of the first blade and the second blade include: a twist of approximately 25 to approximately 30 degrees.

11. The ceiling fan system of claim 7, wherein the tip end of each of the first blade and the second blade include: a twist of approximately 6 to approximately 9 degrees.

12. The ceiling fan system of claim 7, wherein the motor further includes:

means for rotating the first blade and the second blade up to approximately 200 revolutions per minute(rpm).

13. The ceiling fan system of claim 7, wherein the system includes:

a wingspan of up to approximately 52 inches.

14. The ceiling fan system of claim 7, wherein the system includes:

a wingspan of up to approximately 54 inches.

15. The ceiling fan system of claim 7, wherein each of the first blade and the second blade includes:

a longitudinal length between the tip end and the root end, the tip end facing outward and extending away from the motor, the root end having a width being adjacent to the motor, the longitudinal length between the tip end and the root end being substantially greater than the width of the root end adjacent to the motor.

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16. The ceiling fan system of claim 7, wherein the first blade twist and the second blade twist each include:
- a root twist portion adjacent to the root end of the blade;
  - and
  - a tip twist portion adjacent to the tip end of the blade, the root twist portion being greater than the tip twist portion.
17. A method of operating an overhead ceiling fan system, comprising the steps of:
- (a) rotating at least two fan blades attached to a ceiling fan motor at a speed of up to approximately 200 revolutions per minute(rpm); and
  - (b) generating a downward airflow of up to approximately 6500 CFM from the rotating blades, wherein the ceiling fan system enhances axial air flow.

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18. The method of claim 17, further comprising the step of:
- providing the blades and the attached ceiling fan motor with a wingspan of up to approximately 52 inches.
19. The method of claim 17, further comprising the step of:
- providing the blades and the attached ceiling fan motor with a wingspan of up to approximately 54 inches.
20. The method of claim 17, further comprising the step of:
- providing each of the at least two blades with a twist between a blade root end adjacent to the motor to a blade tip end facing outward and extending away from the motor.

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