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## (54) Title: CENTRIFUGAL CEILING FAN

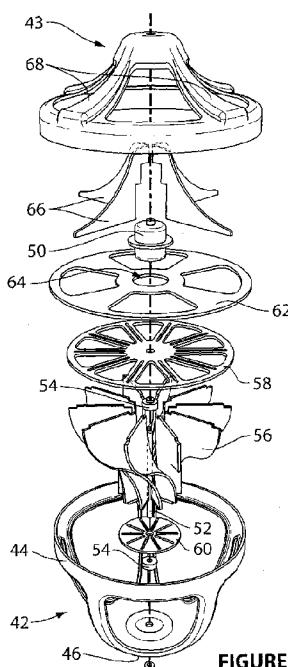


FIGURE 4

(57) **Abstract**: The present document describes a centrifugal ceiling fan. The fan comprises a casing, a motor and a centrifugal propeller. The casing comprises an upper surface comprising an air inlet and a lower surface comprising an air outlet. In an embodiment, the lower surface has a round bowl-like shape including a plurality of openings defining the air outlet. The propeller comprises a shaft and a plurality of blades provided around the shaft. The blades may be curved to push the air in all directions between a first direction substantially perpendicular to the rotation shaft and a second direction substantially parallel to the rotation shaft in order to evenly ventilate the room. The fan may include a heating element for heating the air as it exits from the fan.

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## CENTRIFUGAL CEILING FAN

### **CROSS-REFERENCE TO RELATED APPLICATIONS**

**[0001]** This application Claims priority from U.S. Provisional Application No. 61/257594 filed on November 2, 2009 which is incorporated herein by reference in its entirety.

### **BACKGROUND**

(a) Field

**[0002]** The subject matter disclosed generally relates to ceiling fans.

(b) Related Prior Art

**[0003]** Figure 1 illustrates a conventional axial ceiling fan 20. The ceiling fan 20 includes a plurality of paddles 22, a lamp 24, a motor 26 for turning the paddles 22, and attachment means 28 for attaching the ceiling fan 20 to the roof.

**[0004]** This type of fans has several problems. One of the problems is the uneven distribution of air throughout the room. The paddles are mounted vertically to the axis of rotation and push the air downward in the same direction as the axis of rotation. Therefore, the area outside the radius of the paddles remains unventilated. Other problems associated with axial fans include the space occupied by the paddles and the safety concerns due to the fact that the paddles are exposed as they rotate.

**[0005]** Several attempts have been made to address this problem. For example U.S. Patent Publication No. 2007/0247854 describes a ceiling fan in which the paddles are covered by a casing as shown in Figure 2. The solution described in this reference addresses only the safety concern. However, the space occupied is substantially the same or even greater than that of Figure 1, and the lack of even distribution of air remains the same.

**[0006]** One way for reducing the size of the fan, is to make the paddles shorter. Thus, to obtain the same ventilation results, the rotation speed has to be increased, which results in an increase in energy consumption and noise.

**[0007]** Other attempts to address these problems are described in U.S. 1,699,201; U.S.4,473,000; U.S. 4,768,424, U.S. 7,381,129 etc.. These references address one problem on the expense of the other.

**[0008]** Therefore, there is a need for a ventilation system which is efficient, safe to use, quiet, and provides even distribution of air throughout the room.

## **SUMMARY**

**[0009]** According to an embodiment, there is provided a centrifugal ceiling fan which comprises a centrifugal impeller instead of paddles for forced air current. This centrifugal impeller will be encased, thus eliminating any exterior rotating parts. This configuration will make the fan safer, considering that the paddles create a danger to any object nearing the device.

**[0010]** According to a first aspect, there is provided a centrifugal ceiling fan comprising: a casing comprising an upper surface comprising an air inlet and a lower surface comprising an air outlet, said lower surface comprising an upper section and a lower section and having a variable diameter between said upper and lower sections, said diameter being greater at the upper section than the lower section. The fan also comprises a centrifugal propeller comprising a rotation shaft and a plurality of blades provided around said shaft, said blades being curved to push the air in substantially all directions between a first direction substantially perpendicular to the rotation shaft and a second direction substantially parallel to the rotation shaft; and a motor operatively connected to said centrifugal propeller for rotating said centrifugal propeller; said motor and said centrifugal propeller being provided within said casing. Rotation of the centrifugal propeller causes air to be received from said air inlet and to be

pushed from said air outlet in substantially all directions between the first direction and the second direction.

**[0011]** In an embodiment, the blades have a variable width corresponding to the variable diameter.

**[0012]** In another embodiment, the lower surface has a bowl-like shape.

**[0013]** In a further embodiment the upper section and the lower section are connected by linking members. In yet a further embodiment, at least one of the linking members is provided with a heating element for heating the air. In another embodiment, at least one heating element is provided between two linking members for heating the air.

**[0014]** The casing may comprise an air regulator provided at an outer side of the casing. In this embodiment, the air regulator may comprise a plurality of rings having different diameters provided between the upper section and the lower section for directing the air. In one embodiment, the space between at least two rings is adjustable. In another embodiment, the angle of orientation of at least one ring is adjustable.

**[0015]** The upper surface may be provided as a lid and the upper section of the lower surface may include an opening for receiving said lid.

**[0016]** In an embodiment, the centrifugal propeller comprises an upper plate and a lower plate connected to the rotation shaft, said upper and lower plates having openings therein for receiving an upper edge and a lower edge of each blade, respectively. In this embodiment, the centrifugal fan may comprise a motor having a cylindrical shape and comprising a flange between a first and a second end thereof; a static plate which rests on an inner side of the casing above said upper plate, said static plate comprising an opening therein, said opening having a diameter which is greater than a diameter of said motor and smaller than a diameter of said flange; wherein the motor is supported by said

static plate using said flange and a portion of said motor below said flange passes through said opening for connection to the centrifugal propeller.

**[0017]** In an embodiment, a plurality of spacers are provided between the motor and the portion of said motor above the flange for maintaining said motor in position.

**[0018]** In a further embodiment, direction of air is substantially perpendicular to the rotation shaft in proximity of the upper section, and substantially parallel to the rotation shaft in proximity of the lower section.

**[0019]** In another aspect, there is provided a centrifugal ceiling fan comprising: a casing comprising an upper surface comprising an air inlet and a lower surface comprising an air outlet; a centrifugal propeller operatively connected to a motor for generating an air current, said propeller and said motor being provided within said casing; and an air regulator provided at an outer side of said casing for directing said air current.

**[0020]** In an embodiment, the air regulator comprises a plurality of rings which are spaced apart from and placed one over the other between an upper section and a lower section of the lower surface.

**[0021]** In an embodiment, a space between at least two of the rings is adjustable. In another embodiment, an orientation of at least one of the rings is adjustable.

**[0022]** Features and advantages of the subject matter hereof will become more apparent in light of the following detailed description of selected embodiments, as illustrated in the accompanying figures. As will be realized, the subject matter disclosed and claimed is capable of modifications in various respects, all without departing from the scope of the claims. Accordingly, the drawings and the description are to be regarded as illustrative in nature, and not as restrictive and the full scope of the subject matter is set forth in the claims.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0023] Further features and advantages of the present disclosure will become apparent from the following detailed description, taken in combination with the appended drawings, in which:

[0024] Figure 1 illustrates a conventional axial ceiling fan;

[0025] Figure 2 illustrates a conventional axial ceiling fan with a casing;

[0026] Figure 3 illustrates a centrifugal ceiling fan in accordance with an embodiment;

[0027] Figure 4 is an exemplary exploded view of the centrifugal ceiling fan illustrated in Figure 3;

[0028] Figure 5 illustrates examples of how the blades of the ceiling fan may be curved, in accordance with an embodiment;

[0029] Figure 6 illustrates an example of the even flow of air through the ceiling fan illustrated in Figure 3;

[0030] Figure 7 illustrates a ceiling fan including an air regulator, in accordance with an embodiment;

[0031] Figure 8 illustrates a centrifugal ceiling fan including a plurality of rivets, in accordance with an embodiment; and

[0032] Figure 9 illustrates an impeller in the form of a hamster wheel, in accordance with an embodiment.

[0033] It will be noted that throughout the appended drawings, like features are identified by like reference numerals.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[0034] In embodiments there is disclosed a centrifugal ceiling fan. The fan comprises a casing, a motor and a centrifugal propeller. The casing comprises an upper surface comprising an air inlet and a lower surface comprising an air

outlet. In an embodiment, the lower surface has a round bowl-like shape including a plurality of openings defining the air outlet. The propeller comprises a shaft and a plurality of blades provided around the shaft. The blades may be curved to push the air in all directions between a first direction substantially perpendicular to the rotation shaft and a second direction substantially parallel to the rotation shaft in order to evenly ventilate the room. The fan may include a heating element for heating the air as it exits from the fan.

**[0035]** Referring now to the drawings, Figure 3 illustrates an example of a centrifugal ceiling fan in accordance with an embodiment. As shown in Figure 3, the centrifugal ceiling fan 40 includes a casing. In an embodiment, the casing has a round shape and comprises a lower bowl-like portion 42 comprising an air outlet, and an upper portion 43 defining a lid and comprising an air inlet. The lower portion 42 comprises an upper section 44, and a lower section 46. The lower portion has a variable diameter whereby, the diameter is larger at the upper section 44 than at the lower section 46. The upper and lower sections are connected by a plurality of linking members 48. The linking members 48 are spaced apart to define openings therebetween. The openings may extend between the upper section 44 and the lower section 46.

**[0036]** The centrifugal ceiling fan 40 comprises a centrifugal impeller 52, and an electric motor 50 (Shown in Figure 4) for rotating the impeller 52. The ceiling fan 40 may be attached to the ceiling using known attachment means through the upper end of the lid 43. Clasps or equivalent fastening means may be used for attachment of the entire apparatus to an electrical ceiling box.

**[0037]** Figure 4 is an exemplary exploded view of the centrifugal ceiling fan illustrated in Figure 3. As shown in Figure 4, the impeller 52 comprises a rotation shaft 52 connected between two nuts 54, and a plurality of blades 56 provided angularly around the rotation shaft 52 between an upper plate 58 and a lower plate 60. In an embodiment, the upper and lower plates 58 and 60 include

a plurality of openings for receiving the upper and lower ends of the blades, respectively.

**[0038]** In the present embodiment, the electric motor 50 has a cylindrical shape and includes a flange between the two ends thereof. A static plate 62 is provided between the upper plate 58 and the lid 43 for supporting the motor 50. The static plate 62 rests on the inner side of the casing and includes an opening 64 having a diameter which is slightly greater than the diameter of the motor and smaller than the diameter of the flange for receiving the portion of the motor which is under the flange. In an embodiment, a plurality of spacers 66 is provided between the lid 43 and the plate 62 for holding the motor 50 in place within the casing. As shown in Figure 4, the spacers 66 are dimensioned to receive the upper portion of the motor above the flange. It should be noted that, while advantageous, the provision of the spacers 66 is optional because the lid itself 43 may be shaped to maintain the motor 50 in place.

**[0039]** As shown in Figure 4, the upper section 44 of the casing 40 defines an opening for receiving the lid 43. The lid 43 includes a plurality of ribs 68 connected between the upper surface and the lower surface thereof. The ribs 68 are spaced apart to define openings therebetween. The upper plate 58 and the static plate 62 also include a plurality of cutouts, as shown in Figure 4 for letting the air pass therethrough.

**[0040]** In order to evenly ventilate the room through the air outlet, the blades may be curved to push the air in substantially all directions between a first direction substantially perpendicular to the rotation shaft and a second direction substantially parallel to the rotation shaft, as shown in Figure 6. An example of how the blades may be curved is shown in Figure 5. The blades may have a variable width to fit within the casing. In this case, the width may be larger at the upper edge of the blades than at the lower edge. In an embodiment, the width of the blades corresponds to the diameter of the casing.

**[0041]** During operation, the motor 50 rotates the centrifugal impeller 52. Air is received from the inlet provided in the lid to be directed in all directions between a first direction substantially perpendicular to the rotation shaft and a second direction substantially parallel to the rotation shaft so as to evenly ventilate the room. Figure 6 illustrates an example of the even flow of air through the ceiling fan illustrated in Figure 3. As shown in Figure 6, air is received from the openings provided in the lid 43 through the plate 62, the upper plate 58, and then pushed throughout the room in all directions. The shape of the lower portion 42 which defines the air outlet, and the shape of the blades 56 together allow for an even air distribution of the air throughout the room, as shown in Figure 6.

**[0042]** In an embodiment, a heating element is provided in the ceiling fan 40 for selectively using the ceiling fan for cooling/heating. The heating element may be placed between the impeller and the casing, thereby allowing the current that exits the casing to be heated. This will have the effect of reducing heating costs, making the centrifugal ceiling fan 40 economical. In an embodiment, the heating element may be provided on the linking members 48. In another embodiment, the heating element may be provided between the linking members or may be provided as a screen at one or more of the openings through which the air exits from the fan 40.

**[0043]** The motor 50 and the heating element are powered by an electric current. The motor 50 and the heating element may operate on different types of currents and voltages. Provision of electric power to the motor and the heating element may be performed using well-known techniques.

**[0044]** The motor 50 may have various speed settings to suit different rooms and meet current needs or desires within a given room. Similarly, the heating element may have various heating settings that suit different rooms and heating needs. Both the motor 50 and the heating element may be controlled remotely from a control panel and/or a remote control which are available on the market.

**[0045]** A variety of the elements described herein e.g. motor, control panel, remote control are available on the market and may be chosen for the purposes described herein, as would be appreciated by a person of skill in the art.

**[0046]** In another embodiment, the fan may include an air regulator for directing the air current to its desired destination. Figure 7 illustrates a ceiling fan including an air regulator, in accordance with an embodiment. The air regulator comprises a series of rings 70. The rings 70 are apart from and placed one over the other. These rings 70 are of different radius, the largest ring being the one closest to the upper section 44 and the smallest being the one closer the lower section 46. The rings are angled differently to direct the air in the different directions. In an embodiment, the distance between the rings and/or the angle of each ring may be adjusted by the user manually and/or remotely in accordance with the user's needs, seating area, and/or dimensions of the room. For example when the ceiling is higher than the average, the angle of the rings is diminished so that the air is pushed downward toward the living area rather than perpendicularly toward the walls.

**[0047]** Figure 8 illustrates a centrifugal ceiling fan 80 including a plurality of rivets 82 around the casing, in accordance with an embodiment. These rivets 82 may be a quarter inch apart, which is enough spacing so as not to create any resistance for the egression of the air current. The impeller directs the air to the desired destination, as described earlier. The centrifugal fan 80 may be aesthetically designed for customer satisfaction. In an embodiment, the rivets may include a heating element for heating the air as it exits from the casing.

**[0048]** Figure 9 illustrates an impeller in the form of a hamster wheel, in accordance with an embodiment. In one embodiment, the direction of the current will be determined by the design of the casing and/or the previously described air regulator shown in Figure 7. In another embodiment, (not shown) the blades of

the hamster wheel may be curved to push the air in multiple directions as in the embodiment of Figures 3 to 5.

**[0049]** In any one of the above embodiments, the fan may include lighting to allow for simultaneous ventilation and lighting. The lighting is preferably provided at the lower section of the casing.

**[0050]** While preferred embodiments have been described above and illustrated in the accompanying drawings, it will be evident to those skilled in the art that modifications may be made without departing from this disclosure. Such modifications are considered as possible variants comprised in the scope of the disclosure.

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**CLAIMS:**

1. A centrifugal ceiling fan comprising:
  - a casing comprising an upper surface comprising an air inlet and a lower surface comprising an air outlet, said lower surface comprising an upper section in proximity of the upper surface and a lower section opposite the upper section;
  - a centrifugal propeller comprising a rotation shaft and a plurality of blades provided around said rotation shaft;
  - a motor operatively connected to said centrifugal propeller for rotating said centrifugal propeller;

wherein the blades are curved and have a width that varies along a direction of the rotation shaft, and wherein rotation of the centrifugal propeller causes air to be received from said air inlet and to be pushed from said air outlet in substantially all directions between a first direction substantially perpendicular to the rotation shaft and a second direction substantially parallel to the rotation shaft.
2. The centrifugal ceiling fan of claim 1, wherein the width of the blades diminishes toward the lower section of the lower surface.
3. The centrifugal ceiling fan of claim 1, wherein direction of the air is substantially perpendicular to the rotation shaft in proximity of the upper section, and substantially parallel to the rotation shaft in proximity of the lower section.
4. The centrifugal ceiling fan of claim 1, further comprising a heating element for heating the air pushed out of the casing.
5. The centrifugal ceiling fan of claim 4, wherein the heating element is provided within the casing.
6. The centrifugal ceiling fan of claim 1, further comprising an air regulator for directing the air to a desired location.

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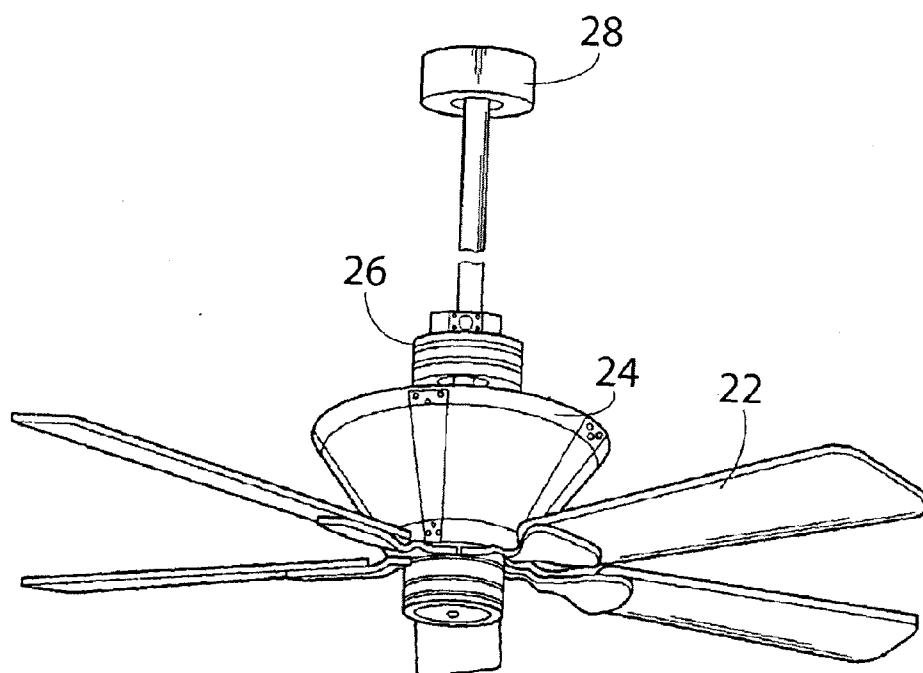
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7. The centrifugal ceiling fan of claim 6, wherein an angle of orientation of the air regulator with respect to the casing is adjustable.
8. The centrifugal ceiling fan of claim 1, wherein the air outlet comprises a plurality of openings separated by linking members.
9. The centrifugal ceiling fan of claim 1, wherein said motor and said centrifugal propeller are provided within said casing.
10. The centrifugal ceiling fan of claim 1, wherein the upper surface defines a lid and the upper section of the lower surface defines an opening for receiving said lid.
11. The centrifugal ceiling fan of claim 1, wherein the centrifugal propeller comprises openings for receiving the blades.
12. The centrifugal ceiling fan of claim 1, wherein the motor has a cylindrical shape and comprises a flange between a first and a second end thereof; the fan further comprising a static plate, said static plate comprising an opening therein, said opening having a diameter which is greater than a diameter of said motor and smaller than a diameter of said flange; wherein the motor is supported by said static plate using said flange and a portion of said motor below said flange passes through said opening for connection to the centrifugal propeller.
13. The centrifugal ceiling fan of claim 4, wherein the heating element is provided within the fan between the centrifugal propeller and the casing.

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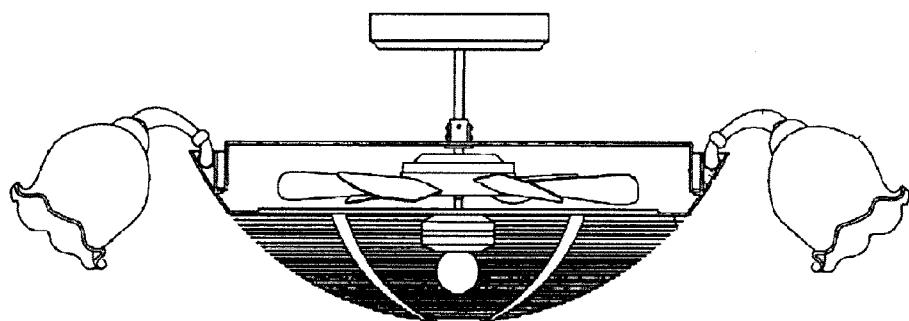
14. The centrifugal ceiling fan of claim 4, wherein the heating element is provided at one of the openings defining the air outlet.
15. A centrifugal ceiling fan comprising:
  - a casing comprising an upper surface comprising an air inlet and a lower surface comprising an air outlet;
  - a centrifugal propeller operatively connected to a motor for generating an air current, said propeller and said motor being provided within said casing; and
  - an air regulator provided at an outer side of said casing for directing said air current;wherein the centrifugal propeller comprises a plurality of blades, said blades being curved and have a width that varies along a direction of the rotation shaft such that the blades become narrower toward a lower end of the casing opposite the air inlet, and wherein rotation of the blades causes air to be received from said air inlet and to be pushed from said air outlet in substantially all directions between a first direction substantially perpendicular to the rotation shaft and a second direction substantially parallel to the rotation shaft.



**FIGURE 1**

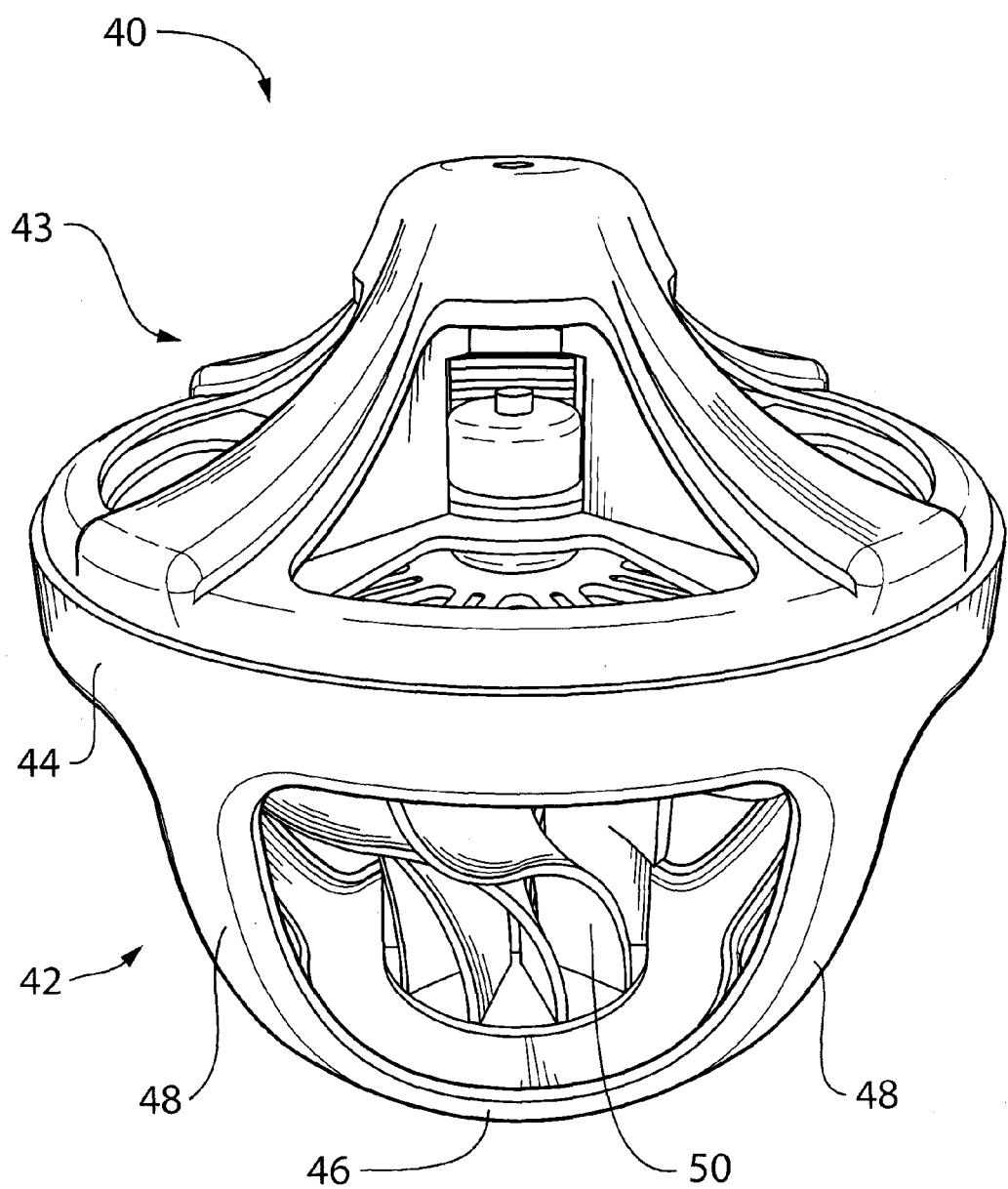
**PRIOR ART**

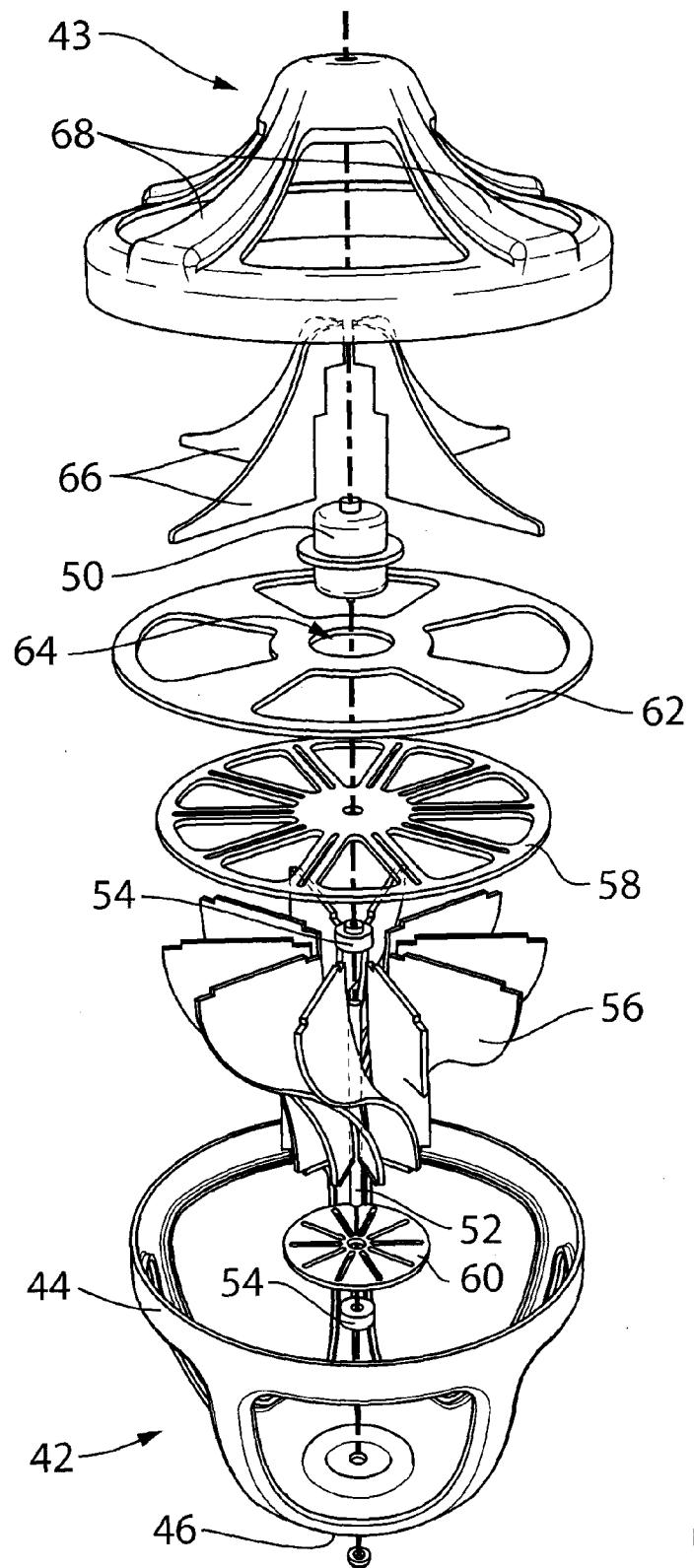
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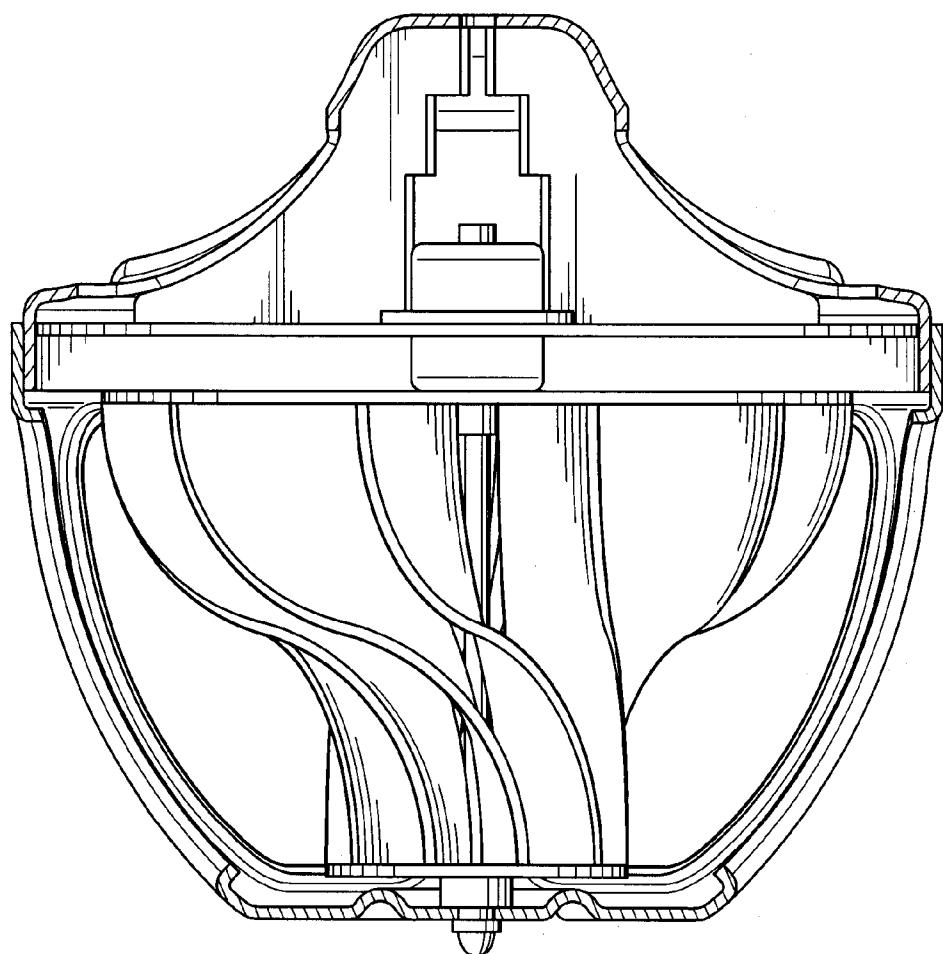


**FIGURE 2**

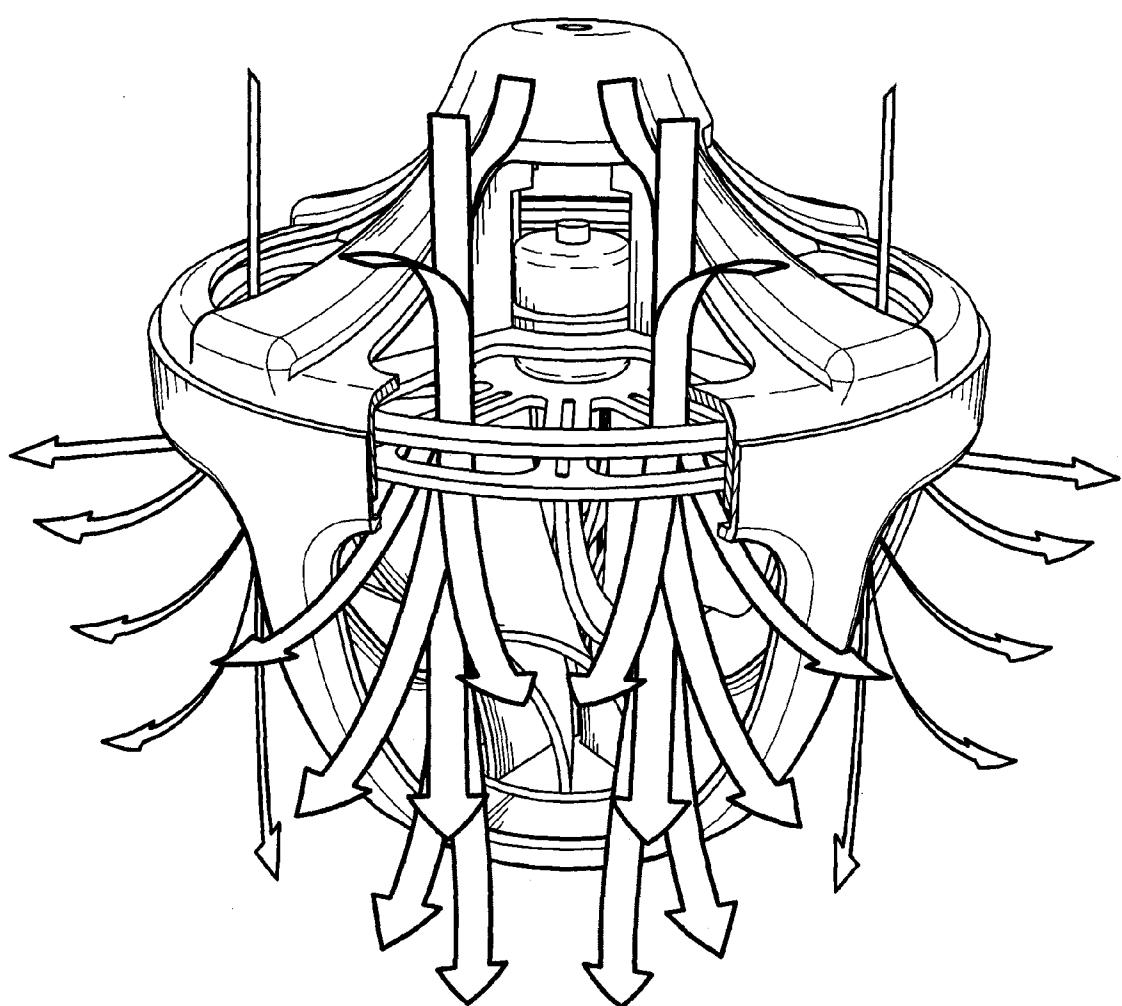
**PRIOR ART**

**FIGURE 3**

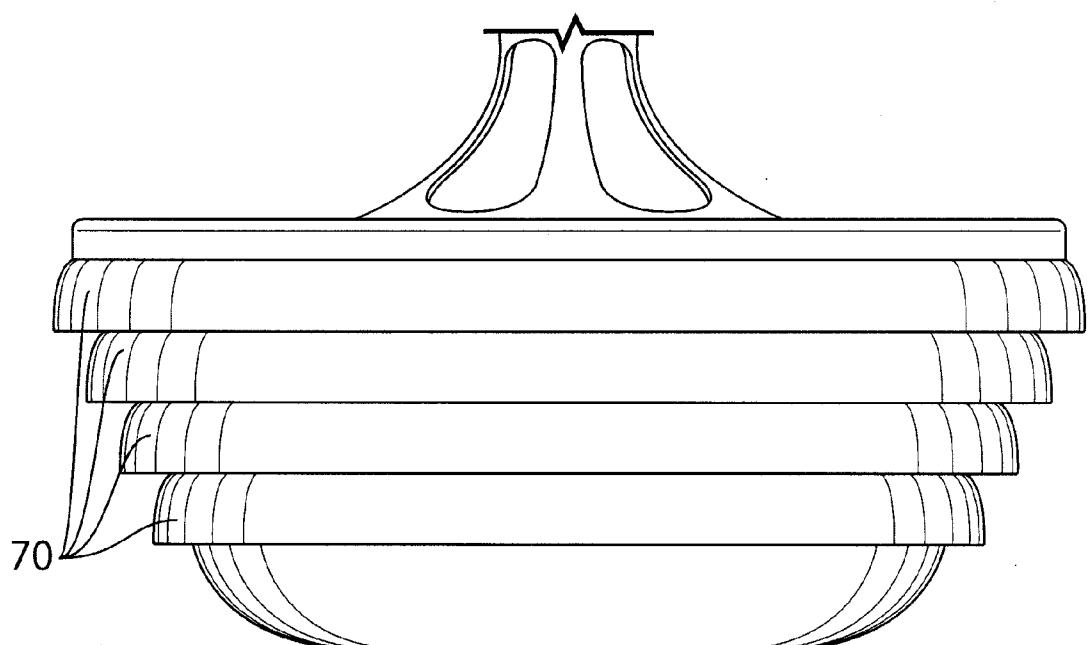
**FIGURE 4**



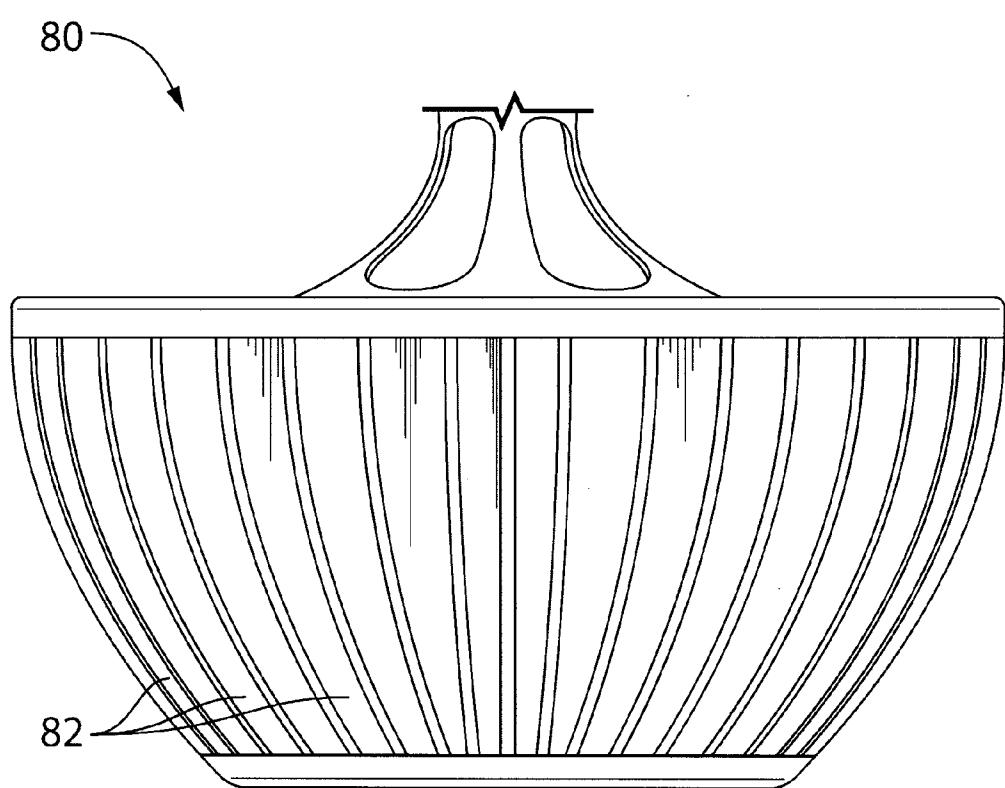
**FIGURE 5**



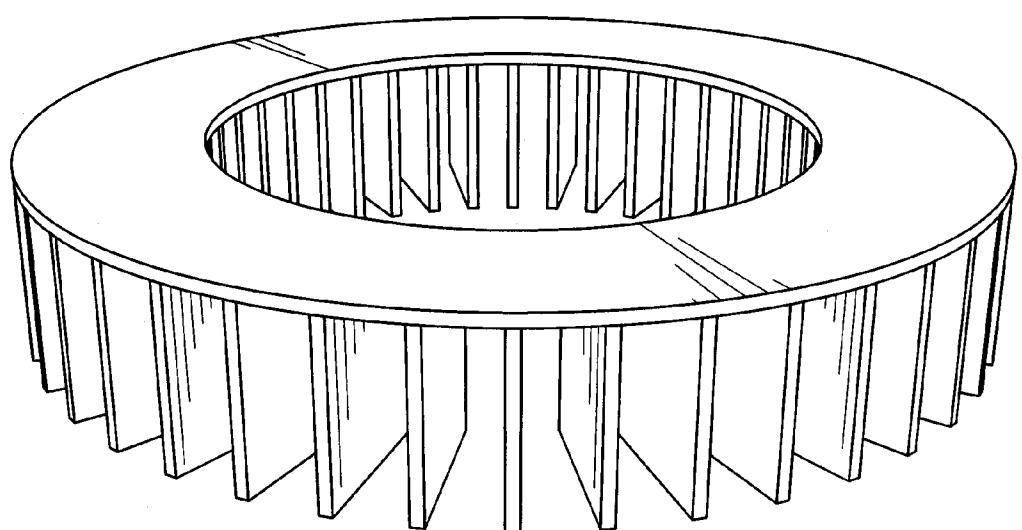
**FIGURE 6**



**FIGURE 7**



**FIGURE 8**



**FIGURE 9**