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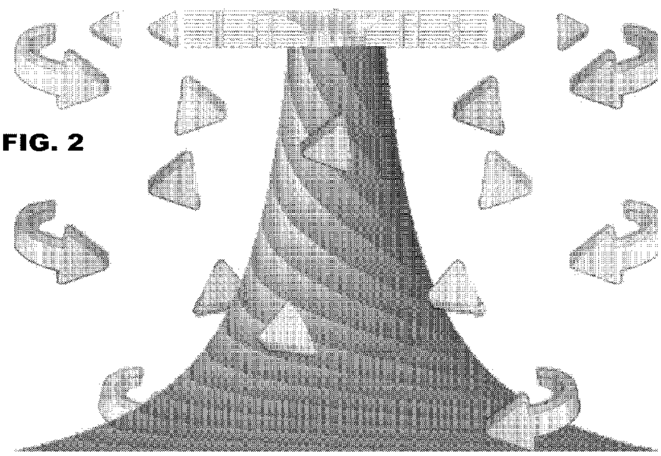

FIG. 2

(57) Abstract: The prior art has used pitched blades attached to a stationary motor, normally electric, to move air within the confines of a structure or room. The preferred invention incorporates a series of solid discs. The discs are affixed to a stationary electric motor and thus rotate around a central axis. The discs are equally spaced and centrally perforated in a manner that will allow air to flow in high volumes through the perforations and pass along the discs thus exiting symmetrically between each disc perpendicularly to the flow of air that is at its entrance. Due to the less restrictive or low pressure air entrance as well as the correct vertical disc spacing a corresponding increase in the laminar flow is realized. This feature of the preferred invention allows for operation at a rotational speed that practical for use as a ceiling fan.

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LAMINAR FLOW RADIAL CEILING FAN

BACKGROUND OF THE INVENTION

[0001] The invention disclosed herein maintains a level of human comfort within a dwelling by employing the forced movement of air. When temperatures are warm, this artificial breeze aids in a feeling cooler as the breeze passes over one's body.

[0002] A preferred embodiment of the invention is a ceiling fan. The job on any fan is to convert the motion of the fan, typically the motion of flat pitched blades, into movement of air. The prior art employs blades rotated by motor which causes the movement of air to create an artificial breeze.

[0003] Since the middle of the 20^{th} Century systems such as central air-conditioning were incorporated in dwellings, to control the internal temperature of homes during summer months. Those systems added heating elements to have a singular central system for the home owner. However, limitations in the distribution of the heat or cold produced by these systems have demonstrated that an uneven distribution within a room or enclosed area of a structure lends itself to the addition of a ceiling fan to supplement the circulation of air within those confines for the comfort of the user.

[0004] As stated the deficiencies that are part of the heating and or cooling system have been partially addressed by the use of a ceiling fan that obviously increases the movement of air within the confines of a room, the normal operating state of the ceiling fan is for its operation to be continuous. This continuous operation occurs while the heating/cooling system is cycled from operating to its off state.

[0005] Another benefit of the prior art bladed ceiling fan is a overall reduction in energy consumption caused by the ability to alter the set temperature of the heating/cooling system to reduce its time of operation yet provide the user the level of comfort with a lower duty cycle of the centralized heating/cooling system.

[0006] The known physical property of air lends itself to the supplemental aid of a ceiling fan. To be specific, the fact that cooler air that has a greater density will seek a level lower with warmer air rising. The fan of the prior art will drive down the warmer air at the ceiling level in an attempt to create a higher state of movement within the confines of a room thus an attempt to equalize the distribution of the cool air when the cooling air source system is in use. Most ceiling fans of the prior art incorporate an ability to reverse the flow of air by reversing the direction of rotation of the fan blades. The purpose of the reverse flow is to enhance the distribution of warm air when the central heating feature of the heating/cooling system is being used, during the winter months. During the reverse flow of operation the warmer air at the ceiling is circulated across the ceiling and the desired results is for this movement to create a circulation that distributes the room air with greater equality.

[0007] Important to note is that all of the ceiling fans of the prior art attempt to gain the improvements in comfort to the user by moving air parallel to the vertical surfaces of the room and thus perpendicular to the horizontal surfaces of the room. Thus the motion of the air circulation of the prior art is limited to a single column of forced air commonly found at the center of the room, or for lager rooms multiple fans are affixed to the ceiling. For the sake of clarity, we describe a preferred embodiment, a single unit mounted in the center of an average room in a typical single family dwelling.

[0008] As previously stated the pitched blade ceiling fan of the prior art forces a singular vertical column of air from the ceiling downward to the floor.

[0009] The prior art uses the movement of the single vertical column of air to strike one of the horizontal surfaces of the room thus requiring an abrupt 90 degree turn of that column of air. This, in turn creates inefficient turbulent air flow. Accordingly, the prior art is deficient in attempting to efficiently circulate the air and equalize or homogenize the natural hot and cold layers.

[0010] There is an alternative fan design. In its most basic set up, it consists of two flat parallel discs. The discs rotate which will rotate the air mass trapped between the discs. Centrifugal force acts on the air mass and expels it outward beyond the edges of the discs and into the surrounding air space. If the discs have some sort of pathway to allow new air to take the place of the expelled air then the rotating discs will circulate the air. Thus, rotating discs can circulate the air without the need of traditional fan blades.

[0011] The prior art has recognized this structure as a “Tesla turbine,” a “Prandtl layer turbine” or a “disc-type” turbine. This design has been considered useful only in the context of water turbines or high pressure air applications such as in vacuum cleaner motors or jet engine turbines.

[0012] The Tesla turbine was considered impractical in the context of a room fan because at the standard air pressure of one atmosphere, it was thought, a Tesla turbine simply could not move a sufficient volume of air without being impractically bulky. The device would have required far too many discs, each disc being far too large and the discs would have to rotate at too high an RPM to be practical.

[0013] Surprisingly, the current inventors have found a practical design for a disc type fan operable at standard atmospheric pressures. Indeed, as will be seen by one skilled in the art the disclosed invention the disc type fan is not only practical, but it improves on prior art fan systems.

OBJECTS OF THE INVENTION

[0014] The following disclosure of invention "objects" is meant to describe examples, or preferred embodiments, to be used in comparing and contrasting the invention with the prior art. This disclosure is not, however, intended to limit the claimed invention in any way.

[0015] It is therefore a general object of the invention to provide a ceiling fan apparatus that will meet the objectives and minimize limitations of the type previously described.

[0016] It is a specific object of the invention to provide a ceiling fan that is forcing its output laterally to its plane of rotation at an increased laminar flow.

[0017] It is another specific object of the invention to provide complete circulation and mixing of air of different temperatures when used within the confines of a room.

[0018] It is another specific object of the invention to disperse its high volume of laminar flow air displacement in all directions (360°) parallel to its plane of rotation.

[0019] It is another object of the invention to have the air entering the ceiling fan to be unobstructed.

[0020] It is another object of the invention to have the output laminar flow air expelled without buffeting caused by the unobstructed input air.

BRIEF SUMMARY OF A PREFERED EMBODYMENT OF THE INVENTION

[0021] In order to provide a solution to the deficiencies of the prior art, a preferred embodiment of the present invention provides a laminar flow radial ceiling fan, comprised of multiple disc(s) stacked about equally and having radial symmetry around a central axis. The fan operates by rotating the discs about the central axis. The rotating disc(s) are manufactured in a fashion that allows unobstructed air to enter from a central opening in the disc(s) and then exit in all directions via equal spaces between the array of disc(s) at a high volume of laminar flow, this unique air flow within the room eliminates any dead air when the preferred invention is in use. Prior art attempts to obtain increased laminar flow at useful rotational speeds customary to ceiling fans failed due to the relativity small input aperture.

[0022] Additionally the preferred invention improves upon the motion of air movement as a result of the relative low pressure wide input aperture. As air returns to the fan it does so as an inverse expanding cone of rotation. This conical shaped return air has its origin at the lowest point within the room (the floor) with its base expanding to the vertical boundaries of the room (the walls). The apex of this conical return air is the base of the fan at the input opening itself.

THE DRAWINGS

[0023] Objects and advantages of the present invention will become apparent from the following detailed description of embodiments taken in conjunction with the accompanying drawings, wherein:

[0024] Figure 1 illustrates a preferred airflow pattern for the air leaving the fan.

[0025] Figure 2 shows a preferred airflow pattern highlighting the air return, a conical return pattern.

[0026] Figure 3 shows the completed view of a preferred embodiment including the unique air flow paths exiting the fan and entering the fan.

[0027] Figure 4 shows an exploded view of the preferred invention.

[0028] Figure 5 is a top view of a single slave disc of the preferred invention.

[0029] Figure 6 is the cross section view of two vertical spacers illustrating the mating cavity.

[0030] Figures 7A-D show various views of an aerodynamic vane, a design variation which further promotes laminar air flow.

[0031] Figure 8 is the top, or master, drive disc of a preferred embodiment which includes a motor attachment and a smooth conical shape to promote laminar air flow.

[0032] Figure 9 is a top view of the attachment retention ring of a preferred embodiment.

[0033] Figure 10 is a cross-section of the bolt receiving cylinder which is mounted on the attachment retention ring of Figure 9.

DETAILED DESCRIPTION

[0034] One improvement over the prior art is more efficient air circulation. Due to the plurality of discs, their specific size, shape and relative positioning, the fan generates, in a preferred embodiment, a laminar air circulation pattern that efficiently circulates air throughout a standard room. For example, when the fan is located in the center of the ceiling, the air exits the rotating discs horizontally across the ceiling, spreading out uniformly in all directions toward the walls of the room as shown in Figure 1. At the walls, the air travels downward, parallel with the walls where the air flow turns inward along the floor and travels back toward the room center, see again Figure 1. Next, the air rotates upward in an inverse cyclonic pattern toward an air return aperture located in the bottom of the fan as show in Figure 2. Finally, the air enters the fan, through the air return aperture, and thus completing the circulation pattern.

[0035] This air circulation is the result of empirical experimentation in various functional fan designs, each of which combine various features of the fan, in particular, the disc dimensions, the disc number and the disc relative positioning.

[0036] These air patterns result from the fan illustrated in Figure 3 which is a built up laminar flow ceiling fan also shown in exploded view in Figure 4 below. The horizontal arrows **407** show the air exiting the fan beyond the edges of the slave discs **401**. The returning air **406** is shown entering the fan through a central air return aperture, see also Figure 5 **103**. As the air enters the fan it is smoothly directed outward by the conically shaped portion **408** of the master drive disc described in more detail in Figure 8 below. This novel feature, directing an air current into and out of a fan without significantly disrupting the laminar flow of that air current is an unique property utterly absent from the prior art.

[0037] The Figure 3 embodiment comprises one master, or drive, disc **405** mounted above an array of eight (8) slave discs **401** below. The through bolts **402** attaching the master disc to the slave discs are threaded through vertical spaces **403** that keep the slave discs **401** parallel and spaced apart a predetermined distance. The master disc also features a smooth invented cone shape that directs air entering through the air entry path **406** to the laminar flow output **407** shown at the side of the array.

[0038] Figure 4 is an exploded view of the complete fan. The electric motor is **501**. Through bolts **502** travel through the entire array, binding the entire slave disc array to the master drive disc **503**, and terminate at the attachment and retention ring **504**. The base air guide **505** covers the motor mounting screw assembly **506** during fan operation but can be removed during fan assembly and servicing. This assembly connects the motor **501** to the master drive disc **503**.

[0039] The completed slave disc array **507** and master drive disc **503** are shown assembled and affixed to the stationary drive motor **501** by affixing five (5) machine screws through the master drive disc motor mounting screw holes **506** completing the construction of the preferred invention. The motor **501** rotates the entire master drive disc and slave disc array **503** and **507** respectively.

[0040] Figure 5 is a top view of a single slave disc **101** of a preferred embodiment. Each slave disc is preferably injection molded from raw plastic and manufactured identically with a circular opening. An air entry cavity **103** is present in the center of each disc. Each disc in the fan will have this cavity. When the discs are stacked together as shown in Figure 3, the air entry cavities will create an air return aperture into which air will flow **406** as will be explained more fully below.

[0041] The slave disc **101** is preferably manufactured via plastic injection molding so as to create smooth surfaces on both sides. A smooth surface is a preferred surface for promoting laminar flow on a rotating disc(s) **101**. Of course any surface designed to promote laminar flow will function in the invention. This is particularly true in high end designs were advanced aeronautical engineering can be employed.

[0042] The diameter of the air entry cavity **103** is derived with the following equations. The disc inner diameter (ID) is a function of the surface area (A) of a single disc as follows:

$$ID = \sqrt{A}$$

The outer diameter (OD) of the slave disc **105** is determined as follows:

$$OD \cong 1.5 \times ID$$

or, more precisely:

$$OD = \sqrt{\frac{4+\pi}{\pi}} \times ID$$

Of course, some variation in the exact ID:OD ratio of is allowable. Indeed, under specific conditions (room size, atmospheric pressure) some testing can be carried out and variations of 2, 5, 10 and up to 15 percent could be necessary to achieve optimal performance.

[0043] In a preferred embodiment, the surface area (A) is about 500 sq. inches, the outer diameter (OD) is about 34 inches and the inner diameter (ID) is about 23 inches.

[0044] An optimal number discs in the array **301**been determined. The fan works more efficiently as one increases the number of slave discs from one (1) to eight (8). (Note, if one includes the master disc then this range is two (2) to nine (9).) In the preferred embodiment, there is a marginal, but significant increase in efficiency as one increases the discs in the array from seven (7) to eight (8). Surprisingly, eight appears to be an upper limit as no increase in efficiency is observed when one increases the number beyond eight.

[0045] Item **102** depicts an integral spacer with a vertical cylindrical or aerodynamic shape. The space between discs, the vertical dimension (V), is a function of the disc outer diameter (OD) and inner diameter (ID) as follows:

$$V = (OD - ID) \times 0.0625$$

In a preferred embodiment, the vertical dimension (V) is 0.75 inches.

[0046] While the preceding formula provides a useful solution for designing an embodiment of the claimed invention, there is of course, an allowable variance in the vertical dimension, but it is surprisingly small. We estimate that laminar flow will persist as one increases the vertical distance by about 10 percent but will have ceased after the vertical distance is increased by 100 percent. Of course, for high end uses one can determine the maximum vertical dimension limit for a particular embodiment by brute force experimentation. One simply builds various fans with different vertical dimensions until one finds the optimal distance for which laminar flow predominates over turbulent flow and maximizing the air volume moved.

[0047] Figure 6 is a vertical cross section of the spacers. A set of spacers are distributed around the slave disc in a uniform circular pattern at a distance that is, in a preferred embodiment, one third (1/3) of the distance from the ID of the disc to the OD of the disc. In a preferred embodiment, a total of 10 integral vertical spacers are molded along the arc signified by the dashed line **104** in Figure 5 and dispersed equally as described above.

[0048] Figure 6 illustrates a preferred design allowing for vertical stacking of the spacers. As described above, the spacer(s) **102** provide for uniform vertical separation by and between each disc in the slave disc array **401**and feature a center hole **102a** that allows the through bolt **402**, **502** to pass through the disc array. In addition the integral spacer has a mating attachment and alignment cavity **101b** that conforms to and accepts the vertical spacer counterpart **102b** that will result in the next successive disc to rest on the shoulder **103b** of the vertical spacer.

[0049] Figures 7A-D illustrate laminar airfoil vane which can, optionally, be connected in the vertical spacers of Figure 6. Figure 7A is an axonometric view. Figure 7B is a top view. Figure 7C is a front view and Figure 7D is a right side view. The height **703** of each vane **701** is less than that of the vertical spacer to which the vane is mounted and the diameter of the mounting hole **702** is slightly larger than the outer diameter of the vertical spacer. Taken together, these features allow the vane to rotate freely. The entire vane can change its angle of attack to align with the incoming laminar air movement which can vary from time to time due to changes in air speed, charges in motor RPM etc. These vanes **701** augment the output air speed due to the centrifugal force of a vertical vane rotating and placed in the path of the incoming laminar flow air. The effect is similar to that that of taking a flat piece of cardboard and waving it in front of one's face to create a cooling breeze.

[0050] The vane as illustrated is a preferred embodiment and may take on differed shapes depending on the type of laminar airfoil desired. The vanes can also be made stationary if so desired.

[0051] Figure 8 is a depiction of the top master drive disc **301** which provides the attachment base for the slave disc(s) array **401** and the drive motor through motor mounting holes **303**. The master disc **301** is preferably molded as a single piece. The master drive disc **301,** in axonometric view, shows the bolt through holes **302** that allow the bolt to pass through and connect to attachment retention ring **201**. Note that the alignment cavity **304** pattern identical to that of Figures 5 and 9 so that the through bolts and the vertical spacers **102** can pass from the upper most disc through the array to the retention ring on the bottom of the fan. Note again that the master drive disc has a conical conformal air guide **305** that aids the entry of air as well as increasing the laminar flow by providing an unobstructed air passage into and out of the rotating disc array.

[0052] Figures 9 and 10 illustrate the retention ring and retention ring bolts, respectively. The attachment retention ring 201 is shown in top view. The purpose of the retention ring is to receive the bolts that pass through the master drive disc **301**, see Fig. 8, and each slave disc **101** in the disc array. Figure 10 shows an alignment and retention ring bolt receiving cylinder **201a, 202a** designed to recess into the bottom slave disc **101** and is formed to accept the threaded bolt through a central hole **102a**, of the bolt receiving cylinder. These retention bolts are distributed in a pattern that will match the that of the integral vertical spacers **201**. This pattern is depicted by the dashed line **203**. The bolt receiving cylinder **201a** is conformal to the alignment cavity **101b** at the bottom of the bolt. The attachment retention ring **201** is affixed to the bottom disc of the array **401** so that its top surface is flush to the bottom most disc.

[0053] The preferred invention as a unit will have the number of discs as described by the aforementioned equation. The operational rotational speed of the preferred invention is within the normal range for a conventional ceiling fan. The motor **501** is designed to accommodate various speeds depending on the user's desired rate of laminar flow air. The formula below can be used to describe the force of the airflow. This is defined as the difference in pressure generated by the air exiting the fan over the surrounding air pressure, (P2 – P1).

$$P2 - P1 = \frac{(fluid\ density \times angular\ velocity^2)}{2(R2^2 - R1^2)}$$

where the “fluid density” is the standard air density and R2 and R1 are the distances to the disc outer edge and inner edge, respectively, as measured from the disc center of rotation.

[0054] As described above, the air flow patterns of prior art fans are inefficient. They are generally limited to creating a single column of column of air that displaces the surrounding air. The size of this air column is limited by the diameter of the blades rotating about the hub of the fan. Also, the air column exits a fan located in the center of the room, in a typical installation, where the air column has a limited effect at any point lateral to that air column until contact is made with a horizontal surface of the room. During the summer the air column, somewhat cooler and denser then the surrounding air, will deflect downward which will allow hot air to collect near the ceiling, a very inefficient way to cool a room.

[0055] In describing the invention, reference are made to preferred embodiments and illustrative advantages of the invention. Those skilled in the art and familiar with the instant disclosure of the subject invention may recognize additions, deletions, modifications, substitutions, and other changes which fall within the purview of the subject invention and claims.

[0056] For example, one of the embodiments described above has eight (8) discs in the array as an optimally number. This array size, however, is dependent on the fan being designed for household use in an ordinary sized room. There is, however, no theoretical reason that a fan be this particular size. Indeed, given the appropriate budget, one could design a fan array suitable for large industrial spaces. In these applications, the air return aperture would be larger and the optimal number of discs in the array could be much greater. Most likely, these larger discs would be more expensive to manufacture. The discs would be subject to greater centrifugal forces and this, in turn, would require proportionally stronger, more expensive, materials. Nevertheless, there are no theoretical problems with constructing an array that could handle a large warehouse or an aircraft hangar.

[0057] In addition to the design features described about, the inventors specifically envision that any air dynamic feature that promotes laminar flow will be useful in certain embodiments of the claimed invention. This description has mentioned only a few, rather cost effective features. Depending on the budget available, additional features also become suitable.

SUMMARY OF MAJOR ADVANTAGES OF THE INVENTION

[0058] After reading and understanding the foregoing detailed description of an inventive laminar flow ceiling fan in accordance with preferred embodiments of the invention, it will be appreciated that several distinct advantages of the subject laminar flow ceiling fan are obtained.

[0059] At least some of the major advantages include providing a disc array 401 made of plastic and injection molded with integral vertical spacers. The disc array is easily constructed without a jig due to the integral vertical spacers 102 that allow the vertical stacking of the discs to be accomplished. The completed disc array 401, when rotated by drive motor 501 will intake unobstructed air via the open air entrance 406 and expel the laminar flow air at a high volume and lower RPM, relative to the prior art, in all directions 360 degrees parallel to the direction of rotation. When used and in relation to the prior art ceiling paddle fans the induced circulation of the preferred invention homogenizes the air within the room to cause even temperature distribution of the heated or conditioned air within without any change to its direction of rotation.

What is claimed is:

1. A method of producing a laminar flow air circulation comprising:

an apparatus comprising:

a plurality of discs oriented parallel, spaced apart and sharing a common central axis, including a bottom most disc, each disc having an outer circumference and an inner circumference, said inner circumference defining a centrally located aperture;

a post located at a central axis of said apparatus and having an outer surface,

said plurality of discs mounted about said post so as to form an air return space between the surface of the post and the inner circumference of said bottom most disc, and

said discs mounted such that they freely rotate around their central axis,

said laminar flow being produced through method steps comprising:

rotating said discs at a speed sufficient to cause air to flow up into the air return space, outward between the discs, out beyond the disc outer circumference and a surrounding air space, wherein said method steps operating upon said apparatus produce generally laminar flow air circulation in the surrounding air space.

2. The method as defined in claim 1 wherein said apparatus further comprises said post having the general shape of an inverted cone with concave sides such that said post helps promote laminar air flow.

3. The method as defined in claim 1 wherein the surrounding air space is a room in a building selected from the group consisting of: a private residence, a retail business space, a front office business space and a back office business space.

4. The method as defined in claim 1 wherein said plurality of discs range in number from 5 to 8.

5. The method as defined in claim 4 wherein said plurality of discs comprise a single drive disc which is driven by a motor and 4 to 7 slave discs which are driven by said drive disc.

6. The method as defined in claim 4 wherein each of said discs are essentially identical said disc outer circumference is about 30 to 38 inches, said disc inner circumference is about 20 to 24 inches.

7. The method as defined in claim 4 wherein each of said discs are spaced apart at a distance of about 0.7 to about 0.8 inches.

8. An apparatus comprising:

a plurality of discs oriented parallel, spaced apart and sharing a common central axis, including a bottom most disc, each disc having an outer circumference and an inner circumference, said inner circumference defining a centrally located aperture;

a post located at a central axis of said apparatus and having an outer surface,

said plurality of discs mounted about said post so as to form an air return space between the surface of the post and the inner circumference of said bottom most disc, and

said discs mounted such that they freely rotate around their central axis, wherein the size of said air return space, the outer surface shape of said post, the distance space said plurality of discs, the number of discs and the speed of rotation are all configured to produce a generally laminar flow air circulation in a space surrounding the apparatus.

9. The method as defined in claim 8 wherein said apparatus further comprises said post having the general shape of an inverted cone with concave sides such that said post helps promote laminar air flow.

10. The method as defined in claim 8 wherein the surrounding air space is a room in a building selected from the group consisting of: a private residence, a retail business space, a front office business space and a back office business space.

11. The method as defined in claim 8 wherein said plurality of discs range in number from 5 to 8.

12. The method as defined in claim 11 wherein said plurality of discs comprise a single drive disc which is driven by a motor and 4 to 7 slave discs which are driven by said drive disc.

13. The method as defined in claim 11 wherein each of said discs are essentially identical said disc outer circumference is about 30 to 38 inches, said disc inner circumference is about 20 to 24 inches.

14. The method as defined in claim 11 wherein each of said discs are spaced apart at a distance of about 0.7 to about 0.8 inches.

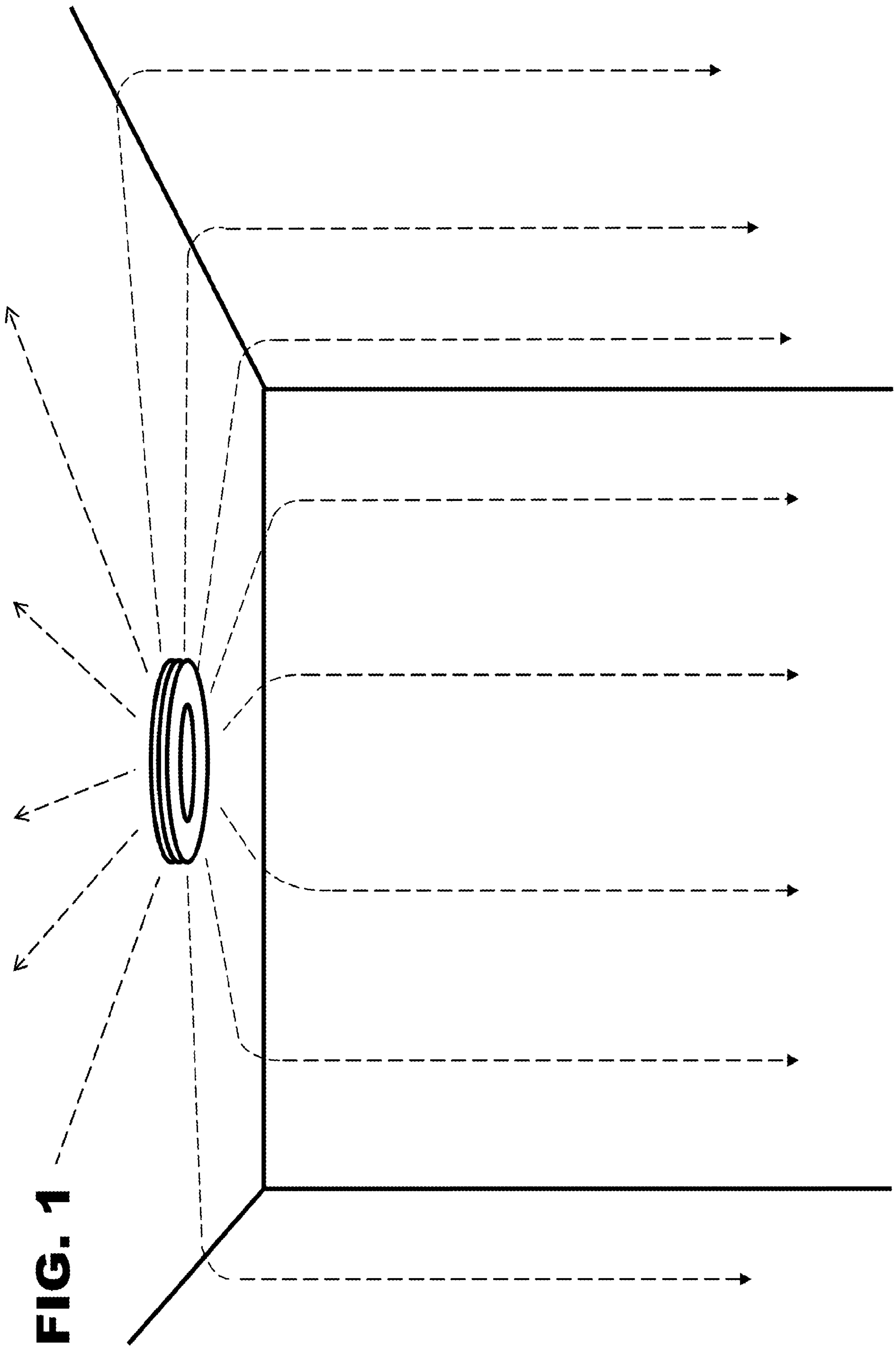


FIG. 1

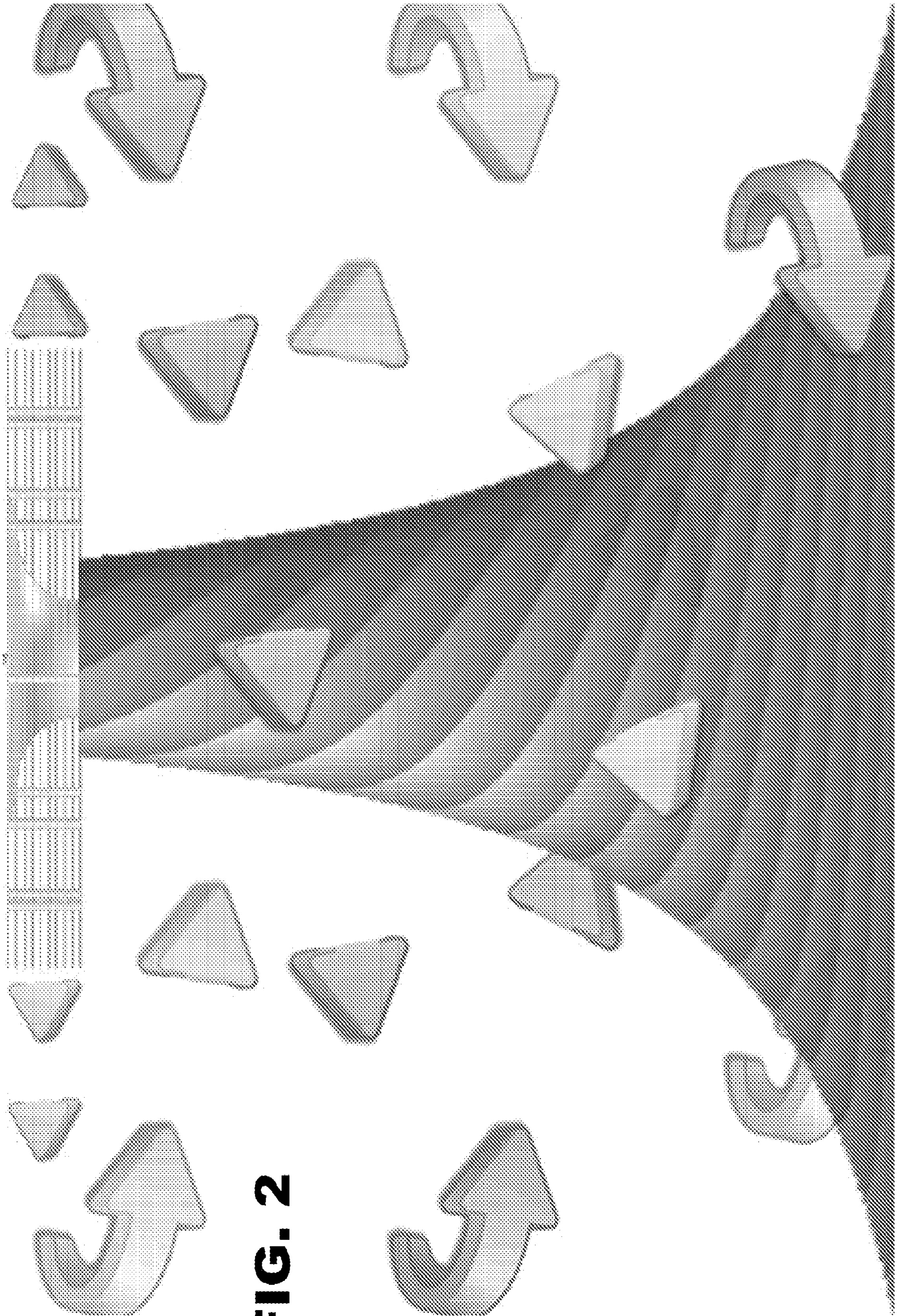


FIG. 2

FIG. 3

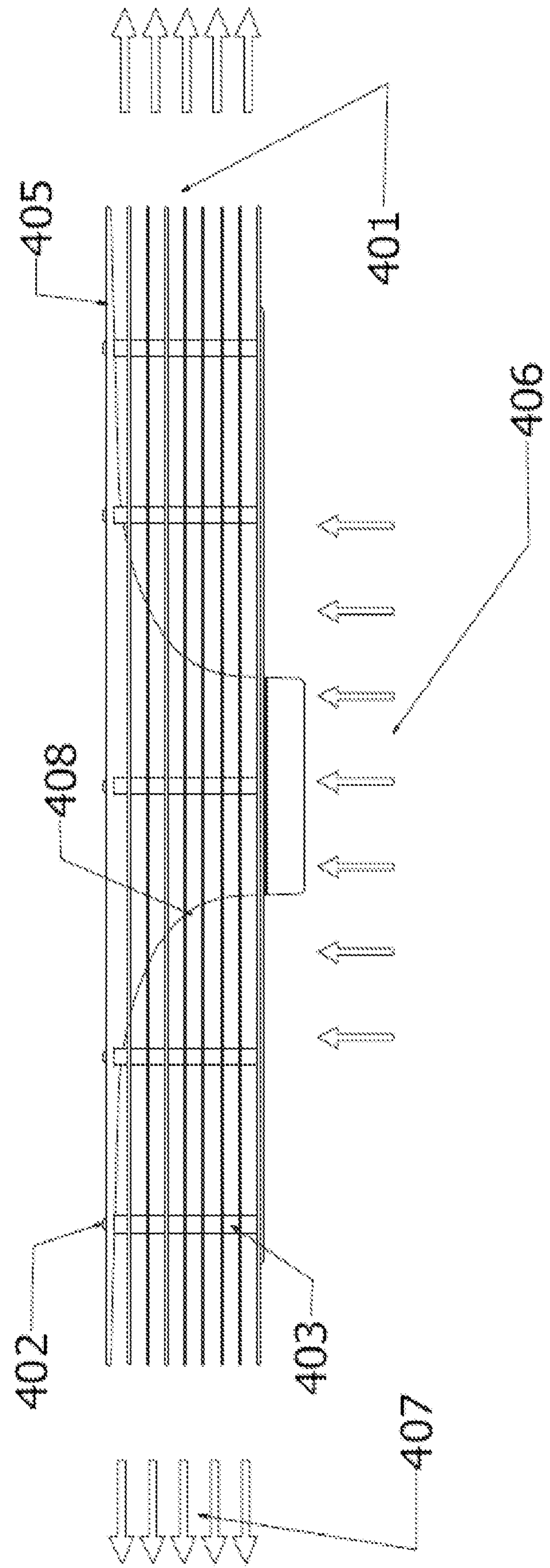


FIG. 4

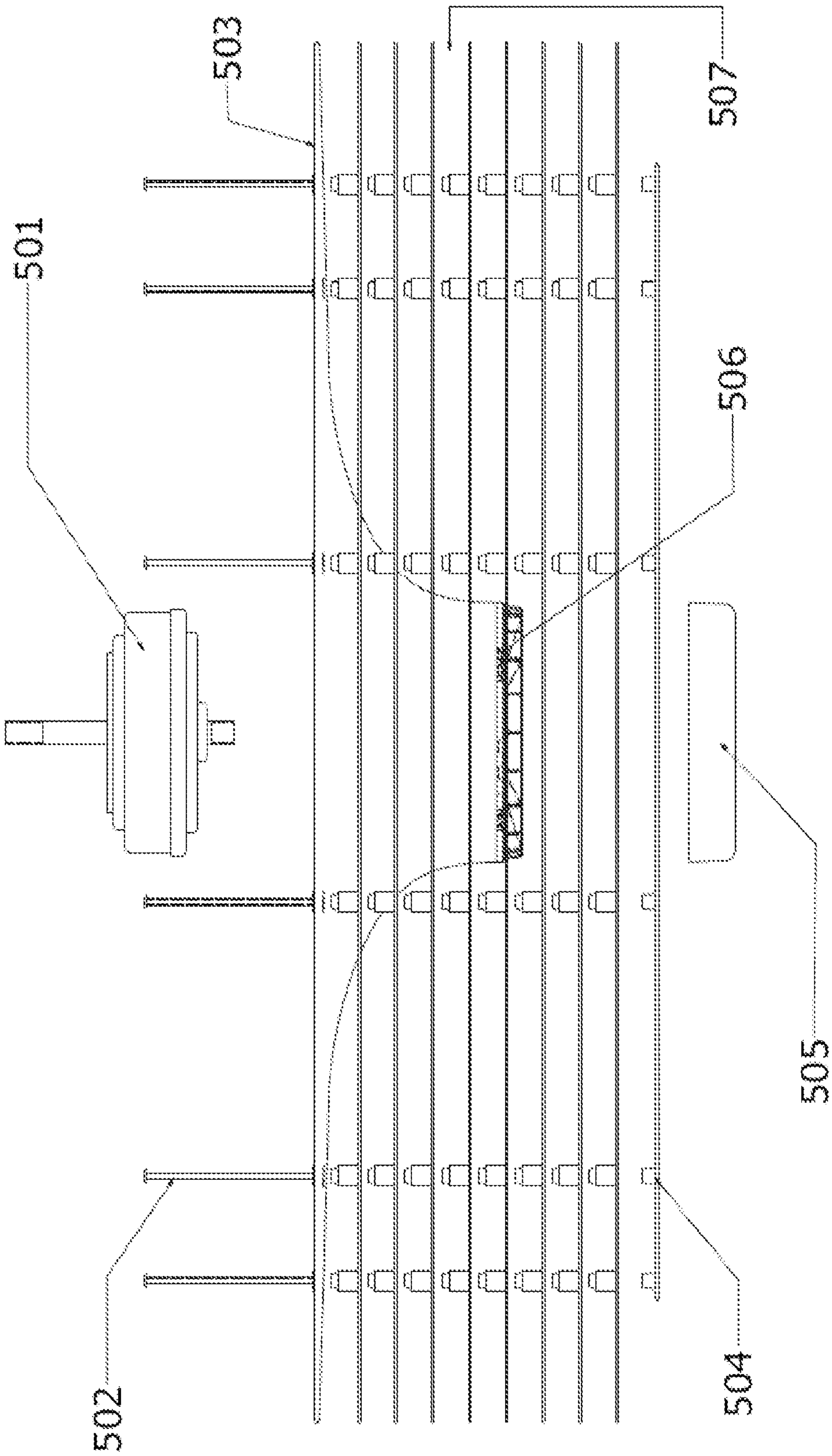


FIG. 5

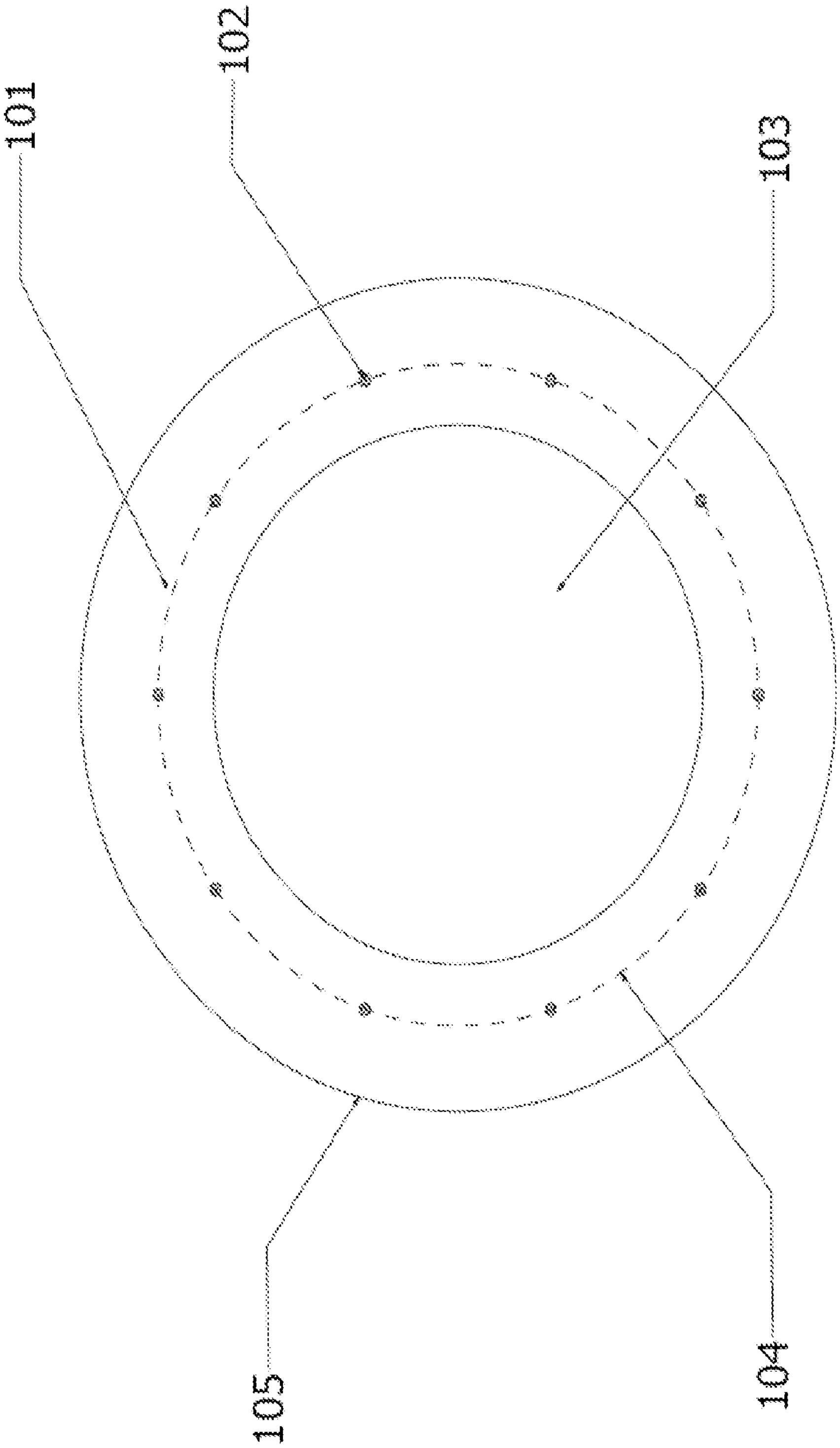
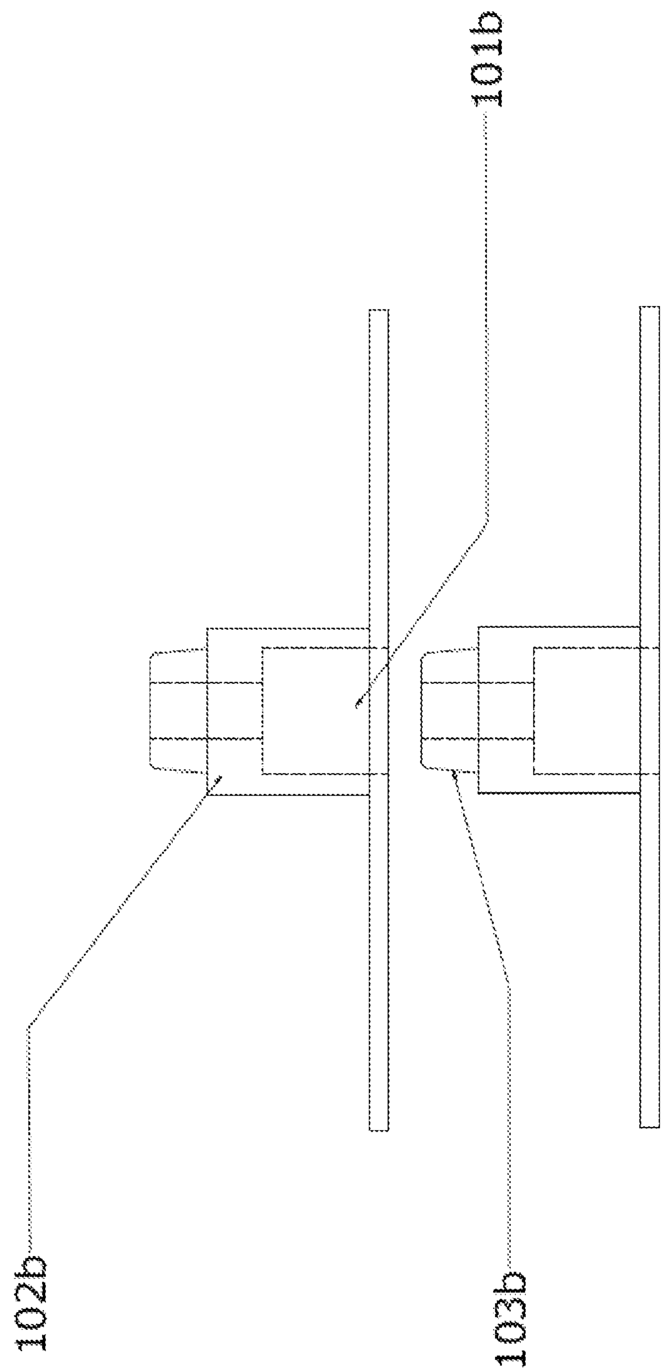


FIG. 6



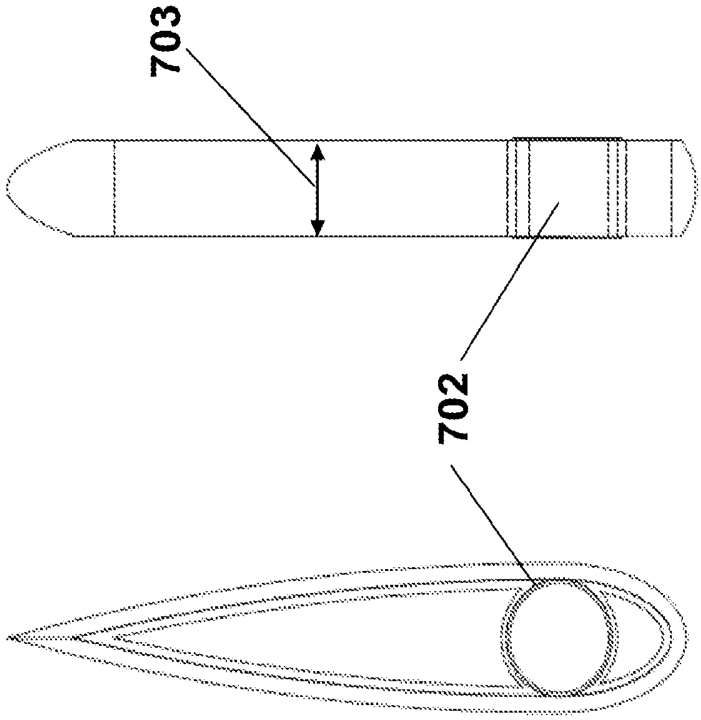


FIG. 7D

FIG. 7B

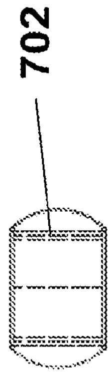


FIG. 7C

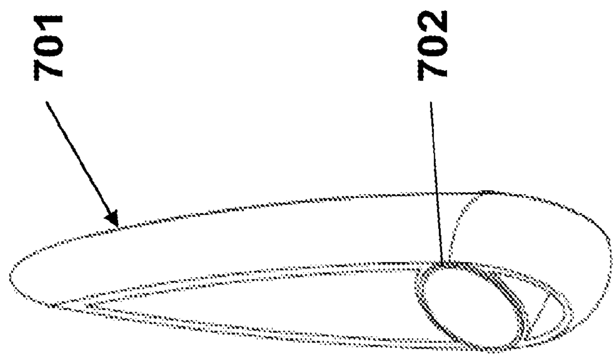


FIG. 7A

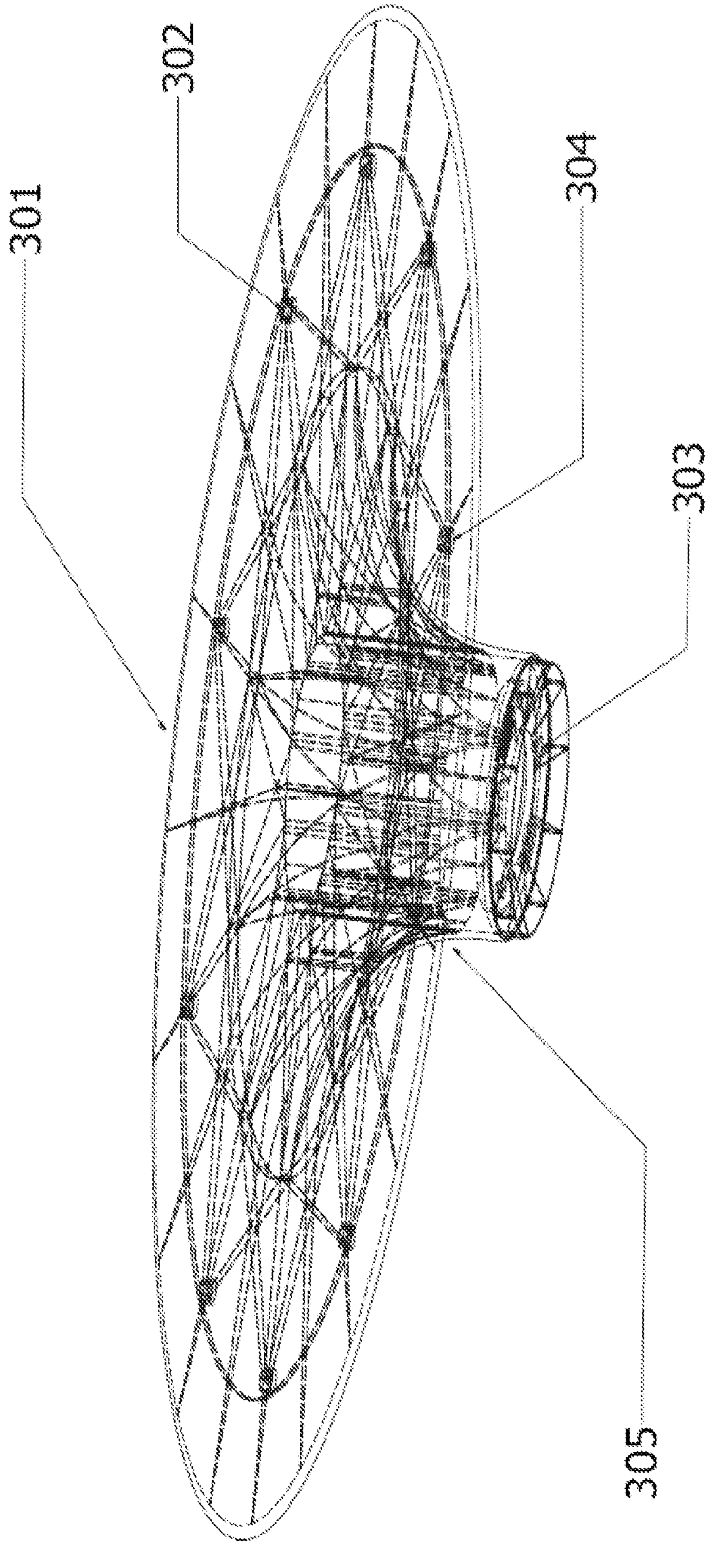


FIG. 8

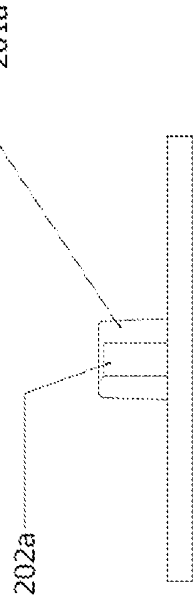
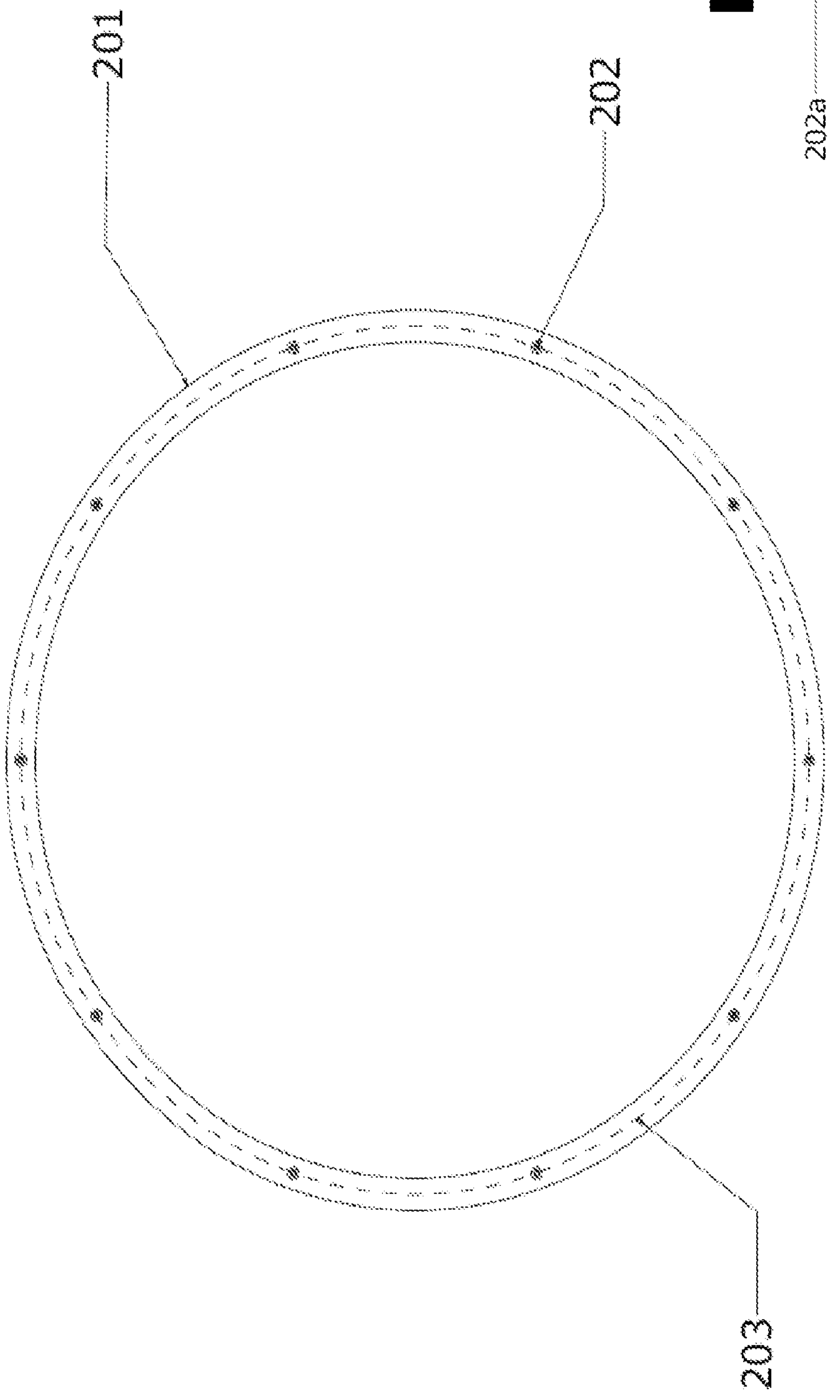


FIG. 10

FIG. 9



INTERNATIONAL SEARCH REPORT

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USPC - 415/90; 454/228
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - F04B 15/00, 17/03; F04D 25/08 (2013.01)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Orbit, Google Patents, Google

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2010/0111720 A1 (HINER) 06 May 2010 (06.05.2010) entire document	1-14
A	US 2009/0317271 A1 (GILL et al) 24 December 2009 (24.12.2009) entire document	1-14
A	US 5,388,958 A (DINH) 14 February 1995 (14.02.1995) entire document	1-14
X,P	EXHALE FANS. Exhale Fans Launches Its Bladeless Ceiling Fan On Indiegogo. YouTube. 03 November 2012. [retrieved on 07 March 2014]. Retrieved from internet: <URL: http://www.youtube.com/watch?v=Chc9L-rouJM>. entire video	1-14

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
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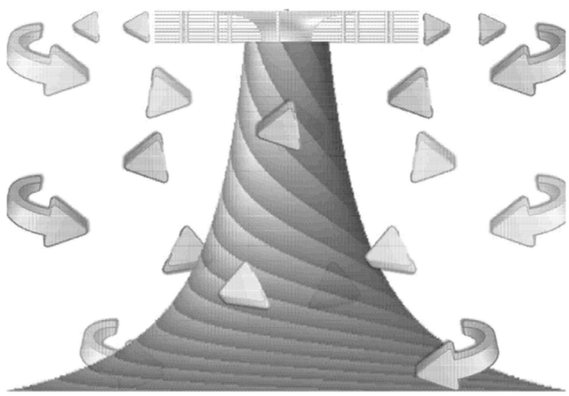
权利要求书2页　说明书6页　附图7页

(54)发明名称

层流径向吊扇

(57)摘要

现有技术已使用连接至固定电机（通常地，电动机）的斜叶片使得建筑物或房间界限内的空气运动。本优选发明包含一系列固体圆盘。圆盘被固定到固定电动机，从而绕中心轴线旋转。圆盘被均等地间隔开且在中心处被穿孔，以允许大体积的空气流动通过穿孔并沿圆盘经过，从而在每个圆盘之间垂直于位于其入口处的空气流对称地离开。由于较少限制或低压的空气入口以及合适的竖直圆盘间隔，实现了层流的相应增大。本优选发明的这种特征允许以吊扇实际使用的旋转速度操作。



CN 104884812 A

1.一种产生层流空气循环的方法，包括：

装置，所述装置包括：

多个圆盘，所述多个圆盘平行定向、彼此间隔开且具有共同的中心轴线，所述多个圆盘包括最底层圆盘，每个圆盘具有外圆周和内圆周，所述内圆周限定出位于中心的中心孔；

杆，所述杆位于所述装置的中心轴线处且具有外表面；

所述多个圆盘围绕所述杆安装以在所述杆的所述外表面和所述最底层圆盘的所述内圆周之间形成空气返回空间；以及

所述圆盘安装为所述圆盘绕所述中心轴线自由地旋转；产生所述层流的方法步骤包括：

以足以使空气向上流入所述空气返回空间，在所述圆盘之间向外流动，流出超出所述圆盘外圆周和周围的空气空间的速度旋转所述圆盘，

其中，在所述装置上操作的所述方法步骤在所述周围的空气空间内大体产生层流空气循环。

2.根据权利要求1所述的方法，其中所述装置进一步包括具有带凹侧面的倒圆锥的大体形状的所述杆，以使得所述杆协助促进空气层流。

3.根据权利要求1所述的方法，其中，所述周围的空气空间是建筑物内的房间，所述建筑物选自由私人居所、零售业务空间、前台业务空间以及后台业务空间组成的组。

4.根据权利要求1所述的方法，其中，所述多个圆盘的数目为5-8个。

5.根据权利要求4所述的方法，其中，所述多个圆盘包括由电机驱动的单个驱动圆盘，以及由所述驱动圆盘驱动的4-7个从动圆盘。

6.根据权利要求4所述的方法，其中，所述圆盘的每个是大体相同的，所述圆盘外圆周为约30-38英寸，所述圆盘内圆周为约20-24英寸。

7.根据权利要求4所述的方法，其中，每个所述圆盘以约0.7到约0.8英寸的距离间隔开。

8.一种装置，包括：

多个圆盘，所述多个圆盘平行定向、彼此间隔开且具有共同的中心轴线，所述多个圆盘包括最底层圆盘，每个圆盘具有外圆周和内圆周，所述内圆周限定出位于中心的中心孔；

杆，所述杆位于所述装置的中心轴线处且具有外表面；

所述多个圆盘围绕所述杆安装以在所述杆的所述外表面和所述最底层圆盘的所述内圆周之间形成空气返回空间，以及

所述圆盘安装为所述圆盘绕所述中心轴线自由地旋转；

其中，所述空气返回空间的大小，所述杆的所述外表面形状，所述多个圆盘的间隔距离，所述圆盘的数目以及旋转的速度被配置为在所述装置周围的空间内大体地产生层流空气循环。

9.根据权利要求8所述的方法，其中，所述装置进一步包括具有带凹面的倒圆锥的大体形状的所述杆，以便所述杆协助促进空气层流。

10.根据权利要求8所述的方法，其中，所述周围的空气空间是建筑物内的房间，所述建筑物选自由私人居所、零售业务空间、前台业务空间以及后台业务空间组成的组。

11.根据权利要求8所述的方法，其中，所述多个圆盘的数目为5-8个。

12.根据权利要求 11 所述的方法，其中，所述多个圆盘包括由电机驱动的单个驱动圆盘，以及由所述驱动圆盘驱动的 4-7 个从动圆盘。

13.根据权利要求 11 所述的方法，其中，所述圆盘的每个是大体相同的，所述圆盘外圆周为约 30-38 英寸，所述圆盘内圆周为约 20-24 英寸。

14.根据权利要求 11 所述的方法，其中，每个所述圆盘以约 0.7 到约 0.8 英寸的距离间隔开。

层流径向吊扇

[0001] 本发明的背景技术

[0002] 本文公开的发明通过利用空气的强制运动维持居所内的人体舒适水平。当温度暖和时，在人造风经过人体时，有助于让人觉得凉爽。

[0003] 本发明的优选实施例是吊扇。任何风扇的任务都是将风扇的运动（典型地，平的斜叶片的运动）转化为空气的运动。现有技术利用由电机旋转的叶片导致空气的运动，从而产生人造风。

[0004] 自从二十世纪中期以来，诸如中央空调系统的系统被装入室内以在夏季期间控制家里的内部温度。这些系统添加了加热元件以使业主具有非凡的中央系统。然而，由这些系统产生的热气或冷气的分布的局限性已经表明房间或封闭的结构区域内的不均匀分布使得要增加吊扇以在房间或封闭的结构区域内增补空气的流通，以使用户觉得舒适。

[0005] 如上所述，通过使用吊扇明显地增加房间的界限内的空气的运动，已经部分地解决了作为制热和/或制冷系统的一部分的缺陷，吊扇的正常操作状态是其操作连续。当制热/制冷系统从操作到其关闭状态循环时发生这种连续操作。

[0006] 现有技术的叶片式吊扇的另一益处是，通过改变制热/制冷系统的设定温度的能力以减少其操作时间而引起的能耗的总体降低，但中央制热/制冷系统仍能以较低的工作周期为用户提供舒适水平。

[0007] 空气的已知物理属性有助于吊扇的补充帮助。具体的，事实是，具有较大密度的较冷空气将寻求较低的水平面，而较热的空气上升。当使用制冷空气源系统时，现有技术的风扇将驱动位于天花板水平面处的较热空气向下，试图在房间的界限内创建较高状态的运动，从而试图均衡冷空气的分布。现有技术的大多数吊扇包括通过反转风扇叶片的旋转方向来反转空气流的能力。反转流的目的在于，在冬季的几个月中，当使用制热/制冷系统的中央制热特征时，增大热空气的分布。在反转流的操作期间，位于天花板处的较热空气循环穿过天花板，且这种运动的期望结果是创建更均等地分布房间空气的循环。

[0008] 需要注意的是，现有技术的所有吊扇试图通过与房间的竖直表面平行地从而与房间的水平表面垂直地移动空气，而获得用户在舒适度方面的改善。因此，现有技术的空气循环的运动局限于通常在房间的中心处发现的单个增压空气柱，或对于较大的房间，将在天花板上固定多个风扇。为简便起见，我们描述优选实施例，在典型的独院住宅内的普通房间的中心安装单个单元。

[0009] 如前所述，现有技术的斜叶片吊扇推动单个竖直空气柱从天花板向下到地板。

[0010] 现有技术使用单个竖直空气柱的运动碰撞房间的水平表面中的一个，从而要求这个空气柱的突然的90度转弯。这将造成无效的气流紊流。因此，现有技术在尝试有效地循环空气并使自然热层和冷层均衡或均匀的方面是有缺点的。

[0011] 存在可选的风扇设计。在其最基本设置中，其包括两个平行的平圆盘。圆盘旋转进而旋转困于圆盘之间的气团。离心力作用于气团上，将其向外驱离到圆盘边缘之外，从而进入到周围的空气空间。如果圆盘具有允许新空气取代被驱离的空气的某种路径，则旋转的圆盘将使空气循环。因此，无需传统的风扇叶片，旋转的圆盘可以使空气循环。

[0012] 现有技术已将这种结构公认为“泰斯拉涡轮机(Tesla turbine)”、“普朗特层涡轮机(Prandtl layer turbine)”或“圆盘类型”涡轮机。这种设计已被认为只在水力涡轮机或高压空气应用（如，真空吸尘器电机或喷气式引擎涡轮机）的情况下是有用的。

[0013] 在房间风扇的情况下，泰斯拉涡轮机被认为是不实用的，因为在一个大气压力的标准气压下，如果没有不切实际地巨大的体积，泰斯拉涡轮机被认为根本不可能使足够体积的空气运动。设备将需要非常多的圆盘，每个圆盘都非常大且圆盘必须以远远超出可实现的 RPM（每分钟的转数）进行旋转。

[0014] 出人意料地，本发明人发现，圆盘类型风扇的实际设计在标准大气压力下是可操作的。确实，正如本领域技术人员将从公开的发明中了解到的，圆盘类型风扇不只实用而且改进现有技术的风扇系统。

[0015] 本发明的目的

[0016] 发明“目的”的以下公开旨在描述用于将本发明与现有技术进行比较或对照的示例，或优选实施例。然而，这种公开并非意图以任何方式限制所主张的发明。

[0017] 因此，本发明的一般目的在于提供一种满足目的并最小化先前所描述的类型的限制的吊扇装置。

[0018] 本发明的特定目的在于提供一种吊扇，该吊扇以增加的层流将其输出侧向地推动到其旋转平面。

[0019] 本发明的另一个特定目的在于当不同温度的空气用于房间的界限内时，提供不同温度的空气的完整循环和混合。

[0020] 本发明的另一个特定目的在于平行于其旋转平面的所有方向(360°)上，分散其大体积的层流空气移动。

[0021] 本发明的另一个目的在于使得空气畅通无阻地进入吊扇。

[0022] 本发明的另一个目的在于无需由畅通无阻输入的空气引起的冲击即可驱离输出的层流空气。

[0023] 本发明的优选实施例的概述

[0024] 为了提供现有技术的缺陷的解决方案，本发明的优选实施例提供层流径向吊扇，该层流径向吊扇包括大体等距地堆叠并具有绕中心轴线的径向对称性的多个圆盘。通过绕所述中心轴线旋转所述圆盘，风扇进行操作。所述旋转的圆盘以这样的方式制作：允许空气畅通无阻地从所述圆盘中的中心开口进入，然后通过圆盘阵列之间的等间距以大体积层流从所有方向离开，当使用本优选发明时，房间内的这种独特的空气流消除任意不流通的空气。由于相对小的输入孔，现有技术试图以吊扇惯用的有用旋转速度获得增加的层流的尝试失败。

[0025] 此外，由于相对低压宽输入孔，本优选发明改进了空气运动的动作。当空气返回风扇时，空气作倒扩展圆锥形式旋转。这种圆锥形的返回空气的起点在房间内的最低点（地板），其基底扩展至房间的竖直边界（墙）。这种圆锥返回空气的顶端是风扇的基底处的其输入开口。

[0026] 附图

[0027] 通过结合附图对实施例进行以下的详细描述，本发明的目的和优点将变得明显，其中：

[0028] 图 1 示出了空气离开风扇的优选气流图案；

[0029] 图 2 示出了突出空气返回的优选气流图案（圆锥形返回图案）；

[0030] 图 3 示出了包括离开风扇和进入风扇的独特气流路径的优选实施例的完整视图；

[0031] 图 4 示出了优选发明的爆炸图；

[0032] 图 5 为优选发明的单个从动圆盘的俯视图；

[0033] 图 6 为示出了配合腔的两个竖直隔离件的横截面视图；

[0034] 图 7A-D 示出了整流片（进一步推进空气层流的设计变化）的各种视图；

[0035] 图 8 是包括电机附件和平滑的圆锥形状以促进空气层流的优选实施例的顶部或主动、驱动圆盘；

[0036] 图 9 是优选实施例的连接保持环的俯视图；

[0037] 图 10 是安装在图 9 的连接保持环上的螺栓接纳圆柱的横截面。

[0038] 详细说明

[0039] 对现有技术的一个改进是更有效的空气循环。由于多个圆盘及其特定大小、形状以及相对定位，在优选实施例中，风扇产生在整个标准房间内有效地循环空气的层流空气循环图案。例如，如图 1 所示，当风扇位于天花板的中心时，空气水平地越过天花板从旋转圆盘出来，在各个方向上均匀地朝房间的墙壁扩散。在墙处，空气平行于墙向下行走，空气流沿着地板向内转并朝着房间中心往回行走，再次参见图 1。接下来，如图 2 所示，空气以倒圆锥图案朝向位于风扇底部的空气返回孔向上旋转。最后，空气通过空气返回孔进入风扇，从而完成循环图案。

[0040] 这种空气循环是各种功能性风扇设计的经验实验的结果，每个功能性风扇设计结合风扇的各种特征，特别是圆盘尺寸、圆盘数目以及圆盘相对定位。

[0041] 这些空气图案是由图 3 中示出的风扇（被构造为层流吊扇）产生的，该层流吊扇也在以下的图 4 中的爆炸图中示出。水平箭头 407 示出离开风扇并超出从动圆盘 401 的边缘的空气。返回空气 406 被示出通过中心空气返回孔（也参见图 5 的 103）进入风扇。当空气进入风扇时，通过以下图 8 中更详细地描述的主动驱动圆盘的圆锥形部 408，被平稳地向外引导。这种在不明显扰乱空气流的层流的情况下将空气流引导进和引导出风扇的新特征是现有技术完全不具备的独特属性。

[0042] 图 3 的实施例包括安装在下面的 8 个从动圆盘 401 的阵列之上的一个主动，或驱动圆盘 405。连接主动圆盘和从动圆盘的贯穿螺栓 402 穿过竖直隔离件 403，竖直隔离件 403 保持从动圆盘 401 彼此平行且彼此间隔开预定距离。主动圆盘还以引导空气通过空气进入路径 406 进入到在阵列旁边示出的层流输出 407 的本发明的平滑圆锥形状为特征。

[0043] 图 4 是完整风扇的爆炸图。501 是电机。贯穿螺栓 502 穿过整个阵列，将整个从动圆盘阵列连接到主动驱动圆盘 503，并在连接和保持环 504 处终止。在风扇操作期间，基座空气导引件 505 覆盖电机安装螺钉组件 506，而在风扇装配和服务期间，基座空气导引件 505 可以被移除。这个组件将电机 501 连接到主动驱动圆盘 503。

[0044] 完整的从动圆盘阵列 507 和主动驱动圆盘 503 被示为通过固定穿过主动驱动圆盘电机安装螺钉孔 506 的 5 个机用螺钉而被装配并固定到固定的驱动电机 501，从而完成本优选发明的制造。电机 501 分别地旋转整个主动驱动圆盘 503 和从动圆盘阵列 507。

[0045] 图 5 是优选实施例的单个从动圆盘 101 的俯视图。优选地，每个从动圆盘由塑料

原料注射成型并被同样地制造为具有圆形开口。空气进入腔 103 位于每个圆盘的中心。风扇中的每个圆盘将具有空气进入腔 103。当如图 3 中所示将圆盘堆叠在一起时，空气进入腔将产生空气流入的空气返回孔 406，这将在下面更全面地解释。

[0046] 优选地，通过塑料注射成型制造从动圆盘 101 以在其两侧上产生平滑表面。平滑表面是用于促进旋转圆盘 101 上的层流的优选表面。当然，设计为促进层流的任意表面将用于本发明。这在可以被先进的航空工程学采用的高端设计中尤其准确。

[0047] 利用以下的等式得到空气进入腔 103 的直径。圆盘内直径 (ID) 是单个圆盘的表面积 (A) 的函数，如下所示 :

[0048] $ID = \sqrt{A}$

[0049] 从动圆盘 105 的外直径 (OD) 如下被确定 :

[0050] OD ≌ 1.5×ID

[0051] 或，更精确地 :

[0052] $OD = \sqrt{\frac{4+\pi}{\pi}} \times ID$

[0053] 当然，准确的 ID:OD 比例的一些变化是允许的。实际上，在特定条件（房间大小，大气压力）下，为了实现最佳性能，可以执行一些测试并且百分之二、百分之五、百分之十并且多达百分之十五的变化可能是必要的。

[0054] 在优选实施例中，表面积 (A) 为约 500 平方英寸，外直径 (OD) 为约 34 英寸以及内直径 (ID) 为约 23 英寸。

[0055] 确定阵列 301 中的圆盘的最佳数目。当将从动圆盘的数目从 1 增加到 8，风扇工作地更有效。（请注意，如果主动圆盘被计入在内，则这个范围是 2 到 9。）在优选实施例中，当阵列中的圆盘从 7 个增加到 8 个时，存在效率的边际 (marginal) 但明显增长。出人意料地是，当数目增加为超过 8 个时，观察不到效率的提高，因此 8 个成为上限。

[0056] 项 102 描述具有竖直圆柱形或空气动力形状的整体隔离件。圆盘之间的空间，竖直尺寸 (V) 是圆盘外直径 (OD) 和内直径 (ID) 的函数，如下所示 :

[0057] V ＝ (OD-ID)×0.0625

[0058] 在优选实施例中，竖直尺寸 (V) 是 0.75 英寸。

[0059] 当先前的公式提供用于设计所主张的发明的实施例的有用方案时，理所当然的存在竖直尺寸的允许变化，但是允许的变化惊人地小。我们估计，当竖直距离增加 10％的幅度时，层流将继续存在，但在竖直距离增加 100％的幅度后，层流将会消失。当然，对于高端使用，可以通过暴力试验确定用于特定实施例的最大竖直尺寸限值。简单地建立具有不同竖直尺寸的各种风扇直到发现层流胜过湍流且最大化运动的空气体积的最佳距离。

[0060] 图 6 是隔离件的垂直剖面图。一组隔离件以在一圆上均匀分布的图案绕从动圆盘分布，各个隔离件之间间隔一定距离，在优选实施例中，这个间隔的距离为从圆盘的 ID 到圆盘的 OD 的距离的 1/3。在优选实施例中，沿着图 5 中的虚线 104 指示的弧，塑造总数为 10 个的整体竖直隔离件，并如上所述均匀地分散。

[0061] 图 6 示出允许隔离件竖直堆叠的优选设计。如上所述，隔离件 102 提供从动圆盘阵列 401 中的每个圆盘之间的均匀竖直分隔，且以允许贯穿螺栓 402、502 穿过圆

盘阵列的中心孔 102a 为特征。此外，整体隔离件具有符合并接受竖直隔离件配对部(counterpart)102b 匹配的连接和对齐腔 101b，这将导致下一个连续的圆盘被放置在竖直隔离件的肩部 103b 上。

[0062] 图 7A-D 示出可以在图 6 的竖直隔离件中随意连接的层流翼叶片。图 7A 是轴测图。图 7B 是俯视图。图 7C 是主视图，图 7D 是右视图。每个叶片 701 的高度 703 小于叶片所安装到其上的竖直隔离件的高度，安装孔 702 的直径稍微大于竖直隔离件的外径。这些特征合在一起允许叶片自由地旋转。整个叶片可以改变它的冲角以与进入的层流空气的运动对齐，由于空气速度的改变、电机 RPM（每分钟的转数）的改变等，进入的层流空气的运动可以不时变化。由于放置在进入的层流空气的路径中并旋转的竖直叶片的离心力，这些叶片 701 增大输出空气速度。效果类似于拿一张平的纸板在人脸之前摇动以产生冷风的效果。

[0063] 示出的叶片是优选实施例，并且根据期望的层流翼型的类型，其可以呈现不同的形状。如果需要的话，叶片也可以被制作成固定的。

[0064] 图 8 是为从动圆盘阵列 401 以及通过电机安装孔 303 的驱动电机提供连接基座的顶部主动驱动圆盘 301 的描述。优选地，主动圆盘 301 被模塑为单件。主动驱动圆盘 301，在轴测图中，示出允许螺栓穿过并连接到连接保持环 201 的螺栓通过孔 302。请注意，对齐腔 304 的形式与图 5 和图 9 中的形式相同，以便贯穿螺栓和竖直隔离件 102 可以从最顶层的圆盘通过阵列到达风扇底部上的保持环。请再次注意，主动驱动圆盘具有圆锥共形空气导引件 305，以辅助空气的进入以及通过提供进出旋转圆盘阵列的畅通无阻的空气通路增大层流。

[0065] 图 9 和图 10 分别示出保持环和保持环螺栓。在俯视图中示出连接保持环 201。保持环的目的在于接纳经过主动驱动圆盘 301（参见图 8）以及圆盘阵列中的每个从动圆盘的螺栓。图 10 示出对齐和保持环螺栓接纳圆柱 201a，202a，对齐和保持环螺栓接纳圆柱 201a，202a 被设计为嵌入底部从动圆盘 101 并被形成为接受通过中心孔 102a 的螺纹栓。以与整体竖直隔离件 201 的图案相匹配的图案分布这些保留螺栓。通过虚线 203 描绘这种图案。螺栓接纳圆柱 201a 与位于螺栓的底部的对齐腔 101b 共形。连接保持环 201 被固定到阵列 401 的底部圆盘，以便它的上表面与最底层的圆盘平齐。

[0066] 本优选发明作为单元将具有如由前述等式所描述的数目的圆盘。本优选发明的操作旋转速度在常规吊扇的正常范围内。电机 501 被设计为根据用户期望的层流空气速度调节各种速度。下面的公式可以用于描述气流的压力。这被定义为由离开风扇的空气产生的压力与周围的空气压力的差值，(P2-P1)。

[0067]

$$P2-P1=\frac{\left(\text{流体密度}\times\text{角速度}^{2}\right)}{2\left(R2^{2}-R1^{2}\right)}$$

[0068] 其中“流体密度”是标准空气密度，R2 和 R1 是分别从旋转的圆盘中心测量的到圆盘外边缘和内边缘的距离。

[0069] 如上所述，现有技术的风扇的气流图案是低效的。它们通常被限于产生空气柱的单个柱取代周围空气。绕风扇的叶毂旋转的叶片的直径限定这个空气柱的大小。而且，在典型的安装中，空气柱离开位于房间中心的风扇，在这个空气柱侧向的任意点处空气柱具有有限的效果，直到空气柱接触到房间的水平面。在夏季期间，比周围的空气稍微凉爽和密

集的空气柱将向下偏转，允许热空气聚集在天花板附近，这是制冷房间的非常低效的方式。

[0070] 在本发明的描述中，参考优选实施例和本发明的说明性的优点。本领域内熟悉本主题发明的目前公开的技术人员可以认识到增加、删除、修改、替换以及其他改变将落入本主题发明和权利要求的范围内。

[0071] 例如，上述实施例的一个中，在阵列中具有8个圆盘作为最佳数目。然而，这个阵列的大小取决于被设计为常规大小的房间内的家用的风扇。然而，不存在风扇是这个特定大小的理论上的理由。实际上，给定适当的预算，可以设计适于大型工业空间的风扇阵列。在这些应用中，空气返回孔将更大，阵列中的圆盘的最佳数目可以更大。最有可能的，制造这些更大的圆盘将会更贵。圆盘将受到更大的离心力，反过来，这将要求成比例地更强更贵的材料。尽管如此，构建可以处理大型仓库或飞机库的阵列，不存在理论上的问题。

[0072] 除了已经描述的设计特征，发明人具体地展望，促进层流的任意的空气动力特征在所主张的发明的某些实施例中是有用的。此描述只提及了一些相当有成本效益的特征。根据可用的预算，另外的特征也变成合适的。

[0073] 本发明的主要优点的概述

[0074] 在阅读并理解依照本发明的优选实施例的本发明的层流吊扇的前述详细描述之后，应当理解的是，可以获得本主题的层流吊扇的一些显著优点。

[0075] 主要优点的至少一些包括提供由塑料制成且被注塑成型为具有整体竖直隔离件的圆盘阵列401。由于允许实现圆盘的竖直堆叠的整体竖直隔离件102，无需夹具即可简单地构建圆盘阵列。当通过驱动电机501旋转完整的圆盘阵列401时，将通过开放的空气入口406畅通无阻地吸入空气并在与旋转方向平行的所有360度的方向上以相对于现有技术高的体积和较低的RPM排出层流空气。当与现有技术的吊顶叶片式风扇相关使用时，本优选发明导致的循环使房间内的空气均匀以引起被加热或被调节的空气的均匀温度分布，且无需其旋转方向的任何改变。

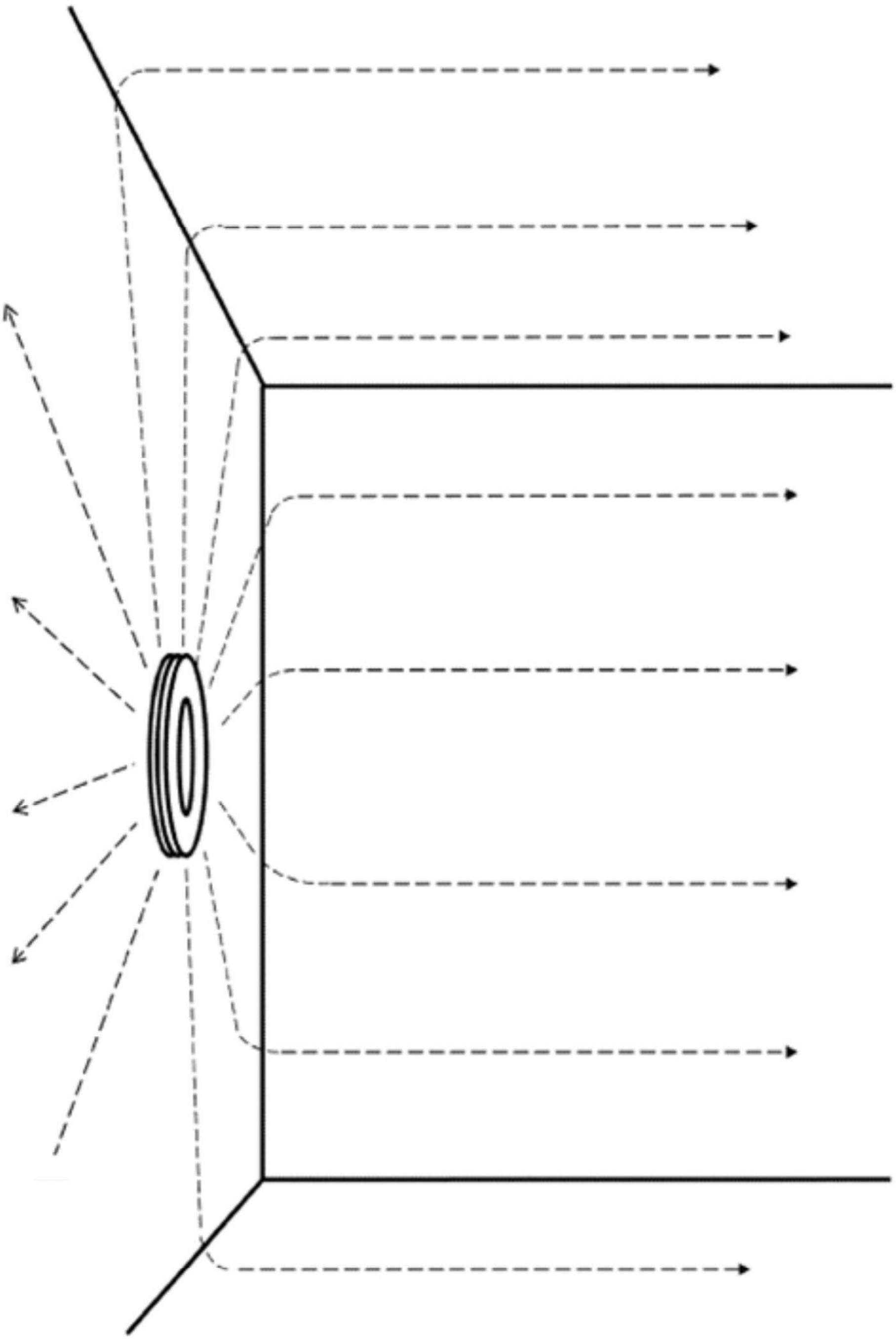


图 1

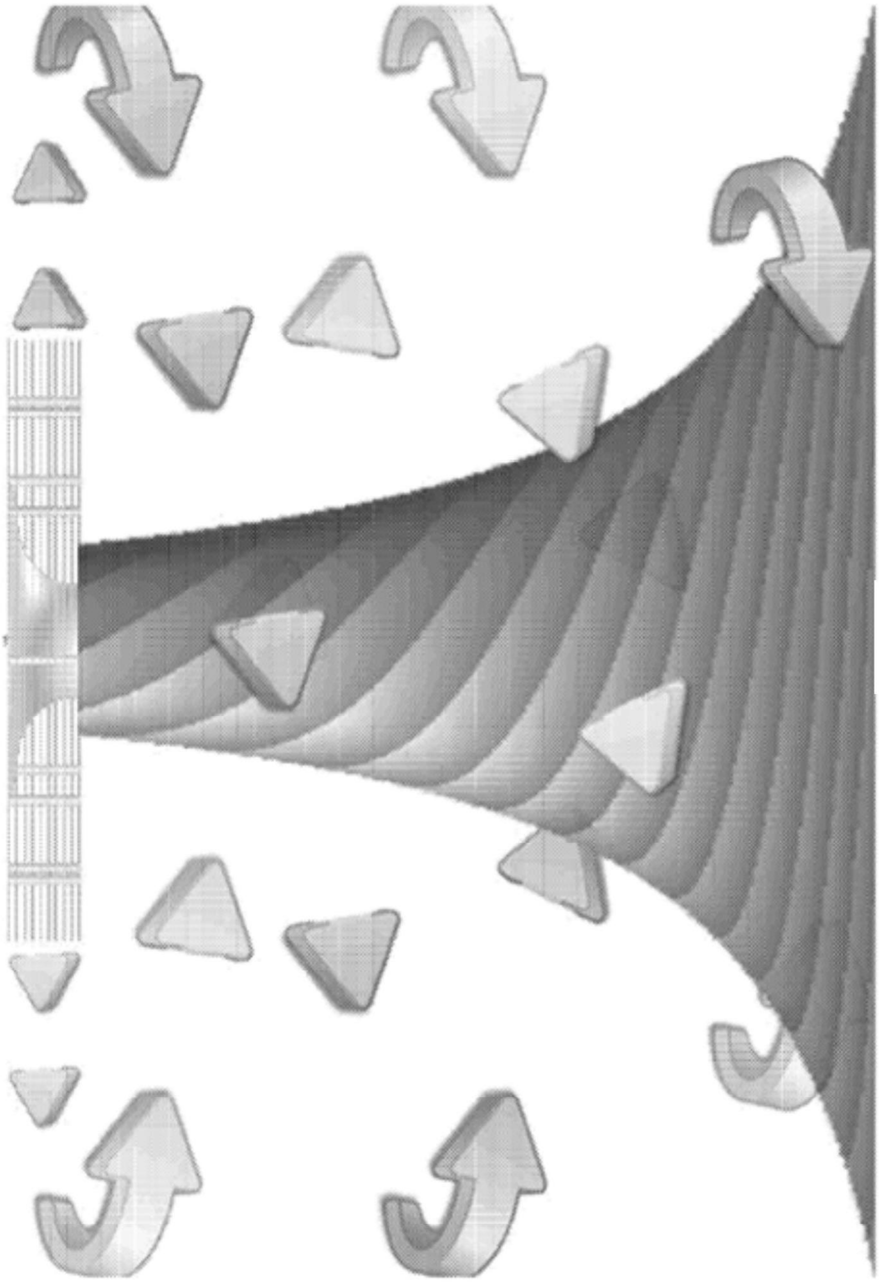


图 2

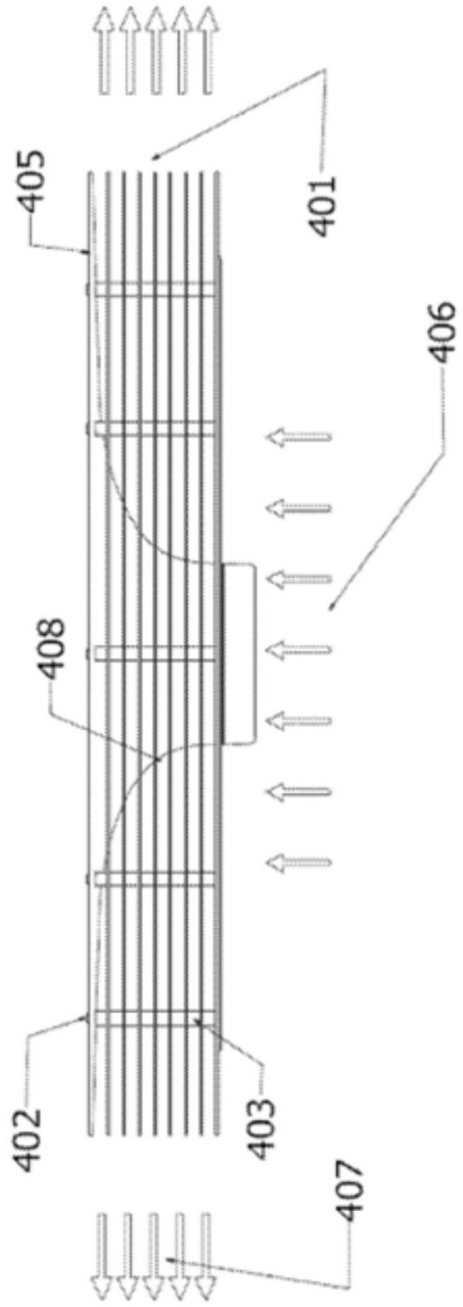


图 3

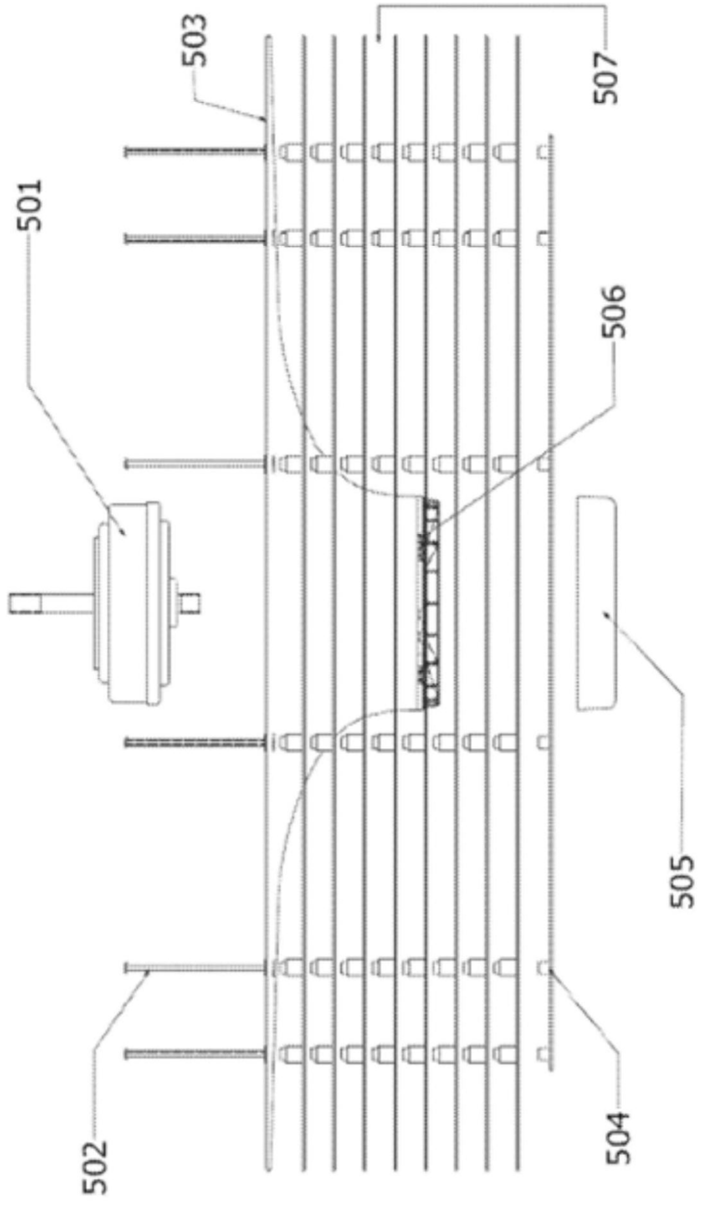


图 4

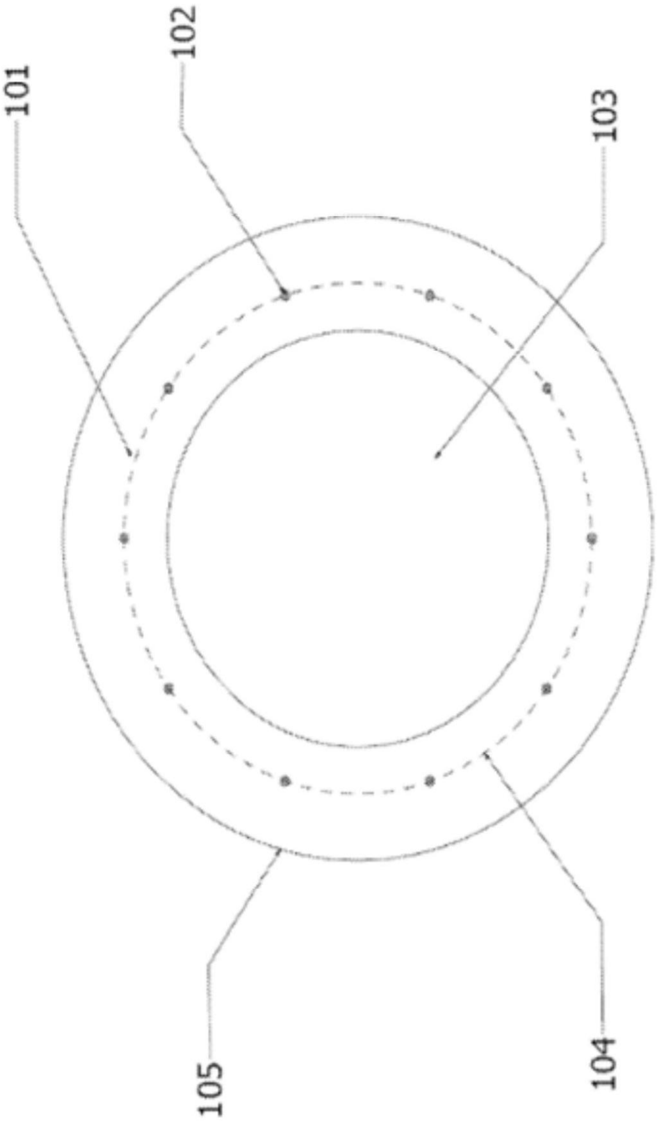


图 5

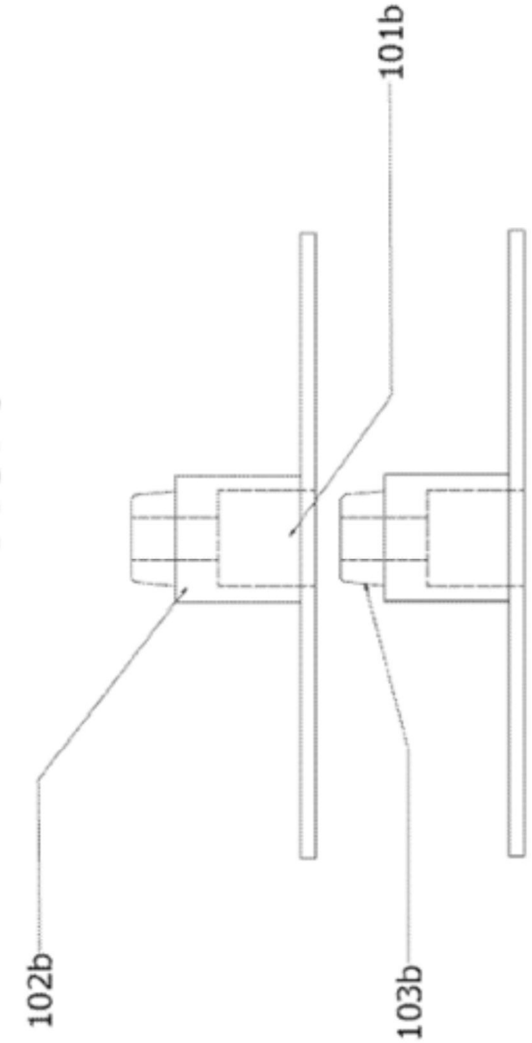


图 6

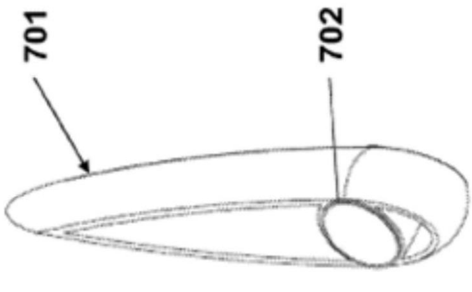


图 7A

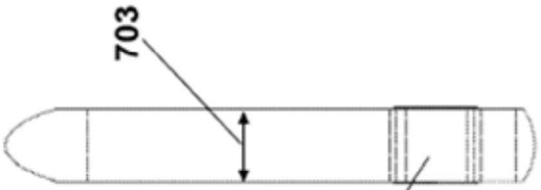


图7D

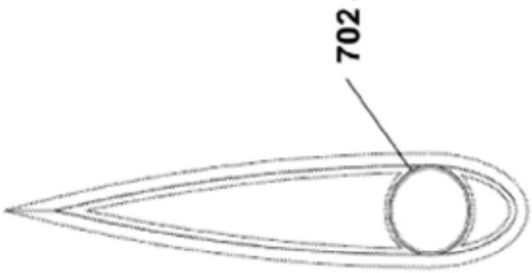


图7B

图7C

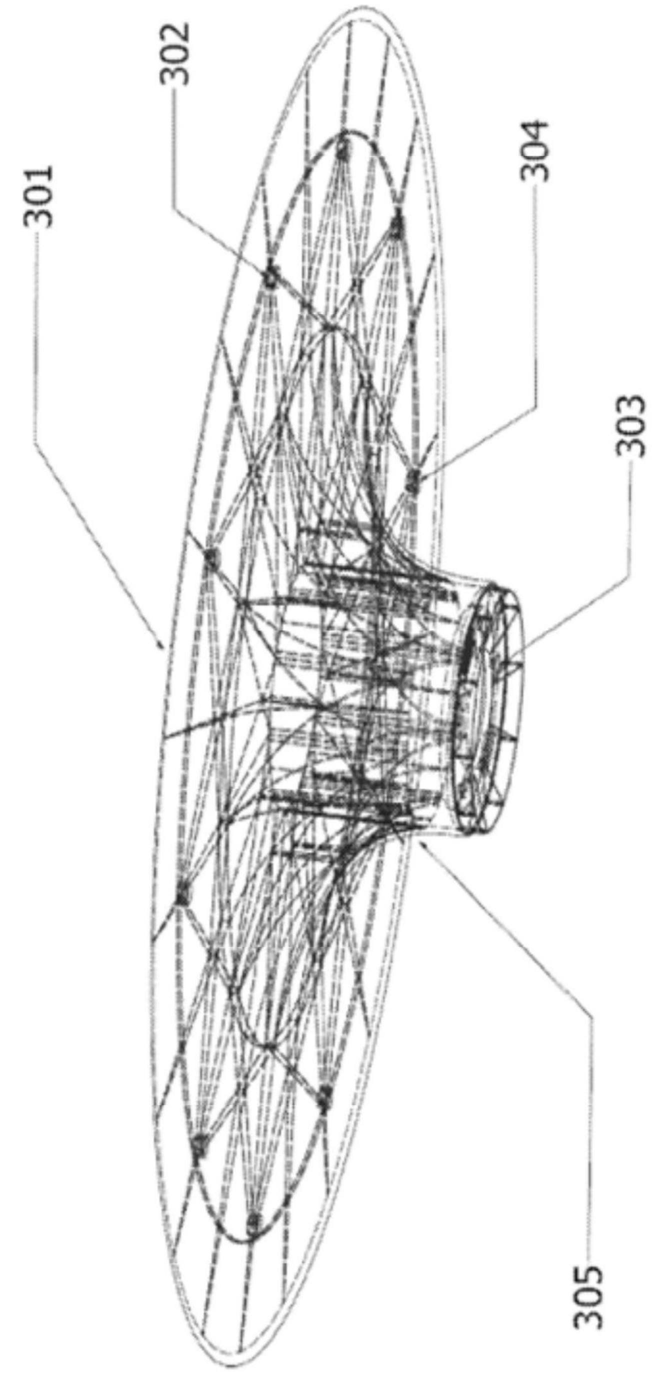


图 8

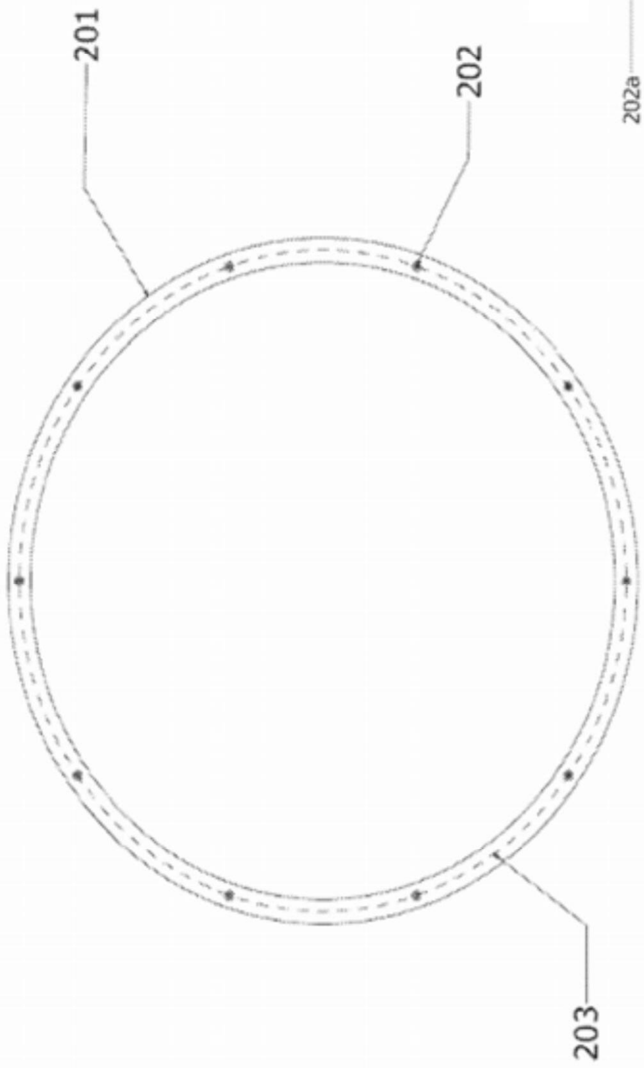


图9

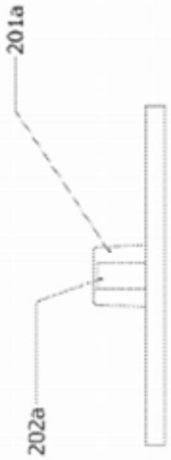


图10

Abstract

The prior art has used pitched blades attached to a stationary motor, normally electric, to move air within the confines of a structure or room. The preferred invention incorporates a series of solid discs. The discs are affixed to a stationary electric motor and thus rotate around a central axis. The discs are equally spaced and centrally perforated in a manner that will allow air to flow in high volumes through the perforations and pass along the discs thus exiting symmetrically between each disc perpendicularly to the flow of air that is at its entrance. Due to the less restrictive or low pressure air entrance as well as the correct vertical disc spacing a corresponding increase in the laminar flow is realized. This feature of the preferred invention allows for operation at a rotational speed that practical for use as a ceiling fan.