



- (51) **International Patent Classification:**
F04D 29/54 (2006.01) *F24F 13/08* (2006.01)
F04D 25/08 (2006.01)
- (21) **International Application Number:**
PCT/US2012/030253
- (22) **International Filing Date:**
23 March 2012 (23.03.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/467,754 25 March 2011 (25.03.2011) US
- (71) **Applicant** (for all designated States except US): **VORNADO AIR, LLC** [US/US]; 415 East 13th Street, Andover, KS 67002 (US).
- (72) **Inventors; and**
- (75) **Inventors/Applicants** (for US only): **EDIGER, Glen W.** [US/US]; 14 Regal Crescent, North Newton, KS 67117 (US). **ISRAEL, Gary P.** [US/US]; 215 Lee Street, Andover, KS 67002 (US). **HOPPOCK, Chase** [US/US]; 907 South Honeybrook Lane, Derby, KS 67037 (US).
- (74) **Agent:** **CONNOLLY, Sean P.**; Advent IP, P.C., L.L.O., 2425 South 144th Street, Suite 202, Omaha, NE 68144 (US).

- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) **Title:** CIRCULAR GRILL FOR AN AIR CIRCULATOR UNIT

(57) **Abstract:** The present disclosure relates to a grill for an air circulator. The grill is configured to divert airflow from an airflow source. The air circulator includes a center hub with a plurality of arcuate ribs coupled to and extending outwardly from the center hub. The arcuate ribs extend outwardly to an outer perimeter of the circular grill.



WO 2012/134983 A2

CIRCULAR GRILL FOR AN AIR CIRCULATOR UNIT

CROSS-REFERENCE TO RELATED APPLICATIONS

[001] This application is being filed on 23 March 2012 as a PCT International Patent Application and claims priority to U.S. Provisional Application Serial No. 61/467,754 filed on 25 March 2011, titled CIRCULAR GRILL FOR AN AIR CIRCULATOR UNIT, which is incorporated by reference herein in its entirety.

BACKGROUND

[002] Air circulators are configured to distribute air throughout an entire room. However, there is a continued desire to improve the distribution of airflow in terms of volumetric flow-rate (cubic feet per minute or CFM), the distance the air travels, and the quality of noise associated with the unit.

SUMMARY

[003] The present disclosure relates to a grill for an air circulator. The grill is configured to divert airflow from an airflow source. The air circulator includes a center hub with a plurality of arcuate ribs coupled to and extending outwardly from the center hub. The arcuate ribs extend outwardly to an outer perimeter of the circular grill. Each rib is comprised of a first portion and a second portion that form a first angle greater than 0° and less than 90° and an aspect ratio between 4:1 and 1:4.

[004] This Summary is provided solely to introduce subject matter that is fully described in the Detailed Description and Drawings. Accordingly, the Summary should not be considered to describe essential features nor be used to determine scope of the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[005] The detailed description is described with reference to the accompanying figures. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears. The use of the same reference numbers in different instances in the description and the figures may indicate similar or identical items.

[006] FIG. 1 is a perspective view of a circular grill.

[007] FIG. 2 is a side, cross-sectional view of a rib coupled to the circular grill.

[008] FIG. 3 is a perspective view of the circular grill of FIG. 1A coupled to an air circulator.

DETAILED DESCRIPTION

[009] It will also be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present. Further, as used herein the term "plurality" refers to at least two elements. Additionally, like numbers refer to like elements throughout.

[0010] Air circulators are designed to circulate air uniformly to a specific area, such as a room or shop. Grills are usually coupled to these air circulators to direct airflow and to prevent user's from coming into direct contact with the air circulator's blades. However, noise levels and airflow restrictions associated with air circulators in the prior art may be unreasonable with consumers.

[0011] Accordingly, a circular grill is described that may be implemented with an air circulator. The circular grill may improve the air flow (CFM), the distance the air travels, and the noise level and quality of noise associated with air circulator units. In an implementation, the grill is configured to divert airflow from an airflow source. The grill is comprised of a center hub with multiple arcuate ribs extending outwardly to the grill's outer perimeter from the center hub. Each rib is comprised of a first portion and a second portion that form a first angle greater than 0° and less than 90° and an aspect ratio between 4:1 and 1:4. In some embodiments, the first angle may be between about 30° and 80° . In some such embodiments, the first angle may be between about 32° and 77° . The circular grill is configured to be coupled to an airflow circulator unit.

[0012] FIGS. 1 and 2 illustrate an example of a circular grill 100 configured for coupling to an airflow circulator unit 200. The circular grill 100 includes a center hub 102, an outer perimeter 104, and multiple arcuate stators shown as ribs 106. The multiple arcuate ribs 106 are coupled to and extend outwardly from the center hub 102. Each rib 106 is comprised of a first portion 108 and a second portion 110, which form a first angle greater than 0° and less than 90° . In other embodiments, the first angle may range between about 25° and 50° . The first angle is defined as the supplementary angle theta (Θ) formed by the intersection of first axis A-A and second axis B-B (as depicted in FIG. 2). In some embodiments, the angle Θ may vary along the length of rib 106.

[0013] There may be equal spacing between each rib 106. Each rib 106 also has a crosssectional aspect ratio between 4:1 and 1:4. The aspect ratio is defined as the ratio of the width of the first portion to the ratio of the width of the second portion. For example, the width of the first portion may be two inches (2")

and the width of the second portion may be 1 inch (1"). In the aforementioned example, the aspect ratio would be 2:1.

[0014] Generally referring to FIG. 2, a cross-section of a stator or rib 106 is depicted.

Each rib 106 may function as a flow straightener that reduces turbulence due to the dimensions, the angle, and the material of each rib 106. A reduction in turbulence may increase airflow distance and airflow (CFM), as well as decrease the decibel level produced by the air circulator 200 during operation. The first portion 108 may have a width of about 0.1 inch and a length of about 0.4 inch and the second portion 110 may have a width of about 0.1 to 0.3 inch and a length of about 0.2 inch.

[0015] The first portion 108 includes a leading edge 112 that is defined as the edge that makes first contact with the airflow produced by the air circulator 200. The second portion 110 includes a trailing edge 114 that is defined as the edge where at least a portion of the airflow separated by the leading edge 112 rejoins. The leading edge 112 may be curved, and the trailing edge 114 may be pointed. It is contemplated that the leading edge 112 and the trailing edge 114 may take other general shapes (e.g. pointed, square, etc.). The first portion 108 has a first chord length 116, and the second portion 110 has a second chord length 118. The first chord length 116 is defined as the distance measured from the leading edge 112 to the first portion's 108 edge 120 that forms the first angle with the second portion 110. The second chord length 118 is defined as the distance measured from the second portion's edge 122 that forms the first angle with the first portion 108 to the trailing edge 114. In an implementation, the specific dimensions and angle formed by a first portion 108 and a second portion 110 of each rib 106 may reduce the turbulence asso-

ciated with the airflow produced by an air circulator 200.

[0016] Generally referring to FIG. 3, an implementation of the circular grill 100 coupled to an air circulator 200 is illustrated. The air circulator 200 includes a base member 202, a hub (not shown), a plurality of blades (not shown) coupled to the hub, and a motor (not shown) operatively coupled to the plurality of blades. For example, when the air circulator 200 is in a powered on state, the plurality of blades move in a first, generally circular direction producing airflow. The circular grill 100 directs the airflow produced from the air circulator in the user's desired direction. The air circulator 200 may include air circulators known in the art. For example, the air circulator may be a 530 VORNADO air circulator 200.

[0017] In a specific implementation, the circular grill 100 may be manufactured from Acrylonitrile Butadiene Styrene (ABS), Polypropylene (PP), High Impact Polystyrene (HIPS), or the like. The manufacturing process may be injection molding or a similar process. Furthermore, the diameter of a particular circular grill 100 may be about 9.41", the number of ribs 106 is nineteen (19), the distance from a blade 204 to the circular grill 100 is fifteen percent (15%), and the first angle is thirty-three degrees (33°). The number of blades should not share a common factor with the number of ribs 106 due to potential disruptions or resonance.

[0018] FIG. 3 illustrates a two-dimensional modeling of airflow over the plurality of ribs 106 according to the aforementioned dimensions and angles. FIG. 3 depicts a turbulent intensity range of 4.5% through 40% with a peak of 60%.

[0019] The plurality of ribs 104 of the present disclosure reduces the turbulent intensity range of the airflow compared with the plurality of ribs previously known

in the prior art.

[0020] Moreover, it will be understood that although the terms first and second are used herein to describe various features, elements, regions, layers and/or sections, these features, elements, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one feature, element, region, layer or section from another feature, element, region, layer or section. Thus, a first feature, element, region, layer or section discussed below could be termed a second feature, element, region, layer or section, and similarly, a second without departing from the teachings of the present invention.

[0021] Although a circular grill has been described in language specific to structural features and/or methodological acts, it is to be understood that the appended claims are not necessarily limited to the specific features or acts described. Rather, the specific features and acts are disclosed as exemplary forms of implementing the claimed devices and techniques.

CLAIMS

What is claimed is:

1. A circular grill for directing airflow from an airflow source, the circular grill comprising:

a center hub;

an outer perimeter; and

a plurality of arcuate ribs extending outwardly from and coupled to the center hub to the outer perimeter of the circular grill, each rib comprising a first portion and a second portion, the first portion and the second portion forming a first angle between 0° and 90° , and each rib having a crosssectional aspect ratio between 4:1 and 1:4.

2. The circular grill of claim 1, where a first chord length of each rib is at least about 2 inches.

3. The circular grill of claim 1, where a second chord length of each rib is at least about one inch.

4. The circular grill of claim 1, where a leading edge of each rib is curved.

5. The circular grill of claim 1, where a trailing edge of each rib is pointed.

6. The circular grill of claim 1, where the first angle is between 25° and 50° .

7. An device comprising:

an airflow circulator; and

a circular grill coupled to the airflow circulator, the circular grill comprising:

a center hub;

an outer perimeter; and

a plurality of arcuate ribs extending outwardly from and coupled to the center hub to the outer perimeter of the circular grill, each rib comprising a first portion and a second portion, the first portion and the second portion forming a first angle between x° and y° , and each rib having an aspect ratio between a and b.

8. The circular grill of claim 7, where a first chord length of each rib is at least about 2 inches.

9. The circular grill of claim 7, where a second chord length of each rib is at least about one inch.

10. The circular grill of claim 7, where a leading edge of each rib is curved.

11. The circular grill of claim 7, where a trailing edge of each rib is pointed.

12. The circular grill of claim 7, where the first angle is between 25° and 50° .

REPLACEMENT SHEET

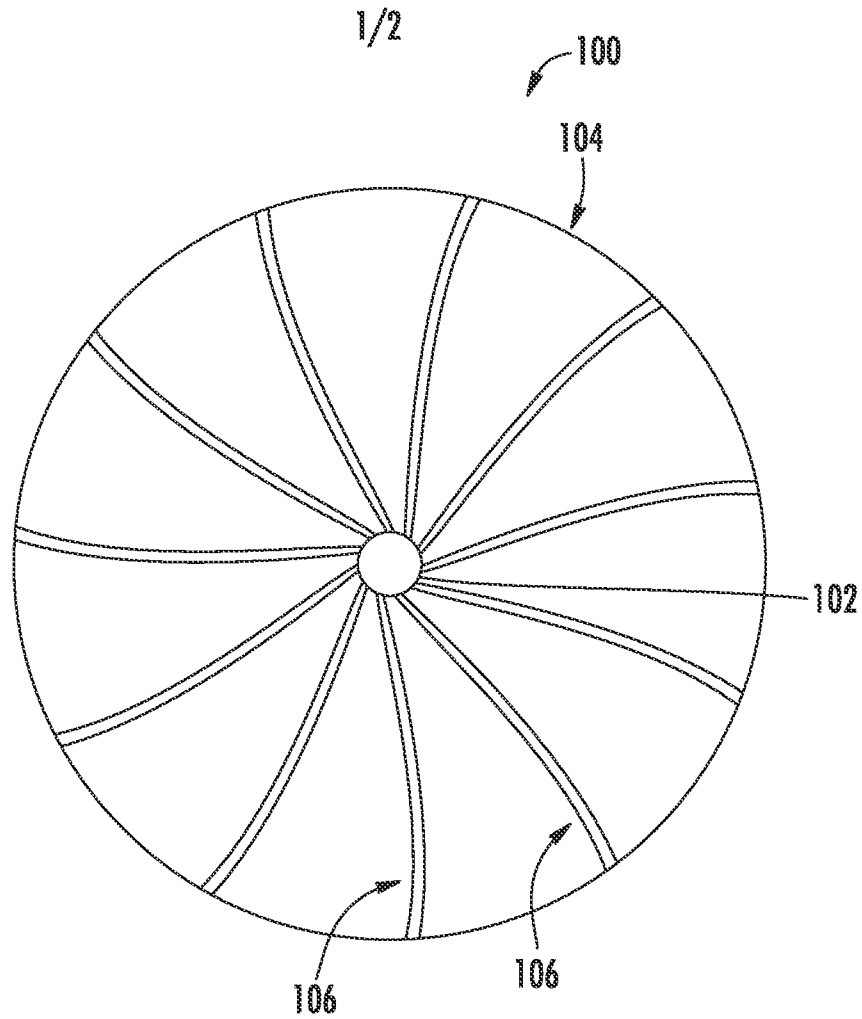


FIG. 1

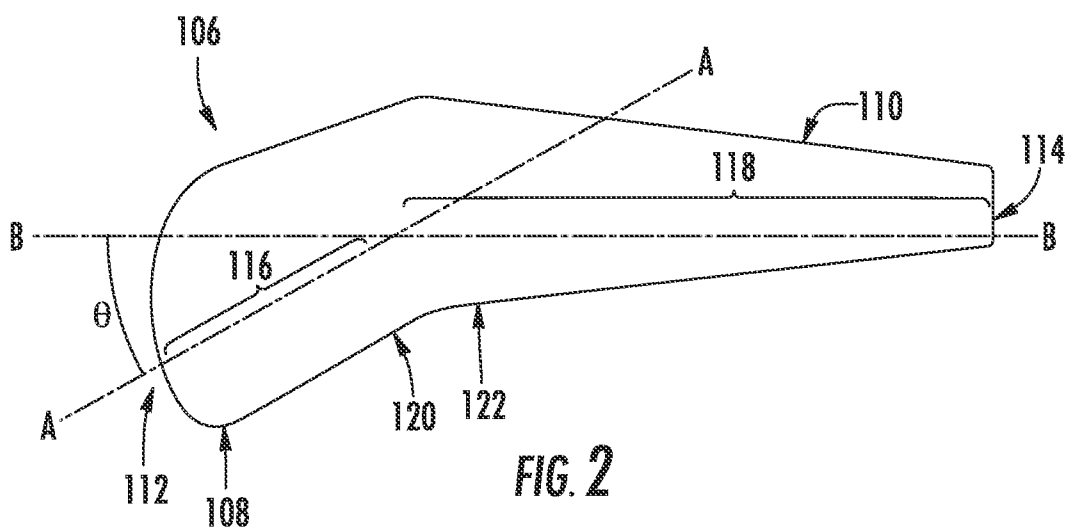


FIG. 2

REPLACEMENT SHEET

2/2

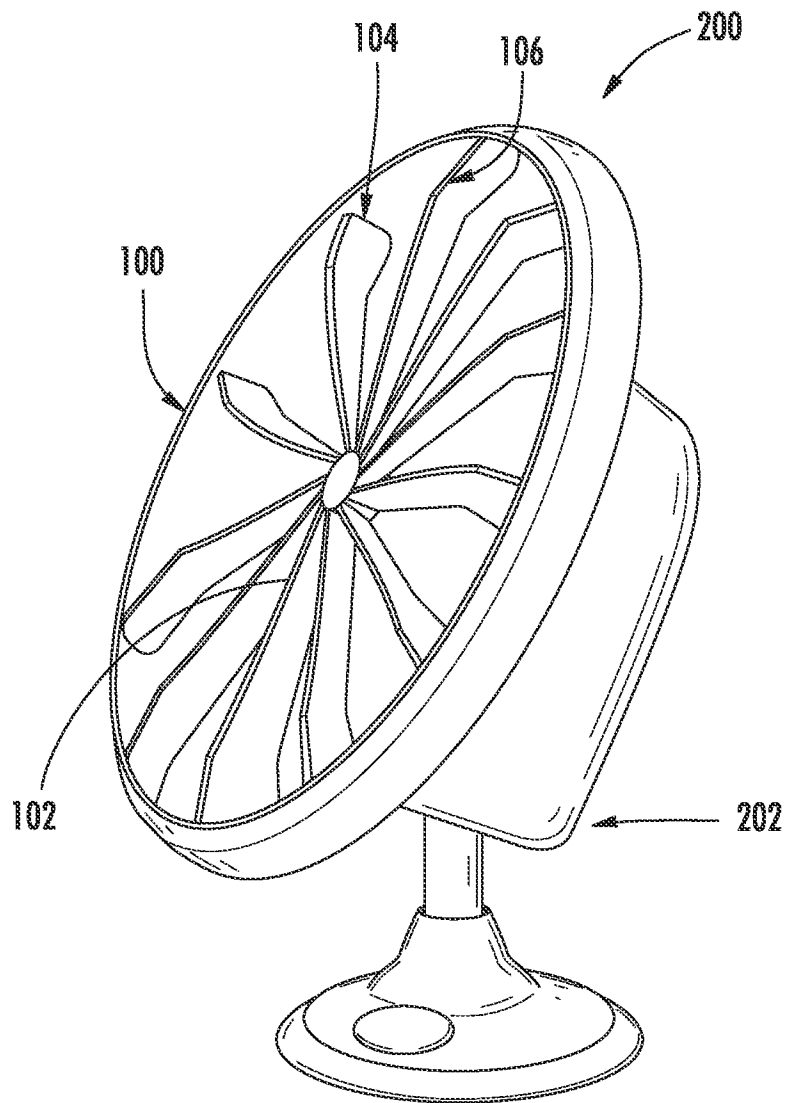


FIG. 3