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VENTILADOR DE REFRIGERACION CON ASPA REFORZADA

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DELTA T CORPORATION

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74. APODERADO

EMILIO FERRERO

C.C. 438.019 de Usaquén.

22. BOGOTA, D.C.,



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☐ Capítulo I.

☐ Patente de Modelo de Utilidad.
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S LICITANTE
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Nombre: **DELTA T CORPORATION**
sociedad constituida y existente bajo las
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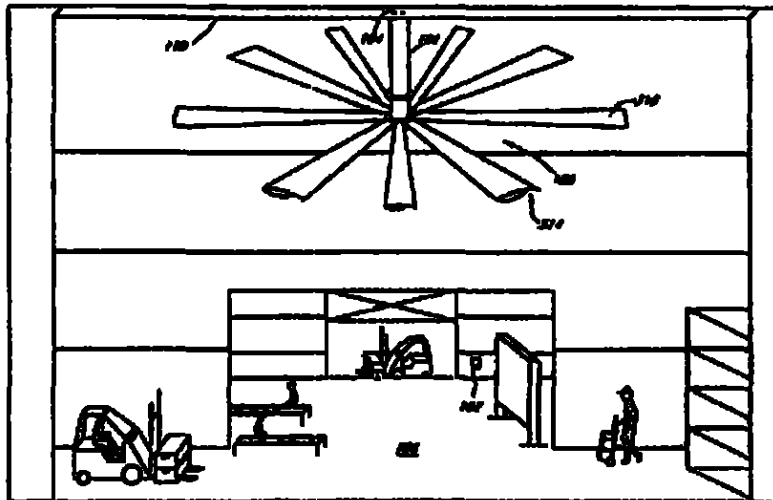
10

Anexos:

- ☒ Comprobante de pago de la tasa de presentación de la solicitud por \$ 422.000.00.
- ☐ Comprobante de pago por reivindicación de prioridad.
- ☐ Documento que acredita la existencia y representación legal cuando el solicitante sea persona jurídica.
- ☐ Poderes, si fuere el caso.
- ☐ Documento de cesión del inventor al solicitante o a su causante.
- ☒ Declaraciones.(De acuerdo con la Regla 4.17.)
- ☒ Copia de la solicitud internacional. (Resumen, descripción, reivindicaciones, dibujos)
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- ☐ Otros. Hoja anexa con documentos presentados.

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FIGURA CARACTERÍSTICA



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NOMBRE: EMILIO FERREROFIRMA: Emilio Ferrero

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Páginas 17 en el idioma original

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2. ☒ **Forma PCT/RO/101. PCT Request**
3. ☒ **Forma PCT/RO/105.PCT – Notification of the international application number and filing date**
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22. ☒ **Respuesta a Opinión escrita emitida por IPEA con anexos, y traducción de nuevas reivindicaciones en las que se debe basar el estudio de patentabilidad.**

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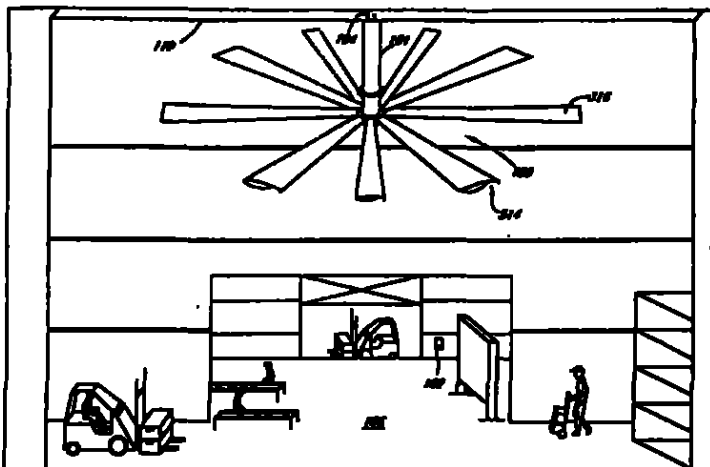
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(Continued on next page)

(54) Title: COOLING FAN WITH REINFORCED BLADE



(57) Abstract: A circulatory device comprising a large diameter fan having reinforced fan blades with a tapered airfoil shape is disclosed. The fan blades may be formed using an extrusion method of fabrication, wherein each fan blade may comprise a reinforced trailing edge with a downwardly extending flange. The benefit of forming each fan blade with a reinforced trailing edge of the present invention results in improved structural characteristics such that the trailing edge of each fan blade may be fabricated longer so as to improve aerodynamic performance. Also, the reinforced trailing edge resists tearing that may occur during extrusion by adding the bent flanged region to at least one distal end of the trailing edge. For example, the bent portion of the trailing edge tends to rigidly orient the extruded material in a stabilized position more readily during formation. Also, the bent portion provides added strength by providing supporting forces in two dimensions that relatively parallel and perpendicular to its length so as to neutralize the adverse effects of pressure forces acting on the trailing edge of the fan blade during extrusion.



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COOLING FAN WITH REINFORCED BLADE

Background of the Invention

5 Field of the Invention

The present invention relates to circulatory devices in large buildings and, in particular, concerns a cooling fan having reinforced blades that may be used to circulate a large volume of air.

10 Description of the Related Art

People who work in large buildings, such as warehouses and airport hangers, are routinely exposed to working conditions that range from being uncomfortable to hazardous. On a hot day, the inside air temperature may reach a point where a person is unable to maintain a healthy body temperature. Moreover, many activities that occur in
15 these environments, such as welding or operating internal combustion engines, create airborne contaminants that may be deleterious to those exposed. The effects of airborne contaminants are magnified to an even greater extent if the area is not properly vented.

The problem of cooling or circulating air in large buildings may not be solved by conventional air conditioning methods. The large volume of air within the building
'20 in conjunction with the large rate of heat conducted through ceilings and walls may require powerful air conditioning devices to be effective. If such devices were used, the operating costs would be substantial. Also, conventional air conditioning routinely re-circulates the internal air for added cooling efficiency. Therefore, conventional air conditioning is not typically used in ventilation systems that serve to rapidly remove
25 airborne contaminants, such as exhaust or smoke, and replace the contaminated air with fresh air from an outside source. For example, when welding and operating internal combustion engines within a structure, the internal air must be replaced and should not be re-circulated due to an unhealthy accumulation of airborne contaminants.

In general, small and large diameter fans may be used to provide some degree of
30 circulation, cooling, and ventilation when conventional air conditioning is not feasible. A drawback of using small diameter fans to circulate air is that the resulting airflow

dramatically tapers-off at downstream locations. Also, the large amount of electrical power required by the simultaneous use of these devices in great numbers negates their advantage as an inexpensive cooling system.

Moreover, a drawback to using large diameter fans is that they typically require specially constructed high-strength light-weight blades that may withstand large stresses caused by significant gravitational torques that increase with an increasing blade length to width aspect ratio. The fact that the rotational inertia of the fan increases with the square of the diameter requires the use of high torque producing gear reduction mechanisms. Unfortunately, conventional drivetrain components may be susceptible to mechanical failure due to the substantially large torque produced by electric motors during their startup phase, which may decrease the reliability of large diameter fans.

Certain large diameter fans have been equipped with low speed mechanisms and large fan blades with aerodynamic features. For instance, U.S. Patent Number 6,244,821 discloses a low speed cooling fan having a large diameter with proportionally large fan blades that may be formed using a generally known extrusion process. Unfortunately, such extruded blades have unsupported trailing edges that may tear from deforming or warping during formation and cooling. As a result, the aerodynamic features are shortened due to tearing created on longer unsupported trailing edges during fabrication, which reduces the overall performance of the large fan blades. Therefore, the shortened trailing edges adversely impact the aerodynamic effectiveness of the large fan blades thereby potentially diminishing the efficiency of generated circulatory air flow within a structure.

From the foregoing, there currently exists a need for a cost efficient circulatory device that provides optimal ventilation and effective cooling in large buildings. In particular, there currently exists a need for such a circulatory device that comprises improved fan blades and a method of manufacturing the same so as to increase the structural rigidity of the blade and maintain the enhanced aerodynamic performance.

Summary of the Invention

The aforementioned needs may be satisfied by a fan assembly for circulating air in an industrial building. In one embodiment, the fan assembly may comprise a support adapted to allow the mounting of the fan assembly to the roof of the industrial building

and a motor coupled to the support, the motor engaged with a rotatable shaft so as to induce rotation of the shaft. The fan assembly may further comprise a plurality of fan blades attached to the rotatable shaft, wherein each fan blade is formed of an extruded metal such that a first curved wall is joined to a second curved wall to form a leading junction and a trailing junction, and wherein the trailing junction extends to form a third curved wall having a trailing edge, each blade further comprising a flange that distally extends from the trailing edge in a continuous manner such that the angular displacement of the flange from the trailing edge forms a bent region that reinforces the trailing edge. In one aspect, each fan blade comprises an airfoil shape having a tapered trailing edge that is bent to form the flange, wherein the flange downwardly extends from the lower surface of the third curved wall.

Additionally, the first curved wall may be joined to a second curved wall to form a hollow interior region. The first curved wall may be joined to a second curved wall to form a solid interior region. Also, the plurality of fan blades may be attached to a hub, which is connected to the rotatable shaft. In one embodiment, the plurality of fan blades may comprise at least ten fan blades. It should be appreciated that the plurality of fan blades may comprise two or more fan blades without departing from the scope of the present invention. Each of the plurality of fan blades may be fabricated using an extrusion technique, wherein the extruded metal comprises aluminum.

Moreover, each fan blade may comprise a cross-sectional width between approximately 5 inches and 8 inches. Each fan blade comprises a cross-sectional height between approximately 0.75 (3/4) inches and 1.50 (3/2) inches. Each fan blade comprises a length between approximately 4 feet and 14 feet. The first and second curved walls comprise a thickness between approximately 0.0625 (1/16) inches and 0.1875 (3/16) inches. The third curved wall comprises a tapered shape that decreases in thickness across its length from approximately 0.125 (1/8) inches at the trailing junction to approximately 0.0625 (1/16) inches at the trailing edge. The flange comprises a length between approximately 0.25 (1/4) and 0.375 (3/8) inches.

In another embodiment, the aforementioned needs may also be satisfied by a metal fan blade for a fan assembly used in an industrial building. In this particular embodiment, the fan blade may comprise an extruded cross-sectional profile having a

plurality of curved walls, wherein a first curved wall is joined to a second curved wall to form an airfoil shape having a trailing edge that includes a flange extending outward from the direction of the trailing edge, wherein the flanged portion of the trailing edge downwardly extends from the lower surface of the trailing edge such that the angular displacement of the flanged portion from the lower surface of the trailing edge forms a reinforced region that increases the structural rigidity of the trailing edge so that the flanged trailing edge resists damage, and wherein the flange increases the volume of airflow resulting from the operation of the fan assembly having the fan blade.

In still another embodiment, the aforementioned may also be satisfied by a fan assembly for cooling industrial buildings. In this particular embodiment, the fan assembly may comprise a mounting assembly having a rotatable hub that attaches the fan assembly to the ceiling of the industrial building. The fan assembly may further comprise a plurality of fan blades mounted to the rotatable hub, wherein each of the plurality of fan blades is at least 3 feet long and is formed of an extruded metal so as to have a first air foil section and a tapered trailing edge, wherein a flange is integrally formed at the end of the tapered trailing edge so as to reinforce the tapered trailing edge and so as to provide increased downward thrust during rotation of the fan blades. In one aspect, the fan blades are formed using an extrusion fabrication process, wherein the flange reinforces the tapered trailing edge during the extrusion fabrication process so that the tapered trailing edge resists tearing while being formed.

In yet another embodiment, the aforementioned needs may be satisfied by a method of forming a fan blade. In this particular embodiment, the method may comprise softening a metal and forcing the metal into an extrusion mold such that a cooled metal fan blade is extruded out of the extrusion mold so as to have in cross-section a first air foil section and a tapered trailing edge integrally attached to an end of the first air foil section and a reinforcing flange that extends outward from the direction of the tapered trailing edge so as to reinforce the tapered trailing edge during extrusion to inhibit tearing of the tapered trailing edge. In one aspect, softening the metal may comprise softening aluminum, wherein softening the metal may further comprise softening an alloyed aluminum with at least one of copper, manganese, silicon, magnesium, and zinc.

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Additionally, the method may still further comprise forming an extrusion die to produce the fan blade with a hollow interior, wherein forcing the metal into the extrusion die comprises applying pressure to the softened metal using an extrusion press so as to force the softened metal through the extrusion die. Also, the joined fan blades
5 may be separated to form a plurality of individual fan blades.

In another aspect, forcing the metal into the extrusion mold may produce at least one fan blade with a uniform cross-section. Moreover, forcing the metal into the extrusion mold may produce the at least one fan blade having a first surface and a second surface that combine to form the airfoil section, which enhances the columnar
10 properties of the airflow produced by the at least one fan blade. Furthermore, forcing the metal into the extrusion mold may produce the at least one fan blade with an extended first surface that comprises at least one of the tapered trailing edge and the reinforcing flange, which results in an improved airfoil design. These and other objects and advantages of the present invention will become more apparent from the following
15 description taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

Figure 1 illustrates one embodiment of a fan assembly having a plurality of fan blades with each having a reinforced trailing edge that may be positioned adjacent to the
20 ceiling of a large commercial building.

Figure 2 illustrates one embodiment of the airflow pattern generated by the fan assembly of Figure 1.

Figure 3 illustrates a side elevation view of the fan assembly of Figure 1.

Figure 4 illustrates an axial view as seen by an observer looking up towards the
25 fan assembly of Figure 1.

Figure 5 illustrates a cross-sectional view of an individual fan blade in Figure 1, wherein the fan blade comprises a reinforced trailing edge.

Figure 6 illustrates the cross-sectional view of the individual fan blade of Figure 5 including the aerodynamic forces generated by the fan assembly of Figure 1.

Figure 7A illustrates one embodiment of a plurality of extrusion based manufacturing components including an extrusion die that may be used to form the extruded fan blade having the reinforced trailing edge.

Figure 7B illustrates one embodiment of an extrusion die that comprises an opening with a pattern similar in shape to the cross-sectional profile of the fan blade having the reinforced trailing edge.

Detailed Description of the Preferred Embodiment

Reference will now be made to the drawings wherein like numerals refer to like parts throughout. Figure 1 illustrates one embodiment of a fan assembly 100 having a plurality of fan blades 316 with each having a reinforced trailing edge 514 that may be positioned adjacent to the ceiling 110 of a large commercial and/or industrial building 106. In a manner as will be described in greater detail herein below, an extrusion process may be used to form each fan blade 316 with the reinforced trailing edge 514. In one aspect, the occurrence of trailing edge tearing to the fan blade 316 during extrusion may be reduced due to the supporting features of the reinforced trailing edge 514 in a manner that will be described in greater detail herein below.

The fan assembly 100 may be attached to any suitable pre-existing supporting structure or to any suitable extension connected thereto in an overhead configuration such that the axis of rotation of the fan assembly 100 is along a substantially vertical direction. It should be appreciated that the structural components of the fan assembly 100 including the scope and functionality of the reinforced trailing edge 114 will be described in greater detail herein below with reference to Figures 3-6.

In one aspect, the fan assembly 100 may comprise a low speed fan assembly as described in the Applicant's issued U.S. Patent Number 6,244,821, which is hereby incorporated by reference in its entirety. Figure 1 further illustrates the fan assembly 100 attached to an extension piece 101, which may be attached to a mounting location 104 positioned on the ceiling 110 using conventional fasteners, such as nuts, bolts, and/or welds, as is known in the art. A control box 102 may be connected to the fan assembly 100 through a standard power transmission line so as to supply electrical power to the fan assembly 100 in a manner that will be described in greater detail herein below.

As further illustrated in Figure 1, each fan blade 316 may take the form of a long narrow piece of aluminum with a hollow interior. In this particular embodiment, the fan blades 316 may be fabricated using a forced aluminum extrusion method of production in a manner as described in greater detail herein below with reference to Figures 7A, 7B.

5 Advantageously, this allows lightweight fan blades 316 with considerable structural integrity to be produced in an inexpensive manner. It also enables the fan blades 316 to be inexpensively fabricated with aerodynamic features, such as flanged trailing edges and airfoil contoured shapes. In addition, each fan blade 316 may be fabricated with a uniform cross-section along its length. However, it should be appreciated that alternative

10 embodiments may incorporate extruded aluminum fan blades with a non-uniform cross-section without departing from the scope of the present invention.

Moreover, the aerodynamic qualities of the fan blade 316 may be improved by forming a tapered trailing edge 514 on the fan blade 316, which may result in a more uniform airflow from the fan assembly 100 as is discussed in greater detail with reference

15 to Figures 5, 6. Also, using standard fasteners, a cap may be mounted on the distal ends of the fan blade 316 so as to cover the end openings and provide a continuous exterior surface. In one embodiment, the cap may comprise a minimal structure that essentially matches the cross-sectional area of the fan blade 316.

Figure 2 illustrates one embodiment of the airflow pattern 200 generated by the fan assembly 100 of Figure 1. As illustrated in Figure 2, when a user places the fan assembly 100 into an operational mode by entering an appropriate input into the control

20 box 102, a circulatory airflow 200 comprising, in one embodiment, gentle and/or uniform airflow patterns may be generated throughout the building's interior 106. In one embodiment, the circulatory airflow 200 comprises a large slowly moving downward airflow 202 that is able to travel through vast open spaces due to its large amount of inertial mass and because it travels away from the fan assembly 100 in a manner as described in the Applicant's issued U.S. Patent Number 6,244,821.

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In one aspect, the airflow 202 initially flows downward in a columnar manner towards a floor area 212 located beneath the fan assembly 100. As the airflow 202

30 approaches the floor area 212, the airflow 202 is subsequently diverted by the floor area 212 to outwardly expand in a radial manner as a lower horizontal airflow 204. Following,

the lower horizontal air flow 204 is directed by the walls 214 of the warehouse into an upward airflow 206, which is further directed by the warehouse ceiling 110 into an upper inwardly moving horizontal airflow 210. Upon reaching a region 216 above the fan assembly 100, the returning air in airflow 210 is directed downward again by the action of the fan assembly 100, thus repeating the cycle. Advantageously, the circulating airflow 200 created by the fan assembly 100 provides a pleasant working environment for individuals working inside the warehouse interior 106.

Figure 3 illustrates a detailed side elevation view of the fan assembly 100 in Figures 1, 2. The fan assembly 100 receives mechanical support from a support frame 302. The support frame 302 includes an upper steel horizontal plate 322 that is adapted to attach to a suitable horizontal support structure adjacent to a ceiling such that contact is made between the support structure and a first surface 366 of plate 322 to thereby allow the fan assembly 100 to be mounted adjacent the ceiling. In one embodiment, the plate 322 is bolted to a ceiling support girder so that the fan assembly 100 extends downward from the ceiling of the building in the manner similar to that shown in Figure 1.

The fan assembly may further comprise an electric motor 304. The electric motor 304 may be adapted to receive an AC power source with a varying frequency which allows the electric motor 304 to produce a variable rotational speed. In one embodiment, the electric motor 304 may comprise an inverter duty electric motor manufactured by Baldor Motor of America. Also, the electric motor 304 may comprise a built-in gear reduction drive or mechanism manufactured by Lenze of Germany that provides the necessary mechanical advantage to drive the large fan assembly 100. It should be appreciated that the maximum rate of power consumption of the electric motor 304 is approximately 370 watts.

The electric motor 304 may be mounted to the support frame 302 in a manner such that the axis of rotation of the motor 304 is along a vertical direction thus providing the fan assembly 100 with a driving torque. The motor shaft 306 transfers torque from the electric motor 304 to a hub 312 that is mounted on the shaft 306. The hub 312 may comprise a single cast aluminum piece of material with a disk-like shape that is adapted to secure a plurality of fan blades 316. A plurality of blade supports 314 extend from a rim section 346 so as to extend radially outward from the axis of rotation defined by the motor

shaft 306 by an approximate distance of 15 inches. The support blades 314 have a paddle-like shape and are adapted to slip into the ends of a plurality of fan blades 316 to provide a means for mounting the fan blades 316 to the hub 312. A more thorough discussion of the mechanical features of the fan assembly 100 including the mounting procedure of the fan blades 316 is described in the Applicant's issued U.S. Patent Number 6,244,821.

Figure 4 is a view of the fan assembly 100 as seen from below and illustrates the relationship between the hub 312, the set of blade supports 314 extending from the hub 312, and the set of fan blades 316 extending from the blade supports 314. Each fan blade 316 extends orthogonally from the rotational axis of the fan assembly 100 as defined by the motor shaft 306 in a manner that results in a uniform distribution of the plurality of fan blades 316. In the one embodiment, the diameter of the fan assembly 100 may be fabricated with a diameter ranging from 8 feet up to 40 feet. This results in the aspect ratio of each fan blade 316 to range between 8:1 up to 40:1. When the fan assembly 100 is operating under normal conditions, the maximum blade tip velocity may range from approximately 25 feet per second up to approximately 75 feet per second depending on the diameter of the fan assembly 100. In addition, the fan blades 316 may be mounted to the hub 312 at an angle so as to improve performance and efficiency by increasing the volume of columnar air flow distributed by the fan assembly 100 during operation.

Figure 5 illustrates a cross-sectional view of the fan blade 316 at an arbitrary location along its length as seen by an observer looking towards the distal end of the fan blade 316 with reference to Figure 1. The fan blade 316 may comprise a first curved wall 524, a second curved wall 526, and a hollow interior region 522 formed therefrom. The two walls 524 and 526 may be joined together at leading junction 531 and a trailing junction 532. At the trailing junction 532, the two walls 524, 526 combine in a continuous manner to form a third wall 530, wherein the third wall 530 continues until it reaches the reinforced trailing edge 514, which may be tapered so as to decrease in thickness across its length. Additionally, a first surface 506 may be formed at the exterior of wall 524 and continues in a seamless manner to the exterior of wall 530 until the reinforced trailing edge 514 may be reached. A second surface 510 may be formed at the exterior of the wall 526 and continues in a seamless manner to the exterior of wall 530 until the reinforced trailing edge 514 may be reached.

In addition, the two surfaces 506, 510 meet at a leading edge 512. The hollow interior region 522, which may also be referred to as a cavity region, may comprise a rectangularly-shaped broad central section 500. A planar third surface 516 may be formed at the interior of wall 524 in the region of section 500, and a planar fourth surface 520 may be formed at the interior of wall 530 in the region of section 500. In one aspect, the planar interior surfaces 516, 520 may be substantially parallel to each other. It should be appreciated that the fan blade 316 may comprise a solid interior region without departing from the scope of the present invention. It should also be appreciated that the cross-sectional dimensions of the fan blade 316 including the reinforced trailing edge 514 will be described in greater detail herein below with reference to Figure 7B.

Moreover, the reinforced trailing edge 514 may comprise a downwardly extending flange 538 supported by a bent region 536. As illustrated in Figure 5, the reinforced trailing edge 514 extends from the trailing junction 532 in a manner so as to follow the curvature of the first curved wall 524. The distal end of reinforced trailing edge 514 bends downward in a manner so as to form the bent region 536 and the downwardly extending flange 538. The flange 538 distally extends from the reinforced trailing edge 514 via the bent region 536 and forms a first angle 540 with the reinforced trailing edge 514. Depending on the particular application and operation of the fan blade 316, the length of the flange 538 and the angular displacement of the first angle 540 may vary in magnitude without departing from the scope of the present invention.

The length of the flange 538 may comprise a magnitude between 0.125 (1/8) and 0.375 (3/8) inches, and the angular displacement of the first angle may comprise a magnitude between 80 and 100 degrees. In a preferred embodiment, the flange 538 may comprise a length of approximately 0.25 (1/4) inches, and the first angle 540 may comprise an angular displacement of approximately 90 degrees. In addition, the fan blade 316 including the reinforced trailing edge may comprise extruded aluminum, but it should be appreciated that the fan blade 316 may comprise various generally known extruded materials without departing from the scope of the present invention.

In one aspect, the structural bend of the bent region 536 increases the strength of the distal end of the reinforced trailing edge 514 in a manner such that the structural bend improves rigidity by providing supporting forces in two dimensions relatively parallel and

perpendicular to its length. The Applicant has observed that, during extrusion of the fan blade 316, the trailing edge without the bent region 536 or the flange 538 may warp, tear, or deform in a manner so as to adversely affect the structural integrity of the trailing edge. For example, tearing of the unsupported trailing edge may occur during extrusion as a result of material being forced through an extrusion die such that pressure forces tend to tear unsupported regions. During formation, as the extruded material leaves the extrusion die, a pressure differential is created at the trailing junction 532 where the larger bulk material of the two exterior surfaces 506, 510 creates a large drifting pressure towards to the smaller bulk material of the trailing edge. Since the two exterior surfaces 506, 510 support each other at the trailing junction 532, the unsupported trailing edge is more susceptible to tearing as the length of the trailing edge 514 is made longer. Unfortunately, a shorter trailing edge reduces the aerodynamic performance of the fan blade 316.

Conversely, the benefit of forming the fan blade 316 with a reinforced trailing edge 514 of the present invention results in improved structural characteristics such that the reinforced trailing edge 514 may be fabricated longer so as to improve the aerodynamic performance of the fan blade 316. In one aspect, the reinforced trailing edge 514 resists damage and/or tearing that may occur during extrusion by adding the bent flanged region 536, 538 to the distal end of the trailing edge 514. For example, the bent portion 536 of the reinforced trailing edge 514 tends to rigidly orient the extruded material in a stabilized position more readily during formation. Moreover, the bent portion 238 provides added strength by providing supporting forces in two dimensions that relatively parallel and perpendicular to its length so as to neutralize the adverse effects of pressure forces acting on the trailing edge of the fan blade 316. Additional benefits associated with the downwardly extending flange 514 will be described in greater detail below.

As illustrated in Figure 5, the two exterior surfaces 506, 510 may be adapted to form the contour of an airfoil shape. For example, the airfoil shape may be based on the shape of a German sail plane wing having a reference number FX 62-K-131. In one aspect, the fan blade 316 may comprise a length between approximately 3 feet and 15 feet long and may be formed of an extruded metal so as to have a first air foil section 502 and a tapered trailing edge 514, wherein the flange 538 may be integrally formed at the end of the tapered trailing edge 514 so as to reinforce the tapered trailing edge 514

and so as to provide increased downward thrust during rotation of the fan blades 316. When the fan assembly 100 is in an operating mode, the cross-sectional image of the fan blade 316, as illustrated in Figures 1, 2, tilted by a corresponding angle of attack in a clockwise manner would appear to travel with the leading edge 512 in front.

5 According to an observer fixed to an individual fan blade 316, the motion of the fan blade 316 may cause air currents 600, 602 along the surfaces 506, 510 of the fan blade 316, respectively. The airfoil shape of each fan blade 316 may further cause the velocity of the upper air current 534 to be greater than the velocity of the lower air current 536. As a result, the air pressure at the lower surface 510 may be greater than the air pressure at the upper surface 506. The apparent asymmetric airflows produced by the rotation of the fan blades 316 results an upward lift force F_{lift} to be experienced by each fan blade 316. A reactive downward force F_{vertical} is therefore applied to the surrounding air by each fan blade 316. Moreover, the airfoil shape of the fan blade 316 may reduce a horizontal drag force $F_{\text{horizontal}}$ acting on each fan blade 316, therefore resulting in a reduced horizontal force $F_{\text{horizontal}}$ being applied to the surrounding air by each fan blade 316. Therefore, the airflow created by the fan assembly 100 may approximate a columnar flow of air along the axis of rotation of the fan assembly 100.

As further illustrated in Figure 6, the downwardly extending flange 538 enhances the performance of the fan blade 316. During rotation of the fan blade 316, the flange 538 may produce two counter rotating vortices 650, 652 adjacently downstream of the reinforced trailing edge 514. An upper vortex 650 may be produced by the upper stream of airflow 600 flowing above the fan blade 316, and a lower vortex 652 may be produced by the lower stream of airflow 602 flowing underneath the fan blade 316. In one aspect, the upper vortex 650 generates a pseudo pumping action that maintains a lower pressure above the fan blade 316, thus effectively producing additional downward force F_{vertical} . Moreover, the counter rotating vortices 650, 652 virtually extend the length of the trailing edge 514 in a manner such that the fan blade 316 produces additional downward force F_{vertical} . Even though the horizontal drag force $F_{\text{horizontal}}$ is slightly increased, the advantages of increasing the downward force F_{vertical} are substantial.

30 Advantageously, the technical difficulties involved in designing the fan assembly 100 have been overcome by incorporating innovative design features. In particular, the

large fan blades 316 may be manufactured using an extruded aluminum technique. This method results in fan blades 316 that are sturdy, lightweight, and relatively inexpensive to manufacture. The extrusion method may also enable the fan blades 316 to be fabricated with an airfoil shape, which enables a columnar airflow to be generated.

5 Figure 7A illustrates one embodiment of a plurality of extrusion manufacturing components 700 including an extrusion die 708 that may be used to form an extruded fan blade 316 having a reinforced trailing edge 514. The material used for the extrusion process may comprise an extrusion billet 702, wherein the extrusion billet 702 may be a solid or hollow piece of material that may be cylindrical in shape. In one aspect, the
10 extrusion billet 702 may comprise alloyed aluminum in a generally known form, such as a cast product, wrought product, or powder compact product that may be cut from a longer length of material. It should be appreciated that alloyed materials may comprise one or more metallic elements without departing from the scope of the present invention. For example, aluminum based extrusion alloys may comprise small amounts
15 of metallic elements such as copper, manganese, silicon, magnesium, or zinc. Advantageously, these alloying elements enhance the natural properties of aluminum and influence the extrusion process.

 The extrusion billet 702 may vary in length depending on a number of pre-determined parameters including the desired length of the finished profile, the extrusion
20 ratio, the length of the run-out, and the requirements of the extrusion press. In one aspect, the length of the extrusion billet 702 may range from approximately 36 inches to about 40 inches. In addition, the outside diameter of the extrusion billet 702 may range from approximately 7 inches to about 8 inches. It should be appreciated that the outside diameter of the extrusion billet 702 may be as large as 14 inches without departing from
25 the scope of the present invention.

 The next extrusion manufacturing component may comprise a heating furnace 704 that may be used to preheat the extrusion billet 702. During the extrusion process, the billet 702 is softened and/or softened in the heating furnace 704 so as to be more pliable. The softening point of aluminum varies with the purity of the metal, but is
30 approximately 1,220° Fahrenheit (660° Centigrade). In one embodiment, the extrusion

process may require the billet 702 to be heated to temperatures in excess of 700°F (375°C) and, depending upon the alloy being extruded, as high as 930°F (500°C).

The following manufacturing component may comprise an extrusion press 706 having an extrusion die 708. Figure 7B illustrates one embodiment of an extrusion die 708 that comprises a pattern similar in shape to the fan blade 316 having the reinforced trailing edge 514. The extrusion die 708 may comprise a steel disk with an opening that may be sized and shaped to substantially match the intended cross-section of the final extruded profile of the fan blade 316. The opening or orifice runs completely through the extrusion die 708 so as to allow the softened billet 702 passage through from the front end to the back end. As is known in the art, dies may be grouped as solid (or flat) dies, which produce solid shapes, and hollow dies, which produce hollow or semi-hollow shapes, such as the fan blade 316 as illustrated in Figures 5, 6.

Combinations of solid, semi-hollow, and/or hollow shapes may be incorporated into a single die, wherein a solid die may have one or more orifices or apertures through which the softened alloy is forced (extruded). As illustrated in Figure 7B, the extrusion die 708 die may be used to produce hollow profiles by means of a fixed or floating mandrel 720. Advantageously, the use of the extrusion die 708 with the mandrel 720 for extruding the fan blade 316 produces a hollow shape. Without departing from the scope of the present invention, it should be appreciated by one skilled in the art that the extrusion die 708 may be formed without the mandrel 720 so as to produce an extruded fan blade 316 with a solid interior region.

As is known in the art, the extrusion press may further comprise an extrusion press container that houses the billet 702 and a ram that may be used to apply pressure and/or force to the billet 702 within the container. Various hydraulic extrusion presses may be capable of exerting anywhere from 100 tons to 15,000 tons of pressure, wherein the pressure capacity of the extrusion press determines how large an extrusion it may produce. When pressure is applied, the billet 702 is forced against the die 708 and expands until restricted by contact with the walls of the container. Then, as the pressure increases, the soft (but still solid) metal forced to squeeze out through the shaped orifice of the extrusion die 708 in a manner so as to emerge on the other side of the extrusion die 708 as a formed profile of the fan blade 316. Subsequently, the extruded fan blade

316 may be removed from the back end of the extrusion die 708. After the extruded fan blade 316 is removed from the extrusion die 708, the still-hot extruded fan blade 316 may be quenched, mechanically treated, and aged.

5 In one embodiment, the cross-sectional dimensions and/or profile of the extruded fan blade 316 may comprise a width between approximately 5 inches and 8 inches and a height between approximately 0.75 (3/4) inches and 1.50 (3/2) inches. In a preferred embodiment, the cross-sectional dimensions of the fan blade 316 may comprise a width of approximately 7 inches and a height of approximately 1 inch. Also, the thickness of the first, second, and third curved walls 524, 526, 530 may be between approximately 0.0625
10 (1/16) inches and 0.1875 (3/16) inches thick. In a preferred embodiment, the thickness of the walls 524, 526, 530 may be approximately 0.15625 (5/32) inches thick. Alternatively, the third wall 530 may comprise a tapered shape so as to decrease in thickness from approximately 0.1875 (3/16) inches at the trailing junction 532 across its length to approximately 0.0625 (1/16) inches at the reinforced trailing edge 514.

15 Additionally, depending on the size of the billet 702 and the size of the die 708 opening, a continuous extrusion as much as 100 feet long may be produced with each stroke of the extrusion press 706. The newly-formed extruded fan blade 316 may be supported on a run-out conveyor as the extruded fan blade 316 leaves the extrusion press 706. The extrusion may then be transferred to a cooling table and cooled after
20 emerging from the die 708 through the use of air or water quenches.

The next manufacturing component may comprise a straightener 710 and a saw 712, wherein the straightener 710 may be used, after the extruded profile has been cooled to straighten the profile and correct any twisting that may have occurred subsequent to the extrusion process. After straightening, conveyors may be used to feed
25 the extruded fan blade 316 to the saw 712. The saw 712 may comprise a finish cut saw that may be used to cut the extruded profile to a desirable length. In one embodiment, the finish cut dimensions of the extruded fan blade 316 may comprise a length between approximately 4 feet and 15 feet. In a preferred embodiment, the finish cut dimensions of the fan blade 316 may comprise a length of approximately 112 inches. Also, circular saws
30 and/or a radial arm saw may be used to cut across the profile at an angle that is substantially perpendicular to the length of the extruded profile. In various other

embodiments, the saw 712 may comprise a power miter saw, that drops down onto the profile, or a table saw with a circular blade that rises to cut the extruded profile. A typical finish cut saw may be 16 to 20 inches in diameter with carbide-tipped teeth.

5 The following manufacturing component may comprise an aging oven 714. As is known in the art, some extrusion alloys reach their optimal strength through the process of aging, which may be referred to as age-hardening. Natural aging may occur at room temperature, and artificial aging may comprise controlled heating in the aging oven 714, which may be referred to as precipitation heat-treating. In one aspect, when the extruded profile emerges from the extrusion press 706, the extruded profile may
10 comprise a semi-solid state, but rapidly solidifies as it cools or is quenched. It should be appreciated that aluminum alloys, such as those comprising manganese or magnesium, derive their strength through natural aging and cold working. Alternatively, other aluminum alloys, such as those comprising copper, zinc, and magnesium with silicon, may be further strengthened or hardened through controlled thermal treatments that
15 affect the metallurgical structure of the alloys. Consequently, the aging process may ensure substantially uniform precipitation of fine particles through the metal, yielding increased strength, hardness, and elasticity for the specific extrusion alloy.

The extrusion process, as described with reference to Figure 7A, may be utilized to shape the fan blade 316 having a continuous cross-section by forcing the extrusion
20 billet 702 through the extrusion die 708, which comprises a profile opening of the fan blade's 316 cross-section as illustrated in Figure 7B. The process of forming the extruded fan blade 316 having the reinforced trailing edge 514 may proceed as follows. The extrusion die 708 may be prepared and attached to the extrusion press 706. Next, the extrusion billet 702, which preferably comprises an aluminum alloy, may be placed in an
25 extrusion press container and preheated in the heating furnace 704. The pliable billet 702 may be forced through the extrusion die 708 by applying pressure to the billet 702 using the extrusion press 706 in a manner so as to form the fan blade 316 with the reinforced trailing edge 514. Once the extruded profile of the fan blade 316 is cooled and straightened in the straightener, the extruded profile may be cut using the saw 712 at pre-
30 determined intervals so as to form a plurality of fan blades 316 with the desired length of the fan blade 316 from the extruded profile. Additional processing may comprise aging

the extruded fan blades 316 in a manner as previously described. After processing the extruded fan blades 316, the process of forming the fan blades 316 is completed.

Advantageously, the technical difficulties involved when extruding the fan blade 316 have been overcome by reinforcing the trailing edge 514 with the bent region 536 and the downwardly extending flange 538. Since the large fan blades 316 are formed using an extruded aluminum technique, the formation process results in improved fan blades 316 that comprise enhanced structural characteristics, such as improved rigidity, sturdiness, and resiliency. The extrusion method may also enable the fan blades 316 to be fabricated with enhanced aerodynamic performance characteristics, which enables a larger columnar airflow to be generated during operation. Therefore, the improved design of the above-mentioned fan assembly 100 with improved fan blades 316 having the reinforced trailing edge 514, as described herein, comprises a significant improvement over the prior art.

Although the preferred embodiment of the present invention has shown, described, and pointed out the fundamental novel features of the invention as applied to this particular embodiment, it will be understood that various omissions, substitutions and changes in the form of the detail of the device illustrated may be made by those skilled in the art without departing from the spirit of the present invention. Consequently, the scope of the invention should not be limited to the foregoing description, but should be defined by the appending claims.

20

WHAT IS CLAIMED IS:

1. A fan assembly for circulating air in an industrial building, the fan assembly comprising:

a support adapted to allow the mounting of the fan assembly to the roof of the industrial building;

a motor coupled to the support, the motor engaged with a rotatable shaft so as to induce rotation of the shaft; and

a plurality of fan blades attached to the rotatable shaft, wherein each fan blade is formed of an extruded metal such that a first curved wall is joined to a second curved wall to form a leading junction and a trailing junction, and wherein the trailing junction extends to form a third curved wall having a trailing edge, ^{a) Following the curvature of the first curved wall} each blade further comprising a flange that distally extends from the trailing edge in a continuous manner such that the angular displacement of the flange from the trailing edge forms a bent region that reinforces the trailing edge.

2. The fan assembly of Claim 1, wherein the each fan blade comprises an airfoil shape having a tapered trailing edge that is bent to form the flange.

3. The fan assembly of Claim 1, wherein the flange downwardly extends from the lower surface of the third curved wall.

4. The fan assembly of Claim 1, wherein the first curved wall is joined to a second curved wall to form a hollow interior region.

5. The fan assembly of Claim 1, wherein the first curved wall is joined to a second curved wall to form a solid interior region.

6. The fan assembly of Claim 1, wherein each fan blade comprises a cross-sectional width between approximately 5 inches and 8 inches.

7. The fan assembly of Claim 1, wherein each fan blade comprises a cross-sectional height between approximately 0.75 (3/4) inches and 1.50 (3/2) inches.

8. The fan assembly of Claim 1, wherein each fan blade comprises a length between approximately 4 feet and 14 feet.

9. The fan assembly of Claim 1, wherein the first and second curved walls comprise a thickness between approximately 0.0625 (1/16) inches and 0.1875 (3/16) inches.

5 10. The fan assembly of Claim 1, wherein the third curved wall comprises a tapered shape that decreases in thickness across its length from approximately 0.1875 (3/16) inches at the trailing junction to approximately 0.0625 (1/16) inches at the trailing edge.

11. The fan assembly of Claim 1, wherein the flange comprises a length between approximately 0.125 (1/8) and 0.375 (3/8) inches.

10 12. The fan assembly of Claim 1, wherein the plurality of fan blades are attached to a hub, which is connected to the rotatable shaft.

13. The fan assembly of Claim 1, wherein the plurality of fan blades includes at least ten fan blades.

15 14. The fan assembly of Claim 1, wherein each of the plurality of fan blades are fabricated using an extrusion technique.

15 15. The fan assembly of Claim 14, wherein the extruded metal comprises aluminum.

20 16. A metal fan blade for a fan assembly used in an industrial building, the fan blade comprising an extruded cross-sectional profile having a plurality of curved walls, wherein a first curved wall is joined to a second curved wall to form an airfoil shape having a trailing edge that includes a flange extending outward from the direction of the trailing edge, wherein the flanged portion of the trailing edge downwardly extends from the lower surface of the trailing edge such that the angular displacement of the flanged portion from the lower surface of the trailing edge forms a reinforced region that increases the structural rigidity of the trailing edge so that the flanged trailing edge resists damage, and wherein the flange increases the volume of airflow resulting from the operation of the fan assembly having the fan blade.

25 17. The fan blade of Claim 16, wherein the first curved wall is joined to a second curved wall to form a hollow interior region.

30 18. The fan blade of Claim 16, wherein the first curved wall is joined to a second curved wall to form a solid interior region.

19. The fan blade of Claim 16, wherein the extruded cross-sectional profile comprises a cross-sectional width of approximately 7 inches.

20. The fan blade of Claim 16, wherein the extruded cross-sectional profile comprises a cross-sectional height of approximately 1 inch.

5 21. The fan blade of Claim 16, wherein the fan blade comprises a length of at least 4 feet.

22. The fan blade of Claim 16, wherein the fan blade comprises a length of at least less than 15 feet.

10 23. The fan blade of Claim 16, wherein the first and second curved walls comprise a thickness of approximately 0.15625 (5/32) inches.

24. The fan blade of Claim 16, wherein the trailing edge comprises a tapered shape that decreases in thickness across its length.

25. The fan blade of Claim 16, wherein the flange comprises a length between approximately 0.125 (1/8) and 0.375 (3/8) inches.

15 26. The fan blade of Claim 16, wherein the fan blade is fabricated using an extrusion die to form the extruded cross-sectional profile of the fan blade.

27. The fan blade of Claim 26, wherein the fan blade is formed using an aluminum extrusion technique.

20 28. A fan assembly for cooling industrial buildings, the fan assembly comprising:

a mounting assembly having a rotatable hub that attaches the fan assembly to the ceiling of the industrial building;

25 a plurality of fan blades mounted to the rotatable hub, wherein each of the plurality of fan blades is at least 4 feet long and is formed of an extruded metal so as to have a first air foil section and a tapered trailing edge, wherein a flange is integrally formed at the end of the tapered trailing edge so as to reinforce the tapered trailing edge and so as to provide increased downward thrust during rotation of the fan blades.

30 29. The fan assembly of Claim 28, wherein a first curved wall is joined to a second curved wall to form the first air foil section having a hollow interior region.

15

30. The fan assembly of Claim 29, wherein the first curved wall is extended to form the tapered trailing edge, and wherein the tapered trailing edge is bent at a distal end to form the flange.

5 31. The fan assembly of Claim 28, wherein the plurality of fan blades are formed using an extrusion fabrication process.

32. The fan assembly of Claim 31, wherein the flange reinforces the tapered trailing edge during the extrusion fabrication process so that the tapered trailing edge resists tearing while being formed.

10 33. The fan assembly of Claim 28, wherein each of the plurality of fan blades comprises aluminum.

34. A method of forming a fan blade comprising:
softening a metal;

15 forcing the metal into an extrusion mold such that a cooled metal fan blade is extruded out of the extrusion mold so as to have in cross-section a first air foil section and a tapered trailing edge integrally attached to an end of the first air foil section and a reinforcing flange that extends outward from the direction of the tapered trailing edge so as to reinforce the tapered trailing edge during extrusion to inhibit tearing of the tapered trailing edge.

20 35. The method of Claim 34, wherein softening the metal comprises softening aluminum.

36. The method of Claim 34, wherein softening the metal comprises softening an alloyed aluminum with at least one of copper, manganese, silicon, magnesium, and zinc.

25 37. The method of Claim 34, wherein the method further comprises forming an extrusion mold to produce the fan blade with a hollow interior region.

38. The method of Claim 34, wherein the method further comprises forming an extrusion mold to produce the fan blade with a solid interior region.

30 39. The method of Claim 34, wherein forcing the metal into an extrusion die comprises applying pressure to the softened metal using an extrusion press so as to force the softened metal through the extrusion mold.

40. The method of Claim 39, wherein the joined fan blades are separated to form a plurality of individual fan blades.

41. The method of Claim 34, wherein forcing the metal into the extrusion mold produces at least one fan blade with a uniform cross-section.

5 42. The method of Claim 41, wherein forcing the metal into the extrusion mold produces the at least one fan blade having a first surface and a second surface that combine to form the airfoil section, which enhances the columnar properties of the airflow produced by the at least one fan blade.

10 43. The method of Claim 42, wherein forcing the metal into the extrusion mold produces the at least one fan blade with an extended first surface that comprises at least one of the tapered trailing edge and the reinforcing flange, which results in an improved airfoil design.

15

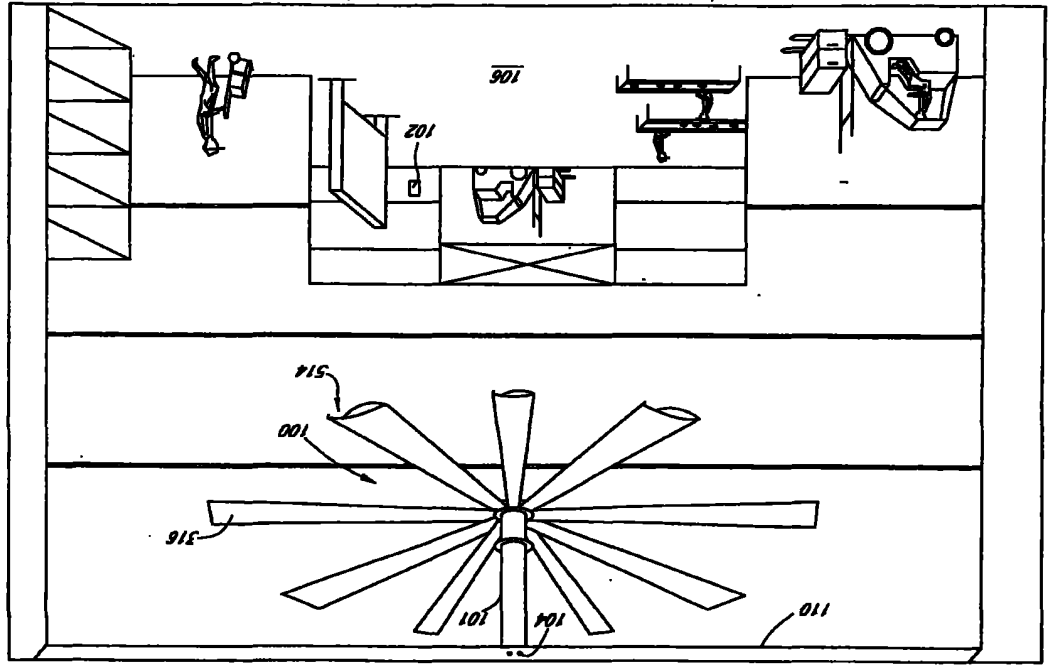


FIG. 1

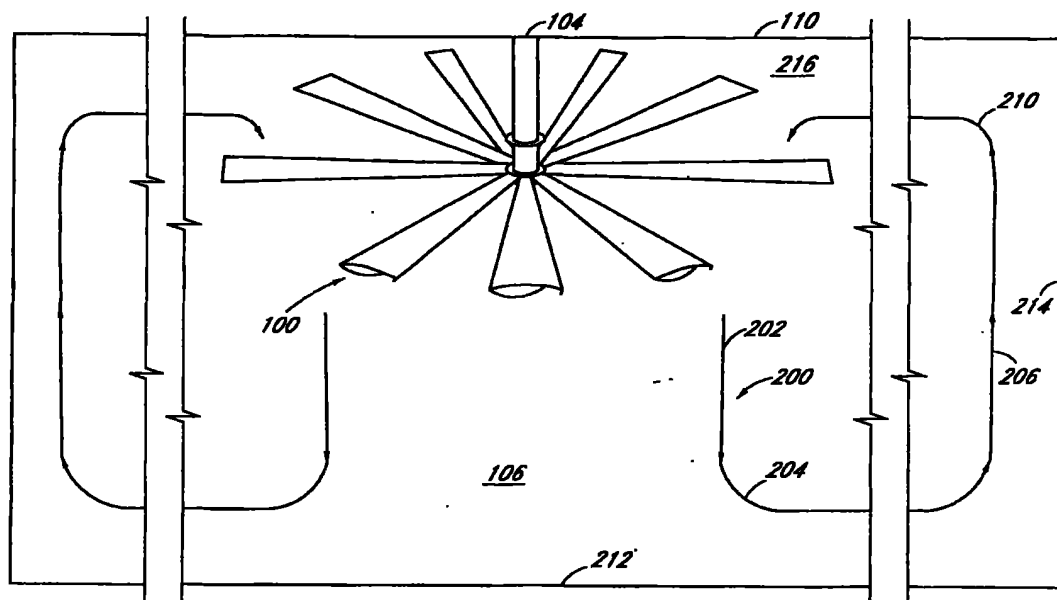


FIG. 2

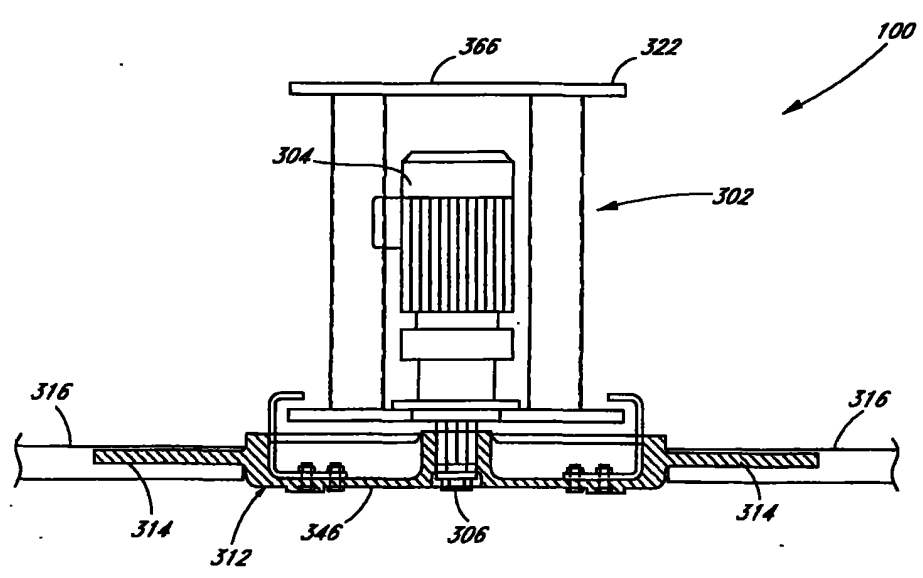


FIG. 3

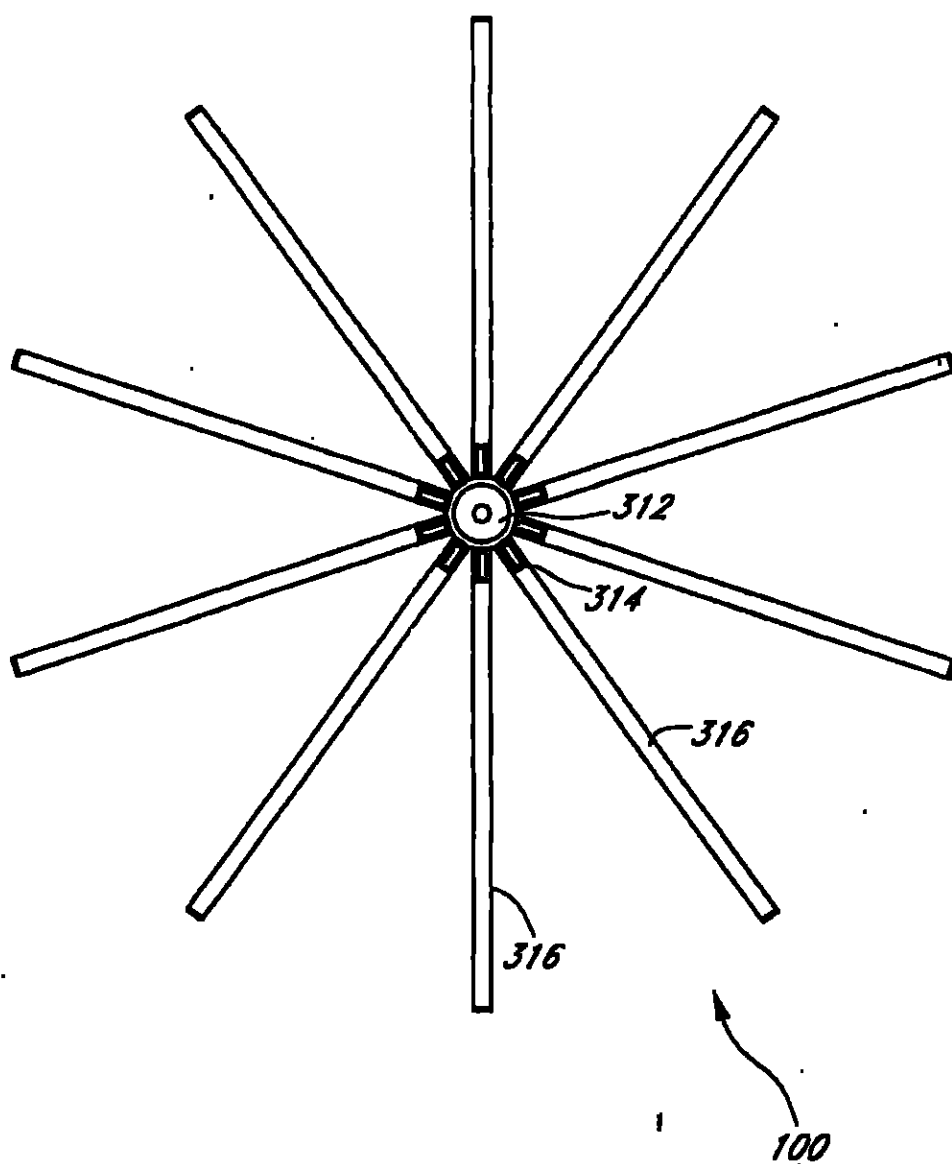


FIG. 4

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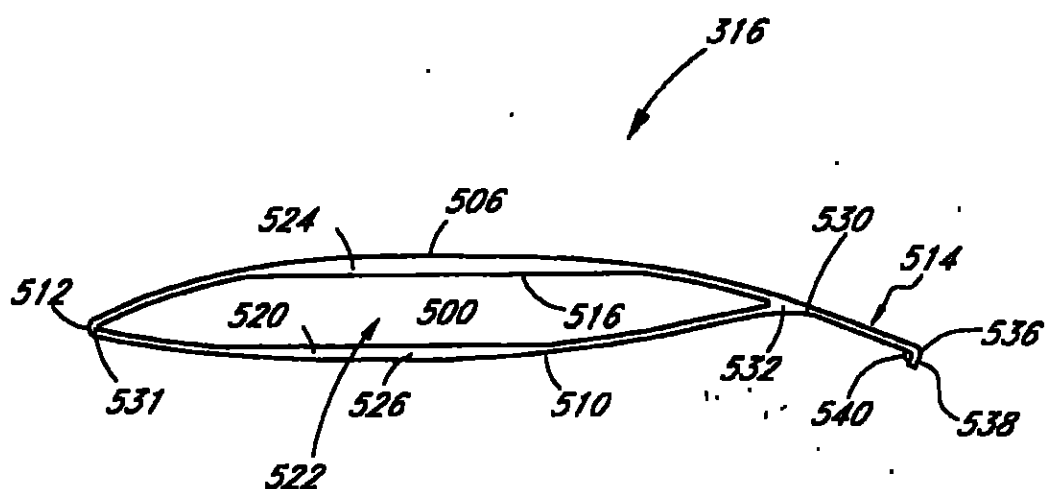


FIG. 5

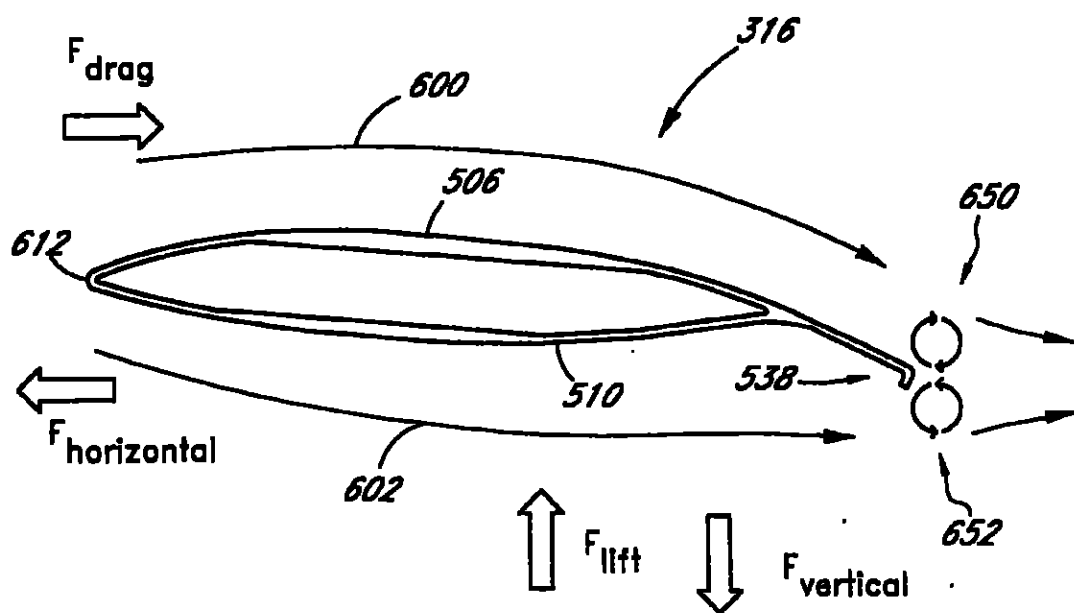


FIG. 6

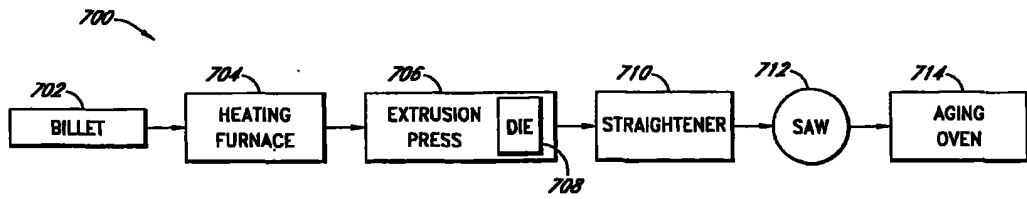


FIG. 7A

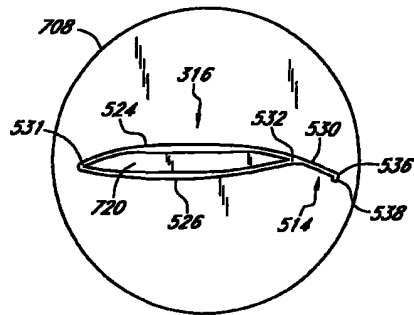


FIG. 7B

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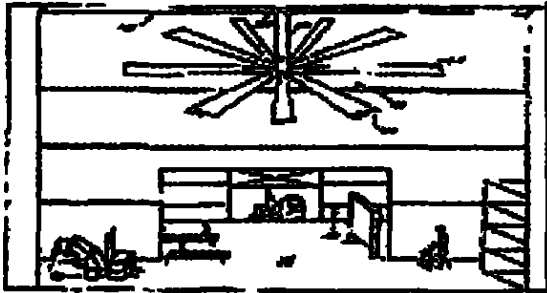
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(54) Título: VENTILADOR DE REFRIGERACIÓN CON ASPA REFORZADA



(57) Resumen: Se revela un dispositivo circulatorio que comprende un ventilador de gran diámetro con aspas reforzadas, con forma de alas cónicas. Las aspas del ventilador pueden estar fabricadas mediante el método de extrusión, por el cual cada aspa del ventilador puede comprender un borde posterior reforzado con una brida extensible hacia abajo. El beneficio de fabricar cada aspa del ventilador con un borde remanente reforzado de la invención actual resulta en características estructurales mejoradas tales que el borde remanente del aspa del ventilador puede ser fabricado más largo, con la finalidad de mejorar el desempeño aerodinámico. Además, el borde remanente reforzado resiste la rotura que puede ocurrir durante la extrusión, agregando la región embridada doblada a por lo menos un extremo distal del borde remanente. Por ejemplo, la porción doblada del borde remanente tiende a orientar de manera rígida el material extrudido a una posición estabilizada más rápidamente durante la fabricación. Además, la porción doblada ofrece una solidez adicional, brindando fuerzas de apoyo en dos dimensiones relativamente paralelas y perpendiculares a su longitud como para neutralizar los efectos adversos de la presión que actúa sobre el borde remanente del aspa del ventilador durante la extrusión.

JR KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, patente ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Patente Euroasiática (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), patente Europea (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), patente OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

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VENTILADOR DE REFRIGERACIÓN CON ASPA REFORZADA**Antecedentes de la invención****Campo de la invención**

La presente invención está relacionada con dispositivos circulatorios en edificios grandes y, en particular, concierne a un ventilador de refrigeración con aspas reforzadas que puede ser utilizado para circular un gran volumen de aire.

Descripción del arte relacionado

Las personas que trabajan en grandes edificios, tales como almacenes o hangares de aeropuertos, están continuamente expuestas a condiciones laborales que oscilan desde incómodas hasta peligrosas. En un día caluroso, la temperatura del aire interno puede alcanzar puntos en los cuales una persona no puede para mantener una temperatura corporal saludable. Además, muchas actividades que ocurren en estos ambientes, tales como la soldadura o el funcionamiento de motores de combustión interna, crean contaminantes en el aire que pueden ser deletéreos para aquellos expuestos a los mismos. Los efectos de contaminantes en el aire son magnificados a un grado aún mayor cuando el área no está adecuadamente ventilada.

El problema del aire refrigerante o circulante en edificios grandes probablemente no se solucione a través de métodos convencionales de acondicionamiento de aire. El gran volumen de aire dentro de un edificio en conjunto con los altos niveles de calor conducido a través de los techos y paredes podría requerir dispositivos para el acondicionamiento del aire muy poderosos para que sean efectivos. Si se usaran tales dispositivos, los costos operativos serían sustanciales. Adicionalmente, los sistemas convencionales de acondicionamiento de aire recirculan el aire interno continuamente para mayor eficiencia en la refrigeración. Por lo tanto, el acondicionamiento convencional del aire normalmente no se utiliza en los sistemas de ventilación para reemplazar el aire contaminado con aire fresco proveniente de una fuente externa. Por ejemplo, durante el soldado o el funcionamiento de motores de combustión interna

dentro de una estructura, el aire interno debe ser reemplazado y no debería ser recirculado, debido a una acumulación insalubre de contaminantes en el aire.

En general, los ventiladores con diámetros pequeños o grandes pueden ser utilizados para proveer algún grado de circulación, refrigeración y ventilación cuando el acondicionamiento convencional del aire no es factible. Un inconveniente de usar ventiladores de pequeño diámetro para circular el aire es que el flujo de aire resultante disminuye dramáticamente en ubicaciones hacia abajo. Además, la gran cantidad de alimentación eléctrica requerida para el uso simultáneo de estos dispositivos en grandes números invalida su ventaja como sistema de enfriamiento económico.

Por otra parte, una desventaja de usar ventiladores de gran diámetro es que normalmente requieren aspas especialmente construidas, livianas y de alta resistencia, que puedan soportar grandes tensiones ocasionadas por torsiones gravitacionales significativas que incrementan a medida que crece la relación de longitud respecto al ancho del aspa. El hecho que la inercia rotacional del ventilador incrementar con el cuadrado del diámetro, requiere el uso de mecanismos con engranajes de reducción para la producción de alto par. Desafortunadamente, los componentes de trenes propulsores convencionales pueden ser susceptibles a fallas mecánicas debido al par sustancialmente alto producido por los motores eléctricos durante su fase de arranque, lo cual podría disminuir la confiabilidad de los ventiladores de gran diámetro.

Ciertos ventiladores de gran diámetro han sido equipados con mecanismos de baja velocidad y grandes aspas con características aerodinámicas. Por ejemplo, la Patente de los EE.UU. Número 6,244,821 revela un ventilador de refrigeración de baja velocidad con un gran diámetro y aspas proporcionalmente grandes que podrían estar fabricadas a través de un procedimiento de extrusión conocido generalmente. Desafortunadamente, tales aspas extrudidas poseen bordes remanentes sin soporte que pueden rasgarse a causa de la deformación o pandeo durante la formación y el enfriamiento. Como resultado, las características aerodinámicas se reducen debido al rasgado que se produce durante la fabricación sobre los bordes remanentes más largos y sin soporte, reduciendo el desempeño general de las grandes aspas del ventilador. Por lo tanto, los bordes remanentes más cortos tienen un impacto adverso sobre la efectividad aerodinámica de las grandes aspas del ventilador, por ende disminuyendo potencialmente la eficiencia del flujo de aire circulatorio generado dentro de una estructura.

De lo anterior, existe actualmente la necesidad de un dispositivo circulatorio económico que ofrezca una ventilación óptima y un enfriamiento efectivo en grandes edificios. En particular, existe actualmente la necesidad de tal dispositivo circulatorio que

comprenda aspas mejoradas y un método de manufactura igual para incrementar la rigidez estructural de las aspas y para mantener el desempeño aerodinámico mejorado.

Resumen de la invención

Las necesidades mencionadas anteriormente podrían ser satisfechas gracias al conjunto de un ventilador para la circulación del aire en un edificio industrial. En una realización, el conjunto del ventilador podría incluir un soporte adaptado para permitir el montaje del conjunto del ventilador al techo de un edificio industrial y un motor acoplado al soporte, el motor activado por un eje giratorio para inducir la rotación del eje. El conjunto del ventilador podría también comprender un grupo de aspas conectadas al eje giratorio, donde cada aspa ha sido fabricada en metal extrudido de manera tal que una pared recurva se une a una segunda pared recurva para formar una unión principal y una unión remanente, donde la unión remanente se extiende para formar una tercera pared recurva con un borde remanente, y cada aspa adicionalmente comprende una brida que se extiende distal desde el borde remanente de manera continua tal que el desplazamiento angular de la brida desde el borde remanente forma un región doblada que refuerza el borde remanente. En un aspecto, cada aspa comprende una forma de ala con un borde remanente cónico doblado para formar una brida, donde la brida se extiende hacia abajo desde la superficie inferior de la tercera pared recurva.

Adicionalmente, la primera pared recurve puede estar unida con una segunda pared recurva para formar una región interna hueca. La primera pared recurva puede estar unida con una segunda pared recurva para formar una región interna sólida. También, el grupo de aspas puede estar unido a un módulo, el cual está conectado a un eje giratorio. En una realización, el grupo de aspas puede comprender por lo menos diez aspas. Es importante apreciar que el grupo de aspas podría comprender dos o más aspas sin alejarse del alcance de la presente invención. Cada uno de los grupos de aspas puede estar fabricado usando una técnica de extrusión, en la cual el metal extrudido comprende el aluminio.

Además, cada aspa puede comprender un ancho transversal entre 5 y 8 pulgadas aproximadamente. Cada aspa comprende una altura transversal entre aproximadamente 0.75 (3/4) pulgadas y 1.50 (3/2) pulgadas. Cada aspa comprende una longitud entre aproximadamente 4 pies y 14 pies. La primera y segunda pared recurva comprenden un espesor aproximadamente entre 0.0625 (1/16) pulgadas y 0.1875 (3/16) pulgadas. La tercera pared recurva comprende una forma cónica que decrece en espesor a lo largo de su longitud desde aproximadamente 0.125 (1/8) pulgadas al comienzo de la unión hasta

aproximadamente 0.0625 (1/16) pulgadas en el borde remanente. La brida comprende una longitud de aproximadamente 0.25 (1/4) y 0.375 (3/8) pulgadas.

En otra realización, las necesidades antes mencionadas también podrían ser satisfechas mediante un aspa de metal para un conjunto de ventilador usado en un edificio industrial. En esta realización en particular, el aspa podría comprender un perfil transversal extrudido con un grupo de paredes recurvas, donde la primera pared recurva está unida a la segunda pared recurva para formar un ala con un borde remanente que incluye una brida que se extiende hacia afuera desde la dirección del borde remanente, donde la posición embrizada del borde remanente se extiende hacia abajo desde la superficie inferior del borde remanente de manera tal que el desplazamiento angular de la porción embrizada del borde remanente forma una región reforzada que incrementa la rigidez estructural del borde remanente para que el borde remanente embrizado resista a los daños, y donde la brida incrementa el volumen del flujo de aire resultante de la operación del conjunto del ventilador con el aspa.

En otra realización más, las necesidades mencionadas anteriormente también podrían ser satisfechas mediante un conjunto de ventilador para la refrigeración de edificios industriales. En esta realización en particular, el conjunto de ventilador podría comprender un conjunto de montaje con un módulo que conecta el conjunto de ventilador al techo del edificio industrial. El conjunto de ventilador podría además comprender un grupo de aspas montadas sobre el modulo giratorio, donde el grupo de aspas es de por lo menos tres pies de largo y está fabricado en metal extrudido, como para obtener una primera sección de alas y un borde remanente cónico, donde una brida está formada integralmente al final del borde remanente cónico para proveer un empuje hacia abajo aún mayor durante la rotación de las aspas. En un aspecto, las aspas están fabricadas usando un proceso de extrusión, en el cual la brida refuerza el borde remanente cónico durante el proceso de extrusión para que el borde remanente cónico resista la rotura durante su fabricación.

En otra realización más, las necesidades antes mencionadas podrían ser satisfechas a través de un método de formación de aspas. En esta realización en particular, el método comprende el ablandamiento del metal y el forzamiento del metal en un molde para extrusión tal que una aspa de metal enfriado es extrudida del molde para obtener en transversal una primera sección de ala y un borde remanente cónico conectado integralmente al final de la sección de al y una brida reforzada que se extiende hacia fuera desde la dirección del borde remanente cónico para reforzar el borde remanente cónico durante la extrusión e inhibir la rotura del borde remanente cónico. En un aspecto, ablandar

el metal podría además comprender ablandar una aleación de aluminio con por lo menos una de cobre, manganeso, silicón, magnesio y zinc.

Adicionalmente, el método podría comprender aún más la formación de una boquilla de extrusión para producir las aspas huecas internamente, mientras que forzar el metal en la boquilla de extrusión comprende aplicar presión al metal ablandado usando una prensa de extrusión para forzar el metal ablandado por la boquilla. Además, las aspas unidas pueden separarse para formar un grupo de aspas individuales.

En otro aspecto, forzar el metal por el molde de extrusión podría producir por lo menos un aspa con una transversal uniforme. Adicionalmente, forzar el metal por el molde de extrusión podría producir por lo menos un aspa con una primera superficie y una segunda superficie que se combinara para formar la sección del ala, la cual mejora las propiedades de columna del flujo de aire producido por al menos un aspa. Además, forzar el metal por el molde de extrusión podría producir al menos un aspa con una primera superficie extendida que comprende por lo menos un borde remanente cónico y refuerza la brida, resultando en un diseño mejorado del ala. Estos y otros objetos y ventajas de la presente invención serán más aparentes gracias a la descripción a continuación, tomada en conjunto con los dibujos que la acompañan.

Breve descripción de los dibujos

La Figura 1 ilustra una realización de un conjunto de ventilador con un grupo de aspas que cuentan con un borde remanente reforzado que puede ser posicionado adyacente al techo de un edificio comercial grande.

La Figura 2 ilustra una realización del modelo del flujo de aire generado por el conjunto de ventilador de la Figura 1.

La Figura 3 ilustra una vista de la elevación lateral del conjunto de ventilador de la Figura 1.

La Figura 4 ilustra una vista axial según la puede observar un observador que mira hacia arriba al conjunto de ventilador de la Figura 1.

La Figura 5 ilustra una vista transversal de un aspa individual de la Figura 1, donde el aspa comprende un borde remanente reforzado.

La Figura 6 ilustra una vista transversal del aspa individual de la Figura 5, incluyendo las fuerzas aerodinámicas generadas por el conjunto de ventilador de la Figura 1.

La Figura 7A ilustra una realización de un grupo de extrusión sobre la base de los componentes de manufactura incluyendo una boquilla de extrusión que puede utilizarse para formar una aspa extrudida con un borde remanente reforzado.

La Figura 7B ilustra una realización de una boquilla de extrusión que comprende una apertura con un molde similar en la forma del perfil transversal del aspa con el borde remanente reforzado.

Descripción detallada de la realización preferida

Ahora se hará referencia a los dibujos donde los numerales similares se refieren a las piezas correspondientes. La Figura 1 ilustra una realización de un conjunto de ventilador 100 con un grupo de aspas 316 donde cada una cuenta con un borde remanente reforzado 514 que puede ser posicionado cerca del techo 110 de un gran edificio comercial y/o industrial 106. De un modo que será descrito en más detalle a continuación, es posible usar un proceso de extrusión para formar cada aspa 316 con el borde remanente reforzado 514. En un aspecto, la ocurrencia del rasgado del borde remanente al aspa 316 durante la extrusión puede ser reducida debido a las características de soporte del borde remanente reforzado 514 en la manera que se describirá en más detalle a continuación.

El conjunto de ventilador 100 puede anexarse a cualquier estructura de soporte preexistente o a cualquier extensión apta conectada al mismo en una configuración aérea tal que el eje de rotación del conjunto de ventilador 100 se encuentre en una dirección sustancialmente vertical. Es de apreciar que los componentes estructurales del conjunto de ventilador 100 incluyendo el alcance y funcionalidad del borde remanente reforzado 114 serán descritos en más detalle en el presente, con referencia a las Figuras 3-6.

En un aspecto, el ventilador 100 puede comprender un conjunto de ventilador de baja velocidad según descrito en la Patente de los EE.UU. Número 6,244,821 emitida y propiedad del Solicitante, la cual se incorpora a la presente por referencia en su totalidad. La Figura 1 ilustra adicionalmente el conjunto de ventilador 100 conectado a una extensión 101, la cual puede estar conectada a una ubicación de montaje 104 posicionada en el techo 110 utilizando amarres convencionales, tales como tuercas, pernos y/o soldaduras, como se conoce en el arte. Una caja de control 102 puede ser conectada al conjunto de ventilador 100 a través de una línea de transmisión eléctrica estándar, para que provea alimentación al conjunto de ventilador 100 en una manera que se describirá con mayor detalle en el presente documento.

Según se ilustra adicionalmente en la Figura 1, cada aspa 316 puede tomar la forma de un pedazo de aluminio angosto y largo, hueco internamente. En esta realización en

particular, las aspas 316 pueden estar fabricadas usando el método de producción por extrusión de aluminio forzado en la manera descrita en más detalle en el presente, con referencia a las Figuras 7A, 7B. Ventajosamente, esto permite aspas 316 livianas con considerable integridad estructural para que sean producidas de manera económica. También permite que las aspas 316 sean fabricadas de manera económica y con características aerodinámicas, tales como bordes remanentes embridados y formas de ala. Adicionalmente, cada aspa 316 puede ser fabricada con un transversal uniforme a lo largo de su longitud. Sin embargo, es de apreciar que realizaciones alternativas pueden incorporar aspas de aluminio extrudido con una transversal no uniforme sin alejarse del alcance de la presente invención.

Además, las calidades aerodinámicas del aspa 316 pueden mejorarse formando un borde remanente cónico 514 sobre el aspa 316, lo cual podría resultar en un flujo de aire más uniforme desde el conjunto de ventilador 100, según se discute en mayor detalle con referencia a las Figuras 5,6. También, usando amarres estándar, es posible montar una tapa en los extremos distales del aspa 316 para cubrir las aperturas en los extremos y proveer una superficie externa continua. En una realización, la tapa puede comprender una estructura mínima que esencialmente concuerda con el área transversal del aspa 316.

La Figura 2 ilustra una realización del modelo del flujo de aire 200 generado por el conjunto de ventilador 100 de la Figura 1. De acuerdo a lo ilustrado en la Figura 2, cuando un usuario coloca un conjunto de ventilador 100 en modalidad operacional ingresando los datos correctos en la caja de control 102, un flujo de aire giratorio 200 comprendiendo, en una realización, modelos de flujo de aire suave y/o uniforme podrían ser generados por todo el interior del edificio 106. En una realización, el flujo de aire giratorio 200 comprende un flujo de aire grande moviéndose lentamente hacia abajo 202 con capacidad para trasladarse por amplios espacios abiertos debido a su gran volumen de masa inercial y debido a que viaja lejos del conjunto de ventilador 100 en una manera tal según descrito en la Patente de los EE.UU. Número 6,244,821 emitida y propiedad del Solicitante.

En un aspecto, el flujo de aire 202 inicialmente fluye hacia abajo en columnas hacia el área del piso 212 ubicado por debajo del conjunto del ventilador 100. A medida que el flujo de aire 202 se acerca al área del piso 212, el flujo de aire 202 es subsiguientemente desviado al área del piso 212 para luego expandirse hacia fuera de manera radial como un flujo de aire horizontal más bajo 204.

Luego, el flujo de aire horizontal más bajo 204 es dirigido hacia las paredes 214 del almacén en un flujo de aire hacia arriba 206, el cual es dirigido hacia el techo del almacén 110 hacia un flujo de aire horizontal con movimiento hacia arriba y adentro 210. Al alcanzar la región 216 por encima del conjunto de ventilador 100, el flujo de aire que retorna 210 es dirigido hacia abajo nuevamente por la acción del conjunto de ventilador 100, por ende repitiendo el ciclo. Ventajosamente, el flujo de aire circulante 200 creado por el conjunto de ventilador 100 provee un ambiente laboral agradable para los individuos que trabajan dentro del almacén 106.

La Figura 3 ilustra una vista de la elevación lateral detallada del conjunto de ventilador 100 en las Figuras 1,2. El conjunto de ventilador 100 recibe soporte mecánico desde un marco de soporte 302. El marco de soporte 302 incluye una placa horizontal superior de acero 322 que se adapta para ser conectada a una estructura de apoyo horizontal adyacente al techo de forma tal que el contacto se realiza entre la estructura de soporte y la primera superficie 366 de la placa 322 para permitirle al conjunto de ventilador 100 ser montado adyacente al techo. En una realización, la placa 322 es atornillada a la viga de soporte del techo de forma tal que el conjunto de ventilador 100 se extiende hacia abajo desde el techo del edificio similarmente a lo que se muestra en la Figura 1.

El conjunto de ventilador podría comprender un motor eléctrico 304. El motor eléctrico 304 puede ser adaptado a una fuente de alimentación de corriente alterna con una frecuencia variable lo cual le permite al motor eléctrico 304 producir una velocidad giratoria variable. En una realización, el motor eléctrico 304 podría comprender un motor eléctrico manufacturado por Baldor Motor of America. También, el motor eléctrico 204 puede comprender un impulsador de reducción de engranajes integrado o un mecanismo manufacturado por Lenze de Alemania, quienes ofrecen las ventajas mecánicas necesarias para impulsar un gran conjunto de ventilador 100. Es de apreciar que la tasa máxima de consumo de un motor eléctrico 304 es de aproximadamente 370 vatios.

El motor eléctrico 304 podría montarse sobre el marco de apoyo 302 de manera que el eje de rotación del motor 304 se encuentre sobre una dirección vertical, proveyendo el conjunto de ventilador 100 con un momento de torsión. El eje del motor 306 transfiere la torsión desde el motor eléctrico 304 a un modulo 312 que está montado sobre el eje 306. El modulo 312 puede comprender una única pieza de material de aluminio fundido con forma de disco que se adapta para asegurar el grupo de aspas 316. Un grupo de soportes para aspas 314 se extienden desde la sección del borde 346, extendiéndose radialmente hacia afuera del eje de rotación definido por el eje del motor 306 por una distancia aproximada de 15 pulgadas. Las aspas de soporte 314 cuentan con una forma de remo y se adaptan para

deslizarse en los extremos del grupo de aspas 316, para proveer un medio para montar las aspas 316 al módulo 312. En la Patente de los EE.UU. Número 6,244,821 emitida y propiedad del Solicitante, se describen con más nivel de detalle de las características del mecanismo del conjunto de ventilador 100, incluyendo el procedimiento de montaje de las aspas 316.

La Figura 4 es una vista del conjunto de ventilador 100 visto desde abajo e ilustra la relación entre el módulo 312, el juego de soportes de las aspas 314 extendiéndose desde el módulo 312 y el juego de aspas 316 extendiéndose desde los soportes de las aspas. Cada aspa 316 se extiende ortogonalmente desde el eje de rotación del conjunto de ventilador 100 según definido por el eje del motor 306 de manera que resulta en una distribución uniforme del grupo de aspas 316. En una realización, el diámetro del conjunto de ventilador 100 podría estar fabricado con un diámetro entre 8 y 40 pies. Esto resulta en una relación de aspecto de cada aspa 316 entre 8:1 hasta 40:1. Cuando el conjunto de ventilador 100 está funcionado en condiciones normales, la velocidad máxima de la punta del aspa puede oscilar entre 15 y 25 pies por segundo hasta aproximadamente 75 pies por segundo, dependiendo del diámetro de conjunto de ventilador 100. Adicionalmente, las aspas 316 pueden estar montadas sobre el módulo 312 a un ángulo tal que mejore el rendimiento y la eficiencia incrementando el volumen del flujo de la columna de aire distribuido por el conjunto de ventilador 100 durante su funcionamiento.

La Figura 5 ilustra una vista transversal del aspa 316 en una ubicación arbitraria a lo largo de su longitud, según visto por parte de un observador mirando hacia el extremo distal del aspa 316 con referencia a la Figura 1. El aspa 316 podría comprender una primera pared recurva 524, una segunda pared recurva 526 y una región interna hueca 522 formada a partir de las dos paredes. Las dos paredes 524 y 526 podrían estar unidas mediante una unión principal 531 y una unión remanente 532. En la unión remanente 532, las dos paredes 524, 526 se combinan de manera continua para formar una tercera pared 530, donde la tercera pared 530 continua hasta que alcanza el borde remanente reforzado 514, el cual puede ser cónico para disminuir su grosor a lo largo de su extensión. Adicionalmente, una primera superficie 506 podría estar formada en la parte externa y continuar sin costuras hacia la pared externa 530 hasta alcanzar el borde remanente reforzado 514. Una segunda superficie 510 podría estar formada en la parte externa de la pared 530 hasta alcanzar el borde remanente reforzado 514.

Adicionalmente, las dos superficie 506, 510 se unen en el borde principal 512. La región hueca interna 522, la cual también podría referirse como la región de la cavidad, podría comprender una sección central ancha y rectangular 500. Una tercera superficie plana 516 podría estar formada en la parte interna de la pared 524 en la región de la sección 500 y una cuarta superficie plana 520 podría estar formada en la parte interna de la pared 530 en la región de la sección 500. En un aspecto, las superficies internas planas 516, 520 podrían ser sustancialmente paralelas una con la otra. Es de apreciar que el aspa 316 podría comprender una región interna sólida sin alejarse del alcance de la presente invención. También es de apreciar que las dimensiones transversales de cada aspa incluyendo el borde remanente reforzado 514 se describirán en mayor detalle en el presente documento, con referencia a la Figura 7B.

Además, el borde remanente reforzado 514 podría comprender una brida que se extiende hacia abajo 538 soportada por una región doblada 536. Como se ilustra en la Figura 5, el borde remanente reforzado 514 se extiende desde la unión remanente 532 de manera tal que sigue la curvatura de la primera pared recurva 524. El extremo distal del borde remanente reforzado 514 se dobla hacia debajo de manera de formar una región doblada 536 y la brida que se extiende hacia abajo 538. La brida 538 se extiende distalmente desde el borde remanente reforzado 514 a través de la región doblada 536 y forma un primer ángulo 540 con el borde remanente reforzado 514. Dependiendo de la aplicación particular y del funcionamiento del aspa 316, la longitud de la brida 538 y el desplazamiento angular del primer ángulo 540 puede variar en magnitud sin alejarse del alcance de la presente invención.

La longitud de la brida 538 podría comprender una magnitud entre 0.125 (1/8) y 0.375 (3/8) pulgadas, y el desplazamiento angular del primer ángulo podría comprender una magnitud entre 80 y 100 grados. En una realización preferida, la brida 538 podría comprender una longitud de aproximadamente 0.25 (1/4) pulgadas, y el primer ángulo 540 podría comprender un desplazamiento angular de aproximadamente 90 grados. Adicionalmente, el aspa 316 incluyendo el borde remanente reforzado podría comprender aluminio extrudido, pero es de apreciar que el aspa 316 podría comprender varios materiales extrudidos conocidos generalmente sin alejarse del alcance de esta invención.

En un aspecto, el doblez estructural de la región doblada 536 incrementa la solidez del extremo distal del borde remanente reforzado 514 de manera tal que el doblez estructural mejora la rigidez, ofreciendo fuerzas de soporte en dos dimensiones relativamente paralelas y perpendiculares a su longitud. El Solicitante ha observado que, durante la extrusión del aspa 316, el borde remanente sin la región doblada 536 o la brida

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538 podrían pandearse, rasgarse o deformarse de manera tal que afecte adversamente la integridad estructural del borde remanente. Por ejemplo, podría ocurrir rasgadura del borde remanente no soportado durante la extrusión, como resultado del material forzado a través de la boquilla de extrusión de manera tal que las fuerzas de presión tienden a rasgar las regiones no soportadas. Durante la manufactura, a medida que el material extrudido sale de la boquilla de extrusión, se crea un diferencial de presión en la unión remanente 532 donde el bloque de material más grande de las dos superficies externas 506, 510 crean una gran presión de desplazamiento hacia el bloque de material más pequeño del borde remanente. En vista que las dos superficies externas 506, 510 se soportan las unas a las otras en la unión remanente 532, el borde remanente no soportado es más susceptible al rasgado a medida que el borde remanente 514 se hace más largo. Desafortunadamente, un borde remanente más corto reduce el desempeño aerodinámico de las aspas 316.

Por el contrario, el beneficio de fabricar un aspa 315 con un borde remanente reforzado 514 para la presente invención resulta en características estructurales mejoradas tales que el borde remanente reforzado 514 puede ser fabricado más largo para mejorar el desempeño aerodinámico del aspa 316. En un aspecto, el borde remanente reforzado 514 resiste los daños y/o rasgado que podría ocurrir durante la extrusión, agregando una región embreada doblada 536, 538 al extremo distal del borde remanente 514. Por ejemplo, la porción doblada 536 del borde remanente reforzado 514 tiende a orientar rígidamente el material extrudido en una posición estabilizada más prontamente durante la formación. Además, la porción doblada 238 provee fortaleza adicional ofreciendo fuerzas de soporte en dos dimensiones relativamente paralelas y perpendiculares a su longitud, para neutralizar los efectos adversos de las fuerzas de presión que actúan sobre el borde remanente del aspa 316. Los beneficios adicionales asociados con la brida que se extiende hacia abajo 514 serán descritos en mayor detalle a continuación.

De acuerdo a lo ilustrado en la Figura 5, las dos superficies externas 506, 510 podrían adaptarse para formar el contorno de un ala. Por ejemplo, el ala podría basarse en la forma de un plano de una vela de navegación alemana con número de referencia FX 62-K-131. En un aspecto, el aspa 316 podría comprender una longitud de aproximadamente 3 pies a 15 pies y podría estar fabricada de metal extrudido como para obtener una primera sección de ala 502 y un borde remanente cónico 514, donde la brida 538 puede estar formada integralmente al final del borde remanente cónico 514 para reforzar el borde remanente cónico 514 y por ende proveer un empuje hacia abajo incrementado durante la rotación de las aspas 316. Cuando el conjunto de ventilador 100 se encuentre en modo operativo, la imagen transversal del aspa 316, según lo ilustrado en las Figuras 1, 2

inclinada a un ángulo de ataque en el sentido de las manecillas del reloj podría aparecer que se mueve con el borde remanente 512 adelante.

De acuerdo a un observador fijado a un aspa individual 316, el movimiento del aspa 316 puede producir corrientes 600, 602 a lo largo de las superficies 506, 510 del aspa 316, respectivamente. La forma de ala de cada aspa 316 podría ocasionar que la velocidad de la corriente de aire hacia arriba 534 sea mayor que la velocidad de la corriente de aire más abajo 536. Como resultado, la presión del aire en la superficie más baja 510 podría ser mayor que la presión del aire en la superficie mayor 506. Los flujos de aire aparentemente asimétricos producidos por la rotación de las aspas 316 resultan en una fuerza de levantamiento F_{lift} experimentada por cada aspa 316. Una fuerza de reacción hacia abajo $F_{vertical}$ es entonces aplicada por cada aspa 316 al aire alrededor. Además, la forma de ala del aspa 316 podría reducir la fuerza de arrastre horizontal $F_{horizontal}$ que se está aplicando al aire alrededor de cada aspa 316. Por ende, el flujo de aire creado por el conjunto de ventilador 100 podría aproximarse a un flujo de columna de aire a lo largo del eje de rotación del conjunto de ventilador 100.

Como se ilustra en más profundidad en la Figura 6, la brida que se extiende hacia abajo 538 mejora el desempeño del aspa 316. Durante la rotación del aspa 316, la brida 538 podría producir dos vértices de rotación contrarios 650, 652 de manera adyacente y hacia abajo del borde remanente reforzado 514. Un vórtice superior 650 podría producirse por el flujo de aire hacia arriba 600 fluyendo por encima del aspa 316, y un vórtice inferior 652 podría producirse por el flujo de aire hacia abajo 602 fluyendo por debajo del aspa 316. En un aspecto, el vórtice superior 650 genera una acción de pseudo bombeo que mantiene una presión más baja por encima del aspa 316, por ende produciendo de manera efectiva una fuerza adicional hacia abajo $F_{vertical}$. Además, los vértices de rotación contraria 650, 652 se extienden virtualmente a lo largo del borde remanente 514 de manera que cada aspa 316 produce una fuerza hacia abajo adicional $F_{vertical}$. Aún cuando la fuerza de arrastre horizontal $F_{horizontal}$ se incrementa levemente, las ventajas de la fuerza hacia abajo $F_{vertical}$ incrementada son sustanciales.

Ventajosamente, las dificultades técnicas involucradas en el diseño de un conjunto de ventilador 100 han sido superadas mediante la incorporación de características de diseño innovadoras. En particular, las grandes aspas 316 pueden ser fabricadas usando la técnica de extrusión del aluminio. Este método resulta en aspas 316 sólidas, livianas y relativamente económicas para su fabricación. El método de extrusión podría también permitir aspas 316 fabricadas con forma de ala, lo cual permite que el flujo de aire en columna se genere.

La Figura 7A ilustra una realización de un grupo de componentes manufacturados por extrusión 700 incluyendo una boquilla de extrusión 708 que podría ser utilizada para fabricar un aspa extrudida 316 con un borde remanente reforzado 514. El material utilizado para el proceso de extrusión podría comprender una barra de extrusión 702, donde la barra de extrusión 702 podría ser un pedazo de material sólido o hueco, que podría ser de forma cilíndrica. En un aspecto, la barra de extrusión 702 podría comprender una aleación de aluminio en una forma conocida generalmente, tal como un producto colado, un producto forjado en una sola pieza o un producto de polvo compacto que podría cortarse de un material de longitud mayor. Es de apreciar que las aleaciones de materiales podrían comprender uno o más elementos metálicos, sin alejarse del alcance de la presente invención. Por ejemplo, las aleaciones para extrusión basadas en el aluminio pueden comprender pequeñas cantidades de elementos metálicos tales como cobre, manganeso, silicón, magnesio o zinc. Ventajosamente, estas aleaciones de elementos mejoran las propiedades naturales del aluminio e influyen en el proceso de extrusión. La barra de extrusión 702 podría variar en longitud dependiendo de un número predeterminado de parámetros incluyendo la longitud deseada del perfil terminado, la relación de extrusión, la longitud de la corrida y los requerimientos de la prensa extrusora. En un aspecto, la longitud de la barra de extrusión 702 podría oscilar desde aproximadamente 36 pulgadas hasta cerca de 40 pulgadas. Adicionalmente, el diámetro externo de la barra de extrusión 702 podría oscilar entre 7 pulgadas aproximadamente hasta cerca de 8 pulgadas. Es de apreciar que el diámetro externo de la barra de extrusión 702 puede ser inclusive tan grande como 14 pulgadas sin alejarse del alcance de esta invención.

El siguiente componente de manufactura de la extrusión comprende un horno de calefacción 704 que podría ser utilizado para precalentar la barra de extrusión 702. Durante el proceso de extrusión, la barra 702 es ablandada y/o ablandada en el horno de calefacción 704 para ser más flexible. El punto de ablandamiento del aluminio varía con la pureza del metal, pero es de aproximadamente 1,220° Fahrenheit (660° Centígrados). En una realización, el proceso de extrusión podría requerir que la barra 702 sea calentada a temperaturas por encima de 700° F (375° C) y, dependiendo de la aleación que se está extrudiendo, inclusive a temperaturas de hasta 930° F (500° C).

El siguiente componente de fabricación podría comprender una prensa extrusora 706 con una boquilla de extrusión 708. La Figura 7B ilustra una realización de una boquilla de extrusión 708 que comprende un modelo similar en forma al aspa 316, con borde remanente reforzado 514. La boquilla de extrusión 708 puede comprender un disco de acero con una apertura con tamaño y forma sustancialmente concordante con la transversal

descada del perfil finalmente extrudido del aspa 316. La apertura u orificio atraviesa por completo la boquilla de extrusión 708 para permitir que la barra 702 ablandada pase del extremo delantero al extremo trasero. Como se conoce en el arte, las boquillas pueden agruparse en boquillas sólidas (planas), que producen formas sólidas, o boquillas huecas, que producen formas huecas o semi huecas, tales como aspas 316, según lo ilustrado en las Figuras 5 y 6.

Las combinaciones de formas sólidas, semi-huecas y/o huecas podrían incorporarse en una única boquilla, donde una boquilla sólida podría tener uno o más orificios o aperturas a través de las cuales se extrude la aleación ablandada. Según se ilustra en la Figura 7B, la boquilla de extrusión 709 podría ser utilizada para producir perfiles huecos mediante el uso de un mandril 720 fijo o flotante. Ventajosamente, el uso de la boquilla de extrusión 708 con un mandril 720 para la extrusión de una aspa 316 produce una forma hueca. Sin alejarse del alcance de la presente invención, es de apreciar por parte de uno diestro en el arte que la boquilla de extrusión 708 puede ser formada sin el uso de un mandril para producir un aspa 316 extrudida con una región interna sólida.

Como es conocido en el arte, la prensa extrusora podría comprender inclusive un contenedor de prensa extrusora que alberga una barra 702 y un ariete que podría utilizarse para aplicar presión y/o forzar la barra 702 dentro del contenedor. Varias prensas extrusoras hidráulicas podrían ejercer desde 100 toneladas hasta 15,000 toneladas de presión, donde la capacidad de presión de la prensa extrusora determina que tan grande puede ser la extrusión producida. Cuando se aplica la presión, la barra 702 es forzada contra la boquilla 708 y se expande hasta que queda restringida por el contacto con las paredes del contenedor. Luego, a medida que la presión aumenta, el metal blando (pero aún sólido) es forzado a través del orificio de extrusión de la boquilla de extrusión 708 de manera de emerger del otro lado de la boquilla de extrusión como un perfil en forma de aspa 316. Subsiguientemente, el aspa extrudida 316 podría ser retirada del extremo trasero de la boquilla 708. Una vez que el aspa extrudida 316 es retirada de la boquilla de extrusión 708, el aspa extrudida 316 aún caliente puede ser templada, tratada mecánicamente y envejecida.

En una realización, las dimensiones transversales y/o el perfil del aspa extrudida 316 podría comprender un ancho de entre aproximadamente 5 pulgadas y 8 pulgadas y una altura de entre aproximadamente 0.75 (3/4) pulgadas y 1.50 (3/2) pulgadas. En una realización preferida, las dimensiones transversales del aspa 316 podrían comprender un ancho de aproximadamente 7 pulgadas y una altura de aproximadamente 1 pulgada. Además, el espesor de la primera, segunda y tercera pared recurva 524, 526, 530 podría oscilar entre aproximadamente 0.0625 (1/16) pulgadas y 0.1875 (3/16) pulgadas. En una

realización preferida, el espesor de las paredes 524, 526, 530 podría ser de 0.15625 (5/32) pulgadas. Alternativamente, la tercera pared 530 podría comprender una forma cónica para disminuir el espesor desde aproximadamente 0.1875 (3/16) pulgadas en la unión remanente 532 a lo largo de su longitud hasta aproximadamente 0.0625 (1/16) pulgadas en el borde remanente reforzado 514.

Adicionalmente, dependiendo del tamaño de la barra 702 y el tamaño de la apertura de la boquilla 708, una extrusión continua de 100 pies de largo podría ser producida con cada golpe de la prensa extrusora 706. El aspa extrudida recién formada 316 podría ser soportada por un transportador extendido a medida que el aspa extrudida 316 es producida por la prensa extrusora 706. La extrusión podría entonces transferirse a una mesa de enfriamiento y ser enfriada después de emerger de la boquilla 708, mediante el uso de aire o agua.

El siguiente componente de fabricación podría comprender un enderezador 710 y una sierra 712, donde el enderezador 710 puede ser utilizado después que el perfil extrudido haya sido enfriado, para enderezar el perfil y corregir cualquier torsión que podría haber ocurrido subsiguiente al proceso de extrusión. Después del enderezamiento, se podrían usar transportadores para alimentar es aspa 316 extrudida a la sierra 712. La sierra 712 podría comprender una sierra de corte de acabado que puede ser utilizada para cortar el perfil extrudido al largo deseado. En una realización, el corte de acabado del aspa extrudida 316 podría comprender una longitud entre aproximadamente 4 pies y 15 pies. En una realización preferida, las dimensiones del corte de acabado del aspa 316 podrían comprender una longitud de aproximadamente 112 pulgadas. Además, es posible utilizar cierras circulares y/o brazos radiales para cortar a lo largo del perfil a un ángulo sustancialmente perpendicular de la longitud del perfil extrudido. En varias otras realizaciones, la sierra 712 podría comprender 712 una sierra ingleteadora eléctrica que cae sobre el perfil, o una sierra de mesa con una cuchilla circular que se levanta para cortar el perfil extrudido. Una sierra de corte de acabado típica podría ser de 16 a 20 pulgadas en diámetro con dientes con punta de carburo de tungsteno.

Los siguientes componentes de manufactura podrían comprender un horno de envejecimiento 714. Como se conoce en el arte, algunas aleaciones de extrusión alcanzan su dureza óptima durante el proceso de envejecimiento, el cual se conoce como envejecimiento. El envejecimiento natural podría ocurrir a temperatura ambiente y el envejecimiento artificial podría comprender la calefacción controlada en el horno de envejecimiento 714, el cual se conoce como precipitación por tratamiento térmico. En un aspecto, cuando el perfil extrudido emerge de la prensa extrusora 706, el perfil extrudido

podría comprender un estado semi-sólido, pero solidificarse rápidamente a medida que se enfría. Es de apreciar que las aleaciones de aluminio, tales como aquellas que comprenden manganeso o magnesio, derivan su dureza del envejecimiento natural y el trabajo en frío. Alternativamente, otras aleaciones de aluminio tales como aquellas que comprenden cobre, zinc y magnesio con silicona podrían endurecida ulteriormente a través de tratamientos térmicos controlados que afectan la estructura metalúrgica de las aleaciones. Consecuentemente, el proceso de envejecimiento podría asegurar una precipitación de partículas finas sustancialmente uniforme a través del metal, resultado en mayor dureza y elasticidad para la aleación de extrusión específica.

El proceso de extrusión, según descrito con referencia a la Figura 7A, podría ser utilizado para formar el aspa 316 con una transversal continua, forzando la barra de extrusión 702 a través de la boquilla de extrusión 708, la cual comprende una apertura del perfil de la transversal del aspa 316 según se ilustra en la Figura 7B. El proceso de formar el aspa extrudida 316 con el borde remanente reforzado 514 podría ser el siguiente. La boquilla de extrusión 708 podría ser preparada y conectada a la prensa de extrusión 706. Luego, la barra de extrusión 702, la cual preferentemente comprende una aleación de aluminio, podría ser colocada en el contenedor de la prensa extrusora y precalentada en el horno de calefacción 704. La barra flexible 702 podría ser forzada a través de la boquilla de extrusión 708 aplicando presión a la barra 702 usando la prensa extrusora 706 de manera de formar un aspa 316 con un borde remanente reforzado 514. Una vez el perfil extrudido del aspa 316 se ha enfriado y enderezado usando el enderezador, el perfil extrudido podría ser cortado usando la sierra 712 a intervalos predeterminados para formar un grupo de aspas 316 con la longitud deseada, a partir del perfil extrudido. El procesamiento adicional podría comprender el envejecimiento de las aspas extrudidas 316 del modo descrito anteriormente.

Después de procesar las aspas extrudidas 316, el proceso de formar las aspas 316 se habrá completado. Ventajosamente, las dificultades técnicas involucradas al extrudir las aspas 316 han sido sobrellevadas, reforzando el borde remanente 514 con la región doblada 536 y la brida que se extiende hacia abajo 538. En vista que las aspas grandes 316 son fabricadas utilizando la técnica de la extrusión del aluminio, el proceso de fabricación resulta en aspas 316 mejoradas que comprenden características estructurales mejoradas tales como rigidez, solidez y flexibilidad mejorada. El método de extrusión también podría permitir que se fabriquen las aspas 316 con características de desempeño aerodinámico mejoradas, lo cual permite un flujo de aire en columna más grande generado durante la operación. Por lo tanto, el diseño mejorado del conjunto de ventilador mencionado arriba

100 con aspas mejoradas 316 y un borde remanente reforzado 514, según descrito en el presente documento, comprende una mejora significativa del arte anterior.

Aún cuando la realización preferida de la presente invención ha demostrado, descrito y señalado las características nuevas fundamentales de la invención, de acuerdo a lo aplicado en esta realización en particular, es de entenderse que varias omisiones, sustituciones o cambios en la forma del detalle del dispositivo ilustrado podrían realizarse por parte de aquellos diestros en el arte, sin alejarse del espíritu de la presente invención. Consecuentemente, el alcance de la invención no puede limitarse a la descripción anterior, sino que debe ser definido mediante las alegaciones que se anexan.

LO QUE SE ALEGA ES:

1. Un conjunto de ventilador para la circulación del aire en un edificio industrial, donde el conjunto de ventilador comprende:

un soporte adaptado para permitir el montaje del conjunto del ventilador al techo del edificio industrial;

un motor acoplado al soporte, el motor accionado por un eje giratorio para inducir la rotación del eje;

y un grupo de aspas unidas al eje giratorio, donde cada aspa es fabricada en un metal extrudido tal que la primera pared recurva es unida a la segunda pared recurva para formar una unión principal y una unión remanente, y donde la unión remanente se extiende para formar una tercera pared recurva con un borde remanente y siguiendo la curvatura de la primera pared recurva, cada aspa comprenderá una brida que se extiende distalmente desde el borde remanente de manera continua tal que el desplazamiento angular de la brida desde el borde remanente forma una región doblada que refuerza el borde remanente.

2. El conjunto de ventilador en la Alegación 1, donde cada aspa comprende una forma de ala con un borde remanente cónico doblado para formar una brida.

3. El conjunto de ventilador en la Alegación 1, donde la brida se extiende hacia abajo desde la superficie inferior de la tercera pared recurva

4. El conjunto de ventilador en la Alegación 1, donde la primera pared recurva es unida a la segunda pared recurva para formar una región interna hueca.

5. El conjunto de ventilador en la Alegación 1, donde la primera pared recurva es unida a la segunda pared recurva para formar una región interna sólida.

6. El conjunto de ventilador en la Alegación 1, donde cada aspa comprende una transversal ancha aproximadamente entre 5 pulgadas y 8 pulgadas.

7. El conjunto de ventilador en la Alegación 1, donde cada aspa comprende una transversal alta entre aproximadamente 0.75 (3/4) pulgadas y 1.50 (3/2) pulgadas.

8. El conjunto de ventilador en la Alegación 1, donde cada aspa comprende una longitud entre aproximadamente 4 pies y 14 pies.

9. El conjunto de ventilador en la Alegación 1 donde la primera y segunda paredes recurvas comprenden un espesor de aproximadamente entre 0.0625 (1/16) pulgadas y 0.1875 (3/16) pulgadas.

10. El conjunto de ventilador en la Alegación 1, donde la tercera pared recurva comprende una forma cónica que decrece en espesor a lo largo de su longitud desde aproximadamente 0.1875 (3/16) pulgadas en la unión remanente hasta aproximadamente 0.0625 (1/16) pulgadas en el borde remanente.

11. El conjunto de ventilador en la Alegación 1, donde la brida comprende una longitud de aproximadamente 0.125 (1/8) y 0.375 (3/8) pulgadas.

12. El conjunto de ventilador en la Alegación 1, donde el grupo de las aspas unidas a un modulo está conectado a un eje giratorio.

13. El conjunto de ventilador en la Alegación 1, donde el grupo de aspas incluye por lo menos diez aspas.

14. El conjunto de ventilador en la Alegación 1, donde cada grupo de aspas es fabricado usando la técnica de extrusión.

15. El conjunto de ventilador en la Alegación 14, donde el metal extrudido comprende el aluminio.

16. Una aspa de metal para un conjunto de ventilador usado en un edificio industrial, el aspa comprendiendo un perfil transversal extrudido con un grupo de paredes recurvas, donde la primera pared recurva es unida a la segunda pared recurva para formar un ala con un borde remanente que incluye una brida que se extiende hacia afuera desde la dirección del borde remanente, donde la porción embridada del borde remanente se extiende hacia abajo desde la superficie inferior del borde remanente tal que el desplazamiento angular de la porción embridada desde la superficie inferior del borde remanente forma una región reforzada que incrementa la rigidez estructural del borde remanente para que el borde remanente embridado resiste a los daños y donde la brida incrementa el volumen del flujo de aire resultante de la operación del conjunto de ventilador con las aspas.

17. Las aspas en la Alegación 16, donde la primera pared recurva se une a la segunda pared recurva para formar una región interior hueca.

18. Las aspas en la Alegación 16, donde la primera pared recurva se une a la segunda pared recurva para formar una región interna sólida.

19. Las aspas en la Alegación 16, donde el perfil transversal extrudido comprende un ancho transversal de aproximadamente 7 pulgadas.

20. Las aspas en la Alegación 16, donde el perfil transversal extrudido comprende una altura transversal de aproximadamente 1 pulgada.
21. Las aspas en la Alegación 16, donde el aspa comprende una longitud de por lo menos 4 pies.
22. Las aspas en la Alegación 16, donde las aspas comprenden una longitud de máximo 15 pies.
23. Las aspas en la Alegación 16, donde la primera y segunda paredes recurvas comprende un espesor de aproximadamente 0.15625 (5/32) pulgadas.
24. Las aspas en la Alegación 16, donde el borde remanente comprende una forma cónica que decrece en espesor a lo largo de su longitud.
25. Las aspas de la Alegación 16, donde la brida comprende una longitud entre aproximadamente 0.125 (1/8) y 0.375 (3/8) pulgadas.
26. Las aspas de la Alegación 16, donde el aspa es fabricada usando una boquilla de extrusión para formar el perfil transversal extrudido del aspa.
27. Las aspas de la Alegación 26, donde el aspa es formada usando la técnica de la extrusión del aluminio.
28. Un conjunto de ventilador para enfriar edificios industriales, donde el conjunto de ventilador comprende:
- un conjunto de montaje con un modulo giratorio que une el conjunto del ventilador al techo del edificio industrial;
 - un grupo de aspas montadas en el modulo giratorio, donde cada grupo de aspas es de por lo menos 4 pies de largo y está fabricado en metal extrudido resultando en una primera sección en forma de ala y un borde remanente cónico, donde una brida es formada integralmente al final del borde remanente cónico para reforzarlo y proveer un empuje hacia abajo adicional durante la rotación de las aspas.
29. El conjunto de ventilador de la Alegación 28, donde una primera pared recurva está unida a una segunda pared recurva para formar la sección en forma de ala con una región interna hueca.
30. El conjunto de ventilador en la Alegación 29, donde la primera pared recurva se extiende para formar un borde remanente cónico y donde el borde remanente cónico está doblado un extremo distal para formar la brida.
31. El conjunto de ventilador de la Alegación 28, donde el grupo de aspas se ha fabricado usando un proceso de extrusión.

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32. El conjunto de ventilador de la Alegación 31, donde la brida refuerza el borde remanente cónico durante el proceso de fabricación por extrusión para que el borde remanente cónico resista las rasgaduras durante la fabricación.

33. El conjunto de ventilador de la Alegación 28, donde cada grupo de aspas comprende aluminio.

34. El método de fabricación de las aspas comprende:
ablandar el metal;

forzar el metal en un molde de extrusión tal que una aspa de metal enfriado es extrudida del molde de extrusión para tener en transversal un primera sección en ala y un borde remanente cónico integralmente anexos en un extreme de la primera sección de ala y una brida de refuerzo que se extiende hacia afuera desde la dirección del borde remanente cónico durante la extrusión, para inhibir el rasgado del borde remanente cónico.

35. El método de la Alegación 34, donde el ablandamiento del metal comprende el ablandamiento del aluminio.

36. El método de la Alegación 34, donde el ablandamiento del metal comprende el ablandamiento de una aleación de aluminio con por lo menos una de cobre, manganeso, silicona, magnesio y zinc.

37. El método de la Alegación 34, donde el método además comprende la fabricación de un molde de extrusión para producir un aspa con una región interna hueca.

38. El método de la Alegación 34, donde el método además comprende la fabricación de un molde de extrusión para producir un aspa con una región interna sólida.

39. El método de la Alegación 34, donde forzar el metal por una boquilla de extrusión comprende la aplicación de presión sobre el metal ablandado, usando una prensa extrusora para forzar el metal ablandado a través del molde de extrusión.

40. El método de la Alegación 39, donde las aspas unidas son separadas para formar un grupo de aspas individuales.

41. El método de la Alegación 34, donde forzar el metal en el molde de extrusión produce por lo menos un aspa con una transversal uniforme.

42. El método de la Alegación 41, donde forzar el metal en el molde de extrusión produce por lo menos una aspa con una primera superficie y una segunda superficie que se combinan para formar una sección en forma de ala, la cual mejora las propiedades de columna del flujo de aire producido por al menos un aspa.

43. El método de la Alegación 42, donde forzar el metal en el molde de extrusión produce por lo menos una aspa con una primera superficie extendida que comprende por lo menos un borde remanente cónico y una brida reforzada, la cual resulta en un diseño de ala mejorado.

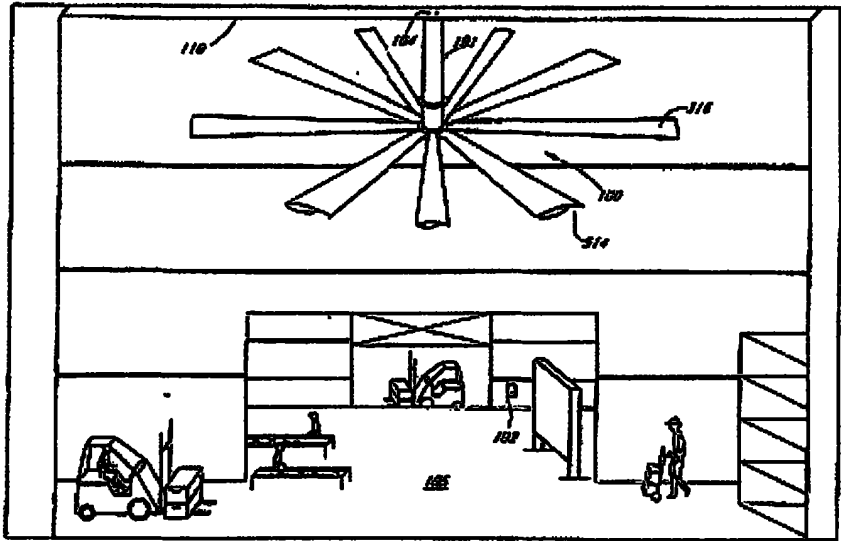


FIG. 1

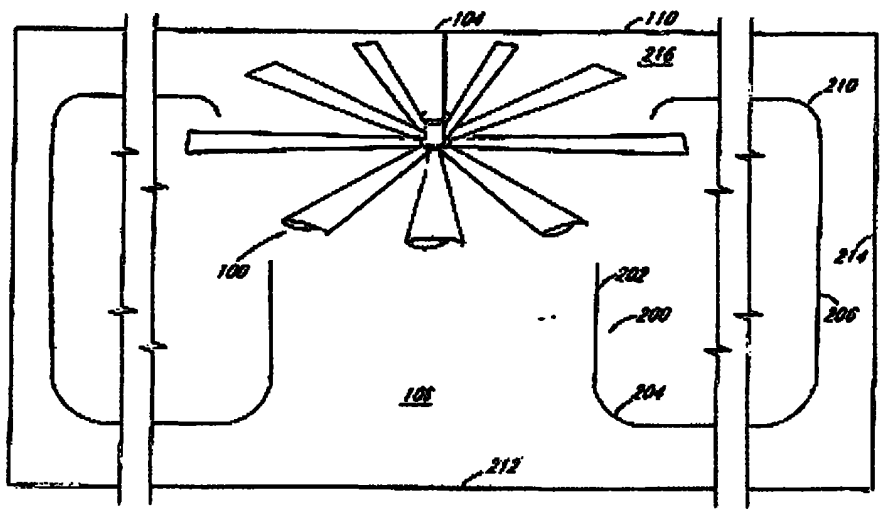


FIG. 2

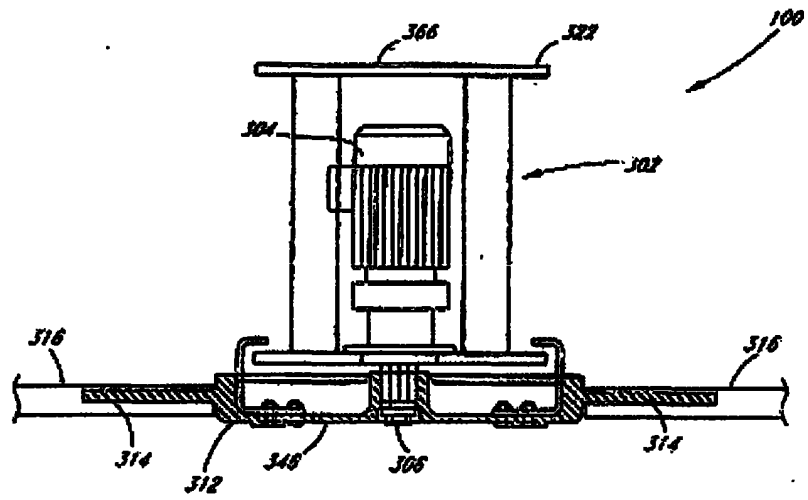


FIG. 3

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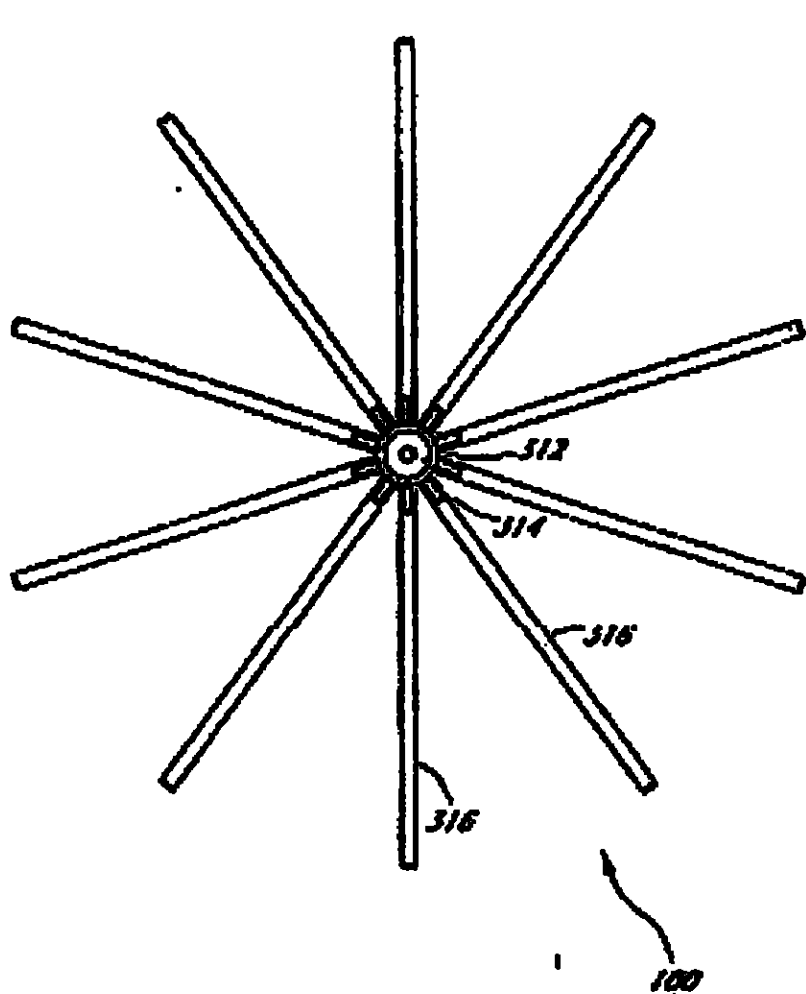


FIG. 4

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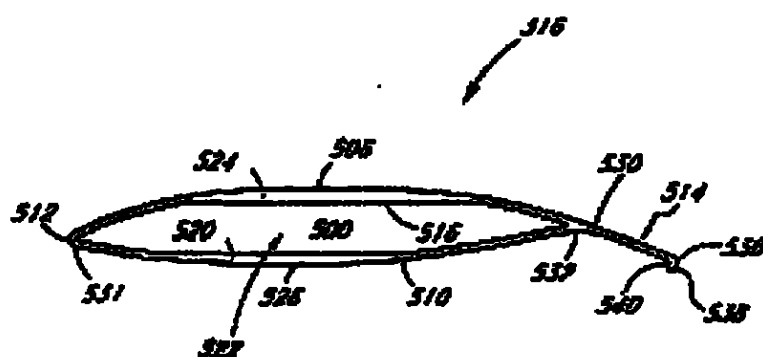


FIG. 5

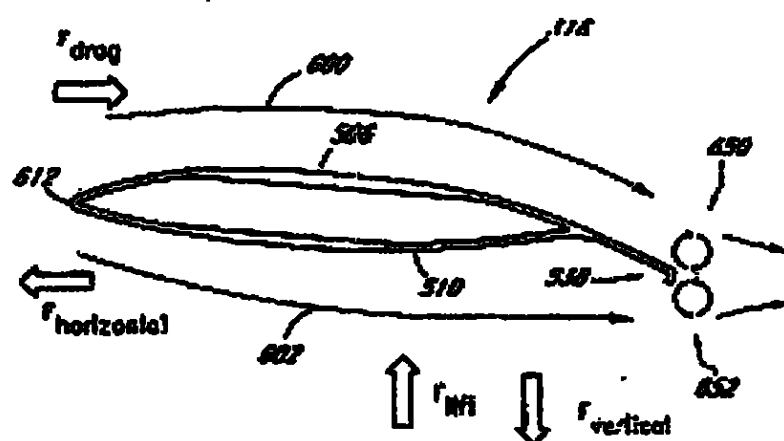


FIG. 6

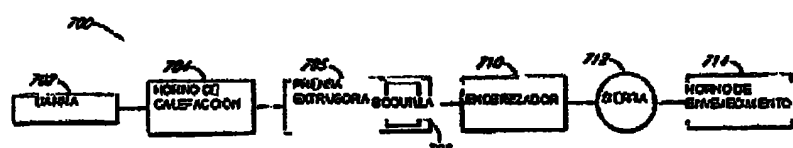


FIG. 7A

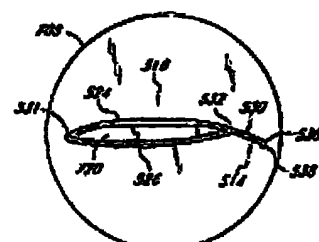


FIG. 7B



PATENT COOPERATION TREATY

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PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF RECEIPT OF
RECORD COPY

(PCT Rule 24.2(a))

To:

LAMBRECHTS, Robert, J.
Lathrop & Gage LC
2345 Grand Boulevard
Suite 2400
Kansas City, MO 64108
United States of America

Date of mailing (day/month/year) 26 March 2004 (26.03.2004)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 4/4706	International application No. PCT/US2004/000125

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

MECHANIZATION SYSTEMS COMPANY, INC. et al (for all designated States except US)
BOYD, Walter (for US)

International filing date : 05 January 2004 (05.01.2004)

Priority date(s) claimed : 06 January 2003 (06.01.2003)

Date of receipt of the record copy
by the International Bureau : 15 March 2004 (15.03.2004)

List of designated Offices :

AP : BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

EP : AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR

OA : BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG

National : AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS,
LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK,
SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW

ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

☒ time limits for entry into the national phase - see updated important information (as of April 2002)

☐ requirements regarding priority documents (if applicable)

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer: Anta NDIAYE (Fax 338-71-30)
Facsimile No. (41-22) 338.71.30	Telephone No. (41-22) 338 9847

INFORMATION ON TIME LIMITS FOR ENTERING THE NATIONAL PHASE

The applicant is reminded that the "national phase" must be entered before each of the designated Offices indicated on the cover sheet of this Notification by paying national fees and furnishing translations, as prescribed by Articles 22 and 39 and the applicable national laws. In addition, the applicant may also have to comply with other special requirements applicable in certain Offices. It is the applicant's responsibility to ensure the necessary steps to enter the national phase are taken in a timely fashion. Most Offices do not issue reminders to applicants in connection with the entry into the national phase.

The applicable time limit for entering the national phase will, subject to what is said in the following paragraph, be 30 MONTHS from the priority date, not only in respect of any elected Office if a demand for international preliminary examination is filed before the expiration of 18 months from the priority date (see Article 39(1)), but also in respect of any designated Office, in the absence of filing of such demand, where Article 22(1) as modified with effect from 1 April 2002 applies in respect of that designated Office. For further details, see PCT Gazette No. 44/2001 of 1 November 2001, pages 18928, 18932 and 18934, as well as the PCT Newsletter, October and November 2001 and February 2002 issues.

In practice, time limits other than the 30-month time limit will continue to apply, for various periods of time, in respect of certain designated or elected Offices. For regular updates on the applicable time limits (20, 21, 30 or 31 months, or other time limit), Office by Office, refer to the PCT Gazette ("Section IV" part published on a weekly basis), to the PCT Newsletter (on a monthly basis) and to the relevant National Chapters in Volume II of the PCT Applicant's Guide (the paper version of which is updated usually twice a year and the Internet version of which is updated usually on a weekly basis). Finally, a cumulative table of all applicable time limits for entering the national phase is available from WIPO's Internet site, via links from various pages the site including those of the Gazette, Newsletter and Guide, at <http://www.wipo.int/pct/en/index.html>.

Information about the requirements for filing a demand for international preliminary examination is set out in the PCT Applicant's Guide, Volume I/A, Chapter IX. Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination (at present, all PCT Contracting States are bound by Chapter II).

REQUIREMENTS REGARDING PRIORITY DOCUMENTS

For applicants who have not yet complied with the requirements regarding priority documents, the following is recalled.

Where the priority of an earlier national, regional or international application is claimed, the applicant must submit a copy of the said earlier application, certified by the authority with which it was filed ("the priority document") to the receiving Office (which will transmit it to the International Bureau) or directly to the International Bureau, before the expiration of 18 months from the priority date, provided that any such priority document may still be submitted to the International Bureau before that date of international publication of the international application, in which case that document will be considered to have been received by the International Bureau on the last day of the 18-month time limit (Rule 17.1(a)).

Where the priority document is issued by the receiving Office, the applicant may, instead of submitting the priority document, request the receiving Office to prepare and transmit the priority document to the International Bureau. Such request must be made before the expiration of the 18-month time limit and may be subjected by the receiving Office to the payment of a fee (Rule 17.1(b)).

If the priority document concerned is not submitted to the International Bureau or if the request to the receiving Office to prepare and transmit the priority document has not been made (and the corresponding fee, if any, paid) within the applicable time limit indicated under the preceding paragraphs, any designated State may disregard the priority claim, provided that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within the time limit which is reasonable under the circumstances (Rule 17.1(c)).

Where several priorities are claimed, the priority date to be considered for the purposes of computing the 18-month time limit (and all other PCT time limits) is the filing date of the earliest application whose priority is claimed (Article 2(xl)(b)).

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

LAMBRECHTS, Robert, J.
Lathrop & Gage LC
2345 Grand Boulevard
Suite 2400
Kansas City, MO 64108
United States of America

Date of mailing (day/month/year) 20 April 2004 (20.04.2004)	
Applicant's or agent's file reference 414706	IMPORTANT NOTIFICATION
International application No. PCT/US2004/000125	International filing date (day/month/year) 05 January 2004 (05.01.2004)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 06 January 2003 (06.01.2003)
Applicant MECHANIZATION SYSTEMS COMPANY, INC. et al	

- By means of this Form, which replaces any previously issued notification concerning submission or transmittal of priority documents, the applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to all earlier application(s) whose priority is claimed. Unless otherwise indicated by the letters "NR", in the right-hand column or by an asterisk appearing next to a date of receipt, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
- (If applicable) The letters "NR" appearing in the right-hand column denote a priority document which, on the date of mailing of this Form, had not yet been received by the International Bureau under Rule 17.1(a) or (b). Where, under Rule 17.1(a), the priority document must be submitted by the applicant to the receiving Office or the International Bureau, but the applicant fails to submit the priority document within the applicable time limit under that Rule, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
- (If applicable) An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b) (the priority document was received after the time limit prescribed in Rule 17.1(a) or the request to prepare and transmit the priority document was submitted to the receiving Office after the applicable time limit under Rule 17.1(b)). Even though the priority document was not furnished in compliance with Rule 17.1(a) or (b), the International Bureau will nevertheless transmit a copy of the document to the designated Offices, for their consideration. In case such a copy is not accepted by the designated Office as priority document, Rule 17.1(c) provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
06 Janu 2003 (06.01.2003)	10/338,820	US	16 Apr 2004 (16.04.2004)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 338.71.30	Authorized officer Rafael CARATSCH Telephone No. (41-22) 338 8752
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PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum) 414706

Box No. I TITLE OF INVENTION COOLING FAN WITH REINFORCED BLADE	
Box No. II APPLICANT ☐ This person is also inventor	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence (if no State of residence is indicated below.)	
MECHANIZATION SYSTEMS COMPANY, INC. 1120 Lincoln Street Colton, California 92324 United States of America	
Telephone No.	
Facsimile No.	
Teleprinter No.	
Applicant's registration No. with the Office	
State (that is, country) of nationality: US	State (that is, country) of residence: US
This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence (if no State of residence is indicated below.)	
DELTA T CORPORATION 800 Winchester Road Lexington, Kentucky 40575-1307 United States of America	
This person is: ☒ applicant only ☐ applicant and inventor ☐ inventor only (If this check-box is marked, do not fill in below.)	
Applicant's registration No. with the Office	
State (that is, country) of nationality: US	State (that is, country) of residence: US
This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.	
Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE	
The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
LAMBRECHTS, Robert J. LATHROP & GAGE LC 2345 Grand Boulevard Suite 2400 Kansas City, Missouri 64108 United States of America	
Telephone No. (816) 460-5814	
Facsimile No. (816) 292-2001	
Teleprinter No.	
Agent's registration No. with the Office 46,854	
☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.	

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)	
<i>If none of the following sub-boxes is used, this sheet should not be included in the request.</i>	
Name and address: <i>(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (that is, country) of residence (if no State of residence is indicated below.)</i> BOYD, Walter 3100 Maricopa Drive Riverside, California 92507 United States of America	This person is: ☐ applicant only ☒ applicant and inventor ☐ inventor only <i>(If this check-box is marked, do not fill in below.)</i> Applicant's registration No. with the Office
State (that is, country) of nationality: US	State (that is, country) of residence: US
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box	
Name and address: <i>(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (that is, country) of residence (if no State of residence is indicated below.)</i>	This person is: ☐ applicant only ☐ applicant and inventor ☐ inventor only <i>(If this check-box is marked, do not fill in below.)</i> Applicant's registration No. with the Office
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
Name and address: <i>(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (that is, country) of residence (if no State of residence is indicated below.)</i>	This person is: ☐ applicant only ☐ applicant and inventor ☐ inventor only <i>(If this check-box is marked, do not fill in below.)</i> Applicant's registration No. with the Office
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
Name and address: <i>(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (that is, country) of residence (if no State of residence is indicated below.)</i>	This person is: ☐ applicant only ☐ applicant and inventor ☐ inventor only <i>(If this check-box is marked, do not fill in below.)</i> Applicant's registration No. with the Office
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.	

See Notes to the request form

Box No. VIII (II) DECLARATION: ENTITLEMENT TO APPLY FOR AND BE GRANTED A PATENT
The declaration must conform to the standardized wording provided for in Section 212: see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (ii). If this Box is not used, this sheet should not be included in the request.

Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51 bis 1(a)(ii)), in a case where the declaration under Rule 4.17(iv) is not appropriate:

in relation to this international application,

MECHANIZATION SYSTEMS COMPANY, INC. and DELTA T CORPORATION is entitled to apply for and be granted a patent by virtue of the following:

an assignment from

BOYD, Walter, 3100 Maricopa Drive, Riverside, California 92507

to MECHANIZATION SYSTEMS COMPANY, INC., dated 7 July 2003;

an assignment from

MECHANIZATION SYSTEMS COMPANY, INC., 1120 Lincoln Street, Colton, California 92324

to DT-MSC, LLC, dated 11 February 2003;

an assignment from

DT-MSC, LLC, 800 Winchester Road, Lexington, Kentucky 40575-1307 of 50% interest

to MECHANIZATION SYSTEMS COMPANY, INC., 18 February 2003; and

an assignment from

DT-MSC, LLC, 800 Winchester Road, Lexington, Kentucky 40575-1307 of 50% interest

to DELTA T CORPORATION, 800 Winchester Road, Lexington, Kentucky 40575-1307.

This declaration is made for the purposes of all designations, except for the designation of the United States of America.

☐ This declaration is continued on the following sheet. "Continuation of Box No. VIII (ii)".

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Box No. VIII (III) DECLARATION: ENTITLEMENT TO CLAIM PRIORITY

The declaration must conform to the standardized wording provided for in Section 213: see Notes to Boxes Nos. VIII, VIII (I) to (IV) (in general) and the specific Notes to Box No. VIII (III). If this Box is not used, this sheet should not be included in the request.

Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application specified below, where the applicant is not the applicant who filed the earlier application or where the applicant's name has changed since the filing of the earlier application (Rules 4.17(iii) and 51bis.1(a)(iii)):

in relation to this international application,

MECHANIZATION SYSTEMS COMPANY, INC. and DELTA T CORPORATION is entitled to claim priority of earlier application

No. 10/338,820

by virtue of the following:

an assignment from

BOYD, Walter, 3100 Maricopa Drive, Riverside, California 92507

to MECHANIZATION SYSTEMS COMPANY, INC., dated 7 July 2003;

an assignment from

MECHANIZATION SYSTEMS COMPANY, INC., 1120 Lincoln Street, Colton, California 92324

to DT-MSC, LLC, dated 11 February 2003;

an assignment from

DT-MSC, LLC, 800 Winchester Road, Lexington, Kentucky 40575-1307 of 50% interest

to MECHANIZATION SYSTEMS COMPANY, INC., 18 February 2003; and

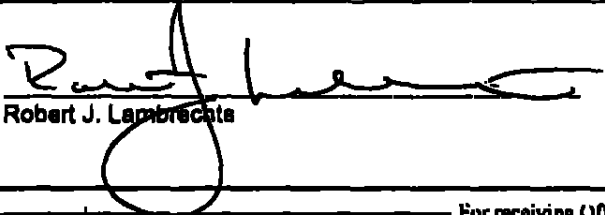
an assignment from

DT-MSC, LLC, 800 Winchester Road, Lexington, Kentucky 40575-1307 of 50% interest

to DELTA T CORPORATION, 800 Winchester Road, Lexington, Kentucky 40575-1307.

This declaration is made for the purposes of all designations, except for the designation of the United States of America.

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iii)".

Box No. IX CHECK LIST; LANGUAGE OF FILING		
This international application contains: (a) In paper form, the following number of sheets: request (including declaration sheets) : 6 description (excluding sequence listing and/or tables related thereto) : 17 claims : 5 abstract : 1 drawings : 8 Sub-total number of sheets : 35 sequence listing : : tables related thereto : : <i>(for both, actual number of sheets if filed in paper form, whether or not also filed in computer readable form; see (c) below)</i> Total number of sheets : 35 (b) ☐ only in computer readable form (Section 801(a)(i)) (i) ☐ sequence listing (ii) ☐ tables related thereto (c) ☐ also in computer readable form (Section 801(a)(ii)) (i) ☐ sequence listing (ii) ☐ tables related thereto Type and number of carriers (diskette, CD-ROM, CD-R or other) on which are contained the ☐ sequence listing: ☐ tables related thereto: <i>(additional copies to be indicated under items 9(ii) and/or 10(ii), in right column)</i>	This international application is accompanied by the following item(s) (mark the applicable check-boxes below and indicate in right column the number of each item): 1. ☒ fee calculation sheet : 1 2. ☒ original separate power of attorney : 1 3. ☐ original general power of attorney : : 4. ☐ copy of general power of attorney; reference number, if any: : : 5. ☐ statement explaining lack of signature : : 6. ☐ priority document(s) identified in Box No. VI as item(s): : : 7. ☐ translation of international application into (language): : : 8. ☐ separate indications concerning deposited microorganism or other biological material : : 9. ☐ sequence listing in computer readable form (indicate type and number of carriers) (i) ☐ copy submitted for the purposes of international search under Rule 13ter only (and not as part of the international application) : : (ii) ☐ (only where check-box (b)(i) or (c)(i) is marked in left column) additional copies including, where applicable, the copy for the purposes of international search under Rule 13ter : : (iii) ☐ together with relevant statement as to the identity of the copy or copies with the sequence listing mentioned in left column : : 10. ☐ tables in computer readable form related to sequence listing (indicate type and number of carriers) (i) ☐ copy submitted for the purposes of international search under Section 802(b-quater) only (and not as part of the international application) : : (ii) ☐ (only where check-box (b)(ii) or (c)(ii) is marked in left column) additional copies including, where applicable, the copy for the purposes of international search under Section 802(b-quater) : : (iii) ☐ together with relevant statement as to the identity of the copy or copies with the tables mentioned in left column : : 11. ☒ other (specify): Trans. Ltr. Cert. of Mail & Post Card : 3	Number of items
Figure of the drawings which should accompany the abstract: 1	Language of filing of the international application: English	
Box No. X SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE <i>Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).</i>		
 Robert J. Lambrecht		
For receiving Office use only		
1. Date of actual receipt of the purported international application:	2. Drawings: ☐ received: ☐ not received:	
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	6. ☐ Transmittal of search copy delayed until search fee is paid	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	5. International Searching Authority (if two or more are competent): ISA /	
For International Bureau use only		
Date of receipt of the record copy by the International Bureau:		

PATENT COOPERATION TREATY

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From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF RECEIPT
OF SEARCH COPY

(PCT Rule 25.1)

To:

ROBERT J. LAMBRECHTS
LATHROP & GAGE LC
2345 GRAND BOULEVARD
SUITE 2400
KANSAS CITY, MISSOURI 64108

Date of mailing
(day/month/year)

12 Mar 2004

Applicant's or agent's file reference
414708

IMPORTANT NOTIFICATION

International application No.

PCT/US2004/000125

International filing date (day/month/year)

05 Jan 2004

Priority date (day/month/year)

06 Jan 2003

Applicant

MECHANIZATION SYSTEMS COMPANY, INC.

1. Where the International Searching Authority and the receiving Office are not the same Office:

The applicant is hereby notified that the search copy of the international application was received by this International Searching Authority on the date indicated below.

Where the International Searching Authority and the receiving Office are the same Office:

The applicant is hereby notified that the search copy of the international application was received on the date indicated below.

12 Mar 2004

(date of receipt).

2. ☐ The search copy was accompanied by a nucleotide and/or amino acid sequence listing or tables related thereto in computer readable form.

3. Time limit for establishment of international search report and written opinion of the International Searching Authority

The applicant is informed that the time limit for establishing the international search report and the written opinion of the International Searching Authority is three months from the date of receipt indicated above or nine months from the priority date, whichever time limit expires later (Rules 42.1 and 43bis.1(a)).

4. A copy of this notification has been sent to the International Bureau and, where the first sentence of paragraph 1 applies, to the receiving Office.

Name and mailing address of the ISA/

Mail Stop PCT, Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450

Facsimile No. 703-305-3230

Authorized officer

Barbara Fridie

Telephone No. 703-3053747

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:

ROBERT J. LAMBRECHTS
LATHROP & GAGE LC
2345 GRAND BOULEVARD
SUITE 2400
KANSAS CITY, MO 64108

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing (day/month/year) 29 JUL 2004	
Applicant's or agent's file reference 414706	FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No. PCT/US04/00125	International filing date (day/month/year) 05 January 2004 (05.01.2004)
Applicant MECHANIZATION SYSTEMS COMPANY, INC.	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: +41 22 740 14 35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders

Shortly after the expiration of 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicants' Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1430 Alexandria, Virginia 22313-1430 Facsimile No. (703) 305-3230	Authorized officer <i>Sharon A. Green</i> Linda Sholl Telephone No. 703-308-1078
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Form PCT/ISA/220 (January 2004)

(See notes on accompanying sheet)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 414706	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/US04/00125	International filing date (day/month/year) 05 January 2004 (05.01.2004)	(Earliest) Priority Date (day/month/year) 06 January 2003 (06.01.2003)
Applicant MECHANIZATION SYSTEMS COMPANY, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the Report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (See Box II).

4. With regard to the title,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the abstract,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. 1



as suggested by the applicant.



None of the figures



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

Form PCT/ISA/210 (first sheet) (July 1998)

DOCKETED

By: MRS Date: 8/4/04

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/00125

Box III TEXT OF THE ABSTRACT (Continuation of Item 5 of the first sheet)

The technical features mentioned in the abstract do not include a reference sign between parentheses (PCT Rule 8.1(d)).

NEW ABSTRACT

A circulator device comprising a large diameter fan having reinforced fan blades with a tapered airfoil shape is disclosed. The fan blades may be formed using an extrusion method of fabrication, wherein each fan blade (316) may comprise a reinforced trailing edge (514) with a downwardly extending flange. The benefit of forming each fan blade with a reinforced trailing edge (514) of the present invention results in improved structural characteristics such that the trailing edge of each fan blade (316) may be fabricated longer so as to improve aerodynamic performance. Also, the reinforced trailing edge resists tearing that may occur during extrusion by adding the bent flanged region to at least one distal end of the trailing edge. For example, the bent portion (538) of the trailing edge tends to rigidly orient the extruded material in a stabilized position more readily during formation.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/00125

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : F01D 5/18; B63H 1/20; B64C 11/28; B21C 23/00

US CL : 416/237, 228, 235, 236R, 210R, 23; 72/253.1, 256

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 416/237, 228, 235, 236R, 210R, 23; 72/253.1, 256

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONEElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)
NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2,450,440 A (MILLS) 05 October 1948 (05.10.1948), See column 1, line 22; column 1, lines 46-50; see col. 3, line 60-65 - see Figs. 2-4.	1,3-9,11-14,16-18,21,22,24-26,28,29,31-38
✓	US 5,492,448 A (PERRY et al.) 20 February 1996 (20.02.1996), See entire document and see fig. 12.	1,3-9,11-14,16-18,21,22,24-26,28,29,31-38
A	US 2,135,700 A (CIERVA) 08 November 1938 (08.11.1938), See entire document.	1-43
A	US 2,312,095 A (WELTY) 23 February 1943 (23.02.1943), See entire document.	1-43
A	US 4,971,521 A (ATARASHI et al.) 20 November 1990 (11.20.1990), See entire document.	1-43
A	US 5,328,329 A (MONROE) 12 July 1994 (12.07.1994), See entire document.	1-43

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

Special categories of cited documents:	
* "A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
* "E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
* "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another claim or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
* "O" document referring to an oral disclosure, use, exhibition or other means	"A" document member of the same patent family
* "P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 07 July 2004 (07.07.2004)	Date of mailing of the international search report 29 JUL 2004
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Theresa Trieu Telephone No. 703-308-6434

"PATENT COOPERATION TREATY"

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From the
INTERNATIONAL SEARCHING AUTHORITY

To:
ROBERT J. LAMBRECHTS
LATHROP & GAGE LC
2345 GRAND BOULEVARD
SUITE 2400
KANSAS CITY, MO 64108

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year) **29 JUL 2004**

Applicant's or agent's file reference

FOR FURTHER ACTION

See paragraph 2 below

414706

International application No.

International filing date (day/month/year)

Priority date (day/month/year)

PCT/US04/00125

05 January 2004 (05.01.2004)

06 January 2003 (06.01.2003)

International Patent Classification (IPC) or both national classification and IPC

IPC(7): F01D 5/18; B63H 1/20; B64C 11/28; B21C 23/00 and US Cl.: 416/237,228,235,236R,210R,23; 72/253.1,256

Applicant

MECHANIZATION SYSTEMS COMPANY, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(1) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US

Mail Stop PCT, Attn: ISA/US

Commissioner for Patents

P.O. Box 1450

Alexandria, Virginia 22313-1450

Facsimile No. (703) 305-3230

Authorized officer

Theresa Trieu

Telephone No. 703-308-6434

Form PCT/ISA/237 (cover sheet) (January 2004)

DOCKETED

By: MRS Date: 8/4/04

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

Internat. application No.

PCT/US04/00125

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

- ☐ a sequence listing
☐ table(s) related to the sequence listing

b. format of material

- ☐ in written format
☐ in computer readable form

c. time of filing/furnishing

- ☐ contained in international application as filed.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

Internat. application No.
PCT/US04/00125

Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims <u>1-43</u>	YES
	Claims <u>NONE</u>	NO
Inventive step (IS)	Claims <u>2,10,15,19,20,23,27,30 and 39-43</u>	YES
	Claims <u>1,3-9,11-14,16-18,21,22,24-26,28,29 and 31-38</u>	NO
Industrial applicability (IA)	Claims <u>1-43</u>	YES
	Claims <u>NONE</u>	NO

2. Citations and explanations:

Please See Continuation Sheet

70 70

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

Internat. application No.

PCT/US04/00125

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

The drawings are objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or content thereof: "the third curved wall is joined to a second curved wall to form a solid interior region" recited in claims 5, 18 and 38.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US04/00125

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

Claims 1, 3-5, 12, 16-18, 24, 28, 29, 34, 37 and 38 lack an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claims 1, 4, 12, 16, 17, 24, 28, 29, 34 and 37, as shown in Figs. 2-4, Mills disclose a fan assembly comprising: a fan blades (1) attached to the rotatable shaft wherein each fan blade is formed of an extruded metal such that a first curved wall (6) is joined to a second curved wall (7) to form a leading junction (8) and a trailing junction (9), and wherein the trailing junction (9) extends to form a third curved wall having a trailing edge (10); the first curved wall (6) being joined to a second curved wall (7) to form a hollow interior region (not numbered; however, clearly seen in Fig. 2); the trailing edge (11, 12) comprising a tapered shape that decreases in thickness across its length. However, Mills fails to disclose a flange distally extending from the trailing edge.

Regarding claims 1, 16, 28 and 34, as shown in Figs. 12A-12J, Perry teaches that it is conventional in the art to utilize a flange (37) distally extending from the trailing edge in a continuous manner such that the angular displacement of the flange (37) from the trailing edge forms a bent region. With regard claims 3, 5, 18 and 38, Perry further discloses the first curved wall (22) is joined to a second curved wall (23) to form a solid interior region. It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have utilized the flange extending from the trailing edge, as taught by Perry in the Mills apparatus, since the use of thereof would have improved the performance of the fan.

Claims 6-9, 21 and 22 lack an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claims 6-9, 21 and 22, the modified Mills discloses the invention as recited above; however, the modified Mills fails to disclose each fan blade comprising a cross sectional width between 5 inches and 8 inches; each fan blade comprising a cross sectional height between 0.75 inches and 1.5 inches; each fan blade comprising a length between 4 feet and 14 feet; the first curved wall and second curved wall comprising a thickness between 1/16 inches and 3/16 inches. It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have utilize of the cross sectional width, height, length of the fan blade and the thickness of the first and second curved walls, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

Claims 11 and 25 lack an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claims 11 and 25, the modified Mills discloses the invention as recited above; however, the modified Mills fails to disclose the flange comprising a length between 1/8 inches and 3/8 inches. It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have utilize of the range of the flange's length, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

Claim 13 lacks an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claim 13, the modified Mills discloses the invention as recited above; however, the modified Mills fails to

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

Intern. application No.
PCT/US04/00125

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

disclose the plurality of fan blades including at least ten fan blades. It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have utilized ten fan blades, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art.

Claims 33, 35 and 36 lack an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claims 33, 35 and 36, the modified Mills discloses the invention as recited above; however, the modified Mills fails to disclose the material which makes up the fan blade. It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have utilized the fan blade being made of aluminum since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice.

Claims 14, 26, 31 and 32 lack an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claims 14, 26, 31 and 32, the modified Mills discloses the invention as recited above; however, the modified Mills fails to disclose the fan blades are fabricated using an extrusion technique. However, where a product by process claim is rejected over a prior art product that appears to be identical, although produced by a different process, the burden is upon the applicants to come forward with evidence establishing an obvious difference between the two.

Claim 2 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest an airfoil shape having a tapered trailing edge being bent to form the flange.

Claims 10, 15, 19, 20, 23, 27 and 30 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the thickness of the third curved wall; the extruded metal comprising aluminum; the extruded cross sectional profile comprising a cross-sectional width of 7 inches and cross-sectional height of 1 inch; the thickness of the first and second curved walls; the third curved wall being extended to form the tapered trailing edge wherein the tapered trailing edge being bent at a distal end to form the flange.

Claims 39-43 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the softened metal using an extrusion press to force the softened metal through the extrusion mold; the metal into the mold producing at least one fan blade with a uniform cross-section.

Claims 1-43 meet the criteria set out in PCT Article 33(4) because the subject matter claimed can be made or used in industry.

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under Article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the *PCT Applicant's Guide*, a publication of WIPO.

In these Notes, "Article," "Rule" and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the letter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Preliminary Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When? Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How? Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

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PATENT
Attorney Docket No.: 414706
Express Mail Label No.: EV413218563US

**PATENT COOPERATION TREATY
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY
UNITED STATES PATENT OFFICE**

Applicant: Mechanization Systems Company, Inc.
International Application No.: PCT/US04/00125
International Filing Date: 05 January 2004
Priority Date Claimed: 06 January 2003
Title of Invention: COOLING FAN WITH REINFORCED
BLADE

September 15, 2004

**Mail Stop: PCT
Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450**

RESPONSE TO WRITTEN OPINION

Dear Sir:

In response to the Written Opinion mailed 29 July 2004, please amend the application as follows.

IN THE SPECIFICATION

Please amend following paragraph in the specification with the following paragraph. A replacement sheet is attached.

Page 10, paragraph starting with line 1 and ending on Page 10, line 10:

In addition, the two surfaces 506, 510 meet at a leading edge 512. The hollow interior region 522, which may also be referred to as a cavity region, may comprise a rectangularly-shaped central section 500. A planar third surface 516 may be formed at the interior wall 524 in the region of section 500, and a planar fourth surface 520 may be formed at the interior of wall 530 in the region of section 500. In one aspect, the planar interior

1
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surfaces 516, 520 may be substantially parallel to each other. It should be appreciated that the fan blade 316 may comprise a solid interior region without departing from the scope of the present invention as is seen in FIG 5A. It should also be appreciated that the cross-sectional dimensions of the fan blade 316 including the reinforced trailing edge 514 will be described in greater detail herein below with reference to Figure 7B.

IN THE CLAIMS

Currently, Claims 1-43 are now pending. Please cancel Claims 2, 30, and 39 without prejudice. Claims 1, 16, 28, and 34 are being amended as follows:

1. (Currently Amended) A fan assembly for circulating air in an industrial building, the fan assembly comprising:
 - a support adapted to allow the mounting of the fan assembly to the roof of the industrial building;
 - a motor coupled to the support, the motor engaged with a rotatable shaft so as to induce rotation of the shaft; and
 - a plurality of airfoil shaped fan blades attached to the rotatable shaft, wherein each fan blade is formed of an extruded material such that a first curved wall is joined to a second curved wall to form a leading junction and a trailing junction, and wherein the trailing junction extends to form a third curved wall having a trailing edge, each blade further comprising a bent flange that distally extends from the trailing edge in a continuous manner ~~such that the angular displacement of the flange from the trailing edge forms a bent region that reinforces the trailing edge.~~
2. (Cancelled)
16. (Currently Amended) A metal fan blade for a fan assembly used in an industrial building, the fan blade comprising an extruded cross-

sectional profile having a plurality of curved walls, wherein a first curved wall is joined to a second curved wall to form an airfoil shape and the first curved wall is extended to form a tapered trailing edge wherein having a the distal end of the tapered trailing edge that is bent to form includes a flange extending outward from the direction of the trailing edge, wherein the flanged portion of the trailing edge downwardly extends from the lower surface of the trailing edge such that the angular displacement of the flanged portion from the lower surface of the trailing edge forms a reinforced region that increases the structural rigidity of the trailing edge so that the flanged trailing edge resists damage, and wherein the flange increases the volume of airflow resulting from the operation of the fan assembly having the fan blade.

28. (Currently Amended) A fan assembly for cooling industrial buildings, the fan assembly comprising:

- a mounting assembly having a rotatable hub that attaches the fan assembly to the ceiling of the industrial building;
- a plurality of fan blades mounted to the rotatable hub, wherein each of the plurality of fan blades is at least 4 feet long and is formed of an extruded metal so as to have a first air foil section and a tapered trailing edge, wherein the tapered trailing edge extends from a wall of the fan blade and wherein the tapered trailing edge is bent at a distal end to integrally form a flange a flange is integrally formed at the end of the tapered trailing edge so as to reinforce the tapered trailing edge and so as to provide increased downward thrust during rotation of the fan blades.

30. (Cancelled)

34. (Currently Amended) A method of forming a fan blade comprising:
 softening a metal;

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 Attorney Docket No.: 414706
 Express Mail Label No.: EV413218583US

forcing the metal into an extrusion ~~mold-die~~ using an extrusion press such that a cooled metal fan blade is extruded out of the extrusion ~~mold-die~~ so as to have in uniform cross-section a first air foil section and a tapered trailing edge integrally attached to an end of the first air foil section and a reinforcing flange that extends outward from the direction of the tapered trailing edge so as to reinforce the tapered trailing edge during extrusion to inhibit tearing of the tapered trailing edge.

39. (Cancelled)

REMARKS

In her written opinion, the Examiner noted that the drawings are objected to under PCT Rule 66.2(a)(iii) as containing defects in the form or content thereof. An additional drawing FIG. 5A has been included to detail a solid interior region. This additional drawing FIG. 5A adds no new matter as page 10, lines 6-8 provide for a solid interior region.

In her written opinion, the Examiner rejected claims 1, 3-9, 11-14, 16-18, 21, 22, 24-26, 28, 29 and 31-38 as lacking inventive step under PCT article 33(3) as being obvious over US-2,450,440 (hereinafter "Mills") in view of US-5,492,448 (hereinafter "Perry"). Claims 1, 16, 28 and 34 have been replaced by amended claims bearing the same numbers. Claims 2, 30 and 39 have been cancelled and all other claims remain unchanged.

Applicant has amended independent claims 1, 16, 28 and 34 by incorporating the inventive step limitations of dependent claims 2 (for both claims 1 and 16), 30 and 39 into the independent claims pursuant to the observation of the Examiner that those dependent claims provide an inventive step. The specific amendments made by Applicant are more fully described in the following paragraphs.

Applicant has incorporated the limitations of dependent claim 2 into independent claims 1 and 16 as the Examiner in her written opinion has

PATENT
Attorney Docket No.: 414706
Express Mail Label No.: EV413218563US

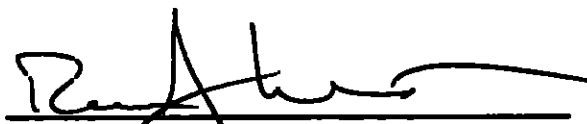
provided that claim 2 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest an airfoil shape having a tapered edge being bent to form the flange. Applicant requests that claim 2 be deleted from the claim set. Applicant respectfully requests that Claims 1 and 16 now possess inventive step over Mills in view of Perry.

Applicant has incorporated the limitations of dependent claim 30 into independent claim 28 as the Examiner in her written opinion has provided that claim 30 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a first wall extended to form a tapered trailing edge, and wherein the tapered trailing edge is bent at a distal end to form the flange. Applicant respectfully requests that Claim 28 now possess inventive step over Mills in view of Perry.

Applicant has incorporated the limitations of dependent claim 39 into independent claim 34 as the Examiner in her written opinion has provided that claim 39 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the use of an extrusion press to force the softened metal through the extrusion die producing at least one fan blade with a uniform cross section. Applicant respectfully requests that Claim 34 now possess inventive step over Mills in view of Perry.

Reconsideration and a favorable International Preliminary Examination Report are requested in view of the foregoing amendments.

Respectfully submitted,
LATHROP & GAGE LC



Robert J. Lambrechts, Reg. No.: 48,854
2345 Grand Boulevard, Suite 2400
Kansas City, Missouri 64108
(816) 460-5814 Telephone
(816) 292-2001 Facsimile

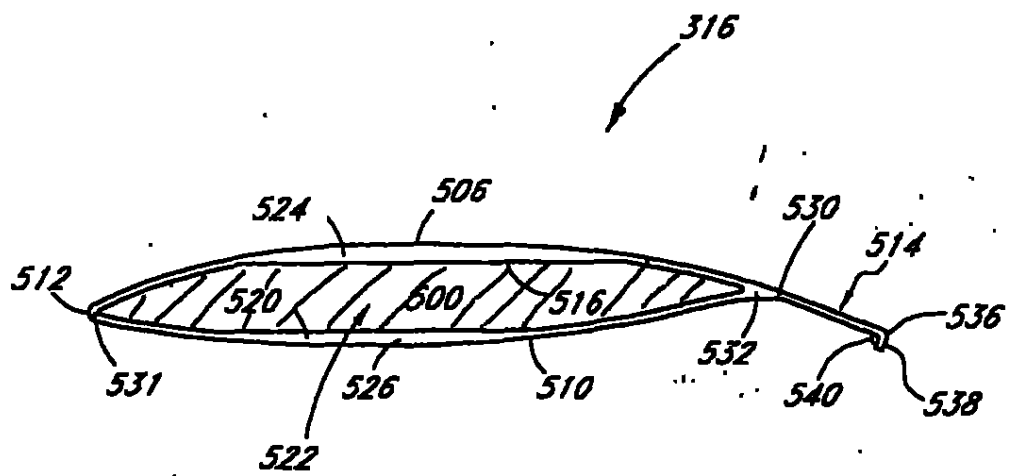


FIG. 5A

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In addition, the two surfaces 506, 510 meet at a leading edge 512. The hollow interior region 522, which may also be referred to as a cavity region, may comprise a rectangularly-shaped central section 500. A planar third surface 516 may be formed at the interior wall 524 in the region of section 500, and a planar fourth surface 520 may be formed at the interior of wall 530 in the region of section 500. In one aspect, the planar interior surfaces 516, 520 may be substantially parallel to each other. It should be appreciated that the fan blade 316 may comprise a solid interior region without departing from the scope of the present invention as is seen in FIG 5A. It should also be appreciated that the cross-sectional dimensions of the fan blade 316 including the reinforced trailing edge 514 will be described in greater detail herein below with reference to Figure 7B.

Moreover, the reinforced trailing edge 514 may comprise a downwardly extending flange 58 supported by a bent region 536. As illustrated in Figure 5, the reinforced trailing edge 514 extends from the trailing junction 532 in a manner so as to follow the curvature of the first curved wall 524. The distal end of reinforced trailing edge 514 bends downward in a manner so as to form the bent region 536 and the downwardly extending flange 538. The flange 538 distally extends from the reinforced trailing edge 514 via the bent region 536 and forms a first angle 540 with the reinforced trailing edge 514. Depending on the particular application and operation of the fan blade 316, the length of the flange 538 and the angular displacement of the first angle 540 may vary in magnitude without departing from the scope of the present invention.

The length of the flange 538 may comprise a magnitude between 0.125 (1/8) and 0.375 (3/8) inches, and the angular displacement of the first angle may comprise a magnitude between 80 and 100 degrees. In a preferred embodiment, the flange 538 may comprise a length of approximately 0.25 (1/4) inches, and the first angle 540 may comprise an angular displacement of approximately 90 degrees. In addition, the fan blade 316 including the reinforced trailing edge may comprise extruded aluminum, but it should be appreciated that the fan blade 316 may comprise various generally known extruded materials without departing from the scope of the present invention.

In one aspect, the structural bend of the bent region 536 increases the strength of the distal end of the reinforced trailing edge 514 in a manner such that the structural bend improves rigidity by providing supporting forces in two dimensions relatively parallel and

1. A fan assembly for circulating air in an industrial building, the fan assembly comprising:
 - a support adapted to allow the mounting of the fan assembly to the roof of the industrial building;
 - 5 a motor coupled to the support, the motor engaged with a rotatable shaft so as to induce rotation of the shaft; and
 - a plurality of airfoil shaped fan blades attached to the rotatable shaft, wherein each fan blade is formed of an extruded material such that a first curved wall is joined to a second curved wall to form a leading junction and a trailing junction, and wherein the trailing junction extends to form a third curved wall having a trailing edge, each blade further comprising a bent flange that distally extends from the trailing edge in a continuous manner that reinforces the trailing edge.
- 10 2. (Cancelled)
- 15 3. The fan assembly of Claim 1, wherein the flange downwardly extends from the lower surface of the third wall.
4. The fan assembly of Claim 1, wherein the first curved wall is joined to a second curved wall to form a hollow interior region.
5. The fan assembly of Claim 1, wherein the first curved wall is joined to a second curved wall to form a solid interior region.
- 20 6. The fan assembly of claim 1, wherein each fan blade comprises a cross-sectional width between approximately 5 inches and 8 inches.
7. The fan assembly of Claim 1, wherein each fan blade comprises a cross-sectional height between approximately 0.75 (3/4) inches and 1.50 (3/2) inches.
- 25 8. The fan assembly of Claim 1, wherein each fan blade comprises a length between approximately 4 feet and 15 feet.
9. The fan assembly of Claim 1, wherein the first and second curved walls comprise a thickness between approximately 0.0625 (1/16) inches and 0.1875 (3/16) inches.

10. The fan assembly of Claim 1, wherein the third curved wall comprises a tapered shape that decreases in thickness across its length from approximately 0.1875 (3/16) inches at the trailing junction to approximately 0.0625 (1/16) inches at the trailing edge.
- 5 11. The fan assembly of Claim 1, wherein the flange comprises a length between approximately 0.125 (1/8) and 0.375 (3/8) inches.
12. The fan assembly of Claim 1, wherein the plurality of fan blades are attached to a hub, which is connected to a rotatable shaft.
13. The fan assembly of Claim 1, wherein the plurality of fan blades includes at
10 least ten fan blades.
14. The fan assembly of Claim 1, wherein each of the plurality of fan blades are fabricated using an extrusion technique.
15. The fan assembly of Claim 14, wherein the extruded metal comprises aluminum.
- 15 16. A metal fan blade for a fan assembly used in an industrial building, the fan blade comprising an extruded cross-sectional profile having a plurality of curved walls, wherein a first curved wall is joined to a second curved wall to form an airfoil shape and the first curved wall is extended to form a tapered trailing edge wherein the distal end of the tapered trailing edge is bent to form a flange extending outward from the direction of the
20 trailing edge, wherein the flanged portion of the trailing edge downwardly extends from the lower surface of the trailing edge such that the angular displacement of the flanged portion from the lower surface of the trailing edge forms a reinforced region that increases the structural rigidity of the trailing edge so that the flanged trailing edge resists damage, and wherein the flange increases the volume of airflow resulting from the operation of the fan
25 assembly having the fan blade.
17. The fan blade of Claim 16, wherein the first curved wall is joined to a second curved wall to form a hollow interior region.
18. The fan blade of Claim 16, wherein the first curved wall is joined to a second curved wall to form a solid interior region.

19. The fan blade of claim 16, wherein the extruded cross-sectional profile comprises a cross-sectional width of approximately 7 inches.
20. The fan blade of claim 16, wherein the extruded cross-sectional profiles
5 comprises a cross-sectional height of approximately 1 inches.
21. The fan blade of claim 16, wherein the fan blade comprises a length of at least 4 feet.
22. The fan blade of claim 16, wherein the fan blade comprises a length of at least less than 15 feet.
- 10 23. The fan blade of claim 16, wherein the first and second curved walls comprise a thickness of approximately 0.15625 (5/32) inches.
24. The fan blade of claim 16, wherein the trailing edge comprises a tapered shape that decreases in thickness across its length.
25. The fan blade of claim 16, wherein the flange comprises a length between
15 approximately 0.125 (1/8) and 0.375 (3/8) inches.
26. The fan blade of claim 16, wherein the fan blade is fabricated using an extrusion die to form the extruded cross-sectional profile of the fan blade.
27. The fan blade of claim 16, wherein the fan blade is formed using an aluminum extrusion technique.
- 20 28. A fan assembly for cooling industrial buildings, the fan assembly comprising:
a mounting assembly having a rotatable hub that attaches the fan assembly to the ceiling of the industrial building;
a plurality of fan blades mounted to the rotatable hub, wherein each of the plurality of
fan blades is at least 4 feet long and is formed of an extruded metal so as to
25 have a first air foil section and a tapered trailing edge, wherein the tapered trailing edge extends from a wall of the fan blade and wherein the tapered trailing edge is bent at a distal end to integrally form a flange to reinforce the tapered trailing edge and so as to provide increased downward thrust during rotation of the fan blades.

29. The fan assembly of Claim 28, wherein a first curved wall is joined to a second curved wall to form the first air foil section having a hollow interior region.

30. (Cancelled)

5 31. The fan assembly of Claim 28, wherein the plurality of fan blades are formed using an extrusion fabrication process.

32. The fan assembly of Claim 28, wherein the flange reinforces the tapered trailing edge during the extrusion fabrication process so that the tapered trailing edge resists tearing while being formed.

10 33. The fan assembly of Claim 28, wherein each of the plurality of fan blades comprises aluminum.

34. A method of forming a fan blade comprising:
softening a metal;
forcing the metal into an extrusion die using an extrusion press such that a cooled
15 metal fan blade is extruded out of the extrusion die so as to have in uniform cross-section a first air foil section and a tapered trailing edge integrally attached to an end of the first air foil section and a reinforcing flange that extends outward from the direction of the tapered trailing edge so as to reinforce the tapered trailing edge during extrusion to inhibit tearing of the
20 tapered trailing edge.

35. The method of Claim 34, wherein softening the metal comprises softening aluminum.

36. The method of Claim 34, wherein softening the metal comprises softening an alloyed aluminum with at least one of copper, manganese, silicon, magnesium and zinc.

25 37. The method of Claim 34, wherein the method further comprises forming an extrusion mold to produce the fan blade with a hollow interior region.

38. The method of Claim 34, wherein the method further comprises forming an extrusion mold to produce the fan blade with a solid interior region.

39. (Cancelled)

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The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ US

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty.

For International Preliminary Examining Authority use only		
Identification of IPEA		Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference 414706
International application No. PCT/US2004/000125	International filing date (day/month/year) 05 January 2004 (05.01.2004)	(Earliest) Priority date (day/month/year) 06 January 2003 (06.01.2003)
Title of invention COOLING FAN WITH REINFORCED BLADE		
Box No. II APPLICANT(S)		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) MECHANIZATION SYSTEMS COMPANY, INC. 1120 Lincoln Street Colton, California 92324 United States of America		Telephone No.
		Facsimile No.
		Teleprinter No.
		Applicant's registration No. with the Office
State (that is, country) of nationality: US		State (that is, country) of residence: US
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) DELTA T CORPORATION 800 Winchester Road Lexington, Kentucky 40575-1307 United States of America		
State (that is, country) of nationality: US		State (that is, country) of residence: US
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) BOYD, Walter 3100 Maricopa Drive Riverside, California 92507 United States of America		
State (that is, country) of nationality: US		State (that is, country) of residence: US
☐ Further applicants are indicated on a continuation sheet.		

Sheet No. 2

International application No.
PCT/US2004/000125

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is ☒ agent ☐ common representative
and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.
☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.
☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: (Family name followed by given name; for a legal entity, full official designation.
The address must include postal code and name of country.)

LAMBRECHTS, Robert J.
LATHROP & GAGE LC
2345 Grand Boulevard
Suite 2400
Kansas City, Missouri 64108
United States of America

Telephone No.

(816) 460-5814

Facsimile No.

(816) 292-2001

Teleprinter No.

Agent's registration No. with the Office

46,854

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION

Statement concerning amendments:*

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filed

the description ☒ as originally filed

☐ as amended under Article 34

the claims ☒ as originally filed

☐ as amended under Article 19 (together with any accompanying statement)

☐ as amended under Article 34

the drawings ☒ as originally filed

☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of the applicable time limit under Rule 69.1(d).

4. ☐ The applicant expressly wishes the international preliminary examination to start earlier than at the expiration of the applicable time limit under Rule 54bis.1(a).

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

☒ which is the language in which the international application was filed.

☐ which is the language of a translation furnished for the purposes of international search.

☐ which is the language of publication of the international application.

☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The filing of this demand constitutes the election of all Contracting States which are designated and are bound by Chapter II of the PCT.

Sheet No. 3

International application No.
PCT/US2004/000125

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (specify) | : | sheets |

For International Preliminary Examining Authority use only

received not received

- | | |
|--------------------------|--------------------------|
| ☐ | ☐ |
| ☐ | ☐ |
| ☐ | ☐ |
| ☐ | ☐ |
| ☐ | ☐ |
| ☐ | ☐ |

The demand is also accompanied by the item(s) marked below:

- | | |
|--|--|
| 1. ☒ fee calculation sheet | 5. ☐ statement explaining lack of signature |
| 2. ☐ original separate power of attorney | 6. ☐ sequence listing in computer readable form |
| 3. ☐ original general power of attorney | 7. ☐ tables in computer readable form related to a sequence listing |
| 4. ☐ copy of general power of attorney; reference number, if any: | 8. ☒ other (specify): Cert of Mail & Post Card |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).


Robert J. Lambrechts

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

- | | |
|--|--|
| 3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.
☐ The applicant has been informed accordingly. | 6. ☐ The date of receipt of the demand is AFTER the expiration of the time limit under Rule 54bis.1(a) and item 7 or 8, below, does not apply. |
| 4. ☐ The date of receipt of the demand is WITHIN the time limit of 19 months from the priority date as extended by virtue of Rule 80.5. | 7. ☐ The date of receipt of the demand is WITHIN the time limit under Rule 54bis.1(a) as extended by virtue of Rule 80.5. |
| 5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82. | 8. ☐ Although the date of receipt of the demand is after the expiration of the time limit under Rule 54bis.1(a), the delay in arrival is EXCUSED pursuant to Rule 82. |

For International Bureau use only

Demand received from IPEA on:

98

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

NOTIFICATION OF RECEIPT
OF DEMAND BY COMPETENT INTERNATIONAL
PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(c) and 61.1(b), first sentence
and Administrative Instructions, Section 601(a))

To:
ROBERT J. LAMBRECHTS
LATHROP & GAGE LC
2345 GRAND BOULEVARD
SUITE 2400
KANSAS CITY, MISSOURI 64108

Date of mailing
(day/month/year)

26 AUG 2004

Applicant's or agent's file reference
414708

IMPORTANT NOTIFICATION

International application No.

PCT/US2004/000125

International filing date (day/month/year)

05 Jan 2004

Priority date (day/month/year)

06 Jan 2003

Applicant

MECHANIZATION SYSTEMS COMPANY, INC.

1. The applicant is hereby notified that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

19 Jul 2004

19.07.04

2. That date of receipt is:

- ☒ the actual date of receipt of the demand by this Authority (Rule 61.1(b)).
☐ the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).
☐ the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. ☐ **ATTENTION:** That date of receipt is after the expiration of 19 months from the priority date. Consequently, in respect of some Offices, the demand does not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)) and the acts for entry into the national phase must therefore be performed within 20 months from the priority date (or later in some Offices). However, in respect of some other Offices, the time limit of 30 months (or later) may nevertheless apply. See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

- ☐ (if applicable) This notification confirms the information given by telephone, facsimile transmission or in person on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA:
Mail Stop PCT, Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450
Facsimile No. 703-305-3230

Authorized officer
Barbara Fridie
Telephone No. 703-3053747

PATENT COOPERATION TREATY

89
A

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
ROBERT J. LAMBRECHTS
LATHROP & GAGE LC
2345 GRAND BOULEVARD
SUITE 2400
KANSAS CITY, MO 64108

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing
(day/month/year) **14 FEB 2005**

Applicant's or agent's file reference

414706

IMPORTANT NOTIFICATION

International application No.

PCT/US04/00125

International filing date (day/month/year)

05 January 2004 (05.01.2004)

Priority date (day/month/year)

06 January 2003 (06.01.2003)

Applicant

MECHANIZATION SYSTEMS COMPANY, INC.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US

Mail Stop PCT, Ann: IPEA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Facsimile No. (703) 305-3230

Authorized officer

Theresa Trieu

Telephone No. 571-272-4868 Tech. Center 3700

Shelia H. Venev
Patent Specialist

Form PCT/IPEA/416 (July 1992)

DOCKETED

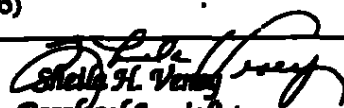
By: *MRS* Date: *2/18/05*

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 414706		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US04/00125	International filing date (day/month/year) 05 January 2004 (05.01.2004)	Priority date (day/month/year) 06 January 2003 (06.01.2003)	
International Patent Classification (IPC) or national classification and IPC IPC(7): F01D 5/18; B63H 1/20; B64C 11/28; B21C 23/00 and US Cl.: 416/237, 228, 235, 236R, 210R, 23; 72/253.1, 256			
Applicant MECHANIZATION SYSTEMS COMPANY, INC.			
1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of 4 sheets, including this cover sheet. ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT). These annexes consist of a total of 5 sheets.			
3. This report contains indications relating to the following items: I ☒ Basis of the report II ☐ Priority III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability IV ☐ Lack of unity of invention V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI ☐ Certain documents cited VII ☒ Certain defects in the international application VIII ☐ Certain observations on the international application			
Date of submission of the demand 19 July 2004 (19.07.2004)		Date of completion of this report 09 January 2005 (09.01.2005)	
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1430 Alexandria, Virginia 22313-1430 Facsimile No. (703) 305-3230		Authorized officer Theresa Trieu Telephone No. 571-272-4868  Sheila H. Verma Paralegal Specialist Tech. Center 3700	

Form PCT/IPEA/409 (cover sheet)(July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US04/00125

I. Basis of the report

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed.
- ☒ the description:
 pages 1-17 as originally filed
 pages NONE, filed with the demand
 pages NONE, filed with the letter of _____.

- ☒ the claims:
 pages 22 as originally filed
 pages NONE, as amended (together with any statement) under Article 19
 pages NONE, filed with the demand
 pages 18-21, filed with the letter of 15 September 2004 (15.09.2004)

- ☒ the drawings:
 pages 1-5 as originally filed
 pages NONE, filed with the demand
 pages 6, filed with the letter of 15 September 2004 (15.09.2004)

- ☐ the sequence listing part of the description:
 pages _____ as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____.

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item. These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

- ☒ the description, pages NONE
- ☒ the claims, Nos. 2, 30 and 39
- ☒ the drawings, sheets/fig NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US04/00125

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims <u>1, 3-29, 31-38 and 41-43</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>1, 3-29, 31-38 and 41-43</u>	YES
	Claims <u>NONE</u>	NO
Industrial Applicability (IA)	Claims <u>1, 3-29, 31-38 and 41-43</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Claims 1, 3-29, 31-38, 41-43 meet the criteria set out in PCT Article 33(2)-(3), because of the following reasons:

Claims 1 and 16: the prior art does not teach or fairly suggest a fan blade comprising an airfoil shape having a tapered edge that is bent to form the flange.

Claim 28: the prior art does not teach or fairly suggest the first curved wall being extended to form the tapered trailing edge and wherein the tapered trailing edge is bent at a distal end to form a flange.

Claim 34: the prior art does not teach or fairly suggest forcing the metal into an extrusion die using extrusion press so as to force the softened metal through the extrusion mold.

Claims 1, 3-29, 31-38 and 41-43 meet the criteria set out in PCT Article 33(4), and thus the invention has industrial applicability as cooling fan with reinforced blade because the subject matter claimed can be made or used in industry.

NEW CITATIONS

NONE

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US04/00125

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claim 40 depends on claim 39. However, claim 39 has been canceled by the applicant; therefore, claim 40 has been canceled.

1. A fan assembly for circulating air in an industrial building, the fan assembly comprising:

- a support adapted to allow the mounting of the fan assembly to the roof of the industrial building;
- 5 a motor coupled to the support, the motor engaged with a rotatable shaft so as to induce rotation of the shaft; and
- a plurality of airfoil shaped fan blades attached to the rotatable shaft, wherein each fan blade is formed of an extruded material such that a first curved wall is joined to a second curved wall to form a leading junction and a trailing junction, and wherein the trailing junction extends to form a third curved wall having a trailing edge, each blade further comprising a bent flange that distally extends from the trailing edge in a continuous manner that reinforces the trailing edge.

10

2. (Cancelled)

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3. The fan assembly of Claim 1, wherein the flange downwardly extends from the lower surface of the third wall.

4. The fan assembly of Claim 1, wherein the first curved wall is joined to a second curved wall to form a hollow interior region.

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5. The fan assembly of Claim 1, wherein the first curved wall is joined to a second curved wall to form a solid interior region.

6. The fan assembly of claim 1, wherein each fan blade comprises a cross-sectional width between approximately 5 inches and 8 inches.

7. The fan assembly of Claim 1, wherein each fan blade comprises a cross-sectional height between approximately 0.75 (3/4) inches and 1.50 (3/2) inches.

25

8. The fan assembly of Claim 1, wherein each fan blade comprises a length between approximately 4 feet and 15 feet.

9. The fan assembly of Claim 1, wherein the first and second curved walls comprise a thickness between approximately 0.0625 (1/16) inches and 0/1875 (3/16) inches.

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10. The fan assembly of Claim 1, wherein the third curved wall comprises a tapered shape that decreases in thickness across its length from approximately 0.1875 (3/16) inches at the trailing junction to approximately 0.0625 (1/16) inches at the trailing edge.

5 11. The fan assembly of Claim 1, wherein the flange comprises a length between approximately 0.125 (1/8) and 0.375 (3/8) inches.

12. The fan assembly of Claim 1, wherein the plurality of fan blades are attached to a hub, which is connected to a rotatable shaft.

10 13. The fan assembly of Claim 1, wherein the plurality of fan blades includes at least ten fan blades.

14. The fan assembly of Claim 1, wherein each of the plurality of fan blades are fabricated using an extrusion technique.

15. The fan assembly of Claim 14, wherein the extruded metal comprises aluminum.

15 16. A metal fan blade for a fan assembly used in an industrial building, the fan blade comprising an extruded cross-sectional profile having a plurality of curved walls, wherein a first curved wall is joined to a second curved wall to form an airfoil shape and the first curved wall is extended to form a tapered trailing edge wherein the distal end of the tapered trailing edge is bent to form a flange extending outward from the direction of the trailing edge, wherein the flanged portion of the trailing edge downwardly extends from the lower surface of the trailing edge such that the angular displacement of the flanged portion from the lower surface of the trailing edge forms a reinforced region that increases the structural rigidity of the trailing edge so that the flanged trailing edge resists damage, and wherein the flange increases the volume of airflow resulting from the operation of the fan assembly having the fan blade.

20

25

17. The fan blade of Claim 16, wherein the first curved wall is joined to a second curved wall to form a hollow interior region.

18. The fan blade of Claim 16, wherein the first curved wall is joined to a second curved wall to form a solid interior region.

REPLACEMENT SHEET

-19-

AMENDED SHEET

19. The fan blade of claim 16, wherein the extruded cross-sectional profile comprises a cross-sectional width of approximately 7 inches.

5 20. The fan blade of claim 16, wherein the extruded cross-sectional profiles comprises a cross-sectional height of approximately 1 inches.

21. The fan blade of claim 16, wherein the fan blade comprises a length of at least 4 feet.

22. The fan blade of claim 16, wherein the fan blade comprises a length of at least less than 15 feet.

10 23. The fan blade of claim 16, wherein the first and second curved walls comprise a thickness of approximately 0.15625 (5/32) inches.

24. The fan blade of claim 16, wherein the trailing edge comprises a tapered shape that decreases in thickness across its length.

15 25. The fan blade of claim 16, wherein the flange comprises a length between approximately 0.125 (1/8) and 0.375 (3/8) inches.

26. The fan blade of claim 16, wherein the fan blade is fabricated using an extrusion die to form the extruded cross-sectional profile of the fan blade.

27. The fan blade of claim 16, wherein the fan blade is formed using an aluminum extrusion technique.

20 28. A fan assembly for cooling industrial buildings, the fan assembly comprising:
a mounting assembly having a rotatable hub that attaches the fan assembly to the ceiling of the industrial building;

25 a plurality of fan blades mounted to the rotatable hub, wherein each of the plurality of fan blades is at least 4 feet long and is formed of an extruded metal so as to have a first air foil section and a tapered trailing edge, wherein the tapered trailing edge extends from a wall of the fan blade and wherein the tapered trailing edge is bent at a distal end to integrally form a flange to reinforce the tapered trailing edge and so as to provide increased downward thrust during rotation of the fan blades.

REPLACEMENT SHEET

-20-

AMENDED SHEET

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29. The fan assembly of Claim 28, wherein a first curved wall is joined to a second curved wall to form the first air foil section having a hollow interior region.

30. (Cancelled)

5 31. The fan assembly of Claim 28, wherein the plurality of fan blades are formed using an extrusion fabrication process.

32. The fan assembly of Claim 28, wherein the flange reinforces the tapered trailing edge during the extrusion fabrication process so that the tapered trailing edge resists tearing while being formed.

10 33. The fan assembly of Claim 28, wherein each of the plurality of fan blades comprises aluminum.

34. A method of forming a fan blade comprising:
softening a metal;

15 forcing the metal into an extrusion die using an extrusion press such that a cooled metal fan blade is extruded out of the extrusion die so as to have in uniform cross-section a first air foil section and a tapered trailing edge integrally attached to an end of the first air foil section and a reinforcing flange that extends outward from the direction of the tapered trailing edge so as to reinforce the tapered trailing edge during extrusion to inhibit tearing of the tapered trailing edge.

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35. The method of Claim 34, wherein softening the metal comprises softening aluminum.

36. The method of Claim 34, wherein softening the metal comprises softening an alloyed aluminum with at least one of copper, manganese, silicon, magnesium and zinc.

25 37. The method of Claim 34, wherein the method further comprises forming an extrusion mold to produce the fan blade with a hollow interior region.

38. The method of Claim 34, wherein the method further comprises forming an extrusion mold to produce the fan blade with a solid interior region.

39. (Cancelled)

REPLACEMENT SHEET

-21-

AMENDED SHEET

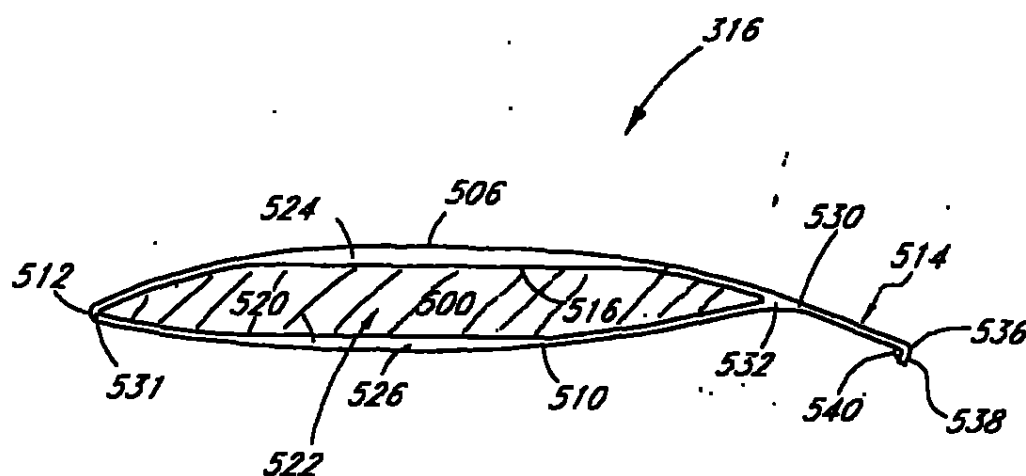


FIG. 5A

AMENDED SHEET

PATENT COOPERATION TREATY

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From the RECEIVING OFFICE

To: ROBERT J. LAMBRECHTS LATHROP & GAGE LC 2345 GRAND BOULEVARD SUITE 2400 KANSAS CITY, MISSOURI 64108		PCT NOTIFICATION OF THE INTERNATIONAL APPLICATION NUMBER AND OF THE INTERNATIONAL FILING DATE (PCT Rule 20.5(c))							
		<table style="width: 100%;"> <tr> <td style="width: 50%;">Date of mailing (day/month/year)</td> <td style="width: 50%; text-align: right;">12 Mar 2004</td> </tr> </table>		Date of mailing (day/month/year)	12 Mar 2004				
Date of mailing (day/month/year)	12 Mar 2004								
<table style="width: 100%;"> <tr> <td style="width: 50%;">Applicant's or agent's file reference</td> <td style="width: 50%; text-align: center;">414708</td> </tr> </table>		Applicant's or agent's file reference	414708	IMPORTANT NOTIFICATION					
Applicant's or agent's file reference	414708								
<table style="width: 100%;"> <tr> <td style="width: 100%;">International application No.</td> </tr> <tr> <td style="text-align: center;">PCT/US2004/000125</td> </tr> </table>	International application No.	PCT/US2004/000125	<table style="width: 100%;"> <tr> <td style="width: 100%;">International filing date (day/month/year)</td> </tr> <tr> <td style="text-align: center;">05 Jan 2004</td> </tr> </table>	International filing date (day/month/year)	05 Jan 2004	<table style="width: 100%;"> <tr> <td style="width: 100%;">Priority date (day/month/year)</td> </tr> <tr> <td style="text-align: center;">08 Jan 2003</td> </tr> </table>	Priority date (day/month/year)	08 Jan 2003	
International application No.									
PCT/US2004/000125									
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Priority date (day/month/year)									
08 Jan 2003									
<table style="width: 100%;"> <tr> <td style="width: 100%;">Applicant</td> </tr> <tr> <td style="text-align: center;">MECHANIZATION SYSTEMS COMPANY, INC.</td> </tr> </table>				Applicant	MECHANIZATION SYSTEMS COMPANY, INC.				
Applicant									
MECHANIZATION SYSTEMS COMPANY, INC.									
<table style="width: 100%;"> <tr> <td style="width: 100%;">Title of the invention</td> </tr> <tr> <td style="text-align: center;">COOLING FAN WITH REINFORCED BLADE</td> </tr> </table>				Title of the invention	COOLING FAN WITH REINFORCED BLADE				
Title of the invention									
COOLING FAN WITH REINFORCED BLADE									

1. The applicant is hereby notified that the international application has been accorded the international application number and the international filing date indicated above.

2. The applicant is further notified that the record copy of the international application:

☒ was transmitted to the International Bureau on 12 Mar 2004

☐ has not yet been transmitted to the International Bureau for the reason indicated below and a copy of this notification has been sent to the International Bureau*:

☐ because the necessary national security clearance has not yet been obtained.
☐ because (reason to be specified):

* The International Bureau monitors the transmittal of the record copy by the receiving Office and will notify the applicant (with Form PCT/IB/301) of its receipt. Should the record copy not have been received by the expiration of 14 months from the priority date, the International Bureau will notify the applicant (Rule 22.1(c)).

Name and mailing address of the receiving Office Mail Stop PCT, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 703-305-3230	Authorized officer Barbara Fridie Telephone No. 703-3053747
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100

TRATADO DE COOPERACIÓN EN MATERIA DE PATENTES
PCT
INFORME DE EXAMEN PRELIMINAR INTERNACIONAL

(artículo 36 y regla 70 del PCT)

Referencia del expediente del solicitante 414706	PARA DAR CURSO Ver la notificación de transmisión del Informe de examen preliminar internacional (formulario PCT/IPEA/416)	
Solicitud internacional n° PCT/US04/00125	Fecha de solicitud internacional 05 de enero de 2004 (05.01.2004)	Fecha de prioridad 08 de enero de 2003 (08.01.2003)
Clasificación Internacional de las patentes (IPC) o clasificación nacional e IPC IPC(7): F01D 5/18; B63H 1/20; B64C 11/28; B21C 23/00 y clasificación US: 416/237, 228, 235, 236r, 23; 72/253.1, 256		
Solicitante MECHANIZATION SYSTEMS COMPANY, INC.		

1. De conformidad con el artículo 36, se transmite al solicitante el presente Informe de examen preliminar internacional preparado por la administración encargada del examen preliminar internacional. 2. Este INFORME comprende <u>4</u> hojas, incluyendo la presente hoja de cubierta <u>X</u> Este reporte está acompañado de ANEXOS, es decir, hojas de la descripción, de las reivindicaciones y/o de los dibujos las cuales fueron modificadas y que sirven de base al presente informe y/o de hojas que contienen rectificaciones hechas ante esta administración (ver la regla 70.16 y la instrucción 607 de las Instrucciones administrativas del PCT) Estos anexos comprenden un total de <u>5</u> hojas.																									
3. El presente informe comprende Indicaciones relativas a los siguientes puntos: <table style="width: 100%;"> <tr> <td style="width: 5%;">I</td> <td style="width: 15%;"><u>X</u></td> <td>Base del informe</td> </tr> <tr> <td>II</td> <td></td> <td>Prioridad</td> </tr> <tr> <td>III</td> <td></td> <td>Ausencia de formación de opinión en cuanto a la novedad, el nivel inventivo y la aplicación industrial</td> </tr> <tr> <td>IV</td> <td></td> <td>Ausencia de unidad de invención</td> </tr> <tr> <td>V</td> <td><u>X</u></td> <td>Declaración motivada bajo el Artículo 35(2) en cuanto a la novedad, el nivel inventivo y la aplicación industrial; citas y explicaciones que apoyan esta declaración</td> </tr> <tr> <td>VI</td> <td></td> <td>Algunos documentos citados</td> </tr> <tr> <td>VII</td> <td><u>X</u></td> <td>Irregularidades en la solicitud internacional</td> </tr> <tr> <td>VII</td> <td></td> <td>Observaciones relativas a la solicitud internacional</td> </tr> </table>		I	<u>X</u>	Base del informe	II		Prioridad	III		Ausencia de formación de opinión en cuanto a la novedad, el nivel inventivo y la aplicación industrial	IV		Ausencia de unidad de invención	V	<u>X</u>	Declaración motivada bajo el Artículo 35(2) en cuanto a la novedad, el nivel inventivo y la aplicación industrial; citas y explicaciones que apoyan esta declaración	VI		Algunos documentos citados	VII	<u>X</u>	Irregularidades en la solicitud internacional	VII		Observaciones relativas a la solicitud internacional
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VII		Observaciones relativas a la solicitud internacional																							
Fecha de presentación de la solicitud de examen preliminar internacional 19 de julio de 2004 (19.07.04)	Fecha de terminación del presente informe 09 de enero de 2005 (09.01.05)																								
Nombre y dirección postal de la administración encargada del examen preliminar internacional/US Mall Stop PCT, Attn: IPEA/US Comisionado de Patentes P.O. Box 1450 Alexandria, Virginia 22313-1450 Fax: (703)305-3230	Funcionario autorizado Theresa Trieu Tel: 571-272-4868																								

Forma PCT/IPEA/409 (hoja de cubierta) (julio 1998)

I. Base del Informe

Respecto a los elementos de la solicitud internacional:*

- ☐ La solicitud internacional como se presentó originalmente
☒ la descripción:

páginas 1-17, como se presentaron originalmente
páginas ninguna, presentadas con la solicitud de examen
páginas ninguna, presentadas junto con la carta del _____.

- ☒ las reivindicaciones:

páginas 22, como se presentaron originalmente
páginas ninguna, como se modificaron (junto con cualquier declaración bajo el artículo 19)
páginas ninguna, presentadas con la solicitud de examen
páginas 18-21, presentadas junto con la carta del 15 de Septiembre de 2004.

- ☒ los dibujos:

páginas 1-5, como se presentaron originalmente
páginas ninguna, presentadas con la solicitud de examen
páginas 6, presentadas junto con la carta del 15 de Septiembre de 2004.

- ☐ la parte de listado de secuencias de la descripción:

páginas _____, como se presentaron originalmente
páginas _____, presentadas con la solicitud de examen
páginas _____, presentadas junto con la carta del _____.

2. Respecto al lenguaje, todos los elementos marcados anteriormente estuvieron disponibles o fueron enviados a la Administración en el lenguaje en que se presentó la solicitud internacional, a menos que se indique otra cosa en este punto. Estos elementos estuvieron disponibles o fueron enviados a esta Administración en el siguiente lenguaje _____ el cual es:

- ☐ el lenguaje de la traducción enviada para propósitos de la búsqueda internacional (bajo Regla 23.1 (b)).
☐ el lenguaje de la publicación de la solicitud internacional (bajo Regla 48.3(b)).
☐ el lenguaje de la traducción entregada con propósitos del examen preliminar internacional (bajo Regla 55.2 y/o 55.3).

3. Respecto a cualquier secuencia de nucleótido y/o amino ácidos divulgada en la solicitud internacional, el examen preliminar internacional se llevó a cabo con base en el listado de secuencias:

- ☐ contenido en la solicitud internacional en forma escrita
☐ presentado junto con la solicitud internacional en forma legible por computador
☐ entregado posteriormente a esta Administración en forma legible por computador
☐ La declaración de que el listado de secuencias posteriormente entregado no va más allá de lo divulgado en la solicitud internacional originalmente presentada, ha sido entregada.
☐ La declaración de que la información grabada en la forma legible por computador es idéntica al listado de secuencias escrito que se ha entregado.

4. ☒ Las modificaciones han dado como resultado la cancelación de:

- ☒ la descripción, páginas ninguna.
- ☒ las reivindicaciones, Nos. 2, 30 y 39
- ☒ los dibujos, pág/fig ninguna.

5. ☐ Este reporte ha sido establecido como si (parte de) las modificaciones no se hubieran realizado, ya que éstas han sido consideradas como una ampliación de lo inicialmente divulgado como se indica en la Casilla Suplementaria (Regla 70.2(c)).**

** Las hojas de reemplazo que han sido entregadas a la Oficina receptora en respuesta a la invitación bajo el Artículo 14 se refieren en este informe como "originalmente presentadas" y no se anexan a este informe ya que ellas no contienen modificaciones (Regla 70.16 y 70.17).*

*** Cualquier hoja de reemplazo que contenga dichas modificaciones deberá ser referida bajo el punto 1 y anexada a este informe.*

V. Declaración motivada según la Regla 66.2(a)(II) en cuanto a la novedad, el nivel inventivo y la aplicación industrial; citas y explicaciones que soportan dicha declaración

1. Declaración

Novedad (N)	Reivindicaciones	<u>1, 3-29, 31-38 y 41-43</u>	SI
	Reivindicaciones	<u>ninguna</u>	NO
Nivel inventivo (NI)	Reivindicaciones	<u>1, 3-29, 31-38 y 41-43</u>	SI
	Reivindicaciones	<u></u>	NO
Aplicación industrial (AI)	Reivindicaciones	<u>1, 3-29, 31-38 y 41-43</u>	SI
	Reivindicaciones	<u></u>	NO

2. Citas y explicaciones

Las reivindicaciones 1, 3-29, 31-38, 41-43 cumplen con los criterios establecidos en el artículo 33(2)-(3) del PCT, por las siguientes razones:

Reivindicaciones 1 y 16: el arte previo no enseña ni sugiere someramente un aspa de ventilador que comprende una forma de ala que tenga un borde cónico que esté doblado para formar la brida.

Reivindicación 28: el arte previo no enseña ni sugiere someramente la primera pared curva que se extiende para formar el borde remanente cónico y en donde el borde remanente cónico está doblado en un extremo distal para formar una brida.

Reivindicación 34: el arte previo no enseña ni sugiere someramente forzar el metal por una boquilla de extrusión usando una prensa de extrusión de manera que fuerce el metal ablandado a través del molde de extrusión.

Las reivindicaciones 1, 3-29, 31-38 y 41-43 cumplen con los criterios establecidos en el artículo 33(4), y por lo tanto muestran aplicabilidad industrial como ventilador enfriador con aspas reforzadas porque la materia reivindicada puede ser fabricada o utilizada en la industria.

____Nuevas anterioridades____

NINGUNA

VII. Ciertos defectos en la solicitud internacional

Los siguientes defectos en la forma o en el contenido de la solicitud internacional se han notado:

La reivindicación 40 depende de la reivindicación 39. Sin embargo, la reivindicación 39 ha sido cancelada por el solicitante y por lo tanto, la reivindicación 40 ha sido cancelada.

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Adicionalmente, las dos superficies 506, 510 se unen en el borde principal 512. La región hueca interna 522, la cual también podría referirse como la región de la cavidad, podría comprender una sección central ancha y rectangular 500. Una tercera superficie plana 516 podría estar formada en la parte interna de la pared 524 en la región de la sección 500 y una cuarta superficie plana 520 podría estar formada en la parte interna de la pared 530 en la región de la sección 500. En un aspecto, las superficies internas planas 516, 520 podrían ser sustancialmente paralelas una con la otra. Es de apreciar que el aspa 316 podría comprender una región interna sólida sin alejarse del alcance de la presente invención como se aprecia en la Fig. 5A. También es de apreciar que las dimensiones transversales de cada aspa incluyendo el borde remanente reforzado 514 se describirán en mayor detalle en el presente documento, con referencia a la Figura 7B.

Además, el borde remanente reforzado 514 podría comprender una brida que se extiende hacia abajo 538 soportada por una región doblada 536. Como se ilustra en la Figura 5, el borde remanente reforzado 514 se extiende desde la unión remanente 532 de manera tal que sigue la curvatura de la primera pared recurva 524. El extremo distal del borde remanente reforzado 514 se dobla hacia debajo de manera de formar una región doblada 536 y la brida que se extiende hacia abajo 538. La brida 538 se extiende distalmente desde el borde remanente reforzado 514 a través de la región doblada 536 y forma un primer ángulo 540 con el borde remanente reforzado 514. Dependiendo de la aplicación particular y del funcionamiento del aspa 316, la longitud de la brida 538 y el desplazamiento angular del primer ángulo 540 puede variar en magnitud sin alejarse del alcance de la presente invención.

La longitud de la brida 538 podría comprender una magnitud entre 0.125 (1/8) y 0.375 (3/8) pulgadas, y el desplazamiento angular del primer ángulo podría comprender una magnitud entre 80 y 100 grados. En una realización preferida, la brida 538 podría comprender una longitud de aproximadamente 0.25 (1/4) pulgadas, y el primer ángulo 540 podría comprender un desplazamiento angular de aproximadamente 90 grados. Adicionalmente, el aspa 316 incluyendo el borde remanente reforzado podría comprender aluminio extrudido, pero es de apreciar que el aspa 316 podría comprender varios materiales extrudidos conocidos generalmente sin alejarse del alcance de esta invención.

En un aspecto, el doblez estructural de la región doblada 536 incrementa la solidez del extremo distal del borde remanente reforzado 514 de manera tal que el doblez estructural mejora la rigidez, ofreciendo fuerzas de soporte en dos dimensiones relativamente paralelas y

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LO QUE SE REIVINDICA ES:

1. Un conjunto de ventilador para la circulación del aire en un edificio industrial, donde el conjunto de ventilador comprende:

un soporte adaptado para permitir el montaje del conjunto del ventilador al techo del edificio industrial;

un motor acoplado al soporte, el motor accionado por un eje giratorio para inducir la rotación del eje;

y un grupo de aspas con forma de ala con borde remanente unidas al eje giratorio, donde cada aspa es fabricada en un metal extrudido tal que la primera pared recurva es unida a la segunda pared recurva para formar una unión principal y una unión remanente, y donde la unión remanente se extiende para formar una tercera pared recurva con un borde remanente y siguiendo la curvatura de la primera pared recurva, cada aspa comprenderá además una brida doblada que se extiende distalmente desde el borde remanente de manera continua.

2. (Cancelada).

3. El conjunto de ventilador en la Alegación 1, donde la brida se extiende hacia abajo desde la superficie inferior de la tercera pared recurva

4. El conjunto de ventilador en la Alegación 1, donde la primera pared recurva es unida a la segunda pared recurva para formar una región interna hueca.

5. El conjunto de ventilador en la Alegación 1, donde la primera pared recurva es unida a la segunda pared recurva para formar una región interna sólida.

6. El conjunto de ventilador en la Alegación 1, donde cada aspa comprende una transversal ancha aproximadamente entre 5 pulgadas y 8 pulgadas.

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7. El conjunto de ventilador en la Alegación 1, donde cada aspa comprende una transversal alta entre aproximadamente 0.75 (3/4) pulgadas y 1.50 (3/2) pulgadas.

8. El conjunto de ventilador en la Alegación 1, donde cada aspa comprende una longitud entre aproximadamente 4 pies y 14 pies.

9. El conjunto de ventilador en la Alegación 1 donde la primera y segunda paredes recurvas comprenden un espesor de aproximadamente entre 0.0625 (1/16) pulgadas y 0.1875 (3/16) pulgadas.

10. El conjunto de ventilador en la Alegación 1, donde la tercera pared recurva comprende una forma cónica que decrece en espesor a lo largo de su longitud desde aproximadamente 0.1875 (3/16) pulgadas en la unión remanente hasta aproximadamente 0.0625 (1/16) pulgadas en el borde remanente.

11. El conjunto de ventilador en la Alegación 1, donde la brida comprende una longitud de aproximadamente 0.125 (1/8) y 0.375 (3/8) pulgadas.

12. El conjunto de ventilador en la Alegación 1, donde el grupo de las aspas unidas a un modulo está conectado a un eje giratorio.

13. El conjunto de ventilador en la Alegación 1, donde el grupo de aspas incluye por lo menos diez aspas.

14. El conjunto de ventilador en la Alegación 1, donde cada grupo de aspas es fabricado usando la técnica de extrusión.

15. El conjunto de ventilador en la Alegación 14, donde el metal extrudido comprende el aluminio.

16. Una aspa de metal para un conjunto de ventilador usado en un edificio industrial, el aspa comprendiendo un perfil transversal extrudido con un grupo de paredes recurvas,

donde la primera pared recurva es unida a la segunda pared recurva para formar un ala con un borde remanente y la primera pared recurva se extiende para formar un borde remanente en donde la porción embridada del borde remanente se dobla para formar una brida que se extiende hacia fuera desde la dirección del borde remanente, en donde la porción embridada del borde remanente se extiende hacia abajo desde la superficie inferior del borde remanente tal que el desplazamiento angular de la porción embridada desde la superficie inferior del borde remanente forma una región reforzada que incrementa la rigidez estructural del borde remanente para que el borde remanente embridado resiste a los daños y donde la brida incrementa el volumen del flujo de aire resultante de la operación del conjunto de ventilador con las aspas.

17. Las aspas en la Alegación 16, donde la primera pared recurva se une a la segunda pared recurva para formar una región interior hueca.

18. Las aspas en la Alegación 16, donde la primera pared recurva se une a la segunda pared recurva para formar una región interna sólida.

19. Las aspas en la Alegación 16, donde el perfil transversal extrudido comprende un ancho transversal de aproximadamente 7 pulgadas.

20. Las aspas en la Alegación 16, donde el perfil transversal extrudido comprende una altura transversal de aproximadamente 1 pulgada.

21. Las aspas en la Alegación 16, donde el aspa comprende una longitud de por lo menos 4 pies.

22. Las aspas en la Alegación 16, donde las aspas comprenden una longitud de máximo 15 pies.

23. Las aspas en la Alegación 16, donde la primera y segunda paredes recurvas comprende un espesor de aproximadamente 0.15625 (5/32) pulgadas.

24. Las aspas en la Alegación 16, donde el borde remanente comprende una forma cónica que decrece en espesor a lo largo de su longitud.

25. Las aspas de la Alegación 16, donde la brida comprende una longitud entre aproximadamente 0.125 (1/8) y 0.375 (3/8) pulgadas.

26. Las aspas de la Alegación 16, donde el aspa es fabricada usando una boquilla de extrusión para formar el perfil transversal extrudido del aspa.

27. Las aspas de la Alegación 26, donde el aspa es formada usando la técnica de la extrusión del aluminio.

28. Un conjunto de ventilador para enfriar edificios industriales, donde el conjunto de ventilador comprende:

un conjunto de montaje con un modulo giratorio que une el conjunto del ventilador al techo del edificio industrial;

un grupo de aspas montadas en el módulo giratorio, donde cada grupo de aspas es de por lo menos 4 pies de largo y está fabricado en metal extrudido resultando en una primera sección en forma de ala y un borde remanente cónico, donde el borde remanente cónico se extiende desde una pared del aspa y en donde el borde remanente cónico se dobla en un extremo distal para formar una brida integralmente para reforzarlo y proveer un empuje hacia abajo adicional durante la rotación de las aspas.

29. El conjunto de ventilador de la Alegación 28, donde una primera pared recurva está unida a una segunda pared recurva para formar la sección en forma de ala con una región interna hueca.

30. (Cancelada).

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31. El conjunto de ventilador de la Alegación 28, donde el grupo de aspas se ha fabricado usando un proceso de extrusión.

32. El conjunto de ventilador de la Alegación 31, donde la brida refuerza el borde remanente cónico durante el proceso de fabricación por extrusión para que el borde remanente cónico resista las rasgaduras durante la fabricación.

33. El conjunto de ventilador de la Alegación 28, donde cada grupo de aspas comprende aluminio.

34. Un método de fabricación de las aspas comprende:
ablandar el metal;

forzar el metal por una boquilla de extrusión utilizando una prensa de extrusión tal que una aspa de metal enfriado es extrudida de la boquilla de extrusión para tener en transversal y de forma uniforme una primera sección en ala y un borde remanente cónico integralmente anexos en un extremo de la primera sección de ala y una brida de refuerzo que se extiende hacia afuera desde la dirección del borde remanente cónico durante la extrusión, para inhibir el rasgado del borde remanente cónico.

35. El método de la Alegación 34, donde el ablandamiento del metal comprende el ablandamiento del aluminio.

36. El método de la Alegación 34, donde el ablandamiento del metal comprende el ablandamiento de una aleación de aluminio con por lo menos una de cobre, manganeso, silicona, magnesio y zinc.

37. El método de la Alegación 34, donde el método además comprende la fabricación de un molde de extrusión para producir un aspa con una región interna hueca.

38. El método de la Alegación 34, donde el método además comprende la fabricación de un molde de extrusión para producir un aspa con una región interna sólida.

39. (Cancelada).

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40. El método de la Alegación 39, donde las aspas unidas son separadas para formar un grupo de aspas individuales.

41. El método de la Alegación 34, donde forzar el metal en el molde de extrusión produce por lo menos un aspa con una transversal uniforme.

42. El método de la Alegación 41, donde forzar el metal en el molde de extrusión produce por lo menos una aspa con una primera superficie y una segunda superficie que se combinan para formar una sección en forma de ala, la cual mejora las propiedades de columna del flujo de aire producido por al menos un aspa.

43. El método de la Alegación 42, donde forzar el metal en el molde de extrusión produce por lo menos una aspa con una primera superficie extendida que comprende por lo menos un borde remanente cónico y una brida reforzada, la cual resulta en un diseño de ala mejorado.

COLO 14823-841-001-0
ID-2

Hoja de reemplazo

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
ROBERT J. LAMBRECHTS
LATHROP & GAGE LC
2345 GRAND BOULEVARD
SUITE 2400
KANSAS CITY, MO 64108

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of Mailing (day/month/year) 29 SEP 2004	
Applicant's or agent's file reference 414706	REPLY DUE within 2 months/days from the above date of mailing
International application No. PCT/US04/00125	International filing date (day/month/year) 05 January 2004 (05.01.2004)
	Priority date (day/month/year) 06 January 2003 (06.01.2003)
International Patent Classification (IPC) or both national classification and IPC IPC(7): F01D 5/18; B63H 1/20; B64C 11/28; B21C 23/00 and US Cl.: 416/237, 228, 235, 236R, 210R, 23; 72/253.1, 256	
Applicant MECHANIZATION SYSTEMS COMPANY, INC.	

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
 - I ☒ Basis of the opinion
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2 (a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☒ Certain defects in the international application
 - VIII ☐ Certain observations on the international application
3. The applicant is hereby invited to reply to this opinion.

When? See the time limit indicated above. ~~The applicant may, before the expiration of that time limit, request this Authority to grant an extension. See rule 66.2(d).~~

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 26 October 2004 (26.04.2004)

Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1430 Alexandria, Virginia 22313-1430 Facsimile No. (703) 305-3230	Authorized officer <i>Sharon H. Greene for</i> Theresa Triou Telephone No. 703-308-0861
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Form PCT/IPEA/408 (cover sheet)(July 1998)

DOCKETED

By: MRS Date: 10/16/04

WRITTEN OPINION

International Application No.

PCT/US04/00125

I. Basis of the opinion

1. With regard to the elements of the international application:*

- ☒ the international application as originally filed
- ☒ the description:
 - pages 1-17 _____, as originally filed
 - pages NONE _____, filed with the demand
 - pages NONE _____, filed with the letter of _____
- ☒ the claims:
 - pages 18-22 _____, as originally filed
 - pages NONE _____, as amended (together with any statement) under Article 19
 - pages NONE _____, filed with the demand
 - pages NONE _____, filed with the letter of _____
- ☒ the drawings:
 - pages 1-6 _____, as originally filed
 - pages NONE _____, filed with the demand
 - pages NONE _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
 - pages NONE _____, as originally filed
 - pages NONE _____, filed with the demand
 - pages NONE _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item. These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

- ☒ the description, pages NONE _____
- ☒ the claims, Nos. NONE _____
- ☒ the drawings, sheets/fig NONE _____

5. ☐ This opinion has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed."

WRITTEN OPINION

International application No.
PCT/US04/00125

V. Reasoned statement under Rule 66.2(a)(II) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims <u>1-43</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>2,10,15,19,20,23,27,30 and 39-43</u>	YES
	Claims <u>1,3-9,11-14,16-18,21,22,24-26,28,29 and 31-38</u>	NO
Industrial Applicability (IA)	Claims <u>1-43</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Please See Continuation Sheet

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WRITTEN OPINION

International application No.

PCT/US04/00125

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

The drawings are objected to under PCT Rule 66.2(a)(III) as containing the following defect(s) in the form or content thereof: "the third curved wall is joined to a second curved wall to form a solid interior region" recited in claims 5, 18 and 38.

WRITTEN OPINION

International application No.
PCT/USD4/00125

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

TIME LIMIT:

The time limit set for response to a Written Opinion may not be extended. 37 CFR 1.484(d). Any response received after the expiration of the time limit set in the Written Opinion will not be considered in preparing the International Preliminary Examination Report.

V. 2. Citations and Explanations:

Claims 1, 3-5, 12, 16-18, 24, 28, 29, 34, 37 and 38 lack an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claims 1, 4, 12, 16, 17, 24, 28, 29, 34 and 37, as shown in Figs. 2-4, Mills disclose a fan assembly comprising: a fan blades (1) attached to the rotatable shaft wherein each fan blade is formed of an extruded metal such that a first curved wall (6) is joined to a second curved wall (7) to form a leading junction (8) and a trailing junction (9), and wherein the trailing junction (9) extends to form a third curved wall having a trailing edge (10); the first curved wall (6) being joined to a second curved wall (7) to form a hollow interior region (not numbered; however, clearly seen in Fig. 2); the trailing edges (11, 12) comprising a tapered shape that decreases in thickness across its length. However, Mills fails to disclose a flange distally extending from the trailing edge.

Regarding claims 1, 16, 28 and 34, as shown in Figs. 12A-12J, Perry teaches that it is conventional in the art to utilize a flange (37) distally extending from the trailing edge in a continuous manner such that the angular displacement of the flange (37) from the trailing edge forms a bent region. With regard claims 3, 5, 18 and 38, Perry further discloses the first curved wall (22) is joined to a second curved wall (23) to form a solid interior region. It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have utilized the flange extending from the trailing edge, as taught by Perry in the Mills apparatus, since the use of thereof would have improved the performance of the fan.

Claims 6-9, 21 and 22 lack an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claims 6-9, 21 and 22, the modified Mills discloses the invention as recited above; however, the modified Mills fails to disclose each fan blade comprising a cross sectional width between 5 inches and 8 inches; each fan blade comprising a cross sectional height between 0.75 inches and 1.5 inches; each fan blade comprising a length between 4 feet and 14 feet; the first curved wall and second curved wall comprising a thickness between 1/16 inches and 3/16 inches. It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have utilize of the cross sectional width, height, length of the fan blade and the thickness of the first and second curved walls, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

Claims 11 and 25 lack an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claims 11 and 25, the modified Mills discloses the invention as recited above; however, the modified Mills fails to disclose the flange comprising a length between 1/8 inches and 3/8 inches. It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have utilize of the range of the flange's length, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

the art.

Claim 13 lacks an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claim 13, the modified Mills discloses the invention as recited above; however, the modified Mills fails to disclose the plurality of fan blades including at least ten fan blades. It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have utilized ten fan blades, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art.

Claims 33, 35 and 36 lack an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claims 33, 35 and 36, the modified Mills discloses the invention as recited above; however, the modified Mills fails to disclose the material which makes up the fan blade. It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have utilized the fan blade being made of aluminum since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice.

Claims 14, 26, 31 and 32 lack an inventive step under PCT Article 33(3) as being obvious over Mills (Patent Number 2,450,440) in view of Perry et al. (Perry) (Patent Number 5,492,448).

Regarding claims 14, 26, 31 and 32, the modified Mills discloses the invention as recited above; however, the modified Mills fails to disclose the fan blades are fabricated using an extrusion technique. However, where a product by process claim is rejected over a prior art product that appears to be identical, although produced by a different process, the burden is upon the applicants to come forward with evidence establishing an obvious difference between the two.

Claim 2 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest an airfoil shape having a tapered trailing edge being bent to form the flange.

Claims 10, 15, 19, 20, 23, 27 and 30 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the thickness of the third curved wall; the extruded metal comprising aluminum; the extruded cross sectional profile comprising a cross-sectional width of 7 inches and cross-sectional height of 1 inch; the thickness of the first and second curved walls; the third curved wall being extended to form the tapered trailing edge wherein the tapered trailing edge being bent at a distal end to form the flange.

Claims 39-43 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the softened metal using an extrusion press to force the softened metal through the extrusion mold; the metal into the mold producing at least one fan blade with a uniform cross-section.

Claims 1-43 meet the criteria set out in PCT Article 33(4) because the subject matter claimed can be made or used in industry.

PATENT
Attorney Docket No.: 414708
Express Mail Label No.: EV413220261US

**PATENT COOPERATION TREATY
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY
UNITED STATES PATENT OFFICE**

Applicant: Mechanization Systems Company, Inc.
International Application No.: PCT/US04/00125
International Filing Date: 05 January 2004
Priority Date Claimed: 06 January 2003
Title of Invention: COOLING FAN WITH REINFORCED
BLADE

November 29, 2004

Mail Stop: PCT
Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO WRITTEN OPINION

Dear Madam:

In response to the Written Opinion mailed 29 September 2004, please amend the application as follows. This response to the Examiner's Written Opinion supplants the Applicant's correspondence dated September 15, 2004, which responds to the Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority.

IN THE SPECIFICATION

Please amend following paragraph in the specification with the following paragraph. A replacement sheet is attached.

Page 10, paragraph starting with line 1 and ending on Page 10, line 10:

In addition, the two surfaces 506, 510 meet at a leading edge 512. The hollow interior region 522, which may also be referred to as a cavity

region, may comprise a rectangularly-shaped central section 500. A planar third surface 516 may be formed at the interior wall 524 in the region of section 500, and a planar fourth surface 520 may be formed at the interior of wall 530 in the region of section 500. In one aspect, the planar interior surfaces 516, 520 may be substantially parallel to each other. It should be appreciated that the fan blade 316 may comprise a solid interior region without departing from the scope of the present invention as is seen in FIG 5A. It should also be appreciated that the cross-sectional dimensions of the fan blade 316 including the reinforced trailing edge 514 will be described in greater detail herein below with reference to Figure 7B.

IN THE CLAIMS

Currently, Claims 1-43 are now pending. Please cancel Claims 2, 19, 30, and 39 without prejudice. New claims 44-49 are being added in the current amendment. Claims 1, 16, 28, and 34 are being amended as follows:

1. (Currently Amended) A fan assembly for circulating air in an industrial building, the fan assembly comprising:
 - a support adapted to allow the mounting of the fan assembly to the roof of the industrial building;
 - a motor coupled to the support, the motor engaged with a rotatable shaft so as to induce rotation of the shaft; and
 - a plurality of airfoil shaped fan blades attached to the rotatable shaft, wherein each fan blade is formed of an extruded material such that a first curved wall is joined to a second curved wall to form a leading junction and a trailing junction, and wherein the trailing junction extends to form a third curved wall having a trailing edge, each blade further comprising a bent flange that distally extends from the trailing edge in a continuous manner ~~such that the angular displacement of the flange from the trailing edge forms a bent region that reinforces the trailing edge.~~

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2. (Cancelled)

16. (Currently Amended) A metal fan blade for a fan assembly used in an industrial building, the fan blade comprising an extruded cross-sectional profile with a cross-sectional width of approximately 7 inches and having a plurality of curved walls, wherein a first curved wall is joined to a second curved wall to form an airfoil shape having a trailing edge that includes a flange extending outward from the direction of the trailing edge, wherein the flanged portion of the trailing edge downwardly extends from the lower surface of the trailing edge such that the angular displacement of the flanged portion from the lower surface of the trailing edge forms a reinforced region that increases the structural rigidity of the trailing edge so that the flanged trailing edge resists damage, and wherein the flange increases the volume of airflow resulting from the operation of the fan assembly having the fan blade.

19. (Cancelled).

28. (Currently Amended) A fan assembly for cooling industrial buildings, the fan assembly comprising:
a mounting assembly having a rotatable hub that attaches the fan assembly to the ceiling of the industrial building;
a plurality of fan blades mounted to the rotatable hub, wherein each of the plurality of fan blades is at least 4 feet long and is formed of an extruded metal so as to have a first air foil section and a tapered trailing edge, wherein the tapered trailing edge extends from a wall of the fan blade and wherein the tapered trailing edge is bent at a distal end to form a flange ~~a flange is integrally formed at the end of the tapered trailing edge so as to reinforce~~ the tapered trailing edge and so as to provide increased downward thrust during rotation of the fan blades.

30. (Cancelled)

34. (Currently Amended) A method of forming a fan blade comprising:

softening a metal;

forcing the metal into an extrusion ~~mold-die~~ using an extrusion press

such that a cooled metal fan blade is extruded out of the extrusion ~~mold-die~~ so as to have in cross-section a first air foil section and a tapered trailing edge integrally attached to an end of the first air foil section and a reinforcing flange that extends outward from the direction of the tapered trailing edge so as to reinforce the tapered trailing edge during extrusion to inhibit tearing of the tapered trailing edge.

39. (Cancelled)

44. (New) A fan assembly for circulating air in an industrial building, the fan assembly comprising:

a support adapted to allow the mounting of the fan assembly to the roof of the industrial building;

a motor coupled to the support, the motor engaged with a rotatable shaft so as to induce rotation of the shaft; and

a plurality of fan blades attached to the rotatable shaft, wherein each fan blade is formed of an extruded metal such that a first curved wall is joined to a second curved wall to form a leading junction and a trailing junction, and wherein the trailing junction extends to form a third curved wall having a tapered shape that decreases in thickness across its length from approximately 0.1875 (3/16) inches at the trailing junction to approximately 0.0625 (1/16) inches at a trailing edge, each blade further comprising a flange that distally extends from the trailing edge in a continuous manner such that the angular displacement of the

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flange from the trailing edge forms a bent region that reinforces the trailing edge.

45. (New) A metal fan blade for a fan assembly used in an industrial building, the fan blade comprising an extruded cross-sectional profile having a plurality of curved walls, wherein a first curved wall comprising a thickness of approximately 0.15625 (5/32) inches is joined to a second curved wall comprising a thickness of approximately 0.15625 (5/32) inches to form an airfoil shape having a trailing edge that includes a flange extending outward from the direction of the trailing edge, wherein the flanged portion of the trailing edge downwardly extends from the lower surface of the trailing edge such that the angular displacement of the flanged portion from the lower surface of the trailing edge forms a reinforced region that increases the structural rigidity of the trailing edge so that the flanged trailing edge resists damage, and wherein the flange increases the volume of airflow resulting from the operation of the fan assembly having the fan blade.

46. (New) The fan blade of Claim 45, wherein the trailing edge comprises a tapered shape that decreases in thickness across its length.

47. (New) The fan blade of Claim 45, wherein the flange comprises a length between approximately 0.125 (1/8) and 0.375 (3/8) inches.

48. (New) The fan blade of Claim 45, wherein the fan blade is fabricated using an extrusion die to form the extruded cross-sectional profile of the fan blade.

49. (New): The fan blade of Claim 45, wherein the fan blade is formed using an aluminum extrusion technique.

REMARKS

In her written opinion, the Examiner noted that the drawings are objected to under PCT Rule 66.2(a)(iii) as containing defects in the form or

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content thereof. An additional drawing FIG. 5A has been included to detail a solid interior region. This additional drawing FIG. 5A adds no new matter as page 10, lines 6-8 provide for a solid interior region.

In her written opinion, the Examiner rejected claims 1, 3-9, 11-14, 16-18, 21, 22, 24-26, 28, 29 and 31-38 as lacking inventive step under PCT article 33(3) as being obvious over US-2,450,440 (hereinafter "Mills") in view of US-5,492,448 (hereinafter "Perry"). Claims 1, 16, 28 and 34 have been replaced by amended claims bearing the same numbers. Claims 2, 19, 30 and 39 have been cancelled and all other claims remain unchanged. Claims 44-49 are newly added.

Applicant has amended independent claims 1, 16, 28 and 34 by incorporating the inventive step limitations of dependent claims 2, 19, 30 and 39 into the respective independent claims pursuant to the suggestion of the Examiner that those dependent claims provide an inventive step. The specific amendments made by Applicant are more fully described in the following paragraphs.

Applicant has incorporated the limitations of dependent claim 2 into independent claim 1 as the Examiner in her written opinion has provided that claim 2 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest an airfoil shape having a tapered edge being bent to form the flange. Applicant requests that claim 2 be deleted from the claim set. Applicant respectfully urges that Claim 1 now possesses inventive step over Mills in view of Perry.

Applicant has incorporated the limitations of dependent claim 19 into independent claim 16 as the Examiner in her written opinion has provided that claim 19 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest an extruded cross sectional profile comprising a cross-sectional width of approximately 7 inches. Applicant requests that claim 19 be deleted from the claim set. Applicant respectfully urges that Claim 16 now possesses inventive step over Mills in view of Perry.

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Applicant has incorporated the limitations of dependent claim 30 into independent claim 28 as the Examiner in her written opinion provided that claim 30 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a wall extended to form a tapered trailing edge, and wherein the tapered trailing edge is bent at a distal end to form the flange. Applicant requests that claim 30 be deleted from the claim set. Applicant respectfully urges that Claim 28 now possesses inventive step over Mills in view of Perry.

Applicant has incorporated the limitations of dependent claim 39 into independent claim 34 as the Examiner in her written opinion has provided that claim 39 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the use of an extrusion press to force the softened metal through the extrusion die producing at least one fan blade with a uniform cross section. Applicant requests that claim 39 be deleted from the claim set. Applicant respectfully urges that Claim 34 now possesses inventive step over Mills in view of Perry.

Reconsideration and a favorable International Preliminary Examination Report are requested in view of the foregoing amendments.

Respectfully submitted,
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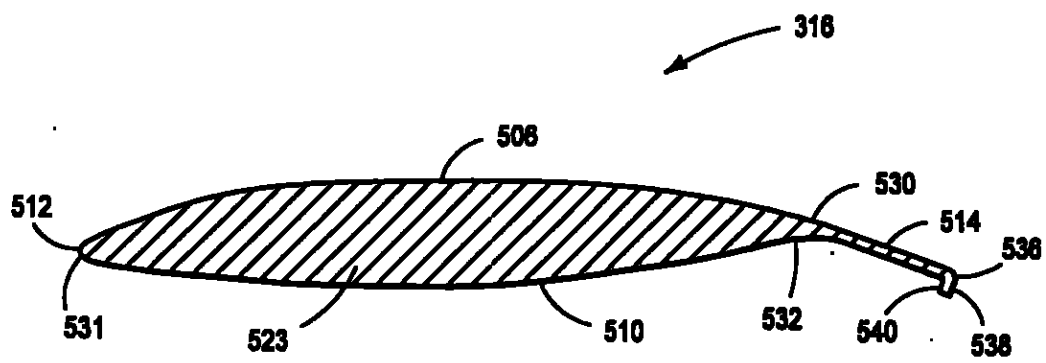


FIG. 5A

In addition, the two surfaces 506, 510 meet at a leading edge 512. The hollow interior region 522, which may also be referred to as a cavity region, may comprise a rectangularly-shaped central section 500. A planar third surface 516 may be formed at the interior wall 524 in the region of section 500, and a planar fourth surface 520 may be formed
5 at the interior of wall 530 in the region of section 500. In one aspect, the planar interior surfaces 516, 520 may be substantially parallel to each other. It should be appreciated that the fan blade 316 may comprise a solid interior region without departing from the scope of the present invention as is seen in FIG 5A. It should also be appreciated that the cross-sectional dimensions of the fan blade 316 including the reinforced trailing edge 514 will be described
10 in greater detail herein below with reference to Figure 7B.

Moreover, the reinforced trailing edge 514 may comprise a downwardly extending flange 58 supported by a bent region 536. As illustrated in Figure 5, the reinforced trailing edge 514 extends from the trailing junction 532 in a manner so as to follow the curvature of the first curved wall 524. The distal end of reinforced trailing edge 514 bends downward in a
15 manner so as to form the bent region 536 and the downwardly extending flange 538. The flange 538 distally extends from the reinforced trailing edge 514 via the bent region 536 and forms a first angle 540 with the reinforced trailing edge 514. Depending on the particular application and operation of the fan blade 316, the length of the flange 538 and the angular displacement of the first angle 540 may vary in magnitude without departing from the scope
20 of the present invention.

The length of the flange 538 may comprise a magnitude between 0.125 (1/8) and 0.375 (3/8) inches, and the angular displacement of the first angle may comprise a magnitude between 80 and 100 degrees. In a preferred embodiment, the flange 538 may comprise a length of approximately 0.25 (1/4) inches, and the first angle 540 may comprise an angular
25 displacement of approximately 90 degrees. In addition, the fan blade 316 including the reinforced trailing edge may comprise extruded aluminum, but it should be appreciated that the fan blade 316 may comprise various generally known extruded materials without departing from the scope of the present invention.

In one aspect, the structural bend of the bent region 536 increases the strength of the
30 distal end of the reinforced trailing edge 514 in a manner such that the structural bend improves rigidity by providing supporting forces in two dimensions relatively parallel and

WHAT IS CLAIMED IS:

1. A fan assembly for circulating air in an industrial building, the fan assembly comprising:

5 a support adapted to allow the mounting of the fan assembly to the roof of the industrial building;

a motor coupled to the support, the motor engaged with a rotatable shaft so as to induce rotation of the shaft; and

10 a plurality of airfoil shaped fan blades attached to the rotatable shaft, wherein each fan blade is formed of an extruded material such that a first curved wall is joined to a second curved wall to form a leading junction and a trailing junction, and wherein the trailing junction extends to form a third curved wall having a trailing edge, each blade further comprising a bent flange that distally extends from the trailing edge in a continuous manner that reinforces the trailing edge.

15 2. (Cancelled)

3. The fan assembly of Claim 1, wherein the flange downwardly extends from the lower surface of the third wall.

4. The fan assembly of Claim 1, wherein the first curved wall is joined to a second curved wall to form a hollow interior region.

20 5. The fan assembly of Claim 1, wherein the first curved wall is joined to a second curved wall to form a solid interior region.

6. The fan assembly of claim 1, wherein each fan blade comprises a cross-sectional width between approximately 5 inches and 8 inches.

25 7. The fan assembly of Claim 1, wherein each fan blade comprises a cross-sectional height between approximately 0.75 (3/4) inches and 1.50 (3/2) inches.

8. The fan assembly of Claim 1, wherein each fan blade comprises a length between approximately 4 feet and 15 feet.

9. The fan assembly of Claim 1, wherein the first and second curved walls comprise a thickness between approximately 0.0625 (1/16) inches and 0.1875 (3/16) inches.

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10. The fan assembly of Claim 1, wherein the third curved wall comprises a tapered shape that decreases in thickness across its length from approximately 0.1875 (3/16) inches at the trailing junction to approximately 0.0625 (1/16) inches at the trailing edge.
- 5 11. The fan assembly of Claim 1, wherein the flange comprises a length between approximately 0.125 (1/8) and 0.375 (3/8) inches.
12. The fan assembly of Claim 1, wherein the plurality of fan blades are attached to a hub, which is connected to a rotatable shaft.
13. The fan assembly of Claim 1, wherein the plurality of fan blades includes at
10 least ten fan blades.
14. The fan assembly of Claim 1, wherein each of the plurality of fan blades are fabricated using an extrusion technique.
15. The fan assembly of Claim 14, wherein the extruded metal comprises aluminum.
- 15 16. A metal fan blade for a fan assembly used in an industrial building, the fan blade comprising an extruded cross-sectional profile with a cross-sectional width of approximately 7 inches and having a plurality of curved walls, wherein a first curved wall is joined to a second curved wall to form an airfoil shape and the first curved wall is extended to form a tapered trailing edge wherein the distal end of the tapered trailing edge is bent to form
20 a flange extending outward from the direction of the trailing edge, wherein the flanged portion of the trailing edge downwardly extends from the lower surface of the trailing edge such that the angular displacement of the flanged portion from the lower surface of the trailing edge forms a reinforced region that increases the structural rigidity of the trailing edge so that the flanged trailing edge resists damage, and wherein the flange increases the volume
25 of airflow resulting from the operation of the fan assembly having the fan blade.
17. The fan blade of Claim 16, wherein the first curved wall is joined to a second curved wall to form a hollow interior region.
18. The fan blade of Claim 16, wherein the first curved wall is joined to a second curved wall to form a solid interior region.

19. (Cancelled)

20. The fan blade of claim 16, wherein the extruded cross-sectional profiles comprises a cross-sectional height of approximately 1 inches.

5 21. The fan blade of claim 16, wherein the fan blade comprises a length of at least 4 feet.

22. The fan blade of claim 16, wherein the fan blade comprises a length of at least less than 15 feet.

10 23. The fan blade of claim 16, wherein the first and second curved walls comprise a thickness of approximately 0.15625 (5/32) inches.

24. The fan blade of claim 16, wherein the trailing edge comprises a tapered shape that decreases in thickness across its length.

25. The fan blade of claim 16, wherein the flange comprises a length between approximately 0.125 (1/8) and 0.375 (3/8) inches.

15 26. The fan blade of claim 16, wherein the fan blade is fabricated using an extrusion die to form the extruded cross-sectional profile of the fan blade.

27. The fan blade of claim 16, wherein the fan blade is formed using an aluminum extrusion technique.

20 28. A fan assembly for cooling industrial buildings, the fan assembly comprising:
a mounting assembly having a rotatable hub that attaches the fan assembly to the ceiling of the industrial building;

25 a plurality of fan blades mounted to the rotatable hub, wherein each of the plurality of fan blades is at least 4 feet long and is formed of an extruded metal so as to have a first air foil section and a tapered trailing edge, wherein the tapered trailing edge extends from a wall of the fan blade and wherein the tapered trailing edge is bent at a distal end to integrally form a flange to reinforce the tapered trailing edge and so as to provide increased downward thrust during rotation of the fan blades.

29. The fan assembly of Claim 28, wherein a first curved wall is joined to a second curved wall to form the first air foil section having a hollow interior region.

30. (Cancelled)

5 31. The fan assembly of Claim 28, wherein the plurality of fan blades are formed using an extrusion fabrication process.

32. The fan assembly of Claim 28, wherein the flange reinforces the tapered trailing edge during the extrusion fabrication process so that the tapered trailing edge resists tearing while being formed.

10 33. The fan assembly of Claim 28, wherein each of the plurality of fan blades comprises aluminum.

34. A method of forming a fan blade comprising:
softening a metal;
forcing the metal into an extrusion die using an extrusion die using an extrusion press
such that a cooled metal fan blade is extruded out of the extrusion die so as to
15 have in uniform cross-section a first air foil section and a tapered trailing
edge integrally attached to an end of the first air foil section and a reinforcing
flange that extends outward from the direction of the tapered trailing edge so
as to reinforce the tapered trailing edge during extrusion to inhibit tearing of
the tapered trailing edge.

20 35. The method of Claim 34, wherein softening the metal comprises softening aluminum.

36. The method of Claim 34, wherein softening the metal comprises softening an alloyed aluminum with at least one of copper, manganese, silicon, magnesium and zinc.

25 37. The method of Claim 34, wherein the method further comprises forming an extrusion mold to produce the fan blade with a hollow interior region.

38. The method of Claim 34, wherein the method further comprises forming an extrusion mold to produce the fan blade with a solid interior region.

39. (Cancelled)

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44. A fan assembly for circulating air in an industrial building, the fan assembly comprising:

- a support adapted to allow the mounting of the fan assembly to the roof of the industrial building;
- 5 a motor coupled to the support, the motor engaged with a rotatable shaft so as to induce rotation of the shaft; and
- a plurality of fan blades attached to the rotatable shaft, wherein each fan blade is formed of an extruded metal such that a first curved wall is joined to a second curved wall to form a leading junction and a trailing junction, and wherein
10 the trailing junction extends to form a third curved wall having a tapered shape that decreases in thickness across its length from approximately 0.1875 (3/16) inches at the trailing junction to approximately 0.0625 (1/16) inches at a trailing edge, each blade further comprising a flange that distally extends from the trailing edge in a continuous manner such that the angular
15 displacement of the flange from the trailing edge forms a bent region that reinforces the trailing edge.

45. A metal fan blade for a fan assembly used in an industrial building, the fan blade comprising an extruded cross-sectional profile having a plurality of curved walls; wherein a first curved wall comprising a thickness of approximately 0.15625 (5/32) inches is
20 joined to a second curved wall comprising a thickness of approximately 0.15625 (5/32) inches to form an airfoil shape having a trailing edge that includes a flange extending outward from the direction of the trailing edge, wherein the flanged portion of the trailing edge downwardly extends from the lower surface of the trailing edge such that the angular displacement of the flanged portion from the lower surface of the trailing edge forms a reinforced region that
25 increases the structural rigidity of the trailing edge so that the flanged trailing edge resists damage, and wherein the flange increases the volume of airflow resulting from the operation of the fan assembly having the fan blade.

46. The fan blade of Claim 45, wherein the trailing edge comprises a tapered shape that decreases in thickness across its length.

- 30 47. The fan blade of Claim 45, wherein the flange comprises a length between approximately 0.125 (1/8) and 0.375 (3/8) inches.

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48. The fan blade of Claim 45, wherein the fan blade is fabricated using an extrusion die to form the extruded cross-sectional profile of the fan blade.

49. The fan blade of Claim 45, wherein the fan blade is formed using an aluminum extrusion technique.

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LO QUE SE ALEGA ES:

1. Un conjunto de ventilador para la circulación del aire en un edificio industrial, donde el conjunto de ventilador comprende:

un soporte adaptado para permitir el montaje del conjunto del ventilador al techo del edificio industrial;

un motor acoplado al soporte, el motor accionado por un eje giratorio para inducir la rotación del eje;

y un grupo de aspas en forma de ala unidas al eje giratorio, donde cada aspa es fabricada en un metal extrudido tal que la primera pared recurva es unida a la segunda pared recurva para formar una unión principal y una unión remanente, y donde la unión remanente se extiende para formar una tercera pared recurva con un borde remanente y siguiendo la curvatura de la primera pared recurva, cada aspa comprenderá además una brida doblada que se extiende distalmente desde el borde remanente de manera continua.

2. (Cancelada).

3. El conjunto de ventilador en la Alegación 1, donde la brida se extiende hacia abajo desde la superficie inferior de la tercera pared recurva

4. El conjunto de ventilador en la Alegación 1, donde la primera pared recurva es unida a la segunda pared recurva para formar una región interna hueca.

5. El conjunto de ventilador en la Alegación 1, donde la primera pared recurva es unida a la segunda pared recurva para formar una región interna sólida.

6. El conjunto de ventilador en la Alegación 1, donde cada aspa comprende una transversal ancha aproximadamente entre 5 pulgadas y 8 pulgadas.

7. El conjunto de ventilador en la Alegación 1, donde cada aspa comprende una transversal alta entre aproximadamente 0.75 (3/4) pulgadas y 1.50 (3/2) pulgadas.

8. El conjunto de ventilador en la Alegación 1, donde cada aspa comprende una longitud entre aproximadamente 4 pies y 14 pies.

9. El conjunto de ventilador en la Alegación 1 donde la primera y segunda paredes recurvas comprenden un espesor de aproximadamente entre 0.0625 (1/16) pulgadas y 0.1875 (3/16) pulgadas.

10. El conjunto de ventilador en la Alegación 1, donde la tercera pared recurva comprende una forma cónica que decrece en

espesor a lo largo de su longitud desde aproximadamente 0.1875 (3/16) pulgadas en la unión remanente hasta aproximadamente 0.0625 (1/16) pulgadas en el borde remanente.

11. El conjunto de ventilador en la Alegación 1, donde la brida comprende una longitud de aproximadamente 0.125 (1/8) y 0.375 (3/8) pulgadas.

12. El conjunto de ventilador en la Alegación 1, donde el grupo de las aspas unidas a un modulo está conectado a un eje giratorio.

13. El conjunto de ventilador en la Alegación 1, donde el grupo de aspas incluye por lo menos diez aspas.

14. El conjunto de ventilador en la Alegación 1, donde cada grupo de aspas es fabricado usando la técnica de extrusión.

15. El conjunto de ventilador en la Alegación 14, donde el metal extrudido comprende el aluminio.

16. Una aspa de metal para un conjunto de ventilador usado en un edificio industrial, el aspa comprendiendo un perfil transversal extrudido con un ancho transversal de aproximadamente 7 pulgadas y con un grupo de paredes recurvas, donde la primera pared recurva es unida a la segunda pared recurva para formar un ala con un borde remanente que incluye una brida que se extiende hacia afuera desde la dirección del borde remanente, donde la porción embridada del borde remanente se extiende hacia abajo desde la superficie inferior del borde remanente tal que el desplazamiento angular de la porción embridada desde la superficie inferior del borde remanente forma una región reforzada que incrementa la rigidez estructural del borde remanente para que el borde remanente embridado resiste a los daños y donde la brida incrementa el volumen del flujo de aire resultante de la operación del conjunto de ventilador con las aspas.

17. Las aspas en la Alegación 16, donde la primera pared recurva se une a la segunda pared recurva para formar una región interior hueca.

18. Las aspas en la Alegación 16, donde la primera pared recurva se une a la segunda pared recurva para formar una región interna sólida.

19. (Cancelada).

20. Las aspas en la Alegación 16, donde el perfil transversal extrudido comprende una altura transversal de aproximadamente 1 pulgada.

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21. Las aspas en la Alegación 16, donde el aspa comprende una longitud de por lo menos 4 pies.

22. Las aspas en la Alegación 16, donde las aspas comprenden una longitud de máximo 15 pies.

23. Las aspas en la Alegación 16, donde la primera y segunda paredes recurvas comprende un espesor de aproximadamente 0.15625 (5/32) pulgadas.

24. Las aspas en la Alegación 16, donde el borde remanente comprende una forma cónica que decrece en espesor a lo largo de su longitud.

25. Las aspas de la Alegación 16, donde la brida comprende una longitud entre aproximadamente 0.125 (1/8) y 0.375 (3/8) pulgadas.

26. Las aspas de la Alegación 16, donde el aspa es fabricada usando una boquilla de extrusión para formar el perfil transversal extrudido del aspa.

27. Las aspas de la Alegación 26, donde el aspa es formada usando la técnica de la extrusión del aluminio.

28. Un conjunto de ventilador para enfriar edificios industriales, donde el conjunto de ventilador comprende:

un conjunto de montaje con un modulo giratorio que une el conjunto del ventilador al techo del edificio industrial;

un grupo de aspas montadas en el modulo giratorio, donde cada grupo de aspas es de por lo menos 4 pies de largo y está fabricado en metal extrudido resultando en una primera sección en forma de ala y un borde remanente cónico, donde el borde remanente cónico se extiende desde una pared del aspa y en donde el borde remanente cónico es doblado en un extremo distal para formar una brida para reforzarlo y proveer un empuje hacia abajo adicional durante la rotación de las aspas.

29. El conjunto de ventilador de la Alegación 28, donde una primera pared recurva está unida a una segunda pared recurva para formar la sección en forma de ala con una región interna hueca.

30. (Cancelada).

31. El conjunto de ventilador de la Alegación 28, donde el grupo de aspas se ha fabricado usando un proceso de extrusión.

32. El conjunto de ventilador de la Alegación 31, donde la brida refuerza el borde remanente cónico durante el proceso de fabricación por extrusión para que el borde remanente cónico resista las rasgaduras durante la fabricación.

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33. El conjunto de ventilador de la Alegación 28, donde cada grupo de aspas comprende aluminio.

34. El método de fabricación de las aspas comprende:
ablandar el metal;

forzar el metal en un molde de extrusión tal que una aspa de metal enfriado es extrudida de una boquilla de extrusión usando una prensa de extrusión para tener en transversal un primera sección en ala y un borde remanente cónico integralmente anexos en un extreme de la primera sección de ala y una brida de refuerzo que se extiende hacia afuera desde la dirección del borde remanente cónico durante la extrusión, para inhibir el rasgado del borde remanente cónico.

35. El método de la Alegación 34, donde el ablandamiento del metal comprende el ablandamiento del aluminio.

36. El método de la Alegación 34, donde el ablandamiento del metal comprende el ablandamiento de una aleación de aluminio con por lo menos una de cobre, manganeso, silicona, magnesio y zinc.

37. El método de la Alegación 34, donde el método además comprende la fabricación de un molde de extrusión para producir un aspa con una región interna hueca.

38. El método de la Alegación 34, donde el método además comprende la fabricación de un molde de extrusión para producir un aspa con una región interna sólida.

39. (Cancelada).

40. El método de la Alegación 39, donde las aspas unidas son separadas para formar un grupo de aspas individuales.

41. El método de la Alegación 34, donde forzar el metal en el molde de extrusión produce por lo menos un aspa con una transversal uniforme.

42. El método de la Alegación 41, donde forzar el metal en el molde de extrusión produce por lo menos una aspa con una primera superficie y una segunda superficie que se combinan para formar una sección en forma de ala, la cual mejora las propiedades de columna del flujo de aire producido por al menos un aspa.

43. El método de la Alegación 42, donde forzar el metal en el molde de extrusión produce por lo menos una aspa con una primera superficie extendida que comprende por lo menos un borde remanente cónico y una brida reforzada, la cual resulta en un diseño de ala mejorado.

44. Un conjunto de ventilador para circular aire en un edificio industrial, donde el conjunto de ventilador comprende:

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un soporte adaptado para permitir el montaje del conjunto de ventilador al techo del edificio industrial;

un motor acoplado al soporte, donde el motor está enganchado con un eje rotacional de forma que induzca la rotación del eje; y

un grupo de aspas unidas al eje rotacional, donde cada aspa está fabricada en metal extrudido de forma que una primera pared recurva se une a una segunda pared recurva para formar una unión principal y una unión remanente, y en donde la unión remanente se extiende para formar una tercera pared recurva con forma remanente que disminuye su grosor a lo largo de su longitud desde aproximadamente 0,1875 (3/16) pulgadas en la unión remanente hasta aproximadamente 0,0625 (1/16) pulgadas en el borde remanente, y cada aspa además comprende una brida que se extiende desde el borde remanente en forma continua de forma tal que el desplazamiento angular de la brida desde el borde remanente forma una región doblada que refuerza el borde remanente.

45. Una aspa de metal para un conjunto de ventilador usado en un edificio industrial, el aspa comprendiendo un perfil transversal extrudido con un grupo de paredes recurvas, donde la primera pared recurva que comprende un grosor aproximado de 0,15625 (5/32) pulgadas es unida a la segunda pared recurva que comprende un grosor de aproximadamente 0,15625 (5/32) pulgadas para formar un ala con un borde remanente que incluye una brida que se extiende hacia afuera desde la dirección del borde remanente, donde la porción embridada del borde remanente se extiende hacia abajo desde la superficie inferior del borde remanente tal que el desplazamiento angular de la porción embridada desde la superficie inferior del borde remanente forma una región reforzada que incrementa la rigidez estructural del borde remanente para que el borde remanente embridado resiste a los daños y donde la brida incrementa el volumen del flujo de aire resultante de la operación del conjunto de ventilador con las aspas.

46. El aspa de metal de la alegación 45, en donde el borde remanente comprende una forma cónica que decrece en espesor a lo largo de su longitud.

47. Las aspas de la Alegación 45, donde la brida comprende una longitud entre aproximadamente 0.125 (1/8) y 0.375 (3/8) pulgadas.

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48. Las aspas de la Alegación 45, donde el aspa es fabricada usando una boquilla de extrusión para formar el perfil transversal extrudido del aspa.

49. Las aspas de la Alegación 45, donde el aspa es formada usando la técnica de la extrusión del aluminio.

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Item		No de unidades	
1	CD		
2	DVD		
3	REVISTA		
4	LIBRO		
5	PERIODICO		
6	DISQUETES		
7	SOBRE DE MANILA		
8	SOBRE BLANCO TAMAÑO CARTA	1	
9	SOBRE BLANCO TAMAÑO OFICIO		
10	OTROS:		
Observaciones: Sobre con figura dentro			

140
#10

SUPERINDUSTRIA Y COMERCIO
Radiacion : 05076607 00300000 Folios: 140
Fecha (AMB): 2005-08-03 17:20:23
Tramite : 011 PCT-PATENT 379 FASE NACI 411 PRESENTAC
Dependencia: 8820 DIVISION DE NUEVAS CREACIONES

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 000176089-2

RECIBO OFICIAL DE CAJA : 05 - 53,300
FECHA : JULIO 18 DE 2005

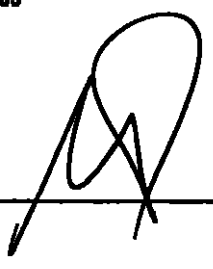
***** CONSIGNACION *****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
CAVELIER ABOGADOS	CONSIGNACION	BANCO POPULAR	050-00110-6	31589394	18/07/2005	53,445,000.00

***** CONCEPTO *****

CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	50005-01-01 SOLICITUDES	1 TRAMITES DE SOL. DE PATENTE DE IN	443,000.00
		TOTAL :	\$ 443,000.00

SOM: CUATROCIENTOS CUARENTA Y TRES MIL PESOS

RESPONSABLE : 

RECIBO DE CAJA APLICADO AL EXPEDIENTE No. _____

Oblo 14823- 841- 001-0

141

REQUISITOS NECESARIOS PARA PRESENTACION Y AGILIZACION DEL
TRAMITE

	USUARIO	RADICADOR
PATENTE DE INVENCION		()
Indicacion de que se solicita la concesion de una patente	()	
Datos de Identificación del solicitante o de la persona que presenta la solicitud	()	
Descripción de la invención.	()	()
Dibujos de ser estos pertinentes.	()	()
Comprobante de Pago de las tasas establecidas		
COMPLETA ()	INCOMPLETA ()	()
DISEÑO INDUSTRIAL ()		
- Indicación de que se solicita el registro de un Diseño Industrial	()	()
- Datos de Identificación del solicitante o de la persona que presenta la solicitud	()	()
- Representación gráfica o fotografía del Diseño Industrial o muestra del Material que incorpora el diseño	()	()
- Comprobante de pago de las tasas establecidas	()	()
COMPLETA ()	INCOMPLETA ()	()
ESQUEMA DE TRAZADO ()		
- Indicación de que solicita el registro de un Esquema de trazado	()	()
- Datos de Identificación del solicitante o de la persona que presenta la solicitud	()	()
- Representación grafica del esquema de trazado	()	()
- Comprobante de pago de las tasas establecidas	()	()
COMPLETA ()	INCOMPLETA ()	()

Firma Responsable

Agosto 3 / 05

Fecha

142

REPUBLICA DE COLOMBIA
SUPERINTENDENCIA DE INDUSTRIA Y C MERCI

Bogotá,
2020

Doctor(a)
FERRERO EMILIO

REFERENCIA	Radicación No.	5 76607
	Solicitud internacional	US2004/000125
	Fecha inicio fase nacional	08/08/2005
	Trámite	11
	Evento	379
	Actuación	430
	Oficio No.	8467

Como resultado del examen de forma, realizado con fundamento en el artículo 38 de la Decisión 486 de la Comisión de la Comunidad Andina, artículo 27 del Tratado de Cooperación en Materia de Patentes (PCT), regla 51 bis del Reglamento y Circular Única de la Superintendencia de Industria y Comercio, se le comunica que:

1. La solicitud no contiene la copia del documento en que consta la cesión del derecho a la patente del inventor al solicitante o a su causante. (Art. 26-k) Decisión 486.

2. La solicitud no contiene el poder debidamente otorgado, con el lleno de los requisitos exigidos por los artículos 63 y subsiguientes del Código de Procedimiento Civil. Adicionalmente, deberá presentar el documento que acredita la existencia y representación legal de la sociedad solicitante, cuando ésta fuere persona jurídica.

En cumplimiento de lo dispuesto por el artículo 39 de la Decisión 486, se le requiere para que dentro del término de dos meses siguientes a la fecha de notificación del presente oficio, complete los requisitos anteriormente enunciados. En caso de no dar cumplimiento al presente requerimiento, la solicitud se considerará abandonada y perderá su prelación.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Unica No.10 de 2001.

ALIX CARMENZA CESPEDES DE VERGEL
Jefe de la división de Nuevas Creaciones

El anterior requerimiento fue notificado por fijación en lista de fecha 16 SET. 2005
adpall