Feb. 28, 1967 N. LAING 3,306,526

FANS

Original Filed Nov. 26, 1963

FIG.1.

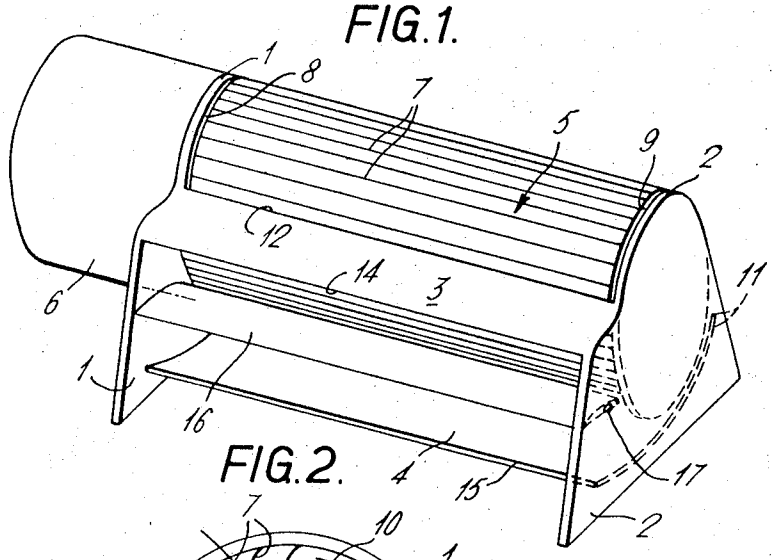


FIG.2.

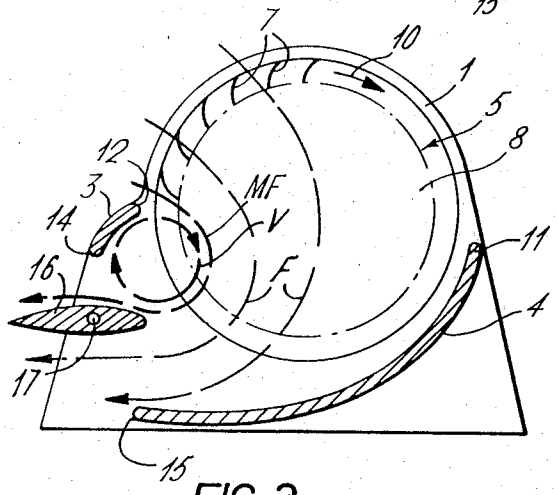


FIG.4.

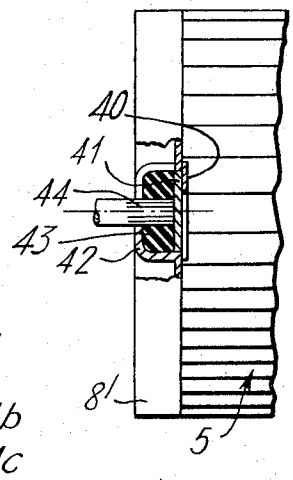
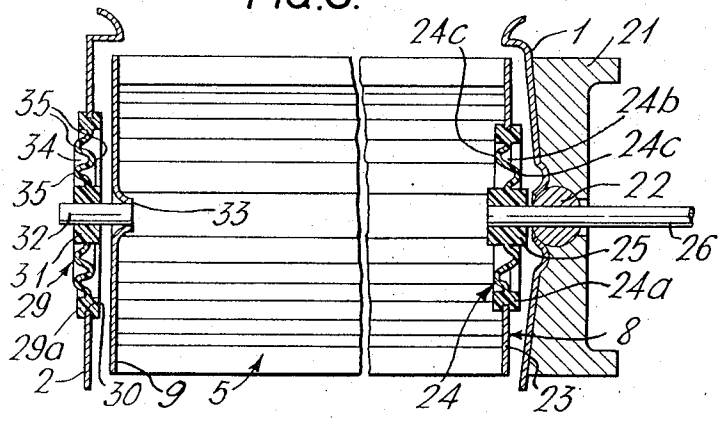


FIG.3.



INVENTOR
Nikolaus Laing
BY Dennis, Edmonds
Morton, Taylor & Adams
ATTORNEYS

United States Patent Office

3,306,526

Patented Feb. 28, 1967

3,306,526

FANS

Nikolaus Laing, Aldingen, near Stuttgart, Germany, assignor, by mesne assignments, to Laing Vortex, Inc., New York, N.Y.

Original application Nov. 26, 1963, Ser. No. 326,297, now Patent No. 3,258,195, dated June 28, 1966. Divided and this application Mar. 2, 1966, Ser. No. 531,081

Claims priority, application Germany, Mar. 11, 1960, L 35,582

1 Claim. (Cl. 230—125)

This invention relates to table fans, that is, small domestic fans which can be stood upon a table or the like horizontal surface and is a division of my U.S. application Serial No. 326,297 dated November 26, 1963, now Patent No. 3,258,195, itself a continuation-in-part of application Serial No. 95,393, filed March 13, 1961.

A main object of the invention is to provide a simple and convenient table fan of the cross flow type. A cross flow fan is herein understood to comprise a bladed cylindrical rotor mounted for rotation about its axis and guide means cooperating with the rotor on rotation thereof to induce a flow of air from an entry region through the path of the rotating blades of the rotor to the interior thereof and thence again through the path of the rotating blades to a discharged side of the rotor.

According to the invention the guide means comprises a pair of vertical end plates aligned substantially with the ends of the rotor and at least one guide wall extending between and interconnecting the end plates. The end plates and guide wall form a structural unit having feet to stand on the table or other horizontal surface; preferably the end plates themselves provide these feet. A motor is mounted on one end plate, and the rotor has one end supported and driven by the motor shaft and the other rotatably mounted on the other end plate. Two guide walls are preferred, both to rigidify the structural unit and to assist aerodynamically. In a preferred arrangement the guide walls leave the upper part of the rotor exposed and form an outlet duct opposite the lower part of the rotor at one side. No guards will normally be needed for the rotor, the mass and diameter of the rotor can be small, and a sufficient air flow is obtained at the usual speeds of shaded pole. A.C. motors, so that the inertia of the rotating parts is not sufficient to cause pain or injury to a person's finger should it accidentally come into contact with the rotor, nor will such contact damage the rotor.

Normally, though not invariably, it will be desired to have some means of varying the angle at which the air stream leaves the fan. According to the invention this may be provided by a vane pivoted to the end plates and extending parallel to the rotor axis between said guide walls, the vane being adjustable against friction to vary the direction of outflow from the discharge region.

One preferred embodiment of the invention and a modification thereof will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of one form of fan according to the invention;

FIGURE 2 is a transverse section of the FIGURE 1 fan;

FIGURE 3 is a longitudinal section of the fan showing certain constructional details, and

FIGURE 4 is a partial longitudinal section of a fan similar to that of FIGURES 1 to 3 but illustrating a different manner of mounting the driven end of the rotor.

Referring to FIGURES 1 and 2 of the drawings, the unit there illustrated comprises a pair of stout vertical end plates **1, 2** which are secured together rigidly by first and second guide walls **3, 4** which extend between them. A cylindrical bladed rotor **5** is mounted at either end for

rotation about a horizontal axis and a small electric motor (not shown) is provided to drive the rotor, this motor being enclosed in a housing **6** supported upon the end plate **1**. The rotor **5** has blades **7** extending parallel to the axis between end members **8, 9**: these blades are concave facing the direction of rotation, indicated by the arrow **10**, and have their outer edges leading their inner edges.

The guide walls **3, 4** and rotor present a constant cross-section as indicated in FIGURE 2 at all points along the rotor axis. The first wall **3** is narrow and as seen in cross-section converges with the rotor **5** in the direction of rotor rotation. The second wall **4** is wider than the wall **3** and extends opposite it from a line **11** diametrally opposite the line **12** of nearest approach of the wall **3** to the rotor: at the line **11** the wall **4** is separated from the rotor **5** by a distance which substantially exceeds a working clearance and which may be one-third to one-half the blade depth. From the line **11** the wall **4** diverges from the rotor with steady increase in radius of curvature. The guide walls **3, 4** leave the upper half of the rotor exposed and define with the end plates **1, 2** an outlet which lies at one side opposite the lower half of the rotor. The walls **3, 4** terminate in lines **14, 15** lying in a plane which is oblique to the direction of flow across that plane.

In operation of the fan unit as so far described a cylindrical vortex having a core shown by the flow lines V in FIGURE 2 is set up adjacent the first guide wall **3** and parallel and eccentric to the rotor axis. Air is guided through the rotor **5** as shown by the flow lines MF, F which are strongly curved about the vortex core and is discharged through the outlet defined by walls **3, 4** and end plates **1, 2**. By reason of the vortex, the flow tube adjacent the vortex core, designated MF, is of much greater velocity than the remainder of the flow, giving rise to a velocity profile in the outlet which has a pronounced peak. The design and operation of the rotor **5** and guide walls **3, 4** follows the principles enunciated in the U.S. application 221,621, now Patent No. 3,232,522.

At the outlet and midway between the walls **3, 4** a deflecting element or vane **16** having a uniform cross-section of streamline shape and extending over the length of the rotor **5**, is mounted for angular movement about an axis **17** parallel to the rotor axis and passing about through the centre of gravity of the element: the deflecting element is adjustable manually and is such as to remain in adjusted position on account of friction. It will readily be appreciated that the direction of outflow from the fan unit can be varied as desired by adjustment of the deflecting element **16**.

It will be seen that the end plates **1, 2** provide feet to enable the unit to be supported on a table or the like. End plates **1, 2** and guide walls **3, 4** form a rigid structural unit and can conveniently be made of sheet metal, as can also the rotor **5** and deflecting element **16**.

FIGURE 3 shows the manner in which the rotor **5** is mounted for rotation.

At the right hand side of the rotor **5** (as seen in FIGURE 3) the end plate **1** is rigid with a casting **21** mounting a self-aligning bearing in the form of a spherical bushing **22** capable of limited universal movement within the casting: the casting **21** and bushing **22** form part of the motor, which is not shown—for clarity the motor casing is also omitted. The rotor end member **8** is constructed as a flat metal ring **23** surrounding a flexible membrane **24**. The membrane **24** has at its outer periphery a circumferential grooved flange or connecting ring **24*a*** within which the inner periphery of the ring **23** engages, a central boss **25** which grips elastically over the motor drive spindle **26** mounted rotatably in the bushing **22**, and an intermediate annular area **24*b*** which

is flexible and is formed with annular corrugations 24c. This arrangement enables the rotor 5 to be driven by the spindle 26 without undue friction despite a limited degree of misalignment between their axes.

The non-driven end of the rotor 5 is supported on the end plate 2. Like the rotor end member 8 the end plate 2 is centrally apertured and surrounds a flexible membrane 29. Like the membrane 24, the membrane 29 has at its outer periphery a circumferential flange or connecting ring 29a which is formed with a radial groove 30 receiving the edge of the aperture in the end plate 2. The membrane 29 has a central boss 31 which carries a fixed stub-shaft 32 engaging a boss 33 formed in the sheet metal of the rotor end disc 9: alternatively the stub shaft could be fixed to the boss 33 and rotatable in the boss 31. Intermediate the central boss 31 and connecting ring 29a the membrane 29 presents an annular area 34 having annular corrugations 35. This arrangement enables the end plate 2 to support the rotor 5 despite imperfect alignment. Alternatively the non-driven end of the rotor 5 can be supported by the means similar to that shown at the right hand side of the figure.

The membranes 24, 29 are conveniently injection moulded of an elastic plastics material on to the end disc or end plate, as the case may be.

By reason of the flexible mounting of the rotor 5 there is no need to take the careful precautions that would otherwise be necessary to ensure proper alignment of the rotor and its supporting means. Thus the invention facilitates economic mass-production of the fan.

FIGURE 4 shows an alternative arrangement for the support through flexible means of the driven end of the rotor of a fan having the general construction illustrated in FIGURES 1 and 2. The rotor, which once again is designated 5, has an end member 8' stamped to provide inwardly joggled lugs 40 locating a disc 41 and outwardly joggled lugs 42 which hold a rubber bushing 43 captive against the washer and in a state of compression. The milled end 44 of a motor shaft is pressed into the bushing 43: the elasticity of the bushing, compressed between the rotor end member and the shaft, enables the shaft to drive the rotor despite minor misalignment between them.

I claim:

A table fan comprising a substantially unguarded bladed cylindrical rotor of a lightweight construction mounted for rotation about a longitudinal axis; guide means cooperating with the rotor on rotation thereof to induce a flow of air from an entry region through the path of the rotating blades of the rotor to a discharge side thereof, said guide means including a pair of vertical end plates, a first guide wall extending between and interconnecting the end plates which on rotation of the rotor forms and stabilizes a fluid vortex having a core which interpenetrates the path of the rotating blades of the rotor, a second guide wall extending between the end plates and having upstream and downstream ends and defining with said end plates and said first guide wall an outlet, portions of said end plates extending below said second guide wall to provide supporting feet adapted to support said fan on a supporting surface, and a portion of said second guide wall adjacent its downstream end having a vertical component of direction whereby said outlet extends in an upward direction and air passing through said outlet will be guided upwardly away from the supporting surface; an enclosed electric motor mounted on one end plate in alignment with the rotor; flexible mounting means for mounting one end of the rotor on the motor shaft for substantial universal movement with respect thereto; and flexible mounting means for mounting the opposite end of the rotor for substantially universal movement with respect to an end plate.

References Cited by the Examiner

UNITED STATES PATENTS

935,114	9/1909	Keith	230—117
2,482,519	9/1949	Schwary	230—117
2,822,674	2/1958	Simmons	230—125
2,942,773	6/1960	Eck	230—125

DONLEY J. STOCKING, *Primary Examiner.*

HENRY F. RADUAZO, *Examiner.*