

Dec. 2, 1969

D. B. PRICE

3,481,534

AIR DEFLECTING MEANS FOR FANS

Filed July 27, 1967

2 Sheets-Sheet 1

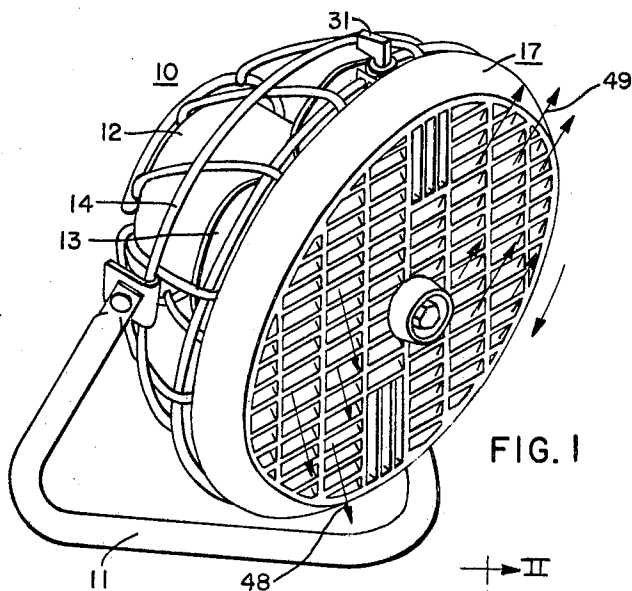


FIG. 1

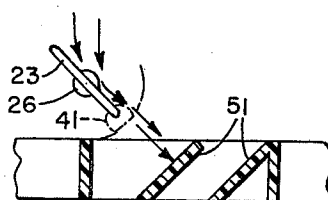


FIG. 4

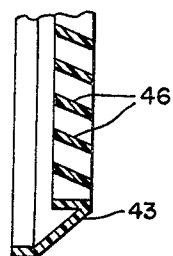


FIG. 5

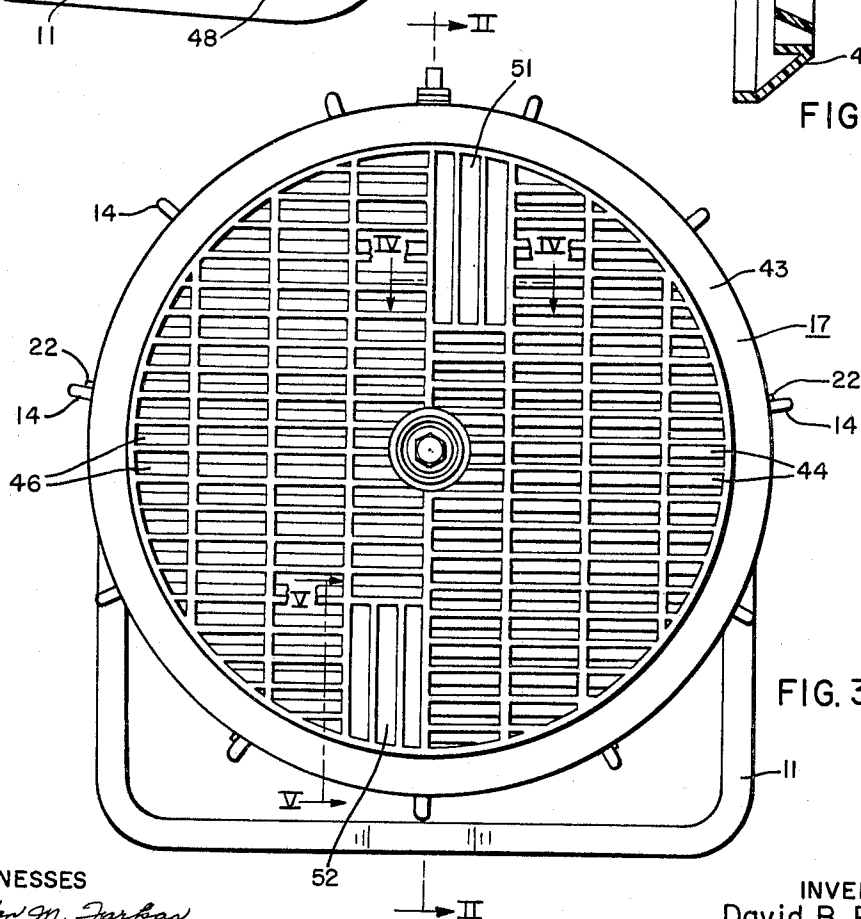


FIG. 3

WITNESSES

Helen M. Jarkas

James H. Young

INVENTOR
David B. Price

BY *W. T. French*
ATTORNEY

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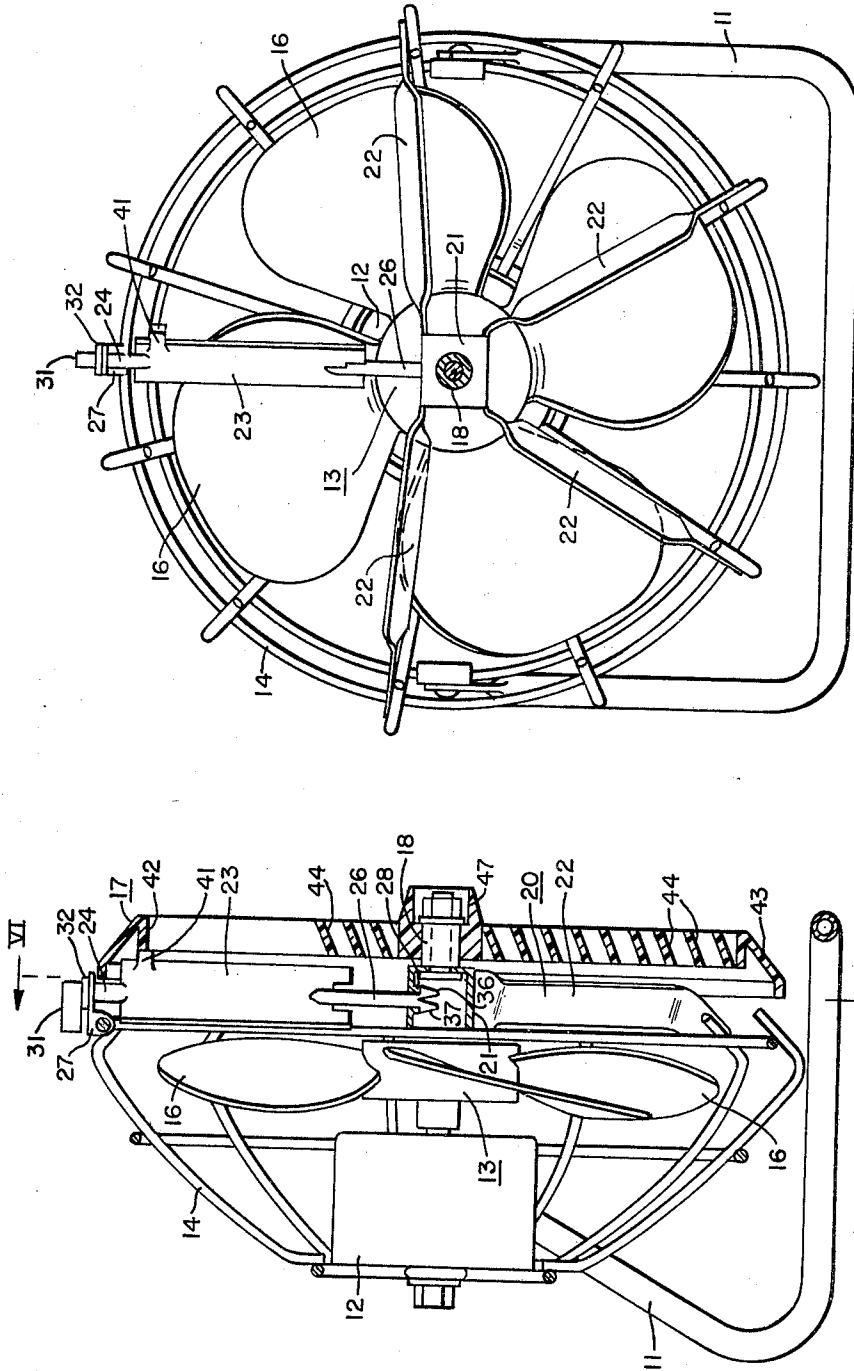


FIG. 6

FIG. 2

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3,481,534

AIR DEFLECTING MEANS FOR FANS

David B. Price, Mansfield, Ohio, assignor to Westinghouse Electric Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Filed July 27, 1967, Ser. No. 656,488

Int. Cl. F04d 29/54; F24f 13/08

U.S. Cl. 230—274

5 Claims

ABSTRACT OF THE DISCLOSURE

A rotating deflector for axial flow fans wherein the vanes of the deflector on one side of a diametrical line are inclined in the opposite direction to that of the vanes on the other side of that line. In addition, a set of radial vanes may be positioned downstream of the fan discharge area and upstream of the deflector and are so inclined that the air discharged by the fan enters the deflector in a direction generally axially of the fan and deflector.

BACKGROUND OF THE INVENTION

In the axial flow type of fan where the blades are inclined to the plane of rotation, the direction that the air particles take in moving away from a blade is dependent upon the pitch of the blade. Since the blades are inclined to the plane of rotation and therefore inclined to the axis of rotation, the particles of air leave the blade in a direction making an angle with the axis of rotation. This imparts a spiral of rotational effect to the particles of air in the air discharge stream. There is inherently in the air discharge stream a component of rotational force which can be utilized to rotate a deflector which may be positioned in front of the fan.

Such deflectors are utilized primarily to obtain lateral diffusion of air from a fan in a wide angle cone effecting creation of air currents through a major area of a room or other region.

In order to develop an enlarged particle pattern of air deflection to obtain wide distribution of the discharge from the fan, the louvers of a deflector must be so positioned as to deflect the air particles laterally of the axis of rotation of the fan. Since the discharge from a fan blade inclined to the axis of rotation makes an angle with the axis of rotation, it will be apparent that at one point in each revolution of the fan blade the particles of air discharged from the fan blade will be substantially parallel to the deflecting louvers. In a position of the fan blade relative to the deflecting louvers displaced 180° from the first position, the air particles will be moving at substantially right angles to the vanes of such an air deflector. This creates back pressure between the fan and these vanes, materially reducing the fan efficiency. In between these two positions there will be a sinusoidal variation in the relation between the angle of movement of the air path and the deflecting louvers.

It might be considered that the air particles discharged by a multi-bladed axial fan follow cork screw paths, with air from each blade moving in its individual path. If the louvers on the deflector are all arranged transversely, parallel and all inclined in one direction, there will be at one position of each of the blades per revolution of the fan relative to the deflector that the air particles discharged from the fan will be parallel to the deflecting louvers on one radius. The relative direction of the paths of the air with respect to the plane of the louvers will be progressively varied from 0 to 90° for a relative displacement of 180° between the fan blade and the deflector and then back again. Accordingly, when the direction of air is 90° to the effective louver, a substantial back pressure will

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be developed. If the deflector and the fan are rotating at the same speed the air particles leaving one side of any given diameter will be parallel while those on the other side will be at substantially 90° with respect to the deflector louvers.

While it is desirable that back pressure between the fan and the deflector be kept to a minimum, some back pressure must necessarily be developed as a result of providing some slippage between the fan and the deflector louvers in order to change the direction of air as it passes through the deflector louvers to increase the pattern of air flow beyond that which would be produced by the fan alone. This minimum back pressure situation or condition is obtained by providing the deflector louvers in an arrangement wherein they are inclined one way on one side of a diametrical line and are inclined the other way on the opposite side of that line. This is distinguished from the prior art arrangement where all louvers have been inclined in the same direction.

To the best of applicant's knowledge, prior deflectors for axial flow fans have either assumed a steady state of air environment or have recognized but ignored existing air currents.

Actually, air is seldom at rest and it is typical to find moving air currents resulting from such situations as an open window, moving objects or convection due to differences in air density. A fan blade, caused to rotate and move air, takes in air from its environment and delivers this air forward of the blade at an increased velocity. The direction that the air particles depart from the plane of the blade is dependent upon the blade pitch angle. Tests show that the environmental air conditions will cause additional changes in this angle. This is due at least in part to the fact that if the angle of incident of an air particle striking the blade surface changes due to the environmental changes in the air currents, the angle of deflection of the air from the blade also changes.

SUMMARY OF THE INVENTION

To minimize the effect of environmental air conditions which change frequently and more or less continuously, the present invention provides means disposed between the fan blades and the deflector for altering the air flow so that, regardless of the environmental air conditions, the air discharge from the fan will strike the deflector louvers at a substantially constant direction, preferably generally parallel to the axis of rotation of the fan and deflector. This means may take the form of a plurality of fixed radial vanes, although I prefer that one of these radial vanes be adjustable about its longitudinal axis to vary the rate of rotation of the deflector as hereinafter explained.

Another feature of the present invention lies in the opposed arrangement of deflector vanes or louvers, as previously mentioned earlier, wherein the vanes on one side of the diametrical line are slanted or angled in a direction reverse to that of the vanes or louvers on the other side of that diametrical line, thereby eliminating the major source of creation of back pressure which existed in prior art deflectors.

BRIEF DRAWING DESCRIPTION

FIGURE 1 is a perspective view of a fan with a rotating deflector utilizing the present invention;

FIG. 2 is a side elevation, partially in section, on the line II—II of FIG. 3;

FIG. 3 is a front elevational view of the device shown in FIG. 1;

FIG. 4 is a partial, sectional detailed view taken on the line IV—IV of FIG. 3 and looking in the direction indicated by the arrows;

FIG. 5 is a partial, sectional view, taken on the line V—V of FIG. 2, looking in the direction indicated by the arrows; and

FIG. 6 is a sectional view taken on the line VI—VI of FIG. 2, looking in the direction indicated by the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the embodiment herein illustrated, there is shown a desk fan 10 mounted on a stand 11 for tilting to various angles. A motor 12 drives a fan 13 and is suitably supported in a cage-type frame 14.

The fan 13 has a plurality of blades 16 which are conventionally curved so that, instead of the blades having a single plane as referred to in the discussion above, there is an infinite number of planes with the result that the paths of air leaving the blades will be more complex than that assumed in the above discussion. For the purpose of producing a wide distribution pattern of the air discharged from the fan a rotating deflector 17 is mounted for rotational movement about a spindle 18 supported in front of the fan 13, the axis of rotation of the deflector 17 coinciding with the axis of rotation of the fan 13. The spindle 18 of the deflector 17 is carried on a hub 21 of an air straightener 20 which includes a series of fixed vanes 22 and an adjustable vane 23.

The outer ends of the vanes 22 are secured to the wire frame 14 which surrounds the fan blades. The adjustable straightener vane 23 may be made of plastic and has an upper pintle 24 and a lower pintle 26. The upper pintle 24 is journaled in a bracket 27 carried by the frame 14 and the lower pintle 26 is journaled in a bearing 28 in the upper side of the hub 21. A manipulating handle 31 is secured to the upper end of the pintle 24 to facilitate changing the position of the adjustable vane 23.

It is desired that the vane 23 be held in any selected position for reasons which will be clear from later description. A suitable friction washer 32 is provided on the pintle 24, interposed between the lower side of the handle 31 and the bracket 28 to provide sufficient friction to maintain the vane 23 in any selected position. To hold the friction washer 32 under compression, the lower pintle 26 has a V-notch 36 and tapered ribs 37. The material of which the vanes 22 and 23 and the pintle are made is flexible so that the pintle 26 with its tapered external ribs 37 may be pushed through the bearing 28 to the point where the lower end of the pintle 26 springs back into a position where it locks the pintle 26 against upward movement and, in effect, produces a biasing effect on the friction washer.

If desired, the adjustable straightener vane 23 may be used as a brake for preventing the rotation of the deflector 17 or for adding frictional resistance to its rotation. In this connection, the vane 23 is provided with a boss 41 which, when the vane 23 is turned a sufficient amount, will frictionally engage an annular rim 42 on the inside of the deflector 17.

In accordance with the general discussion which preceded this description, the deflector 17 has an outer annular rim 43 integral with the transverse vanes 44 and 46. A hub 47 is integral with the vanes and is journaled on the spindle 18. Upon reference to FIGS. 1 and 2 it will be apparent that the vanes 44 on one side of the centerline of the deflector, as viewed in FIG. 3, are inclined upwardly while the vanes 46 on the opposite side of the centerline are inclined downwardly. This construction distinguishes from prior art devices of this type wherein the vanes on each side of the centerline were inclined in the same direction. As a result of the present opposed inclination of vanes at opposite sides of the centerline the back pressure present in prior devices of this type is eliminated or substantially reduced. When the fan 13 rotates in a counterclockwise direction as viewed in FIGS.

1 and 3, the air will be discharged through the front of the deflector and the air passing between the vanes 46 on the left side of the centerline will be deflected downwardly as indicated by the arrows 48 while the air passing between the vanes 44 on the right side of the centerline will be deflected upwardly as indicated by the arrows 49.

When the air from the fan 13 is discharged through the fan straightener vanes 22 and 23 the path of the air will be generally along the axis of the fan and therefore when the air strikes the vanes 44 and 46 a component of rotational force will be applied to the deflector 17 tending to cause it to rotate. However, the deflector vanes 44 and 46 are preferably not relied upon to cause rotation of the deflector. For purposes of rotating the deflector, special vanes 51 and 52 are provided to supply the necessary rotation-producing force. In this connection FIG. 4 shows how the adjustable vane 23 directs a portion of the air against the vanes 51 and 52 to provide the primary rotational force. By varying the preselected angle of the adjustable vane 23, the rotational force of the air against the vanes 51 and 52 may be varied, thereby varying the rotational speed of the deflector 17.

What I claim is:

1. In combination with an axial flow type fan, a rotatable air deflector having vanes for deflecting air discharged by the fan and means between said fan and said deflector for changing the direction of the air discharged by said fan toward a direction more nearly parallel to the axis of rotation of said fan, said deflector vanes including at least one vane against which air discharged by the fan acts to exert a component of force for rotating the deflector member.

2. Structure as specified in claim 1, wherein said deflector member has at least one vane disposed perpendicularly to the air deflecting vanes of the deflector member and against which air acts to develop a component of force for rotating said deflector member.

3. Structure as specified in claim 1, wherein said means comprises a plurality of straightening vanes extending substantially radially of said deflector, at least one of said straightening vanes being adjustable to deflect a portion of the air discharged by said fan in a direction transversely on the axis of rotation of said fan and deflector for the purpose of developing a rotational force on said deflector element.

4. In combination with an axial flow type fan, a rotatable air deflector member, said deflector member having a plurality of parallel air deflecting means on one side of a diameter of said member inclined in one direction and a second set of deflector vanes on the opposite side of said diameter of said deflector member inclined in the opposite direction.

5. Structure as specified in claim 4, wherein the air deflector member is mounted for rotational movement in the air discharge stream from said fan, and the inclination of both sets of deflector blades is such as to be substantially parallel to the direction of path of discharge of air from said fan along a diameter of said fan, the structure including a set of rotation-inducing vanes disposed perpendicularly to the respective sets of deflector vanes, said rotation-inducing vanes being adapted to produce rotation of said deflector member.

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LEONARD H. GERIN, Primary Examiner

U.S. Cl. X.R.