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ELECTRIC FAN

The present invention relates to an electric fan having a grille including a multiplicity of inclined grille plates for deflecting the flow of air generated by the fan. The electric fan of the invention can suitably be used as
5 a floor or desk-top type fan, wall-hung type fan or as a ventilation fan mounted in a window to induce fresh outdoor air into the room.

Such an electric fan has been proposed as having means for changing the direction of air flow in relation to
10 time, in order to attain a pleasant flow of air well resembling natural wind.

A typical example of such an electric fan is the so-called oscillation type electric fan in which an electric motor, to which a fan blade unit is connected
15 directly, is oscillated in a horizontal plane to change the direction of flow of air in relation to time. Another example of such an electric fan is the so-called rotary grille type fan in which a rotary grille having a number of grille plates is rotated at a low speed, while the
20 direction of the motor is kept unchanged, to change the direction of flow of air in relation to time. The latter type of electric fan is disclosed, for example, in the specification of the United States Patent No. 4,123,197 issued to Phillip W. Keem et al.

The oscillation type electric fan, however, has various drawbacks. namely, the direction of flow of air can be changed only horizontally, because the motor oscillates only in a horizontal plate. In addition, since a complicated link mechanism is required for the oscillatory motion of the motor, the electric fan is difficult to produce and is susceptible to break down.

The rotary grille type electric fan has an extremely simple construction because the rotary grille is rotated at a low speed simply by a small-sized electric motor. This type of electric fan, however, has a disadvantage that the wind is directed also to the area where there is no person who would receive and enjoy the wind.

It is, therefore, an object of the invention to provide an electric fan having a rotary grille capable of changing the area of application of wind by a simple construction.

15 According to the present invention there is provided an electric fan having a frame, an electric motor attached to said frame, a fan blade unit adapted to be driven by said electric motor, a rotary grille disposed in front of said fan blade unit and provided with a multiplicity of inclined grille plates, a small sized synchronous motor for rotating
20 said rotary grille at a low speed and limit means for limiting the range of angular rotation of said rotary grille; wherein when the angular rotation of said rotary grille is limited by the limit means, so the reactional force applied to the rotary motor causes rotation thereof to stop and restart in an opposite rotational direction. Thus, when the
25 stopper is contacted

1 by the selected one of the projections, the reactional force is applied to the synchronous motor to reverse the latter so that the rotary grille is reciprocatingly rotated within a selected range of angle.

5 An embodiment of the present invention will now be described by way of example with reference to the accompanying drawing, in which;

Fig. 1 is a vertical sectional view of an electric fan constructed in accordance with an embodiment of the invention with the mounting or attaching members
10 being omitted; and

Fig. 2 is a front elevational view of the electric fan as shown in Fig. 1.

15 A preferred embodiment of the invention will be described hereinafter with reference to the accompanying drawings.

Referring to the drawings, the electric fan of the invention has a box-shaped frame 1 accommodating an
20 electrically driven fan unit which will be explained later. The frame 1 is constituted by a square body 2, a suction grille 3 provided at the rear end of the body 2 and support arms 4 provided on the front end of the body 2. The support arms 4 are arranged in plural to extend radially. A hub 5
25 having a container recess is formed in the center of the frame 1 unitarily with the latter as will be seen from the drawings. The container recess of the hub 5 receives a small-sized synchronous motor 6 having a built-in reduction

1 gear. A motor support 7 is attached in such a manner as
to cover the synchronous motor 6. A single-phase induction
motor 8 is mounted on the motor support 7. Furthermore,
a fan blade unit 9 is secured to the shaft of the induction
5 motor 8 by means of a stopper nut 10. The small-sized
synchronous motor 6 has a single-phase stator coil having
no directivity of rotation. Namely, if the rotor (not
shown) of the motor is stopped for any external force or
obstruction, the rotor starts to rotate in the reverse
10 direction.

A circular rotary grille 11 is fixed to the shaft
of the small-sized induction motor 6 extending through the
hub 5. The rotary grille 11 has a multiplicity of inclined
grille plates 12. The rotary grille 11 as a whole is
15 formed as a unit from a plastic to have integral projec-
tions A, B and Y, Z formed on the rear face of peripheral
portion thereof. The projections A and B are disposed at
radially outer side of the projections Y and Z. The angle
formed between the projections A and B around the center
20 of the rotary grille is 180° , while the angle formed
between the projections Y and Z around the center of the
rotary grille is 90° (270°).

A reference numeral 13 denotes an elongated
slot which permits the stopper 14 to be slid up and down
25 as shown by arrow. The stopper 14 is provided with a
retainer portion 15 and a knob portion 16. The arrange-
ment is such that the retainer portion 15 can be moved to
and stopped at one of the three positions mentioned below,

- 1 by a manual operation of the knob 16. Namely, these three
positions are a position (a) which does not reach the
locus of movement of the projections A, B, a position (b)
which reaches the locus of movement of the projections A,
5 B and the position (c) which reach the projections Y, Z.

In operation, as the electric power is supplied
to the motor 8, the fan blade unit 9 is rotated to induce
air from the rearward suction grille 3. The fan blade
unit 9 then imparts kinetic energy to the air to forcibly
10 displace the latter forwardly. Since the rotary grille
having a multiplicity of inclined grille plates 12 are
disposed at the front side of the fan blade unit 9, the
wind displaced by the fan blade unit 9 is deflected in
accordance with the rotational position or condition of
15 operation of the rotary grille 11.

Assuming here that the small-sized synchronous
motor 6 is not operating, the rotary grille 11 is kept
stationary, because the stationary friction torque of the
driving mechanism for driving the rotary grille 11,
20 including the small-sized synchronous motor 6, is large
enough to prevent the rotary grille from being rotated
by the flow of air displaced by the fan blade unit 9.
When the rotary grille 11 is kept stopped at the position
shown in the drawings, the wind is continuously directed
25 downwardly. This position at which the grille 11 is
stopped, however, can be selected and determined freely
as required. The position of the stopper 14 has nothing
to do with the determination of the stopping position.

1 As the small-sized synchronous motor 6 is
started by a manipulation of a control switch (not shown),
while the fan blade unit 9 is rotating, the flow of air
from the fan blade unit 9 is deflected by the rotary
5 grille 11 which is now rotating. It is possible to obtain
three different patterns of wind, depending on the posi-
tion of the stopper 14. Namely, if the knob 16 of the
stopper 14 is operated manually to bring the retainer
portion 15 to the aforementioned position (a), the rotary
10 grille 11 rotates continuously in one direction, because
the retainer portion 15 does not reach the locus of
projections A, B nor the locus of the projections Y, Z
of the rotary grille 11. In this state, the wind has a
conical form diverging forwardly around the axis of the
15 fan blade unit 9.

 If the stopper 14 is manipulated to bring the
retainer portion 15 at the position (b), the retainer
portion 15 is contacted by, for example, the projection B
as the rotary grille 11 rotates, to prevent the further
20 rotation of the latter. In consequence, the small-sized
synchronous motor is reversed due to the characteristic
peculiar to this motor to rotate the rotary grille 11 in
the reverse direction. This reverse rotation of the
rotary grille 11 is continued until the retainer portion
25 15 comes to be stopped by the projection B. Namely, as
the retainer portion 15 is stopped by the projection B,
the small-sized synchronous motor is reversed again, i.e.
starts to rotate in the forward direction, for the same

1 reason. Consequently, the rotary grille 11 is rotated reciprocatingly within the angular range of 180° between the projections A and B. Although in the illustrated embodiment the wind is directed downwardly over an area
5 of 180° , it is possible to arrange to direct the wind upwardly if necessary.

More specifically, when the electric fan is hung from a wall or attached to an window, it is preferred to direct the wind downwardly, while, when the
10 electric fan is used as a floor type fan to apply the air to a user seated on a seat, the wind is preferably directed upwardly.

If the stopper 14 is manipulated to position the retainer portion 15 at the position (c), the rotary
15 grille 11 is rotated between the projections Y and Z to direct the wind downwardly over an area of 90° which is the angle formed between these projections Y and Z.

The ranges of angle of rotation of the rotary grille 11, which are 180° and 90° in the illustrated
20 embodiment, can be varied as desired by changing the angles formed between two projections of respective pairs.

In the illustrated embodiment, two pairs of projections are formed at different angular interval and to have different loci of movement. This arrangement,
25 however, is not exclusive and it is possible to dispose all projections on the same locus or path. In this case, different pairs of projections have different height and the stopper 14 is provided with a plurality of

retainer portions 15 of different heights.

From the foregoing description, it will be understood that the present invention provides an electric fan having a rotary grille in which the area of region of application of wind can be varied by an extremely simple mechanism.

CLAIMS:

1. An electric fan having a frame, an electric motor attached to said frame, a fan blade unit adapted to be driven by said electric motor, a rotary grille disposed in front of said fan blade unit and provided with a multiplicity of inclined grille plates, a small sized synchronous motor for rotating said rotary grille at a low speed and limit means for limiting the range of angular rotation of said rotary grille; wherein when the angular rotation of said rotary grille is limited by the limit means, so the reactional force applied to the rotary motor causes rotation thereof to stop and restart in an opposite rotational direction.
2. An electric fan as claimed in Claim 1, wherein said limit means for limiting the range of angular rotation of said rotary grille includes a plurality of projections formed on said rotary grille at different angular positions, and a stopper mounted on said frame, said stopper having a retainer portion which is movable into and out of the locus of movement of said projections.
3. An electric fan as claimed in Claim 2, wherein said projections are formed in a plurality of pairs having different loci of movement and different angular intervals.
4. An electric fan substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

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