No. 697,697. Patented Apr. 15, 1902.

J. J. WOOD.

FAN.

(Application filed June 15, 1901.)

(No Model.)

FIG. 1.

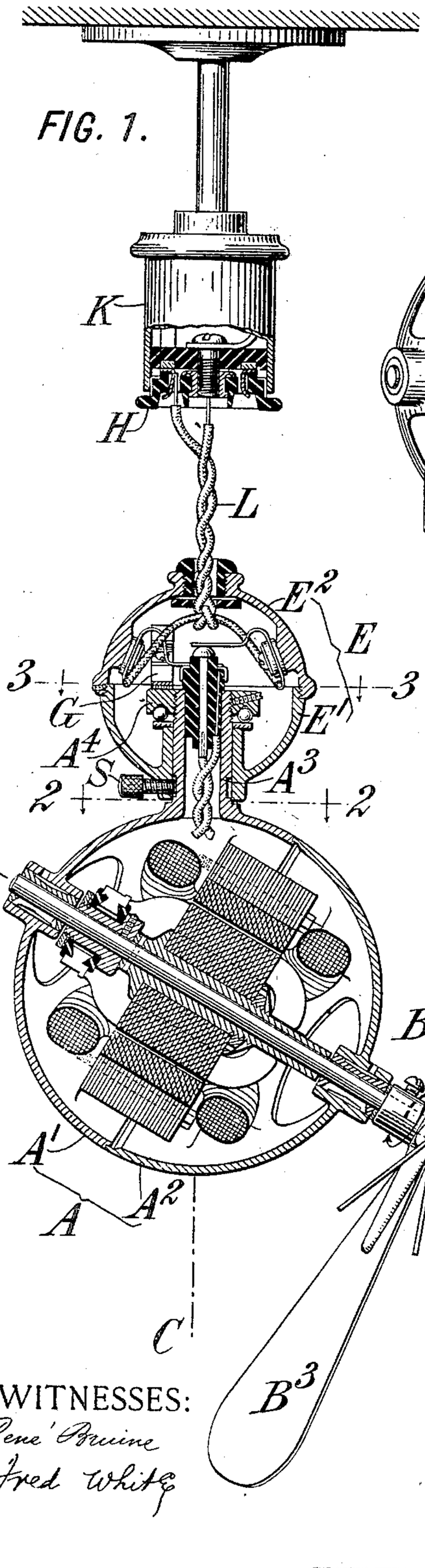

FIG. 2.

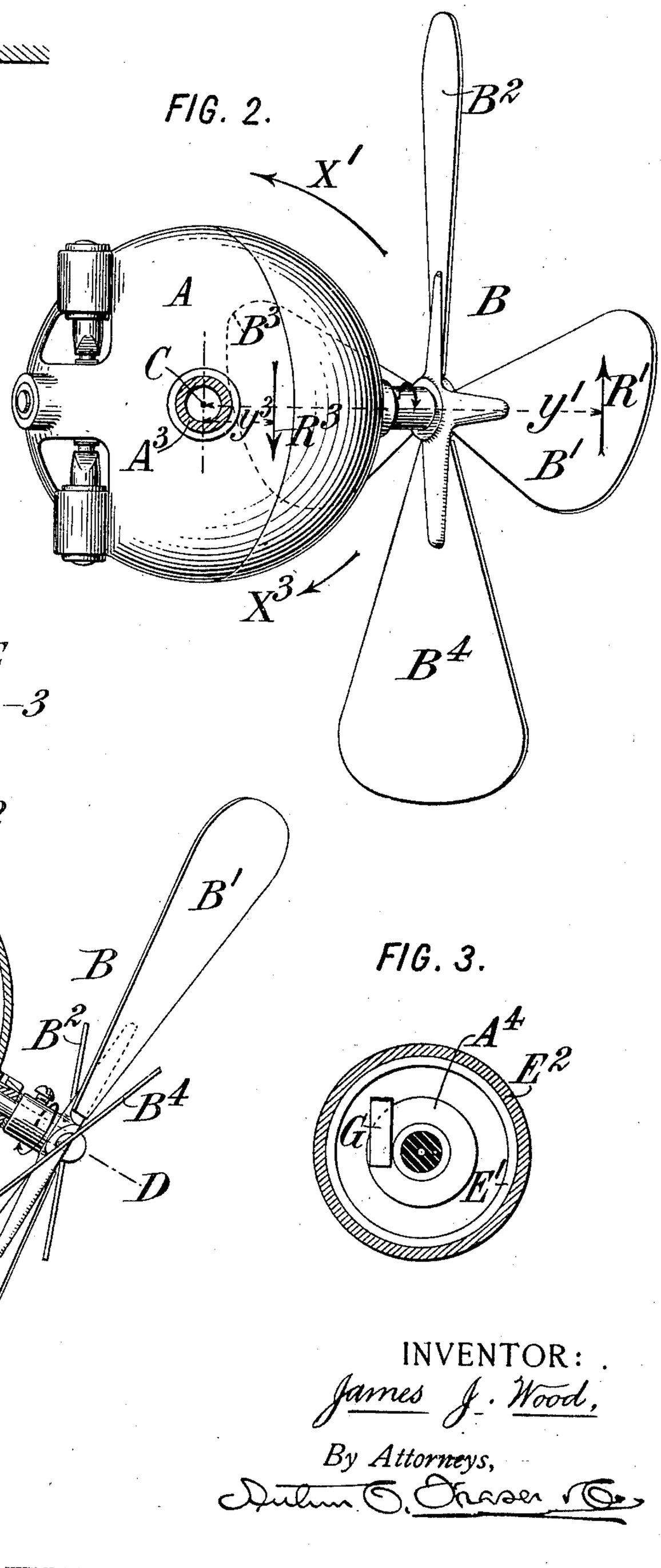

FIG. 3.

WITNESSES:
Rene' Bruine
Fred Whitty

INVENTOR:
James J. Wood,
By Attorneys,
Arthur O. Fraser & Co.

UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF FORT WAYNE, INDIANA.

FAN.

SPECIFICATION forming part of Letters Patent No. 697,697, dated April 15, 1902.

Original application filed February 25, 1901, Serial No. 48,846. Divided and this application filed June 15, 1901. Serial No. 64,641. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Fans, of which the following is a specification.

My invention aims to provide an improved electric fan, of which the support rotates on an axis and which propels a column of air in a direction oblique to said axis, and especially to provide a fan of the type specified which acts to produce in the most direct manner the results aimed at and which therefore requires a minimum amount of current for its operation and which is compact and simple in construction.

This application is in part a division of my application, Serial No. 48,846, filed February 25, 1901, but presenting certain improvements thereon in the manner of suspending the motor.

Referring to the accompanying drawings, illustrating an embodiment of my invention, Figure 1 is a diametric vertical section through the motor and the means for attaching it to the main support, the fan proper being shown in side elevation. Fig. 2 is a section on the line 2 2 of Fig. 1. Fig. 3 is a section on the line 3 3 of Fig. 1.

The principal feature of my improved fan is the arrangement of the parts whereby I secure the most direct and therefore the most efficient application of the motive force to the production of a rotary movement of the support. For this purpose a support in which the fan (and preferably the motor also) is immediately mounted is arranged to permit a rotary motion about an axis, and the axis of rotation of the fan itself is oblique to the axis of the support, said obliquity alone effecting the rotation of the immediate support of the fan about its axis according to a principle of operation newly discovered by me and explained more fully hereinafter. The immediate support of the fan is in turn supported in a relatively stationary casing or other support carrying the motor-circuit terminals, and which is preferably designed to be connected by a flexible connection with an ordinary incandescence-lamp socket.

Referring to the drawings, A indicates a suitable immediate support for a fan B of the ordinary "propeller" type and which support is adapted to rotate about an axis C, shown as vertical in the present case, but which may be arranged in any desired direction, while the fan itself rotates about an axis D oblique to the axis of the support. A suitable stationary support is shown at E. By reason of the fact that the fan-blades B' B^2 B^3 B^4 are oblique to their plane of rotation, as shown, their movement exerts a force in a direction perpendicular to the fan-shaft, (disregarding for present purposes that they produce also a force parallel to the direction of the fan-shaft.) This force perpendicular to the fan-shaft I term a "paddle-wheel" effect, because it is of the same nature as that produced by a paddle-wheel—that is, a wheel having blades lying in axial planes. This force exerted by the moving blades upon the air produces a reaction of equal intensity and in the opposite direction, which therefore is also perpendicular to the direction of the fan shaft or axis of rotation. It is this reaction transmitted to the support A which causes the desired rotation of the same about its vertical axis, as hereinafter explained. For each of the blades this reaction is constant and equal in amount always for the same dimensions and velocity of rotation. The point of application of the reaction and the direction thereof for the blades B' and B^3 are approximately indicated at R' and R^3, Fig. 2. The perpendicular distance or the moment-arm of the reaction R' from the axis of rotation of the support is indicated at y' and that of the reaction R^3 at y^3. The moment of the force R'—that is to say, its tendency to produce rotation of the fan and the support A about the axis of the support—is the product of the force R' by its moment-arm y'. The direction and amount of the rotative tendency is indicated by the arrow X'. Similarly the moment of the force R^3 or its tendency to produce rotation about the axis of the support is equal to the product of the force into the moment-arm y^3, its direction and amount being shown by the arrow X^3. These two opposing rotary moments X' and X^3 will be in proportion to the moment-arms y' and y^3, since the reactions R'

and R^3 are equal, and the resultant of the two rotary forces will be a rotation of the parts in the direction of the arrow X′ at a rate depending upon the difference between X′ X^3, which in turn depends obviously upon the degree of inclination of the fan-shaft A′.

The reactions on the blades B^2 and B^4 will be equal and opposite in direction to each other and being at equal perpendicular distances from the axis of rotation of the support will neutralize each other and will have no rotative effect. I thus secure by the most direct application of the power and without any extraneous means the desired rotary effect about the axis of the support, utilizing for this purpose the paddle-wheel effect, which in previous fans has existed merely as a hindrance to the rotation of the fan on its axis without any accompanying useful effect to make up for the loss of power. The column of air receives the desired forward movement in a straight line and with the full force due to the rotation of the fan on its axis, since there is no obstruction to such movement.

The support A may consist of a pair of shells A′ A^2, the meeting edges being in a plane transverse to the axis of rotation D of the fan. The shell A′ is provided with a tubular extension A^3 for supporting it rotatively in the stationary support E, which preferably consists of a pair of shells E′ E^2. The rotary support A is suspended, preferably, by means of a collar A^4, carried by a ball-bearing on an upward projection within the shell E′. The connecting-wires are attached to the shell E^2, and by means of suitable terminals the current is carried from said shell down through the neck A^3 to the motor within the rotary support A, as shown.

It is sometimes advisable to employ a brake in order to prevent too rapid rotation about the axis of the support for the following reasons: If the support revolve on its axis at a very rapid rate, it imparts but a slight forward movement of the air in the direction of the fan-shaft, since it does not stand in any one position more than a short instant of time, not long enough to give the necessary impulse to the air. Thus its actual efficiency as a propeller-fan is reduced by a too-rapid rotation on the axis of the support. With the inclination of the fan-shaft shown I find the efficiency to be substantially at a maximum when it revolves at about three revolutions per minute on the axis of the support, and that if the apparatus revolve around such axis more than five or six times a minute the efficiency falls off quite fast. A convenient means for braking the apparatus is to provide a spring G, attached to the stationary support E, and bearing at its free end on the collar A^4 or any other suitable part of the rotary support A. By attaching the same to the shell E^2, as shown, it is possible to adjust the pressure by screwing the two shells E′ E^2 together or apart. The brake is preferably provided with a piece of felt at its free end.

The fan may be permanently attached to a ceiling or chandelier or to a standard suitable for placing on desks and tables; but I prefer to make it detachable from its support and to adapt it for connection to the ordinary incandescence-lamp sockets at present in use. For this purpose I propose to provide a head H or any other head of the form common on incandescence lamps, so that it may be easily attached to or detached from ordinary sockets, such as K, carried from the ceiling, wall, chandelier, or the like. This head is preferably connected with the stationary support of the fan proper, E, by means of a flexible connection—as, for example, by utilizing the usual electric wires L both for the mechanical and electrical connection of the parts E and H. The purpose of this flexible connection is to prevent the transmission to the socket K of any vibrations which occur by reason of the movement of the rotary support A, which vibrations might cause a disagreeable humming noise.

My improved fan may also be adapted for use as a fixed fan, in which case the rotatable support A may be adapted for clamping to the fixed support E by any suitable mechanism. A convenient means for this purpose comprises a set-screw S, Fig. 1, passing through the lower part of the fixed support E and bearing against the neck A^3 of the rotary support. The rotary support may first be set to point in any desired direction and then the screw S tightened to hold it there.

It will be obvious that the construction shown is capable of considerable modification both in the details and in the arrangement of the parts without departure from the spirit of my invention.

What I claim is—

1. The combination with a support mounted to rotate on an axis, of means for rotating said support consisting of a fan mounted on said support on a shaft oblique to said axis, the exit from said fan being substantially unobstructed and the obliquity of said fan-shaft alone causing the rotation of said support.

2. The combination with a support mounted to rotate on an axis, of means for rotating said support consisting of a fan mounted on said support on a shaft oblique to and intersecting said axis, the exit from said fan being substantially unobstructed and the obliquity of said fan-shaft alone causing the rotation of said support.

3. The combination with a support mounted to rotate on an axis, of a fan mounted on said support on a shaft oblique to said axis, means for rotating said fan whereby said support is rotated on its axis, and means for controlling the speed of rotation of said support on its axis.

4. The combination with a support mounted to rotate on an axis, of a fan mounted on said support on a shaft oblique to said axis, means for rotating said fan whereby said support is rotated on its axis, and a brake for

retarding the rotation of said support on its axis.

5. The combination with a support mounted to rotate on an axis, of a fan mounted on said support on a shaft oblique to said axis, means for rotating said fan whereby said support is rotated on its axis, a brake for retarding the rotation of said support, and means for adjusting said brake so as to control the speed of rotation of said support on its axis.

6. The combination with a rotary motor-casing, of a stationary casing supporting it, said stationary casing being composed of a shell E′ carrying the rotary casing, and a shell E^2 carrying a brake adapted to bear upon the rotary casing, and means for giving said shells a movement toward or away from each other so as to adjust the pressure of said brake on said rotary casing.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:
ARTHUR L. HADLEY,
FRED S. HUNTING.