

March 1, 1932.

L. M. PERSONS

1,847,666

FAN

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2 Sheets-Sheet 1

Fig. 1.

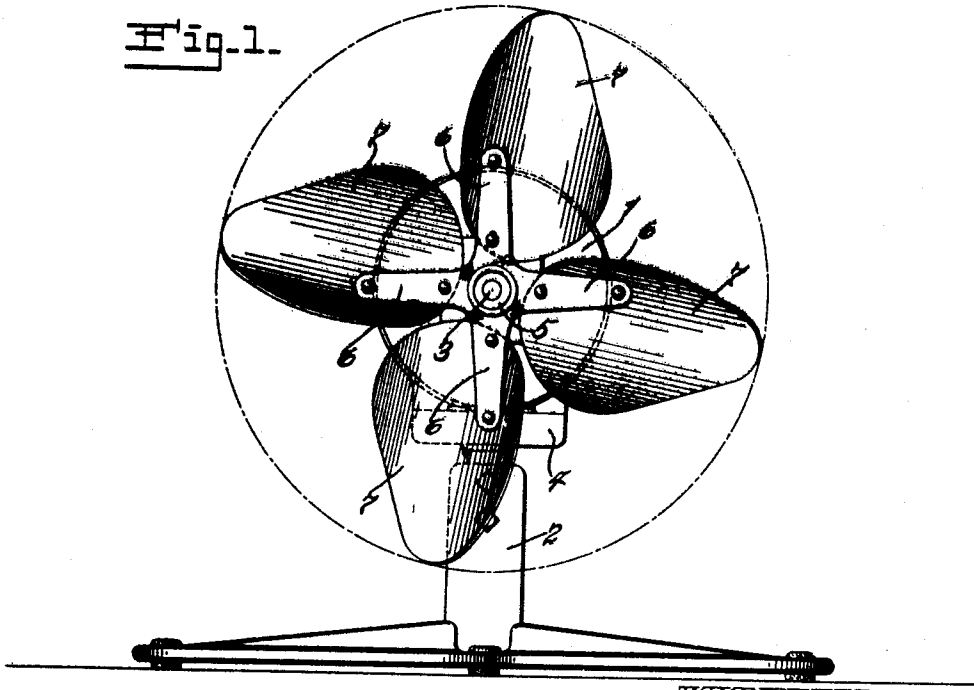
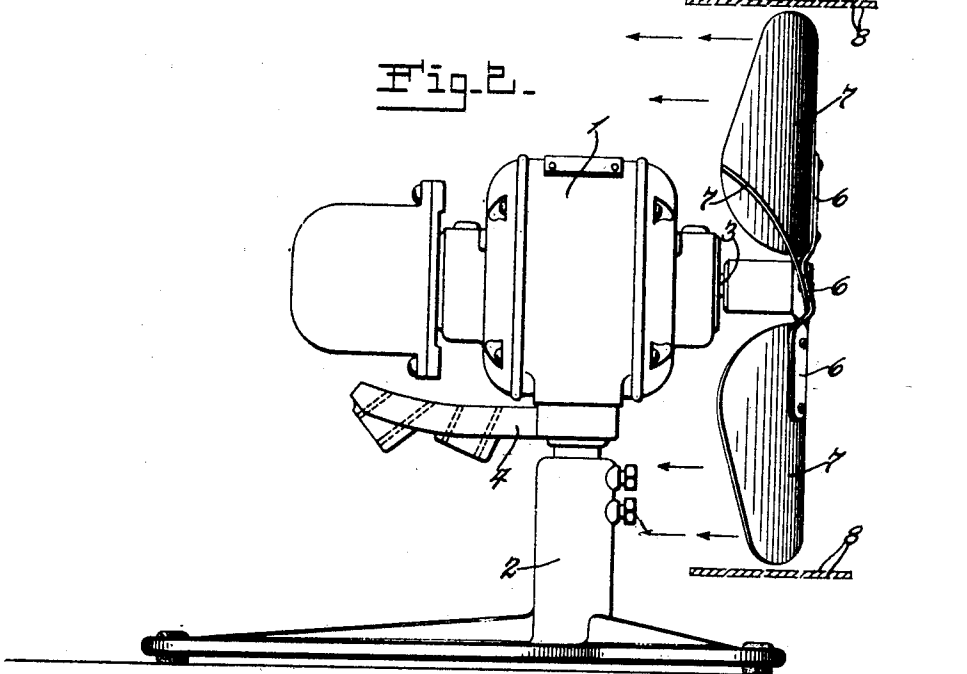


Fig. 2.



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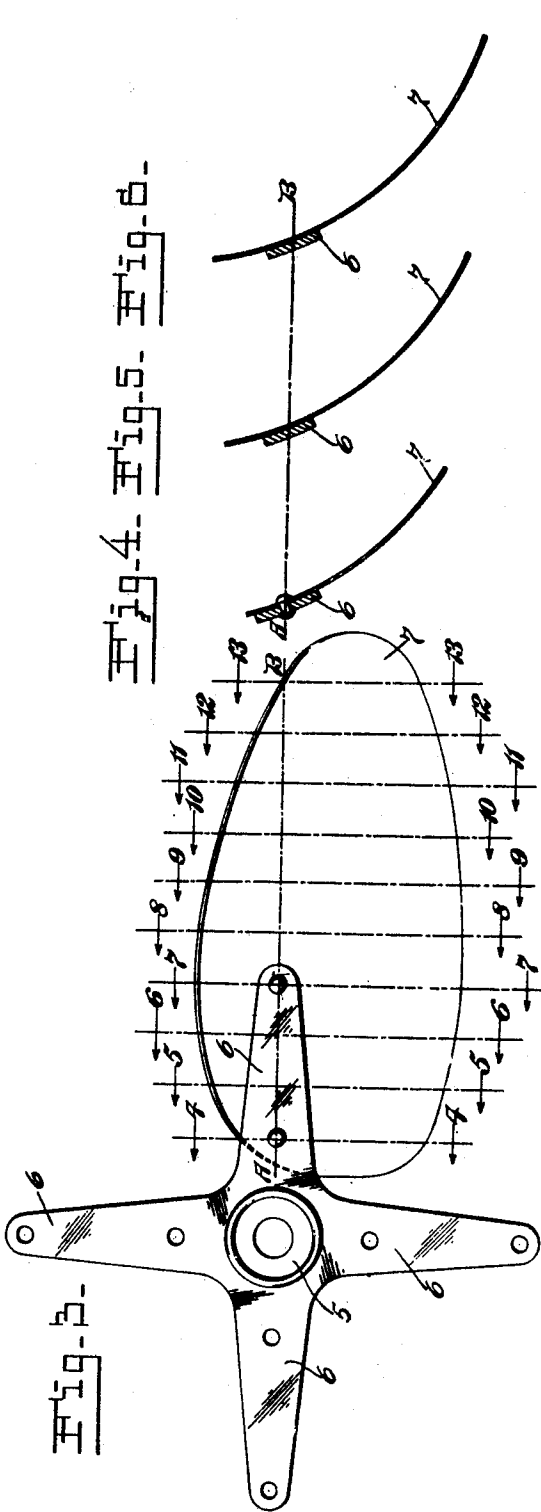
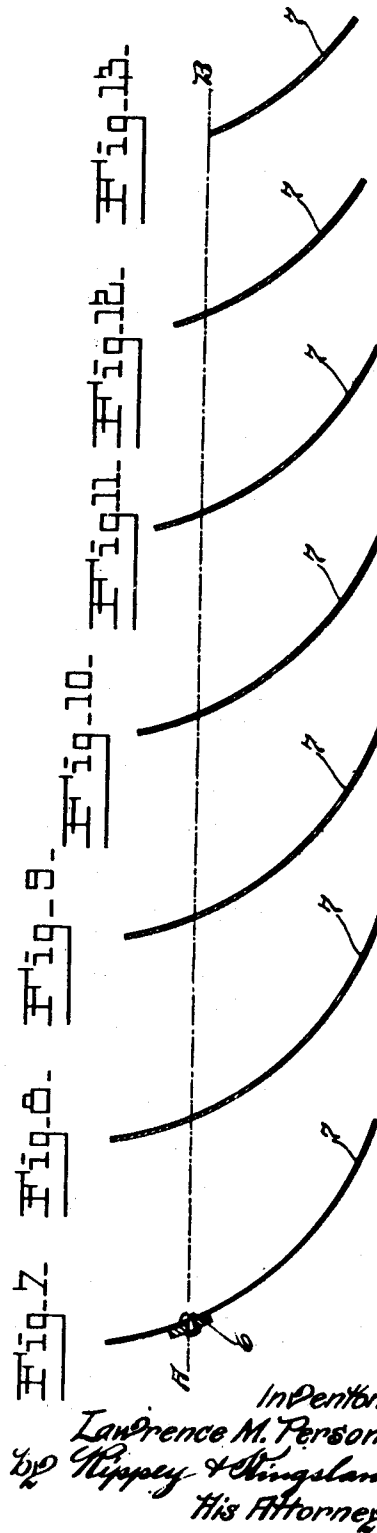
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UNITED STATES PATENT OFFICE

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FAN

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This invention relates to an improvement in fans, and consists in the novel construction hereinafter disclosed.

An object of the invention is to provide a motor driven fan having a plurality of specially designed blades whereby the fan will deliver a substantially cylindrical volume of air across the motor housing, said fan construction being primarily designed for delivering air through a closed conduit, such for example, as an air conduit to a hot-air furnace.

The full objects of the invention will appear from the following detailed description thereof, taken in connection with the accompanying drawings, in which—

Fig. 1 is a front view of the fan construction.

Fig. 2 is a side elevation.

Fig. 3 is a construction view of one of the blades.

Figs. 4 to 13 inclusive, are sections through the fan blades on the corresponding lines indicated on Fig. 3, to illustrate the contour of the blade through equally spaced planes outwardly from the axis of the fan.

It has been discovered that the movement of air through a conduit involves a special problem in order to avoid the setting up of eddy or cross currents in the conduit, and resulting in unequal distribution of air in the conduit and in reduction of the volume of air delivered through the conduit.

The use of fans in air conduits of hot-air furnaces for delivering heated air through the hot air delivery pipes, and also for delivering air from the cold air supply, has become quite common, but the usual type of fan is not satisfactory for this purpose because of the unequal distribution and deflection of the air volume moved through the conduit.

The cylindrical air column developed by the fan of present construction avoids cross or eddy currents in the conduit, and, therefore, provides a substantially uniform movement of the volume of air throughout the conduit, and thereby accomplishes an equal distribution of the air throughout the air delivery system of the furnace.

While the present invention is especially

designed for the purpose of moving air through a conduit, it should be understood that its application is not limited to this purpose alone, but that it may have other and wider application in practice.

In the embodiment of the invention illustrated in the drawings, the fan is shown as associated with a motor 1 supported by a base 2, said motor having a motor shaft 3 that extends from one end of the motor housing. The motor is shown mounted on a base member 4 provided with holes giving different angular mountings on the post in the base 2.

The fan proper comprises a hub 5 adapted to be attached to the projecting end of the motor shaft, said hub having connected therewith a spider 6 to the arms of which are attached the specially designed fan blades 7.

The fan is particularly adapted for insertion in a cold air duct of a hot-air furnace, and the duct or conduit is shown diagrammatically by the lines 8 (Fig. 2).

The special form of the fan blades is illustrated in the construction drawings, Figs. 3 to 13. The general principle of the blade construction is that the blade is so formed as to increase, by blade deflection and blade area, the initial movement of air at the inner portion of the cylindrical air volume, and to gradually decrease the blade area and blade deflection from the inner edge of the blade to the tip. It is obvious that the speed of rotation of the blade as it approaches the axis decreases, and in order to compensate for the decreased speed, the quantity and speed of the air displacement is increased by the blade deflection and area, and thus by coordinating the speed factor with the angularity of the blade and blade area, a substantially uniform cylindrical volume of air is displaced by the fan structure.

The blades may conveniently be formed of sheet metal and comprise segments of a cylinder of a diameter somewhat larger than the fan radius. For instance, in a fan having a radius of six inches, a cylinder having a diameter of six and five-eighths inches has been found satisfactory.

The form of blades is that of a flattened ellipse, or pear-shaped, with the larger or

base end attached nearer the hub. It departs slightly from symmetry in having the driving edge on a greater degree of curvature than the following edge.

- 5 The blade is attached to the spider radial to the hub on a line substantially parallel to the center line of the blade and parallel to the axis of the cylinder of which it is a section. The attaching line is forward of the center line of the blade, or in other words, nearer the driving edge. An acute angle of $67\frac{1}{2}^\circ$ between the tangent of the blade at its line of attachment and the plane of rotation, has been found satisfactory.
- 15 The blade angle, or the acute angle between the chord of a blade section and a plane perpendicular to the axis of rotation, is constant, except that near each end it may be somewhat increased. A blade angle of 50° through sections 6—6, 7—7, 8—8, 9—9, 10—10 and 11—11, with angles of 53° through section 4—4, 52° through section 5—5, 52° through section 12—12, and 51° through section 13—13, have been found satisfactory.

- 25 The sections shown, for a fan having a radius of six inches, are taken at distances of one-half inch.

- It will thus be seen that a fan blade has been provided which, for a major portion of the fan radius, is arranged to compensate for the difference in the speed of rotation, and deliver a cylinder of air of uniform pressure and volume, avoiding eddy currents.

- Since the quantity and speed of movement of the air is dependent upon the factors of blade area, blade inclination and speed, a blade of the type disclosed, when embodied in a plural blade fan, provides means for compensating for the relative difference in the speed of rotation of the sections of the blade as measured outwardly from the axis. The air column developed by the fan equipped with the blades of this specific type, is substantially cylindrical in form, the column moving forward from the fan across the motor housing substantially parallel with the axis of the fan.

- A fan of the present construction, therefore, avoids outward deflection of air currents and thereby prevents cross or eddy currents being set up in the closed conduit through which the air column is delivered.

- I am aware that the invention may be modified in certain particulars without departing from the spirit and scope of the invention.

- What I claim and desire to secure by Letters Patent is:—

1. A fan comprising a driven shaft, a plurality of blades mounted on and driven by the shaft, each of said blades being substantially a section of a cylinder having a diameter slightly longer than the fan radius, and having its largest cross-dimension in a section inwardly towards the shaft and gradually decreasing towards the tip.

2. A fan comprising a driven shaft, a plurality of blades mounted on and driven by the shaft, each of said blades being pear-shaped, having its largest cross-section inwardly towards the shaft and gradually decreasing towards the tip, and mounted on a line radial to the fan coincident with a line on the blade parallel to its center line and forwardly of said center line.

3. A fan comprising a driven shaft, a plurality of blades mounted on and driven by the shaft, each of said blades having a concave surface, the blades being pear-shaped, having their largest cross-section inwardly towards the shaft and gradually decreasing towards the tip, and mounted on a line radial to the fan coincident with a line on the blade parallel to its center line and forwardly of said center line.

4. A fan comprising a driven shaft, a plurality of blades mounted on and driven by the shaft, each of said blades being substantially a section of a cylinder, and being of pear-shape, having its largest cross-section inwardly toward the shaft and gradually decreasing towards the tip, and mounted on a line radial to the fan coincident with a line parallel to the axis of the cylinder of which the blade is a section, forwardly of the center of the blade.

5. A fan comprising a driven shaft, a plurality of blades mounted on and driven by the shaft, each of said blades being substantially a section of a cylinder of a diameter slightly larger than the fan radius, and being of pear-shape having its largest cross-section nearer the fan axis than the tip and gradually decreasing towards the tip, and departing from symmetry by having the driving edge of greater degree of curvature than the following edge, having a substantially constant blade angle, and mounted on a line radial to the fan coincident with a line parallel to the axis of the cylinder of which the blade is a section, forwardly of the center of the blade.

6. A fan comprising a driven shaft, a plurality of blades mounted on and driven by the shaft, each of said blades being pear-shaped, having its largest cross-section nearer the axis than the tip and gradually decreasing towards the tip, and departing from symmetry by having the driving edge of a greater degree of curvature than the following edge and mounted so as to have substantially a constant blade angle of approximately fifty degrees.

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