

2 Sheets—Sheet 1.

No. 584,917.

Patented June 22, 1897.

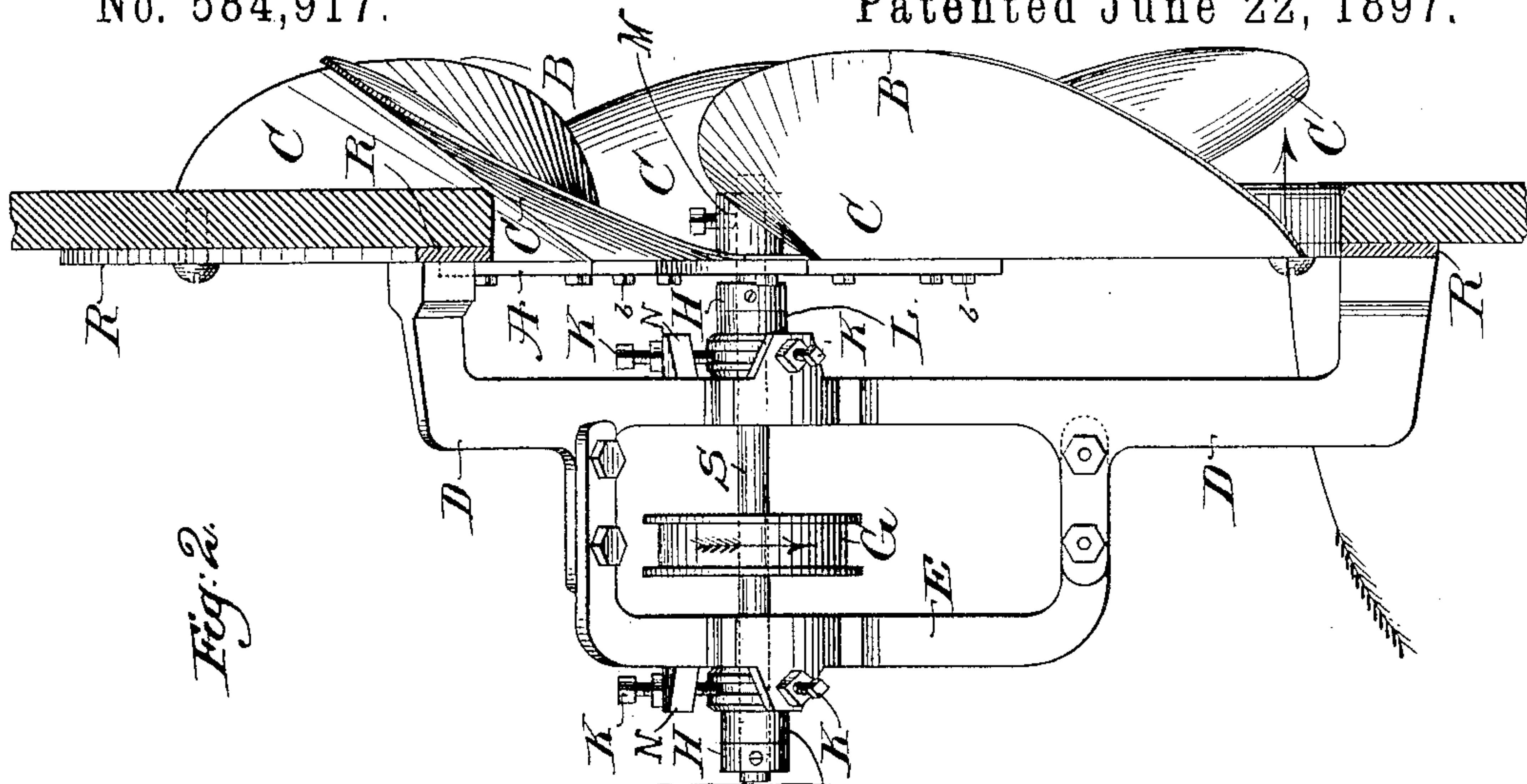


Fig. 2.

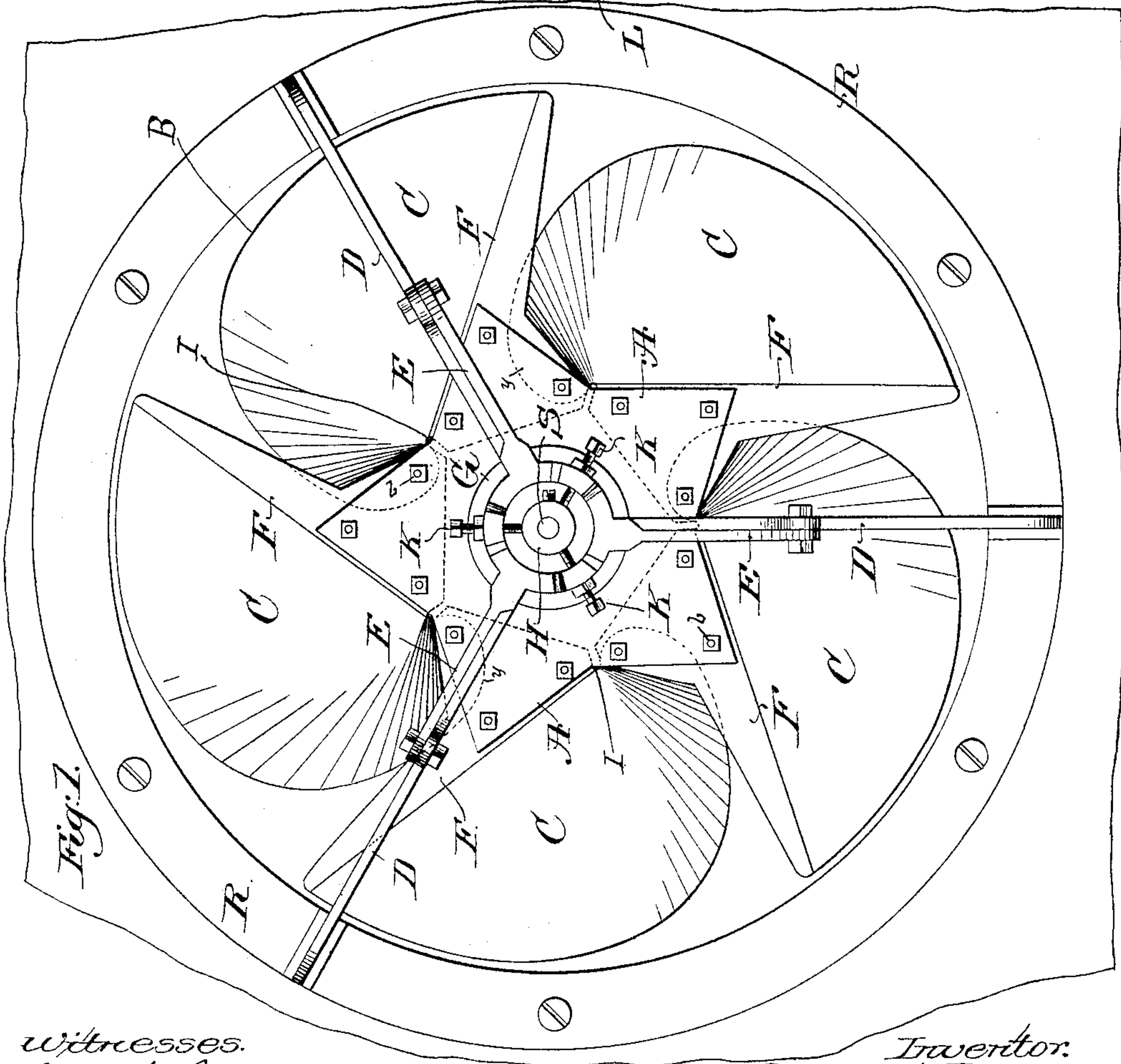


Fig. 7.

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(Model.)

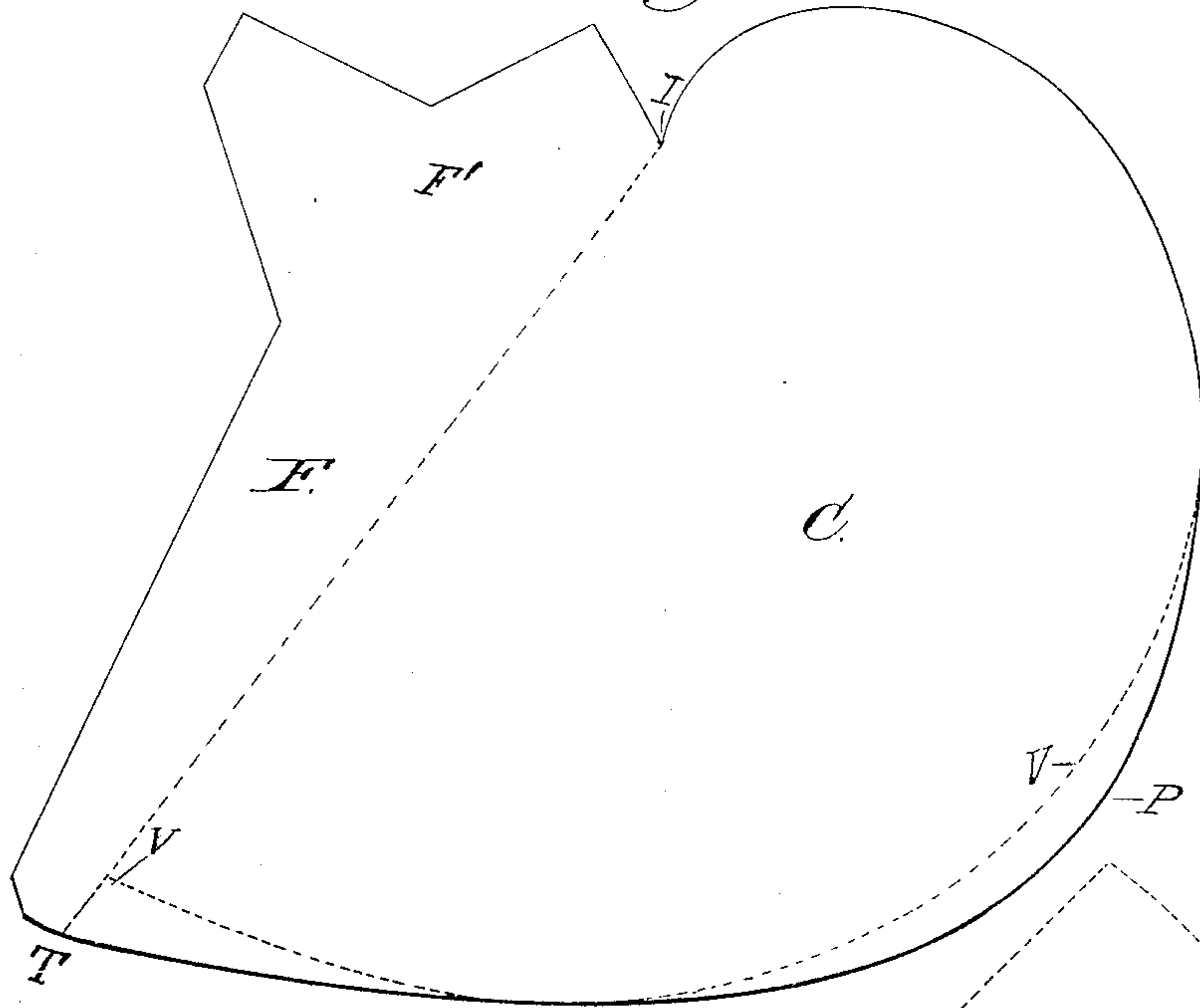
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G. H. BARNEY.  
VENTILATING FAN.

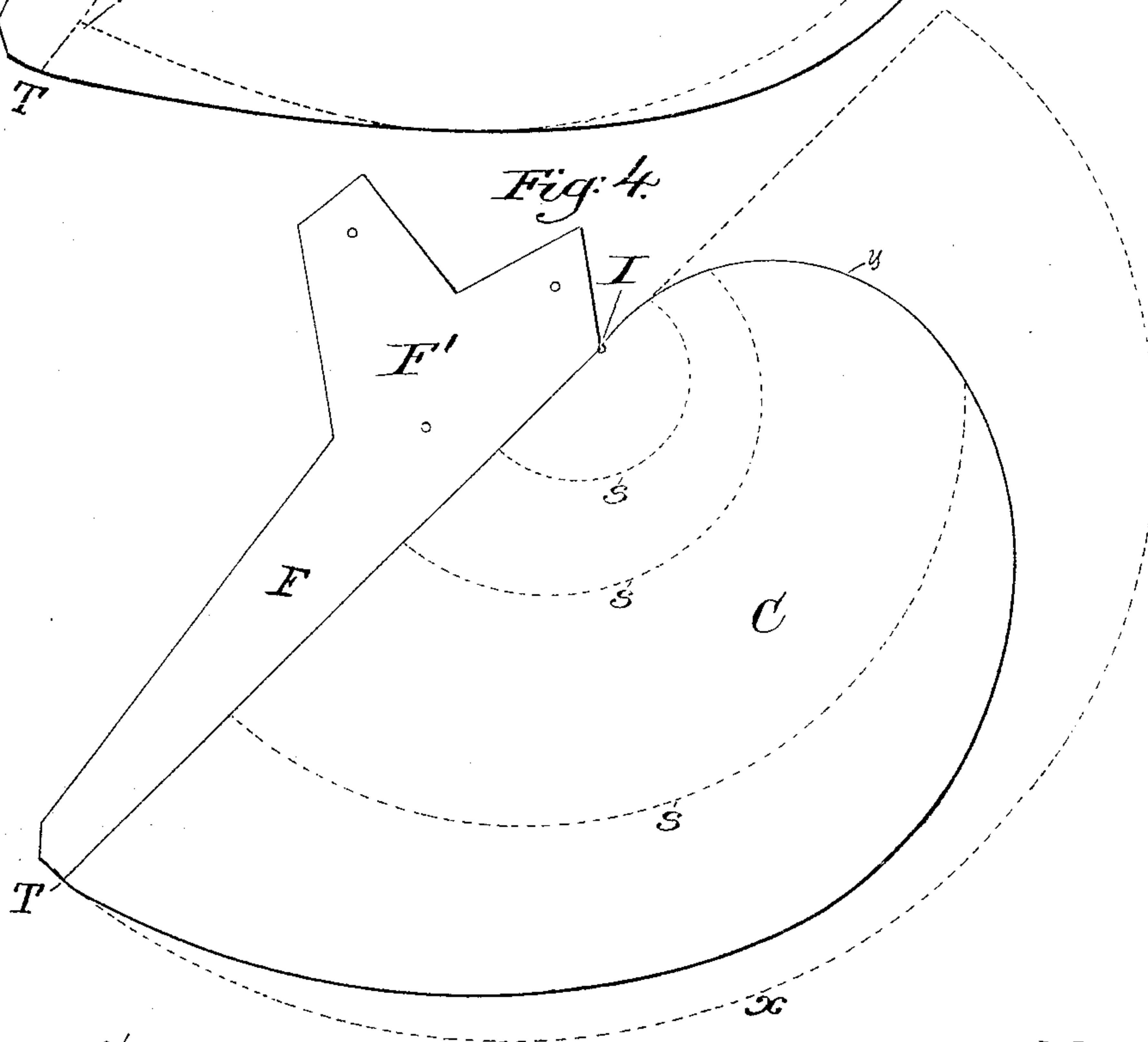
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*Fig. 3.*



*Fig. 4.*



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# UNITED STATES PATENT OFFICE.

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## VENTILATING-FAN.

SPECIFICATION forming part of Letters Patent No. 584,917, dated June 22, 1897.

Application filed May 13, 1896. Serial No. 591,426. (Model.)

*To all whom it may concern:*

Be it known that I, GEORGE H. BARNEY, of Winthrop, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Ventilating or Air-Blast Fans, of which the following is a specification.

My invention relates chiefly to the improved form and construction of the fan-blades and of the frame which supports the fan; and it consists of a blade of conoidal form, the surface of which is described by a right line passing through the apex and moving along an involute curve, which blade for convenience I will designate as a "spiral cone," the outer or discharge edge of each blade being substantially an involute curve, the point of origin of which curve is approximately the apex of the spiral cone when the blade has been bent into proper form, and near the inner or exhaust side of the fan each blade has a flat portion which is defined by a bend at a distinct angle with the adjacent curved portion thereof along a straight line extending from the apex of said spiral cone to its base-line or the periphery of the blade, which straight line is tangent to the circle or evolute curve, from which the involute curve of the discharge edge of the blade is described. The outer edge of this flat portion is the cutting edge of the blade at the exhaust side of the fan and preferably should be cut away toward the periphery of the blade in order to give more space for the ingress of air to the fan.

It also consists in a solid plate at the center, which is attached to the hub or shaft of the fan, and the fan-blades secured directly to this plate by an enlargement of the flat portion of each, thus obviating the necessity of spokes or strengthening-arms for the blades; further, in a frame consisting of a flat ring, with the bearings for the fan-shaft all upon one side of the ring, whereby it may be readily fastened to the wall or other flat surface by merely cutting a hole therein of a diameter sufficient to admit the fan.

In the drawings which form a part of this specification, Figure 1 is an elevation of the fan in its frame, viewed from the exhaust side. Fig. 2 is a side elevation viewed from the right of Fig. 1, a portion of the ring of the frame and the surface to which it is attached being broken away and shown in sec-

tion. Fig. 3 is a plan of a blank of my improved blade before it is bent into conoidal form. Fig. 4 is a plan view of my spiral-cone blade with the apex thereof upward.

Referring to the drawings, A is a solid plate attached to the fan-hub M or shaft S.

C are the fan-blades, of spiral conoidal form, with the discharge edges B substantially in the form of involute curves, the apex of the spiral cone being at I. The blades C have a flat portion F at the exhaust side, the outer edge of which is the cutting edge of the blade. This flat portion is enlarged at F' to afford a proper surface for attachment to the plate A, which may be by bolts b, as shown. There is a distinct bend in the fan-blade between the flat portion F and the immediately adjacent curved surface along a straight line I T, Fig. 4, extending from the apex of the spiral cone to the outer edge or periphery of the blade, which straight line is tangent to the circle or evolute curve, from which the involute curve of the discharge edge of the blade is described. For ordinary practical purposes an angle of from thirty to forty degrees between the plane of the portion F and the immediately adjacent surface of the blade will be found sufficient. The angle, however, should depend upon the quality of work desired to be accomplished by the fan.

If the angle is increased, the fan will produce less pressure, although the volume of air projected will be greater, and, vice versa, as the angle becomes less the ability of the fan to create air pressure or exhaust becomes greater, while the volume passing through it is less.

In Fig. 3, which is an illustration of the flat sheet-metal blank before it is bent into the spiral cone, the curve I V V—the portions V V being dotted lines—is an involute curve. When the blank is bent into the completed fan-blade, the outline of the plan view will be considerably contracted, particularly at the portion of the blade marked P, Fig. 3, and in order to give the blade greater capacity for practical purposes I enlarge the blade beyond the true involute curve, as shown in full lines I P T in said Fig. 3, the curve toward the point of the blade T being substantially that of a circle having the axis of the fan-shaft as a center.



In Fig. 4 is illustrated a plan view of the spirally-conical blade, the apex I of the cone being uppermost. The dotted lines s s s s show the spiral curves of the blade produced by planes at right angles to the perpendicular axis of the cone and cutting it at different altitudes, the spiral curves converging from the cutting edge to the discharge edge. The dotted line x indicates a portion of the curve of the base of the cone produced by projecting the surface of the completed blade to a plane which is at right angles to the axis of the spiral cone and touches the edge of the blade at T.

When the blades C are attached to the plate A in proper position, the inner portion y of each (shown in dotted lines, Fig. 1) overlaps somewhat the flat part of the one next to it. This tends to prevent any backward current of air through the center of the fan. Also the flat portions F of all of the blades should occupy a position in the same plane which is perpendicular to the axis of the fan.

For practical purposes the solid plate A may be about one-third the diameter of the fan. That is, as illustrated, the minimum radius of the plate, which is the distance from the center of the fan to the point where the apex I of the blade-cones are located, should be about one-third the radius of the fan, the points of the plate which extend beyond that distance being for convenience in attaching the blades.

My improved frame consists of a flat ring R, which may be screwed or bolted to any flat surface, through which a hole for the fan should first be cut of a diameter equal to the opening through the ring. The portion of the frame which sustains the bearings for the fan-shaft are all upon one side of said ring, the arms D being cast integral with the ring R and the arms E made in a separate piece and bolted to the arms D. The shaft S is supported in bearings L, which are centrally adjusted in the frame by means of screw-bolts K, which pass through lugs N, projecting from the frame.

II are collars upon the shaft S to prevent any sliding motion of the fan longitudinally of the shaft.

G is the driving-pulley, the arrow thereon indicating its proper direction of revolution to cause the fan to drive a current of air in the direction indicated by the large arrow near the bottom of Fig. 2.

The advantages of my improved construction are that the solid center plate prevents a backward current of compressed air through the center of the fan and thereby enables the fan to develop greater pressure on the discharge side and consequently greater exhaust or suction on the opposite side. The spirally-conical curve of the blades carries the air toward the center and thus tends to discharge the air in a column parallel to the fan-shaft instead of throwing it off the outer edges of the blades in a hollow cone, as is the case

with nearly all fans heretofore in use. The construction of the fan-blades with a flat portion at their exhaust edges and the angular bend between that portion and the curved part will admit of the blades being made of sheet metal and at the same time gives them sufficient stiffness to obviate the necessity of spokes, outside peripheral ring, or other strengthening pieces upon them, and they may be attached directly to the center plate; but it will be evident that blades of this improved form may be held in place in the fan by means of spokes and without the plate A, if desired, in which case the flat portion F may be omitted and the substantial benefits of my improved form of blade be obtained. The flat ring of the frame with all the supporting parts for the bearings of the fan upon one side of the frame is of great convenience in use as well as economy in construction, for in order to set up the fan it is only necessary to cut a hole of the size of the inside diameter of the ring and then screw or bolt the ring in place around it. The most economical and convenient manner of constructing the frame is to cast one portion of it, that marked D, integral with the ring and the other portion, that marked E, separate and attach it to the part D, as illustrated in the drawings, which construction has never before been employed in frames for ventilating-fans so far as I am aware. Another advantage of this improved construction of the frame is that both bearings being upon one side of the fan and outside the wall to which it may be attached they are at all times readily accessible for the purposes of adjustment and lubrication without stopping the fan, if desired, or removing any portion of the frame, and also the support for the outer bearing being separable from the remainder of the frame may be readily removed either for the purpose of applying a driving-pulley to the shaft or a belt to the driving-pulley without removing the remainder of the frame or the fan from its position.

I claim—

1. A blade for a ventilating or air-blast fan comprising the following peculiarities of construction, namely: an outer or discharge edge which is substantially an involute curve, the surface of the blade being conical in form with the apex thereof in said involute curve, at or near its point of origin, and spiral in-converging curves from the cutting edge to the discharge edge.

2. A blade for a ventilating or air-blast fan, comprising the following peculiarities of construction, namely: a discharge edge which is essentially an involute curve, the form of the surface of the blade from said discharge edge to a line near the cutting edge being a spiral cone with the apex thereof in said involute curve, at or near its point of origin, the said line near the cutting edge being defined by a bend in the blade at a distinct angle with the adjacent curved surface and extending from



the apex of said cone to its base-line, or periphery of the blade, along a straight line which is tangent to the circle, or evolute from which the said involute curve is described, 5 and beyond said bend being a plane surface to the cutting edge of the blade.

3. A ventilating-fan embodying the following elements, namely, a central plate to support the fan-blades which are directly attached thereto, blades constructed with a flat 10 portion at their exhaust edge, each of which

portions is located in the same plane, which is at right angles to the axis of revolution of the fan, the remaining surface of the blades having the form of a spiral cone, the apex of 15 each of which is at the inner limit of the junction of the said flat and curved portions of the fan-blades.

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