P. KESTNER.

CENTRIFUGAL FAN.

APPLICATION FILED JAN. 4, 1908.

**949,150.** Patented Feb. 15, 1910.

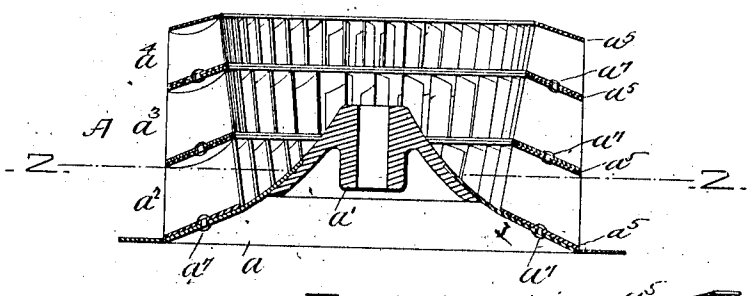


Fig. 1.

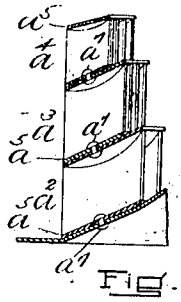

Fig. 1.A.

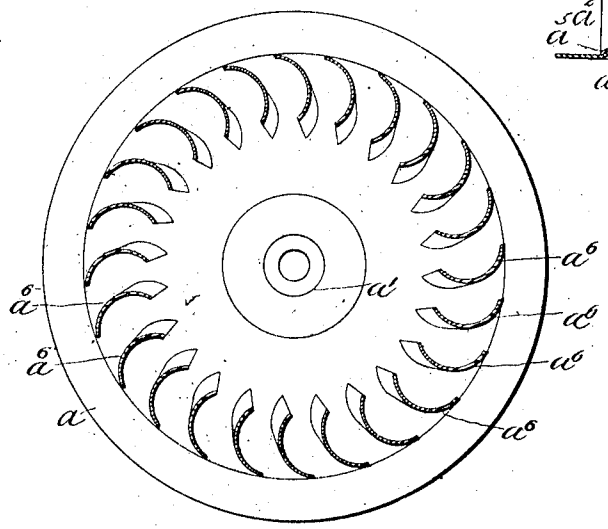

Fig. 2

WITNESSES

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# UNITED STATES PATENT OFFICE.

PAUL KESTNER, OF LILLE, FRANCE.

## CENTRIFUGAL FAN.

949,150. Specification of Letters Patent. Patented Feb. 15, 1910.

Application filed January 4, 1908. Serial No. 409,255.

*To all whom it may concern:*

Be it known that I, PAUL KESTNER, of Lille, France, a citizen of the Republic of France, have invented a new and useful Improvement in Centrifugal Fans, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

My invention relates to an improvement in centrifugal fans having a fan chamber, an axial intake leading into said chamber and a circumferential discharge. These fans, in the nature of a fan wheel, have heretofore been usually constructed with long blades of equal depth surrounding the fan chamber. The customary manner of mounting these blades has been to mount them upon a rotating frame or disk from which the blades project outwardly. With long and narrow blades stays have to be provided to give the blades the necessary rigidity and these stays are objectionable as they create eddies and obstruct the intake of the fan. This objection is especially true of a fan of the above character when used for the purpose of atomizing water. Under such circumstances greater strain comes upon the blades of the fan and the auxiliary means employed to reinforce the blades prevents such an even or regular distribution of water in the fan as is necessary to insure the best results. From the point of view of efficiency in a fan of the above character a blade of equal depth throughout its length is not an effective one especially when the fan is rotated at a high speed. The reason for this is that the air drawn into the chamber of the fan enters at a great speed and strikes with considerable force against the frame or disk at the back of the fan from which the blades are projecting. The result is that a strong pressure is formed in that part of the fan adjacent to the disk and the rear portions of the fan blades are doing the most work while the forward portions thereof are doing but little work and in some cases creating a back draft. I have attempted with considerable success to remedy the defect in the ordinary form of blade as above noted, by making the blades tapering from back to front, or in other words, making the blades deeper at their inner ends adjacent to the disk than at the eye of the fan, and a fan having such blades is described in my Letters Patent of the United States, No. 888,444, dated May 19, 1908. This arrangement although an improvement upon the ordinary form of blade of the same depth throughout, has, however, this defect: that the interval of distance between the blades at their disk ends where their depth is increased, becomes too small to permit of such free passage of air as will give to the fan a maximum efficiency.

It is accordingly the object of my present invention to make a fan in which the blades will require no auxiliary reinforcement or such reinforcement as will cause eddies or interfere with the free passage or entry of fluid into the interior or chamber of the fan.

It is the further object of my invention to so arrange or mount the blades of the fan that a tapering arrangement of the blades of the fan may be obtained, or in other words, the fan will be provided with blades gradually increasing in depth from the intake or eye of the fan inwardly, while the interval of distance separating the blades will be sufficiently ample to insure a free passage of air outwardly between the blades from the interior of the fan.

In the drawings:—Figure 1 represents the fan in longitudinal cross section. Fig. $1^a$ represents a section of the fan slightly modified in construction, to which modification special reference will hereinafter be made. Fig. 2 is a section on the line 2—2 of Fig. 1.

Referring to the drawings:—A represents the improved type of fan containing the basic principles of my invention. The fan has a supporting frame or disk $a$ which is provided with a hub $a^1$ adapted to receive the shaft by which the disk may be turned. Connecting with this disk and with one another are a series of blade-carrying sections $a^2$, $a^3$, $a^4$. These sections are independent in the sense that each section forms a portion of the fan complete in itself, one section being connected to the disk and the other sections attached to this connecting section and to one another in succeeding order or arrangement. Each of the sectional members $a^2$, $a^3$, $a^4$ comprises separate annular flange-forming plates $a^5$ between which are interposed a series of blades $a^6$ which for the several successive sections of the fan have a gradually diminishing radial depth, the blades of the section nearest or adjacent to the disk $a$ being the deepest. In this con-

nection it is to be observed that in Fig. 1 the blades of each individual section of the fan taper, the outer ends of the blades of the inner section being of about the same radial depth as the inner ends of the blades of the middle section and the outer ends of the blades of the middle section being of about the same radial depth as the inner ends of the blades of the outer section, there being obtained a gradually tapering effect. In Fig. 1ª, however, the blades of each individual section are of the same radial depth throughout so that the combined blades while producing a tapering effect are not tapered in the individual sections. It is also to be noted that the blades of the respective sections are so arranged that the sections shall be preferably of the same diameter; the blades of the respective sections are also preferably of the same axial length. The sections are attached to the disk and to one another by means of rivets $a^7$ or other means of fastening which pass through the flanges of the respective sections. By thus building the sections onto the disk and onto one another a fan is made which may be rotated at high speed without the necessity of any auxiliary reinforcement, and leaving a free unobstructed entrance into the interior or chamber of the fan. The number of blades in the several sections vary. The section having the deepest blades has the least in number, the blades increasing in number as their depth diminishes. In practice I prefer to make the section nearest the disk with 24 blades, the next section with 32 and the next with 48. The number of blades may be varied, however, to meet particular requirements. By proportioning the number of blades to the width of each blade I am enabled to so arrange that the inlet to the passage between the blades of each section will not be too small to prevent a proper ingress of air. In other words, I am enabled by making the fan in sections to study each section in itself as to the proportions and arrangement to give to its blades a maximum efficiency. Each section being as effective as possible the fan as a whole will also be equally effective.

I prefer to make the fan with three sections. More sections may, of course, be added, but in order not to make the fan too complicated and not to exaggerate the cost it is better to make the fan with three sections only. A three-section fan I have also found to be the one best adapted to be used for atomizing water. I prefer also to provide the sections of the fan with curved blades, a curved blade furnishing a larger working area for a mean width of blade.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States:—

1. In a centrifugal fan having a fan chamber, an axial intake leading into said chamber and a circumferential discharge, the combination of a supporting frame at one end of said chamber opposite the intake of the fan, and mounted upon said frame a plurality of blade-carrying sections the blades of which sections surround said chamber of the fan and which sections connect successively with and support one another and are collectively mounted on said supporting frame.

2. In a centrifugal fan having a fan chamber, an axial intake leading into said chamber and a circumferential discharge, the combination of a series of fan blades surrounding said chamber, said blades being successively arranged in sections, the blades of the respective sections being fewer in number but of greater depth in each successive section from the intake of the fan inwardly, and means for supporting said blades.

3. In a centrifugal fan having a fan chamber, an axial intake leading into said chamber and a circumferential discharge, the combination of a supporting frame at one end of said chamber opposite the intake thereof, and mounted on said frame a plurality of blade-carrying sections secured successively to one another and to said frame, the blades of said respective sections surrounding said chamber and which blades for the respective sections are fewer in number but of greater depth in each successive section from the intake of the fan inwardly.

4. A centrifugal fan of the character specified having in combination a supporting frame and mounted thereon a plurality of bladed sections secured side by side to each other, said sections being of substantially the same outside diameter, and having blades of substantially the same axial length, the said blades of the respective sections, also, being fewer in number but of greater radial depth in each section in succession from the intake of the fan inwardly.

PAUL KESTNER.

Witnesses:
HENRI CHARRIER,
LÉON PECKEL.