G. M. CAPELL.

CENTRIFUGAL FAN AND PUMP.

APPLICATION FILED JULY 31, 1909.

991,134. **Patented May 2, 1911.**

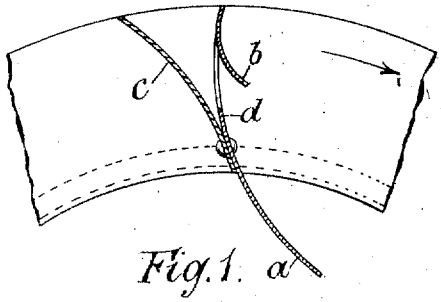

Fig. 1.

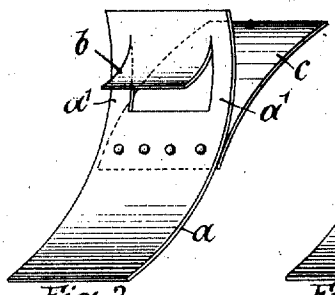

Fig. 2.

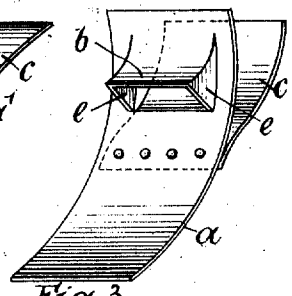

Fig. 3.

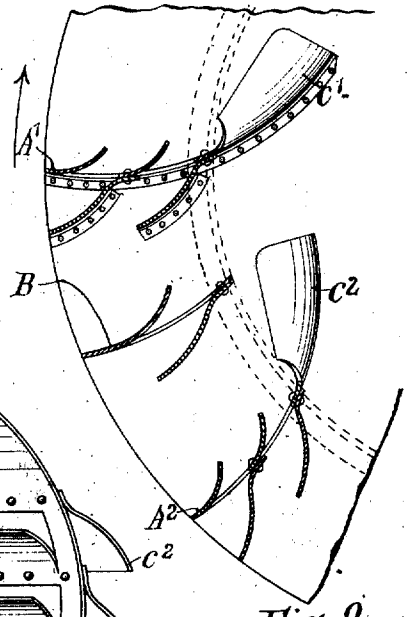

Fig. 9.

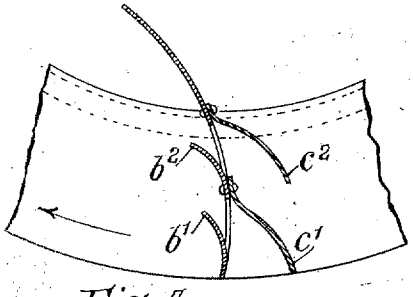

Fig. 4.

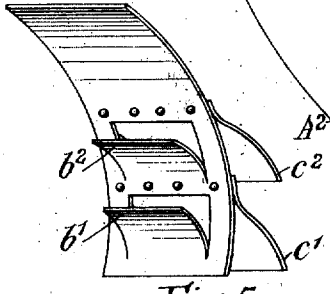

Fig. 5.

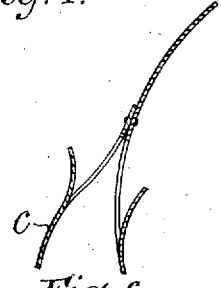

Fig. 6.

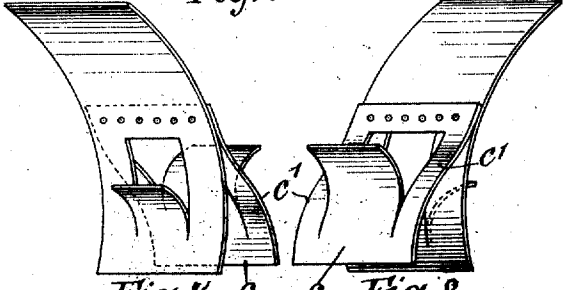

Fig. 7. Fig. 8.

WITNESSES

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CENTRIFUGAL FAN AND PUMP.

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To all whom it may concern:

Be it known that I, GEORGE MARIE CAPELL, a subject of the King of Great Britain, residing at Passenham Rectory, near Stony Stratford, in the county of Northampton, England, have invented new and useful Improvements in Centrifugal Fans and Pumps, of which the following is a specification.

In the operation of fans and centrifugal pumps of normal construction, a loss of effect is nearly always encountered which is due to the return flow, toward the center of the wheel at the back of a vane, of some of the fluid delivered through the outer periphery of the wheel from the front face of the vane. Such an action may be regarded as a spilling of some of the contents of the vane-buckets which are employed in conveying the fluid from a region of relatively low pressure to one of higher pressure, this return flow or spilling action being due to the well-known tendency of a moving surface to create, at the back thereof, a pressure which is less than that of the surrounding fluid through which the surface is traveling which action may be referred to shortly as "cavitation action".

By means of a tail-blade secured to the back of a vane and diverging therefrom in a radially outward direction at a rate greater than that due to the mere increase of radius, the tendency for fluid to return along the back of the vane will be counteracted and by separating the tail-blade from the vane and providing between the inner edge of the tail-blade and the back of the vane a liberal passage for the flow of fluid between them, "cavitation action", which previously was a cause of loss of effect, will be converted into a potent cause of augmentation of effect. The flow of fluid through the diverging space between the tail-blade and the back of the vane, induced by cavitation action and rendered operative by the above described modified construction, is entirely additional to that due to centrifugal action merely. Having by such a new method of inspiration induced fluid to enter the inclosed space at the back of the vane, such additional fluid will become, by the impelling effect of the rear or tail-blade, subject to the head due to the whirling motion of the wheel, like the fluid which is driven in front of the vane, and the consequent evacuation of one mass of such additionally inspired fluid will necessitate its place being taken by another mass and so on continuously, the inspiration of a fresh mass due to the centrifugal evacuation of a preceding mass superposing itself on inspiration due to cavitation, resulting in a considerably augmented output of fluid from the wheel.

The object of the present invention is in the first place to enhance the above described effect and second to show how the effect can be derived by a more simple, and reliable construction than that previously described.

According to the present invention I arrange to deliver air to the space between the vane and a following divergent tail-blade from the front of the vane through a port-hole formed in the vane itself or a port-hole formed in the tail-blade, or by port-holes formed in the tail-blade as well as in the vane. One or more such port-holes may be formed in each vane or the principal vanes may be formed with two port-holes and scoop-shaped extensions into the air inlet circle of the wheel may be added to such principal vanes, there being interposed secondary vanes formed with a single port-hole in the vane itself, in the tail-blade thereof or in both the vane and tail-blade, scoop-shaped extensions being omitted from these secondary vanes.

The details of the construction may be varied as will be described with reference to the accompanying drawing.

In this drawing:—Figure 1 is a transverse section of a single-ported vane:—Fig. 2 being an isometric view of the same. Fig. 3 is an isometric view of a single-ported vane varied in some details. Fig. 4 is a transverse section of a double-ported vane:—Fig. 5 being an isometric view of the same. Fig. 6 is a transverse section of a single-ported vane combined with a single-ported tail-blade, Figs. 7 and 8 being isometric front and back views respectively of such a vane. Fig. 9 is a representative example of an assemblage of single and double-ported vanes on a wheel.

In Figs. 1 and 2 is shown a vane in which a single port-hole is formed of less than the full width of the vane, by cutting three sides of a rectangular orifice in the vane plate *a* and bending the portion *b*, thus partially severed, about the uncut edge of the orifice,

which is the outer edge of the port-hole thus formed, the plate being bent forward relatively to the direction of motion of the vane which is indicated by the arrow in Fig. 1. The plate *b* will thereby serve as a deflecting plate to direct a portion of the fluid which is flowing along the front surface of the vane-plate *a* into the space at the back of the vane and in front of a tail-blade *c* which is secured to the inner edge *d* of the port-hole and extends, as shown in Fig. 1, as far as the outer periphery of the wheel with a gradually increasing rate of divergence. The spaces behind the side portions of the vane, indicated by a^1 a^1 in Fig. 2, will be supplied with fluid by a lateral deviation of a portion of that which enters the port-hole and the fluid which flows over the front of the side portions a^1 a^1 will avoid interference by the deflecting plate *b*.

In Fig. 3 gusset-shaped side-plates *e e* are provided to more completely separate the streams of fluid which flow over the front face of the vane from that deflected by *b* to the back of the vane. The construction of Fig. 3 still further differs from that of Figs. 1–2 in respect to the fact that the tail-blade *c* diverges from the back of the vane at a rate which first gradually increases and then gradually decreases so that the tail-blade is concave to the back of the vane. Instead of extending as far as the outer periphery of the wheel, the tail-blade *c* may stop short thereof.

Figs. 4 and 5 show double-ported vanes, the outer port having a deflecting plate b^1 leading forward and inward from the outer edge of the port-hole, and a tail-blade c^1 leading backward and outward from the inner edge of the port-hole. A corresponding deflecting plate b^2 and a tail-blade c^2 are fitted to the outer and inner edges respectively of the inner port-hole. With such a construction there will be a duplex inspiration effect, for not only will the tendency to cavitation at the back of the outer portion of the main-vane be utilized to augment the flow of fluid through the wheel by the combined operation of the outer port-hole and the tail-blade c^1 thereof, but also the tendency to cause cavitation at the back of the tail-blade c^1 will be requisitioned to induce still more fluid to flow through the wheel by the combined effect of the inner port-hole and the tail-blade c^2 secured to its inner edge. The principle of action above described may be utilized still further by the employment of more than two port-holes in each vane.

In Fig. 6 is shown a vane in which the port-hole construction is applied to the tail-blade *c* as well as to the vane itself, Fig. 7 showing the port-hole in the vane and Fig. 8 the port-hole in the tail-blade. In the drawing the port-hole in the vane is shown of less width than the port-hole in the tail-blade, the fluid deflected by the plate *b* being in this arrangement intended to assist in entraining other fluid through the wider port-hole formed in the tail-blade, the combination enhancing the before described inspiration effect. The port-hole construction of tail-blade whereby fluid is admitted to the diverging space provided between the vane and tail-blade possesses the advantage that the partial vacuum tended to be continually maintained by centrifugal action within the diverging space between the sides marked c^1 c^1 (Fig. 8) of the tail-blade and the vane has a flow-inducing effect on the fluid. Accordingly the port-hole construction of tail-blade may be adopted with advantage even without a port-hole in the vane itself.

Fig. 9 shows an assemblage of double-ported principal vanes A^1 A^2 with an interposed single-ported secondary vane B provided with a single port and a tail-blade which does not extend to the outer periphery of the wheel. The principal vanes A^1 A^2 are shown fitted with scoop shaped additions c^1 c^2 extending into the air-inlet circle of the wheel in a manner already known.

I claim:

1. In a centrifugal fan or pump-wheel, a vane formed with a port-hole therein and a tail-blade at the back of the vane the surface of which is so shaped and situated as to diverge from the back surface of the vane at a rate which is greater than that due to mere increase of radius.

2. In a centrifugal fan or pump-wheel, a vane formed with a port-hole therein and a tail-blade at the back of the vane the surface of which is so shaped and situated as to diverge from the back surface of the vane at a rate which is greater than that due to mere increase of radius and which is so situated and directed as to guide the fluid which passes through the port-hole to the divergent space between the outer portion of the back of the vane and the immediately following tail-blade.

3. In a centrifugal fan or pump-wheel, a vane formed with a port-hole therein and a tail-blade, the inner edge of which is in close proximity with the inner edge of the port-hole, the tail-blade being so shaped as to diverge from the back of the vane.

4. In a centrifugal fan or pump-wheel, a vane formed with a port-hole therein and a tail-blade, the inner edge of which is secured to the inner edge of the port-hole, the tail-blade being so shaped as to diverge from the back of the vane.

5. In a centrifugal fan or pump-wheel, a vane formed with a port-hole therein and a tail-blade, the inner edge of which is in close proximity with the inner edge of the port-hole, the tail-blade being so shaped as to di-

verge from the back of the vane and extend to a greater radius than that of the outer edge of the port-hole.

6. In a centrifugal fan or pump-wheel, a vane formed with a port-hole therein, a tail-blade extending backward from the inner edge of the port-hole in a direction diverging from the vane to a radius greater than that of the outer edge of the port-hole, and a deflecting plate leading from the outer edge of the port-hole in a direction forward from the vane and toward the axis of the wheel.

7. In a centrifugal fan or pump-wheel, a vane formed with a port-hole therein, a tail-blade extending backward from the inner edge of the port-hole in a direction diverging from the vane, a deflecting plate leading from the outer edge of the port-hole in a direction forward from the vane and toward the axis of the wheel and gusset side-plates leading from opposite edges of the deflecting plate to the forward surface of the vane.

8. In a centrifugal fan or pump-wheel, a vane formed with a port-hole therein and a tail-blade at the back of the vane the surface of which is so shaped and situated as to diverge from the back surface of the vane at a rate which is greater than that due to mere increase of radius, the said tail-blade being concave to the back surface of the vane.

9. In a centrifugal fan or pump-wheel, a vane formed with a plurality of port-holes and for each port-hole a tail-blade leading in a divergent direction backward from the vane from the inner edge of the port-hole and extending to a radius greater than that of the outer edge of the port-hole.

10. A centrifugal fan or pump-wheel, comprising a plurality of vanes formed with port-holes therein and diverging tail-blades leading rearward from the inner edges of the port-holes and scoop-shaped additions to such vanes extending into the air inlet circle of the wheel.

11. A centrifugal fan or pump wheel, comprising a plurality of scoop-provided vanes and a plurality of interposed vanes without scoops, each vane being formed with a port-hole therein fitted with a backwardly diverging tail-blade extending from the inner edge of the port-hole to a radial distance not less than the radius of the outer edge of the said port-hole.

12. In a centrifugal fan or pump-wheel, a combination comprising a vane and a tail-blade at the back of the vane, the surface of which is so shaped and situated as to diverge from the back surface of the vane at a rate which is greater than that due to mere increase of radius, the tail-blade being formed with a port-hole therein.

13. In a centrifugal fan or pump-wheel a combination comprising a vane and a tail blade secured thereto, the vane and the tail-blade having each a port-hole formed therein.

14. In a centrifugal fan or pump-wheel, a combination comprising a vane formed with a port-hole and a tail-blade formed with a port-hole and secured to said vane, the width of the port-hole in said vane being less than the width of the port-hole in said tail-blade.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE MARIE CAPELL.

Witnesses:

HENRY WEBB WAGHORN,

H. D. JAMESON.