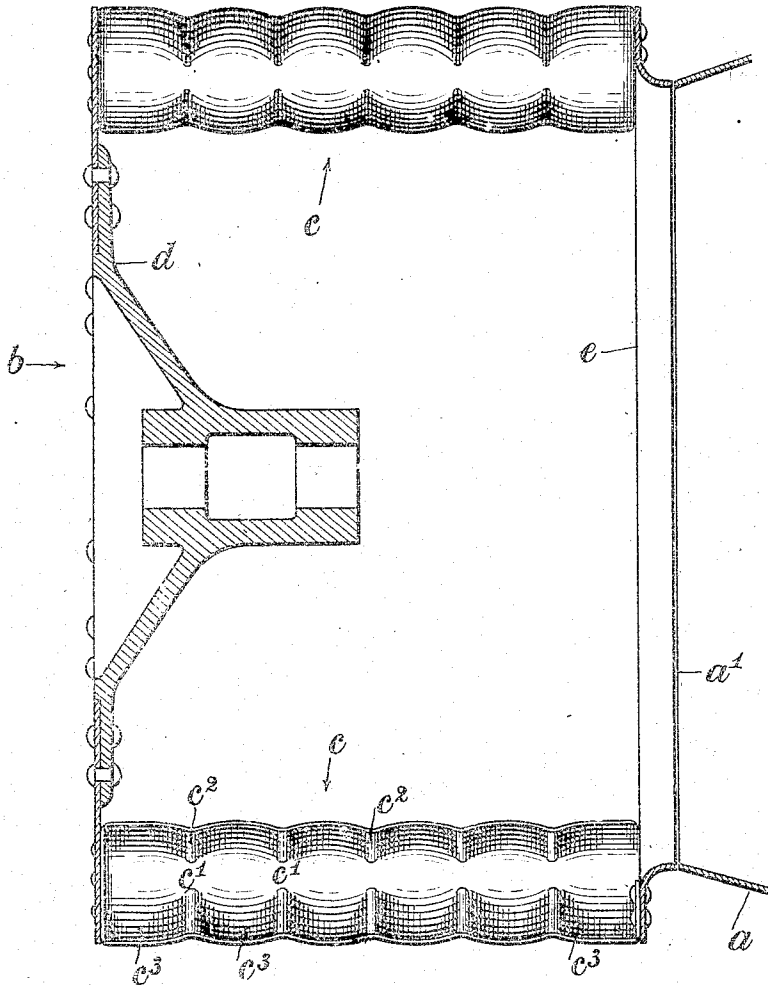


O. B. JACOBSEN.
BLADE OF CENTRIFUGAL FANS.
APPLICATION FILED MAY 28, 1909

939,136.

Patented Nov. 2, 1909.
2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

[Signature]
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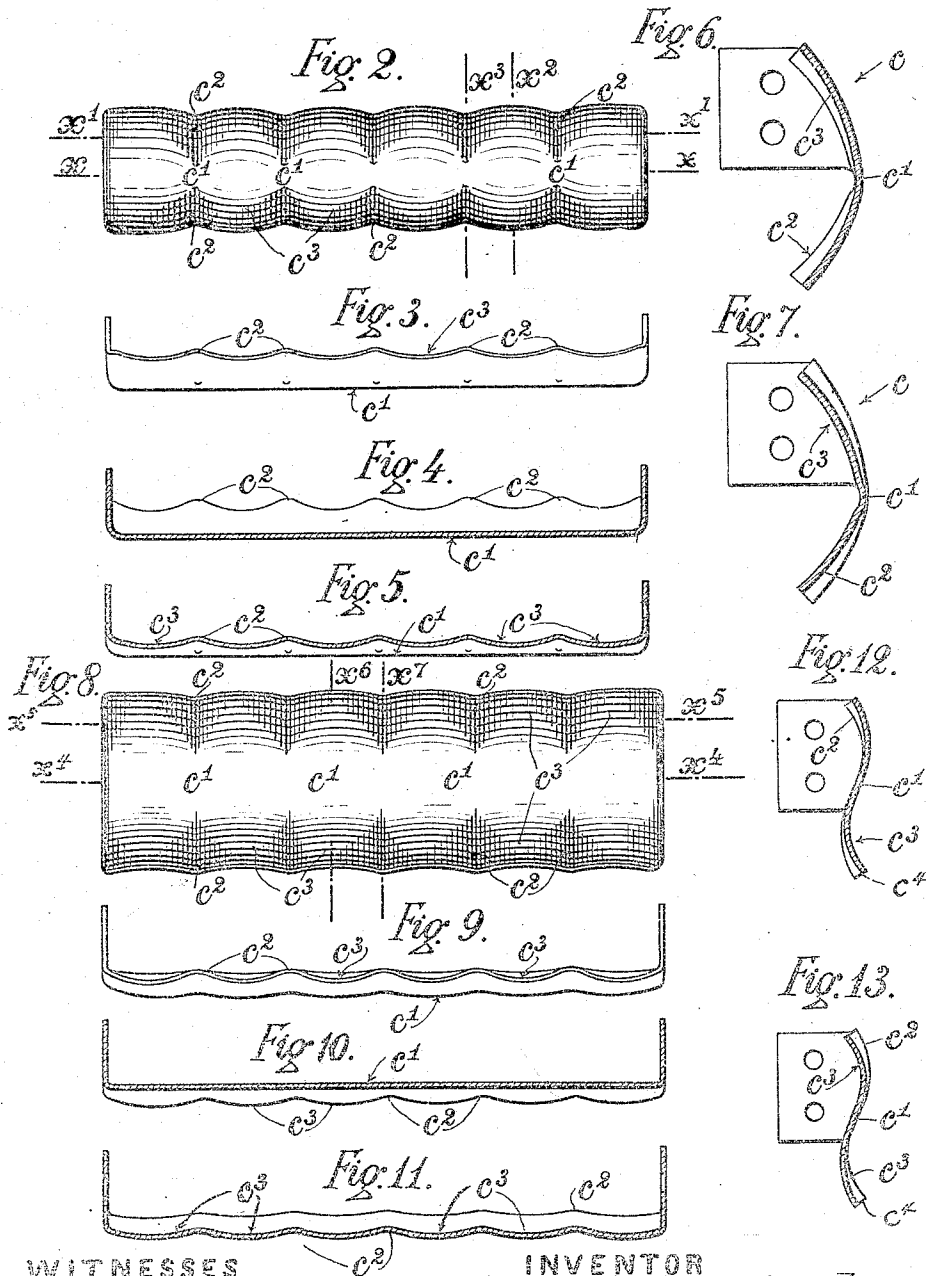
INVENTOR

Olaf B. Jacobsen
By James L. Norris
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UNITED STATES PATENT OFFICE.

OLAF BERG JACOBSEN, OF ASTON, NEAR BIRMINGHAM, ENGLAND, ASSIGNOR OF ONE-HALF TO THE ELECTRIC AND ORDNANCE ACCESSORIES COMPANY LIMITED, OF BIRMINGHAM, ENGLAND.

BLADE OF CENTRIFUGAL FANS.

939,136.

Specification of Letters Patent.

Patented Nov. 2, 1909.

Application filed May 28, 1909. Serial No. 498,844.

To all whom it may concern:

Be it known that I, OLAF BERG JACOBSEN, a subject of the King of Great Britain, residing at Aston, near Birmingham, England, have invented certain new and useful Improvements in the Blades of Centrifugal Fans, of which the following is a specification.

This invention has reference to blades for centrifugal fans of what are known as the multivane type in which the runner is provided at the periphery, with a plurality of long and narrow blades arranged parallel to the axis of the fan and consists in improvements in the construction or formation of blades of the kind described in the specification of the British Letters Patent No. 14,080 of 1905, wherein said blades are made of a compound corrugated formation; that is of a corrugated section longitudinally combined with a plurality of cross or transverse corrugations. This compound corrugated formation has the effect of providing, along the length of the acting face of the blade, a series or plurality of spoonings or air cuppings, which are divided from one another laterally by the transverse corrugations or ridges which extend uninterruptedly from edge to edge of the blade in its narrow dimension. But it has been found in practice that, as a consequence of the transverse corrugations corresponding to the ridges between the air-cups, the longitudinal stiffness of the blades is impaired and they therefore have a tendency (particularly when used in fan-runners of large diameter) to bend or arch in their longer direction under the stresses to which they are subjected when the fan is run at high velocities.

The object of the present invention is to remedy this defect and produce spooned or cupped blades which are so stiffened or strengthened in their longer direction as to enable them to effectually resist the bending or arching stresses, even such as may occur when a fan of large dimensions is being run at high velocities or on high pressure work. This object it is proposed to attain by embodying in the blade, an integral stiffener or stay, which is provided by forming the middle of the same, from end to end, with a part which, instead of partaking of the general compound corrugated formation, is left plain or intact or straight in its longitudinal

section and bisects or intersects the whole of the transverse ridges or corrugations so that each of the laterally-separated air-cups or spoonings is divided, as it were, into two parts located respectively on the opposite sides of the plain intact or uncorrugated area, while the transverse ridges or cross corrugations have their maximum depth or prominence at the edges of the blade and thence gradually shallow down or fall away and merge into the said uncorrugated middle area. The said intact area, or the part which is straight in its longitudinal section, may either be flat in its cross section, or of a flattened curve, or it may be given a ridge-like, ribbed or similar transverse section differentiating from the general transverse section of the blade so that it interrupts or breaks the continuity of the cross ridges or corrugations and imparts that longitudinal stiffness which resists and counteracts arching or bending under centrifugal or other stresses. This formation does not upset the air currents or affect the discharge of air through the ports between the blades and as the blades are still cupped by virtue of their compound corrugated formation above and below the plain or uncorrugated rib-like part, the advantages due to the cupped or spooned formation are in no way impaired.

Figure 1 of the accompanying drawings represents a centrifugal fan having a multivane runner whose blades are formed or constructed in accordance with one form of the present invention. This view shows elevations of the front or concave side of one blade and the back or convex side of another blade; the other parts of the fan being represented in section. Fig. 2 is an elevation of one of the said blades separately. Fig. 3 is an edge view of the said blade, and Fig. 4 is a longitudinal section through the plain part or stiffener upon the dotted line x Fig. 2. Fig. 5 is another longitudinal section taken on the dotted line x' Fig. 2. Figs. 6 and 7 show two sections taken through the transverse direction of the blade upon the dotted lines x^2 and x^3 respectively. Fig. 8 shows an elevation of a double curved or reflected blade in which the series of cross ridges and air cups or spoonings are bisected by an uncorrugated longitudinal part. Fig. 9 is an edge view of the blade shown in Fig. 8. Fig. 10 is a longitudinal section along the

line x^4-x^4 Fig. 8. Fig. 11 is a longitudinal section upon the line x^5-x^5 , Fig. 8, and Figs. 12 and 13 are two transverse sections taken respectively upon the lines x^6-x^6 and x^7-x^7 , Fig. 8.

The same letters of reference indicate corresponding parts in the said Figs. 1 to 7.

a is the casing of the fan and a^1 its intake eye, and b is the runner which comprises a plurality of blades or vanes c , arranged in the ordinary manner between the disk d and the mouth-ring e at the intake side. Each of the said blades is constructed or formed, as shown in Figs. 2 to 7, with the plain longitudinal part c^1 which runs from end to end along the middle of the said blade, and bisects, at a right angle, the cross corrugations or transverse ridges c^2 between the air cups or spoonings c^3 . As shown in Fig. 4, the said plain or intact part is straight in section in the longer direction, while in its transverse section it is slightly curved, the curvature being, as seen in Figs. 6 and 7, much flatter than the general transverse curvature of the compound corrugated blade which embodies the divided air-pockets or spoonings c^4 that alternate with the interrupted cross ridges c^2 . Or in other words, these ridges gradually diminish in depth as they proceed from the edges toward the middle of the blade and fall away or become gradually merged in the uncorrugated area c^1 . Instead of the transverse section of the plain or straight longitudinal part being of a flattened curve, differentiating from the general transverse curvature of the blade, the said part may be quite flat, or of any other section that will interrupt the ridges and constitute an integral or embodied stay which imparts the desired strength and longitudinal and transverse stiffness to the blades.

When a plurality of the improved blades are built into a fan-runner, their enhanced stiffness so strengthens the structure as to render unnecessary the use of the tangential stay-arms or tie-rods which have ordinarily to be arranged between the hub and the mouth ring in order to prevent the distortion of the latter by the centrifugal forces set up when such fans are driven at a high speed. In the fan shown in Fig. 1, no such separate stay-arms or tie-rods are used, as the blades themselves embody their own stays and are sufficiently stiff to keep the runner mouth ring e concentric with the eye a^1 of the casing, even when the runner is being driven at maximum speed.

The blades above described are (disregarding the uncorrugated longitudinal part)

generally of a single curved formation in the transverse or radial direction, but the improvement is also applicable to blades which have a double-curved reflected or ogee curved transverse or radial formation, as shown in Figs. 8 to 13, inclusive. In these figures the blade is shown as being double curved or reflected, and the series of cross ridges c^2 and air cups or spoonings c^3 as bisected by the plain or uncorrugated longitudinal part or stiffening area c^1 , which is disposed at the junction of the two opposite curves of the transverse section.

As shown in Figs. 8 to 13, inclusive, the longitudinal part c^1 , by reason of its differentiated transverse section, interrupts the continuity of the double curvature of both the ridges c^2 and the pockets c^3 and thereby stiffens the blade or enables it to effectively resist arching and other stresses.

Preferably these blades, when built up into a runner, are arranged with the inner edge c^4 leading, or presented in the direction of rotation. This particular form of blade admits of the construction of large diameter fans which are absolutely stiff or rigid and can be driven at much higher velocities than are obtainable, with the same power, in fans of the same dimensions but having ordinary plain or corrugated blades.

Having fully described my invention, what I desire to claim and secure by Letters Patent is:—

1. A compound-corrugated centrifugal fan blade embodying an integral stay or rib formation or stiffening area, substantially as described.

2. A compound-corrugated blade for centrifugal fans, embodying an integral stay or stiffener consisting of a part or area which is plain or intact or which is straight in longitudinal section and intersects or interrupts the transverse ridges or cross corrugations and extends from end to end of the blade, substantially as described.

3. An improved compound corrugated fan blade having a plain or intact longitudinal stiffening area for the purpose set forth.

4. The improved compound corrugated fan blade having a double curved or reflected transverse section and a plain or intact longitudinal stiffening area, for the purposes herein referred to.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

OLAF BERG JACOBSEN.

Witnesses:

HENRY SKERRETT,

HENRY NORTON SKERRETT.