May 22, 1923. 1,456,085

J. WILKINSON

ELASTIC FLUID TURBINE

Filed Dec. 29, 1921

Fig. 1.

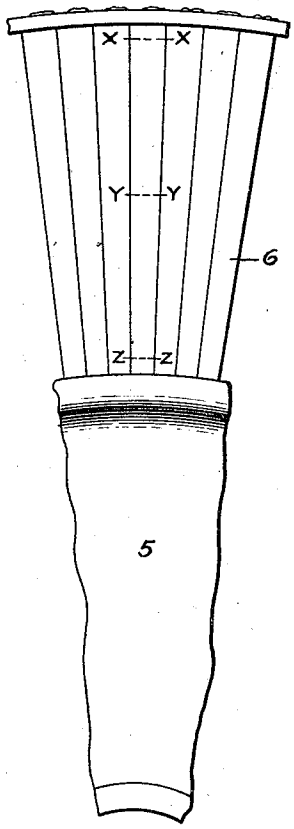



Fig. 2.

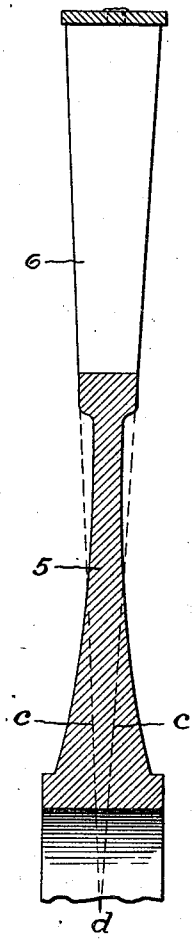
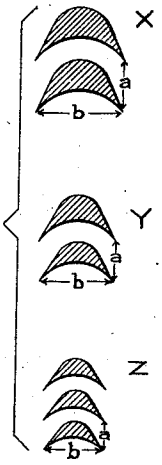



Fig. 3.




Inventor:
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His Attorney.

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# UNITED STATES PATENT OFFICE.

JAMES WILKINSON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## ELASTIC-FLUID TURBINE.

Application filed December 29, 1921. Serial No. 525,666.

*To all whom it may concern:*

Be it known that I, JAMES WILKINSON, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

The present invention relates to elastic fluid turbines and has for its object to provide an improved bucket or blade structure.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing Fig. 1 is a side elevation of a part of a turbine rotor element having blades or buckets embodying my invention; Fig. 2 is a radial sectional view of Fig. 1 taken between two adjacent blades, and Fig. 3 comprises three sectional views marked X, Y and Z of adjacent blades, the views being taken on lines X—X, Y—Y and Z—Z, respectively, Fig. 1.

Referring to the drawing, 5 indicates a turbine rotor member here shown in the form of a disk or wheel. Mounted on its periphery is a ring of blades or buckets 6 which may be attached to it in any suitable manner. The foregoing is to be taken as typical of any turbine rotor comprising a carrying member with a ring or rings of blades or buckets mounted thereon.

According to my invention, I provide blades or buckets of such shape that when mounted on the carrying member the ratio of the pitch to the width of blade or bucket is constant, or substantially constant, throughout the length of blade or bucket. By pitch is meant the distance between blades, being the distance indicated by $a$ in Fig. 3, and by width of blade is meant the distance between the entrance edge and the exit edge indicated by $b$ in Fig. 3. At every point throughout the length of the blades $\frac{a}{b}$ = constant. To this end the blades are made tapering in the direction of their length, the blades being narrowest at their inner ends and widest at their outer ends. They are preferably tapered uniformly along lines which converge to the center of the rotor as indicated by dotted lines $c$, the center of the rotor being indicated at $d$. This gives a constant ratio between pitch and width, since the blades all radiate from the center of the rotor. Furthermore, I preferably shape the blades so as to obtain uniform overlap, by overlap being meant the amount which the concave side of a blade overlaps the convex side of the next adjacent blade. With blades having a uniform taper converging to the center of the rotor, uniform overlap is obtained by a blade, having a radius of curvature which increases uniformly throughout its length from root to tip.

It is well recognized that for given conditions, a certain ratio of pitch to width and a certain amount of overlap gives the highest efficiency. With blades of uniform width, however, these conditions must be successively compromised. It is clear that with such blades if the ratio of pitch to width has its most efficient value midway between the ends of the blades then toward the roots the ratio becomes too small while toward the tips it becomes too great. In other words, the blades are too close together at their roots and too far apart at their tips. Also if the overlap is correct midway between the ends of the blades, then it becomes too great at the base and insufficient at the tip. By my invention I overcome these difficulties and thereby increase the efficiency of the blade ring.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In an elastic fluid turbine, a carrying member and blades projecting radially therefrom, the ratio of pitch to width being substantially uniform throughout the length of the blades.

2. In an elastic fluid turbine, a carrying member and blades projecting radially therefrom, said blades being widest at their tips and tapering toward the roots.

3. In an elastic fluid turbine, a carrying member and blades projecting radially therefrom, said blades having substantially uni-

form overlap throughout their length.

4. In an elastic fluid turbine, a carrying member and blades projecting radially therefrom, the ratio of pitch to width being substantially uniform throughout the length of the blades, and said blades having substantially uniform overlap throughout their lengths.

5. In an elastic fluid turbine, a carrying member and blades projecting radially therefrom, said blades being widest at their tips and tapering toward the roots, the taper being along lines which converge to the center of the carrying member.

6. As an article of manufacture, a turbine blade which tapers outwardly from its root to its tip.

7. As an article of manufacture, a turbine blade which tapers outwardly from its root to its tip and has a gradually increasing radius of curvature.

8. In an elastic fluid turbine, a carrying member and blades thereon, said blades tapering from their tips to their roots along lines which converge to the center of the carrying member.

In witness whereof, I have hereunto set my hand this 28th day of December, 1921.

JAMES WILKINSON.