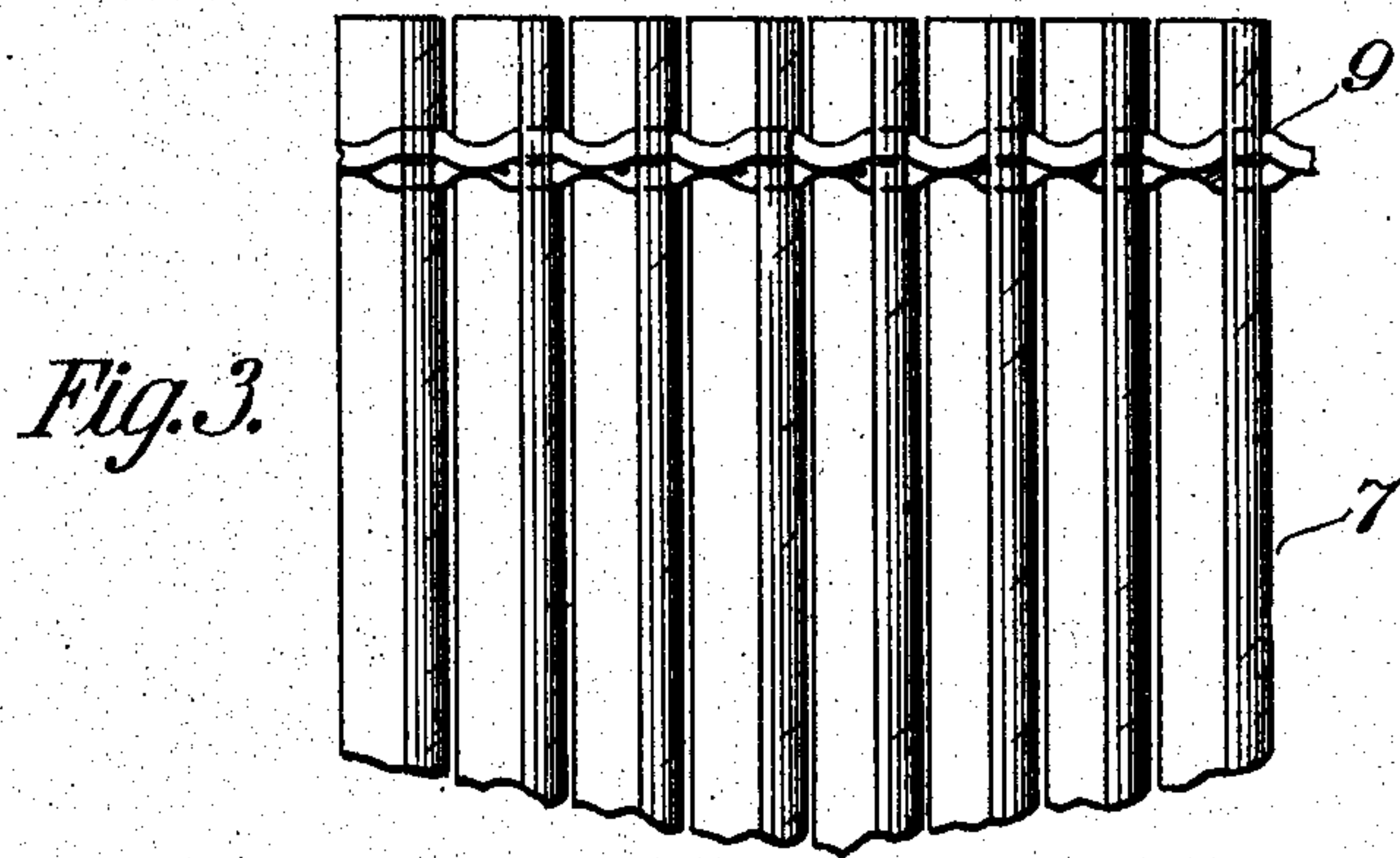
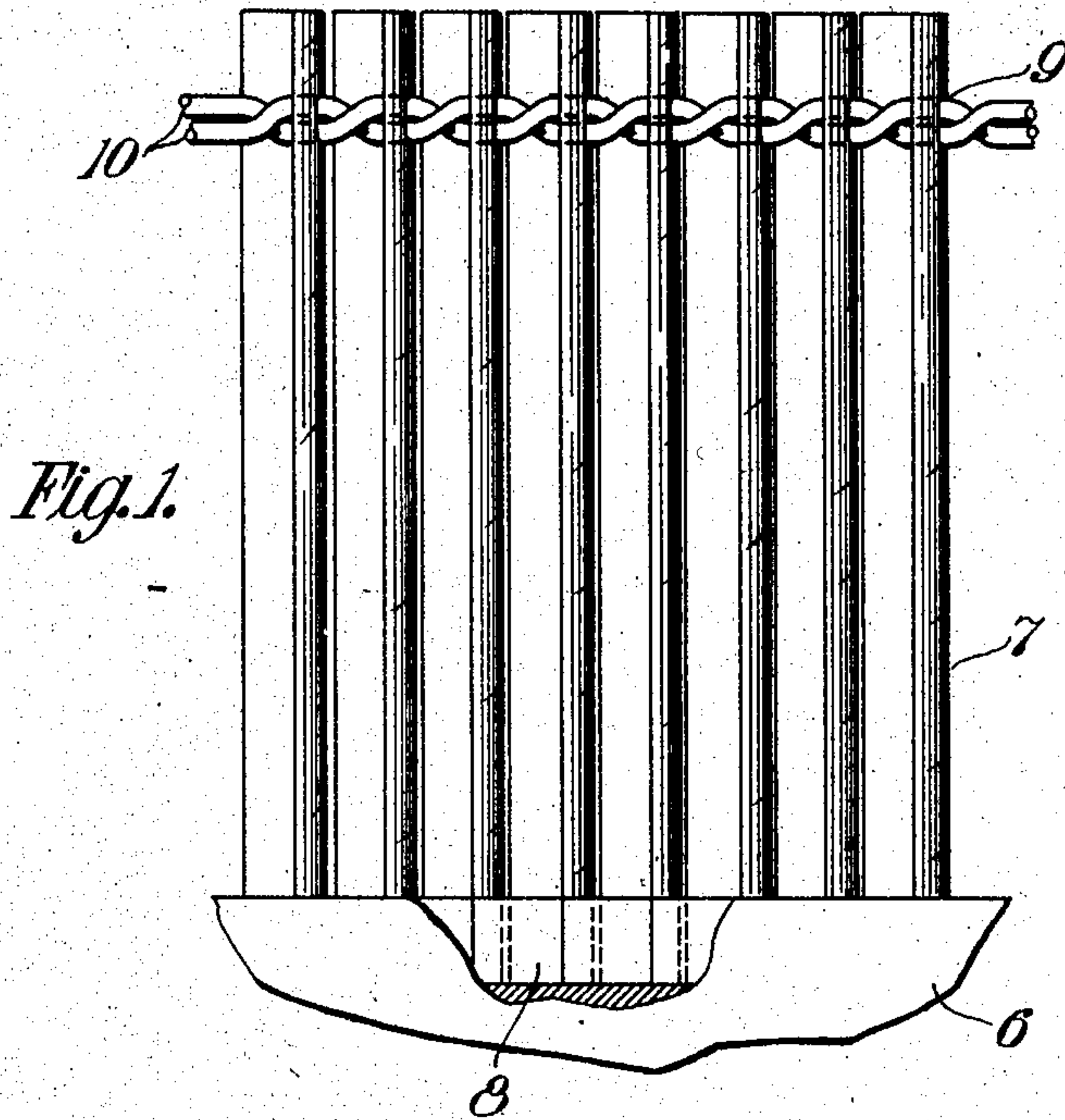


No. 791,744.

PATENTED JUNE 6, 1905.

E. E. ARNOLD.  
ELASTIC FLUID TURBINE.  
APPLICATION FILED MAR. 22, 1905.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

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## ELASTIC-FLUID TURBINE.

SPECIFICATION forming part of Letters Patent No. 791,744, dated June 6, 1905.

Application filed March 22, 1905. Serial No. 251,422.

*To all whom it may concern:*

Be it known that I, EDWIN E. ARNOLD, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Elastic-Fluid Tur-

bines, of which the following is a specification. This invention relates to elastic-fluid turbines, and more particularly to tying or binding means for the blades or vanes thereof.

It is now common in elastic-fluid turbines in which the vanes and blades thereof are arranged in annularly-extending rows to secure the outer ends of the blades and vanes comprised in one such row together, and as shown by Letters Patent No. 639,608, of December 19, 1899, attempts have been made to this end by soldering or brazing the blades comprised in a row to a binder strip or wire passing through openings therefor in said blades or vanes. In practice it has been found that the results secured by the method described and illustrated in said patent are not as satisfactory as might be desired; and to the end of reducing the cost of manufacture by reducing both the cost of labor and material, to the securing of a stronger construction, as well as numerous other results which will readily appear to one skilled in the art to which this invention pertains, my invention consists in the method hereinafter described and the means illustrated in the drawings accompanying this application and forming a part thereof.

In the drawings accompanying this application and forming a part thereof, Figure 1 is a view in side elevation of a plurality of turbine blades or vanes, the outer or free ends of which are shown tied or bound together. Fig. 2 is a plan view of the said blades or vanes and their binding-wires. Fig. 3 is a fragmentary view of a plurality of turbine blades or vanes, the outer ends of which are tied or bound together by a modification of the method illustrated in Fig. 1. Fig. 4 is a plan view of the said blades or vanes and their binding-wires.

As this invention may be utilized in various types of turbines and also in various types of

compressors and pumps and is applicable either to the rotor-blades or stator-vanes thereof, the blades or vanes may be of any desired contour in cross-section, of any desired length, or formed of any desired material in any desired manner. The blades or vanes may be secured to the rotors or stators in any desired manner; but they are preferably secured to their holding member—that is, either the rotors or stators—as illustrated and described in said Letters Patent No. 639,608. As illustrated in the drawings, the rotor or stator member, which may be represented by 6, is provided with an annular or circumferentially-extending slot or channel, within which the inner ends of the blades or vanes 7 are secured by means of calking or spacing elements or pieces 8, as is now common. For the sake of clearly describing this method it will be understood that the side walls of these channels or slots are roughened or undercut and that by means of suitable calking-irons or other tools the spacing pieces or blocks 8 are caused to spread transversely to the applied pressure and to grip the walls of the channels and the vanes or blades, whereby said vanes or blades are securely held to the stator or rotor, as the case may be. Each blade adjacent to its outer end, as at 9, is provided with a hole or opening through which is inserted one or more binding strips or wires. As shown in Fig. 1 of the drawings, two wires 10 are utilized. If desired, these wires may be cut into lengths sufficient to embrace only a few blades or vanes, and the ends of the adjacent lengths may be secured together by brazing or any other suitable manner, and in mounting the blades the two binding-wires after being inserted through each blade are given one turn. This turn or twist holds the ends of the individual blades in definite and rigid position relative one to another. It will be seen by this operation of twisting the wires that the outer ends of the blades or vanes are locked together and secured against movement out of the row plane, as well as against movement toward or away from one another circumferentially.



In Figs. 3 and 4 the blades 7 are provided with holes, as at 9, through which the two binding-wires 10 are inserted. As in the previous case, these wires may be cut into lengths sufficient to embrace only a few blades or vanes and the ends of the adjacent lengths may be secured together by brazing or any other suitable means. After the lengths of wire have been placed in position by inserting them through the holes 9 they are distorted by being twisted or turned one about the other between adjacent blades or vanes. As in the previous case, this distortion of the wires locks the blades together and secures them against movement toward or away from one another circumferentially, as well as against movement out of the plane of rows. In this second method the wires may be inserted through the holes with which the blades are supplied after the blades or vanes are mounted to the rotor or stator, as the case may be.

Having thus described my invention, what I claim as new and useful, and desire to be secured by Letters Patent, is—

1. In combination with a turbine blade or vane holding element, a plurality of blades or vanes arranged in an annular row and locking-strips passing through the outer ends of said blades or vanes and which, between adjacent blades or vanes, are twisted.

2. In combination with a turbine blade or vane holding element, a plurality of blades or

vanes arranged in an annular row and locking-strips passing through the outer ends of said blades or vanes and which, between adjacent blades or vanes, are distorted by turning one about the other.

3. In combination with a turbine blade or vane holding element, a plurality of blades or vanes arranged in an annular row and two locking strips or wires adjacent to each other and passing through the outer ends of said blades or vanes and which, between adjacent blades or vanes, are twisted.

4. In combination with a turbine blade or vane holding element, a plurality of blades or vanes arranged in an annular row and two locking strips or wires adjacent to each other and passing through the outer ends of said blades or vanes and which, between adjacent blades or vanes, are distorted by turning one about the other.

5. In combination with an annular row of turbine blades or vanes, two locking-strips passing through said blades or vanes and which between adjacent blades or vanes are twisted one about the other.

In testimony whereof I have hereunto subscribed my name this 17th day of March, 1905.

EDWIN E. ARNOLD.

Witnesses:

DAVID WILLIAMS,  
JNO. S. GREEN.