

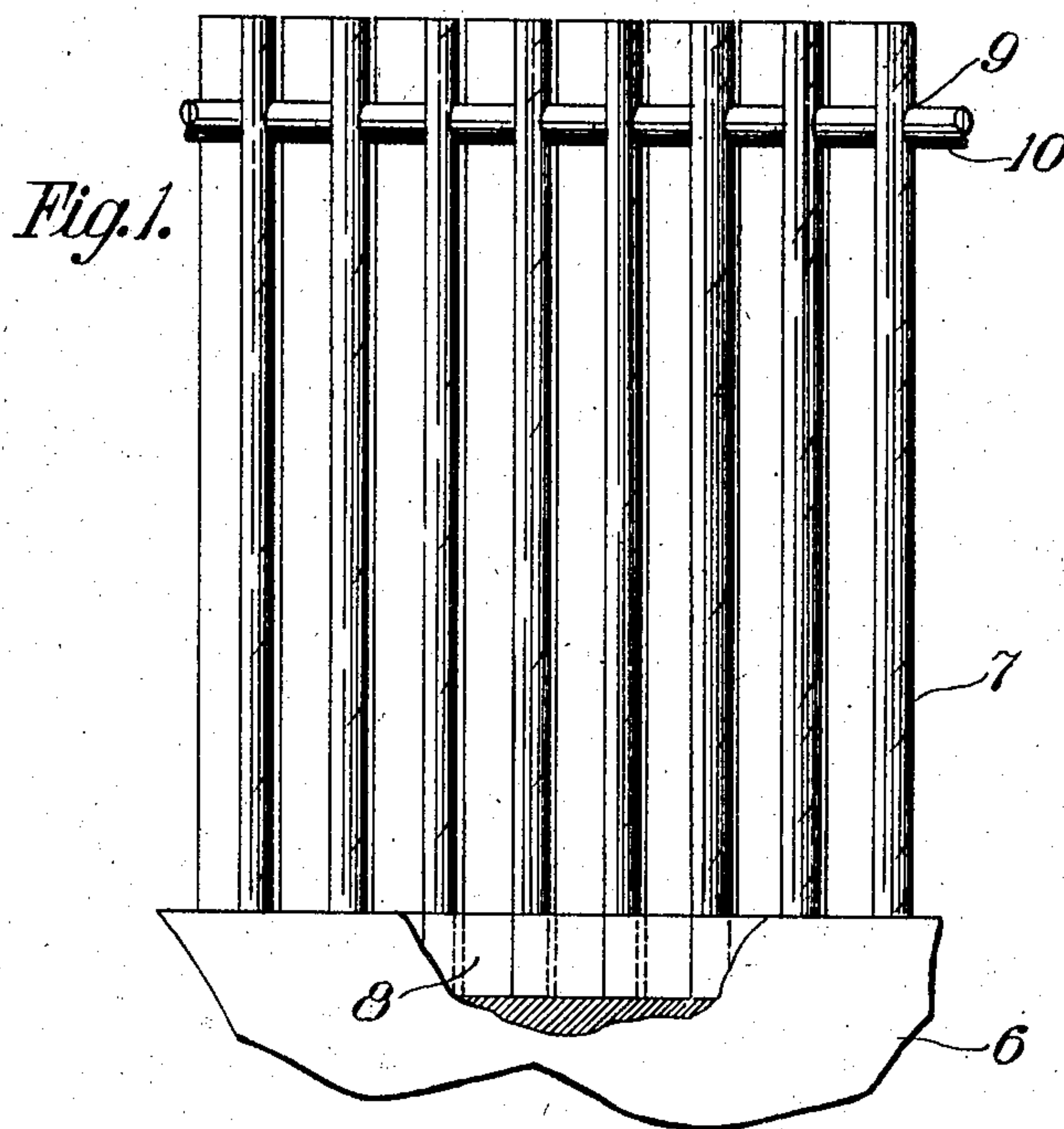
No. 791,735.

PATENTED JUNE 6, 1905.

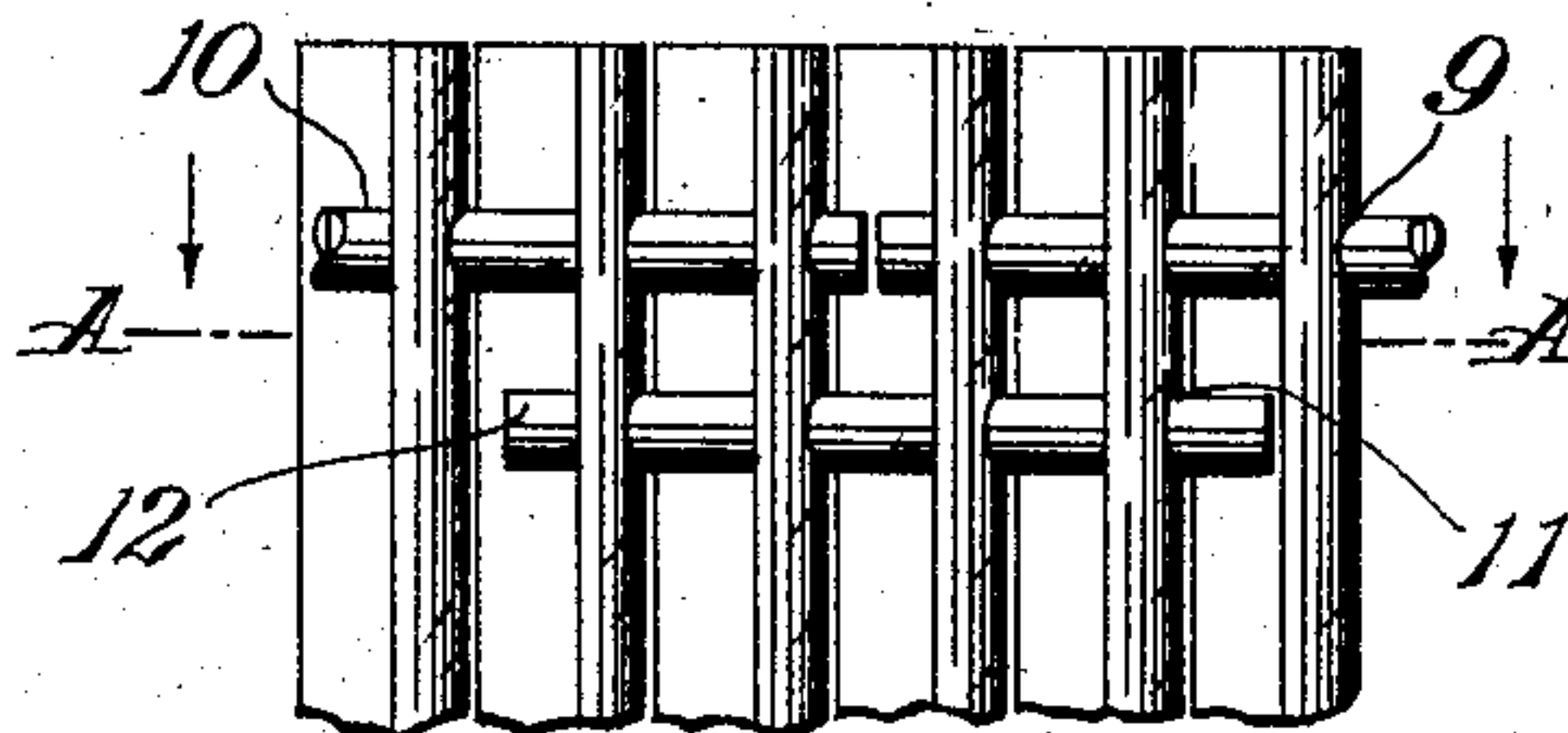
J. H. WAGENHORST.  
ELASTIC FLUID TURBINE.  
APPLICATION FILED MAR. 18, 1905.



*Fig. 2.*



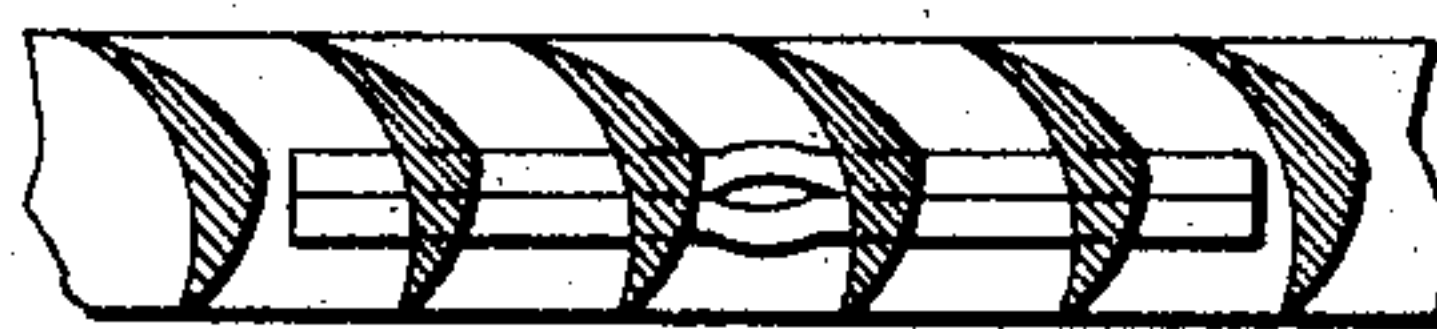
*Fig. 1.*



*Fig. 3.*



*Fig. 4.*



*Fig. 5.*

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# UNITED STATES PATENT OFFICE.

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## ELASTIC-FLUID TURBINE.

SPECIFICATION forming part of Letters Patent No. 791,735, dated June 6, 1905.

Application filed March 18, 1905. Serial No. 250,823.

*To all whom it may concern:*

Be it known that I, JAMES H. WAGENHORST, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Elastic-Fluid Turbines, 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 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, 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 bound or tied together by my method. Fig. 2 is a plan view looking toward the outer ends of said blades or vanes. Fig. 3 is a fragmentary view similar to Fig. 1 and illustrates the method and means for caring for the blades or vanes adjacent to the ends of the binder wires or strips which are utilized. Fig. 4 is a plan view looking toward the ends of the blades or vanes illustrated in Fig. 3; and Fig. 5 is a view in cross-section of the blades or vanes, taken on the line A A looking in the direction of the arrows in Fig. 3.

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 therefor, 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 members—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 for the passage therethrough of one or more binding strips or wires. As shown in Fig. 1 of the drawings, two wires or strips 10, each one of which is half-round in cross-section, are utilized. If desired, these wires may be cut into lengths sufficient to embrace only a few of the blades or vanes, and the ends of the adjacent lengths may be secured together by brazing or in any other suitable manner. After the lengths of wire or strips have been placed in position those extending through the same blades may be spread apart or separated, as shown in Fig. 2, and it will be seen that by thus spreading or separating the wires or strips the outer ends of the blades or vanes are locked together and secured against movement toward or away from one another circumferentially as well as against movement out of the plane of the row.

As illustrated in Fig. 3, the adjacent ends of



two split binding strips or wires 10, which extend through adjacent blades or vanes 7, are slightly separated. The split strips or wires at their ends are spread, as shown in Fig. 4, and extending through a second series of holes or openings 11, provided below the holes or openings 9, is another split binder wire or member 12, and between the blades or vanes adjacent to the separated ends of the binder strip or wire 10 this supplemental binder strip or wire 12 is spread, as shown in Fig. 5. By this method it will be seen that the two blades or vanes adjacent to the separated ends of the primary binder strip or wire 10 may be prevented from moving out of the row plane, and a joint in the nature of an expansion-joint is provided between adjacent groups of blades or vanes.

It will be seen that the spreading of the wires or binder-strips may be accomplished in various ways and that any method will fall within the scope of this invention in which the outer ends of a plurality of groups of blades or vanes are locked or bound together by distorting the binder strip or strips or wire or wires between the blades or vanes in such group.

Having thus described this invention, what I claim as new and useful, and desire to secure by Letters Patent, is—

1. In a turbine, a plurality of blades or vanes comprised in an annular row, and means preventing relative movement between said blades or vanes, which consists in a binder-strip which passes through said blades or vanes and which between adjacent blades or vanes is distorted.

2. In a turbine, a plurality of blades or vanes comprised in an annular row and a binding-strip formed of two half-round sections pass-

ing through said blades or vanes and which between adjacent blades or vanes is distorted.

3. In combination with an annular row of turbine blades or vanes, means binding a number of said blades or vanes together in groups and means binding adjacent groups together.

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

5. 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 lying side by side and passing through the outer ends of said blades or vanes and which between adjacent blades or vanes are spread apart.

6. In combination with the blade or vane holding element of a turbine, a plurality of blades or vanes comprised in an annular row, means locking the blades or vanes comprised in each row into groups, and an agent for locking the several groups together and which is adapted to allow two groups to move a predetermined distance toward or away from one another.

7. In combination with an annular row of turbine blades or vanes, binding means separating the blades or vanes into groups and connecting means forming expansion-joints between the adjacent groups.

In testimony whereof I have hereunto subscribed my name this 13th day of March, 1905.

JAMES H. WAGENHORST.

Witnesses:

DAVID WILLIAMS,  
JNO. S. GREEN.