

No. 767,367.

PATENTED AUG. 9, 1904.

G. WESTINGHOUSE.

TURBINE BLADE.

APPLICATION FILED DEC. 30, 1903.

NO MODEL.

Fig. 1.

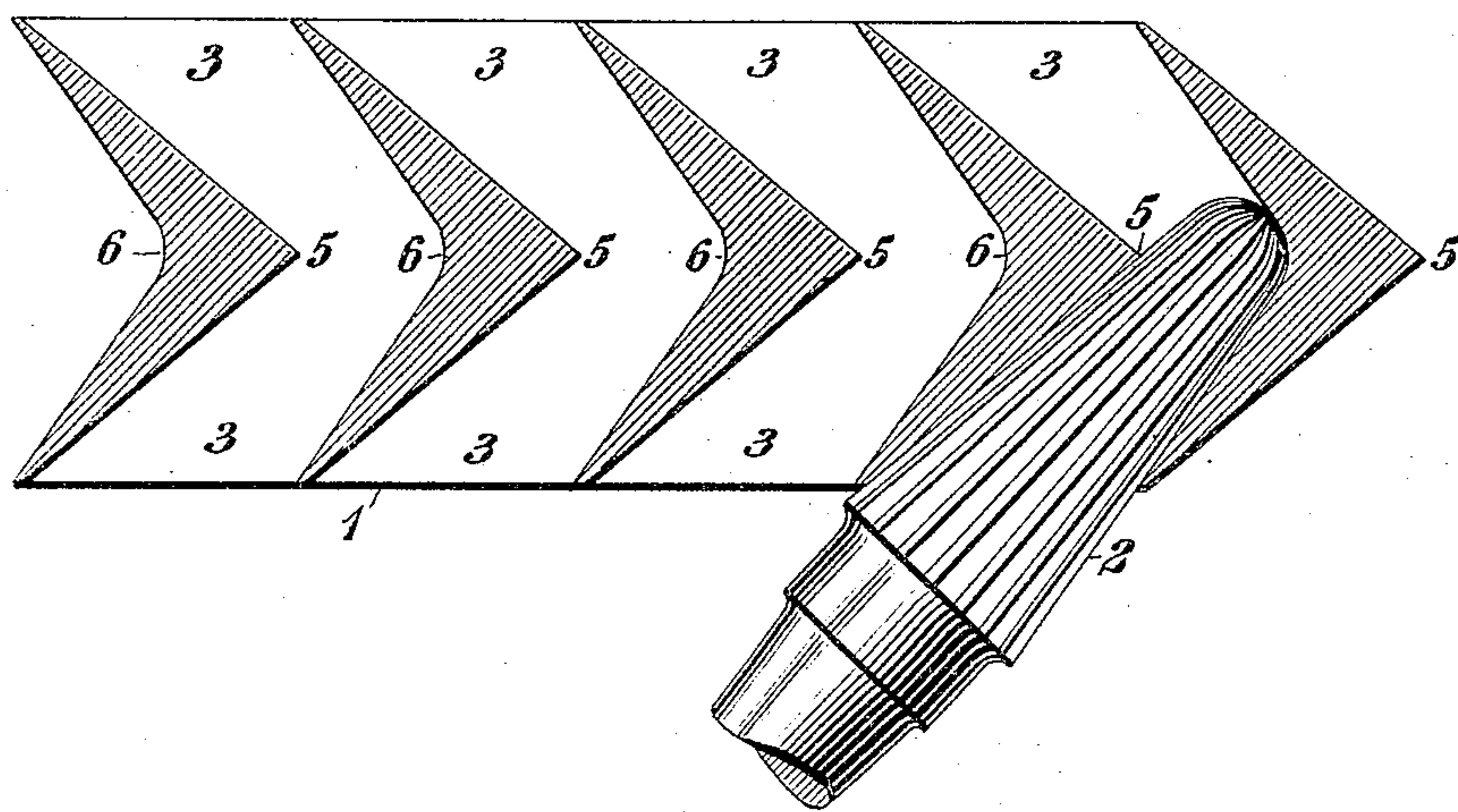
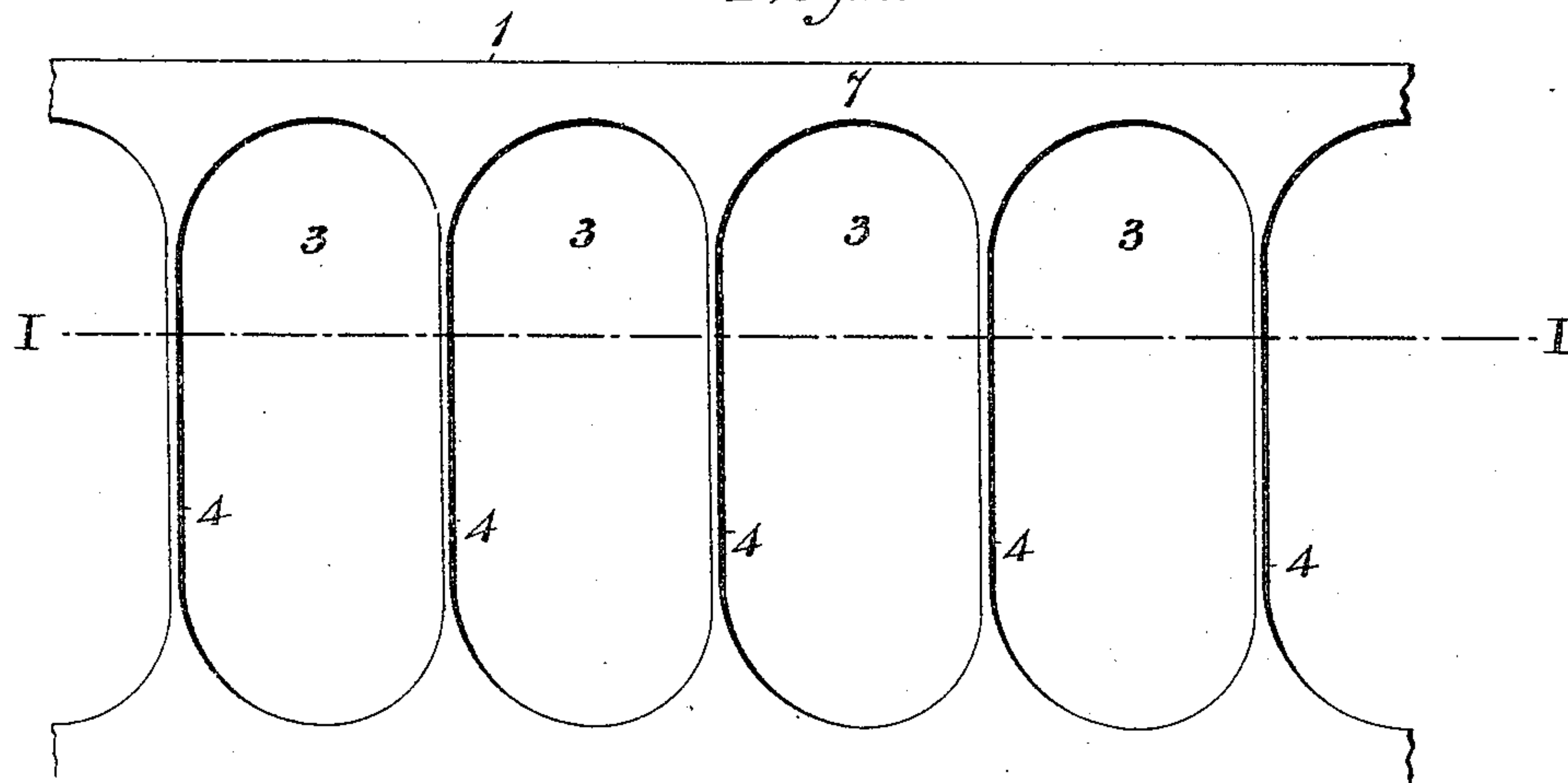


Fig. 2.



WITNESSES:

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TURBINE-BLADE.

SPECIFICATION forming part of Letters Patent No. 767,367, dated August 9, 1904.

Original application filed June 24, 1903, Serial No. 162,911. Divided and this application filed December 30, 1903. Serial
No. 187,243. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Turbine-Blades, of which the following is a specification, this application being a division of an application filed June 24, 1903, Serial No. 162,911, in which is claimed the method herein described but not claimed.

My invention relates to fluid-pressure turbines, and particularly to the blades or vanes and intervening passages which direct and utilize the velocity of the expanded fluid for producing rotary motion; and it has for its object to provide a simple, compact, and durable structure of the character indicated.

It has been a usual practice in constructing turbines of the Parsons type to form the blades and vanes as separate articles and to independently mount them in position in suitable grooves formed in the bases which are to serve as their supports, or in some cases the blades and vanes have been cut by a suitable milling-tool from the body of metal which constitutes the base for the blades or vanes; but in such cases the outer or free ends of the vanes or blades have been either unsupported or have been provided with separate shrouding rings or bands, and in such cases when applied to the rotating member it has been found difficult to so apply the bands that they shall be securely held in position against the strains exerted by the centrifugal action due to the high speed at which such member operates.

In accordance with my present invention I provide an integral structure which is easily and cheaply manufactured and which is practically free from any danger of destruction or disarrangement in service, whether embodied in the stationary or the rotating member of the turbine.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a sectional view on line I I of Fig. 2 and showing in operative position the

cutting portion of a tool employed for making the vanes and blades. Fig. 2 is a side elevation of a portion of a turbine member constructed in accordance with and embodying my invention.

Assuming that the blades or vanes are to be formed in a ring 1 of suitable metal, I first bore a series of holes into one side of the ring, preferably all at the same angle with the side face of the ring, by means of a suitable boring-tool, (not shown,) the angle at which the tool is operated being that selected for the steam-passages between the blades or vanes. I then bore a series of holes in the opposite side of the ring which correspond in number and position to the first set and preferably all at the same angle and equally spaced, but making any desired angle with the holes of the first set. I then insert the tool 2 into one of these holes and rotate it by suitable means and at the speed desired until the hole is cut to the desired depth, the tool being preferably tapered and rounded at its inner end, as indicated, so as to form a tapered passage which is widest at its outer end. I then move the tool laterally during its rotation, so that it will cut an oblong passage 3, as indicated in Fig. 2. The tool may then be inserted in the next hole in the series, and so on until all of them are cut as indicated. The ring may then be reversed and the tool inserted successively in the holes at the opposite side of the ring and after cutting to the desired depth be moved laterally, so as to form like oblong passages 3 in the opposite side of the ring. Each of the blades or vanes 4 thus formed in the ring has two plane front faces that meet at a sharp angle in the center of the ring and two rear plane faces which make a greater angle with each other and are joined at their inner ends by a curved surface 6.

It will be understood that the entire cutting operation may be effected by means of a single tool; but, as above stated, it will be generally found advantageous to make the preliminary holes by means of a separate boring-tool.

It will thus be seen that the vanes or blades are integral with the body portion of the ring and are connected by an integral shroud or web 7 at their outer ends.

5 As hereinbefore indicated, the meeting passages may be cut at such angles that the forward faces of each blade or vane may make like angles with the sides of the ring or different angles, as may be desired in practice. It
10 is also feasible to employ a cutter of different shape and dimensions and to otherwise vary the shape of the passages and the blades or vanes in any manner and to any degree desired.

15 I claim as my invention—

1. In a fluid-pressure turbine, a series of annularly-disposed blades having their corresponding ends connected by integral webs or bodies of metal and each having front sides

that meet at sharp angles and having rear 20 sides that are joined by a curved section.

2. In a fluid-pressure turbine, a series of annularly-disposed blades having their outer ends connected by an integral shroud and their inner ends connected by the body of metal 25 from which they are cut and each having double front and rear sides that are angularly disposed with reference to each other, the plane portions of the rear sides being connected by a curved space. 30

In testimony whereof I have hereunto subscribed my name this 11th day of December, 1903.

GEO. WESTINGHOUSE.

Witnesses:

H. C. TENER,
WM. H. CAPEL.