No. 752,340. PATENTED FEB. 16, 1904.

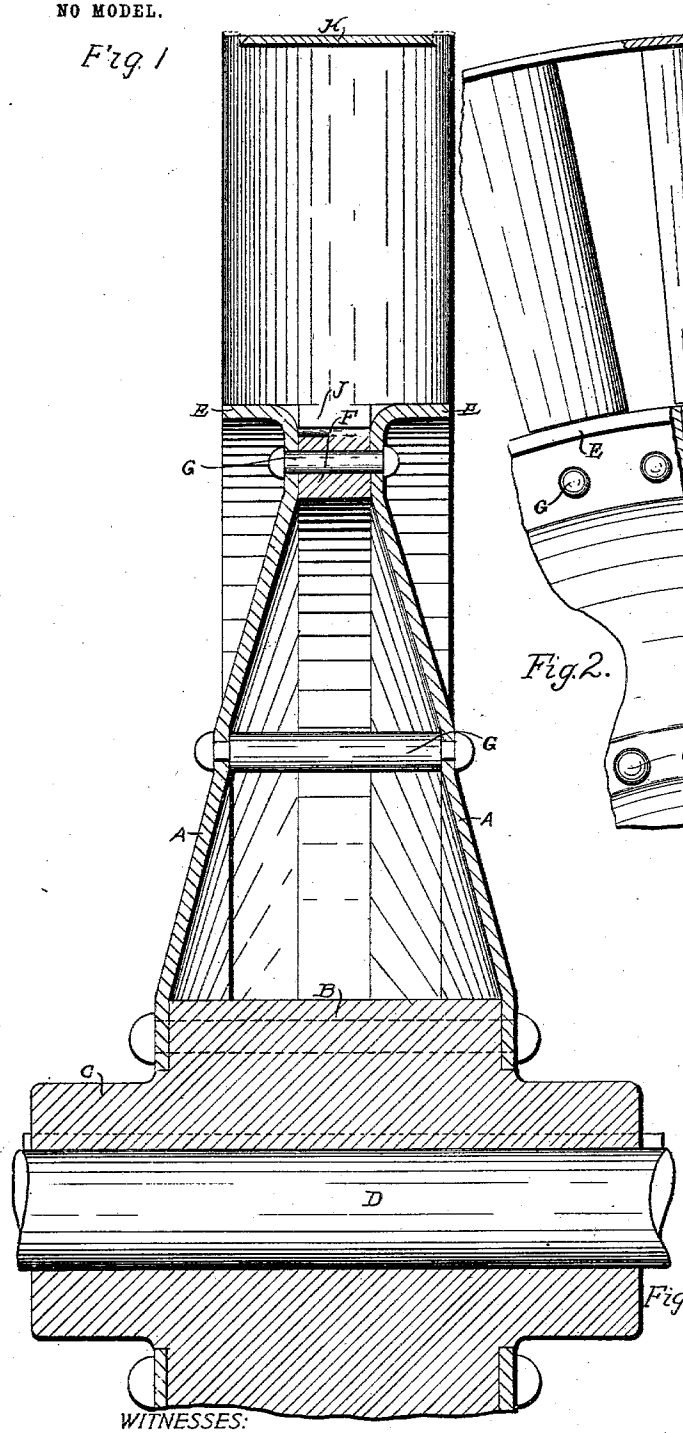
H. HOLZWARTH.

TURBINE.

APPLICATION FILED OCT. 22, 1903.

NO MODEL.

Fig. 1



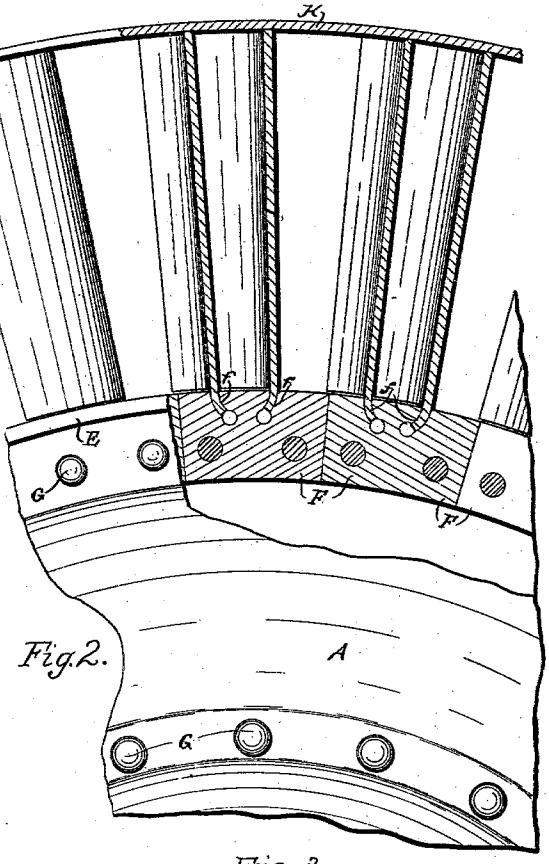
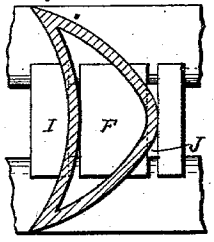


Fig. 2.

Fig. 3



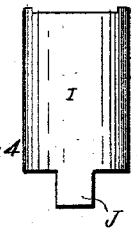


Fig. 4

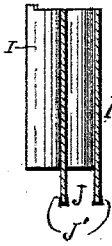


Fig. 5

WITNESSES:

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 752,340. Patented February 16, 1904.

UNITED STATES PATENT OFFICE.

HANS HOLZWARTH, OF HAMILTON, OHIO, ASSIGNOR TO THE HOOVEN-OWENS-RENTSCHLER COMPANY, OF HAMILTON, OHIO, A CORPORATION OF OHIO.

TURBINE.

SPECIFICATION forming part of Letters Patent No. 752,340, dated February 16, 1904.

Application filed October 22, 1903. Serial No. 178,062. (No model.)

To all whom it may concern:

Be it known that I, HANS HOLZWARTH, a citizen of Germany, residing at Hamilton, county of Butler, and State of Ohio, have invented new and useful Improvements in Turbines, of which the following is a specification.

My invention relates to improvements in the movable member of a turbine, with especial reference to the construction of the running wheels and vanes.

The object of my invention is to provide means for adequately supporting and securing the vanes in position.

In the following description reference is had to the accompanying drawings, in which—

Figure 1 is a radial sectional view of one of the running-wheels and a portion of the shaft. Fig. 2 is a side view of an outer portion of one of the wheels, drawn partly in section. Fig. 3 is a detail view of a portion of the periphery, showing one vane with the retaining-band removed. Fig. 4 is a view of one of the vanes, showing its concave side. Fig. 5 is a sectional view of the same.

Like parts are identified by the same reference characters throughout the several views.

The wheel is formed with two disks A A, which are bolted to a ring B on a sleeve C, the latter being mounted upon and turning with the shaft D to which it is splined. The outer edges of the disks are expanded to form laterally-projecting flanges E, and blocks F are secured in an annular row between the disks adjacent to the flanges E by bolts G. An intermediate row of bolts G′ is also provided to reinforce the disks. The latter preferably converge radially to more adequately reinforce each other. The blocks F taken together form a vane-supporting ring, of which each block is a segment.

Each of the blocks F is provided with angular channels *f*, extending inwardly from the outer surface of the block and converging, as best shown in Fig. 2, the bottom of each channel being preferably enlarged slightly, as shown. The vanes I are formed with lips J J on their front and rear walls, respectively, and these lips are bent convergingly and forced into the channels *f* as the outer edges of the vanes rest upon the flanges E. If desired, each lip may be thickened at J′ J′ in correspondence with the enlarged bottom portion of the channel. When the entire series of vanes are in position, a band K is adjusted to encircle the series, the band engaging the outer edges of the vanes, which are preferably slightly notched or recessed for the reception of the band.

It will be observed that with the described construction each of the vanes will be held rigidly in position by the engagement of its lips J J in the channels *f* of the blocks and by the outer band K. The blocks F may, if desired, be connected or formed integrally as a continuous ring. The lips J may be entered laterally before the disks are placed in position, or they may be pressed into the channels by direct pressure.

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

1. In a turbine, a vane-supporting wheel comprising a plurality of disks; a supporting-shaft rigidly connected with the disks; and a ring located between the outer portions of the disks; a series of vanes, each having a plurality of lips extending at different angles into cross-channels in said ring from the inner and outer sides of the vane respectively; said disks being arranged to cover the ends of the cross-channels to hold the vanes in position laterally.

2. In a turbine, a movable member having a vane-supporting ring provided with channels in its periphery substantially parallel at the surface of the ring, but extending inwardly at different angles; and a series of vanes each having a plurality of lips engaged in said channels.

3. In a turbine, a movable member having a vane-supporting ring; and a series of vanes mounted on the ring; each of said vanes and the ring being formed to interact in different planes cutting the surface of the ring along substantially parallel lines, but extending at different angles to such surface; together with

means for holding the interacting portions of the vanes in position against lateral movement.

4. In the running-wheel of a turbine, a vane-supporting block provided with channels extending at different angles in the outer surface of the block; and a vane having lips entering said channels.

5. In the running-wheel of a turbine, a vane-supporting block having channels extending into the outer portion of the block at different angles but parallel at the surface; and a vane having lips engaged in said channels.

6. In the running-wheel of a turbine, a vane-supporting block having channels extending into the outer portion of the block at different angles but parallel at the surface; and a vane having lips engaged in said channels, said lips having enlarged portions fitting enlarged portions of the channels.

7. In a turbine, a movable member having a shaft; radially-converging disks rigidly connected with the shaft; a ring interposed between the outer portions of the disks and rigidly secured thereto; a series of vanes having lips engaging in channels in the ring; and a ring encircling the outer ends of the vanes, whereby the latter are held in the inner ring.

8. In a turbine, a movable member having a vane-supporting ring; and a series of vanes mounted on the ring; each of said vanes being arranged to interact with the ring at the central end portions of inner and outer surfaces of the vane, and at different angles.

In testimony whereof I affix my signature in the presence of two witnesses.

HANS HOLZWARTH.

Witnesses:

EDW. D. FRANK,

EUGEN WEBER.