No. 749,770. PATENTED JAN. 19, 1904.

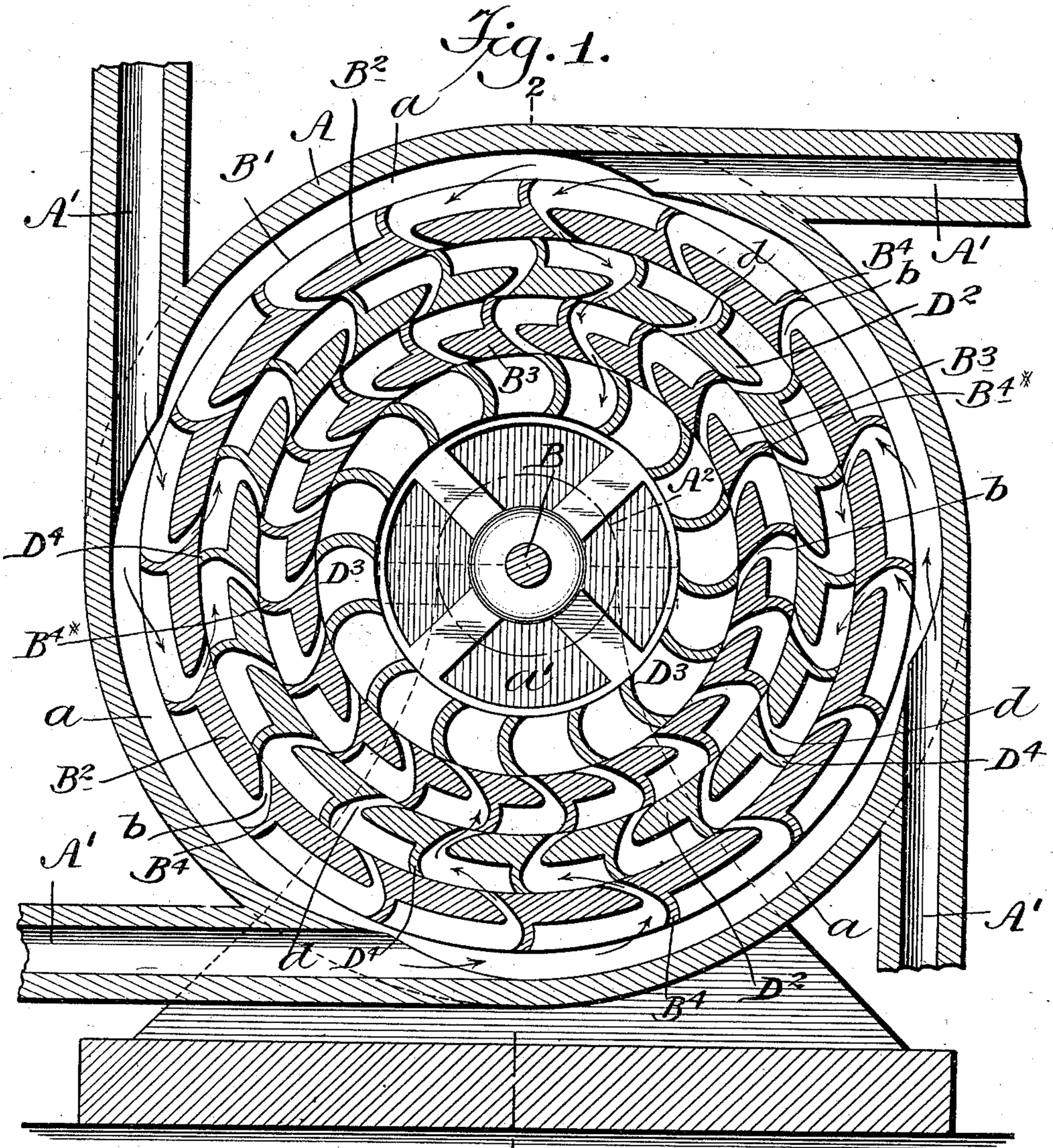
E. J. WOOD.

TURBINE.

APPLICATION FILED JUNE 1, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

M. F. Boyle

INVENTOR

Edgar J. Wood

BY

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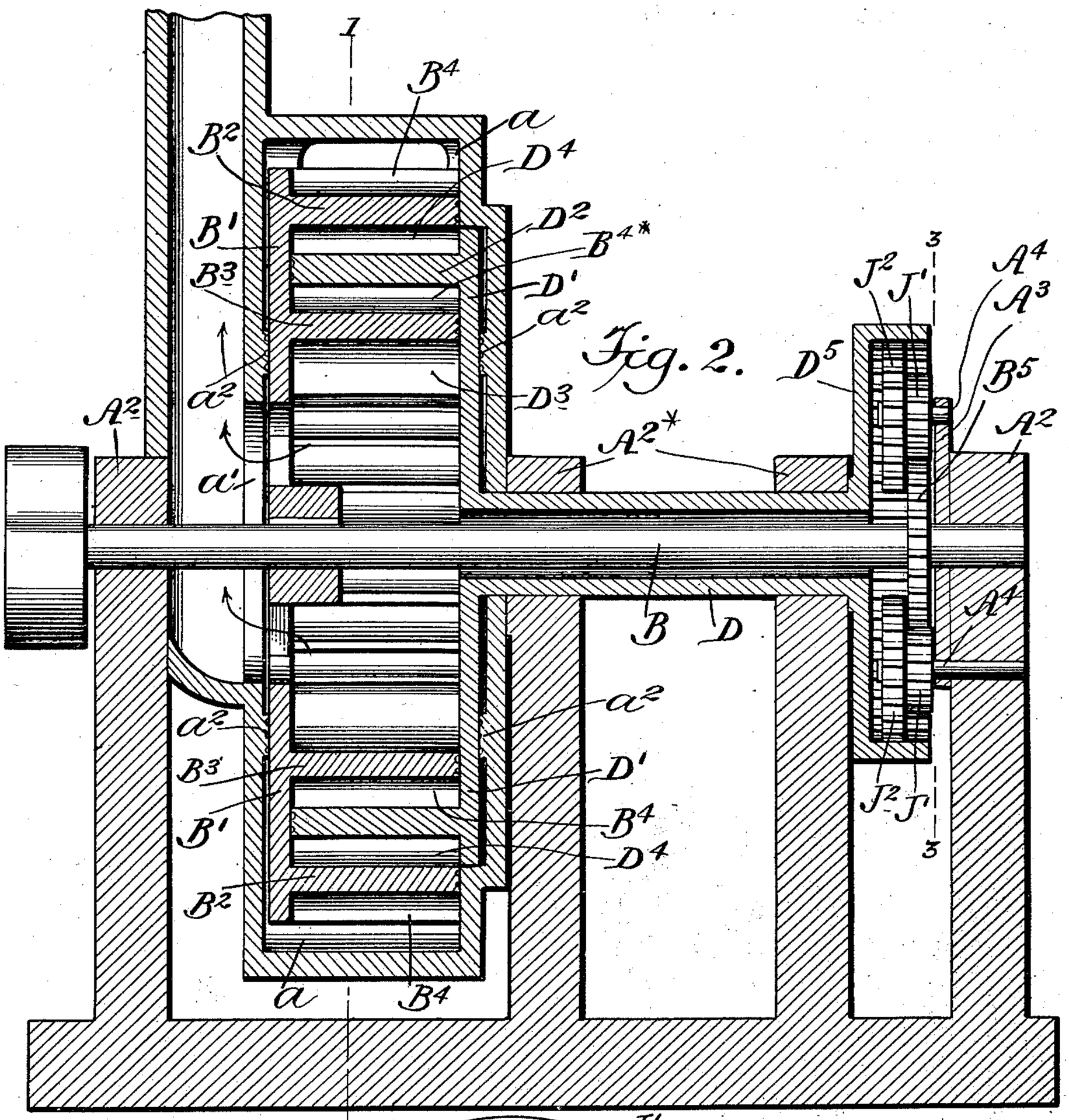

Fig. 2.

Fig. 3.

WITNESSES:

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No. 749,770. Patented January 19, 1904.

UNITED STATES PATENT OFFICE.

EDGAR J. WOOD, OF NEW YORK, N. Y., ASSIGNOR TO MARGARET A. WOOD, OF BROOKLYN, NEW YORK.

TURBINE.

SPECIFICATION forming part of Letters Patent No. 749,770, dated January 19, 1904.

Application filed June 1, 1903. Serial No. 159,551. (No model.)

To all whom it may concern:

Be it known that I, EDGAR J. WOOD, a citizen of the United States, residing in the borough of Brooklyn, in the city and State of New York, have invented a certain new and useful Improvement in Turbines, of which the following is a specification.

The improvement is intended more particularly for steam, and I will describe it as thus applied. The construction is of that class in which two wheels are combined turning rapidly in opposite directions. I have made a new departure by devising a construction in which each wheel has a disk body and a series of semibuckets or semivanes curving oppositely to those in the other wheel. I can duplicate the concentric series of semivanes and will show them as duplicated. A stout ring within each series of semivanes and formed integral therewith affords great strength and stiffness. Each such ring is perforated at an inclination, one perforation for each semivane; but the perforations through the ring are not nearly as wide as the spaces between the semivanes. The retardation which such rings produces on the flow of the steam I esteem an advantage. As the wheels turn in opposite directions the series of semivanes and each corresponding stout ring with its inclined perforations or apertures in one wheel play closely but easily between the corresponding parts in the opposite wheel. The perforations may vary; but I prefer that, measured diametrically, each perforated ring be of about equal thickness to that of the accompanying semivanes. I have also discovered that it is of advantage to introduce the current of steam at a high velocity into a space which extends continuously around the revolving wheels.

The following is a description of what I consider the best means for carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 is a vertical section on the line 1 1 in Fig. 2 seen from the right. Fig. 2 is a corresponding section on the line 2 2 in Fig. 1 seen from the left. Fig. 3 is a section on the line 3 3 in Fig. 2.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

A is a stationary casing made smooth in its interior and equipped with four tangential nozzles A′ A′, &c., each receiving a pipe arranged to bring steam at high pressure from a boiler (not shown) and to deliver it tangentially into a considerable passage *a*, which extends continuously around the periphery of the combined wheels inclosed within contracted at four points, as shown. (See Fig. 1.) A liberal aperture *a′* near the center allows the steam to flow idly away after it has done its work on the wheels.

B is a slender shaft mounted in bearings A^2 A^2, on which is fixed a circular disk B′, which forms the body of one of the rapidly-revolving wheels.

D is a sleeve lightly surrounding the shaft B for a considerable portion of its length and carrying a disk D′, revolving rapidly in the opposite direction in a plane parallel to that of the disk B′. On the inner face of the disk B′—that face which is presented toward the disk D′—are two strong rings formed integral with the disk and marked, respectively, B^2 and B^3. Similarly on the inner face of the disk D′—that face which is presented toward the disk B′—is a ring D^2, formed integral with the disk D′ and arranged to revolve in the space between the rings on the opposite disk B′.

I provide inclined apertures *b* in each of the rings B^2 B^3 and provide adjacent to each of these apertures on the outer face of the rings smoothly-projecting curved extensions B^4, of metal, which serve as semivanes. The ring D^2, made integral with the disk D′, is correspondingly equipped with a semivane $D^{4\#}$ for each of the perforations. The semivanes B^4 on the wheel B are each set in front of a corresponding inclined aperture *b*, and a corresponding relation obtains between the semivanes $D^{4\#}$ and the inclined apertures *d*. In each wheel the steam impinges tangentially at a high velocity against the semivanes and is caused to move smoothly inward on the rear face of the semivane and is afterward retained and imprisoned a brief period and later de-

livered in a smooth continuous stream through the inclined aperture connected, and is thus discharged at a greatly-reduced but still high velocity tangentially to serve against the semivanes of the next series within, and so on.

My construction holds the parts in each wheel and presents the several passages with great firmness and reliability in regard to their positions.

The inner faces of the fixed casing A are grooved circumferentially, as indicated by a^2. The grooving a^2 in concentric lines along a considerable extent of close-fitting surface prevents any strong flow of steam from the periphery inward through these very thin spaces. As in other wheels of this class, the useful effect is produced by the strong action through the complex provisions on the inner faces of these wheels.

On the extended shaft B is firmly fixed a wheel B^5, carrying spur gear-teeth B^6. The sleeve D terminates with a large wheel D^5, which carries at its periphery internal gear-teeth D^6. Outside of the rapidly-revolving wheel B^5 is a fixed disk A^3, which carries studs A^4, on which studs are freely-revolving sleeves J, on each of which sleeves are fixed two gear-wheels J′ and J^2 of different diameters. The smaller wheel J′ engages with the spur-teeth B^6. The larger wheel J^2 engages with the internal gear-teeth D^6. This gearing communicates to the shaft B the power which is developed by the wheel D without involving much lateral pressure.

I attach importance to the proportions of the semivanes and rings. The rings and the spaces where they are left uncut by the oblique perforations should be of sufficient thickness to afford strength and perform the double function of supporting the semivanes, which are formed integral therewith, and restrain the inward flow of the steam. The pressure should be reduced by about equal instalments from the initial boiler-pressure at the periphery to substantially the atmospheric or vacuum, as the case may be, at the center. I attach importance to the passage *a* around the exterior contracted but not arrested at points properly related to the several tangential induction-passages, because such passage promotes the freedom of the admission of the steam from the induction-nozzles and allows free action on each of the several wings and the contractions forbid any considerable flow around the periphery. I attach importance to the concentric grooves a^2 in the combination, because they in a marked degree retard the wasteful flow of steam inward past them, while involving no additional friction and allowing the steam a just sufficiently free passage circumferentially in their action on the several semivanes. I attach importance to the fact that the series of vanes D^3 are complete vanes instead of semivanes, because the series is of so small diameter that it can be sufficiently supported without the perforated ring. I attach importance to the fact that the steam is received at the periphery and discharged from the center, for the reason, among others, that the lateral pressure of the strong steam on the casing is at the periphery, where it is strongly tied together, and that only weak steam is inclosed within the portions of the casing near the center, so that those parts which are more liable to spring apart by the pressure of the inclosed steam are so little strained that it is easy to make them sufficiently stiff to maintain reasonably tight joints.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. I have shown the concentric space outside of the outermost series of semivanes B^4 as more or less interrupted by a contraction of the casing in diameter adjacent to each point where a fresh current of steam is received from the next induction-nozzle A′. Such interruption may be made more pronounced, so that it may be an extension of metal inward into close contact with the nicely-finished exteriors of the outermost series of semivanes, that marked B^4, or these interruptions may, on the other hand, be reduced, so that the steam may flow around the wheels in a nearly uniform channel *a*′.

I claim as my invention—

1. In a turbine having combined wheels turned in opposite directions geared together, the several obliquely-perforated rings B^2 D^2 B^3 and corresponding series of smoothly-curved semivanes extending outward beyond the rings, receiving the strong steam at the periphery and allowing the weak to escape from a point near the center, proportioned and arranged to serve substantially as herein specified.

2. In a turbine having combined wheels turned in opposite directions geared together, the several obliquely-perforated rings B^2 D^2 B^3 and corresponding series of semivanes B^4 D^4 $B^{4\#}$, the tangential nozzles A′ connected with a source of steam and the close-fitting casing A having a liberal passage *a* within its periphery, all arranged to serve substantially as herein specified.

3. In a turbine having combined wheels turned in opposite directions geared together the several obliquely-perforated rings B^2 D^2 B^3 and corresponding series of semivanes B^4 D^4 $B^{4\#}$ the tangential nozzles A′ connected with a source of steam and the close-fitting casing A having a liberal passage *a* within its periphery and concentric grooves a^2 in its interior faces, all arranged to serve substantially as herein specified.

4. In a turbine having combined wheels turned in opposite directions geared together, the tangential induction-nozzles A′ receiving

elastic fluid at a high pressure at the periphery, the several obliquely-perforated rings B^2 D^2 B^3 and corresponding series of semi-vanes B^4 D^4 B^{4*} and the series of complete vanes D^3 carried on one of the wheels within said rings, all proportioned and arranged to serve substantially as herein specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

EDGAR J. WOOD.

Witnesses:

THOMAS DREW STETSON,

M. F. BOYLE.