No. 765,806. PATENTED JULY 26, 1904.

I. BENJAMINS.

TURBINE.

APPLICATION FILED MAR. 18, 1904.

NO MODEL.

Fig. 1.

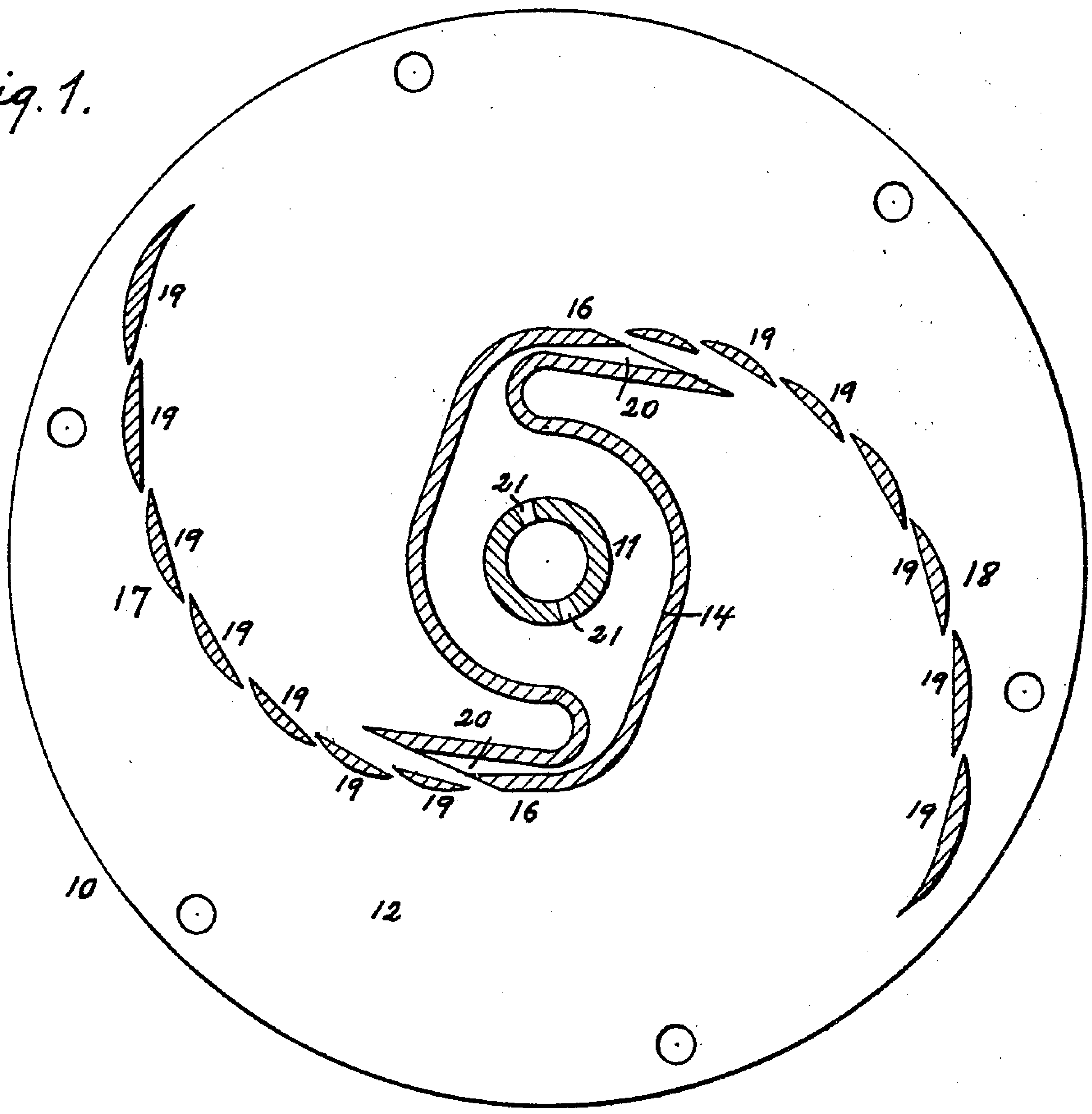
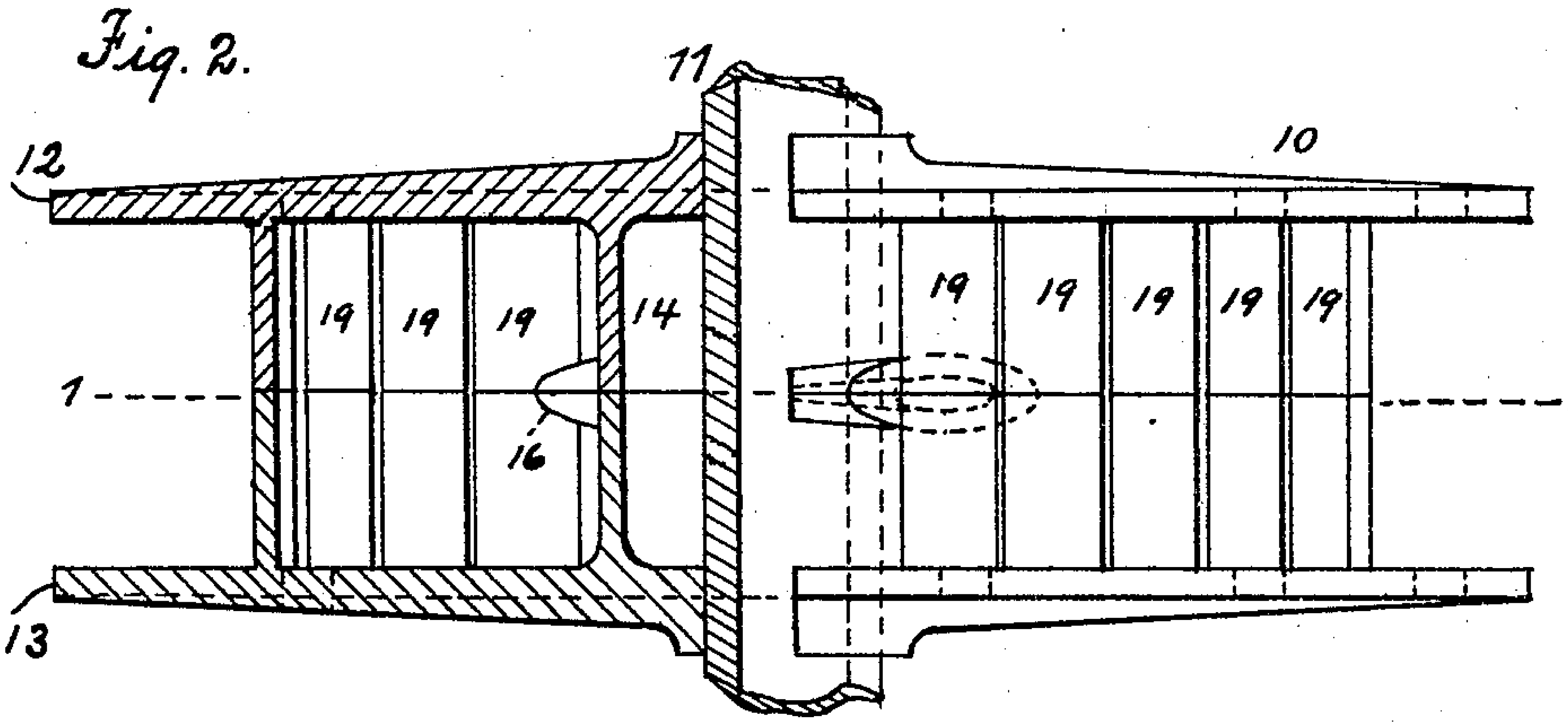


Fig. 2.



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No. 765,806. Patented July 26, 1904.

UNITED STATES PATENT OFFICE.

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TURBINE.

SPECIFICATION forming part of Letters Patent No. 765,806, dated July 26, 1904.

Application filed March 18, 1904. Serial No. 198,765. (No model.)

To all whom it may concern:

Be it known that I, Israel Benjamins, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Turbine-Engines, of which the following is a specification.

The invention relates to improvements in elastic-fluid turbine-engines; and it consists in the novel features hereinafter described and claimed.

The purpose of the invention is to produce a novel turbine-engine constructed on such principles as will enable the attainment therein of high efficiency and slow motion and a power adapted to the dynamo or machine or machinery to be driven, whether such power be great or small.

One of the desirable features of my invention is that it enables the construction of a turbine capable of slow motion and comparatively small power with high efficiency.

My invention is not limited to details of form or construction; but I present herein one very simple and desirable embodiment of my invention adapted to secure high efficiency and comparatively slow motion and embracing in its operation the several principles characterizing my invention, and in which embodiment of my invention I provide a wheel rigidly mounted upon a hollow shaft through which the steam or other fluid under pressure is admitted to the central portion of the wheel and which wheel is provided with rigid vanes extending on approximately spiral curves from the center to the periphery of the wheel and forming series of surfaces, each to receive impact of the fluid and direct or transmit the fluid to the surfaces following in series, so that said surfaces may also be acted upon by impact, the inner one of each series of said surfaces being in proper relation to an exit for the elastic fluid to the wheel.

One of the characteristic features of the operation of the engine is that the steam or other elastic fluid admitted to the rotary member of the engine after being expanded within a suitable nozzle delivers its impact continuously from the point of its discharge from said nozzle in a direction contrary to the direction of motion of the vanes, which feature is conducive to the attainment of a slow speed.

A further feature of the operation is that when the steam has become expanded to the pressure of the surrounding medium it will operate to drive the rotary member by impact, the normal component of which will produce motion in the wheel in the same direction as that imparted to it by the expanding steam.

Another feature of the operation is that the steam on leaving each vane will by reaction continue to drive the wheel in the same direction as before, and a further feature is that with a suitable load the steam leaves the wheel or rotary member at about the same velocity as the wheel is turning, but in a direction contrary thereto, which is a condition of maximum efficiency.

The invention will be more fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional elevation of a turbine constructed in accordance with and embodying the invention, the section being on the dotted line 1 1 of Fig. 2, which is a top view, half in plan and half in central horizontal section, of same.

In the drawings, 10 denotes the wheel or rotary member to be driven, and 11 the shaft upon which said rotary member is rigidly mounted and which is turned thereby and communicates motion to the dynamo or other machine with which it may be connected.

The wheel or member 10 in the construction illustrated is formed of two corresponding matched disk-sections 12 13, adapted to be secured together by bolts and forming between their facing sides the central steam-chamber 14, having discharge-nozzles 16 and the approximately spiral sets of vanes 17 18, each composed of a series of smaller vanes or blades 19 and extending from a discharge-nozzle to the periphery of the wheel, said smaller vanes or blades 19 preferably increasing in area in series, commencing with the inner ones thereof. The chamber 14 surrounds the shaft 11, and the nozzles 16 extend in opposite directions therefrom and have outwardly-diverging bores 20 to permit of the expansion of the steam therein. The outer ends of the nozzles 16 are tapered, as shown, so that their inner walls, or those nearer to the shaft 11, may overlap the inner ends of the sets of vanes 17 18 and effectively discharge the steam thereon. The shaft 11 is provided within the chamber 14 with ports 21 for the passage of the steam from within said shaft to said chamber, whence the steam will escape through the nozzles 16.

The transverse blades or vanes 19 and the chamber 14 are in the present instance, though not necessarily, integral with the disk-sections 12 13, one-half of each of said vanes and one-half of said chamber being cast with each disk and the halves when brought together forming the complete vanes and chamber 14, as shown in Fig. 2.

The sets of vanes 17 18, made up of the series of smaller vanes or blades 19, are on curved lines and may conveniently approximate a spiral or winding form, and when the two sets of vanes 17 18 are employed they will commence at opposite sides of the shaft 11 and terminate at opposite points at the periphery of the wheel, as indicated in Fig. 1, thus nicely balancing the wheel. The fact that the sets of vanes 17 18 are made up of series of the smaller vanes or blades 19 is a matter of great importance, and, as shown in Fig. 1, the vanes or blades 19 are separated from one another by spaces and overlap one another in series, commencing with the inner vanes 19, the inner vane of each series overlapping the next adjacent vane and that overlapping the succeeding vane, and so on throughout the series. The outer faces of the vanes 19 are preferably convex in form, and the inner faces of said vanes may be either flat or curved.

In the operation of the turbine the elastic fluid under pressure passing through the openings 21 and filling the chamber 14 will discharge through the nozzles 16 against the inner vanes 19 and continue outwardly along the series of vanes 19 until finally with a suitable load the steam will be discharged from the wheel or rotary member at about the same velocity in its direction as the circumferential velocity of the turbine in the opposite direction, which is a condition of maximum efficiency. The steam upon and while passing through the nozzles 16 will expand to the pressure of the surrounding medium, and after leaving said nozzles the steam will, coacting with said vanes 19, by its impact or by its impact and reaction exert its force to drive the wheel in the direction of motion imparted to the latter by the steam issuing from the nozzles 20, the gradually-increasing area of the vanes 19 affording means of accumulation of the steam consequent to its retardation. The steam upon leaving the nozzles 16 will strike the surface of innermost vanes 19 and be by said vanes directed or deflected to the inner surface of the next adjoining vanes 19 and by the latter to the next adjoining vanes 19, and so on, until the steam leaves the wheel, said vanes 19 affording a series of successive impact-surfaces for the fluid.

It is evident that during the travel of the steam or elastic fluid along and the delivery of its impact upon the vanes 19 there will be a considerable torque created, whereby a slow speed is attained. It may be said, however, that the design of the vanes 19 may be varied to attain any suitable speed. The greater the torque the smaller will be the velocity.

The turbine described is thus a very simple and inexpensive one, and while it may be constructed of any size and for any speed desired it possesses the advantage of being capable of being made of small size and slow motion and of utilization in driving machinery at present not driven by turbine-engines, due to the size and speed of the latter. The simplicity of the engine will also aid to efficiency by reducing the losses due to friction, eddies, and other causes.

I do not limit the invention to the special example thereof illustrated in the drawings, since my invention is generic in character, and the turbine shown may be varied in many ways without departing from the spirit or scope of my invention. For instance, the steam-chamber 14 may be omitted and the nozzles 16 led directly from the ports 21 in the shaft 11. The number of series of vanes 19 may also be increased, and while I prefer to employ at least two series of the vanes 19, as shown, the rotary member or wheel may be driven on the principle of my invention with the presence of only one series of the vanes 19, and such series may be variously disposed as to their line of curvature or winding. The turbine may also be designed to work with or without a condenser and either horizontally or vertically. The rotary member may be variously constructed within the scope of my invention—as, for example, it may be given the form of a shaft having a winding series of vanes 19 encompassing the same, or the rotary member may be of cone outline, having an exterior winding series of vanes 19 of an increasing surface or impact area.

The turbine may also be so constructed as to embody only some of the principles, each within the scope of my invention—as, for example, it may embrace either or both of the principles of impact characterizing my invention—to wit, impact producing motion of steam in a direction contrary to the direction of motion of the engine or impact made on a series of vanes 19 of increasing area, permitting the accumulation of steam during retardation, or the steam may be expanded before reaching the rotary member and drive the latter by impact and reaction, or the vanes may be arranged so that the steam may act either by impact alone or reaction alone. The direction of motion of the steam may be either outward, as shown, or parallel with the shaft, or inwardly, as in the case of water-turbines, or in more than one direction at the same time.

In the turbine shown in the drawings the steam will act continuously on each series of vanes, the latter being thus saved the cooling at intervals which occurs in turbines in which blades move from the nozzle or from one nozzle to another nozzle, and thereby I secure increased efficiency in the turbine of my invention. This feature of the construction also enables the construction of a turbine of a larger diameter with the same or even a smaller number of vanes for the same power.

Without, therefore, limiting my invention to details of form or construction, what I claim as new, and desire to secure by Letters Patent, is—

1. In an elastic-fluid turbine, a rotary member having rigid vanes arranged in series on a curved or winding line and with their corresponding faces adapted to receive a jet of the fluid and deflect the same from one to the other thereof in series continuously in a direction contrary to the direction of motion of said rotary member; substantially as set forth.

2. In an elastic-fluid turbine, a rotary member having two or more sets of rigid vanes, each set arranged in series on a curved or winding line and with their corresponding faces adapted to receive a jet of the fluid and deflect the same from one to the other thereof in series continuously in a direction contrary to the direction of motion of said rotary member; substantially as set forth.

3. In an elastic-fluid turbine, a rotary member having rigid vanes arranged in series on a curved or winding line and with their corresponding faces adapted to receive a jet of the fluid and deflect the same from one to the other thereof in series continuously in a direction contrary to the direction of motion of said rotary member, said faces of said vanes having a gradually-increasing area in series; substantially as set forth.

4. In an elastic-fluid turbine, a rotary member having rigid vanes arranged in series on a curved or winding line and with their corresponding faces adapted to receive a jet of the fluid and deflect the same from one to the other thereof in series continuously in a direction contrary to the direction of motion of said rotary member, said faces of said vanes each being arranged to receive an impact; substantially as set forth.

5. In an elastic-fluid turbine, a rotary member having rigid vanes arranged in series on a curved or winding line and with their corresponding faces adapted to receive a jet of the fluid and deflect the same from one to the other thereof in series continuously in a direction contrary to the direction of motion of said rotary member, said faces of said vanes being arranged to produce a reaction and to thereby increase the moment; substantially as set forth.

6. In an elastic-fluid turbine, a rotary member having rigid vanes arranged in series on a curved or winding line and with their corresponding faces adapted to receive a jet of the fluid and deflect the same from one to the other thereof in series continuously in a direction contrary to the direction of motion of said rotary member, combined with a nozzle connected to rotate with said member in fixed relation to said vanes and within which nozzle the fluid expands and which delivers the jet of fluid to said vanes at one end of the series thereof; substantially as set forth.

7. In an elastic-fluid turbine, a rotary member having at opposite sides of its center the oppositely-projecting nozzles leading from a source of supply for the fluid, and rigid curved or winding vanes extending from said nozzles and adapted to continuously direct the fluid issuing therefrom in a direction contrary to the direction of motion of said rotary member; substantially as set forth.

8. In an elastic-fluid turbine, a rotary member having adjacent to its center a projecting nozzle leading from a source of supply for the fluid and adapted to deliver the fluid in the form of a jet, and curved or winding means extending outwardly from a point adjacent to said nozzle and adapted to receive said jet on one face, said face being adapted to continuously direct the fluid in a direction contrary to the direction of motion of said rotary member; substantially as set forth.

9. In an elastic-fluid turbine, a rotary member having at opposite sides of its center the oppositely-projecting nozzles leading from a source of supply for the fluid, and the sets of rigid vanes extending on curved or winding lines from said nozzles, the vanes of each set at their corresponding faces being adapted to receive the jet of fluid and deflect the same from one to the other thereof in series continuously in a direction contrary to the direction of motion of said rotary member; substantially as set forth.

Signed at New York, in the county of New York and State of New York, this 16th day of March, A. D. 1904.

ISRAEL BENJAMINS.

Witnesses:
CHAS. C. GILL,
ARTHUR MARION.