No. 736,011. PATENTED AUG. 11, 1903.

# J. H. PITKIN.

## ROTARY ENGINE.

APPLICATION FILED OCT. 4, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

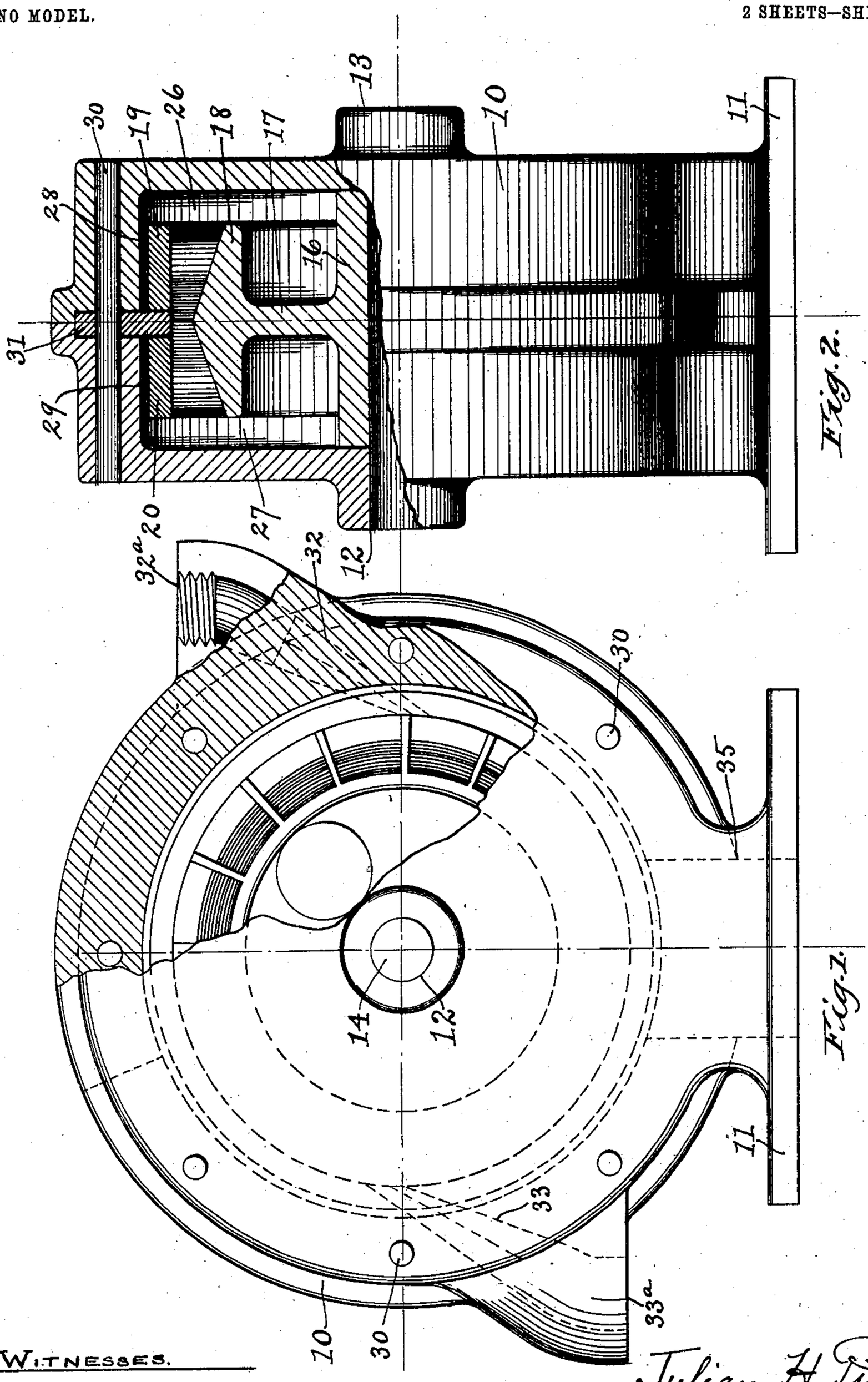


Fig. 2.

Fig. 1.

WITNESSES.

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NO MODEL

2 SHEETS—SHEET 2.

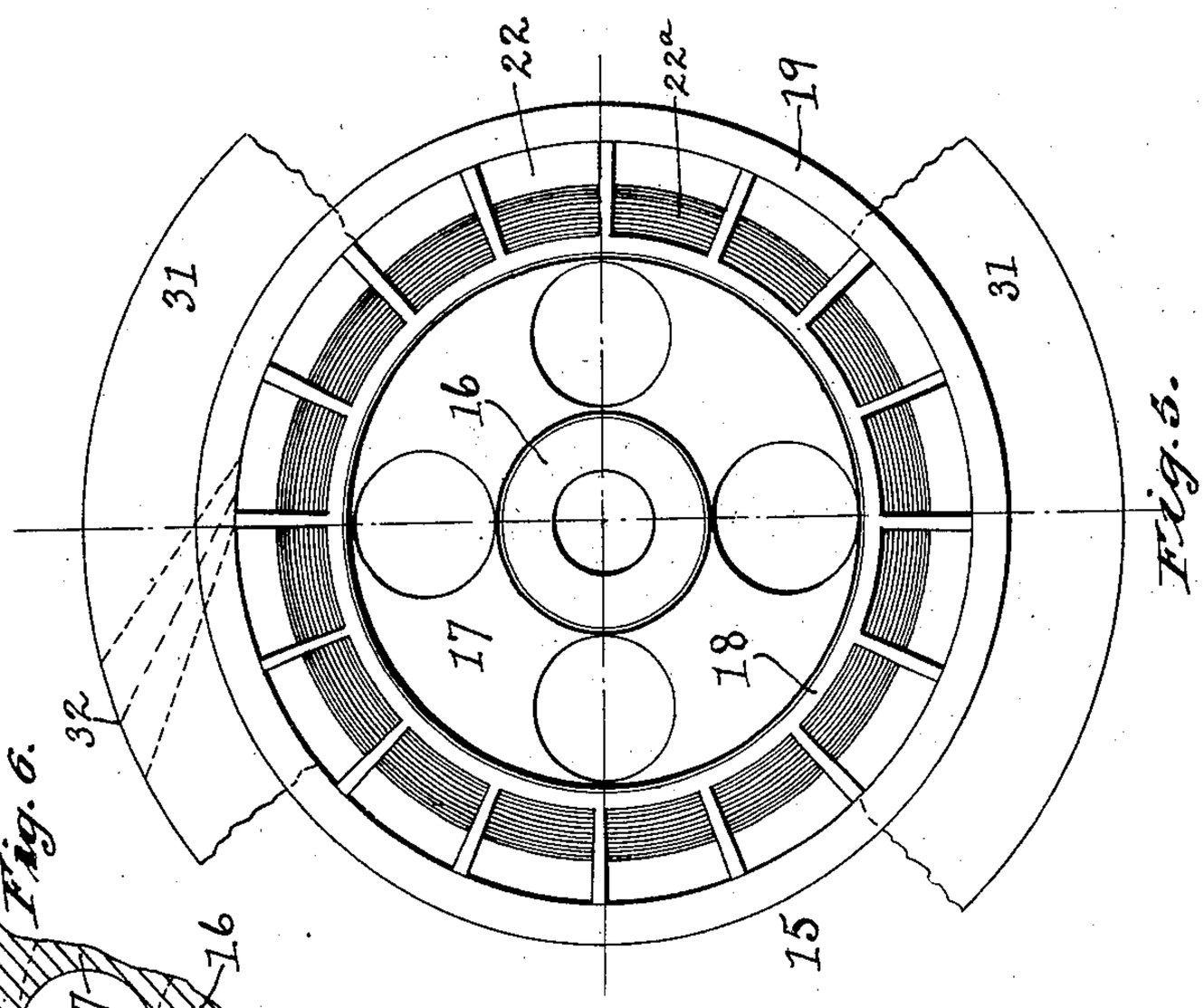


Fig. 5.

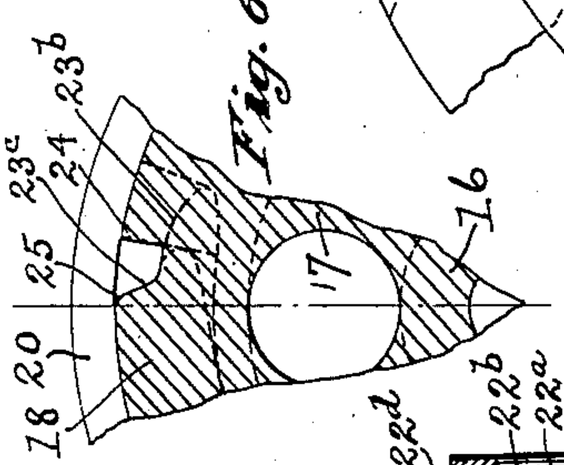


Fig. 6.

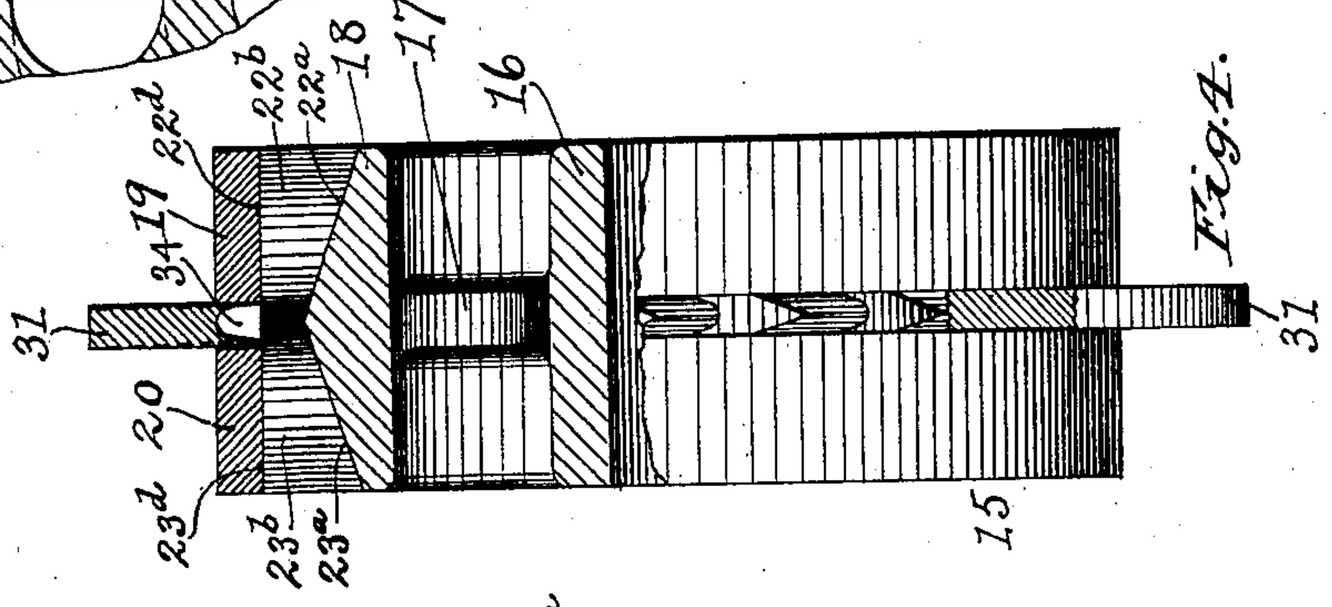


Fig. 4.

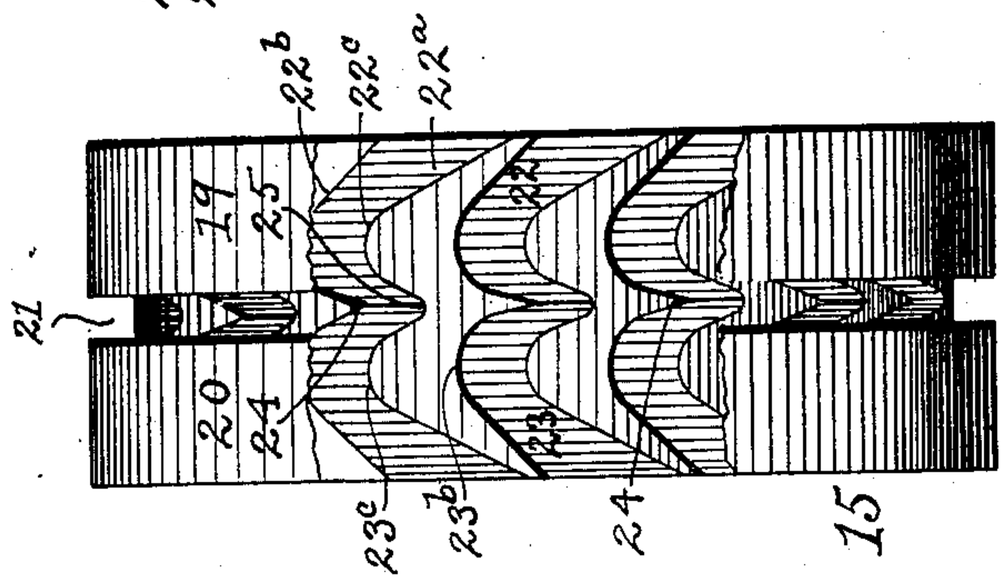


Fig. 3.

WITNESSES

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No. 736,011. Patented August 11, 1903.

# UNITED STATES PATENT OFFICE.

JULIAN H. PITKIN, OF CHICAGO, ILLINOIS.

## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 736,011, dated August 11, 1903.

Application filed October 4, 1902. Serial No. 125,873. (No model.)

*To all whom it may concern:*

Be it known that I, JULIAN H. PITKIN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to rotary steam or gas engines, and has to do more particularly with that class of rotary engines known as "turbine-motors," wherein the energy of a suitably-directed jet of motive fluid is directed against a series of vanes or buckets mounted on the periphery of a rotary wheel or disk and impacting and expanding against successive vanes or buckets of the latter causes it to rotate at high speed.

My invention has for its primary object to provide an improved motor of this type characterized by increased efficiency through a more complete utilization of the expansive energy of the motive agent, and this object I carry out through a novel construction of motor, and more particularly of the buckets or chambers in the periphery of the wheel, which being of increasing cross-sectional dimensions from inlet to outlet enables the motive fluid to expand in passing therethrough against a continually-increasing surface area and in continually-increasing volume, thereby insuring a more complete utilization of the expansive effect of the motive agent than has heretofore been possible in engines of this type.

The accompanying drawings show an engine embodying my invention adapted to work with steam or compressed air or an expanding burning gas or gaseous mixture, and in said drawings—

Figure 1 is a side elevation of the motor with the inner side thereof partially broken out to disclose the interior mechanism. Fig. 2 is a similar edge elevation. Fig. 3 is an edge elevation of the turbine-wheel detached, partially broken out to show the formation of the buckets therein. Fig. 4 is a similar view, partly in central vertical section and partly broken away, also showing in place the central stationary ring through which the inlet-passages are formed. Fig. 5 is a side elevational view of the turbine-wheel detached, with the surrounding ring through which the inlet-passages are formed partially broken away; and Fig. 6 is a vertical sectional detail view longitudinally of the turbine-wheel and further illustrating the formation of the buckets therein.

In the drawings, 10 designates the stationary casing of the motor erected upon an integral bed-plate 11. Within this hollow casing is mounted to rotate in bearings 12 and 13 a shaft 14, on which latter is mounted within the casing a central rotary wheel or drum 15. The wheel 15 comprises the central hub 16, Fig. 4, an intermediate web 17, an annular body 18 of considerable thickness, and a peripheral rim which I preferably form by the agency of a pair of metal bands 19 and 20, shrunk over the periphery of the annular body, but with a narrow space 21 left therebetween, Fig. 3, adapted to receive a stationary element, hereinafter described, through which the inlet jet-passages are formed. In the outer portion of the annular body 18 of the wheel are formed at uniform intervals a series of symmetrical right and left buckets, (designated by 22 and 23, respectively,) the buckets being defined by lower walls or bottoms $22^a$ and $23^a$, which, it will be observed, slope centrally of the wheel from their inner meeting ends to the outer peripheries of the wheel, concave front walls $22^b$ and $23^b$, convex and rearwardly-sloping rear walls $22^c$ and $23^c$, and top walls $22^d$ and $23^d$, formed by the inner surface of the peripheral rings 19 and 20, respectively. It will be observed that the front walls $22^b$ and $23^b$ of each pair of laterally-adjacent buckets converge centrally of the wheel and meet in a point or apex 24, the corresponding rear walls $22^c$ and $23^c$ of each pair of laterally-adjacent buckets similarly converging in a concavity 25. The described construction results in the formation on either side of the central longitudinal plane of the wheel of a series of pairs of symmetrically-formed buckets, the characteristic feature of which is that they are comparatively constricted at their inner meeting ends, but are outwardly divergent on their front, rear, and bottom walls toward the sides of the wheel, thereby creating buckets of gradually and continually expanding dimensions and capacity from their inner to their outer ends.

As will be seen by reference to Fig. 2, the

wheel 15 does not fit the stationary casing closely, but is of such a size relatively thereto as to secure the presence of lateral spaces 26 and 27 on either side thereof, as well as the provision of narrow annular spaces 28 and 29 between the outer periphery of the wheel and the inner wall of the casing.

The casing of the motor is conveniently formed in two mating halves united by transverse tie-bolts 30, and between the meeting faces of the sections of the casing is rigidly clamped an annular ring 31, the inner periphery of which is adapted to fit within the annular space 21, formed in the periphery of the turbine-wheel, with freedom for the latter to rotate in contact with said stationary ring. The ring 31 is preferably formed in four sections, two of which are disposed on either side of a pair of jet-inlet openings 32 and 33, and the adjacent ends of each pair of sections are hollowed out transversely, as shown at 34 in Fig. 4, which hollowed edges meet in the center line of the inlet-opening, the registering hollow edges thus united forming the walls of the tapered inlet-opening, the latter communicating at diametrically opposite points on the periphery of the casing with suitable inlet-nozzles $32^a$ and $33^a$, to which are connected the conducting-pipes of the motive fluid. In the lower end of the casing and through the base-plate 11 is conveniently formed an exhaust passage-way 35, communicating at its inner end with the bottom of the annular chambers 28 and 29 and the side chambers 26 and 27, surrounding the walls.

The operation is substantially as follows: Assuming that the engine is to be actuated by steam, the inlet-nozzles $32^a$ and $33^a$ are suitably connected to a pair of steam-inlet pipes and the steam at any desired pressure is turned on. The steam-jets entering the casing of the motor through the inlet-passages 32 and 33 first strike against and split upon the points or projections 24 of the buckets, the jet being divided thereby and passing in equal volumes to the companion buckets lying on either side. The effective area of the front wall of each bucket is considerably greater in extent than the area of the rear wall thereof, whereby the steam tends to drive the wheel forward in the direction of the forward wall of the bucket, and by reason of the fact that the transverse dimensions of the bucket gradually increase from the inner to the outer end thereof the steam is enabled to expand during its passage through the bucket and in so doing to expend its energy in a manner to impel the bucket forward. The steam finally escapes through the widened outlet of the bucket into the side chambers 26 and 27, whence it readily passes through the exhaust-opening 35 and is discharged. The pressure of the steam-jets sets up a rapid rotation of the wheel, and the expansive energy of the steam acts in rapid succession upon the series of buckets formed entirely around the periphery of the wheel, and this expansive energy is, through the web and hub of the wheel, transmitted to the driving-shaft 14, from which the power thus derived may be taken off and utilized by any suitable means. While I have shown two inlet-nozzles, it will be evident that as many may be employed as desired or as the dimensions of the motor may require.

I am aware that turbine-motors wherein the motive fluid is admitted to a series of buckets formed on the periphery of a rotary turbine-wheel is old; but so far as I am aware I am the first to equip a turbine-wheel of this type with a series of peripheral buckets or chambers so formed as to permit the expansion of steam or other motive fluid, and the consequent giving up of its energy to the wheel while the motive fluid is passing through the buckets or chambers. I do not, therefore, limit my invention to the specific formation of the buckets as herein shown and described, so long as the principle of the invention is preserved.

I claim—

1. In a rotary engine of the type described, a turbine-wheel provided about its periphery with laterally-disposed expansion-buckets lying wholly below or within the peripheral surface of the wheel, each of said buckets having outwardly-divergent top and bottom walls and outwardly-divergent side walls between a relatively contracted inlet-orifice and an enlarged discharge-orifice coincident with the plane of the side of the wheel, substantially as described.

2. In a rotary engine of the type described, a turbine-wheel provided about its periphery with a series of pairs of expansion-buckets, each pair occupying the entire width of the wheel and having contracted inlet-orifices coincident with the longitudinal central plane of the wheel and enlarged outlet-orifices coincident with the planes of the sides of the wheel and opening therethrough, substantially as described.

3. In a rotary engine of the type described, a turbine-wheel provided about its periphery with a series of pairs of expansion-buckets, each pair occupying the entire width of the wheel and having inlet-orifices coincident with the longitudinal central plane of the wheel and outwardly-divergent containing-walls extending thence to and opening through the sides of the wheel, substantially as described.

4. In a rotary engine of the type described, a turbine-wheel provided about its periphery with a series of pairs of expansion-buckets, each pair occupying the entire width of the wheel and having inlet-orifices coincident with the longitudinal central plane of the wheel and outlet-orifices through its sides, each bucket having outwardly-divergent front and rear walls, the former of which is concave and the latter convex, substantially as described.

5. In a rotary engine of the type described, the combination with a stationary casing, of

a rotary turbine-wheel mounted therein and provided with an annular groove located in the longitudinal central plane thereof, said wheel being further provided with symmetrical pairs of buckets, each pair having their inlet-orifices communicating with the base of said annular groove and their discharge-orifices coincident with the planes of the sides of the wheel, and a stationary ring secured to the casing and having its inner peripheral portion housed in said groove, said ring being provided with inlet jet-openings therethrough disposed substantially tangential to the periphery of the wheel, substantially as described.

6. In a rotary engine of the type described, the combination with a stationary casing, of a rotary turbine-wheel mounted therein and provided with an annular groove located in the longitudinal central plane thereof, said wheel being further provided with symmetrical pairs of buckets, each pair having their inlet-orifices communicating with the base of said annular groove and having outwardly-divergent containing-walls extending to the sides of the wheel, and a stationary ring secured to the casing and having its inner peripheral portion housed in said groove, said ring being provided with inlet jet-openings therethrough disposed substantially tangential with the periphery of the wheel, substantially as described.

JULIAN H. PITKIN.

Witnesses:
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JENNIE NORBY.