April 8, 1924. **J. R. CLARY** 1,489,930

TURBINE

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Fig. 1.

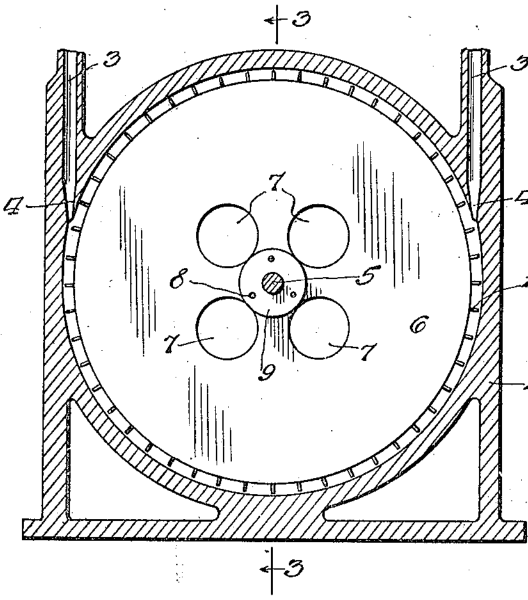


Fig. 2.

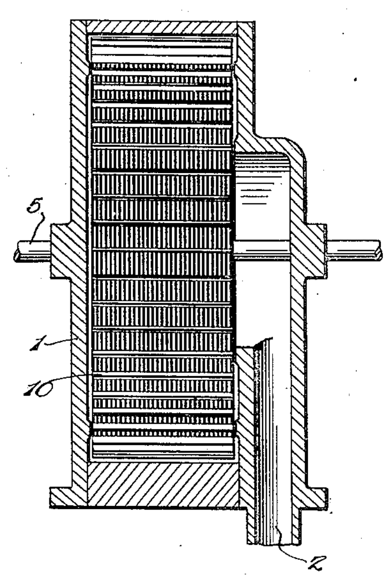


Fig. 3.

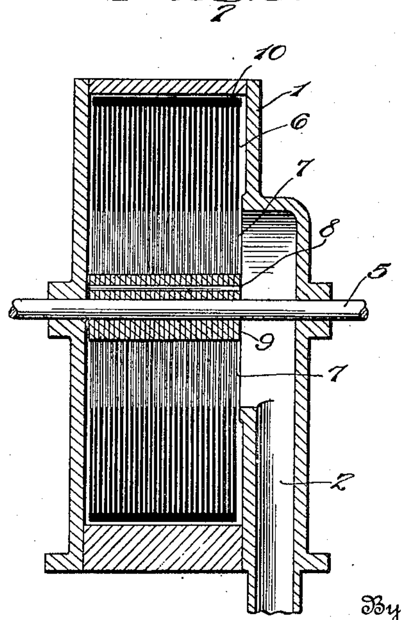
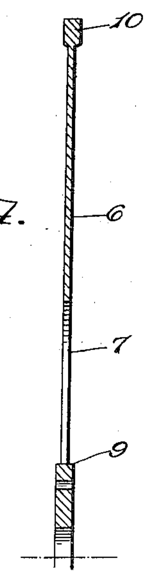


Fig. 4.



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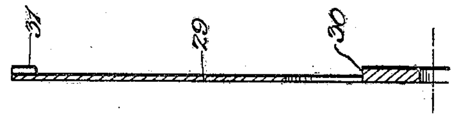

Fig. 11.

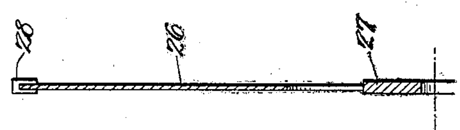

Fig. 10.

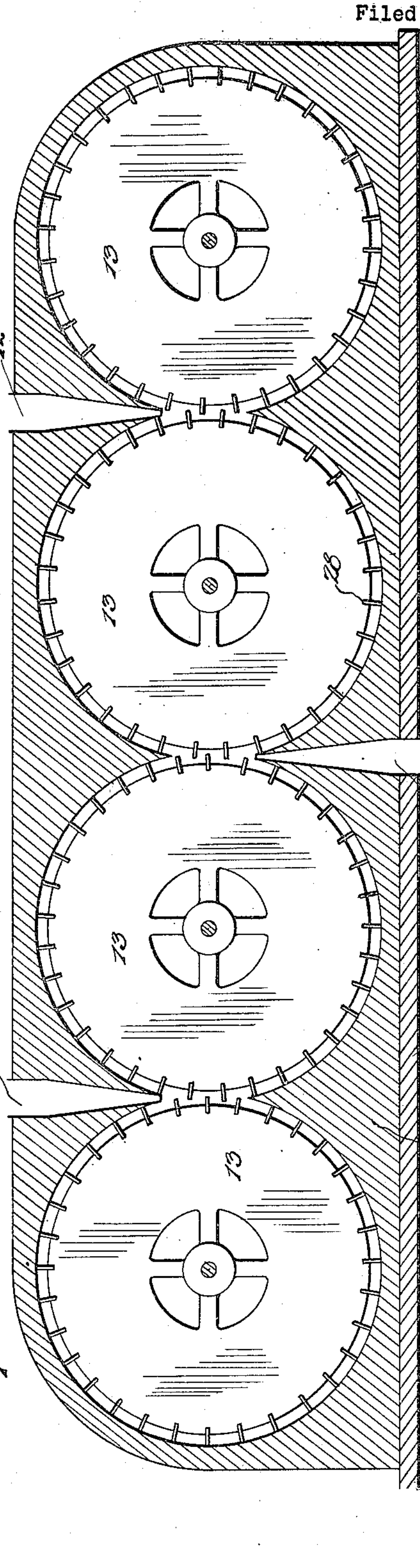

Fig. 5.

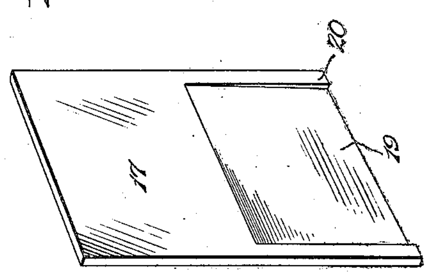

Fig. 7.

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Fig. 6.

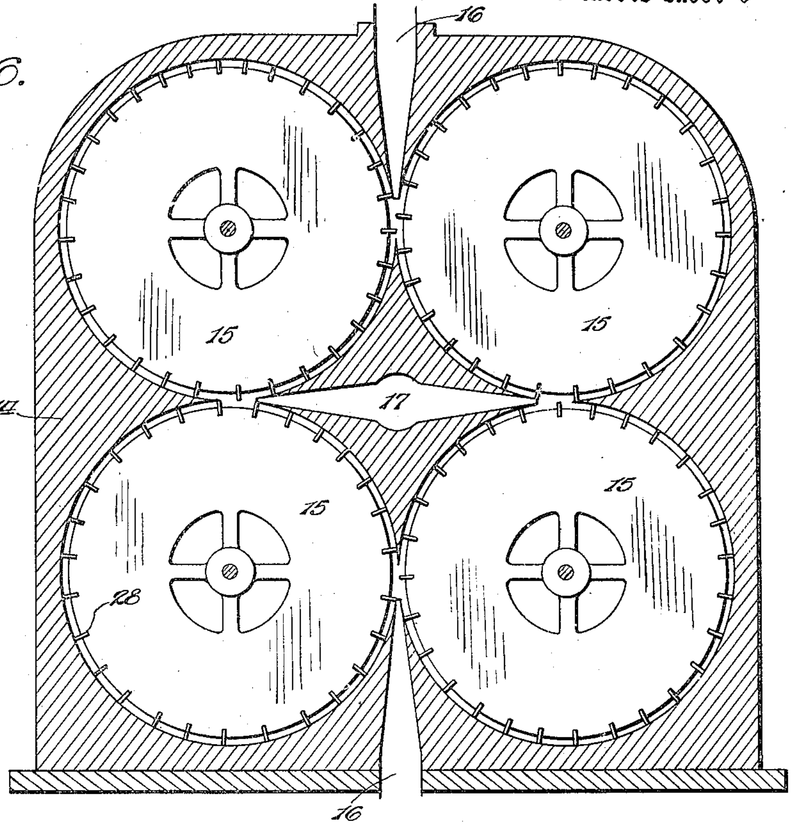


Fig. 8.

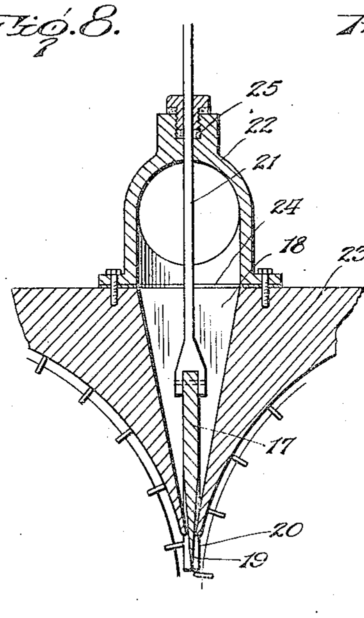
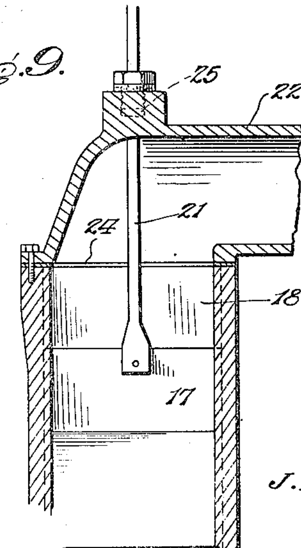


Fig. 9.



Inventor

J. R. Clary

By Lacey & Lacey, Attorneys

Patented Apr. 8, 1924. **1,489,930**

UNITED STATES PATENT OFFICE.

JAMES R. CLARY, OF ASHLAND, OREGON.

TURBINE.

Application filed January 10, 1923. Serial No. 611,891.

To all whom it may concern:

Be it known that I, JAMES R. CLARY, a citizen of the United States, residing at Ashland, in the county of Jackson and State of Oregon, have invented certain new and useful Improvements in Turbines, of which the following is a specification.

My invention relates to improvements in rotor steam engines or turbines of the type disclosed in Letters Patent, No. 1,061,206, granted May 6, 1913, to Nikola Tesla. One object of my invention is to provide means whereby the force of the steam or other motive fluid may be utilized by impact as well as by adhesion and viscosity, and another object of the invention is to provide means whereby the supply of motive fluid to the rotor or runner may be regulated at the point where it acts upon the runner or rotor. The stated objects, and other objects which will incidentally appear in the course of the following description, are attained in my invention, several embodiments of which are illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a sectional elevation showing a simple form of my improved turbine;

Fig. 2 is a view showing the casing in longitudinal section and the rotor in elevation;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged detail section of one of the disks;

Fig. 5 is a sectional elevation of another form of the invention;

Fig. 6 is a similar view showing another arrangement;

Fig. 7 is a detail perspective view of a regulating valve which may be employed in an engine embodying the invention;

Figs. 8 and 9 are detail sections taken at right angles to each other showing the slide and its mounting;

Figs. 10 and 11 are detail sections of different forms of disks.

In the Tesla patent above mentioned, the runner or rotor consists of a plurality of disks having flat faces and provided with openings therethrough near their centers, the disks being secured to a central shaft and spaced apart by washers interposed between them adjacent the shaft, the washers and the disks being all rigidly secured together. This runner or rotor is mounted in a casing provided with nozzles at its opposite sides through which the steam or other motive fluid may be admitted to the periphery of the rotor which fits closely within the central portion of the casing, the result being that the fluid will pass between the disks and follow a spiral path to the center of the same and thence escape through the openings in the disks to outlets provided in the sides of the casing. In its travel from the inlet to the outlet or exhaust, the motive fluid will set the rotor in motion, due to the adhesion between the particles of the moving fluid and the plane-faced disks of the rotor.

In carrying out my invention, I employ a casing 1 which, in Figs. 1, 2 and 3 of the present drawings, is similar to and may be identical with the casing shown in the Tesla patent, having one or more outlets or exhausts 2 extending from its center and having inlets 3 disposed at opposite sides of the rotor and terminating in nozzles 4 tangential to the rotor. A shaft 5 extends through the casing and is journaled in the sides of the same, the bearings being as nearly frictionless as possible, and it will be readily understood that the structural details of the bearings and of the casing are not illustrated in the present drawings for the reason that, in themselves, they form no part of the invention and are, therefore, represented in a more or less conventional manner. The rotor consists of a plurality of disks 6 having plane faces and provided adjacent their centers with openings 7 through which the motive fluid may pass to the outlet 2 of the casing. The disks are placed closely together on the shaft 5 and are secured thereto by keys or other means, as will be readily understood. Rivets or bolts 8 are inserted through the disks adjacent the shaft so as to secure the disks rigidly together, and to maintain the disks in spaced relation, offsets 9 are formed on the faces thereof which offsets, on adjacent disks, will abut and constitute spacing members, as is obvious. In Fig. 4 of the drawings, the offset is illustrated as extending equal distances from the opposite faces of the disk and they, therefore, constitute reinforcements to strengthen the disks at the point of attachment to the motor shaft. The disks will, of course, be secured in such relation that the openings 7 therethrough will be axially alined and consequently provide passages extending through the entire rotor and communicating with the outlet of the casing, as will be readily understood upon reference to Fig. 3 of the drawings. Around the periphery of each disk at intervals are formed small blades 10 similar to the offsets or enlargements 9 which will project radially and laterally from the periphery of the disk and extend into the path of the inflowing fluid, as clearly shown in Fig. 1, so that the impact of the fluid upon the rotor will be utilized as well as the adhesive force between the fluid and the faces of the rotor disks. The several blades or projections 10 are, of course, arranged in alinement so that the side edge of a blade or projection on one disk will abut the corresponding blade or projection on the adjacent disk and thereby present a continuous blade co-terminous with the sides of the rotor, as clearly shown in Fig. 2.

The motive fluid is admitted to the rotor through either inlet 3 according to the direction of rotation desired for the rotor or runner and the impact of the fluid against the successive blades will be utilized to impart motion to the rotor. The fluid, of course, will enter the spaces between the several disks constituting the rotor and will pass to the openings through the disks and eventually pass out through the exhaust or outlet passage 2, acting upon the faces of the several disks through the forces of adhesion and viscosity so that the rotor will be very economically driven. The operation of my improved turbine reduces the exhaust pressure and thereby minimizes waste of energy which would otherwise be present.

In Figs. 1, 2 and 3, I have illustrated a simple form of engine embodying the invention, in which there is only one rotor and rotor chamber. It is, of course, within the scope of the invention to employ a plurality of rotors, and in Fig. 5, I have shown four rotors arranged in alinement within a single casing, the casing being indicated by the reference numeral 11 and having inlet ports 12 disposed alternately at its opposite sides, each inlet port being disposed between two adjacent rotors 13. The rotors correspond in all essentials with the rotor shown in Figs. 1, 2 and 3, but it will be readily noted that the alternate rotors are driven in opposite directions and each inlet nozzle supplies fluid to two rotors. This embodiment of the invention will be found advantageous where power is to be applied to a series of parallel shafts which are to be rotated in opposite directions so that gearing to connect the shafts may be omitted or employed in very simple forms.

In Fig. 6, I have shown a casing 14 containing four rotary chambers disposed in substantially rectangular relation, and in each chamber is a rotor 15, corresponding in all essentials to the rotor previously described. At diametrically opposite points of the casing are inlet ports 16 each of which conveys motive fluid to two adjacent rotors, and centrally within the casing is formed or constructed a double inlet 17, the branches of which extend laterally to the adjacent rotors so that in this arrangement each rotor will receive motive fluid from two nozzles arranged ninety degrees apart. In this arrangement, the rotors are actuated by streams of fluid at two different points of their peripheries so that the propelling action will be distributed and, therefore, more fully utilized.

An engine embodying my invention will, of course, be provided at any convenient point with a throttle valve so that the flowing motive fluid may be cut-off or controlled in a convenient manner. It is frequently desirable, however, to provide a regulating valve at the point of admission of the fluid to the rotor so that the force of the fluid at the working point may be readily controlled and adjusted to the load. In Figs. 7, 8 and 9, I have illustrated a valve consisting of a slide 17 mounted in grooves in the opposite walls of the inlet port or passage 18 and having its opposite faces at its inner end beveled, as shown at 19, so that it forms a chisel-like blade which may pass through the mouth of the supply nozzle, as clearly shown in Fig. 8, and thereby restrict the flow of fluid through said nozzle very accurately. The side portions of the slide have their faces parallel throughout, as shown at 20, whereby they will effectually act as guides and tend to prevent leakage through the grooves in which the slide is mounted. The slide may be adjusted or operated through any desired or convenient mechanism and is shown as carried by and rigidly secured to the inner end of a rod 21 passing outwardly through the supply pipe 22 which leads to the inlet nozzle 18 and may be secured upon the casing 23 in any convenient manner, packing 24 being interposed between the opposed surfaces so as to prevent leakage, and the rod passing through a packing box 25 of any well-known or preferred form so as to prevent leakage around the rod. This valve may, of course, be employed in an engine having a single rotor, although its advantages are more apparent in engines having a plurality of rotors as, by its use, the motive fluid is divided into two streams before acting upon the rotors and, therefore, will be more evenly distributed and will act more equally upon the adjacent rotors. If the conditions are such that the load on the engine is constant and the pressure of the motive fluid is constant, the valve may be entirely omitted.

In Fig. 4, the offsets or enlargements 9 and the projections 10 constituting the blades are shown as integral with the rotor disk and as being disposed equally on the two faces of the disk. In Figs. 10 and 11, I have illustrated forms of rotor disks which differ from the first described form in details of construction but which are identical therewith in operation. In Fig. 10, the disk 26 is provided with an integral enlargement or offset hub portion 27 which is of the same construction and form as the offset or enlargement 9, but the blade 28 is a relatively thin plate set into the peripheral edge of the disk and disposed so as to project beyond the periphery and laterally from both faces of the disk. This form of the device will be found advantageous when necessity for repairing or renewing the blade arises as a broken or badly bent blade may be easily withdrawn and a new blade substituted therefor without requiring the provision of an entirely new disk. Of course, the blade may be welded or otherwise secured in the disk so that it will not be apt to be accidentally loosened and removed therefrom so as to diminish the effectiveness of the engine while it is in use. In Fig. 11, the disk 29 is provided at its hub portion or center with an offset 30 which is disposed upon only one side of the disk but will, of course, project laterally to a greater distance than in the forms previously described. The blade member 31 is also disposed upon only one side or face of the disk and it may be integral with or separate from and secured to the disk. While the drawings show the projection as terminating at the periphery of the disk, it may, of course, project beyond the periphery. In all forms, however, the disks will be assembled so that the blade members will be in alinement and will abut so as to present a blade extending continuously the entire width of the rotor. When employing the form of disk shown in Fig. 11, the disks will be so arranged that the blade and hub members of each disk will abut the smooth plane face of an adjacent disk so that, in the finished rotor, the disks will be effectually spaced and maintained in spaced relation at both their centers and their peripheries and a continuous blade will be produced extending the full width of the rotor.

Having thus described the invention, what is claimed as new is:

1. In a turbine of the type described, a rotor consisting of a plurality of axially alined closely spaced plane-faced disks rigidly secured together and having alined openings therethrough near their centers, and radially extending circumferentially spaced projections on each disk at the periphery thereof, said projections being in alinement transversely of the disks and in abutting relation to adjacent disks whereby to form a continuous radial blade extending across the entire longitudinal extent of all the disks.

2. In a turbine of the type described, a casing having an inlet nozzle in its side, rotors disposed within the casing at opposite sides of said nozzle, and a valve slidably mounted in the nozzle to project through the mouth thereof and between the peripheries of the rotors tangentially to both rotors.

3. A turbine of the type described comprising a casing, an inlet nozzle extending through the side of the casing and having two opposite walls converging toward the interior of the casing and provided with longitudinal grooves in the walls connecting the converging walls, a pair of rotors mounted within the casing at opposite sides of the nozzle to receive motive fluid peripherally therefrom, and a slide having its side edges mounted in the said grooves and having a tapered inner edge portion adapted to project through and beyond the mouth of the nozzle between the peripheries of the rotors whereby to regulate the flow and hold fluid at each side to the periphery of the adjacent rotor.

4. In a turbine, a casing having an inlet nozzle in its side, said nozzle having inwardly converging walls, a rotor within the casing receiving motive fluid upon its periphery tangentially from the nozzle, and a flat slide mounted within the nozzle and adapted to project through and beyond the inner end of the nozzle, the inner end edge portion of the slide being tapered.

5. A turbine comprising a plurality of chambers disposed in substantially rectangular relation, rotors within the respective chambers having parallel axes, and nozzles delivering motive fluid tangentially to the peripheries of the rotors at the points of closest approach thereof whereby each nozzle will deliver to two rotors and each rotor receive fluid from two nozzles.

In testimony whereof I affix my signature.

JAMES R. CLARY. [L. S.]