No. 882,127. PATENTED MAR. 17, 1908.

B. STEVENS.

TURBINE MOTOR.

APPLICATION FILED DEC. 9, 1907.

Fig. 4.

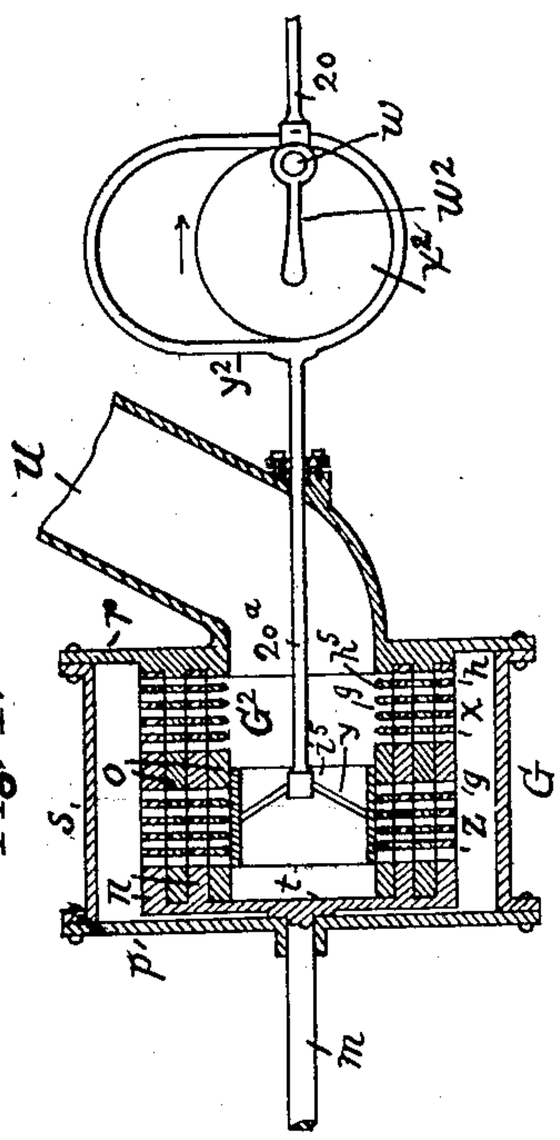


Fig. 2.

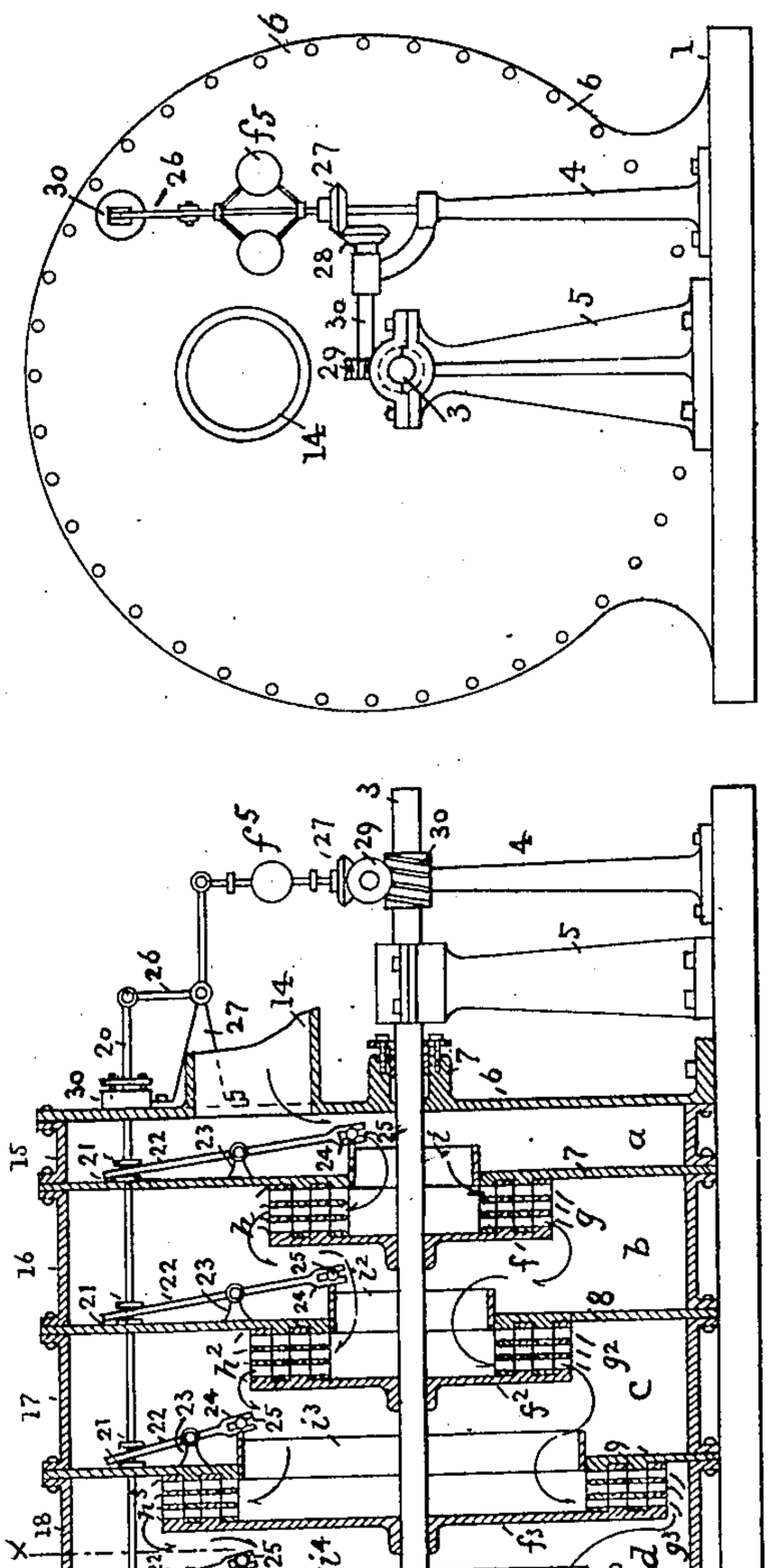


Fig. 3.

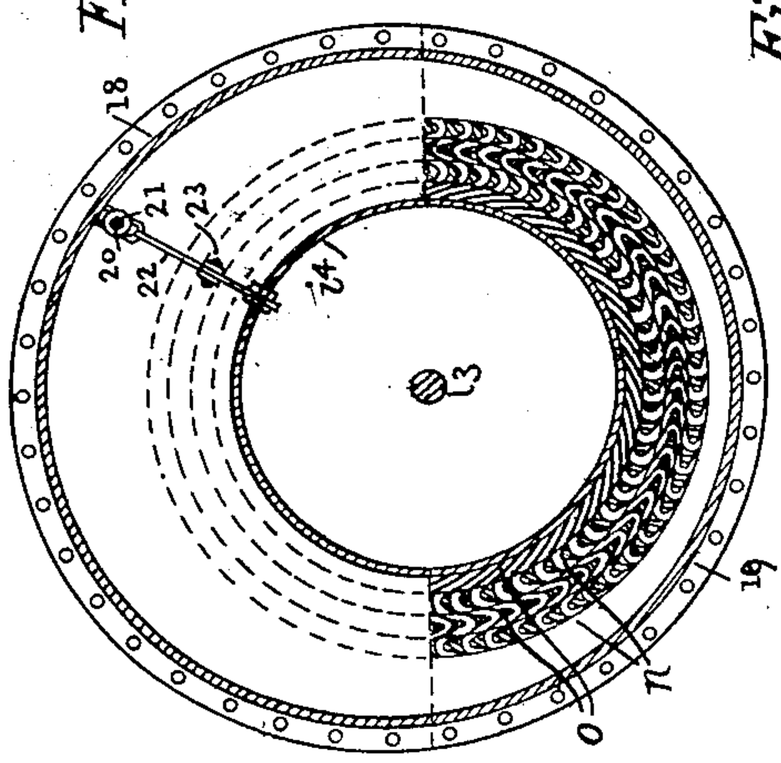
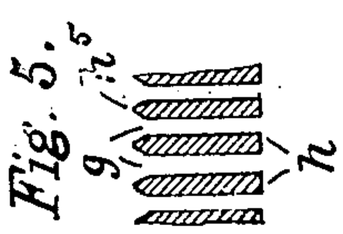


Fig. 1.

Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

BYRON STEVENS, OF OAKLAND, CALIFORNIA.

TURBINE-MOTOR.

No. 882,127. Specification of Letters Patent. Patented March 17, 1908.

Application filed December 9, 1907. Serial No. 405,695.

To all whom it may concern:

Be it known that I, BYRON STEVENS, residing at Oakland, in the county of Alameda and State of California, have invented certain Improvements in Turbine-Motors, of which the following is a specification.

The present invention relates to turbine-motors, by means of which the energy of steam or other elastic fluid under pressure is converted into mechanical power; and it is an improvement upon the invention filed by me in the Patent Office September 7, 1907, Serial Number 391,780.

The special features involved in the present application are, first, a reversing device for a turbine-motor consisting of two sets of vanes, either of which may be brought into action by means of a valve, so that the motor may be rotated in either direction; and a second feature is the compounding of two or more wheels upon the same shaft, each wheel being of different capacity in order that the steam may expand from one into the other with the greatest efficiency; and each wheel is inclosed in a chamber by itself constituting a unit, the several chambers or units being of the same diameter and bolted to each other, and inclosing the shaft.

This application also concerns a governing device by means of which the valves of all of the wheels are regulated, in order that the proper amount of steam may be admitted to each.

The invention also relates to certain details of construction, all of which I will now proceed to describe and point out in the appended claims.

In the drawings, which form a part of and illustrate the invention,—Figure 1 is a sectional elevation of the compounded turbine-motor embodying my invention; Fig. 2 is an end elevation of the same; Fig. 3 is a section on line *x*—*x* of Fig. 1; Fig. 4 is a sectional elevation of a single wheel turbine-motor to illustrate my reversing device; and Fig. 5 is a detail of the vanes, to be explained.

In the drawings 1 is a base plate to support the parts composing the compound turbine-motor; 2 and 5 are standards, provided at their upper ends with bearings in which rotate the shaft 3, and *a*, *b*, *c*, *d* and *e* are units composed of the ends 6 and 11, partitions 7, 8, 9 and 10, and the rings 15, 16, 17, 18 and 19, bolted to each other at their external flanges; the ends 6 and 11 are provided with stuffing boxes 7 and 12 to inclose the shaft 3, and 14 is the inlet pipe and 13 the outlet pipe.

The units *b*, *c*, *d* and *e* are chambers in which are located turbine wheels constructed similarly to the one described in the application referred to, *i. e.*, with interleaved vanes, one set *o*, *o*, integral with the walls or partitions 7, 8, 9 and 10, and the other set integral with the disks f, f^2, f^3 and f^4 which are secured to and rotate with the shaft 3, the openings *g* in each set registering with each other as do the partitions *h*, and with a central chamber forming the fluid inlet.

Regulating valves i^1, i^2, i^3 and i^4, consisting of plain short tubes, are adapted to slide into the central space of each wheel across the openings *g* to prevent the fluid from passing through them; a main valve is, however, located in the inlet pipe 14 (not shown) as represented in said application.

The valves are operated by a ball regulator f^5 supported upon the standard 4, which is connected to the valves by the ball crank lever 26 pivoted to the stand 27, the lever being pivoted to the rod 20 which passes through the stuffing box 30 and through the walls 7, 8, 9 and 10, and is provided with the double collars 21 in the chambers *a*, *b*, *c* and *d*, between which extends the bifurcated end of the levers 22 pivoted to the stands 23, the opposite bifurcated ends of which embrace the pins 25 on the valves so that the regulator f^5 operates all of the valves at the same time. The regulator receives motion from the shaft 3 from the screw 30 into which meshes the gear 29 upon the shaft 30, provided with the bevel gear 20 which meshes with the bevel gear 27 on the regulator shaft.

It will be observed that the drawings are not strictly mechanical but are somewhat schematic and are for illustration of the invention.

It may be known that the efficiency of the turbine depends largely on keeping a solid jet of steam impinging on the vanes, and in order that this may be done the nozzle has to be designed for the particular initial and terminal pressure under which it operates.

In order to carry out the invention the drawings represent four wheels of different capacity for the admission of steam which are designed for pressures of 135, 78, 45 and 26 pounds per square inch each, and the areas of the nozzles to correspond to the

different volumes of the same amount of steam at these pressures are proportionally .52, .90, 1.56 and 2.70, and the circumferences and areas of the nozzles are proportional to these figures.

The maximum velocity of steam flowing in a nozzle is obtained when the lower pressure is .6 of the upper and does not increase any when this difference is made greater, so the pressure of each succeeding wheel is made .6 of the previous one. But these are the theoretical formulæ which may have to be changed slightly to compensate for the friction in the passages.

It is proposed to design the vanes so that they will be a continuation of the nozzle, so that the solidity of the jet of steam will not be broken, and the section shown in Fig. 3 is drawn to represent this feature.

Referring to Figs. 4 and 5, *m* is a shaft terminating in the disk *t* within the chamber G^2, provided with the concentric tubes *n*, *n*, in which are vanes interleaving with the concentric tubes *o*, *o*, attached to the rear wall *r* of the chamber also provided with vanes coinciding with those in the tubes *n*, and *u* is the inlet pipe in which is located the valve i^5. The valve i^5 is a section of a tube having an internal spider *y* connecting with a hub upon the rod 20^a, which extends through the inlet pipe *u* and terminates in the yoke y^2 within which is a cam x^2 upon a shaft *w* to which is pivoted a rod 20 connecting with a regulator similar to that shown in Fig. 1. The cam may be turned in the direction of the arrow by a lever w^2 on the shaft *w*. In the position shown the valve covers the openings in one set of vanes *z* while the other set of vanes *x*, which slope in an opposite direction to those at *z*, are open to receive steam from the inlet pipe, which steam is regulated thereto by the regulator or governor; and when it is desired to have the motor rotate in an opposite direction the cam is turned in the direction of the arrow and the valve moves to the opposite end of the chamber and closes the openings *g* at the end *x* while uncovering those at *z*. Thus a simple means is provided for reversing the direction of the rotation of the motor at the same time the steam is regulated by a governor.

Fig. 5 is a section of an immovable internal tube *o*, and *g*, *g* are the openings between the vanes *h*, *h* which, upon their inner side are tapered to form a bell mouth to the openings, or the openings are divergent toward the intake, in order that a solid jet of steam may be delivered to the succeeding vanes beyond, as it is well known that a more solid jet of fluid can be passed through an orifice if the intake is divergent.

I claim as my invention:—

1. A turbine-motor composed of a series of chambers, a shaft extending through the chambers, a series of wheels in the chambers, each composed of a movable part and an immovable part, the former part being connected to the shaft while the latter part is connected to a wall of a chamber, the vanes of the wheels being located in interleaved tubes alternately connected to said parts, a central fluid inlet for each wheel, a regulating valve in said inlet, and a governor or regulator adapted to operate the valves.

2. A turbine-motor composed of a series of chambers composed of circular rings, ends and cross walls or partitions, a central orifice in each partition, a tubular valve in each orifice, a shaft extending through the chambers, a series of wheels in the chambers, consisting of movable and immovable interleaved tubes provided with vanes registering with each other, the movable tubes being connected to the shaft and the immovable tubes connected to a cross wall of a chamber, a governor or regulator adapted to operate the valves and an inlet and an outlet pipe, as set forth.

3. In a turbine-motor wheel composed of a series of interleaved tubes, each alternate tube being movable while the others are immovable, a central axial fluid inlet chamber, the tubes having vanes coinciding with each other, the vanes of the inner tube being divergent toward the said chamber, and in direct proximity thereto.

4. In a turbine-motor wheel composed of a series of interleaved tubes, each alternate tube being movable while the others are immovable, a central axial inlet chamber, the tubes having vanes coinciding with each other, the inner tube being immovable and having its vanes divergent toward the chamber, and in direct proximity thereto.

5. A turbine-motor composed of a series of chambers, a shaft extending through the chambers, a series of wheels in the chambers each composed of a movable part and an immovable part, the former part being connected to the shaft while the latter part is connected to a wall of a chamber, the vanes of the wheels being located in interleaved tubes alternately connected to said parts, a central fluid inlet for each wheel, a regulating valve in said inlet, a valve rod extending through the chambers with connecting means between the same and each regulating valve, and a governor or regulator adapted to operate said valve rod.

6. A turbine-motor composed of a series of chambers composed of circular rings, ends and cross-walls or partitions, a central orifice in each partition, a tubular valve in each orifice, a shaft extending through the chambers, a series of wheels in the chambers consisting of movable and immovable interleaved tubes provided with vanes registering with each other, the movable tubes being connected to the shaft and the immovable tubes connected to a cross-wall of a chamber,

a valve rod extending through the chambers with connecting means between the same and each regulating valve, and a governor or regulator adapted to operate said valve rod.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this 29th day of November, 1907.

BYRON STEVENS.

Witnesses:
F. BOEGLE,
W. S. HARLOW.