S. T. HOLLY.

TURBINE.

APPLICATION FILED JAN. 13, 1908.

942,829.

Patented Dec. 7, 1909.

3 SHEETS—SHEET 1.

Fig. 1.

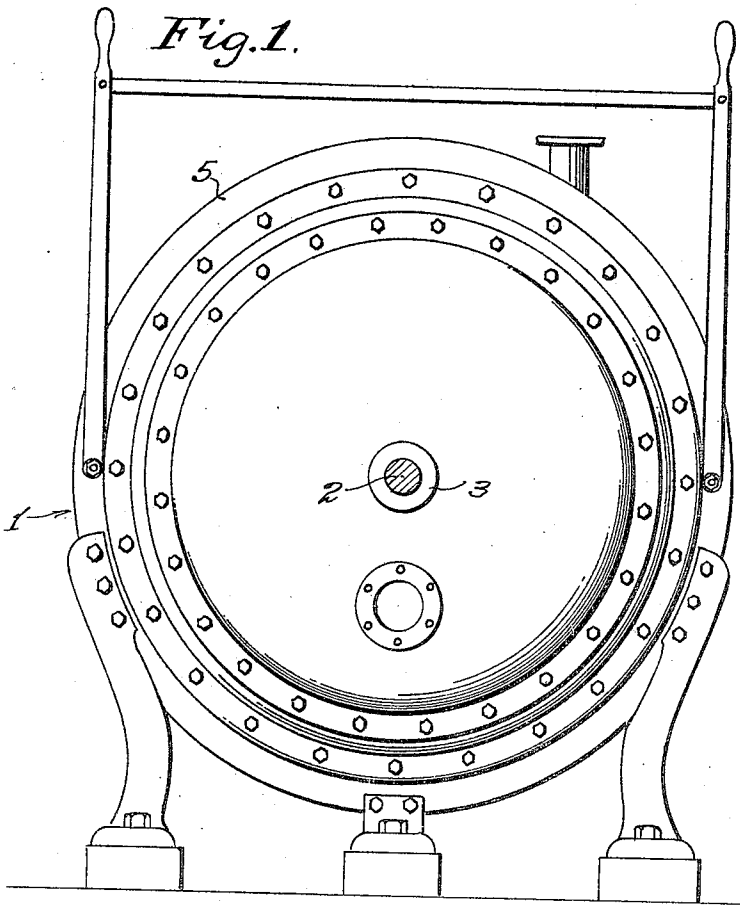


Fig. 3

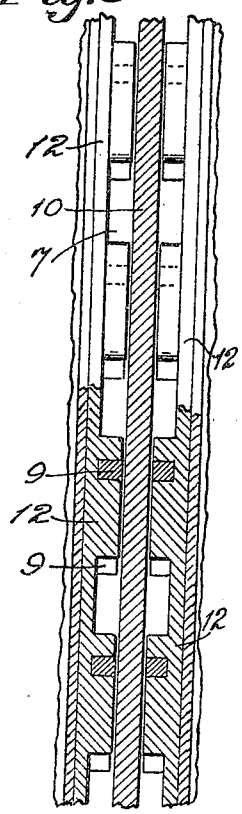


Fig. 4

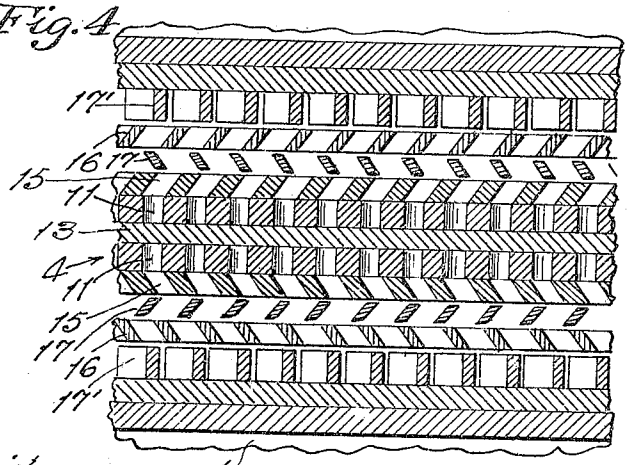
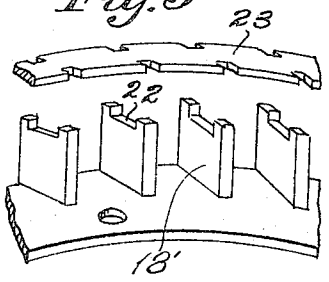


Fig. 5



Witnesses

C. C. Holly.

A. M. Marston.

Inventor

Solomon Townsend Holly

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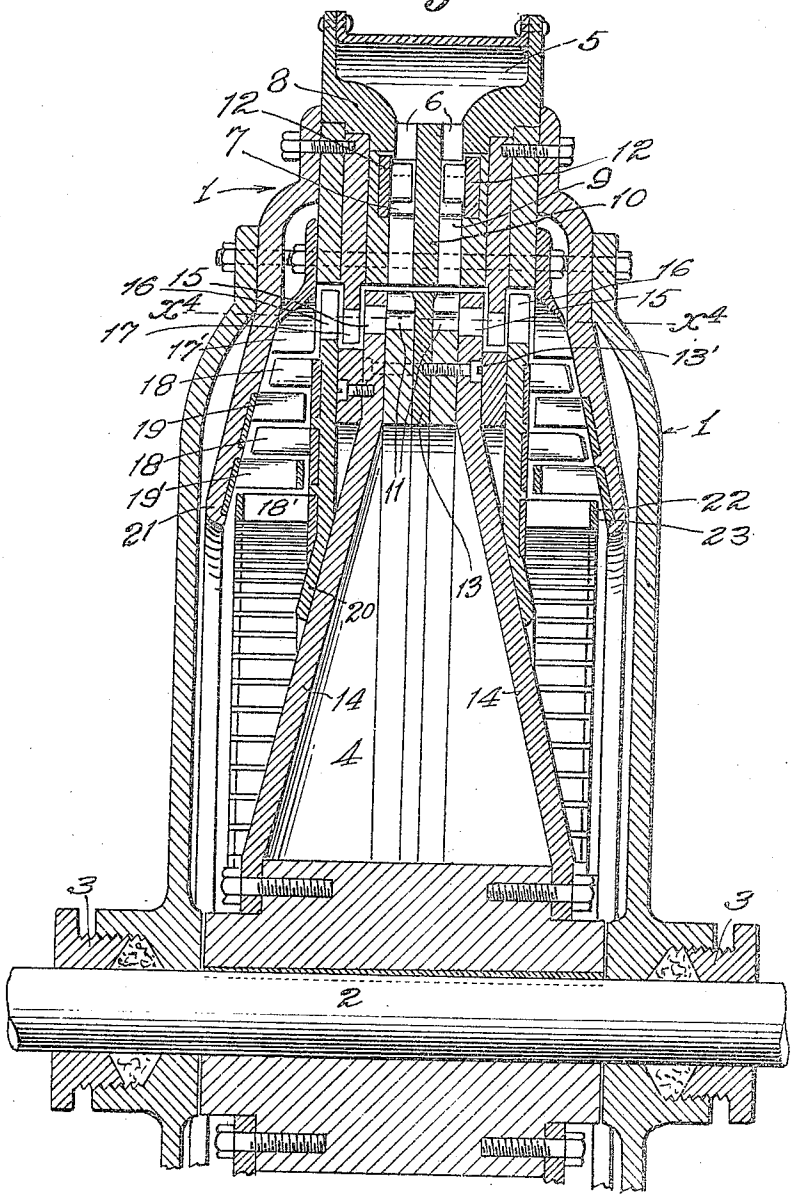
3 SHEETS—SHEET 2.

Fig. 2



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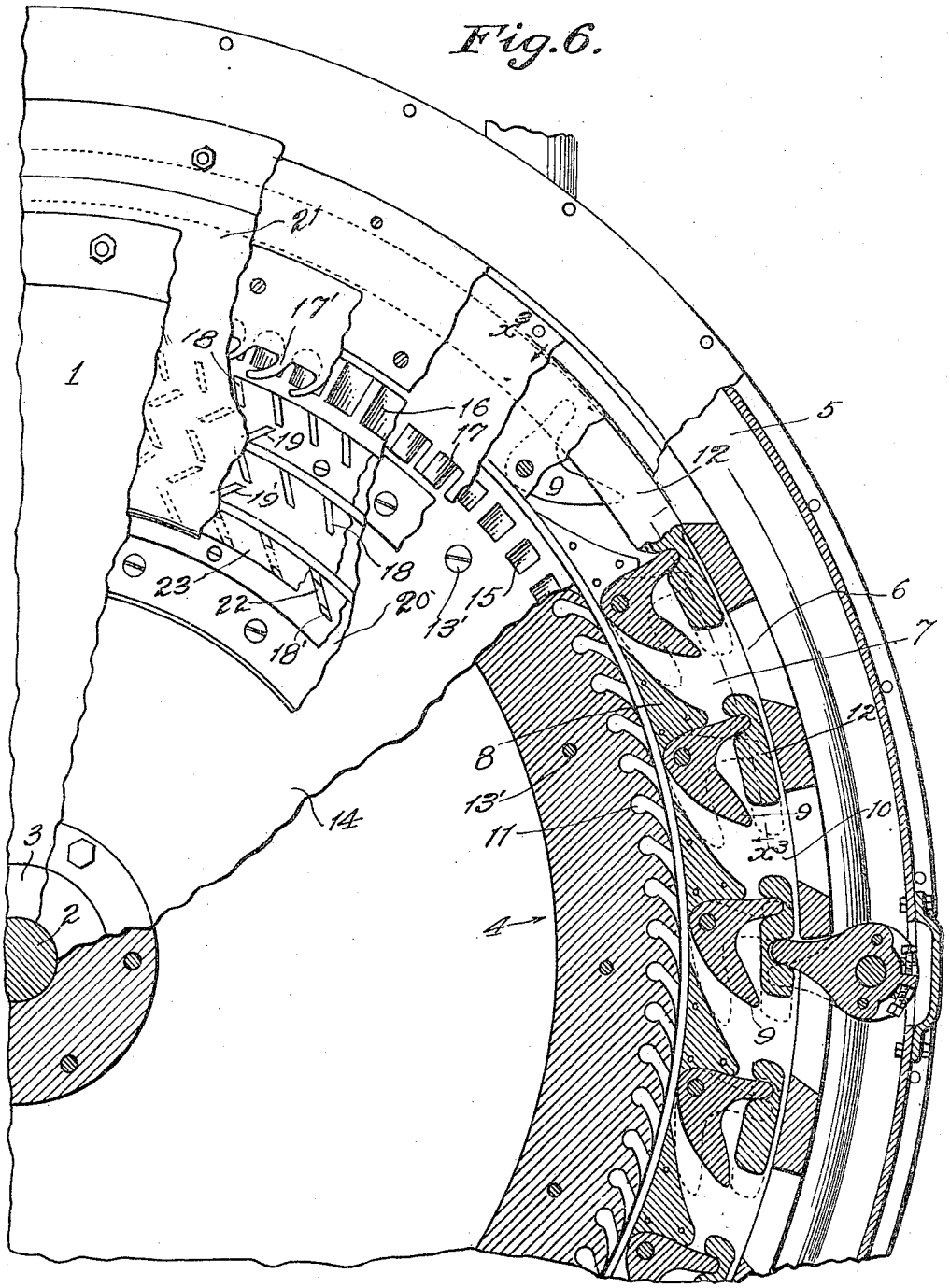
3 SHEETS—SHEET 3.

Fig. 6.



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Inventor

Solomon Townsend Holly

UNITED STATES PATENT OFFICE.

SOLOMON TOWNSEND HOLLY, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-FOURTH TO CARRIE C. HOLLY, ONE-FOURTH TO LUTHER M. MARSTON, AND ONE-FOURTH TO ANNIE M. MARSTON, ALL OF LOS ANGELES, CALIFORNIA.

TURBINE.

942,829. Specification of Letters Patent. Patented Dec. 7, 1909.

Application filed January 13, 1908. Serial No. 410,709.

To all whom it may concern:

Be it known that I, SOLOMON TOWNSEND HOLLY, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Turbines, of which the following is a specification.

This invention relates to turbines and has particular reference to that class of turbines illustrated and described in my Patent No. 858,599 issued July 2, 1907, wherein the elastic fluid is first directed upon the rotor or turbine wheel at the periphery thereof and midway between the ends, and is then caused to flow each way from the middle plane of the wheel and to successively impinge upon the wheel in such manner as to give a compounding effect of the elastic fluid. In the present invention, however, the steam is arranged to be delivered to the wheel through openings composed of two series of passages, or nozzles, located on opposite sides of the central plane of the rotor and on opposite sides of an interposed diaphragm, from which passages, or nozzles, the elastic fluid is discharged in the plane of rotation into the pockets or buckets of the wheel or rotor in such manner that each series of nozzles shall discharge in the line of rotation and the elastic fluid caused to re-act toward the appropriate end of the wheel.

One of the important objects of this invention is to utilize to its greatest extent the expansive force of elastic fluid. It has been found that the first impact in its initial passage to the wheel when delivered in the direct line of rotation and tangentially to the periphery of the wheel imparts more force and momentum to the rotating wheel than at any succeeding impact. In this invention, therefore, I have provided a disk or diaphragm in the central portion of the wheel case, thereby to deliver two separate streams of expansive fluid tangentially and in the direct line of rotation of the wheel. The streams of steam or elastic fluid are divided until each stream is conducted toward the exhaust ends of the wheel.

A further improvement contemplated by this invention consists in providing the series of rotating vanes nearest the final exhaust, where the vanes are more elongated and widened, with strengthening bands or rings to brace the blades against the excessive vibratory motions caused by the rapid rotation of the rotor, such bands or rings, as well as the ends of the blades being recessed or notched to embrace the parts to which they are fitted, and when placed in such embrace should be clenched or riveted together, so as to hold the clamped parts more securely, either with or without brazing.

With these and other objects in view, this invention relates to the features, details of construction and combination of parts that will be described in connection with the accompanying drawings, and then be more particularly pointed out in the claims.

In the drawings; Figure 1 is a side elevation of the turbine. Fig. 2 is a horizontal fragmentary section of the turbine. Fig. 3 is a fragmental vertical section of the turbine showing fragments of the valve controlling rings. Fig. 4 is a plan section on lines X^4 X^4 Fig. 2. Fig. 5 is a perspective detail of a portion of the blades, and the ring for securing the blades against vibration. Fig. 6 is a fragmentary sectional side elevation of the turbine, showing the valve mechanism, control therefor and the blades of the turbine and case.

Specifically referring to the drawings, 1 designates a casing or stator, 2 a shaft extending axially through said casing and mounted on suitable journals not shown.

3 designates stuffing boxes for the shaft 2.

4 is a rotor mounted on the shaft 2. A steam chest or distributing trunk 5 extends around the stator or casing and connects through openings 6 with an annular valve chamber 7 formed interiorly of the casing or stator, which valve chamber is arranged to be closed on its inner face by a ring 8, provided with a central diaphragm or disk 10 which divides the incoming steam from the steam chest into two distinct and separate streams, the quantity of which incoming stream being controllable by the valve members 9, which are governed by rings 12. The turbine wheel 4 or rotor is provided with the two series of peripheral pockets or buckets 11, arranged in the same plane as the valve members 9 and adapted to receive the

steam from the steam chest when these valve members are operated.

13 is a central diaphragm or disk which divides the peripheral pockets or buckets of the rotor into two separate series, the said diaphragm being secured in place in a desirable manner as by screw 13′ extending through the walls 14 of the wheel. These buckets 11 extend inwardly and forwardly in the direction of the rotation of the wheel or rotor and communicate with outlets 15 extending rearwardly at an angle to the direction of the rotation of the rotor, so as to discharge the steam in a backward direction.

A plurality of series of vanes 16 are secured to the turbine wheel on each side of the outlets 15, and a corresponding plurality of series of wide directing blades 17 are secured in fixed position adjacent to such series of vanes on the turbine, one series of blades, viz; 17 being adjacent to the outlet 15 to receive and to direct the steam against the first series of vanes 16, and the succeeding series of blades 17′, receiving the steam from each preceding series of rotating vanes and directing the steam against the next series of rotating vanes.

To further increase the compounding action, moving and fixed vanes 18 and blades 19 are secured respectively to the two faces or ends 20 of the rotor and the fixed supports 21 of the stator 1.

In order to insure against the excessive vibratory action of the rotating vanes which are nearest the final exhaust, viz; those blades indicated at 18′, and 19′ and which blades as seen by the drawings, are necessarily elongated, I have made the provision illustrated in Fig. 5. This provision consists in notching the ends of the blades as seen at 22 and inserting in the notched space of the blades a similarly notched band or ring 23, which band is set in place in the respective vanes in any desired manner, and firmly clenched or riveted.

Since this invention is an improvement over that class of turbines mentioned in my aforementional patent, it has been deemed unnecessary to dwell extensively upon the mechanical details of construction of the turbine, as illustrated and described, the present description and drawings being deemed sufficient for a lucid and explicit understanding of the invention involved.

The provision of a central diaphragm 13 to divide the pockets or buckets of the rotor into two distinct and isolated groups, subserves a twofold purpose which may be briefly stated to consist first; in the fact that only one jet of elastic fluid may be used to propel the rotor, and second, the turbine, including stator and rotor, may be placed on an angle to a vertical axis, in which case the steam supply may be regulated to deliver variable quantities to the rotor sufficient to highly propel the rotor and at the same time equalize any end thrusts resulting from the inclination of the turbine.

A greater or lesser number of series of compounding blades or vanes may be used according to size of turbine without departing from the principles of this invention.

The buckets 11 of the rotor consist of pockets so cut into the periphery thereof that the adjacent sides of contiguous pockets meet in acute angles leaving no intervening portion of the circumferential curve of the rotor intact between the pockets, but instead presenting a peripheral series of vanes between the pockets formed integral with the rotor and terminating in rearwardly directed acute angles adapted to continuously direct the incoming elastic fluid into the pockets. The ring 8, however, through which the elastic fluid is delivered to the pockets 11 has an inner curve which covers a plurality of pockets at a time between each of the ports through which the fluid is directed to said pockets. There is sufficient clearance between said ring and the solid sections of the rotor between said pockets, to permit a portion of the fluid, directed toward a pocket beneath a given port in the ring to pass forwardly along said clearance and by reason of its expansive properties force its way efficiently into a plurality of the pockets next in advance of the pocket directly beneath a given port in the ring, thereby to supply force also to pockets between adjacent ports in the ring. The ring is supplied with a multiplicity of ports extending therearound in a series, said ports being placed as close together as they well can be without interfering with the means for regulating the flow of fluid therethrough, but the pockets of the rotor are not spaced so far apart as said ports, there being a plurality of pockets between adjacent ports.

What I claim is:

1. A rotor provided with rows of peripheral buckets which extend forwardly and inwardly and then outwardly to the side thereof, and a diaphragm centrally dividing said buckets, in combination with a stator having an annular steam chest means for dividing the steam from the steam chest into two streams, and means to cause the steam to be directed to one or both rows of buckets.

2. A rotor provided with two rows of peripheral buckets which extend forwardly and inwardly to the side thereof, and a diaphragm centrally dividing and isolating one row of buckets from the other, in combination with a stator, provided with an annular steam chest, means for dividing the steam from said steam chest into two jets, and means carried by said stator to cause said jets to be delivered to one or the other, or both said buckets.

3. In a turbine, a rotor provided with two rows of peripheral buckets, vanes of various angles and lengths to receive the fluid, and a diaphragm centrally dividing said buckets in combination with a stator, a steam chest, an annular divided valve chamber to deliver elastic fluid to the buckets of said rotor, blades of varying lengths and angles fixed in said stator to direct the fluid, and means for securing said vanes and blades against vibration.

4. In a turbine, a stator having blades of varying lengths to direct the fluid, a rotor having vanes of varying lengths to receive the fluid, the longer of said blades being notched and a notched band or ring fitting the notches of said blades and vanes to secure same against vibration.

SOLOMON TOWNSEND HOLLY.

Witnesses:

LUTHER M. MARSTON,

ANNA MAY MARSTON.