H. H. WAIT.

TURBINE.

APPLICATION FILED AUG. 29, 1916.

1,318,035.

Patented Oct. 7, 1919.

3 SHEETS—SHEET 1.

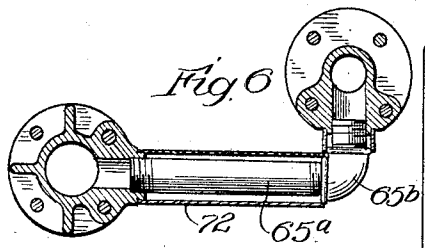


Fig. 6

Fig. 1

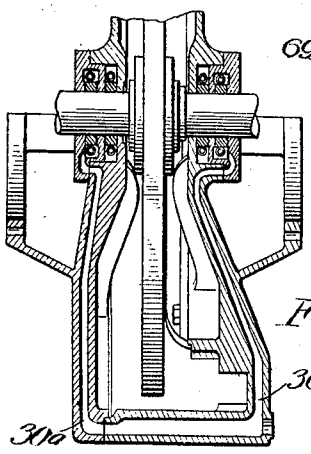


Fig. 3.

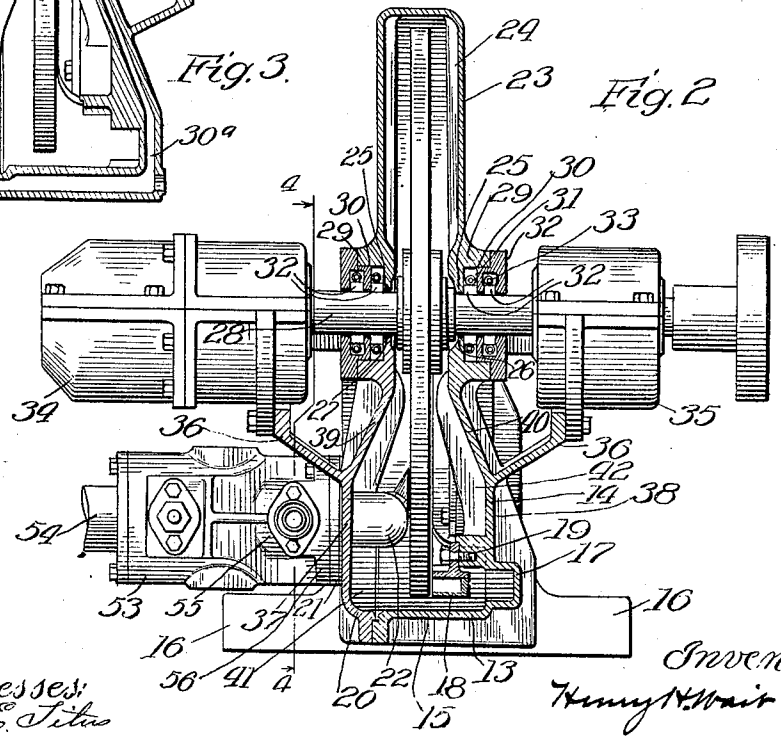


Fig. 2

Witnesses:
John E. Titus

Inventor
Henry H. Wait

by Redfield Hibbard Davis & Macaulay
Attys

H. H. WAIT.

TURBINE.

APPLICATION FILED AUG. 29, 1916.

1,318,035.

Patented Oct. 7, 1919.

3 SHEETS—SHEET 2.

Fig. 4.

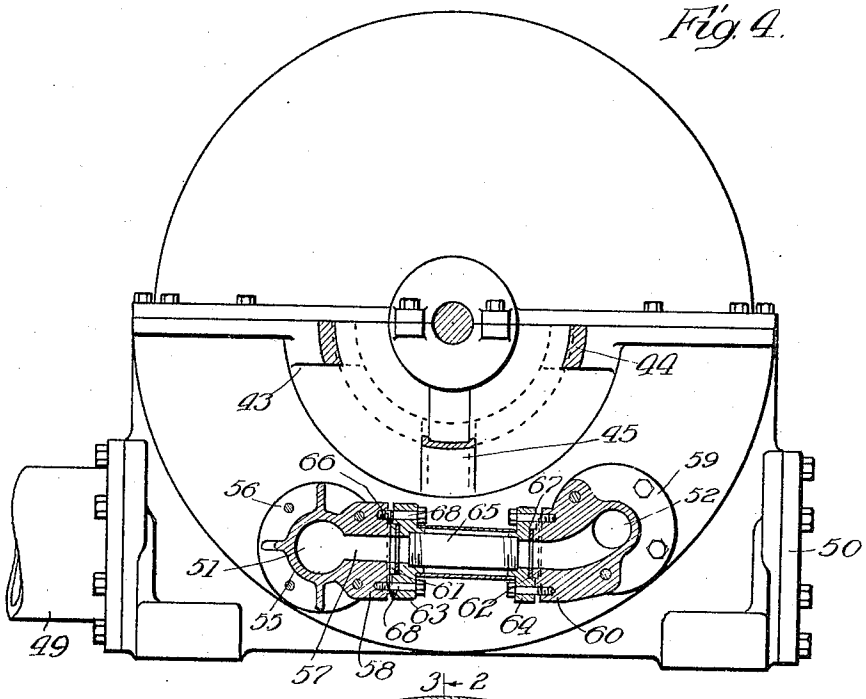
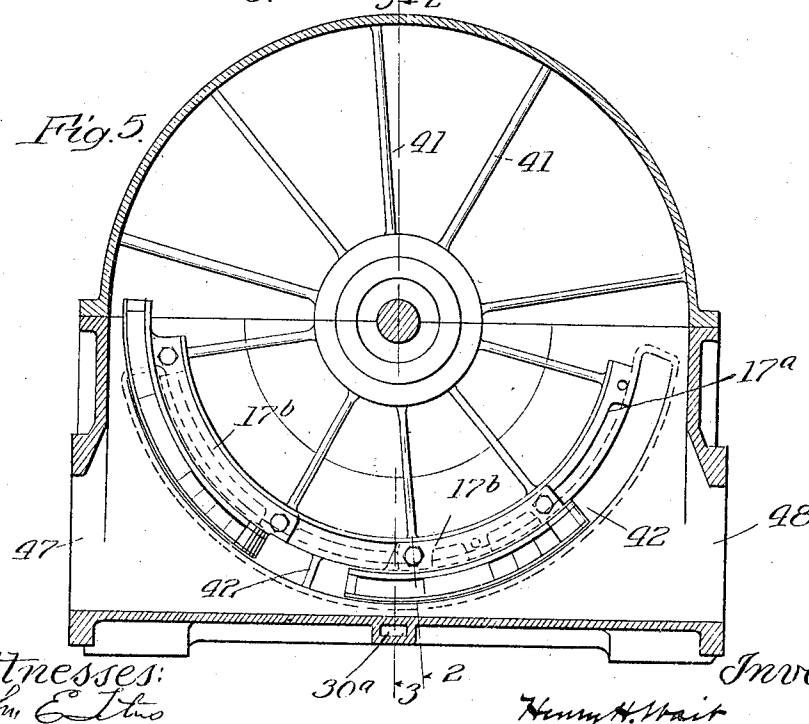


Fig. 5.



Witnesses:
John E. Ellis

Inventor
Henry H. Wait
by Richardson Davis Masland & Attys

H. H. WAIT.

TURBINE.

APPLICATION FILED AUG. 29, 1916.

1,318,035.

Patented Oct. 7, 1919.

3 SHEETS—SHEET 3.

Fig. 7.

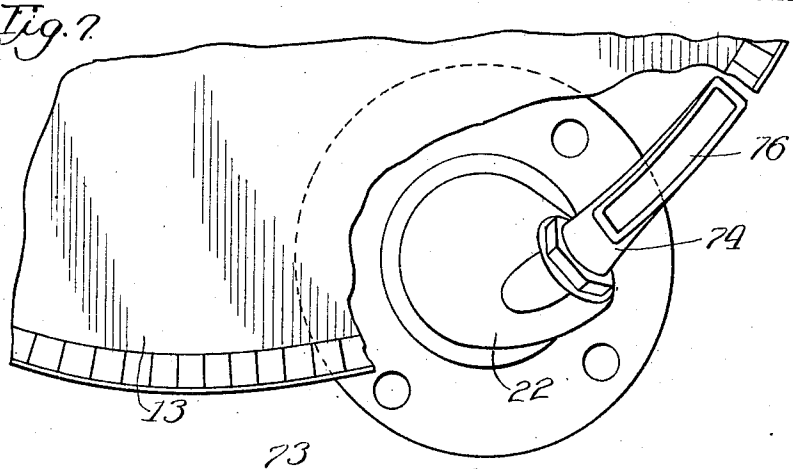


Fig. 8.

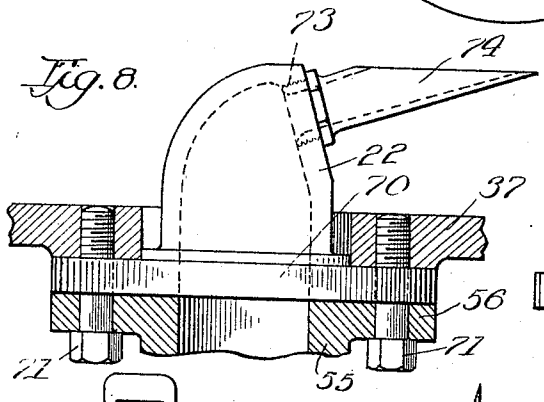


Fig. 9.

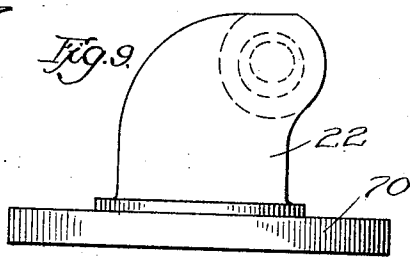


Fig. 10.

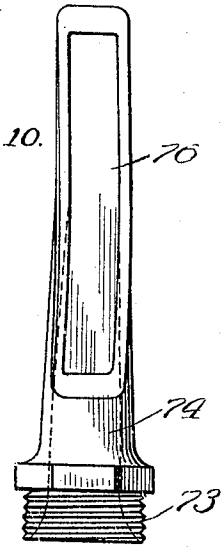


Fig. 11.

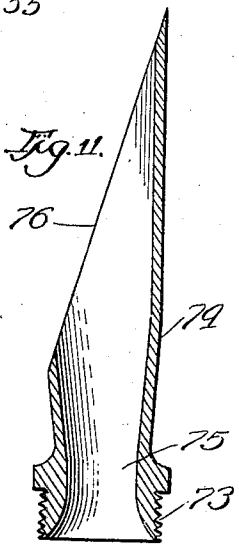
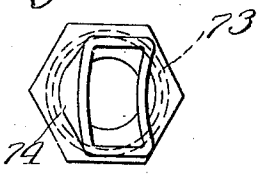


Fig. 12.



Witnesses:
John E. Titus

Inventor.
Henry H. Wait
By Richardson Hibbard Brownell & Campbell
Attys.

THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HENRY H. WAIT, OF CHICAGO, ILLINOIS.

TURBINE.

1,318,035. Specification of Letters Patent. Patented Oct. 7, 1919.

Application filed August 29, 1916. Serial No. 117,466.

To all whom it may concern:

Be it known that I, HENRY H. WAIT, 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 Turbines, of which the following is a specification.

My invention relates more particularly to certain details in the construction of the casing and steam supply pipe and nozzle for a turbine and has for its object to simplify, strengthen and cheapen the construction of these parts.

In the accompanying drawings I have shown a preferred form of the construction and in the specifications I have described the same in detail. It is to be understood, however, that the specific disclosure is for the purpose of exemplification only, and that the scope of the invention is set forth in the following claims, in which I have endeavored to distinguish it from the prior art, so far as known to me, without, however, relinquishing or abandoning any portion or feature thereof.

In the drawings, Figure 1 is a side elevation of a turbine embodying my invention; Fig. 2 is a section on the broken line 2—2 of Fig. 5: Fig. 3 is a vertical axial section on the line 3—3 of Fig. 5, the upper part of the construction not being illustrated; Fig. 4 is a transverse vertical section upon the line 4—4 of Fig. 2; Fig. 5 is an inside view of one of the casing walls, the upper portion thereof being in vertical section; Fig. 6 is a view similar to Fig. 4, of a modification, parts shown in the last named figure, however, being omitted; Fig. 7 is a side elevation of a steam nozzle and nozzle stand for supplying steam to the turbine, a portion of the wheel being shown broken away; Fig. 8 is a view of the same, partially in section on a plane perpendicular to the plane of Fig. 7; Fig. 9 is an elevation perpendicular to Fig. 8; Fig. 10 is an elevation of the nozzle; Fig. 11 is a longitudinal section thereof, at right angles, to the plane of Fig. 10; and Fig. 12 is an end view thereof.

The turbine chosen to illustrate my invention is of the horizontal type and the wheel may be of any ordinary construction in which the buckets are arranged to receive steam from the side. It is therefore not illustrated in detail.

The wheel casing is shown as composed of three castings, to-wit two lower sections divided upon a vertical transverse plane and an upper section or hood, the several sections being joined together by bolted flanges in the usual manner. Lower section 13 comprises side wall 14 and annular wall 15 of the wheel chamber, and a foot or base 16, all of which are cast integrally. A pocket 17 is formed in said wall to receive the return steam guides 18 which are bolted at 19 to bosses formed on said wall and may be of any suitable construction to receive steam from the turbine wheel and return it thereto. The pocket 17 is concentric with the casing and a flattened concentric rib 17^a (see Fig. 5) is formed at the inner edge thereof to form a seat for the attaching flanges 17^b of the steam guides. Radial ribs 41 extend from said arcuate rib to the central boss of the casing section and short ribs 42 extend across the pocket at points where they do not interfere with the guides, and serve to brace and strengthen the casing at those points.

The other lower casting, 20, completes the lower half of the wheel casing. Said casing section is formed with openings 21 for the reception of the steam nozzle stands 22, carrying and communicating with the nozzles by which steam is supplied to the wheel. The upper casing section or hood 23 is semi-cylindrical and formed with internal strengthening ribs 24, and the horizontal meeting edges of said hood and of the lower sections are formed with matched semi-cylindrical openings 25, 26, 27, which, when the parts are assembled, provide for the passage of the wheel shaft 28 through the opposite sides of the casing. A cylindrical boss 29 surrounds each of said openings formed partially in the upper section or hood and partially in the respective lower section and contains a packing chamber 30 which is closed by a cap or cover 31. As said packing chamber and cap form no part of the present invention, they need be no further described than to say that they contain graphite or other packing rings 32 surrounded by garter springs 33 and are drained through channels 30^a formed in the casing.

The bearings for the wheel shaft are, as usual in constructions of this character, spaced away from the casing walls, the housings therefor being shown at 34, 35 on opposite sides of the casing, and said hous-

ings are supported from the casing being bolted to brackets 36, 36, formed integral with the lower sections of the latter respectively. The lower half of the casing containing the nozzles and guides is enlarged with respect to the central portion and upper half thereof, the outer parallel walls 37, 38 being connected to the narrow central portion of the casing by conical dished portions 39, 40. (See Fig. 2).

By reducing the width of the central portion of the turbine chamber in this way it is possible to lessen the distance between the bearing for the shaft and so reduce the over-all width of the construction. By making the central portion conical it is best adapted to resist the steam pressure which is most formidable at this portion of the casing.

The brackets 36 for supporting the bearings comprise each three legs, 43, 44, 45, diverging from a semi-circular plate 46 in a conical surface and merging into the wall integral therewith at about the base of the conical portion. Thus when the bearing housing is bolted to the semi-circular plate, bridging the cavity therein, the bracket structure forms a truss with the conical wall, making a strong rigid structure therewith. In order that the shaft may not be thrown out of alinement due to the unequal heating of the parts, the central lower legs of the brackets are made quite thin and elastic as compared to the side legs 43, 44, thereof, which are substantially horizontal, so that said lower legs yield under expansion and contraction and the stiff side legs of the brackets therefore maintain the alinement of the shaft bearings.

In the construction shown the casing is formed with two steam outlets 47—48, upon opposite sides thereof, either of which may be connected to a steam conduit 49, and the other closed by a plate 50.

In the particular example of my invention shown provision is made for supplying steam to the wheel at two points in the casing, a main nozzle being located at 51 and an auxiliary nozzle at 52; see Fig. 4. A valve chamber 53, connected to a supply steam conduit 54, is formed with a reduced neck 55 and a flange 56, by which it is connected to the casing over the opening 51 therein leading to the main nozzle 22. The valve casing may contain a valve of any desired character for controlling the flow of steam. The neck 55 of the valve casing is formed with a lateral passage 57, surrounded by a boss 58, for the purpose of supplying steam to the auxiliary nozzle at 52. An elbow connection is mounted over the opening at 52 by flange 59, and formed with a boss 60. Each of the lateral bosses is provided with a male projecting portion 61—62 which enters a corresponding recess formed in a coupling head 63—64 secured to the end of a short pipe section 65, by which said valve casing and nozzle elbow are connected. Compressible packing 66—67 are interposed between said male portions and their seats, and bolts 68 extending through the flanges of the coupling sections 63—64 secure tight joints between the parts. By this construction provision is made for the difference in expansion of the pipe connection and the casing between the intakes for the two nozzles, and thus leakage is prevented. The elbow connection for the auxiliary nozzle is formed with a valve seat and provided with a valve 69, by which the steam supply to the auxiliary nozzle can be controlled.

In Fig. 6 I have shown a modification of the connection between the valve casing and the auxiliary nozzle elbow in which the connecting pipe 65^a is formed with an elbow 65^b, and the ends of said pipe threaded directly into the bosses on the valve casing and auxiliary nozzle elbow respectively. Because of the elbow bend sufficient resiliency is provided in this construction to avoid leakage due to the unequal expansions of the casing and conduit respectively between the valve and the auxiliary nozzle stand. In order to check radiation the connecting pipe is surrounded by a pipe 72 of larger diameter whether the straight or elbow connection is employed.

Turning now to Figs. 7 to 12 of the drawings showing the construction of the nozzle and nozzle stand, the wall of the casing is fragmentarily shown in Fig. 8 at 37, and the flange 70 of the nozzle stand 22, and flange 56 of the valve casing or elbow as the case may be, are shown bolted thereto at 71.

The stand 22 is as shown generally dome shaped with an inclined flattened face eccentrically located upon one side of the dome, which is formed with a tapped opening 73, to receive the threaded end of the nozzle 74. By locating the nozzle eccentrically of the dome and away from the center of the turbine I am enabled to provide a materially larger space for the dome without interfering with the location of nozzle. The nozzle is circular in cross section at its base 75, but oblong or flattened in cross section toward its outlet, the outlet opening being formed on a sharp angle to the axis of the nozzle at 76. When the nozzle is assembled with the wheel and casing the walls of the outlet opening are close to the peripheral buckets of the wheel. As shown in Fig. 7, the nozzle is curved throughout the extent of the outlet opening upon the arc of the buckets of the turbine wheel so that it closely follows the same, and said opening is somewhat narrower radially than the height of the buckets and may also be narrower than the diameter of the circular

portions of the nozzle. By making the opening narrower than the height of the buckets in the wheel steam is prevented from impinging upon the band and edge of the wheel respectively.

By making the diameter of the throat of the nozzle larger than the radial dimension of the nozzle outlet opening a larger steam flow may be used and consequently greater output obtained with a given height of wheel blades.

This method of arranging the nozzle tends to increase, for given conditions, the circumferential span of the nozzle on the wheel thereby minimizing the losses in efficiency which occur where the wheel blades enter and emerge from the space in front of the nozzle.

I claim:

1. In a turbine and in combination with the wheel and shaft thereof, a casing for the wheel, a portion of which is enlarged axially of the turbine toward the periphery thereof, the walls of the enlarged portion being connected to the central portion of the turbine casing by dished conical walls.

2. In a turbine and in combination with the wheel and shaft thereof, a casing for the wheel, a structure alined with the shaft and spaced from the casing, a bracket supporting said structure to the casing comprising a supporting plate, relatively stiff legs connecting the plate to the casing in a substantially horizontal plane, and a relatively flexible leg connecting the plate to the casing arranged at an angle to the horizontal.

3. In a turbine and in combination with the wheel and shaft thereof, a casing for the wheel, a bearing for the shaft, spaced away from the casing, means supporting the bearing from the casing, comprising a bracket having a supporting plate, and legs diverging from the supporting plate and merging into the casing a substantial distance from the center thereof whereby said bracket forms a strengthening member for the casing.

4. In a turbine and in combination with the wheel and shaft thereof, a casing for the turbine, a bearing for the shaft spaced from the casing, means supporting the bearing from the casing comprising a semi-circular plate, and legs diverging therefrom in a substantially conical surface and merging into the wall of the casing, the bearing being connected to said semi-circular plate.

5. In a turbine and in combination with the wheel and shaft thereof, a casing for the wheel, a portion of which is enlarged toward the outer periphery thereof, the walls of the enlarged portion being connected to the center portion by conical dished walls, a bracket for supporting a construction in alinement with the shaft, comprising a supporting plate and legs diverging therefrom and merging into the casing wall a substantial distance from the center thereof, whereby said bracket forms with the conical portion of the wall a strengthening truss for the conical portion of the wall.

6. A steam turbine comprising a casing, a wheel and a shaft on which the wheel is mounted, an opening in the wall of the casing adjacent the periphery of the wheel, a steam dome mounted in said opening and extending into said casing, and a steam nozzle mounted eccentrically and tangentially upon said dome and communicating with the interior thereof.

7. In a turbine of the class described, having a plurality of nozzles, nozzle stands supporting the nozzles extending through the walls of the casing and having flanges upon the outside thereof, castings having flanges mounted upon the flanges of the stands, the flanges of the castings and stands being bolted together to the casing, said castings being formed with channels connecting with said stands, and a conduit or conduits connecting said castings.

8. In a turbine of the class described, having a plurality of nozzles, stands supporting the nozzles extending through the casing and having flanges on the outside thereof, castings having flanges mounted upon the flanges of the stands, said flanges being secured together and to the casing by bolts, said castings formed with channels connecting with the nozzle stands, bosses on said castings surrounding the channels and formed with male projections, one or more conduits connecting said castings and provided at their ends with coupling members having recessed seats into which said male portions extend.

9. In a steam turbine of the class described, a casing, a plurality of nozzles in the casing, stands on which said nozzles are mounted extending through the casing and to the outside thereof, a branch pipe connecting said stands and provided with an elbow intermediate the same.

10. In a steam turbine of the class described, a casing, a plurality of nozzles in the casing, nozzle stands for supporting and supplying the latter extending through the casing to the outside thereof, a branch pipe connecting said stands external to said casing and provided with expansion joints.

HENRY H. WAIT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."