Feb. 12, 1929. 1,701,539

L. H. MORRILL

TURBINE CONSTRUCTION

Filed March 3, 1927 2 Sheets-Sheet 1

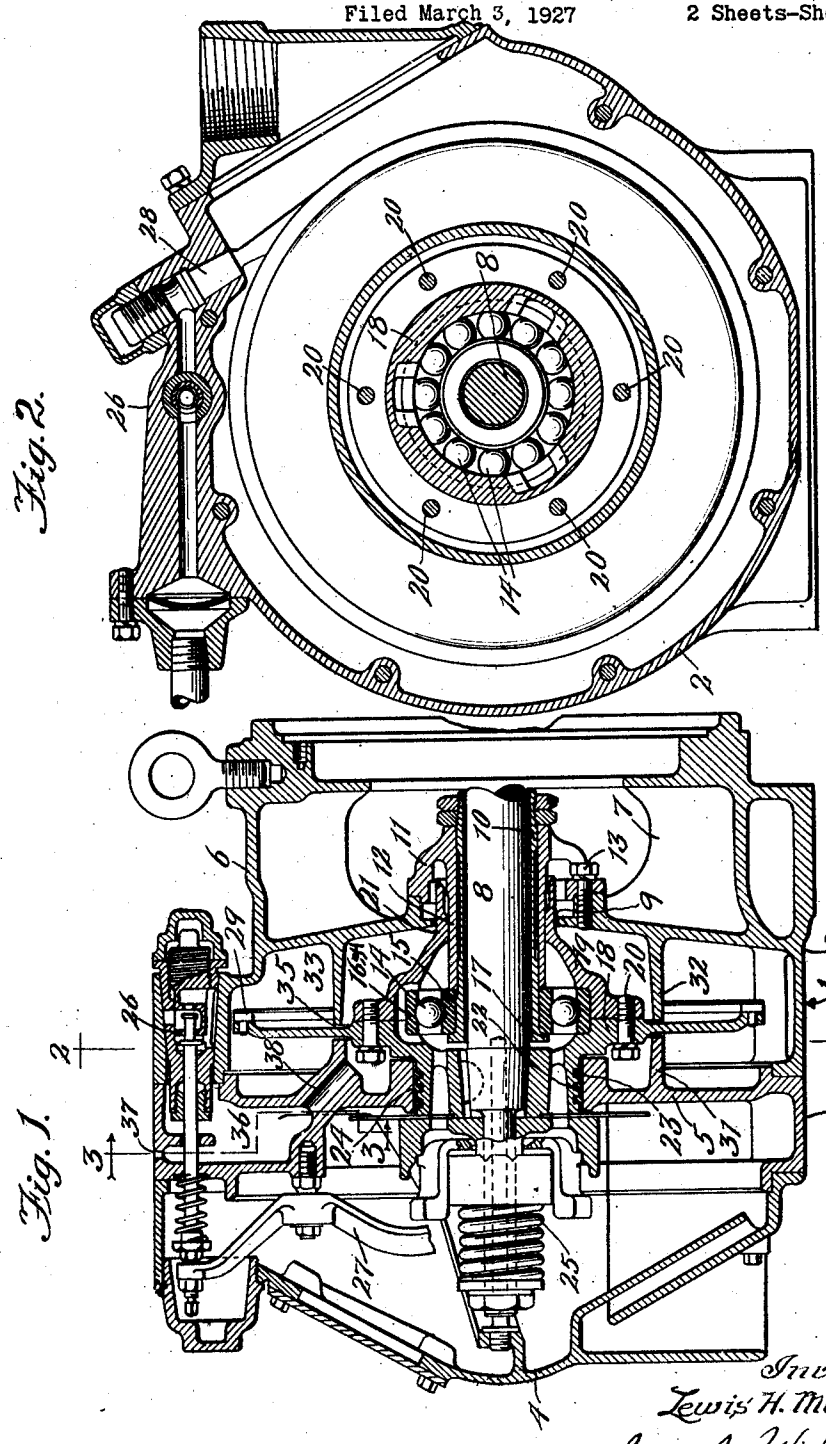


Fig. 2.

Fig. 1.

Inventor:
Lewis H. Morrill
By Ira J. Wilson
Atty.

Feb. 12, 1929. 1,701,539

L. H. MORRILL

TURBINE CONSTRUCTION

Filed March 3, 1927 2 Sheets-Sheet 2

Fig. 3.

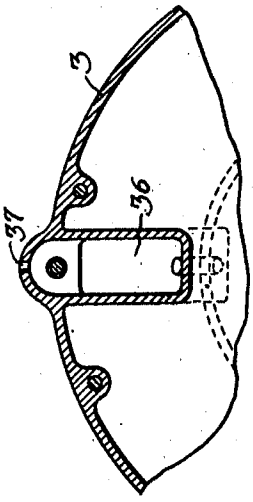


Fig. 5.

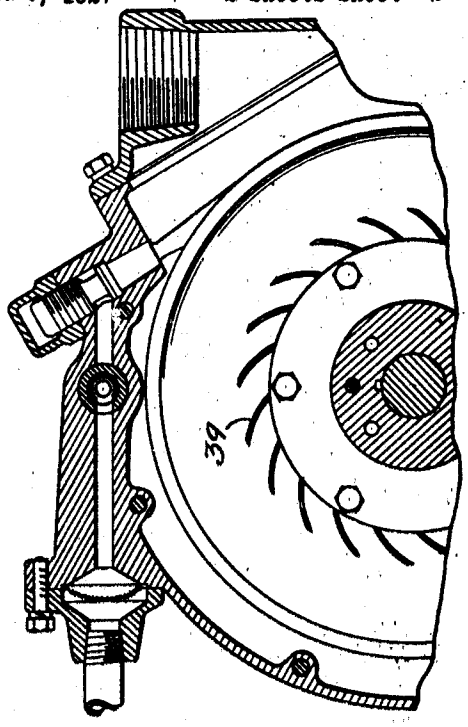
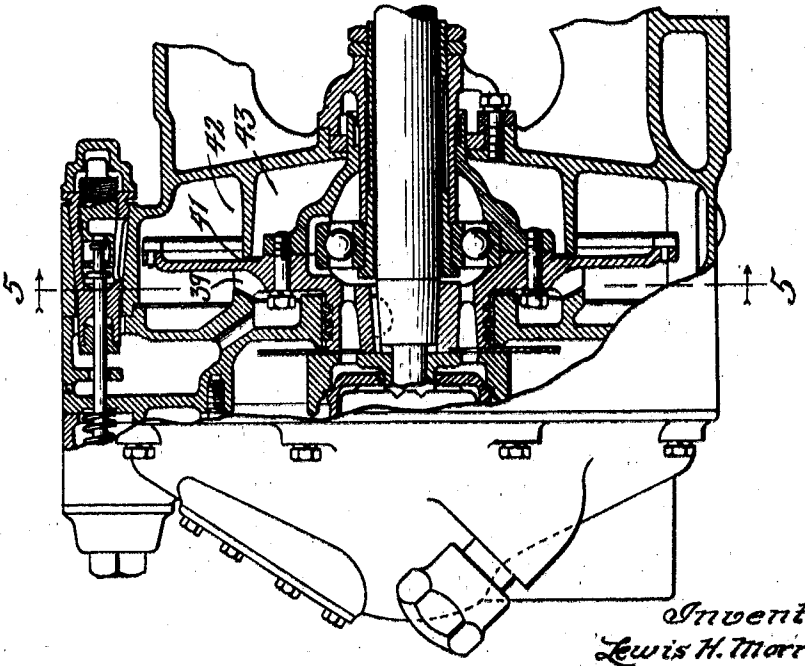


Fig. 4.



Inventor;
Lewis H. Morrill
By Ira J. Wilson
Atty.

Patented Feb. 12, 1929. 1,701,539

UNITED STATES PATENT OFFICE.

LEWIS H. MORRILL, OF HARVEY, ILLINOIS, ASSIGNOR TO THE BUDA COMPANY, OF HARVEY, ILLINOIS, A CORPORATION OF ILLINOIS.

TURBINE CONSTRUCTION.

Application filed March 3, 1927. Serial No. 172,291.

This invention relates to turbine constructions and aims to provide a construction wherein the steam chamber is substantially isolated from other parts of the turbine, particularly the governor thereof in order that the steam from said chamber may not cause either deterioration of said parts or faulty lubrication thereof.

More specifically it is an object of this invention to provide a construction which permits the creation of a partial vacuum in the turbine housing intermediate of the steam chamber and various other parts of said housing desired to be kept free from said steam and condensate therefrom.

It is further an object of this invention to provide a construction of the above type which may be conveniently assembled and economically manufactured and which will afford a maximum of accessibility for inspection, renewal or repair.

Other and further objects of this invention will be apparent as the same becomes better understood from an examination of the specification and claims in connection with the accompanying drawings which illustrate a preferred embodiment of said invention.

Fig. 1 is a fragmentary longitudinal vertical section with parts in elevation of the turbine end of a turbine generator, such as is shown in connection with my copending application for governor, Serial No. 172,290 filed March 3, 1927.

Fig. 2 is a vertical transverse section taken at the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary detail section taken at the line 3—3 of Fig. 1.

Fig. 4 is a fragmentary vertical section showing a modification.

Fig. 5 is a fragmentary transverse section taken at the line 5—5 of Fig. 4.

Referring to the drawings more particularly, numeral 1 represents generally the housing of the turbine end of a turbine generator set, such as is disclosed in general in connection with my above copending application. The housing 1 is preferably cast in sections 2, 3 and 4, the section 2 being cast with the left side open, as viewed in Fig. 1. The left side of the section 2 is closed by the section 3, the right side of which forms a partition 5, the left side of the latter section being closed by the section 4 which is in the form of a front cover. The aforementioned sections are suitably secured together and the section 2 is provided at the right thereof with axially extending webs 6 and 7, which are secured to the generator housing (not shown). A drive shaft 8 is rotatably mounted with one end extending through an aperture 9 in the wall of the section 2. The shaft 8 is supported at one end in a suitable manner in the generator housing (not shown) and at the other end in the housing 1 by a turbine wheel 18 rigid on said shaft and having a bearing mounted in said housing 1 through the intermediary of a sleeve 10 surrounding said shaft. The sleeve 10 extends through the aperture 9, is rigidly supported therein by means of a yoke 11 and sleeve 10 and has plenty of clearance with respect to the shaft 8. The yoke 11 is bolted around the edge of the aperture 9 by means of bolts 13. The bearing for the shaft 8 comprises a ball bearing unit 14 including an inner race 15 and an outer race 16, the former race being held on the sleeve 10 between a flange 17 on the inner end thereof and the inner end of the sleeve 12. The bearing unit 14 is protected by being inclosed within the hub of the turbine wheel 18 with the inner race stationary, the outer race being rigidly secured in a suitable recess in the center of said turbine wheel by means of a tapered cylindrical closure 19 bolted through means of bolts 20 to the side of said wheel. The closure 19 includes a cylindrical portion 21 which extends through the aperture 9 and acts to further protect the bearing 14 from any steam or condensation which might obtain access thereto, as will be hereinafter explained.

Leakage through the partition 5 is prevented by providing the side of the wheel 18 opposite to the closure 19 with an integral cylindrical hub portion 22 which extends through an aperture 23 in said partition. The hub 22 is provided with packing rings 24. A governor 25, such as shown in the above mentioned copending application, is mounted on the end of the shaft 8 to the left of the partition 5. A suitable steam valve 26,

such as is also shown in said application, is mounted in the housing 1 and is adapted to be operated through the governor 25 by a lever 27 operatively connected to said governor, as shown in said copending application. The valve 26 is adapted to deliver steam to a nozzle 28 which in turn is adapted to direct steam to the blades 29 of the turbine wheel 18 for driving the same.

In order to keep steam and condensate from parts which are apt to be damaged thereby a construction is provided which effects a partial vacuum in the housing 1 between the steam chamber thereof and said parts. The section 3 is provided with an integral circular rib 31 which extends very close to the side of the wheel 18 and the section 2 is provided with a similar rib 32 which is coaxial with the rib 31 and extends very close to the side of the wheel 18 opposite to the rib 31. The ribs 31 and 32 thus form, together with their respective sections 3 and 2, a toroidally shaped steam compartment 33 and an inner compartment 34, the said compartment 33 having in effect a slot 35 on its inner peripheral wall through which the wheel 18 extends. The section 3 is shaped to provide a separate compartment 36 which is adapted to receive any leakage past the stem of the valve 26. The compartment 36 is thus a high pressure leakage compartment and is provided with an opening 37 in the housing at the upper end of said compartment communicating with the exterior of said housing and a passage 38 at the lower end of the compartment communicating with the compartment 34.

In the operation of the turbine the compartment 33 would normally be filled with steam from the nozzle 28, but as the wheel 18 is revolved at a high rate of speed the gases in the compartment 34 will through centrifugal action be forced out through the slot 35 into the compartment 33 against the pressure of the steam therein. Thus a partial vacuum will be created within the compartment 34 withdrawing moisture, high pressure steam leakage, and gases from the compartment 36 and preventing any leakage of steam past the rings 24 into the governor compartment. The closure 19 will prevent any steam which may leak into the compartment 34 when the turbine is started up from coming in contact with the bearing 14.

Since the governor 25 and the bearing 14 are both oiled from the left side of the partition 5, as illustrated and described in connection with my copending application for lubrication system, Serial No. 172,290, filed March 3, 1927, the aforedescribed construction not only prevents moisture from attacking the comparatively delicate governor mechanism but also prevents such moisture from interfering with either the lubrication of said governor or said bearing unit 14.

In Figs. 4 and 5 is shown a modification in which fan blades 39 are formed on the turbine wheel within the slot 41 which communicates between the steam compartment 42 and the inner vacuum compartment 43. These blades are circularly arranged, act to accentuate the vacuum created in the chamber 43 and may be used when the turbine wheel is adapted to be revolved comparatively slow.

As the turbine wheel is revolved a circulation will be set up with air flowing in through the opening 37 to the compartment 36 and thence through the passage 38 to replenish the gases which have been driven through the slot 35 from the compartment 34.

I am aware that many changes may be made and details of construction varied throughout a wide range without departing from the principles of my invention and I therefore do not propose being limited to the details shown and described.

I claim:

1. The combination with a turbine housing, of a drive shaft rotatably mounted therein, a turbine wheel mounted on said shaft for driving the same, a governor on said shaft spaced from said wheel, said housing including an annular chamber inclosing the outer periphery of said wheel and annular baffles forming an inner peripheral wall for said chamber provided with a slot through which said wheel extends, the slot permitting gases to pass therethrough, and a partition in said housing extending between said governor and wheel, said chamber being adapted to receive steam therein for driving said wheel, said partition and said baffles also defining an inner chamber of considerable space around the center of the wheel, whereby sufficient vacuum may be built up within said chamber to cause an appreciable vacuum to continue when said shaft is slowed or momentarily stopped.

2. The combination with a turbine housing, of a drive shaft rotatably mounted therein, a turbine wheel mounted on said shaft for driving the same, and a governor on said shaft spaced from said wheel, said housing including an annular chamber inclosing the outer periphery of said wheel and annular baffles forming an inner peripheral wall for the chamber provided with a slot through which said wheel extends, the slot permitting gases to pass therethrough, said chamber being adapted to receive steam therein for driving said wheel, said baffles and the interior of the housing defining a chamber affording considerable space around the center of the wheel, whereby sufficient vacuum may be built up within said chamber to cause an appreciable vacuum to continue when said shaft is slowed or momentarily stopped.

3. The combination with a turbine housing, of a drive shaft rotatably mounted therein, and a turbine mounted on said shaft for driving the same, said housing including an

annular chamber inclosing the outer periphery of said wheel, and annular baffles forming an inner peripheral wall for the chamber provided with a slot through which said wheel extends, said slot permitting gases to pass therethrough, said chamber being adapted to receive steam therein for driving said wheel, said baffles and the interior of the housing defining an inner chamber affording considerable space around the center of the wheel, whereby sufficient vacuum may be built up within said chamber to cause an appreciable vacuum to continue when said shaft is slowed or momentarily stopped.

4. The combination with a turbine housing, of a drive shaft rotatably mounted therein, and a turbine wheel mounted on said shaft for driving the same, said housing including an annular chamber inclosing the outer periphery of said wheel and an inner peripheral wall for the chamber provided with a slot through which the web of said wheel extends, said inner peripheral wall forming a second annular chamber near the center of said wheel, said slot permitting gases to pass between said chambers, said housing having an opening therein and a passage leading from said opening to said second chamber.

5. The combination in the turbine end of a turbine generator set of a housing for said end, and a drive shaft supported at one end in said housing, the support therefor including a sleeve surrounding said shaft and secured to said housing in one wall thereof, a ball bearing having the inner race thereof rigidly secured to the end of said sleeve, a turbine wheel mounted on said bearing and rigidly secured to said shaft, the outer race of said bearing being rigidly secured to said wheel, said housing including a partition on the side of said wheel opposite said wall, the hub of said wheel inclosing said bearing and having a portion thereof extending into said partition and another portion extending into said wall.

6. The combination in the turbine end of a turbine generator set of a housing for said end, and a drive shaft supported at one end in said housing, the support therefor including a sleeve surrounding said shaft and secured to said housing in one wall thereof, a ball bearing having the inner race thereof rigidly secured to the end of said sleeve, a turbine wheel mounted on said bearing and rigidly secured to said shaft, the outer race of said bearing being rigidly secured to said wheel, said housing having a partition on the side of said wheel opposite said wall, the hub of said wheel inclosing said bearing and having a portion thereof extending into said partition and another portion extending into said wall, said housing including a pair of separately formed castings, with said wall integral with one casting and said partition integral with the other casting.

7. The combination with a turbine housing of a drive shaft rotatably mounted therein, a turbine wheel mounted on said shaft for driving the same, a governor on said shaft spaced from said wheel, said housing having an annular chamber surrounding said wheel, and a partition in said housing extending between said governor and wheel, said chamber being adapted to receive steam therein for driving said wheel, said housing including a pair of separately formed castings, said partition being integral with one of said castings and forming one side of said annular chamber, the wall of said housing opposite said partition being integral with the other of said castings and forming the opposite wall of said chamber.

8. The combination with a turbine housing, of a drive shaft rotatably mounted therein, and a turbine wheel mounted on said shaft for driving the same, said housing including an annular chamber over the outer periphery of said wheel, said chamber having an inner peripheral wall provided with a slot through which said wheel extends, said slot permitting gases to pass therethrough, said chamber being adapted to receive steam therein for driving said wheel, said housing being formed of two separate sections with one side of said chamber integral with one section and the other side of said chamber integral with the other.

9. The combination with a turbine housing, of a drive shaft rotatably mounted therein, and a turbine wheel mounted on said shaft for driving the same, said housing including a chamber over the outer periphery of said wheel, said chamber having a restricted portion through which said wheel extends, said chamber being adapted to receive steam therein for driving said wheel, said housing having a passage establishing communication between the exterior of the housing and the interior thereof between said restricted portion and shaft.

10. The combination with a turbine housing, of a turbine shaft rotatably mounted therein, and a turbine wheel mounted on said shaft for driving the same, said housing provided with means communicating with said wheel for creating a partial vacuum in the vicinity of said shaft and a high pressure steam leakage compartment in communication with said partial vacuum.

11. The combination with a turbine housing, of a turbine shaft rotatably mounted therein, and a turbine wheel mounted on said shaft for driving the same, said housing being provided with means communicating with said wheel for creating a partial vacuum in the vicinity of said shaft, a high pressure steam leakage compartment in com-

munication with said partial vacuum and an opening establishing communication between the exterior of the housing and said high pressure steam leakage compartment.

12. The combination with a turbine housing, of a drive shaft rotatably mounted therein, and a turbine wheel mounted on said shaft for driving therein, said housing including means cooperating with said wheel for creating a partial vacuum in the vicinity of the shaft and an opening establishing communication between the exterior of the housing and the partial vacuum thus created.

In witness of the foregoing I affix my signature.

LEWIS H. MORRILL.