K. BAUMANN.

AXIAL FLOW STEAM TURBINE.

APPLICATION FILED AUG. 23, 1917.

1,322,221.

Patented Nov. 18, 1919.

2 SHEETS—SHEET 1.

Fig. 1

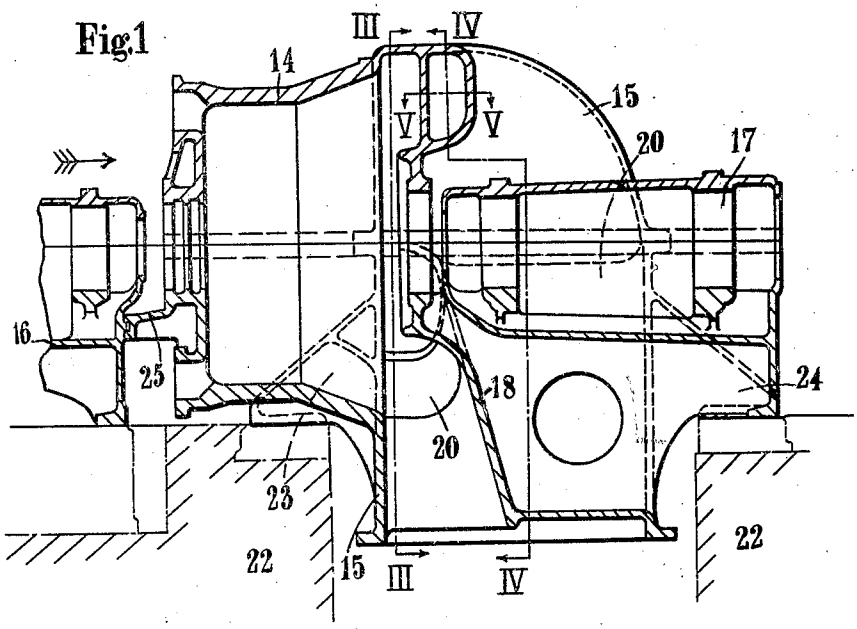
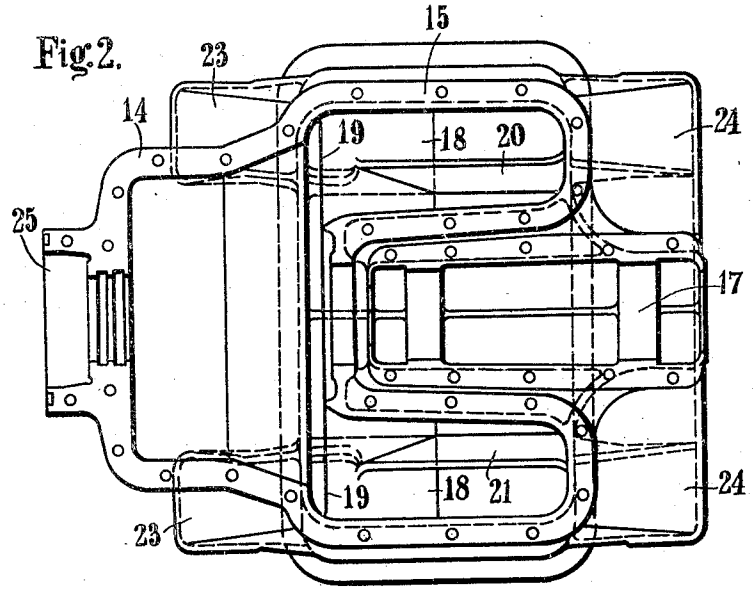


Fig. 2.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 3.

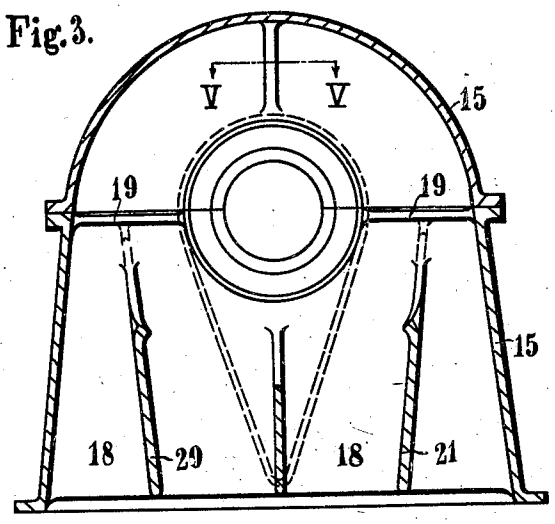
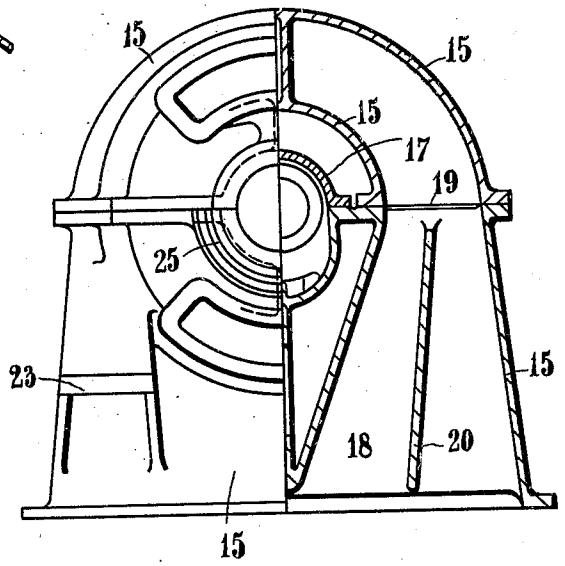


Fig. 5.



Fig. 4.



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UNITED STATES PATENT OFFICE.

KARL BAUMANN, OF URMSTON, ENGLAND, ASSIGNOR TO THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY LIMITED, A COMPANY OF GREAT BRITAIN.

AXIAL-FLOW STEAM-TURBINE.

1,322,221. Specification of Letters Patent. Patented Nov. 18, 1919.

Application filed August 23, 1917. Serial No. 187,857.

To all whom it may concern:

Be it known that I, KARL BAUMANN, a citizen of the Confederation of Switzerland, and a resident of Urmston, in the county of Lancaster, England, have invented a new and useful Improvement in or Relating to Axial-Flow Steam-Turbines, of which the following is a specification.

This invention relates to steam turbines of the axial flow type in which the volume of steam leaving the exhaust blades is considerable and consequently the exhaust casings and outlets are of considerable size.

With turbines of comparatively small size it is usual to support them at either end from the pedestals which carry the bearings. In turbines of larger size this method of support is found insufficient and it is usual to support them on a bed-plate from feet attached to the sides of the turbine cylinder as well as from feet attached to one or both ends of the latter. For turbines of the kind to which this invention relates this latter arrangement is not very desirable because the width of the bed-plate becomes considerable and access to the joint between the exhaust outlet of the turbine and the condenser inlet is rendered difficult. In addition the girders which are usually employed extending from the foundation block at the exhaust end of the turbine to the foundation block at the high pressure end, render the joint between the exhaust outlet of the turbine and the inlet to the condenser still more inaccessible.

The present invention has for its object to provide an improved construction whereby the turbine may be supported from feet located at the end of the exhaust casing. To enable this to be done the exhaust casing is, according to this invention provided with a plurality of substantially parallel internal webs or the like which extend across the lower portion of the exhaust casing in a direction substantially parallel with the turbine shaft. The feet located at either end of the exhaust casing are preferably also provided with strengthening webs some or all of which form continuations of the aforesaid webs in the exhaust casing. In some cases however said webs when extended beyond the exhaust casing form some of the side walls of the supporting feet.

In order that the invention may be clearly understood it will now be described with reference to the accompanying drawings in which Figure 1 is a central, vertical, longitudinal section; Fig. 2 a plan view of the lower half; Fig. 3 a cross section taken on the line III—III of Fig. 1, Fig. 4, as regards its left hand half, an end view looking in the direction of the arrow of Fig. 1, and as regards its right hand half, a cross section on the line IV—IV of Fig. 1, and Fig. 5 a detail view on the line V—V of Fig. 1 of a turbine cylinder and exhaust casing constructed in accordance with this invention. The section indicating lines show the direction of view from which the various sectional views are taken and the same reference numerals are used to refer to like parts throughout the several figures of the drawings.

Referring now to Figs. 1 to 5, the turbine cylinder is indicated at 14 and the exhaust casing at 15. The bearing pedestal for the shaft bearing at the high pressure end of the turbine is indicated at 16, the shaft bearing 17 at the low pressure end being supported, as shown, from the lower half of the exhaust casing 15.

The exhaust casing is here shown as being provided with a diaphragm 18, the upper edge 19 of which extends across the exhaust casing near the final row of moving blades and separates the steam flowing from the upper half of such blades through the exhaust casing from the steam flowing from the lower half of such blades through the exhaust casing. A diaphragm of this kind is well known and forms no part of the present invention.

The lower half of the exhaust casing is provided with two internal webs 20, 21, extending, as shown, across the exhaust casing in a direction substantially parallel with the turbine shaft. Such webs should preferably be made of considerable depth and where the width of the exhaust casing is relatively great the webs may advantageously extend in a vertical direction from the exhaust opening to the horizontal joint of the turbine. These webs stiffen the lower portion of the exhaust casing to such an extent that the turbine may be supported in position on its foundations 22 by feet 23, 24, located respectively at the high pressure and low pressure end of the ex-

haust casing 15. At the high pressure end each foot 23 preferably extends inwardly, as shown, a short distance only from the sides of the exhaust casing toward the center line of the turbine while at the low pressure end of the turbine the feet 24 preferably extend from one side to the other of the exhaust casing so that the outer end of the shaft bearing 17 may be supported from said feet. The supporting feet 23 at the high pressure end of the exhaust casing are, as shown, not directly connected to any portion of the turbine cylinder 14 subjected to high temperatures. In this way during the running of the turbine the temperature of the feet at the high pressure end of the casing is not raised to any great extent and consequently little or no expansion of the feet in a vertical direction will occur.

With the construction above described and illustrated in Figs. 1 to 4 the exhaust casing may readily be made of sufficient strength to enable the condenser to be hung directly from the exhaust outlet, no other support therefor being provided. The overhung portion of the cylinder is preferably connected at the high pressure end by a semicircular portion 25 with the pedestal 16 supporting the shaft bearing at this end. This connection is provided not for the purpose of supporting the overhung portion of the cylinder 14 but chiefly for the purpose of maintaining this part of the cylinder in its proper position relative to the shaft so that the clearances between the stator and rotor of the turbine may be made as fine as possible.

The stiffening webs 20, 21, which extend across the lower half of the exhaust casing are preferably, as shown, so located with reference to the sides of the exhaust casing that passages of gradually increasing cross-sectional area are provided for the steam flowing through the exhaust casing to the exhaust outlet and should be so formed and located as to interfere as little as possible with the flow of steam through the exhaust casing. Additional webs similar to the webs 20, 21, may be provided if desired and with turbines of considerable size this will sometimes be found necessary. The webs need not be substantially continuous as shown but may also consist of lattice or girder work. Preferably said webs are continued through the ends of the exhaust casing across the supporting feet to strengthen them, the inner side walls of the supporting feet at the high pressure end of the turbine being conveniently formed by such extensions of the webs.

Although in the several figures of the drawings the exhaust casing is shown as having an internal diaphragm 18 of a well known kind, it is to be understood that the employment of such a diaphragm although desirable is in no way essential to the carrying out of the present invention and may be omitted if desired.

Although the preferred construction is that shown and described herein in which the turbine is supported from feet located at the ends only of the exhaust casing, the invention is also applicable to turbines in which a portion of the weight of the turbine is carried by feet on the sides of the exhaust casing, resting on a suitable bedplate, girders or the like.

In the constructional form of the invention herein described and illustrated the internal webs in the lower part of the exhaust casing are shown as being parallel with one another and with the turbine shaft. It is to be understood however that while this is a very desirable arrangement the invention is not limited in this respect as said webs may in some cases converge toward one or the other end of the turbine especially the low pressure end. In such cases the transverse width of the supporting feet at that end of the turbine toward which said webs converge may be less than the width of the feet at the other end of the turbine.

I claim as my invention:—

1. Turbine apparatus comprising an exhaust casing provided with supporting feet attached to opposite end walls thereof and having an internal reinforcing web connecting the end walls carrying the supporting feet.

2. Turbine apparatus comprising an exhaust casing provided with opposing end walls having integral supporting feet and an internal integral reinforcing web connecting the said end walls.

3. Turbine apparatus comprising an exhaust casing provided with supporting feet attached to opposite end walls thereof and having an internal reinforcing web connecting the said end walls, and a turbine cylinder mounted upon and supported by the said casing.

4. Turbine apparatus comprising an exhaust casing provided with supporting feet attached to the opposite end walls thereof and a turbine cylinder mounted upon and entirely supported by the said casing.

5. Turbine apparatus comprising an exhaust casing provided with supporting feet attached to the opposite end walls thereof, and a turbine cylinder carried by the said casing and mounted thereon at a point remote from the said feet.

6. Turbine apparatus comprising an exhaust casing and a turbine cylinder mounted on and supported thereby, and supporting feet secured to the end walls of the exhaust casing at a point remote from the turbine cylinder adapted to support the exhaust casing and the turbine cylinder.

7. Turbine apparatus comprising an exhaust casing carrying a bearing at the low pressure end of the apparatus and a turbine cylinder alined therewith at the high pressure end of the apparatus, and supporting feet secured to the ends of the exhaust casing spaced from and straddling the turbine cylinder at one end of the casing and being beneath the bearing at the other end of the casing.

8. Turbine apparatus comprising an exhaust casing and a turbine cylinder entirely carried thereby and projecting from the walls of the casing, feet on the casing adapted to support the combined casing and turbine cylinder, and an independently supported bearing attached to the projecting end of the turbine cylinder whereby the bearing and cylinder are held in alinement.

9. Turbine apparatus comprising an exhaust casing provided with opposing end walls having integral supporting feet reinforced with vertically disposed side webs, and internal webs connecting the end walls and being continuations of the said side webs.

10. The combination with a turbine apparatus having a horizontal turbine cylinder, and an exhaust casing having its outlet connection extending beneath the cylinder, of supporting feet secured to the casing at opposite ends thereof adapted to support the combined casing and cylinder, and having their supporting faces spaced above the outlet connection and substantially flush with the underside of the cylinder.

11. In combination in a turbine, an exhaust casing supported only at opposite ends longitudinally of the turbine, a reinforcing web located within the casing and extending between the casing supports, and a turbine cylinder supported by said casing.

12. In combination in a turbine, an exhaust casing having three supporting feet formed thereon and located adjacent the longitudinal axis of the turbine, one of said feet being located below a bearing support formed on the casing, and the other two being spaced apart and located at the opposite end of the casing, and a turbine cylinder solely supported by said casing and located in the space between said two last mentioned feet.

In testimony whereof I have hereunto subscribed my name this tenth day of July, 1917.

KARL BAUMANN.

Witnesses:
WILFRED MORRIS,
FREDERICK NIXON.