July 14, 1931. R. C. ALLEN 1,814,626

TURBINE SUPPORT

Filed Oct. 12, 1926

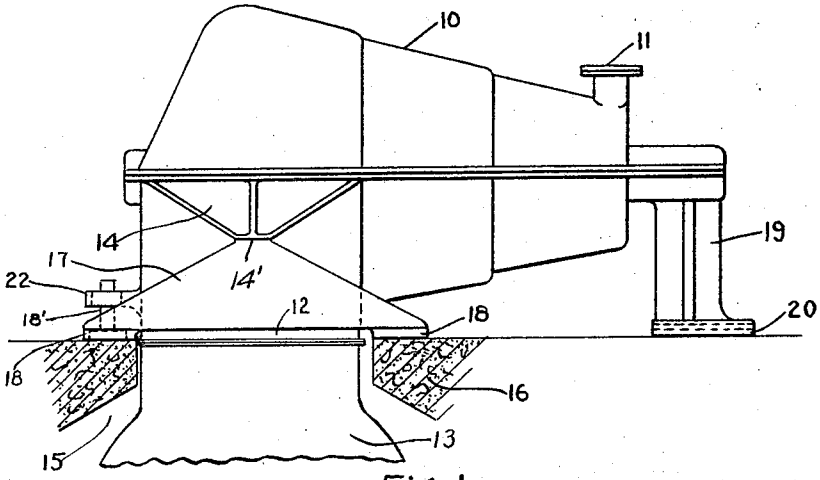


Fig. 1.

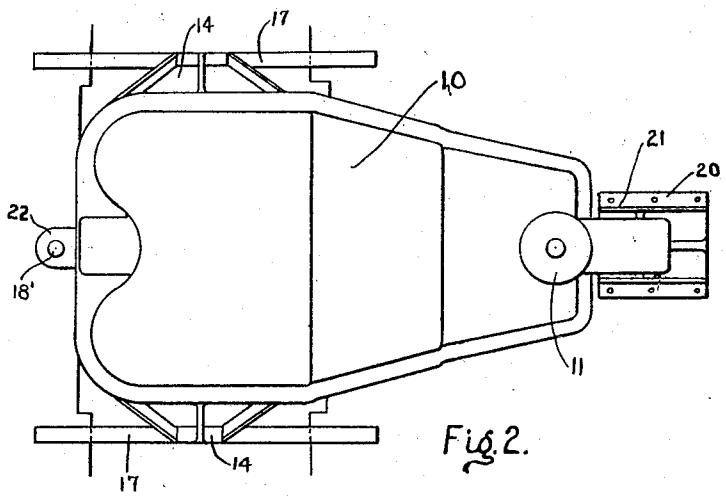


Fig. 2.

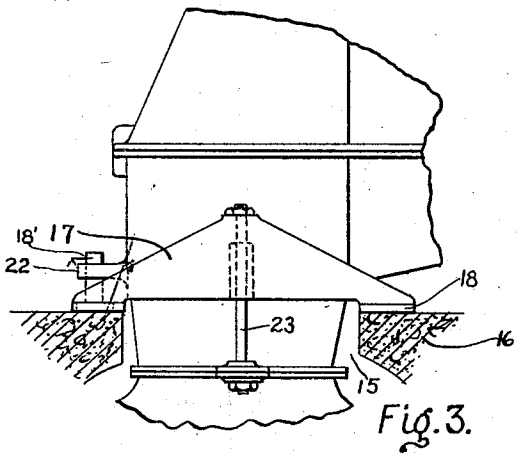


Fig. 3.

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UNITED STATES PATENT OFFICE

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TURBINE SUPPORT

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My invention relates to a support for a massive body, more especially to a support for the cylinder structure of an elastic fluid turbine, and it has for an object to provide a support which will eliminate distortion of the body or cylinder structure, due to settling of the foundation or other changes in the relative positions of the points of support in the foundation.

A further object is to provide a three-point support for a turbine cylinder structure which is suitable for the general conditions found in power plants, and which distributes the weight over a sufficient number of points on the foundation.

In central station power plants the cylinder structures are so large that it is common to support them on the foundation at five points, one point usually being at the high pressure or thrust end and two points on each side near the low pressure end. It will be apparent, however, that settling of the foundation or expansion of the foundation columns due to temperature changes may cause a change in the relative vertical positions of the points of support. Such changes distort the turbine cylinder structure, causing a weakening thereof and disturbing the blade clearances. Disturbance of the blade clearances, in turn, causes rubbing of the parts where the clearances are reduced or taken up, and excessive leakage where the clearances are increased.

Distortion of the turbine cylinder structure may be avoided by supporting it at three points. If the vertical position of one point is then changed, the cylinder structure will merely turn about the other two points as a pivot without changing the portion of the load taken by each point of support, and therefore without distorting the cylinder structure.

A three-point support, however, presents the difficulty of distributing the heavy weight of the structure on the foundation. The large turbines of modern power plants are so heavy that the load on each point of the foundation would be excessive if they were supported at only three points on the foundation.

In accordance with my invention, I provide three points on the cylinder structure at which it may be supported and I then support one or more of these points from a supporting member, which is in turn supported on the foundation at a plurality of points, thereby distributing the weight of the structure among more than three points. In this way, I obtain the advantage of a three-point support and provide sufficient distribution of the weight of the turbine on the foundation.

In the accompanying drawings, illustrating two embodiments of my invention:

Fig. 1 is a side elevation of the preferred embodiment;

Fig. 2 is a plan view thereof; and

Fig. 3 is a fragmentary side elevation of a modified form.

Referring now to the drawings in detail, I show a turbine cylinder structure 10 having an inlet 11 at the high pressure end and an exhaust connection 12 at the low pressure end, providing communication between the exhaust chamber of the turbine and a condenser 13 disposed beneath and attached to the cylinder structure. The condenser 13 is disposed in the space 15 provided in the foundation 16.

Supporting members 17, which may be in the form of longitudinal beams disposed across the condenser space with their ends resting on pads 18 on the foundation, are provided to distribute the load of the cylinder structure. The cylinder structure is provided with downwardly facing flat surfaces 14′ of relatively small area, which may be formed on lugs 14 extending from the sides of the cylinder at the low pressure end. The surfaces rest upon the supporting members intermediate the ends thereof and permit some rocking and sliding due to expansion of the cylinder.

As will be apparent from the drawings, the surfaces 14′ are disposed substantially in the vertical plane passing through the center of the condenser. By this arrangement the weight of the condenser is transmitted almost directly to the supporting members, imposing minimum load on the turbine cylinder structure.

At the high pressure end, the cylinder structure is supported by a pedestal 19, slidingly mounted on the sole plate 20. The sole plate 20 is rigidly secured on the foundation and provided with walls 21 which restrain lateral movement of the pedestal 19 but permit longitudinal sliding. A vertically disposed centering pin 18', rigidly secured to the foundation, extends vertically through an opening in lug 22, which extends from and is secured to the low pressure end of the cylinder structure. This pin and lug prevent any lateral or longitudinal movement at the low pressure end, but do permit vertical movement. The center line of the turbine is therefore maintained by the lug 22 and pedestal 19 and longitudinal expansion of the turbine is taken care of by the sliding of pedestal 19, such sliding being away from the low pressure end.

Should the foundation 16 in settling shift the relative position of one of the points of support, the end of the supporting member 17 resting at that point will be moved accordingly. The movement transmitted to the adjacent bracket 14, however, will be less, depending upon the relative distances of the bracket from the ends of member 17. The position of the cylinder structure will be shifted at this point but the distribution of the weight of the structure among the three points will not be disturbed.

From the above description, it will be apparent that I have provided a three-point support for the turbine and have at the time distributed the load over five points on the foundation in such a manner that a practical foundation can be built with a proper space for the condenser.

While in the illustrated embodiment the rotor bearings are contained within the cylinder structure, it will be apparent to those skilled in the art that the bearings may be supported in any suitable manner known in the art. My invention contemplates the support of the cylinder structure whether the rotor is supported by the cylinder structure or otherwise.

While I have described my invention as applied to an elastic fluid turbine structure, I desire it understood that this is merely for the purpose of illustration, the invention being particularly useful in connection therewith, but it may be applied to any massive body which it is desired to support in a manner to prevent distortion thereof.

It will be apparent that details of my invention may be modified in many respects without departing from the principle thereof. For example, the points of support of the turbine may be suspended from the supporting members 17 by bolts 23 as shown in Fig. 3. This arrangement, however, has a disadvantage in that expansion of the cylinder changes the vertical position of the center line of the cylinder structure. The operation of this modification is otherwise the same as the preferred form.

It will also be apparent that the supporting members 17 may be supported upon the foundation at any suitable number of points.

While I have shown my invention in but two forms, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

I claim as my invention:

1. The combination of a stationary foundation, a turbine cylinder structure supported at three and only three points and two longitudinal beams each resting upon the foundation at its ends and intermediately of its ends supporting the cylinder structure at one of said points.

2. The combination of an elastic fluid turbine having a casing, a foundation, means for supporting the high pressure end of the turbine upon the foundation, lugs or brackets upon the turbine casing on its opposite sides near the exhaust end, and longitudinal beams resting upon the foundation at their ends and intermediately of said ends supporting said lugs or brackets.

3. The combination of an elastic fluid turbine having a condenser disposed thereunder and connected to the exhaust chamber of the turbine, a foundation having a space in which said condenser is disposed, and members disposed on either side of said turbine and across said space and supported on the foundation on opposite sides of said space, the cylinder structure of said turbine having a point at each side supported from one of said members intermediately of its points of support.

4. The combination of an elastic fluid turbine having a condenser disposed thereunder and connected to the exhaust chamber of the turbine, a foundation having a space in which said condenser is disposed, and longitudinal beams disposed on either side of said turbines and across said space and having its ends supported on the foundation on opposite sides of said space, the cylinder structure of said turbine having a point at each side supported from one of said beams intermediately of its points of support.

5. The combination of a turbine cylinder structure, a condenser disposed beneath the exhaust chamber thereof, a foundation having a space therein to accommodate the condenser, means for supporting the high pressure end of the turbine cylinder structure, lugs or brackets formed on opposite sides of the turbine casing at the exhaust chamber, and supporting members spanning the condenser space and resting at their ends upon

the foundation, and said lugs or brackets resting upon said supporting members intermediately of the ends thereof.

6. The combination of a turbine cylinder structure having an exhaust chamber, a foundation, a bracket on each side of the cylinder at the exhaust chamber, two members each supported upon the foundation at a plurality of points and supporting a bracket intermediately of said points, means for supporting the high pressure end of said structure, said means permitting longitudinal sliding but restraining lateral movement, and means for anchoring the low pressure end of the cylinder structure, said means permitting vertical movement only.

7. In a turbine, the combination of a casing supported at a single point at its high-pressure end and providing an exhaust chamber at the low-pressure end, opposed lateral feet carried by the exhaust chamber-defining portion of casing and disposed intermediately of the length of the chamber, and beams supported at their ends and, at intermediate points, supporting said feet.

8. In a turbine, the combination of a casing supported at a single point at its high-pressure end and providing an exhaust chamber at the low-pressure end, a condenser disposed beneath the casing and attached thereto at said exhaust chamber, opposed lateral feet carried by said casing and disposed substantially in the vertical plane passing through the center of the condenser, and beams supported at their ends and, at intermediate points, supporting said feet.

9. The combination of a turbine cylinder structure having an exhaust chamber, a foundation, a bracket on each side of the cylinder at the exhaust chamber, two members each supported upon the foundation at a plurality of points and supporting a bracket intermediately of said points, means for supporting the high pressure end of said structure, means restraining lateral movement of the structure at each end thereof to prevent displacement of its axis, and means for retaining one part of the structure against longitudinal movement.

10. The combination of a stationary foundation, a turbine including a cylinder and means for supporting the turbine on and distributing the weight thereof with respect to the foundation including a support for one end of the cylinder and disposed beneath the turbine axis, two supports for the other end of the cylinder, the last-named supports being disposed laterally at either side of the turbine axis and means providing for the carrying of said supports by the foundation including at least one member supported at each end by the foundation and supporting at an intermediate point thereof one of said supports.

11. The combination of a turbine cylinder structure having an exhaust chamber, a foundation, means for supporting the high pressure end of the cylinder structure, and means for supporting the other end of the cylinder structure including members disposed on opposite sides of the cylinder structure at the exhaust chamber, said members being supported on the foundation at a plurality of points and intermediately of said points carrying the exhaust chamber of the cylinder structure.

In testimony whereof, I have hereunto subscribed by name this twenty-second day of September, 1926.

ROBERT C. ALLEN.