

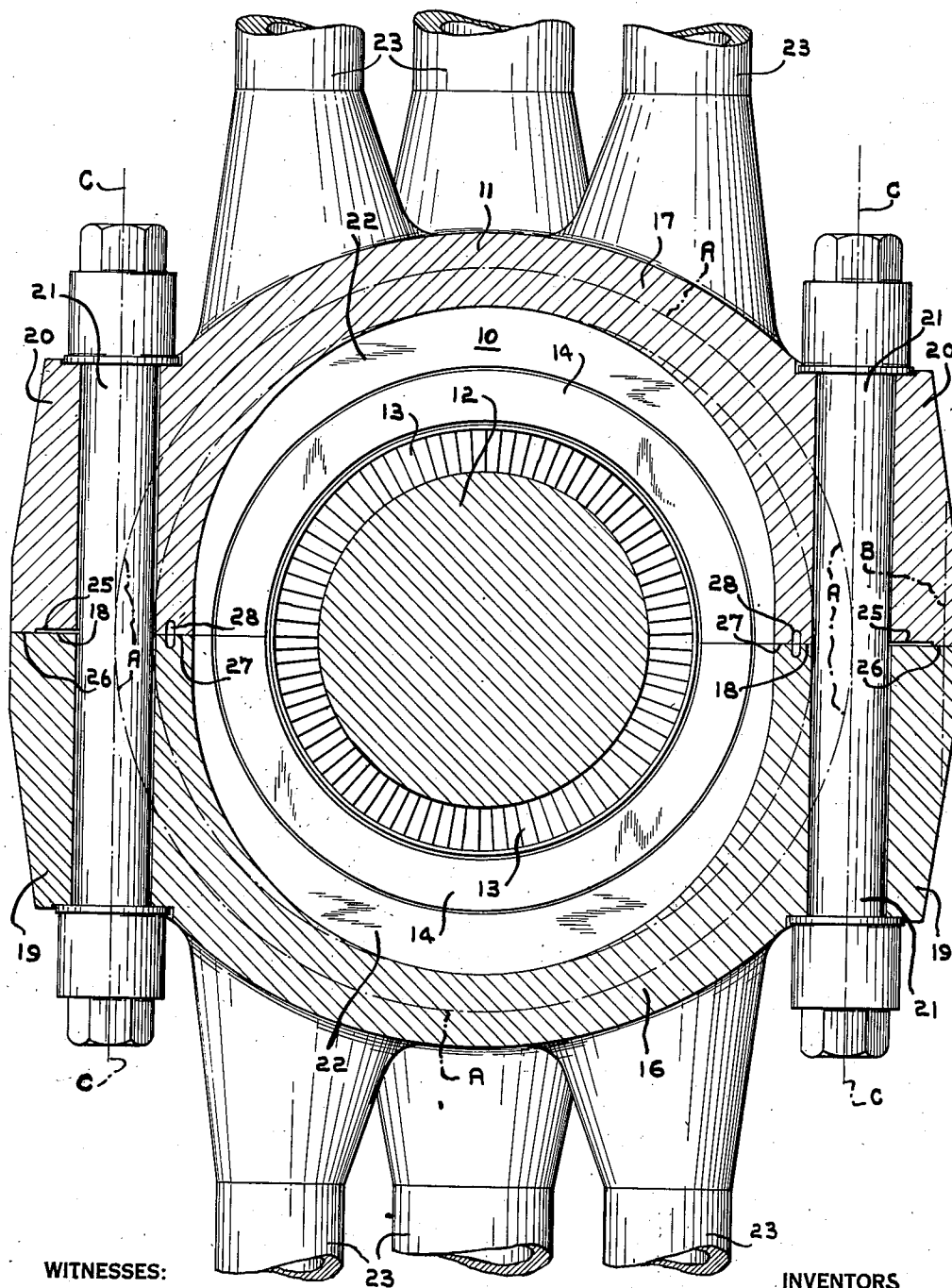
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JOINT CONSTRUCTION

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JOINT CONSTRUCTION

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3 Claims. (Cl. 253—39)

The invention relates to casings, more particularly to casings subject to high pressures, and has for an object the provision of an improved bolting arrangement for joints thereof.

Another object of the invention is the provision of a bolting arrangement for casing joints, whereby bending moments tending to open the joints are eliminated.

A further object of the invention is the provision of a bolting arrangement for casing joints wherein the bolts are subjected to tension stresses only.

Yet another object of the invention is the provision of a turbine casing having its wall thickened in the vicinity of the horizontal main joint, with the interior wall of the casing forming an oval whose major axis is perpendicular to the plane of the casing main joint, together with motive fluid inlets for both the top and the bottom part of the casing.

These and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

In the drawing, the single figure is a transverse sectional view through an elastic fluid turbine embodying the invention.

Referring now to the drawing more in detail, there is shown, at 10, an elastic fluid turbine comprised by a casing 11 and a rotor 12, together with a plurality of rows of blades 13, alternate rows being mounted upon the rotor 12 and upon blade rings 14, respectively. The casing 11 is comprised by a base portion 16 and a cover portion 17 having meeting surfaces providing a horizontal joint 18 lying approximately in a plane containing the longitudinal axis of the rotor. The base and cover portions are provided with integral flanges 19 and 20, respectively, and held in assembled relation by suitable means, such as the bolts 21. Motive fluid is supplied to the steam space 22, between the casing and rotor, through a plurality of inlets 23 opening through both the base 16 and cover 17. At least one of the meeting surfaces defining the joint 18 is relieved at 25 to provide outer contact surfaces 26 and inner contact surfaces 27. Preferably, the inner contact surface is provided with the conventional leak-off groove 28.

The high pressures and temperatures encountered in present-day turbine practice render it increasingly difficult to design the turbine casing with a joint free of leakage, where the conventional bolted flanges are relied upon for main-

taining the joint fluid tight. Such joints are subject, not only to direct force, but also to a bending moment, the latter being due to the eccentric location of the bolts with respect to the centroid of the main casing wall.

This invention provides a design and structure avoiding, insofar as possible, any eccentricity of the bolts.

To this end, the bolts, in the preferred embodiment herein illustrated, are positioned with their longitudinal centerlines C disposed tangent to an arc describing the center of the casing wall.

While this tangent relationship of the centerline of the bolts with respect to the centroid of the turbine casing wall is the preferable arrangement, it will be readily appreciated that any positioning of the bolts closely approximating the preferred arrangement, would be a big improvement over prior practice. Therefore, it is proposed that the bolts shall be positioned so that the ratio of the distance from the point at which a pure force would hold the halves of the cylinder in equilibrium, against the internal pressure, without rotation of the contact surfaces, to the centroid of the compression stress in the outer contact surface, divided by the distance from the centroid of the bolt pull to the centroid of the compression stress in the outer contact surface, is of a value between 1.5 and 0.6. For all practical purposes, this ratio may be expressed as the distance from the arc describing the center of the main casing wall, indicated by the dot-dash line A, to the center of the outer contact surface dot-dash line B, divided by the distance from the centerline C of the bolts to the centerline B of the outer contact surface.

Values of ratio greater than unity are a direct measure of the lever arm of the bolting, that is, the steam load on the joint multiplied by the ratio gives the required bolt pull to obtain contact at the inner contact surface. For values of the ratio below unity, the fulcrum changes to the inner contact surface, and the foregoing ratio loses its meaning as a ratio of bolt pull. Although, as the bolts are moved inward below a ratio of unity, the bolt stress to prevent rotation of the joint increases, nevertheless, under certain conditions, it may be desirable to employ the "self sealing" effect of the pressure by transferring load from the outer to the inner contact surface under this condition.

The value of unity for the ratio previously defined eliminates the inherent eccentricity of the conventional flanged joint and is unique in freeing the bolting of the duty of preventing

the flanges from rotating, but very great benefit compared to past practice can be had without realizing a ratio value of exactly unity. For example, a ratio of 1.1 would increase the bolt stress 10%.

Moving the bolts inwardly in the manner proposed, would, in many cases, result in the bolt holes extending through the inner walls of the casing, and hence it is necessary to thicken the walls at this point by increasing the amount of material at the inner portions thereof adjacent the joints. As shown in the drawing, this produces an inner casing wall of elliptical section, resulting in a steam passage 22 which tapers in cross-section from the top and bottom of the casing toward the horizontal joint. Due to this narrowing of the steam passage 22 in the vicinity of the horizontal joint 18, it is necessary to have steam inlets, such as at 23, for both the base 16 and cover 17 of the casing.

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and it is desired, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What is claimed is:

1. A casing subject to high internal pressure comprising a pair of parts; flange portions integral with said parts; said parts, including the flange portions, having meeting surfaces defining a joint; at least one of said surfaces having a groove extending longitudinally thereof and defining inner and outer contact surfaces; and a plurality of bolts associated with said flanges for connecting said parts, said bolts being positioned with said inner and outer contact surfaces disposed inwardly and outwardly thereof and at such a distance from the longitudinal centerline of the casing that the ratio of the distance from an arc describing the center of the casing wall to the center of the outer contact surface to the distance from the centerline of said bolts to

said center of the outer contact surface lies between the limits 1.5 and 0.6.

2. A turbine cylinder casing subject to high internal pressure comprising a base and a cover both provided with steam inlets; flange portions integral with said base and cover; said base and cover, including the flange portions, having meeting surfaces defining a horizontal joint; at least one of said surfaces having a groove extending longitudinally thereof and separating inner and outer contact surfaces; a cylindrical rotor within the casing, said casing in cross-section having an oval interior, with the major axis of said oval disposed perpendicular to the plane of the joint between the base and cover, whereby the casing wall is thickened adjacent said joint and the steam space between the rotor and casing decreases in area from the top and bottom of the casing toward the joint; and a plurality of bolts associated with the flanges for connecting the base and cover, said bolts being positioned with said inner and outer contact surfaces disposed inwardly and outwardly thereof and at such a distance from the longitudinal centerline of the casing that the distance from an arc describing the center of the casing wall to the center of the outer contact surface, divided by the distance from the centerline of the bolt to said center of the outer contact surface results in a quotient between 1.5 and 0.6.

3. A casing subject to high internal pressure comprising a pair of parts having meeting surfaces defining a joint, at least one of the parts having a longitudinal groove providing inner and outer contact surfaces cooperating with the surface of the other part, and a plurality of bolts extending through the walls of said parts at right angles to the plane of the joint and disposed so that said inner and outer contact surfaces are arranged inwardly and outwardly thereof, respectively, with the longitudinal centerlines of said bolts approximately tangent to an arc describing the radial center of the casing wall.

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