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GUIDE BLADE DEVICE FOR STEAM OR GAS TURBINES

Technical drawing of a mechanical assembly in cross-section. The drawing shows a housing (2) with internal components (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18). The drawing includes various dimensions and labels such as Δa , Δr_1 , Δr_2 , 10a, 13a, and 21.

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GUIDE BLADE DEVICE FOR STEAM OR GAS TURBINES

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1 Claim. (Cl. 253—78)

The present invention relates to guide blade devices for steam or gas turbines which comprise two concentric rings the inner one of which carries the guide blades. A feature of the invention involves that said rings are separately connected with a stationary member of the turbine by means of stays pivotally connected to the respective rings and to said member, said stays being arranged in such inclined positions and being of such lengths that the axial positions of the rings with relation to each other will be maintained substantially unchanged upon radial displacements of the rings owing to variations of temperature.

In the accompanying drawing an embodiment of the invention is illustrated as applied to a jet propulsion turbine. The drawing is an axial section through part of the turbine.

In the drawing, the reference numeral 1 indicates a shaft supporting at its free end a turbine wheel 2 adjacent which the shaft is mounted in a bearing 3 attached to a conical casing 4, hereinafter referred to as a central frame. The gaseous driving medium is supplied to the turbine wheel by way of a guide blade device comprising two concentric rings 5 and 6 and a set of guide blades 7 secured at one end, for instance, by riveting, to the inner ring 6 and connected at their other end to a shroud ring 8.

The guide blades are surrounded by a shroud ring 8 located in an annular groove formed in the inside of the outer ring 5. In order that the guide blades may be able to resist those forces produced by the gas which are directed axially against the turbine wheel, the edge of said shroud ring facing the turbine wheel bears against a ring-shaped member 9 concentrically surrounding the turbine wheel 2 so as to form a casing therefor, the inner diameter of said ring being somewhat smaller than the diameter of the groove in the ring 5. Said ring 9 is rigidly attached to the outer guide blade ring 5 which in its turn is connected to a collector (not shown) for gas received from the combustion chambers of the turbine.

Let it be assumed, for instance, that an increase of temperature takes place. Then, the guide blade rings 5 and 6 expand differentially in radial direction because of their different size. Provided the axial positions of the rings with relation to each other would change, then the axial support for the shroud ring above referred to would no longer exist with the resulting effect that the guide blades under the action of the gas forces would be subjected to a bending moment at the point of fixation, like a beam fixed at its one end. In case of large displacements it would happen that the radial edge of the groove in the outer ring 5 would exert a force upon the shroud ring 8, thereby increasing the bending moment acting on the guide blades. A displacement of the rings 5 and 9 towards the combustion chambers of the turbine with relation to ring 6 would result in a bending of the guide blades in the other direction against the gas forces. From strength point of view it is preferred to support

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the guide blades like beams freely supported at both ends, which would be the case if the axial positions of the rings 5 and 6 with relation to each other remain unchanged. This optimum result may be obtained according to the invention by the following means:

A set of a plurality of stays or links are pivotally connected at 11 and 12 to the outer guide blade ring 5 and the central frame 4, respectively. The stays or links 13 of another set are pivotally connected at 14 and 15 to the inner guide blade ring 6 and the central frame 4, respectively. Each set of stays are so arranged that its individual stays are located on the surface of imaginary cones 10a and 13a respectively. By adjusting the inclined positions of the stays or links 10 and 13 with relation to each other, the following result may be obtained. Let it be assumed that the radius of ring 6 is increased by Δr_1 under the influence of a given increase in temperature. (In the drawing the increase is indicated on a magnified scale for the sake of clearness.) Since the diameter of ring 5 is larger than that of ring 6, a greater increase of radius $=\Delta r_2$ is obtained in respect to ring 5. Owing to the increase of the radii above mentioned the stays 10 and 13 will cause the rings 5 and 6 to turn in a slight degree about the pivots 12 and 15, respectively, so that the centers of the pivots 11 and 14 will move to the points 16 and 17, respectively. The inclination and the length of the stays 10 and 13 are so adjusted that the axial displacements of the rings 5 and 6 will be equal for both rings, say equal to Δa . This means that the position of the guide blades 7 with respect to the rings 5 and 6 has not undergone any change, that is to say, the blades are still bearing against the ring 9 of the turbine casing. In other words, the optimum case of load desired, that is to say, that of a beam supported at both ends, is obtained.

The reference numeral 18 indicates a diaphragm connecting the inner guide blade ring 6 with the central frame 4, while at the same time forming a partition between the gas and the surrounding air. Said diaphragm is of such a nature as to permit both radial and axial movements of the ring 6 with relation to the central frame 4 while transmitting the torque from the guide blades to the central frame.

What I claim is:

In an elastic fluid turbine the combination of a turbine shaft, a turbine wheel supported by said shaft, a set of turbine blades for axial flow supported by said wheel, a frame member surrounding and supporting the turbine shaft, said frame member tapering conically in a direction towards said turbine wheel, a guide blade device provided in front of said set of blades of said turbine wheel, said guide blade device including an inner ring concentric with relation to said turbine shaft, a set of guide blades supported by said inner ring at the outer cylindrical surface thereof, a shroud ring surrounding said set of guide blades and connected to the outer ends thereof, an outer ring having an annular groove formed in its inner cylindrical surface and free end surface, said surfaces of said outer ring bounding said annular groove being engaged by said shroud ring, a stationary ring freely surrounding said turbine wheel and its blades, said stationary ring bearing with its one side surface against the outer ring of said guide blade device as well as against said shroud ring so as to act as an axial stop therefor, a set of links pivoted at their one ends to said conical frame member surrounding and supporting the turbine shaft and at their other ends to the inner ring of the guide blade device, another set of links pivoted at their one ends to said frame member and at their other ends to the outer ring of said guide blade device,

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the angle formed by the first-mentioned links with the conical frame member being larger than the angle formed by the other links with said frame member and said first-mentioned links being shorter than said last-mentioned links so that the axial positions of said rings of the said blade device with relation to each other will be maintained substantially unchanged irrespective of radial displacement of said rings owing to variations of temperature.

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