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[54] **DEVICE FOR COOLING ROTOR BLADES WITH SOLID PROFILE OF MOTOR VEHICLE GAS TURBINES**

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[58] **Field of Search** 415/116, 115, 117, 174; 416/92, 95, 96, 97

[56] **References Cited**

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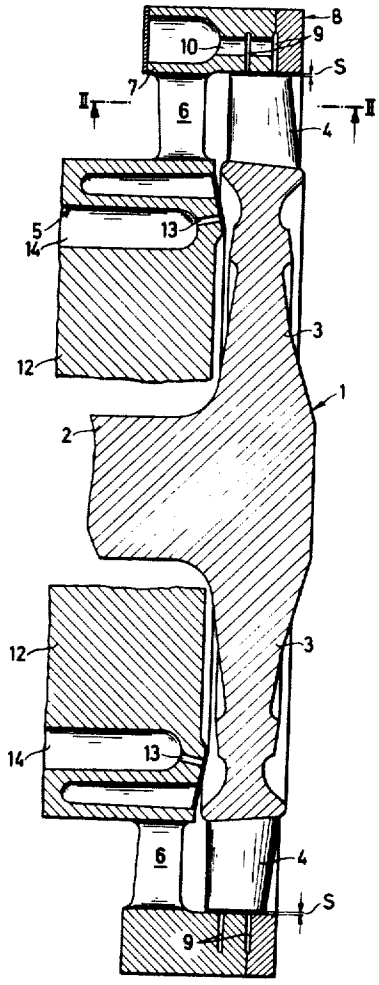
[57] **ABSTRACT**

A device for cooling the twisted rotor blades with solid profile of a motor vehicle gas turbines, according to which on or in the support for the guiding device preceding the rotor part, nozzles actuated by cooling air are so arranged that that part of the turbine rotor which is adjacent to the active blade profile is swept over by the cooling air. Also, the guiding device has that part thereof which overlaps the ends of the rotor blades provided with nozzle means acted upon by cooling air, said nozzle means being so arranged that the cooling air flows off in radial direction.

2 Claims, 2 Drawing Figures



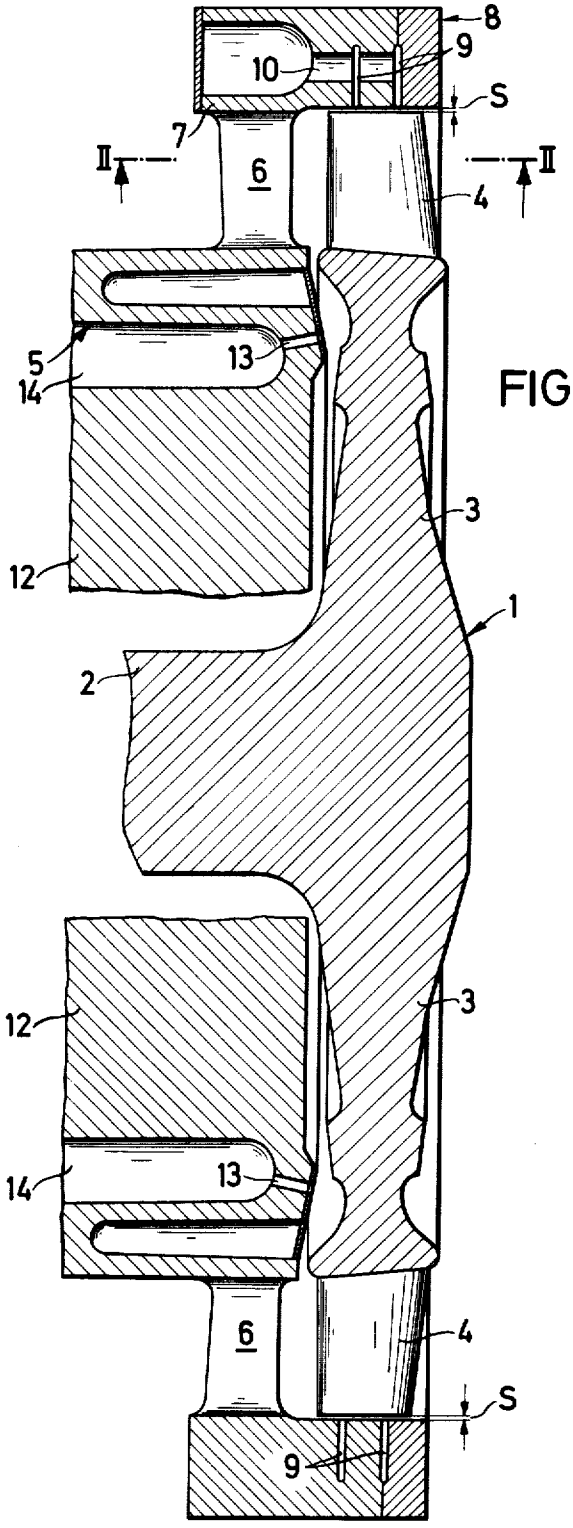
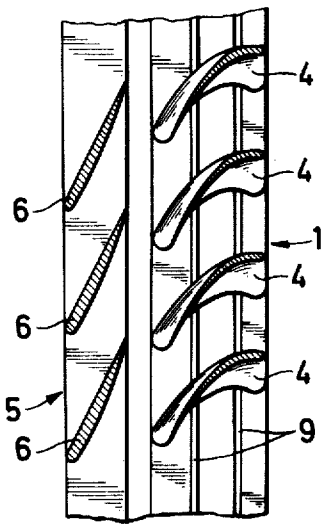


FIG. 1

FIG. 2



DEVICE FOR COOLING ROTOR BLADES WITH SOLID PROFILE OF MOTOR VEHICLE GAS TURBINES

The present invention relates to a device for cooling twisted rotor blades with solid profile of motor vehicle gas turbines, according to which on, or in the support for the guiding device preceding the rotor part, nozzles actuated by cool air are so arranged that that part of the turbine rotor which is adjacent to the active blade profile is swept over by cooling air.

The increase in the gas temperature at the turbine entrance desired with gas turbines in order to obtain an increase in the output and in the thermal degree of efficiency is limited by the material available for turbine wheels and turbine blades. The temperature limit of these materials is at present at approximately 950°C for turbines with reasonable life span. In order to increase the gas temperature at the turbine entrance, it has been suggested with a heretofore known motor vehicle gas turbine to cause cooling air to act upon the blade base or that part of the turbine rotor which is adjacent to the active blade profile while by heat conduction heat from the blade body was continuously conveyed to the blade base and from there to the cooling air. While with this heretofore known construction it is possible to reduce the temperature at the blade base to a considerable extent, the temperature at the blade head is still relatively high so that also the medium blade temperature (equaling one-half times the blade head temperature, plus the blade base temperature) still remained relatively high.

It is, therefore, an object of the present invention to provide a blade cooling device by means of which it will be possible at a predetermined gas temperature at the turbine entrance to realize an as low as possible medium blade temperature. This object and other objects and advantages of the invention will appear more clearly from the following specification, in connection with the accompanying drawings, in which:

FIG. 1 is a longitudinal section through a rotor of a vehicle gas turbine and through a portion of the guiding device.

FIG. 2 illustrates a section taken along the line II—II of FIG. 1 and shows a development of the rotor and guide wheel.

The device according to the present invention for cooling the rotor blades with solid profile of motor vehicle gas turbines is characterized primarily in that also the guiding device has that portion thereof which overlaps the rotor blade ends provided with a nozzle device adapted to be actuated by cooling air while the nozzles are so arranged that the cooling air flows out in radial direction. Inasmuch as a cold air ring forms around the blade ends, it will be appreciated that with the cooling device according to the invention, in addition to the drop in temperature from the blade center to the blade base there also exists a drop in temperature from the blade center to the blade head so that the medium rotor blade temperature (equal turbine entrance temperature assumed), is lower than the medium rotor blade temperature of heretofore known turbine rotors with exclusive blade base cooling, so that in conformity with the present invention the life span of the rotor blades is considerably increased. A further advantage of the cooling device according to the invention consists in that the cooling air reduces the loss in working gas through the gap provided between the rotor blade ends and that portion of the guiding device overlapping the latter.

In order to avoid siren-like noises in the rotor part due to the provided nozzles in that part of the guiding device which overlaps the blade ends, it is suggested according to a further feature of the invention to design the nozzles as one or more annular slots.

Referring now to the drawings in detail, the arrangement shown therein comprises a rotor **1** of a motor vehicle gas turbine of the axial type, said rotor having a hub **2**, a wheel body **3**, and the rotor blades **4**. The blades **4** are twisted in the heretofore customary manner and while being thin-walled have a solid profile. The rotor **1** is provided by a guiding device **5** with guiding blades **6**. The outer guiding blade ring **7** continues in the direction toward the rotor **1** while being correspondingly reinforced and overlaps the rotor. Between the ends of the rotor and the inner wall of the outer guiding blade ring extension **8**, there is an axial gap S having a width of, for instance, 0.5 mms. The extension **8** which is coaxial with the rotor **1** has that part thereof which overlaps the rotor provided with annular slots **9** directed perpendicularly with regard to the rotor axis. The slots **9** communicate through a conduit **10** with a nonillustrated source of compressed cooling air. As cooling air may be employed a portion of the air compressed by the compressor of the gas turbine. Expediently, however, if as cooling air there is employed the compressed air which is considerably cooler than the compressor air and is fed directly by the compressed air storage container to the slots **9**.

In a heretofore known manner, an additional cooling device is arranged in the part **12** of the guiding device **5**. This last mentioned cooling device serves for cooling the blade base. The cooling device comprises a plurality of nozzles **13** which, through an annular chamber **14**, are in communication with a source of compressed air (not illustrated).

The cooling air for the rotor blade ends flows under pressure from the slots **9** radially inwardly toward the ends of the rotor. The curvature of the rotor blades **4** brings about on one hand a conveying of the cooling air in a direction counter to the direction of flow of the working gas and on the other hand the flow of working gas brings about a conveying of the air in the direction of the working gas. Inasmuch as the cooling air is specifically heavier than the working gas, due to the centrifugal force, a cold air ring remains around the blade ends. In view of this cool air zone, a temperature drop toward the blade ends is created. Since, in view of the cooling of the blade base there exists also a temperature drop toward the base of the blades, heat is conveyed radially inwardly and also radially outwardly.

It is, of course, to be understood that the present invention is, by no means, limited to the specific showing in the drawings, but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In combination with a gas turbine rotor of a motor vehicle having a hub and twisted peripheral rotor blades with solid profile, a guide wheel coaxially arranged with said rotor and including: a central section extending around said hub, a peripheral section extending around said rotor blades, and guide blades interconnecting said central section and said peripheral section, annular chamber means radially inwardly of said guide wheel blades and provided with first nozzle means di-

rected and open toward that portion of said turbine rotor which is near to and radially inwardly of said peripheral rotor blades, said annular chamber means being adapted to be connected to a source of cooling air, and second nozzle means provided in said peripheral section and directed at least approximately radially toward the peripheral portion of said peripheral rotor blades, said second nozzle means being adapted to be connected to a source of compressed cooling air.

2. An arrangement in combination according to claim 1 in which said second nozzle means includes at least one annular slot.

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