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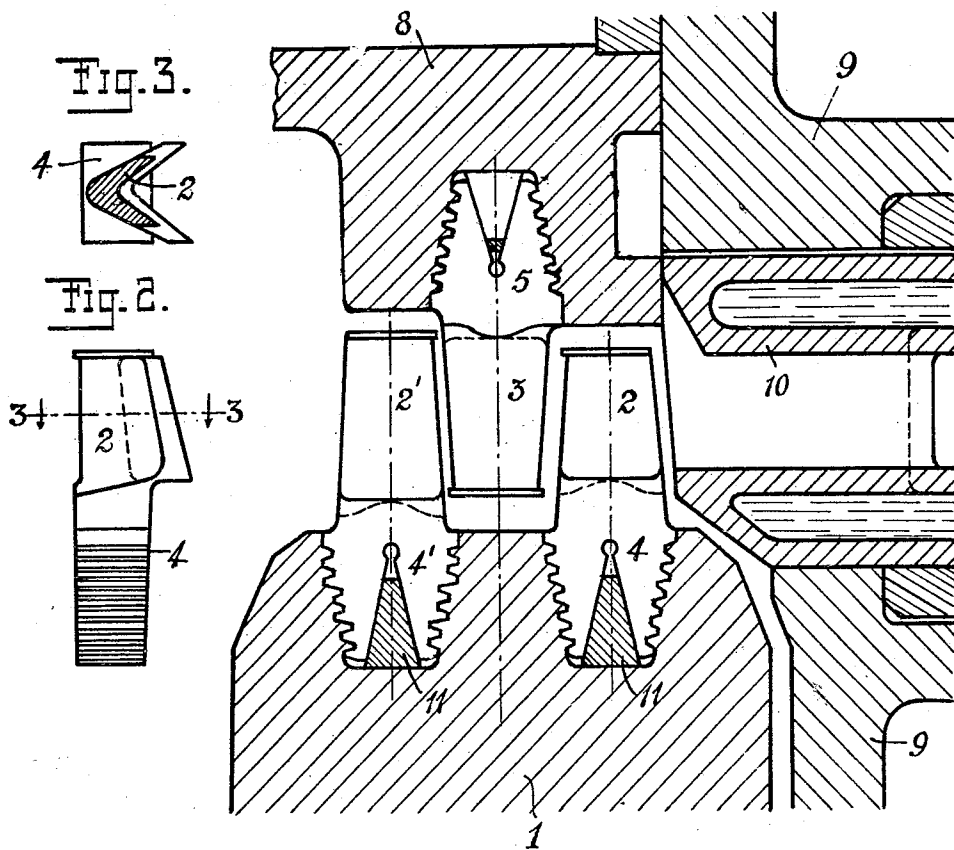
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GAS TURBINE BLADE

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Fig. 1.



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GAS-TURBINE BLADE

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The efficiency with which heat is utilized in turbines driven by hot motive agents, and particularly by hot combustion gases, depends largely upon carrying out the operation at temperatures as high as possible. This requires not only that the turbine blades and the reversing blades be made of a material very resistant to heat, but also that proper provision be made for dissipating the heat absorbed by the blades. The heat absorbed by the rotor blades is to be carried away to the rotor body and the heat absorbed by the reversing blades is to be conducted away to the casing in which the annular set of reversing blades is mounted. A calculation based on theory and checked with the aid of practical experience will determine the length, measured in the direction in which the gases flow, to be given to the blades of the rotor and of the set of reversing blades. This length will also determine the blade cross-section available for carrying away the heat, if, as is customary, the blade is made rectangular in a cross-section taken in a plane passing through the axis of rotation, that is to say, if the foot or base of the foot or attached portion of the blade is made of a size corresponding to the projection of the blade into said plane.

According to the present invention, superior results are obtained by making the blades of a cross-section which, instead of being rectangular, increases in width toward the foot or attached portion, and in the preferred form of the invention the cross-section of the blade in an axial plane and likewise that of the foot is trapezoidal.

Through this form of the blade, the advantage is obtained first of all that its reduced top portion takes up less heat than it would if the blade had throughout a rectangular cross-section of the width of the foot, which rectangular form would lead to overheating of the blades. Furthermore, by means of the widened foot the heat taken up from the top part is conducted better into the rim of the wheel than if the foot were only as wide as the top portion. If the foot of the blade, which is secured in the rim of the wheel, were of rectangular cross-section, then here again

poor heat conduction and an accumulation of heat would take place especially between the flanks of the blade feet lying close to each other where several rings of blades are arranged in proximity. According to the invention, these feet are therefore likewise of trapezoidal cross-section, such that they become narrower toward the axis of the wheel. By this construction of the blade feet the dissipation of heat at the outside of the wheel is favored, so that at this point also local over-heating is prevented.

Without restricting myself to the specific details shown, I will now proceed to describe a typical and satisfactory embodiment of my invention as illustrated by the accompanying drawings, in which Fig. 1 is a fragmentary axial section of a turbine provided with my improvements; Fig. 2 is a detail view in elevation of one of the rotor blades adjacent to the gas nozzle, looking from the right in Fig. 1, and Fig. 3 is a cross-section of such blade taken on the line 3—3 of Fig. 2.

At 9 I have indicated a portion of the stationary frame or casing of the turbine, which casing contains a water-cooled nozzle 10 through which hot combustion gases from a suitable source are discharged against an annular set of blades 2 secured to the rotor body 1 so as to move in unison therewith. The section in Fig. 1 is taken through the axis of rotation which therefore would be represented by a horizontal line at the bottom if Fig. 1 were extended downward sufficiently. The drawing shows a second set of rotor blades 2' likewise held to rotate with the rotor 1. The blades 2, 2' have feet 4, 4' respectively fitted into correspondingly shaped recesses of the rotor and secured therein by wedges 11. The blades 2 rotate in a path different from the blades 2' and into the space between them project the stationary reversing blades 3, the general shape and purpose of which are well-known in the art, said reversing blades being secured rigidly to a ring 8 projecting laterally from the frame or casing 9 and firmly secured thereto. The reversing blades have toothed feet 5 for fastening them on the ring with the aid of wedges 12.

According to the form of my invention

illustrated, the rotor blades, 2, 2' and the reversing blades 3 are made trapezoidal in axial section, that is to say, their free ends are narrower than their attached portions, the blades tapering toward said free ends. Thus an efficient path of gradually increasing width is provided for the passage of heat from the blades 2, 2', 3 through their feet 4, 4' and 5 respectively to the rotor body 1 and to the ring 8 respectively, and the transfer of heat thus takes place more efficiently than when the blades are of uniform cross-section or rectangular shape in axial section, as has been customary hitherto. With the rectangular blades of earlier construction, the heat is not carried off so readily and the blades therefore retain a temperature which endangers their strength. Owing to the better cooling effect obtained with my invention, the blades 2, 2', 3 are enabled to resist the heat effects much more reliably than when employing the rectangular shape above referred to.

In order to prevent a local accumulation of heat in the rotor body 1, I have found it desirable to make the toothed feet 4, 4' likewise of trapezoidal or tapering cross-section, as shown in Fig. 1, the feet 4, 4', however, tapering in a direction opposite to the blades 2, 2', so that the maximum cross-section will be at the point where the blades emerge from the rotor body 1. I thus avoid the danger of heat accumulation, particularly in that portion of the rotor 1 which lies between the feet 4 and the feet 4'. This shape of the feet also promotes the dissipation of heat toward the outside of the rotor body and assists in keeping it reasonably cool. For a similar purpose I prefer to taper the feet 5 in a direction opposite to the tapering of the reversing blades 3, so that the maximum width will again be at the point where the reversing blade emerges from the ring or member 8 in which it is mounted, or, in other words, at the joint of the blade proper with the foot of the blade. It will be seen that the rotor body 1 constitutes a carrier for the blades 2, 4 and 2', 4', and similarly the ring 8 constitutes a carrier for the reversing blades, 3, 5.

Various changes in the specific form shown and described may be made within the scope of the claim without departing from the spirit of my invention.

I claim:

A turbine adapted for operation by a hot driving medium, provided with a blade having an active portion adapted to be impinged upon by said driving medium and with a foot portion, both said foot portion and said active portion increasing in width from their opposite ends toward their adjacent ends, and a carrier in which said foot portion is mounted.

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