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MEANS FOR COOLING THE BLADES OF TURBINE ROTORS

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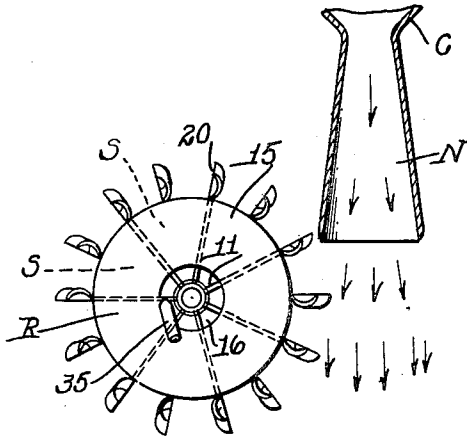


Fig. 1.

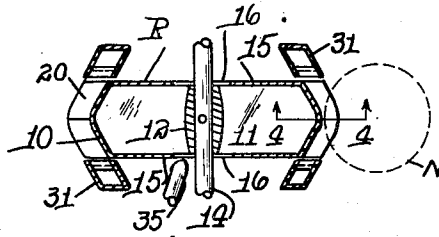


Fig. 2.

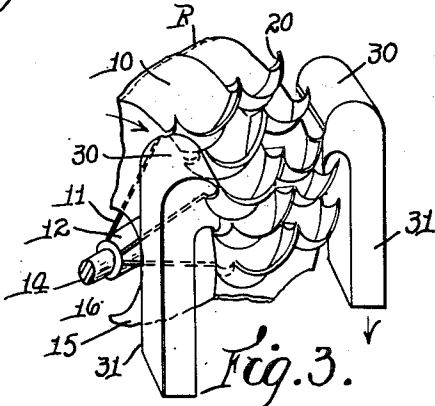


Fig. 3.

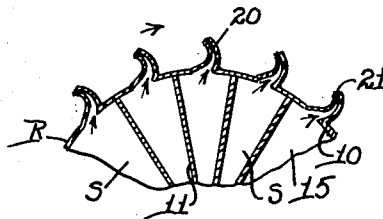


Fig. 4.

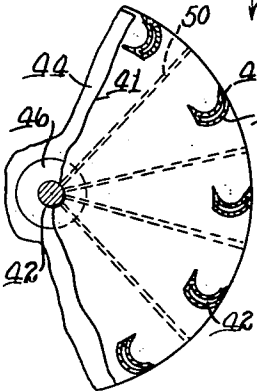


Fig. 6.

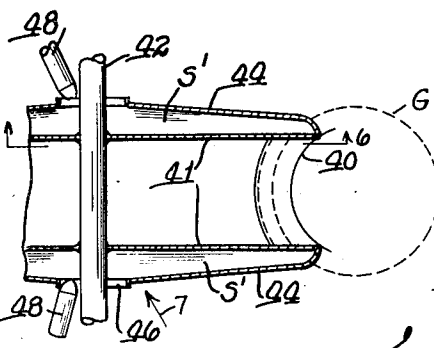


Fig. 5.

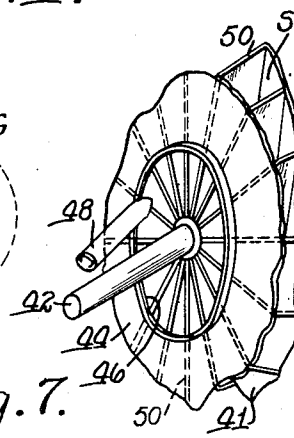


Fig. 7.

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MEANS FOR COOLING THE BLADES OF
TURBINE ROTORS

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1 Claim. (Cl. 253—39.15)

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This invention relates to means for cooling the blades of a turbine rotor by the action of a cooling liquid, as water, delivered thereto.

This invention is particularly applicable to turbines which are driven by a blast of hot combustion gases, as in certain types of rocket apparatus.

It is the general object of this invention to provide improved means for liquid-cooling a set of turbine blades, and particularly when the blades are not enclosed at their peripheral edges.

In the preferred form, the cooling liquid is supplied at the inner portion of the rotor and is distributed to the blades by centrifugal force.

The invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claim.

Preferred forms of the invention are shown in the drawings, in which

Fig. 1 is a side elevation of one form of the invention;

Fig. 2 is a sectional plan view of the rotor and certain associated parts;

Fig. 3 is a partial perspective view of the mechanism shown in Fig. 2;

Fig. 4 is a partial sectional side elevation of the rotor, taken along the line 4—4 in Fig. 2;

Fig. 5 is a partial sectional plan view showing a modified construction;

Fig. 6 is a partial sectional side elevation, taken along the line 6—6 in Fig. 5; and

Fig. 7 is a partial perspective view, looking in the general direction of the arrow 7 in Fig. 5.

Referring to Figs. 1 to 4, a turbine rotor R is shown which comprises an annular band 10 of V-shaped cross section which is mounted on a plurality of radiating partitions 11 secured to a hub 12 fixed on a shaft 14. Side plates 15 are secured to the outer edges of the ring 10 and are provided with axial openings 16 spaced outward from the shaft 14.

Hollow turbine blades 20 are mounted in spaced relation on the ring 10 and are slotted or perforated at their outer tips, as indicated at 21 in Fig. 4. These blades 20 are preferably double-curved in plan, as clearly shown in Fig. 3, and are also backwardly curved in transverse section, as shown in Fig. 4.

The rotor R is so mounted that the tips of the

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blades 20 extend only into the outer portion of a blast of hot combustion gases issuing from a combustion chamber C through a nozzle N. The deflected gas portions are discharged laterally from the blades 20 against stationary guiding members 30 by which their direction is reversed, so that they are redirected and finally discharged through passages 31 in a direction substantially parallel to the normal path of travel of the combustion gases.

For cooling the blades 20, a suitable cooling liquid, as water, is supplied under pressure through a fixed nozzle 35 and through an annular opening 16 to the radiating spaces S which are defined by the side plates 15 and the partitions 11. The cooling liquid flows outward through the spaces S by centrifugal force, and is discharged through the slots or openings 21 at the outer tips of the curved blades 20. The partitions 11 accelerate the centrifugal action.

The blades 20 are thus effectively cooled, and overheating is prevented.

In the construction shown in Figs. 5 to 7, a plurality of blades 40 are mounted between discs 41 secured on a shaft 42. The blades 40 are curved in side elevation as shown in Fig. 5 to present a concave outer edge to the blast of combustion gases indicated by the circle G in Fig. 5. The blades are also curved in transverse section as shown in Fig. 6 and have lengthwise open channels 42a. The blades 40 are also provided with slots or openings 43 in their concave outer edges. These blades 40 are welded or otherwise secured to the plates 41 and are freely open through slots in the plates 41 to radiating jacket spaces S'.

These jacket spaces S' are formed between the discs 41 on the inside and casing members 44 on the outside. The members 44 are secured at their outer edges to the edges of the plates 41 and have axial openings 46 adjacent the shaft 42, through which openings water under pressure may be supplied from fixed nozzles 48.

Radiating partitions 50 separate the jacket spaces S' and hold the plates 41 and casing members 44 in definite spaced relation. The partitions 50 also provide more effective centrifugal action.

Water supplied through the nozzles 48 flows outward through the spaces S' to the open ends

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of the channels 42 in the blades 40. From these channels 42 the water or vapor will be ejected through the edge slots or openings 43.

With this construction also each blade is effectively cooled and overheating is avoided.

Having thus described the invention and the advantages thereof, it will be understood that the invention is not to be limited to the details herein disclosed, otherwise than as set forth in the claim, but what is claimed is:

In a turbine apparatus, a rotor having spaced hollow end discs enclosing jacket spaces, a plurality of hollow turbine blades mounted between said discs and secured thereto at their ends only and entirely supported thereby, said blades having their outer edges concave lengthwise and with no part of any blade extending radially beyond the peripheral outer edges of said discs, said blades having lengthwise passages open at each end of each blade through the inner sides of said discs to said jacket spaces and having discharge openings at their free peripheral concave outer edges, means to supply a cooling liquid to the jacket spaces in said hollow end discs, and a plurality of radiating partitions in the jacket space of each hollow end disc, which partitions sub-

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divide said jacket spaces into radiating space portions through which said cooling liquid is fed by centrifugal force to the lengthwise passages in said hollow blades and through said blades to said edge-discharge openings.

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Executrix of the Last Will and Testament of Robert H. Goddard, Deceased.

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