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COOLING ARRANGEMENT FOR GAS TURBINES

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Fig. 1.

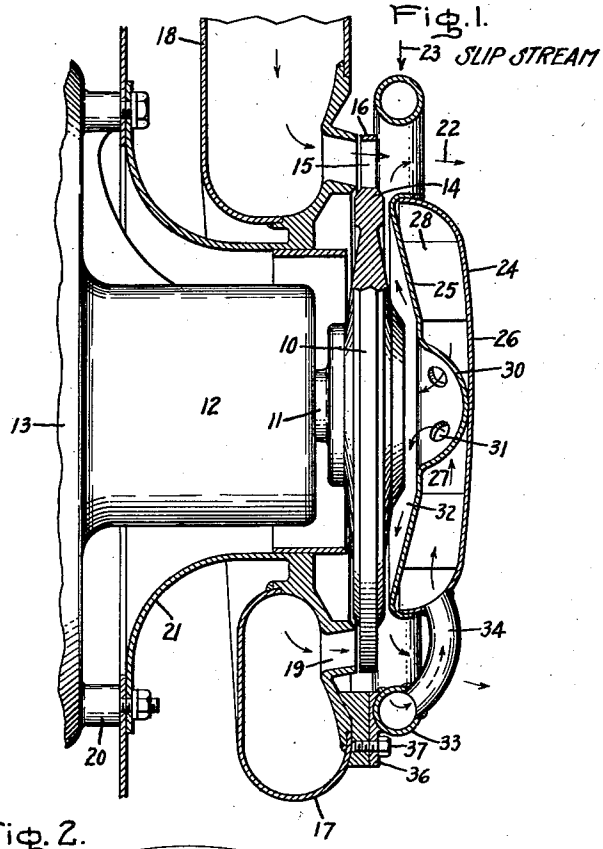
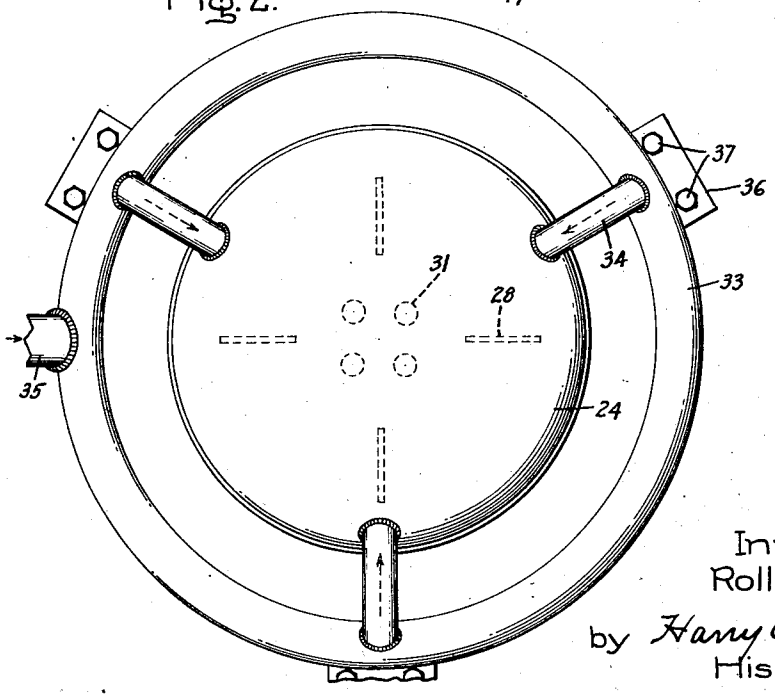


Fig. 2.



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COOLING ARRANGEMENT FOR GAS TURBINES

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2 Claims. (Cl. 60—41)

The present invention relates to cooling arrangements for gas turbines, particularly of the type of turbines which include a bucket wheel supported on an overhung shaft and having a row of buckets arranged to discharge gases directly into the atmosphere. Such turbines are often used on aircraft for driving superchargers or generators. During operation the bucket wheel may be subject to excessive heat by the gases discharged therefrom. This is particularly the case where the bucket wheel is mounted so that some of the gases discharged from it are forced towards a central portion thereof by the action of the slip stream.

The object of my invention is to provide an improved construction and arrangement of gas turbines whereby such turbines may be operated safetly with gases at high temperatures of the order of 750° C. and above.

For a consideration of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto in connection with the accompanying drawing.

In the drawing Fig. 1 illustrates a sectional view of a gas turbine arrangement for aircraft embodying my invention, and Fig. 2 is a front view of a part of Fig. 1.

The arrangement comprises an axial flow gas turbine with a solid bucket wheel 10 mounted on an overhung shaft 11 adjacent a bearing 12 of a supercharger 13. The bucket wheel 10 has a solid disk with a rim 14 on which an annular row of buckets 15 is mounted. The outer ends of the buckets are connected by a band 16. An annular nozzle box 17 is mounted adjacent the inlet side of the bucket wheel and has an inlet portion 18 for receiving gases from a suitable source, such as the exhaust manifold of a combustion engine, not shown. The nozzle box includes a row of nozzles 19 adjacent the buckets 15 for properly directing operating gas to the bucket wheel. The nozzle box in the present instance is mounted on studs 20 formed on the casing of the supercharger 13 by means including a wall 21 which also serves to protect the bearing 12 from heat radiated from the nozzle box 17. During operation high temperature gases are conducted from the nozzle box to one side of the bucket wheel passing through the passages formed between adjacent buckets and issuing from the other side of the bucket wheel directly into the atmosphere. During operation the bucket wheel may be subject to excessive heat, as pointed out above, especially when the direction of discharge into the atmosphere is substantially perpendicular to the direction of the slip stream. The direction of discharge has been indicated in the drawing by an arrow 22 and the direction of the slip stream has been indicated by an arrow 23. The latter in the present instance is parallel to a diameter of the bucket wheel and perpendicular to the direction of discharge of gases, as well as to the axis of rotation of the wheel. With reference to the direction of the slip stream, the upper portion of the bucket wheel 10 in the drawing is leading and the lower portion of the bucket wheel is trailing. In such arrangement the slip stream forces gases issuing from the leading portion of the bucket wheel towards a central portion thereof and causes excessive temperatures of the wheel.

This difficulty is overcome in accordance with my invention by the provision of a device for protecting and effectively cooling the bucket wheel disk. The device comprises a hollow cap 24 coaxially arranged with a bucket wheel and closely spaced with the outer face thereof. The cap has an inner wall 25 and an outer wall 26 with the outer edges of the walls secured together, preferably by fusing to form a space 27. A plurality of radially disposed partitions 28 are secured to the walls inside the space 27 to reinforce the cap. Both walls are essentially concave-shaped when viewed from the bucket wheel. The inner wall 25 has a central portion 30 which is depressed towards the outer wall to engage a central part thereof. This central portion 30 has a plurality of openings 31 establishing communication between the space 27 and the space 32 formed between the cap and the outer face of the bucket wheel 10. The diameter of the cap is slightly smaller than the outer diameter of the rim 14 of the wheel to permit free discharge of gases from the latter. Cooling air under pressure is conducted to the space 27 formed by the cap by means including an annular conduit 33 concentrically spaced from the cap and having an inner diameter slightly larger than the outer diameter of the bucket wheel. This conduit or channel 33 communicates with the cap through three circumferentially spaced conduits 34 connected between the annular conduit 33 and the cap 24. The connecting conduits 34 are curved outward to permit expansion during operation without setting up excessive stresses in the device. An inlet conduit 35 is connected to the annular conduit 33 for conducting air under pressure thereto from any suitable source, such as the discharge side of

the supercharger 13, or from the slip stream. The device is supported on the nozzle box 17 by means including flanges 36 welded to the annular conduit 33 and bolts 37. During operation cooling air under pressure is conducted through the inlet conduit 35 to the annular conduit 33, whence the air is conducted through the connecting conduits 34 to the space 27 of the cap to be discharged therefrom through the openings 31 towards a central portion of the wheel. It will be noted that the directing of the cooling air towards the central portion of the wheel is facilitated by the depressed portion 30 of the inner wall 25 of the cap. The cooling air is discharged from the space 32 between the wheel and the cap through an outer clearance formed between the rim and the cap. The wall portions of the annular conduit 33 and the cap 24 facing each other are both curved to constitute together an annular nozzle with flaring opening through which the gases issuing from the bucket wheel are discharged.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Gas turbine arrangement for aircraft comprising a turbine wheel, a nozzle box on one side of the wheel for conducting operating gas thereto and a device for cooling the wheel disposed on the discharge side of the wheel, said device comprising a hollow cap having inner and outer walls sealed at their edges with an opening in a central portion of the inner wall, and means for conducting cooling air under pressure to the cap, said means including an annular conduit concentrically spaced from and surrounding the cap, connecting conduits between the annular conduit and the cap, adjacent walls of the cap and the annular conduit being curved to define a nozzle-shaped space through which the turbine wheel discharges directly into the atmosphere.

2. Gas turbine having a bucket wheel, means for conducting operating gas to the inlet side of the wheel, and a cooling and protecting device adjacent the outlet side of the wheel, said device comprising a hollow cap having an inner and an outer wall with edges sealed together, the inner wall having a discharge opening for directing cooling air towards the bucket wheel, an annular conduit concentrically spaced from the cap and having an inlet for cooling medium, and a plurality of circumferentially spaced connecting conduits between the cap and the annular conduit, adjacent walls of the cap and the annular conduit being curved to define a nozzle-shaped space for conducting gases discharged from the bucket wheel.

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