March 11, 1941. W. H. ALLEN 2,234,792

COOLING ARRANGEMENT FOR GAS TURBINES

Filed June 28, 1939

Fig. 1.

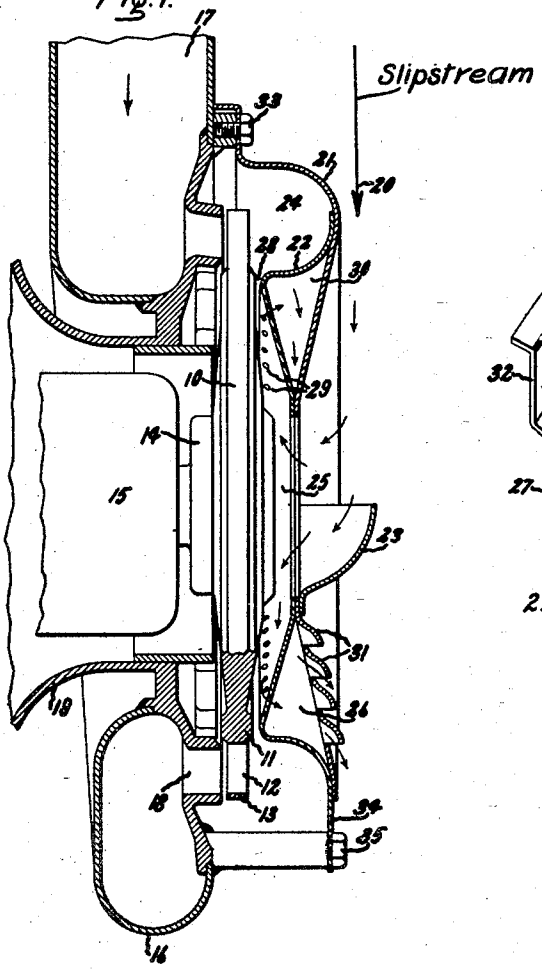
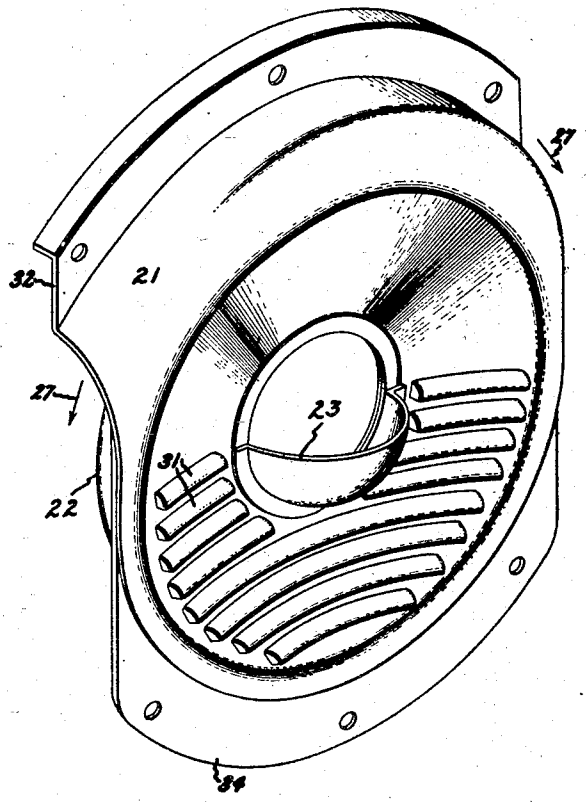


Fig. 2.



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COOLING ARRANGEMENT FOR GAS TURBINES

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4 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 discharge side exposed to the atmosphere. Such turbines are used on aircraft for driving superchargers or generators. Operating gas is ordinarily conducted to the bucket wheel by means including a nozzle box disposed on one side of the wheel and connected to a source of supply such as the manifold of a combustion engine. In many aircraft the bucket wheel is arranged so that the slip stream of the aircraft may sweep across the face of the wheel and thereby cause excessive heating thereof. This is especially the case where the axis of rotation of the wheel is perpendicular to the direction of the slip stream where the gases issuing from the leading portion of the wheel are forced towards the central portion thereof. The heating is augmented where the gases contain considerable unburned fuel, causing after-burning of the gases near the discharge face of the bucket wheel.

The object of my invention is to provide an improved construction and arrangement of the type of turbines above specified whereby a gas turbine may be operated safely with gases at high temperature 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 partly broken away of a gas turbine arrangement embodying my invention, and Fig. 2 is a perspective view of a part of Fig. 1.

The arrangement comprises a gas turbine having a bucket wheel 10 with a solid disk having a rim 11 to which an annular row of buckets 12 is secured. The outer ends of the buckets are shrouded to form a band 13. The wheel is fastened to an overhung shaft 14 which is supported on a bearing 15. The bearing may form part of a supercharger, generator or like machine driven by a turbine. An annular nozzle box 16 with an inlet 17 for receiving operating gas and a row of nozzle blades 18 is located on one side of the wheel to direct operating gases to the buckets. The nozzle box is suitably supported by means including a wall 19 disposed between the box 16 and the bearing 15 and also acting to reduce radiation of heat from the box to the bearing and elements associated therewith.

During operation, operating gases are conducted from a suitable source, not shown, to the box 16, whence they are discharged into the spaces formed between adjacent buckets 12. The arrangement so far described is intended to be mounted on aircraft with the face of the bucket wheel substantially parallel to the direction of the slip stream or, from another viewpoint, with the axis of rotation of the wheel perpendicular to the direction of the slip stream indicated by an arrow 20.

My invention comprises a device which prevents gases issuing from the leading portion of the wheel, that is, the upper portion in the drawing, from being forced towards the disk of the wheel and also serves to supply cooling air to the wheel. The device as shown in the drawing is made up essentially of three metal sheets 21, 22 and 23. These three sheets are formed and secured together, preferably by a fused metal, to define together with the adjacent portions of the bucket wheel three spaces, chambers or channels 24, 25 and 26. The chamber 24 which is formed near a leading portion of the bucket wheel serves to receive gases issuing from said portion and causing these gases to issue laterally as indicated by arrows 27 in Fig 2 or, from another viewpoint, the chamber 24 prevents gases issuing from the leading portion of the bucket wheel from being forced towards a central portion thereof by the action of the slip stream and also to prevent after-burning in proximity of the leading portion of the bucket wheel. The chamber 24 extends over an angle of about 120°. The side portions of the sheet 21 which form a hood are cut away to permit radiation of heat from the hot bucket directly into the atmosphere. The cooling chamber 25 formed between a conical portion of the sheet 22 and a central portion of the bucket wheel serves to cool the latter. Cooling air is conducted to the chamber 25 by a duct in the present instance by a scoop formed by the sheet 23 secured to a central opening of the sheet 22 and arranged to receive air from the slip stream. The outer portion of the sheet 22 which bounds the cooling space 25 forms a close clearance 28 with the rim 11 of the bucket wheel. Cooling air is discharged from the chamber 25 through openings or perforations 29 near the clearance 28 into an annular channel 30 formed between adjacent portions of the sheets 21 and 22. A lower portion of the sheet 21 is formed to define louvers 31 opening downwardly, that is, in the direction of the slip stream, whereby the discharge of air from the chamber 30

through the louver spaces is aided by the action of the slip stream. The device is supported on the nozzle box. To this end the outer sheet has an upper portion forming a flange 32 secured to the nozzle box by means including bolts 33, and the inner sheet 22 has an extension forming a flange 34 secured to the nozzle box by means including bolts 35.

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 bucket wheel with its axis of rotation substantially perpendicular to the direction of the slip stream, means including a nozzle box located on one side of the wheel for conducting operating gases thereto, and a device located on the opposite side of the wheel for protecting and cooling the wheel, said device having walls defining three chambers, a first chamber adjacent the leading portion of the wheel to effect lateral discharge of gases issuing therefrom, a second chamber adjacent the central portion of the wheel for receiving cooling air from the slip stream and a third chamber communicating with the second chamber and having a lower portion adjacent the trailing part of the bucket wheel for discharging cooling air into the atmosphere.

2. Gas turbine arrangement for aircraft comprising a bucket wheel with its axis of rotation substantially perpendicular to the direction of the slip stream, means including a nozzle box located on one side of the wheel for conducting operating gases thereto, and a device for cooling the wheel, said device having walls forming three chambers, a first chamber adjacent the leading portion of the wheel opening laterally into the atmosphere for discharging gases issuing from the leading wheel portion, a second chamber having a central opening for receiving cooling air and outer openings communicating with the third chamber, and means for directing air from the slip stream into the central opening of the second chamber, the third chamber having a lower outer wall portion forming louvers opening in the direction of the slip stream to effect discharge of air from the third chamber by action of the slip stream.

3. Gas turbine arrangement for aircraft comprising a bucket wheel with its axis of rotation substantially perpendicular to the direction of the slip stream, and a device forming a curved channel of about 120 angular degrees in length disposed adjacent the leading portion of the bucket wheel and open at both ends to receive gases issuing therefrom and to discharge them laterally directly into the atmosphere.

4. Gas turbine arrangement for aircraft comprising a bucket wheel with its axis of rotation substantially perpendicular to the direction of the slip stream, means including a nozzle box located on one side of the wheel for conducting operating gases thereto, and a device located adjacent the central portion on the other side of the wheel for protecting the wheel against excessive heating, said device having a wall with a central opening and an outer perforated portion closely spaced with the rim, means for forcing cooling air through the central opening into the space formed between said wall and the wheel, and an annular chamber concentrically surrounding said opening and being formed partly by said perforated portion to receive cooling air through the perforation and discharge it into the atmosphere and a curved channel of about 120 angular degrees in length disposed adjacent the leading portion of the bucket wheel and open at both ends to receive gases issuing from the wheel and to discharge them laterally directly into the atmosphere.

WAYNE H. ALLEN.