This invention relates to partial admission gas turbine engines. A gas turbine with partial admission generally comprises a compressor, a combustor, a casing, and a bladed turbine rotor disposed in the casing.

11 Claims, 3 Drawing Figures
PERIPHERAL SUCTION OPENINGS IN GAS TURBINE ENGINES

In the present invention, a peripheral opening extends through the casing outwardly and in the plane of the turbine rotor, and opens to atmosphere; a power-inducer nozzle e.g., a combustor nozzle is disposed immediately downstream of the peripheral opening and is directed to the turbine blades; a suction zone is provided immediately uprotation of the power-inducer nozzle; and a scavenging zone is provided immediately downstream of the power-inducer nozzle.

The power-inducer nozzle is disposed between the suction zone and the exhaust zone.

The gases issuing from the power-inducer nozzle, the rotatin turbine blades, the suction zone, and the scavenging zone, together, induce a suction flow of atmospheric air through the peripheral opening to the turbine blades. A cooling effect is secured on the turbine blades as they pass through the suction zone, and the total mass of air intake and exhaust is augmented.

This invention relates to gas turbine engines and particularly to partial admission gas turbine engines in which atmospheric air is drawn to the turbine blades through a peripheral opening in the casing.

The peripheral opening is uprotation of a power-inducer nozzle, downrotation of a blade scavenging zone, and outward of and in the plane of the turbine blades. The opening is part of a suction zone and opens directly to atmosphere.

The power-inducer nozzle comprises a combustor outlet nozzle directed to the turbine blades downrotation of the peripheral opening. The gases issuing from the power-inducer nozzle drive the turbine rotor and are also instrumental in inducing suction flow through the peripheral opening. A compressor nozzle may form part of the power-inducer nozzle.

In the blade scavenging zone, pressure gases remaining between the turbine blades downrotation of the power-inducer nozzle are expelled. Pressure in a peripheral suction zone would counteract peripheral suction.

In this invention, the rotating turbine blades, the power-inducer nozzle, the blade scavenging zone and the peripheral suction zone, together, produce effective suction flow through the peripheral opening into the casing and to the turbine blades as they pass through the suction zone. Then the peripheral air is moved rearward.

The peripheral air is atmospheric and will secure a fresh-air cooling effect, especially on the extreme blade tips, and will augment the total mass of the air intake and of the exhaust.

If the compressor nozzle constitutes part of the power-inducer nozzle, direct front cooling of the turbine blades will also be effected.

With this cooling device, the engine can be operated at higher temperatures than without, thereby increasing power and improving efficiency, and in some engines e.g., jet engines also increasing exhaust velocity and thrust. Besides, modern turbine blade material can be used, thereby reducing initial cost and maintenance.

Therefore, the main objects of this invention are to operate the engine at higher temperatures to obtain maximum efficiency, to secure a cooling effect in the blade zone and even to cool the extreme blade tips, to augment the total mass of the air intake and of the exhaust, and to use relatively ordinary turbine blade material.

These and other objects are apparent in the description, in which characters of reference refer to like names parts in the drawing.

The drawing is schematic and shows plan views illustrating the invention, but the invention is not limited to the particular construction shown.

Referring briefly to the drawing,

FIG. 1 illustrates an embodiment of the invention, showing a combustor nozzle as power-inducer nozzle.

FIG. 2 shows a compressor nozzle as part of a power-inducer nozzle.

FIG. 3 also shows a pressure air emitting nozzle as part of a power-inducer nozzle.
In the blade-scavenging zone, the action of the blades is instrumental in expelling pressure gases from between the blades.

There may be plural power-inducer nozzles, with the described peripheral suction openings immediately uprotation of the nozzles. Here, the power-inducer nozzles must be spaced far enough apart to allow for both peripheral suction zones and blade scavenging zones.

The turbine rotor(s) may drive any load(s) besides driving the compressor, and the gas turbine engine can have any suitable final exhaust channel, not shown. In connection with jet propulsion engines, there probably will be a jet exhaust nozzle, also not shown.

In the text and claims, by "blade" is meant turbine rotor blade; by "uprotation" is also meant on the blade entering side of, rotationally upward of, by "downrotation" is also meant on the blade exiting side of, rotationally downward of; by "scavenging zone" or "blade scavenging zone" is meant the zone downrotation of the power-inducer nozzle, where the pressure gases remaining between the blades after the power-inducer stroke are removed as is practicable; by "combustor nozzle" or "power nozzle" is meant combustion gas emitting nozzle; by "compressor nozzle" is meant pressure air-emitting nozzle; by "pressure nozzle" is meant pressure gas emitting nozzle; by "inducer nozzle" is meant a nozzle being instrumental in effecting the peripheral suction flow; by "power-inducer stroke" or "power-inducer zone" is meant blade driving and peripheral suction inducing stroke or zone; by "in the plane of" is also meant partly in the plane of; by "peripheral opening" is also meant peripheral suction zone opening; by "in front of" is also meant upstream of; by "immediately" is also meant closely.

Basically, this gas turbine engine may be considered to have three zones or "strokes" per cycle. In the direction of rotation, if considered beginning with the peripheral suction opening, they are:

1. the peripheral suction zone or stroke, to draw in peripheral air;
2. the power-inducer zone or stroke to drive the turbine, and instrumental in inducing suction flow through the peripheral opening in the suction zone; and
3. the blade scavenging zone or stroke to remove or scavenge the effective pressure gases remaining between the turbine blades downrotation of the power-inducer zone or stroke. Then a new cycle begins.

Of course, the cycle may also be considered to begin with any other stroke e.g., the power-inducer stroke or the blade-scavenging stroke.

There may be only one combustor nozzle in the power-inducer zone or peripheral combustor nozzles, or there may be combustor nozzle-compressor nozzle combinations in this zone. That is, in the power-inducer zone, the turbine blades may pass across the end of one combustor nozzle, or across the ends of plural combustor nozzles, or across any combination of combustor and compressed air emitting nozzles. Regardless, there will always be the described peripheral suction opening on the blade entering side of the power-inducer zone, and there will be the described scavenging zone on the blade exiting side of the power-inducer zone.

In the text and claims, by "power-inducer nozzle" is meant single combustor nozzle, plural combustor nozzles, or any combination of combustor and compressor nozzles; by "nuzzle" is also meant opening, duct; by "opening" is also meant aperture, openwork, perforations, passage, duct, openings; by "atmospheric" is also meant air under atmospheric pressure; by "turbine" or "turbine wheel" is also meant bladed turbine rotor; by "periphery" is also meant perimeter, circumference; by "combustor" is also meant combustion chamber, flame tube; by "casing" is also meant turbine casing, turbine and fan duct casing, housing, cover.

In gas turbine engines with plural turbine rotors, the peripheral opening through the casing is outward of and in the plane of the first rotor, and peripheral air is drawn to the blades of the first turbine rotor. Therefore, in the text and claims, by "turbine rotor" is also meant first turbine rotor. Also in the text and claims, by "outwardly of and in the plane of the turbine rotor" is also meant outward of the blade tips of the turbine rotor.

This invention can be used in any suitable partial admission gas turbine engine e.g., in industrial engines, marine engines, automobile engines, aircraft engines, jet engines etc.

In an exemplary fan-jet application, the defined peripheral opening takes the form of a duct or passage extending through the turbine casing and through a fan duct and fan duct casing to atmosphere, atmospheric air being drawn through the duct or passagelike peripheral opening to the turbine blades. In view of this, by "casing" is also meant fan duct casing, turbine fan duct casing, or any combination of existing or new casings.

All illustrated and/or described features are meant to be interchangeable.

It is to be noted that changes may be made without departing from the spirit or scope of the invention.

I claim:

1. A partial admission gas turbine comprising a casing, a turbine rotor with turbine blades disposed in the casing, a combustor furnishing combustion gases, and a compressor furnishing compressed air at least partly for use in the combustor, a peripheral opening extending through the casing outwardly of and in the plane of the turbine rotor and opening to atmosphere, a power-inducer nozzle issuing gases under pressure disposed downrotation of the peripheral opening and directed to the turbine blades, wall means uprotation of the power-inducer nozzle providing a suction zone, and wall means downrotation of the power-inducer nozzle providing a scavenging zone; the turbine rotor being rotated, and atmospheric air being drawn through said peripheral opening to the turbine blades as they pass through the suction zone, the gases issuing from the power-inducer nozzle driving the turbine rotor and being a factor in inducing the suction flow through the peripheral opening.

2. A gas turbine according to claim 1, said power-inducer nozzle comprising a combustor nozzle disposed between said peripheral opening and said scavenging zone and directed to the turbine blades.

3. A gas turbine according to claim 1, said power-inducer nozzle comprising plural combustor nozzles disposed between said peripheral opening and said scavenging zone and directed to the turbine blades.

4. A gas turbine according to claim 1, said power-inducer nozzle comprising a combustor nozzle and a compressor nozzle, disposed between said peripheral opening and said scavenging zone and directed to the turbine blades.

5. A gas turbine according to claim 1, said power-inducer nozzle comprising a combination of combustor nozzles and compressor nozzles, disposed between said peripheral opening and said scavenging zone and directed to the turbine blades.

6. A gas turbine according to claim 1, the gases issuing from the power-inducer nozzle, the rotating turbine blades, the suction zone, and the scavenging zone, together, inducing a suction flow of atmospheric air through said peripheral opening to the turbine blades.

7. A gas turbine according to claim 1, wherein the inner end of the peripheral opening faces the turbine blades radially, the outer end of the peripheral opening communicating with atmosphere.

8. A gas turbine according to claim 1, wherein the power-inducer nozzle is immediately between said peripheral opening and said scavenging zone.

9. A gas turbine according to claim 1, wherein said peripheral opening is immediately uprotation of the power-inducer nozzle, and the scavenging zone is immediately downrotation of the power-inducer nozzle.

10. In a gas turbine according to claim 1, a forward extension of said peripheral opening beyond the turbine blades.

11. In a gas turbine according to claim 1, a rearward extension of said peripheral opening beyond the turbine blades.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,645,096 Dated February 29, 1972

Inventor(s) Georg S. Mittelstaedt

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet, "[57]: ABSTRACT" should appear as shown below

ABSTRACT

This invention relates to partial admission gas turbine engines. A gas turbine with partial admission generally comprises a compressor, a combustor, a casing, and a bladed turbine rotor disposed in the casing.

In the present invention, a peripheral opening extends through the casing outwardly of and in the plane of the turbine rotor, and opens to atmosphere; a power-inducer nozzle e.g. a combustor nozzle is disposed immediately downrotation of the peripheral opening and is directed to the turbine blades; a suction zone is provided immediately uprotation of the power-inducer nozzle; and a scavenging zone is provided immediately downrotation of the power-inducer nozzle.

The power-inducer nozzle is disposed between the suction zone and the exhaust zone.

The gases issuing from the power-inducer nozzle, the rotating turbine blades, the suction zone, and the scavenging zone together, induce a suction flow of atmospheric air through the peripheral opening to the turbine blades. A cooling effect is secured on the turbine blades as they pass through the suction zone, and the total mass of air intake and exhaust is augmented.

Column 1, lines 3 through 19 should be canceled.

Signed and sealed this 20th day of February 1973.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR. ROBERT GOTTSCHALK
Attesting Officer Commissioner of Patents