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AXIAL FLOW GAS TURBINE

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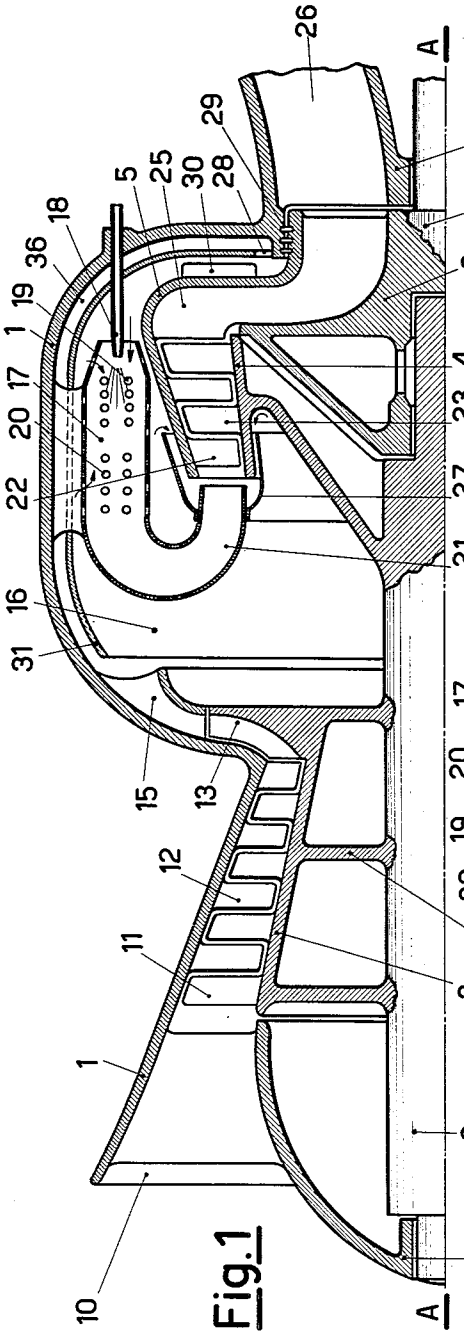


Fig.1

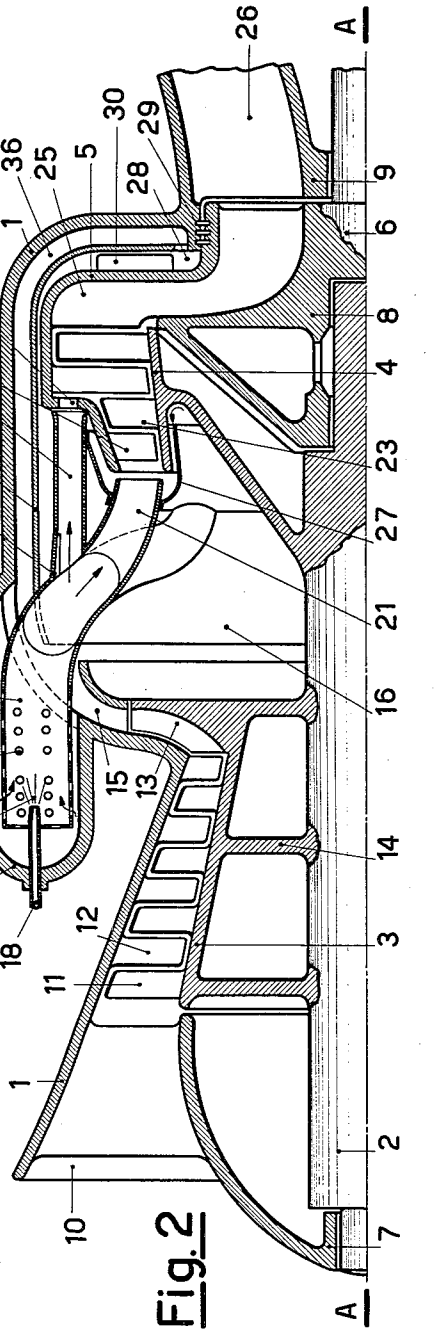


Fig.2

INVENTOR.

BY

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AXIAL FLOW GAS TURBINE

Alessandro Valota, Milan, Italy

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One of the difficulties arising in the construction of gas turbines is constituted by the enormous centrifugal force stressing the rotating parts and particularly the blades, which centrifugal force is originated by the speed of rotation. It is evident that such an arrangement of the rotating members reducing to the half the speed of rotation (dimensions and useful effect remaining unchanged) would be of great utility, since the centrifugal force would be correspondingly reduced in the proportion of the squares.

Moreover, gas turbines require the employment of a compressor for the feed air, which absorbs a considerable fraction of the power developed by the turbine. One of the objects of the present invention is to utilize one of the two rotors of a turbine having rotors turning in opposed senses, to actuate the respective compressor.

The gas turbine according to the present invention is characterized in that in lieu of a stator and a rotor, there are in the driving part two rotors, which are coaxial and have radial blades, and are located one outside the other and turn one in a sense opposed to that of the other; one of these rotors actuates the rotor of the compressor, while the second rotor of the turbine, completely indepndent from the first one, has the task of supplying the useful drive force.

In the accompanying drawing:

Fig. 1 is a longitudinal section of the upper half of a turbine according to the present invention.

Fig. 2 is a longitudinal section of the upper half of a variation of said turbine.

With reference to Fig. 1, the line A—A represents the axis of rotation of the compressor and of the turbine. The whole is composed essentially of three main parts: an external casting 1; a shaft 2 carrying at its left end the rotor 3 of the air compressor and at its right end the internal rotor 4 of the turbine; and at last the external rotor 5 of the turbine, intended to supply the useful energy and to transmit it by way of the extension of its shaft 6, connected to drive electric machines, vehicles or other loads.

The shaft 2 is supported at 7 by the casing and at 8 by the shaft 6, within which it can freely rotate on bearings not represented in the drawing. The shaft 6, which is supported itself by the casing at 9, carries the external rotor 5, which turns in a sense contrary to that of the internal rotor 4.

The air enters from the intake conduit 10, sucked by the blades 11 of the compressor rotor 3, which may be of any kind. In the drawing there is represented a mixed type compressor, having a first set of mobile blades 11 and fixed blades 12, which are axial, and are followed by a centrifugal stage with blades 13. The axial blades 11 and the centrifugal blades 13 are carried by the conical body of the rotor 3, connected to the shaft 2 by means of the ribs 14. The compressed air leaves the compressor through the conduit 15 which introduces it into an empty space 16, wherein there are numerous

combustion chambers 17, at the right end of which there is placed the fuel injector 18 feeding the flame 19, which meets with the compressed air entering into the combustion chamber through the holes 20. The combustion chambers (which in Fig. 1 have been shown as of the well known reversed flow type) may be of any type, provided they be arranged in such a manner that their delivery nozzle 21 is in front of the inlet of the rotors 4 and 5 of the turbine. Said rotors carry respectively the blades 22 and 23, and under the impulse of the hot gases turn in senses opposed to each other, the internal one driving the compressor, the external one supplying the useful energy of the whole set. The external rotor 5 is shaped so that after a set of axial blades 22 it carries a set of centripetal blades 25, which after recuperating the last energy of the gases, leads them to the outlet 26.

To obtain the compressed air filling the space 16 to pass to the turbine through the holes 20 of the combustion chamber, there has been provided an annular member 27 of substantially U-shaped cross-section, the bottom whereof reaches the vicinity of the border of the rotors and is passed through by the nozzles 21 of the combustion chambers. Said member 27 embraces over a certain length the external side of the rotors in such a manner that the part of air that will enter the turbine without passing first into the combustion chambers will be compelled to lick the rotors and thus cool the connection bases of the first rows of blades, which are those most exposed to the heat of the gases.

The combustion chambers may be any number and eventually even one single combustion chamber 17 may suffice. In any case and specially in the case of only one combustion chamber, this may be provided with a plurality of nozzles or delivery mouthpieces 21 opening all in angularly spaced relationship with one another, in the member 27.

At the same time, inside the cavity 16 there has been provided a metal sheet 31 dividing into two portions the flow of air coming from the compressor: one part goes to the combustion chambers as has been seen; the other passes through the annular space 36 confined between the metal sheet 31 and the casing 1, reaches the opening 28 (where a sealing labyrinth 29 prevents outflow of the compressed air), is sucked by the centrifugal blades 30 (applied outside the rotor 5), and is fed to the combustion chamber 17 in a sense contrary to the main air flow entering from the holes 20. In this way, the wall of the casing 1 will be protected by the metal sheet 31 from the internal heat radiations and practically all the walls of the rotor 5 will be cooled by the current of air, to the great advantage of the safety of their operation and duration. Contemporaneously, an excellent heat recuperation will be obtained, of heat which else would be lost.

A turbine such as that forming the object of the present invention offers particular advantages if applied to traction. If one supposes, in fact, that the effort of traction of the vehicle, to which the turbine is applied, comes to increase (owing to uphill running, etc.), the rotor 5 would slow down, the rotor 4 automatically would increase its number of revolutions (since the force of repulsion between the two rotors is kept constant), the compressor would deliver a larger quantity of air, permitting to feed a larger quantity of fuel, which would increase the power developed by the assembly of the rotors 4 and 5. This turbine will be substantially endowed with a great elasticity of operation.

Fig. 2 represents diagrammatically in axial section the half of another turbine according to the present invention. In Fig. 2, members having the same reference numeral have the same character and function as those indicated and described in Fig. 1. In said Fig. 2, the combustion chambers are external to the compressor in-

stead of being external to the rotors, and are contained by projections 32 of the external casing 1.

At the outlet ends of said chambers, which convey the burnt gases to the rotors, there are provided branch connections 33, one or more for each chamber, which may be opened or closed at will by valve means 34 for introducing the burnt gases into the space confined between the two rotors through the access port 35 provided in the external rotor 5. It is possible in this way to introduce a stream of hot gases towards the half of the turbine, with the advantage of raising at that point the mean temperature of the gases, which had lowered in the course of expansion. Also in this case the chambers 17 may be in any number and eventually there may be only one single chamber.

What I claim is:

1. An axial flow turbine gas engine comprising a casing, two concentric rotors in said casing each including an annular rim having an inlet edge and an outlet edge, the rim of one of said rotors surrounding the rim of the other rotor, circumferential rows of respectively-alternating reversely directed blades on said rims, a power shaft connected with one of said rotors, an air compressor connected to be driven by the other of said rotors, a passageway between said compressor and said casing for blowing air into said casing, a stationary annular member of substantially U-shaped cross section enclosing both inlet edges of said rims with a gap between said annular member and said rims for passage of compressed air therethrough around said inlet edges, a combustion chamber located in said casing and communicating therewith, means for feeding fuel to said combustion chamber, apertures in said combustion chamber for admitting the compressed air therein, and nozzles for delivering the combustion gases from said combustion chamber to said annular member toward said blades.

2. A turbine as claimed in claim 1, characterized by the fact that one of said rotors includes a centripetal bladed passageway in the last stage of the turbine conveying the discharge gases near the axis of the turbine.

3. A turbine as claimed in claim 1, characterized by a wall adjacent to a portion of said casing, defining therewith a jacket having two open ends, one of said open ends facing said passageway and the other end being in the vicinity of the outlet edge of the first mentioned

rotor, the latter being provided with centrifugal blades on its outer surface for enhancing circulation of air from the first mentioned to the second mentioned end of said jacket and toward the combustion chamber.

4. A turbine as claimed in claim 1, characterized by an apertured plane annular step portion in said annular rim of the first mentioned rotor at a distance from the inlet edge thereof, conduits from said combustion chamber terminating near said apertured annular portion, and valve means for closing said conduits.

5. An axial flow turbine gas engine comprising a casing, two concentric rotors in said casing each including an annular rim having an inlet edge and an outlet edge, the rim of one of said rotors surrounding the rim of the other rotor, circumferential rows of respectively-alternating reversely directed blades on said rims, a power shaft connected with one of said rotors, an air compressor connected to be driven by the other of said rotors, a passageway between said compressor and said casing for blowing air into said casing, a stationary annular member of substantially U-shaped cross section enclosing both inlet edges of said rims with a gap between said annular member and said rims for passage of compressed air therethrough around said inlet edges, a plurality of combustion chambers located in said casing and communicating therewith, means for feeding fuel to said combustion chambers, apertures in said combustion chambers for admitting the compressed air therein, and nozzles for delivering the combustion gases from said combustion chambers to said annular member toward said blades.

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