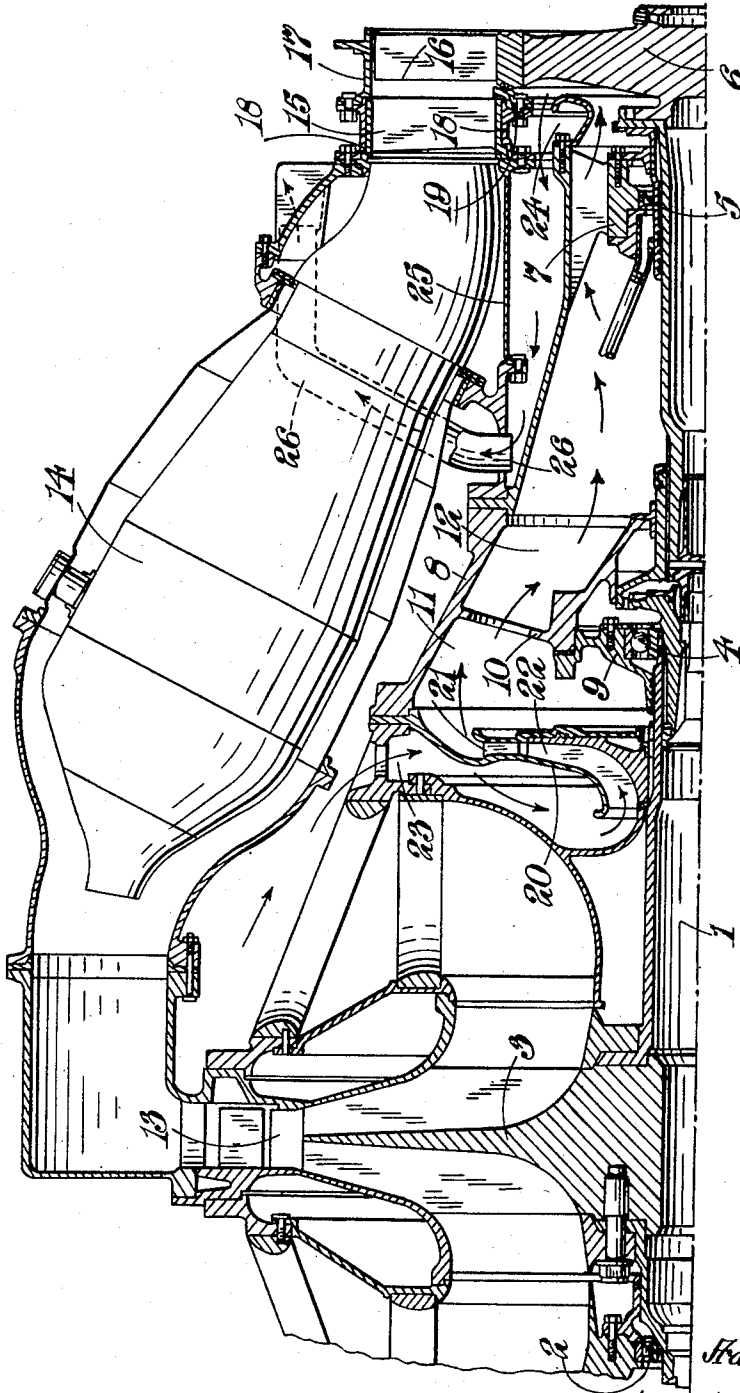


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GAS TURBINE POWER PLANT WITH AUXILIARY COMPRESSOR
SUPPLYING COOLING AIR FOR THE TURBINE
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GAS TURBINE POWER PLANT WITH AUXILIARY COMPRESSOR SUPPLYING COOLING AIR FOR THE TURBINE

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This invention relates to internal-combustion turbine engines of the kind in which air under pressure is delivered by a compressor to one or more combustion chambers from which the products of combustion flow to a turbine which is coaxial with the compressor and is connected by a driving shaft to the compressor impeller, the driving shaft having at least one bearing between the compressor impeller and turbine rotor. In such plants, more than one compressor may deliver to the combustion chamber or chambers, and more than one turbine rotor may be driven by the products of combustion.

To cool the engine structure, air may either be drawn through it by a suction fan or forced through that structure under pressure and the latter arrangement is preferable since the increase in the pressure around the main bearings over the atmospheric pressure reduces the oil leakage from the bearings and improves the efficiency of the lubrication system. It has been proposed to circulate the cooling air under pressure by bleeding it from the delivery from the main compressor and passing it through a cooler to the turbine structure.

The object of this invention is to provide an internal-combustion turbine engine of the kind described with means to improve the cooling of the engine structure.

According to the present invention, an internal combustion turbine engine of the kind described comprises an intermediate casing extending between the compressor and the turbine, which casing houses a support for a bearing of the driving shaft between the compressor and the turbine, and accommodates an auxiliary compressor, the rotor of which is supported on and driven by the said shaft, said auxiliary compressor being arranged to deliver air under pressure into the interior of the intermediate casing to flow past the said bearing, to cool it.

This arrangement has the advantage that the cooling air has a lower temperature than with the arrangement referred to above at the same pressure so that the arrangement is more efficient and it avoids the unbalancing of the flow from one side of the main compressor which occurs when the cooling air is bled from it.

A construction in accordance with the invention will now be described by way of example with reference to the accompanying drawing which illustrates the application of the invention to an internal-combustion turbine engine in which the impeller of a double inlet centrifugal compressor is secured on the front end of a main driving

shaft and a turbine rotor is secured on the rear end of the shaft.

The main driving shaft 1 between the turbine rotor and compressor-impeller is mounted in a front main bearing 2 immediately in front of the compressor impeller 3, a centre main bearing 4 to the rear of the impeller and a rear main bearing 5 immediately in front of the turbine rotor 6. The rear bearing 5 is mounted in a housing 7 carried by the smaller end of a frusto-conical intermediate casing 8 through which the shaft 1 extends and which encloses the space between the compressor and turbine rotor; and the centre bearing is mounted in a housing 9 carried by a perforated partition 10 disposed towards the front end of the intermediate casing 8. The partition 10 divides the casing into a forward portion 11 and a main rearward portion 12.

The compressor, which is generally indicated at 13 in the drawing, delivers compressed air to a number of combustion chambers one of which is shown at 14 in the drawing and which are arranged in a circle round the casing 8; and the products of the combustion flow from the combustion chambers through a ring of fixed guide vanes 15 to the blades 16 of the rotor 6. The vanes 15 and blades 16 are enclosed by a fixed external shroud 17 while the guide vanes have a fixed internal shroud 18. The rotor has an internal shroud 19 for its blades and the two internal shrouds 18 and 19 are arranged to minimise the escape of hot gases through the clearance space between them.

The auxiliary compressor for cooling comprises a casing 20 mounted on the front end of the intermediate casing 8 with its outlet 21 opening into the front portion 11 of the casing. The casing 20 contains a centrifugal impeller 22 secured on the driving shaft 1. An air intake 23 is provided through the intermediate casing between the fan casing 20 and the casing of the compressor 13 and extends radially inwards to the eye of the impeller 22.

The centre bearing housing 9 and the rear bearing housing 7 are so designed that the cooling air can flow from the front portion 11 of the intermediate casing through the perforated partition 10 past the centre bearing housing to the main portion 12 of the casing and thence through the rear bearing housing 7 and then over the front face of the turbine rotor 6 to a space 24 within the fixed inner shroud 19 for the guide vanes. A cylindrical casing 25 extends from this shroud forwardly to meet the frusto-conical wall of the intermediate casing 8 so as to enclose the

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space 24. A number of ducts, one of which is shown at 25 in the drawing, are arranged to deliver cooling air from the space 24 to cool the outer fixed shroud 17.

It will be observed that the space 24 is enclosed partly by the turbine rotor 6 and partly by the inner fixed shroud 18 of the ring of fixed guide blades 15 through which the products of combustion flow to the blades of the turbine. The pressure of the cooling air delivered into the space 24 by the action of the cooling fan therefore reduces the pressure drop through the clearance space between the shrouds 18 and 19 so that the leakage of hot gases through this clearance space is reduced. Further any hot gas leaking through this clearance is carried by the cooling air away from the rear main bearing 5.

It will be seen that the invention provides a simple arrangement for circulating cooling air under pressure through the turbine structure which does not have the disadvantages of the known arrangement for pressure circulation referred to above and does not require a complicated pipework installation which was found necessary with the known arrangement.

I claim:

1. In combination in an internal combustion turbine engine a main compressor rotor, a main compressor stator structure, a turbine rotor, a turbine stator structure, driving shaft connecting means between said main compressor rotor and said turbine rotor, combustion equipment receiving compressed air from said main compressor stator structure, and delivering products of combustion to said turbine stator structure, an intermediate annular casing structure interconnecting said main compressor stator structure with said turbine stator structure and surrounding said driving shaft connecting means, a turbine bearing for said turbine rotor supported within and by said intermediate casing structure, an auxiliary compressor rotor carried on said driving shaft connecting means, an auxiliary compressor stator structure within said intermediate casing, an inlet duct to said auxiliary compressor stator structure and discharge means therefrom, an exhaust outlet from said intermediate casing on the side of said bearing remote from said auxiliary compressor and communicating passages through the supporting structure of said bearing between the discharge

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means of said auxiliary compressor and said exhaust outlet.

2. The combination of a gas-turbine, a main rotary compressor coaxial therewith, a driving-shaft connecting said gas-turbine and said compressor, combustion equipment extending between said compressor and said turbine and arranged around said driving-shaft connection, an intermediate annular casing structure located axially between said gas-turbine and said compressor, a turbine bearing for said gas-turbine supported within and by said intermediate casing, an auxiliary rotary compressor located within said intermediate casing and driven by said driving-shaft and arranged to discharge air under pressure into said intermediate casing, an inlet duct for said auxiliary compressor, an exhaust outlet from said intermediate casing on the side of said bearing remote from said auxiliary compressor, and communicating passages through the supporting structure of said bearing between the discharge of said auxiliary compressor and said exhaust outlet.

3. A combination according to claim 2 further comprising a shaft-bearing for said driving-shaft connection located within and supported by said intermediate casing and located between said turbine-bearing and said auxiliary compressor and having communicating passages through the supporting structure of said shaft-bearing from the auxiliary compressor side thereof to the turbine-bearing side thereof.

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