

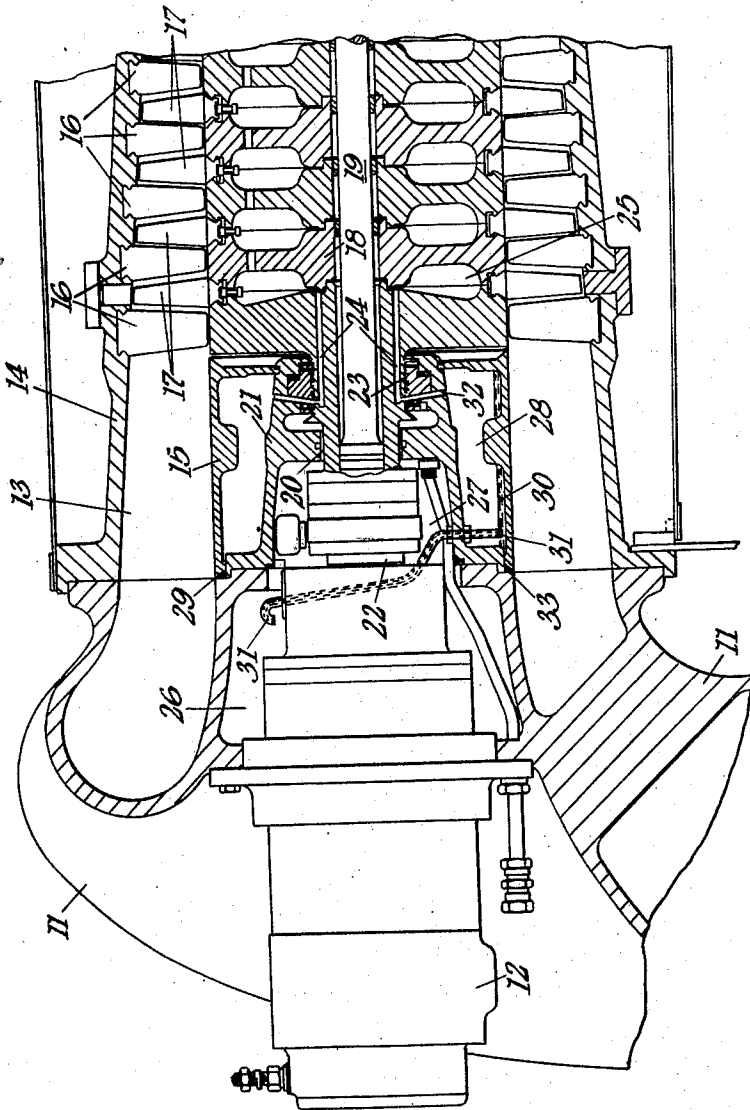
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TURBO-MACHINES

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TURBO-MACHINES

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1 Claim. (Cl. 230—207)

This invention relates to gas-turbo-machines, that is to say to machines, whether motors or compressors, in which a gaseous fluid passes through a system comprising at least one set of rotary blades; such passage of gas serving in the case of a motor to cause rotation of the rotary sets of blades, and resulting in the case of a compressor in a compression of the gas.

In gas-turbo-machines there is the risk, by reason of the differential pressures that may exist between various parts, of lubricating oil leaking into some part where its presence may be deleterious. Thus in the case of an axial flow compressor for a gas-turbo-engine, the blades of the compressor are defined with great exactitude in their profiles; and a film of oil on the blades, with the consequent adherence of dust thereto, can soon reduce the efficiency of the machine in a most severe manner. Again, dirt on the diffuser vanes of a centrifugal compressor is almost as objectionable as dirt on the blades of an axial compressor.

It is thus one of the objects of this invention to prevent the passage of leakage lubricating oil to parts where its presence is undesirable.

The following description relates to the accompanying drawing which shows, by way of example only, an embodiment of the invention. This drawing is a vertical diametrical section through an axial-flow compressor of a kind which can be set up in known manner to feed air into a combustion chamber whence in turn hot gases are fed into a turbo-motor the complete assembly, of compressor, combustion chamber, and turbo-motor, constituting the main components of a gas-turbo-engine.

In the drawing a compressor inlet casing 11 is shaped around a starting motor 12 so that air drawn in is delivered through an annulus of substantially uniform radial dimension to a smooth and slightly tapering inlet channel 13 also of annular formation defined between the outer wall 14 of the compressor and an inner fairing 15. The outer wall 14 below (i. e. downstream of) the inlet channel 13 carries sets of inwardly directed circumferentially arranged stator blades 16. Intercalated with the sets of stator blades 16 are sets of rotary blades 17 all mounted upon a composite rotor 18 which in turn is fixed upon a rotor shaft 19. The rotor shaft 19 has a bearing 20 among others, at its upper (i. e. upstream) end, where it is journaled in a white metal bearing in a bearing housing 21. A dog clutch 22 on the upper end of the rotor shaft 19 is engageable by the starting motor 12.

On the downward side of the bearing 20 is a labyrinth seal 23, to which air is fed through a passage 24 in the rotor body 18 from a space 25 beneath the first set of rotor blades.

For an appreciation of the present invention it is necessary to consider the air pressures that obtain during normal running in various parts of the system as so far described.

Atmospheric pressure will prevail at the upper or front end of the inlet casing 11, in the space 26 around

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the inner end of the starting motor 12, in the space 27 around the upper end of the rotor shaft 19, and in the space 28 between the bearing housing 21 and the fairing 15. A pressure somewhat below atmospheric will exist at the lower or rear end of the inlet channel 13. A pressure greater than atmospheric will obtain in the space 25 beneath the first set of rotor blades.

In consequence of the pressure differences that will thus exist, there is a tendency for air to flow, in particular, from the space 28 to the inlet channel 13. Such air flow may occur at the junction 29 between the inlet casing 11 and the fairing 15, and again at the junction, in a horizontal axial plane, between the lower and upper parts of the fairing 15, this fairing 15 being constructed, in a known manner which is not evident from the drawing, in two parts, upper and lower (i. e. physically so), in order that with a similar construction of the bearing housing 21 access may be had to the rotor and the rotor removed as a unit in the upward direction without having to dismantle the machine in an axial direction.

Now there is a tendency for lubricating oil to be thrown off the rotor bearing 20 into the space 28 and to collect in a pool 30 at the (physical) bottom of the space 28. Such lubricating oil is likely to be caught up in the outflowing air and be delivered into the inlet channel 13, whence it passes into the compressor and is deposited upon the blades 16 and 17. Such deposition can be very harmful; the profiles of the blades, especially the rotor blades 17, are worked out with a high degree of precision, in order to enhance the efficiency of the machine, and the presence of a film of oil upon the blades, with the consequent adherence of dust thereto, can soon reduce the efficiency of the machine in a most severe manner. It is thus one of the objects of the present invention to avoid passage of lubricating oil in this way into the air stream.

To this end provision is made for maintaining a pressure within the space 28 slightly above atmospheric, and for discharging air and oil from that space to a location where such oil will be harmless.

A pipe 31 leads from the space 28 to the space 26 around the starting motor 12. The pipe 31 has its orifice lying close against the bottom of space 28, where the pool 30 collects, and extends up through the bearing housing 21 to a point high up in the space 26, thereby forming what may be described as a stand-pipe.

At the same time a passage 32 is made from the labyrinth seal 23 through the bearing housing 21 to the space 28, so that air can flow into the space 28 from the passages 24 which carry air at above atmospheric pressure from the space 25.

Again, a rubber sealing ring 33 is fitted at the junction between casing 11 and fairing 15. This serves to prevent leakage when the machine is not running.

It will be understood that the invention may take other forms than that shown. Thus the air at super-atmospheric pressure, instead of coming to space 28 from the space 25, may be brought by an external pipe from the belt of the compressor.

It will thus be appreciated that by the use of this invention it is possible to avoid or reduce the leakage of lubricating oil from a space where such oil may be present to the air inlet channel leading to the turbo-machine blading; and that this is accomplished by providing a stand pipe leading to a space into which oil can be discharged harmlessly, the first space being maintained at a pressure slightly above that of the second space.

By a stand pipe is meant a pipe of sufficiently small bore which rises from a space at higher pressure to a space at lower pressure so that oil collected in the first

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space and entrained in the air passing from the first to the second space either passes out into the said second space by reason of the sufficient differential pressure, or remains in the pipe and thus constitutes a seal against a back-flow of air from the second space to the first.

What I claim is:

In an axial flow compressor having a rotor carrying compressor blades which rotor is supported at one end in an oil-lubricated bearing surrounded by an annular air inlet, and in which there is a tendency for leakage oil from said bearing to enter said air inlet, an arrangement for preventing such leakage oil from reaching said air inlet comprising means forming a closed annular chamber surrounding said bearing for receiving said leakage oil, means providing an air passage from a space within the bladed section of said rotor operating at super-atmospheric pressure to said annular chamber to maintain said annular chamber at a pressure above atmosphere, and a stand-pipe having a predetermined length and extending substantially upwardly from a position within the chamber below the bearing into a space in front of said bearing which is maintained at substantial-

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ly atmospheric pressure, whereby leakage oil accumulating in said annular chamber is forced out of said chamber by super-atmospheric pressure developed in the bladed section of said rotor and a column of oil thus formed in said pipe constitutes a seal between the chamber and said space at substantially atmospheric pressure to maintain a predetermined air pressure in the said chamber.

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