

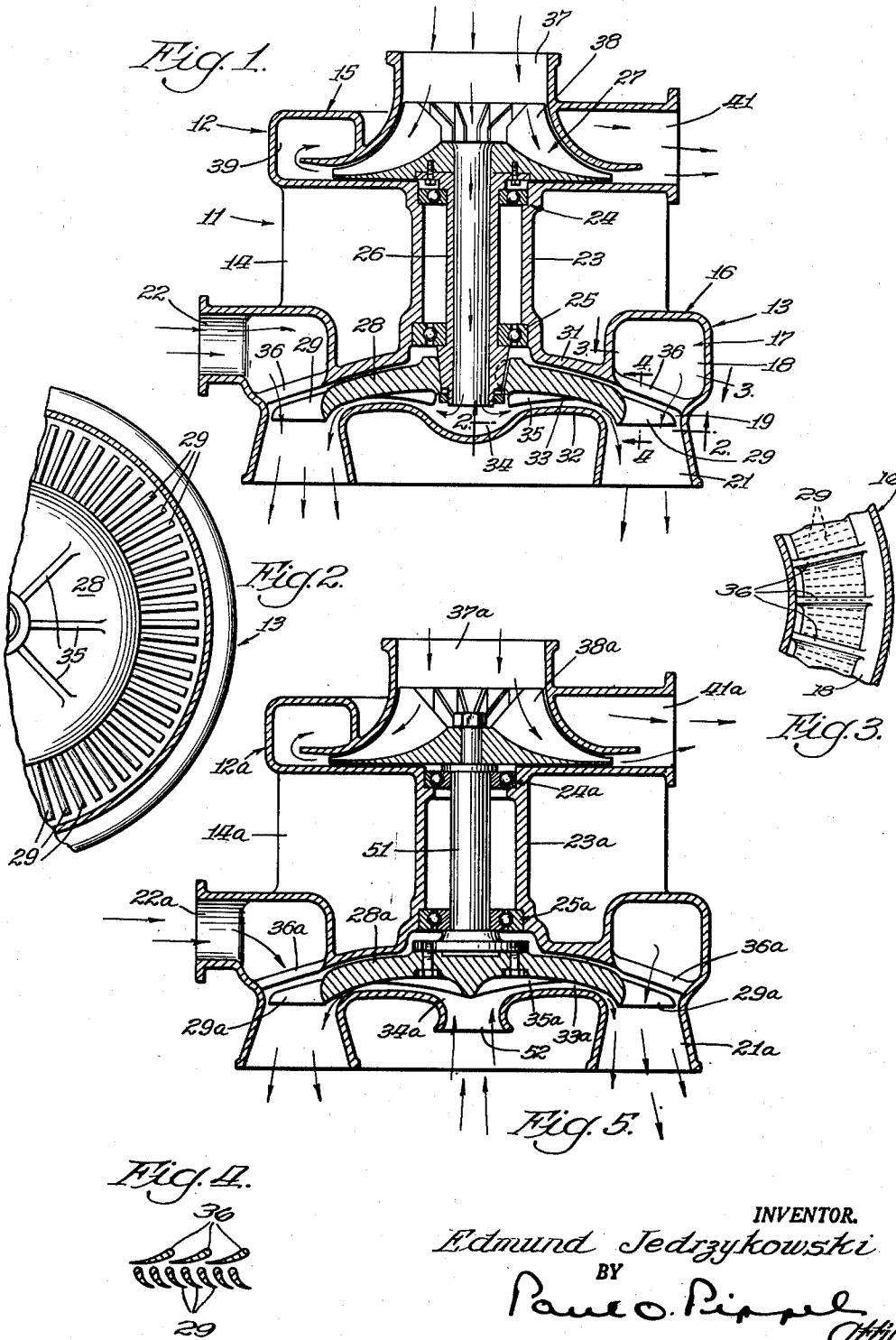
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GAS TURBINE

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GAS TURBINE

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This invention relates to gas turbines and more particularly concerns structure for directing a cooling gas against the turbine rotor or wheel thereof.

An object of the invention is the provision of a gas turbine in which the casing has a central section for the reception of cooling gas, together with a space through which the gas is directed radially of and against the surface of the turbine wheel for cooling the same during operation.

A further object is the provision of a gas turbine according to the preceding object and wherein the cooling gas is discharged from said space into the low pressure or discharge section of the hot gas passage to cool the gas and thereby diminish its volume and pressure.

A further object is the provision of a gas turbine incorporating the features of the preceding objects and incorporated with a blower into a turbocharger unit wherein a tubular shaft connects the blower rotor and the gas turbine wheel and serves as a conduit through which the cooling gas flows from the blower into the central section of the gas turbine casing.

These and other desirable objects of more specific character inherent in and encompassed by the invention will be more readily apparent from the ensuing description and the annexed drawings, wherein:

Fig. 1 is a sectional view taken centrally and axially through a turbocharger which embodies a preferred form of the invention.

Fig. 2 is a fragmentary transverse sectional view taken on the line 2-2 of Fig. 1, showing an end view of the turbine rotor.

Figs. 3 and 4 are fragmentary views taken respectively on the lines 3-3 and 4-4 of Fig. 1.

Fig. 5 is a sectional view taken similarly to Fig. 1 through a modified form of the invention.

With continued reference to the drawings, a turbocharger device 11 shown in Fig. 1 embodies a preferred form of the invention. This device is generally of the type used upon internal combustion engines and comprises a blower unit 12 driven from a turbine unit 13.

A common frame 14 connects a casing 15 of the blower unit with a casing 16 of the gas turbine unit. Casing 16 includes an annular hot gas passage 17. Passage 17 has an annular high pressure section 18, an adjacent annular turbine blade accommodating section 19, and an annular low pressure section 21. Hot gas from the exhaust manifold of an internal combustion engine (not shown) is introduced into the high pressure passage section 18 through an inlet 22 and then

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flows from the passage section 18 successively through the passage sections 19 and 21.

A tubular portion 23 of the frame 14 contains axially spaced bearing units 24 and 25 which rotatively support a tubular blower drive shaft 26. A gas inlet end of the tubular shaft 26 has a vaned rotor 27 of the blower unit constrained for rotation therewith. The opposite or gas outlet end of the shaft 26 has a gas turbine wheel 28 constrained for rotation therewith. A row of circumferentially spaced turbine blades or buckets 29 upon the perimeter of the turbine wheel 28 traverse the turbine blade accommodating section 19 of the hot gas passage 17.

The body of the turbine wheel is disposed between opposite end walls 31 and 32 of the turbine casing 16. A space 33 is provided between opposed sides of the end wall 32 and of the turbine wheel, this space being communicative between a cooling gas receiving zone or section 34 at a central part of the turbine casing and the low pressure section 21 of the hot gas passage 17. Radiating vanes 35 upon the end face of the turbine wheel opposite to the casing end wall 32 expedite the flow of cooling air from the central section 34 radially outwardly through the space 33.

In the operation of the turbocharger, hot gas from the exhaust manifold of an internal combustion engine enters the turbine passage section 18 through the inlet 22. This gas flows from the annular passage section 18 past circumferentially spaced stationary blades 36 and thence past the turbine wheel blades 29 for rotating the turbine wheel. The hot gas is expanded into the low pressure passage section 21 after passing the turbine wheel blades 29 and thereafter is exhausted into the atmosphere.

The rotating turbine wheel rotates the tubular shaft 26 and consequently the vaned blower rotor 27, whereby air is drawn into the blower casing 15 through an axial opening 37 past the rotor blades 38 and into an annular chamber 39 of the casing 15 from which it is discharged through an opening 41. Conduit means (not shown) communicates between the discharge opening 41 and an intake manifold of the engine. Part of the air or cooling gas flowing axially into the blower inlet opening 37 rams axially into the tubular drive shaft 26, through which it reaches the central zone 34 of the gas turbine casing from where it is conducted radially outwardly through the space 33. The cool gas in the space 33 conducts heat from the turbine wheel. This cooling gas, elevated slightly in temperature from heat received from the turbine wheel, is discharged into the low pressure section 21 of the hot gas passage

where additional heat is absorbed from the hot gas discharged into the passage section 21 from the turbine blade accommodating section 19. This absorption of heat from the hot gas diminishes its volume and pressure thereby diminishing the back pressure in the low pressure passage section 21 and thereby increasing the efficiency of the gas turbine.

The second embodiment shown in Figure 5 differs principally from the first embodiment in the respect of using a solid blower drive shaft 51 instead of the tubular drive shaft 26. Cooling gas or air, in the second embodiment, is introduced into the central chamber 34^a, which corresponds to the chamber 34 in Figure 1, through an inlet opening 52 in the turbine casing end wall 33^a. For the most part the various elements of the second embodiment are identical with or correspond to respective parts of the first embodiment and are therefore designated by the same reference characters plus the letter "a." The operation of the second embodiment is identical with that of the first embodiment excepting for the means of introducing the cooling air or gas into the central chamber section 34^a.

Having thus described a limited number of embodiments of the invention with the view of clearly and concisely illustrating the same, I claim.

1. In a turbocharger unit, a blower comprising a rotor and a tubular drive shaft for said rotor, said drive shaft having an air intake end communicating axially through said rotor, the opposite end of said shaft being open and constituting an air outlet, a gas turbine comprising a casing including end walls and an axially directed passage disposed radially outwardly with respect to said end walls, said passage having a high pressure section, a low pressure section and a turbine blade accommodating section between said high and low pressure sections, a turbine wheel disposed within said casing, the opposite end of said drive shaft being disposed within said casing and having a driving connection with said turbine wheel, said turbine wheel having a circumferential row of blades which traverse said intermediate passage section during rotation of said wheel, one of said casing end walls being in opposed spaced relation with respect to an end of said turbine wheel to provide a radially extending space communicating with said low pressure passage section, and said opposite end of the tubular drive shaft projecting axially through the turbine wheel to place the air outlet thereof in communication with said space.

2. In a turbocharger unit, a blower comprising a casing having an end wall containing an air inlet passage entering axially into such casing, a radially discharging rotor in said casing in axial registry with the inlet passage to receive air therefrom for radial discharge, and an open-ended tubular drive shaft for and coaxially of the rotor, said drive shaft extending axially from the rotor oppositely from said air inlet passage but having an air inlet end extending through the rotor in axial registry with said inlet passage for receiving a portion of the air caused to be precipitated into the casing by the rotating rotor; a gas turbine comprising a cas-

ing including end walls arranged coaxially with said shaft, said casing also including an annular axially directed passage circumscribing said end walls, said annular passage having axially spaced high pressure and low pressure sections and a turbine blade accommodating section between said high pressure and low pressure sections, the opposite open end of said tubular drive shaft projecting into the turbine casing coaxially through one of its end walls, a turbine wheel drivingly mounted on the drive shaft in the turbine casing and having a circumferential row of blades which sweep about the turbine blade accommodating passage section during rotation of such wheel, the other turbine casing wall being in opposed spaced relation with respect to an end of the turbine wheel to cooperate therewith in providing a radially extending space directly communicating with said low pressure passage, and said other end of the tubular shaft projecting through the turbine wheel into direct communication with said radially extending space.

3. In a turbocharger unit, a frame containing axially spaced coaxial bearings, a tubular shaft journaled in said bearings and open at each of its ends which project respectively outward from said bearings, a blower disposed upon one end of said frame and comprising a casing having opposite end walls of which one contains an opening receiving one open end of the tubular drive shaft and of which end walls the other contains an air inlet passage in communicative axial registration with the tubular drive shaft, a radially discharging rotor in said casing and mounted coaxially upon said drive shaft for rotation thereby; a gas turbine comprising a casing disposed at the opposite end of said frame and including opposite end walls through one of which the opposite open end of the tubular drive shaft projects, said turbine casing also including an annular axially directed passage circumscribing said end walls, said annular passage having axially spaced high pressure and low pressure sections and a turbine blade accommodating section between said high pressure and low pressure sections, a turbine wheel drivingly mounted on the drive shaft in the turbine casing and having a circumferential row of blades which sweep about the turbine blade accommodating passage section during rotation of said wheel, the other turbine casing wall being in opposed spaced relation with respect to an end of the turbine wheel to cooperate therewith in providing a radially extending space directly communicative with said low pressure passage, and said other open end of the tubular shaft extending through the turbine wheel and being directly communicative with said radially extending space.

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