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2,407,164

INTERNAL-COMBUSTION TURBINE

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FIG. 1

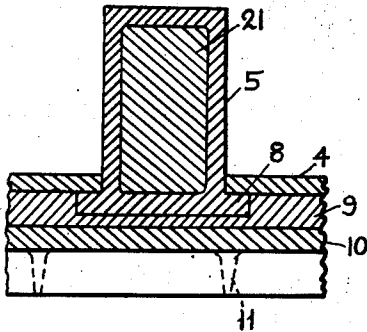


FIG. 2

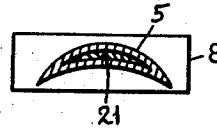


FIG. 3

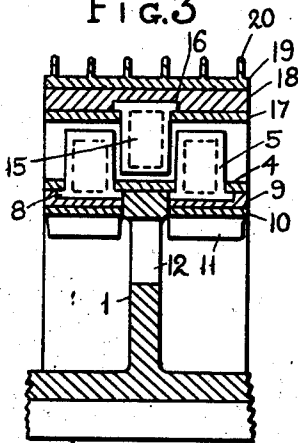


FIG. 4

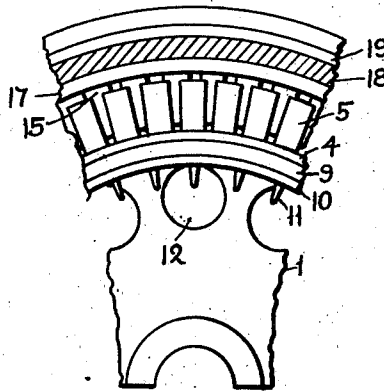
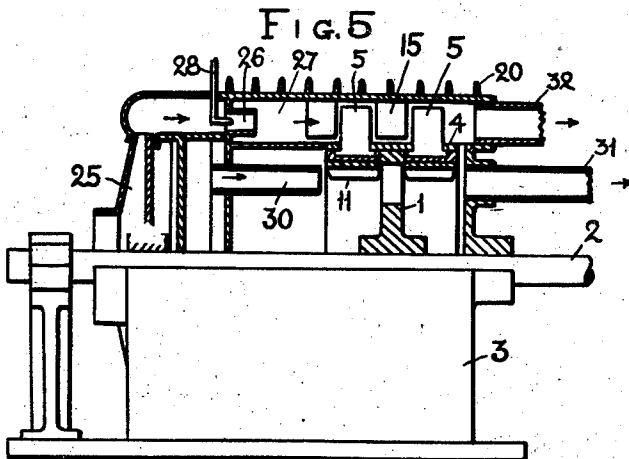


FIG. 5



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INTERNAL-COMBUSTION TURBINE

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4 Claims. (Cl. 60-41)

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My invention relates to internal combustion turbines and has particular reference to the construction of the turbine wheel and, more particularly, to the blades and the rim of the turbine wheel.

Internal combustion turbines, while having considerable advantages over steam turbines in eliminating the necessity for operating boilers with the accompanying heat losses, possess at the same time a disadvantage in that the blades, as constructed by ordinary methods, cannot stand the relatively high temperatures required for the efficient operation of such turbines. As a result, it has been found necessary to mix the hot burning gases with a cooling medium, such as steam, etc., whereby the overall efficiency of the turbine and its power output were considerably reduced.

My invention has for its main object to provide means for rapidly removing heat from the blades to the supporting rim whereby hot products of combustion can be directed on the blades with considerably reduced amount of cooling air. As one of the practical means for accomplishing this purpose, I provide my blades with cavities filled with a suitable heat conducting material such as metallic sodium, certain salts, etc. Heat is thereby rapidly conducted from the tips of the blades to their bases where it is absorbed by the relatively large bulk of the supporting rim. The rapid rate of heat conduction thereby accomplished, results in the lowering of temperature at the base of the blades where the stresses are the highest. The drop of temperature, therefore, takes place along the blade in an approximately direct proportion with the increase in tensile stresses so that the blades, as I have found, can be safely operated with gases having temperature of 1500° F. or over.

Another object of my invention is to provide means to dissipate the heat conducted to the rim of the turbine wheel from the blades. This is accomplished in one form of my invention by the provision of a liner inside the rim, made of a material having high thermal conductivity, such as aluminum or its alloy. As further means for dissipating the heat, I provide vanes on the inside of the cooling liner through which a draft of air or other cooling medium may be directed.

My invention is more fully described in the accompanying specification and drawing in which:

Fig. 1 is a sectional elevational view of my blade;

Fig. 2 is a transverse sectional view of the blade;

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Fig. 3 is a fractional elevational view of a turbine with my blades;

Fig. 4 is a fractional end view of the same;

Fig. 5 is an elevational view partly in section of a turbine employing my blades.

My internal combustion turbine as shown by way of an example in Fig. 5 consists of a rotor 1 mounted on a shaft 2 in a housing or stator 3. The rotor has a cylindrical rim 4, shown more in detail in Figs. 3 and 4, and provided with openings for blades 5. The rim is preferably made of a strong, non-oxidizable material such as stainless steel, etc. The blades have enlarged inner ends 8 engaging the inner side of the rim 4 for retaining the blades in their positions against the action of the centrifugal force.

The blades are preferably made of steel or alloy having high tensile strength at elevated temperatures, such as tungsten-cobalt alloy steels, etc.

The blades are further retained in their positions by an inner shell 9 having corresponding recesses for the inner ends 8 of the blades. The shell 9, of which two are shown in Figs. 3 and 5, is tightly fitted in its position and is preferably made of a strong metal having relatively high thermal conductivity, such as aluminum bronze alloy. The shell 9 is finished smooth on the inside for a third shell 10 preferably made of an aluminum alloy or a similar metal having high thermal conductivity. The inner shell 10 may be provided with cooling fins 11. The rotor 1 may be provided with openings 12 for circulating air along the fins 11.

Stationary blades 15, Fig. 3, may be similarly constructed, with enlarged rear ends 16 held in openings in a stationary outer shell 17. The enlarged portions 16 are similarly held by an intermediate shell 18 made of a strong alloy having relatively high thermal conductivity, with an outer shell 19 made of a metal or alloy with a high thermal conductivity. Fins 20 may be provided on the outside for cooling the shells.

The blades 5 are hollow inside, having cavities closed on all sides and filled with a material having high coefficient of thermal conductivity, preferably metallic sodium or a suitable melted salt.

The stationary blades 15 may be similarly provided with cavities, filled with sodium or similar heat conducting material. It should be noted, however, that this arrangement is of relatively less importance for stationary blades in view of the fact that they are not subjected to high tensile stresses due to centrifugal force.

The blades may be arranged for the use in

connection with a suitable internal combustion engine of an impulse or reaction type. A reaction turbine is shown by way of an example in Fig. 5, having two rows of rotor blades 5 and two rows of stationary blades 15. The rotor shaft 2 carries a blower 25 for delivering compressed air to nozzles 26 extending into a combustion chamber 27. Fuel, liquid or gaseous, is conducted by a pipe 28 to the nozzles. The combustible mixture is ignited in the combustion chamber by any suitable means (not shown), either by electric sparks, or by hot bulbs, etc. The products of combustion are directed through the first row of the stationary blades 15 to the first row of the rotor blades, and through the second row of the stationary blades to the second row of the rotor blades, being exhausted by a pipe 32. It is understood, of course, that any suitable number of such rows may be employed to obtain a more complete expansion of the hot gases and utilization of their heat.

A certain amount of the compressed air from the blower is directed by ducts 30 toward the inner side of the rotor rim against the cooling fins 11. The heated air is exhausted by a pipe 31 and may be directed to the intake of the blower if desired for effecting further economy of the operation.

It will be understood that various features and principles of each of the embodiments of the invention above described or referred to may be utilized or substituted in the other embodiments.

While the invention has been described in detail with respect to certain particular preferred examples, it will be understood by those skilled in the art after understanding the invention, that various changes and further modifications may be made without departing from the spirit and scope of the invention, and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. A turbine wheel comprising a rim; means to rotatively support the rim; a plurality of blades supported radially on the periphery of the rim;

a liner on the inner surface of the rim made of a material having relatively high coefficient of heat conductivity; and a plurality of cooling fins at the inner side of the liner.

2. A turbine wheel comprising a rim; means to rotatively support the rim, the rim having a plurality of radial openings; blades fitted in the openings extending radially from the rim; enlarged bases on the blades engaging the inner surface of the rim at the openings; an intermediate liner fitted in the rim engaging the blade bases, the liner being made of a material having relatively high tensile strength and a higher coefficient of thermal conductivity than the material of the rim; and an inner liner fitted inside the intermediate liner made of a material having relatively high coefficient of heat conductivity.

3. A turbine wheel comprising a rim; means to rotatively support the rim, the rim having a plurality of radial openings; blades fitted in the openings extending radially from the rim; enlarged bases on the blades engaging the inner surface of the rim at the openings; an intermediate liner fitted in the rim engaging the blade bases, the liner being made of a material having relatively high tensile strength and a higher coefficient of thermal conductivity than the material of the rim; an inner liner fitted inside the intermediate liner made of a material having relatively high coefficient of heat conductivity; and a plurality of cooling fins at the inner surface of the inner liner.

4. A turbine wheel comprising a rim; means to rotatively support the rim, the rim having a plurality of radial openings; blades fitted in the openings extending radially from the rim; enlarged bases on the blades engaging the inner surface of the rim at the openings; portions of the rim at the bases of the blades being made of a metal having relatively high tensile strength and relatively low heat conductivity; an inner liner fitted inside the rim and made of a metal having relatively high coefficient of heat conductivity; and longitudinal vanes extending inwards from the liner.

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