A radial turbine blade system comprised of airfoils forming a circular array on a disk or series of disks around a central opening which serves as the exhaust outlet. Single or multiple sections comprised of a circular array of airfoils on a disk are arranged along the central axis. Nozzles direct high velocity mass flow fluids between the disks and onto the leading edges the airfoils. Three forces are used to convert the high velocity mass flow to mechanical output. First, is the shock effect of high velocity particles striking the leading surface of the airfoils. Second, is the lift force vector produced by the fluid flow over the airfoils. Third, is the fluid motive force of the high velocity mass flow contacting the inner walls of the disks. The invention can utilize various types of fluid forces such as gasses produced from the combustion of fuel or steam.
RADIAL TURBINE BLADE SYSTEM

FIG. 1
RADIAL TURBINE BLADE SYSTEM

FIG. 2
RADIAL TURBINE BLADE SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Provisional application No. 60/303,844, Jul. 9, 2001.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH AND DEVELOPMENT

[0002] “Not Applicable”

REFERENCE TO SEQUENCE LISTING, A TABLE, OR A COMPUTER PROGRAM LISTING COMPACT DISK APPENDIX

[0003] “Not Applicable”

BACKGROUND OF THE INVENTION

[0004] The field of the invention pertains to the blade systems of turbine engines which transfer the energy from the mass flow of high velocity fluids to a rotating mechanical device for the purpose of performing useful work.

[0005] Many existing turbine engines, such as those employed in vehicular and aircraft power plants and stationary applications such as power generation, exhibit inefficiencies and disadvantages due to a lack of ruggedness caused by relatively small and delicate blade construction, a requirement for high operating pressures; thereby necessitating secondary steam processes when utilizing certain combusted fuel sources (i.e. solid matter such as wood), high operating rpm which makes a reduction gear box a necessity for most shaft output applications, friction losses from fluid flow against static surfaces, efficiency losses from relative fluid flow vectors across the blades which move in a direction which does not vectorially contribute to the direction of the rotation of the axial turbine blades, blowby which allows fluid forces to transfer undesirably between mechanism components, an inability to operate at extreme high operating temperatures, and a high cost of production. This invention has the potential to eliminate or significantly improve upon all of the inefficiencies and disadvantages outlined above.

[0006] This invention utilizes a combination of the concepts of a smooth runner surface for working fluid frictional contact and that of blades projecting axially from plural transverse runner faces. This type of turbine blade system is a unique improvement upon the inventions of the Fluid Propulsion Apparatus, U.S. Pat. No. 1,061,142, and the Turbine, U.S. Pat. No. 1,061,206, both of which were invented by Mr. Nikola Tesla. Other patents (as exemplified in U.S. Pat. No. 4,655,679) have sought to improve upon these inventions by Mr. Tesla, but none have lived up to the potential of widely replacing both axial turbine and internal combustion engines which are used in the majority of internal combustion engine applications today. This invention seeks to revive the technology originally patented by Mr. Tesla and to provide a practical and economical alternative to the majority of modern engines.

BRIEF SUMMARY OF THE INVENTION

[0007] A radial turbine blade system which is comprised of airfoils which form a circular array on a disk around a central opening which serves as the exhaust outlet. The longest airfoils extend from the outer edge of the disk to the outer edge of the exhaust opening. Due to the physical necessity of incorporating enough opening area to allow for the exit of exhaust gasses, only a limited number of airfoils which extend from the outer edge of the disk to the outer edge of the exhaust outlet are utilized. Smaller airfoils are interspersed in the remaining gaps between the longer airfoils. The number of arrays and different distinct lengths of the interspersed airfoils situated on each disk will vary with the size of the disks. Multiple sections comprised of a circular array of airfoils on a single disk may be arranged side-by-side along the central axis (e.g. stacked) in order to increase the power output of a single system. In a system comprised of a single disk and airfoil array, as well as a system comprised of multiple disks and airfoil arrays, it should be noted that an additional disk is always required on the end to close, or complete, the system. In other words, there will always be one more disk than the number of airfoil arrays. The radial turbine blade system rotates about the central axis of the disks.

[0008] Nozzles are used to direct the high velocity mass flow of fluids between the disks and onto the leading edges of the airfoils which extend radially from the central exhaust opening. The widths of the airfoils and the disks are designed to be of minimum thickness, but must not be thinner than the outlet diameter of the mass flow nozzles. Design accommodations for a turbine engine application which utilizes this invention must be made to affix the radial turbine blade system to a rotating shaft for mechanical output while also allowing for the exit of exhaust gasses. One possible method is to make one of the outer disks without the central exhaust outlet for the purpose of attaching a rotating shaft and allowing the exhaust gasses to exit from the opposite end opposite of the shaft. There are three forces which are used to obtain the efficient conversion of high velocity mass flow to mechanical output in this invention. First, is the shock effect of the high velocity particles striking the leading surface of the airfoils; this may be simply explained as the paddle wheel effect. The second force is the lift force vector produced by the fluid flow over each individual airfoil. The third force is the fluid motive force of the high velocity mass flow contacting the inner walls of the disks. These forces all act in a way which contributes to the rotational output of the invention. The invention can utilize various types of fluid forces as the motive means such as the gasses produced from the combustion of a fuel source (liquid, solid, or gas), or steam. The invention incorporates a structural configuration which permits its construction of advanced composite materials, providing for operation at high temperatures, thus increasing overall efficiency. An engine produced with composite materials would also have a high power to weight ratio, thus further increasing efficiencies for locomotive applications. This type of radial turbine blade system can be incorporated into an engine which operates at relatively low pressures, which decreases or eliminates the requirement for the utilization of a secondary compressed air process in a liquid or gaseous fuel internal combustion engine. In an engine which uses solid fuels, such as biomass, an engine which incorporates this invention could operate without the requirement of a secondary steam process to produce the requisite mass flow to propel the turbine system. An engine which utilizes this invention would have very few moving
parts, thereby decreasing the manufacturing costs and making the engine low maintenance. Engines produced utilizing this invention would also require oil only for the shaft bearings. This would help to make the engine more environmentally friendly as well as decreasing operating costs.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0010] FIG. 1 is a cutaway of a side view of the radial turbine blade system.

[0011] FIG. 2 is a front view of the radial turbine blade system which utilizes an arrangement of nine (9) blades (although the number of blades is not fixed).

DETAILED DESCRIPTION OF THE INVENTION

[0012] Illustrated in FIG. 1 is a cutaway of a side view of the radial turbine blade system wherein the mass flow of high velocity fluids travel through a nozzle 3 and impinge upon the leading edges of the airfoils 1, 2 which are arranged in a circular array in between two or more disks 4. By means of traveling across the airfoils 1, 2 which are situated between two or more disks 4 the fluid motive forces are translated into mechanical energy by causing the turbine blade system to rotate about the axis located at the center of the disk 4. There are basically three forces which cause the efficient transfer of fluid motive force to mechanical rotational output which is used to perform useful work. First, is the shock effect of the high velocity particles striking the leading surface of the airfoils 1, 2; this may be simply explained as the paddle wheel effect. The second force is the lift force vector produced by the fluid flow over each individual airfoil 1, 2. The third force is the fluid motive force of the high velocity mass flow contacting the inner walls of the disks 4. The fluids exhaust through an inner opening 5. FIG. 2 illustrates a front view of a radial turbine blade system which utilizes 9 blade sections (the number of sections is not fixed). Multiple blade sections are used to tailor the power output of the turbine blade system to meet the requirements of a particular application. The widths of the airfoils 1, 2 and the disks 4 are designed to be of minimum thickness, but must not be thinner than the outlet diameter of the mass flow nozzle(s) 3. The invention can be incorporated into a turbine engine which produces shaft output by connecting a drive mechanism to one of the outermost disks 4, while still allowing for the exit of exhaust gases through the outlet 5. One possible method is to make one of the outer disks 4 without the central exhaust outlet 5 for the purpose of attaching a rotating shaft and allowing the exhaust gases to exit from the exhaust outlet 5 on the opposite end. Due to the physical necessity of incorporating enough opening area to allow exhaust gases to exit 5, only a limited number of airfoils which extend from the outer edge of the disk to the outer edge of the exhaust outlet area are utilized 1. Smaller airfoils are interspersed in the remaining gaps 2. The embodiment of the invention depicted in the illustrations shows a single row of larger airfoils 1 and a single row of smaller airfoils 2. For applications which require a larger size disk 4 the number of circular arrays and the sizes of smaller airfoils 2 can be increased in order to insure that fluid motive energy is not wasted due to large gaps between the airfoils 1, 2, thereby decreasing the system efficiency.

I claim:

1. A rotational radial turbine blade system for translating motive energy comprised of airfoils which form a circular array on a disk or series of disks around a central opening which serves as the exhaust outlet. The longest airfoils on each disk extend from the outer edge of the disk to the outer edge of the exhaust opening. Smaller airfoils are interspersed in the remaining gaps between the longer airfoils. The number of longer airfoils and length of the longer airfoils varies depending on the size of the disk(s). The number of smaller airfoils and the number of arrays of distinct lengths of smaller airfoils varies depending on the size of the disk and the application. Multiple sections may be arranged side-by-side along the central axis (e.g. stacked) in order to increase the power output of a single system. The radial turbine blade system rotates about the central axis of the disks. Nozzles are used to direct the high velocity mass flow of fluids between the disks and onto the leading edges of the airfoils which extend radially from the central exhaust opening. The airfoil array and disk system combined with at least one nozzle between each disk spacing, with the nozzle outlet positioned in line with each airfoil array, comprise this claim.

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