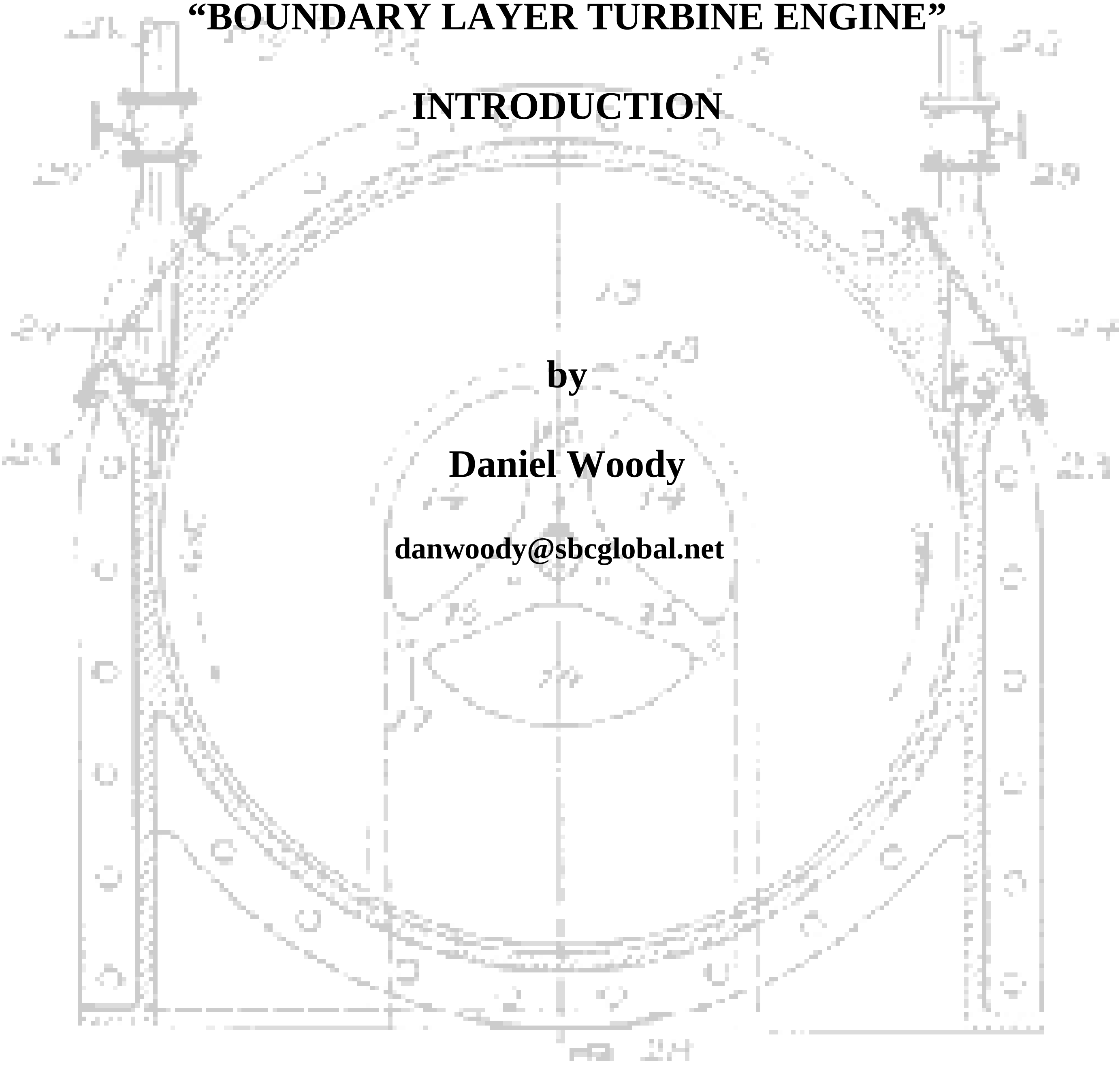
“BOUNDARY LAYER TURBINE ENGINE”

INTRODUCTION



by

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“Boundary Layer Turbine Engine”

It is said…
“If someone should discover a new mechanical principle -- something as fundamental as James Watt's discovery of the expansive power of steam -- by the use of which it became possible to build an engine that would give ten horse power for every pound of the engine's weight, a motor so simple that a novice in mechanics could construct it and so elemental that it could not possibly get out of repair. Then suppose that this motor could be run forward or backward at will, that it could be used as either an engine or a pump, that it cost almost nothing to build as compared with any other known form of engine, that it utilized a larger percentage of the available power than any existing machine, and, finally, that it would operate with combustion gas products, steam, compressed air or water, any one of them, as its driving power. It does not take a mechanical expert to imagine the limitless possibilities of such an engine. It takes very little effort to conjure up a picture of a new world of industry and transportation made possible by the invention of such a device.” – Dr. Nicola Tesla

Introduction

This view into the future allows one to discover the fascinating secret behind the most powerful and economic combustion engine of our time:

> “A whirl wind machine of natural harmony, the “Boundary Layer Turbine Engine” will be able to supply power for ground and air transportation, power generation, power tools or any application requiring the power potential of internal combustion.”

This smaller, lighter and more controllable power plant has an equivalent power output to, and is considerably less expensive than any of today’s reciprocating or gas turbine engines. Described in this document are the advantages and disadvantages of the “Boundary Layer Turbine Engine” technology. The “Boundary Layer Turbine Engine” can have up to 10 times the power to weight ratio of any existing engine that provides shaft power. The simplicity of its construction, along with the use of inexpensive materials inspires the critical observer of the promise of its compact design, manufacturability and maintainability. An efficient fuel conversion unit, its operational principal uses natural laminar flow to avoid energy absorbing eddy currents which are produced in reciprocating or vane rotor & stator arrangements (ex. the” Curtis Turbine”). Ultimately, this development evolution will produce various custom designed continuous burn turbines:

“Boundary Layer Turbine Engine” features:

- No complicated and bulky cooling system, which means the engine runs hotter and much more of the fuel energy is converted to mechanical shaft energy,
- No close fitting parts, eliminating the type of wear and friction inherent with the piston prime movers and power sources of today,
- A continuous combustion process provides a smooth quiet continuous power output and avoids the smoke and pollution of the ignition, burn and extinguish cycles of the reciprocating process,
- A simple construction with only one moving assembly, that offers the ultimate in reliability and maintainability,
- A wide range of fuel sources, making it independent of the high end fuel refining process,
- A small size, which will entice the designers dream of compact packaging,
- Upward or downward scalability of engine size and power output,
- Inherent reversibility of engine operation

This basic engine can be scaled up from fist sized producing @2-5 horsepower to one producing several thousand horsepower and, at the higher power rating, would still fit comfortably under the hood of an automobile. The "evolved" engine, the final goal of this development (proof of concept) effort, will represent the pinnacle of 150 years of continuous combustion engine development and combustion engine applications.

The basis of efficiency for this device is the gentle slope of the working fluids dragging across the disk faces. The higher energy working fluid component finds its own path around the disk which would be different (a longer path) than the lower energy component. This is an entirely different concept than any reciprocating engine which conducts the working fluid into confined chambers (cylinders) of completely different shape than the intake plenum and again different than the exhaust plenum.

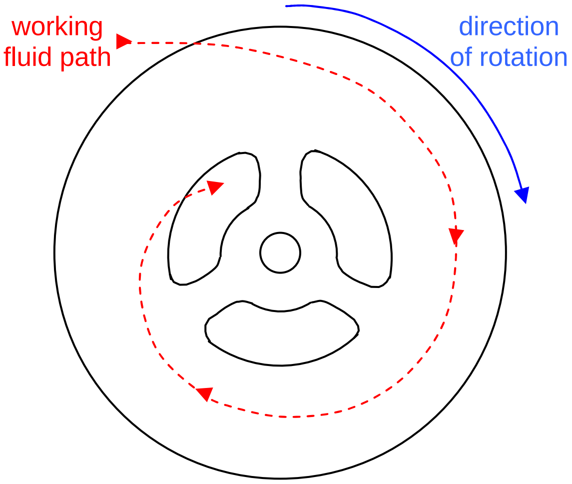
With reference to the conventional axial flow turbine engine, the presence of blades constrains the efficiency of this type of engine in two major areas:

1. The configuration of rotor and stator requires the path of the working fluid to make abrupt changes of direction each time a rotor or stator blade is encountered. These abrupt changes result in eddy and vortex currents which rob the engine of useful output power which, is instead used to create these vortices. The movement of the compressor and exhaust disks requires an air flow directed against these blades at a prescribed angle. The spinning of air in vortices defeats that purpose; in addition eddy currents convert the energy of laminar flow to heat which can be lost to entropy.
2. The placement of blades around the periphery of the disks restricts the working area of those disks to the area of the blades. The rest of the disk is structural and uninvolved in the process of compression or expansion and thus uninvolved in the production of output power.

For radial flow turbine engines, radial vanes located on the rotating disks conduct the working fluid into specified paths. Again the abrupt redirection of the working fluid against those vanes produces eddy currents resulting in loss of energy. The angle of those blades in turn limits the operation of those engines to a narrow spectrum of the most efficient possible operating speed range.

"Conventional pumps and engines pale in comparison."

The main characteristic of turbine engines over reciprocating engines are: 1.) the higher engine speeds, 2.) the higher engine power outputs, 3.) its simplicity of construction and, 4.) its reduced maintenance burden. Take these turbine advantages and couple to them higher fuel efficiency, reduced size and greater operating speed range and it becomes obvious how the "Boundary Layer Turbine Engine" can become the vehicle which will power the world into the 21st century and beyond. This jewel of mechanics has no equal! No other pump or engine can match the longevity, economy, size, safety, silent operation and vibration free Herculean power of this truly elegant machine.



"In the practical application of mechanical power based on the use of fluid as the vehicle of energy, it has been demonstrated that, in order to attain the highest economy, the changes in velocity and direction of movement of the fluid should be as gradual as possible." – Dr. Nicola Tesla

Operation

The “Boundary Layer Turbine Engine” operation is as a single rotating assembly housed in a pressure chassis. The operational part of this engine, the disks, are flat with three exhaust ports near the center and a hub at the center for mounting on the rotating shaft.

Currents of working fluid introduced at the disk periphery are directed inward in a spiraling motion toward the exhaust port. The “energy” delivered to the disk by the inward spiral of fluid, progressively reducing its radius of spin, is inversely proportional to the “torque” produced by the engine. Because the primary coupling effect is “drag” on the both sides of the disk, that effective torque times the high speed of the engine is proportional to the power output. The one-part construction of the disk naturally lends to potentially higher radial speed than its vane turbine counterpart. In addition, these disks can be made very thin to reduce the centrifugal and gyroscopic effects at high rotational speeds.

The immediate and obvious benefits of this design are smoothness and simplicity of operation. The only moving component of the engine which contacts any surface of the engine chassis are made through the bearing surfaces on which the shaft is mounted. In a piston driven reciprocating engine the average power output is equal to or less than the amount of power required to internally run the engine itself; these stem from the friction of pistons against cylinder walls, the energy required to open valves and drive gears at the operational speed of the engine. These losses represent an initial 75% or more decrease in efficiency. The “Boundary Layer Turbine Engine” has no pistons, valves or internal gears. Because of the absence of these energy consuming devices it also has no cooling system and no energy is wasted producing explosive noises and thunderous vibrating impulses that rock the vehicle and jar parts.

“This amazing engine will improve all aspects of our mechanical life. Today’s applications range from high mileage vehicles and supersonic aircraft to Freon (refrigerant) free air conditioning and virtually indestructible pumps.” – Dr. Nicola Tesla

Applications

Automotive both Commercial & Military

Rotary or Shaft Driven Aircraft

Marine

Power Generation

Personal (small) Power Generation

Power Tools

Centrifuge Pumps…

“Experience the excitement of understanding as the vortex energy, of a perfectly controlled mechanical tornado, shatters the boundaries of our current mechanical standards.”

Frequently Asked Questions

Are turbine capabilities available now using the well developed turbine technology pioneered by aircraft?

Yes, with today's turbine engines, high output power is available but only with the monolithic crystalline structured metals that allow blades or buckets running red hot at high RPM to do so without stretching. This type of blade construction constitutes the single most expensive component of this style of engine (the typical Axial Flow Turbine). Contemporary radial flow turbines have high output power but at the expense of fuel efficiency and depending on engine type, still require expensive specialized metal components. The premier construction and operation of the "Boundary Layer Turbine Engine" allows high speed and high temperature operation using relatively inexpensive materials. This design takes advantage of the natural laminar flow of fluids instead of forcing fluids into cylinders, buckets or between vanes which can cause huge amounts of entropic energy waste in the form of vortices and eddy currents at every un-natural twist.

What is the resilience of this technology to its environmental circumstances?

The "Boundary Layer Turbine Engine" is exceptionally immune to water and debris up to the size where the debris would clog the air intake mechanism. Otherwise this machine which is absent of flush or close fitting surfaces will not suffer the same wear or abrasion characteristics that a reciprocating, an axial flow (bladed) turbine or of a conventional radial flow turbine. The susceptibility of these other types of engines is due to either the contacting nature of its components or due to the direct impingement of the debris particles on the blades or vanes. The "Boundary Layer Turbine Engine" does require bearings that are sealed against external contaminants, are continually cooled and lubricated due its high speed operation which is the same requirement for any turbine.

How much competition will conventional engine technology represent?

The vast majority of prime movers are reciprocating engine types. Over 100 years of development has advanced the technology of these devices almost as far as they will go with the limits imposed by today's materials. As long as the working fluids must be taken into a cylinder, combusted and its cylinder motion reversed for the power stroke and again for the exhaust process, as long as pistons rub against cylinder walls, as long as there are 200 – 300 moving parts, as long as liquid or air cooling is required and as long as the combustion cycle requires massive metal walls to contain the huge power bursts typically peaking at 4 to 5 times the average calculated output of a piston driven engine then the piston driven reciprocating engines will be limited in power, efficiency, size and complexity resulting in a high manufacturing and maintainability expense. In addition the cycle of "ignition, burn & extinguish" is inherently a smoke and emission laden process as is evidenced by the lighting and extinguishing of a candle as compared to a continuous burn of that same candle. Each start-stop process produces a prodigious amount of smoke, noise and vibration (if produced by a large enough device) by-products.

The infrastructure of maintenance, spare parts and high grade fueling are industries that are well entrenched in our automotive culture. The people representing these interests can be expected to offer, to varying degrees, resistance to a change which would represent a possible reduction of their industry revenue. However with the support of government in the transportation and environmental sectors, there is tremendous opportunity now to gradually replace huge application areas of the reciprocating engine and to explore new internal combustion applications.

What efforts are currently under way to produce this technology?

Very little is presently being done with regard to the construction and/or development of this engine technology. This Engine waits patiently, ready to solve the efficiency and pollution problems of today and will literally usher in a new horizon of turbine engine operation and economy.

Various efforts to develop this turbine technology

- Turbine Associations
- Individual Efforts
- University Investigations

On the other hand a multi-million dollar, vibrant industry has grown around the sale of flat disk centrifugal pumps. These high flow pumps can pressurize and pass along debris containing material which more conventional displacement and centrifugal pumps cannot handle without damage.

What will it take to make this device a reality?

Project Plan
- Specification
- Schedule
- Capital
- Proof of Concept, Prototype, Application, Manufacturing

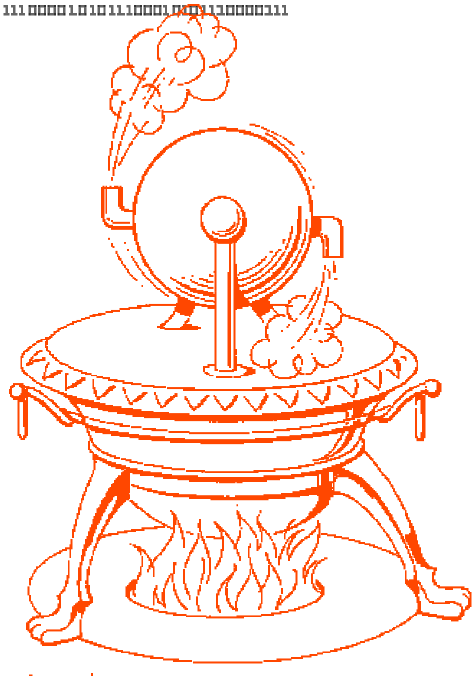
Facilities
- Office
- Lab
- Engine Room

Equipment
- Analysis
- Data Logging

Personnel
- Project
- Engineering
- Technician
- Consulting

Stock
- Material
- Engine Parts
- Tools
- Office Equipment

Proper funding is necessary to finance a facility to build an experimental turbine engine with proper analysis and support. Financial investment for development carries with it the risk of not accomplishing the intended goals. Government funding is available for energy production of the type that this engine would bring to market. In addition, this engine has run successful in an external combustion configuration circa 1910.

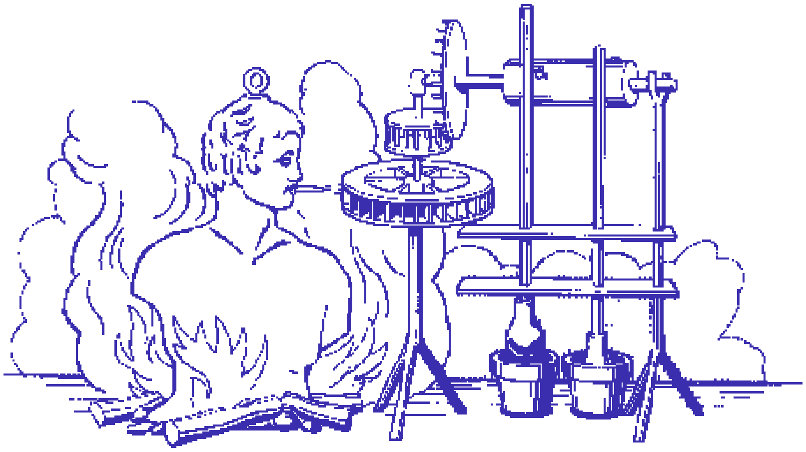


GAS-TURBINE HISTORY

The history of the gas turbine begins with a quest for jet propulsion.

The earliest example of jet propulsion can be traced as far back as **150 BC** to an Egyptian (or Greek) named **Heron**. Heron invented a toy that rotated on top of a boiling pot due to the reaction effect of hot air or steam exiting several nozzles arranged radially around a wheel. He called this invention an aeolipile.

Around **1500** A.D. **Leonardo da Vinci** drew a sketch of a device that rotated due to the effect of hot gasses flowing up a chimney. The device was intended to be used to rotate meat being roasted. In **1629** another Italian named **Giovanni Branca** actually developed a device that used jets of steam to rotate a turbine that in turn was used to operate machinery. This was the first practical application of a steam turbine.



Ferdinand Verbiest, a Jesuit in China, built a model carriage that used a steam jet for power in **1678**.

The first patent for a turbine engine was granted in **1791** to an Englishman named **John Barber**. It incorporated many of the same elements of a modern gas turbine but used a reciprocating compressor. There are many more early examples of turbine engines designed by various inventors, however, none were considered to be true gas turbines because they incorporated steam at some point in the process.

In **1872** a man by the name of **Stolze** designed the first true gas turbine. His engine incorporated a multistage turbine section and a multistage axial flow compressor. He tested working models in the early **1900's**.

Charles Curtis the inventor of the Curtis steam engine filed the first patent application in the U.S. for a gas turbine engine. His patent was granted in **1914** but not without some controversy.

The General Electric Company started their gas turbine division in **1903**. An engineer named **Stanford Moss** led most of the projects. His most outstanding development was the General Electric turbo-supercharger during World War 1. (Although credit for the concept is given to **Rateau** of France) It used hot exhaust gasses from a reciprocating engine to drive a turbine wheel that in turn drove a centrifugal compressor used for supercharging. The evolutionary process of turbo-supercharger design and construction made it possible to construct the first reliable gas turbine engines.

Sir Frank Whittle of Great Britain patented a design for a jet aircraft engine in **1930**. He first proposed using the gas turbine engine for propulsion in 1928 while a student at the Royal Air Force College in Cramwell, England. In 1941 an engine designed by Whittle was the first successful turbojet airplane flown in Great Britain.

Concurrently with Whittle's development efforts, **Hans von Ohain** and **Max Hahn**, two students at Gottingen in Germany developed and patented their own engine design in **1936** these ideas were adapted by The Ernst Heinkel Aircraft Company. The German Heinkel Aircraft Company is credited with the first flight of a gas turbine powered jet propelled aircraft on **August 27th 1939**. The HE178 was the first jet airplane to fly.

The Heinkel HeS-3b developed 1100 lbs. of thrust and flew over 400 mph, later came the ME262, a 500 mph fighter, more than 1600 of these were built by the end of WWII. These engines were more advanced than the British planes and had such features as blade cooling and a variable orifice exhaust nozzles.

In **1941** Frank Whittle began flight tests of a turbojet engine of his own design in England. Eventually The General Electric Company manufactured engines in the U.S. based on Whittle's design.