

## Chapter 8: Fuel-less Engines

We have been raised with the idea that it is necessary to burn a fuel to produce power which we can use. We are sold coal, coke, timber, paraffin/kerosene, petrol/gasoline, diesel, propane, etc. for us to burn in order to “get” energy. While it is perfectly true that burning these things will indeed result in energy in a form which we find convenient to use in heating, cooling, powering engines, etc. what is carefully avoided is the fact that it is not at all necessary to burn a fuel in order to run the things which we want to power. This ‘inconvenient’ fact has been concealed and denied for more than fifty years now (very surprisingly, by the people who want to sell us these fuels to burn – do you perhaps think that they may have some motive for this, other than our best interests about which they are no doubt, very concerned?).

This chapter is about ‘fuel-less’ motors. Strictly speaking, they are not self-powered but as they don’t burn a fuel of any kind, in everyday language they can be described as ‘self-powered’. In the same way that a solar panel in sunlight uses no fuel and yet puts out electrical power, these motors draw energy from the environment and provide us with mechanical power. In actual fact, power is never “used up” but just converted from one form into another. In the case of our trusty solar panel, some 17% of the radiation from the sun (mainly ultraviolet) is **converted** into electrical power and 83% goes in heating and other losses, but as we don’t have to supply the sunlight, and the solar panel pours out the electricity which we want without us having to do anything to make it happen, we really don’t care very much about its extremely low efficiency. As far as we are concerned, the electricity flowing from the panel is “free-energy”.

It is really amazing that we have been persuaded that we must burn a fuel in order to get power. Take the case of a heavy-displacement sailing yacht. The skipper can voyage using his inboard diesel engine:



This matches perfectly with the thinking that you need to burn a fuel in order to get power as the yacht is moving along, pushed by the engine which is powered by burning diesel fuel. But, what if the skipper decides to switch the engine off and set the sails?:



Now, the same boat, weighing exactly the same with the same crew, is now continuing the voyage at the same speed, but no fuel is being burnt. The really interesting thing is that while we know this perfectly well, and we are aware that people have sailed right around the world in boats which do not have engines, it does not seem to occur to us that this shows conclusively that it is not necessary to burn a fuel to power some item of equipment or form of transport.

In the case of our yacht, the energy comes from the sun which heats the atmosphere unevenly, causing winds to blow and the yachtsman uses the sails to make those winds power his boat through the water. So, a sailing boat is actually powered by the sun although we don't usually think about it that way.

There are many hydro-electric "power stations" where electricity is 'generated' by machines driven by water pressure. In actual fact, no power is 'generated' at all, but instead, the potential energy of the body of water is **converted** into electricity by having the water fall and spin the shaft of a machine. So, how did the water get up there in the first place? Well, it came from rain. And how did the rain get up there? It rose up there due to evaporation caused by the heat of the sun. So, the bottom line again is that hydro-electric 'power' stations are powered by the sun.

Windmills are also powered by the sun. But, and here is the really interesting thing, if I state that it is perfectly possible for a compressed-air engine to produce mechanical power with burning any fuel, then there is an immediate and strong reaction where people will say "Impossible – that is perpetual motion !!" They imply that perpetual motion is impossible but never supply any rational evidence to support that implication. The Earth has been spinning on its axis for millions of years, so when exactly do they expect it to stop? All the planets in the Solar System have been orbiting for millions of years, how long do they have to orbit before they can be considered to be in perpetual motion? Why then are people so opposed to the idea of perpetual motion? Presumably, because perpetual motion shows clearly that a fuel does not have to be burned to 'produce' power and that would not be good for people who sell fuels, and so, we are all told from an early age that perpetual motion is "impossible".

Well, that does not matter here as we are going to look at compressed-air engines which run off the heat of the sun. That is, they are heat-pumps which are a well accepted engineering fact and they work on wholly accepted standard scientific principles. An ordinary refrigerator outputs three or four times as much heat power as the electrical power driving it, and it could be twice that efficient if it were used properly. This is a Coefficient Of Performance (COP) of 3 or 4, which is supposed to be "impossible" but unfortunately, all refrigerators work like this and you can't exactly say that refrigerators don't exist, just because their performance does not appear to fit in with some theories.

Actually, there is no magic involved here as the extra energy is being drawn from the heat content of the air in the immediate locality. The refrigerator is not operating in isolation and there is a heat exchange with the air surrounding it. This outside energy causes the COP>1 performance. In passing, all COP>1 devices operate by drawing energy in from an external source (usually the zero-point energy field) and none of them actually break the 'rules' of science. But, enough of that.

The people who don't want self-powered engines used in the world today, pin their hopes on a continued ignorance of Engineering facts relating to heat pumps. A self-sustaining compressed-air engine is actually running off power from the sun just as sailboats, windmills and hydro-electric power stations do. Sorry folks, no magic here, just bog-standard Engineering. Admittedly, very few people know or realise the implications of this standard Engineering:

1. All work done in compressing air into a storage tank is converted into heat and then lost to the atmosphere, so the energy in the compressed air inside the tank is the same as that produced by atmospheric heating of that air, but as more of it is now in the tank, there is additional potential for work to be done. This extra energy was fed into the air by atmospheric heating before the air was compressed.

The First Law of Thermodynamics states that where heat is converted into mechanical energy, or mechanical energy is converted into heat, the quantity of heat is exactly equivalent to the amount of mechanical energy. We then have the intriguing situation where all of the mechanical energy put into compressing air into a storage tank is lost as heat, and yet, the tank contents now has a higher potential for doing work. This information comes from Engineering textbooks.

2. If the expanded cold air leaving the engine is used to cool the intake air of the compressor, then there will be an added gain when it warms up inside the cylinder, pulling heat in from the local environment.

3. If the heat of compression is transferred to the air container feeding the engine and not given time to dissipate, then there is a further power gain for the engine.

4. If compressed air is allowed to expand rapidly, there is a marked drop in temperature. The Leroy Rogers engine design, shown later in this chapter, uses this fact to create air-conditioning for a car driven by a compressed-air engine.

OK then, in broad outline, the energy available from a tank of compressed air comes directly from the heat contained in the atmosphere, in spite of the fact that we always imagine that the energy in the tank was put there by our energetic pumping.

Let's check this out by taking a look at some of the engines which use these principle to provide fuel-less operation, starting with the design of Bob Neal specified in his (slightly re-worded) patent:

**US Patent 2,030,759**

**11<sup>th</sup> Feb. 1936**

**Inventor: Bob Neal**

### **COMPRESSOR UNIT**

This invention relates to the construction of a compressor, and more particularly to a combined fluid-operated engine and compressor.

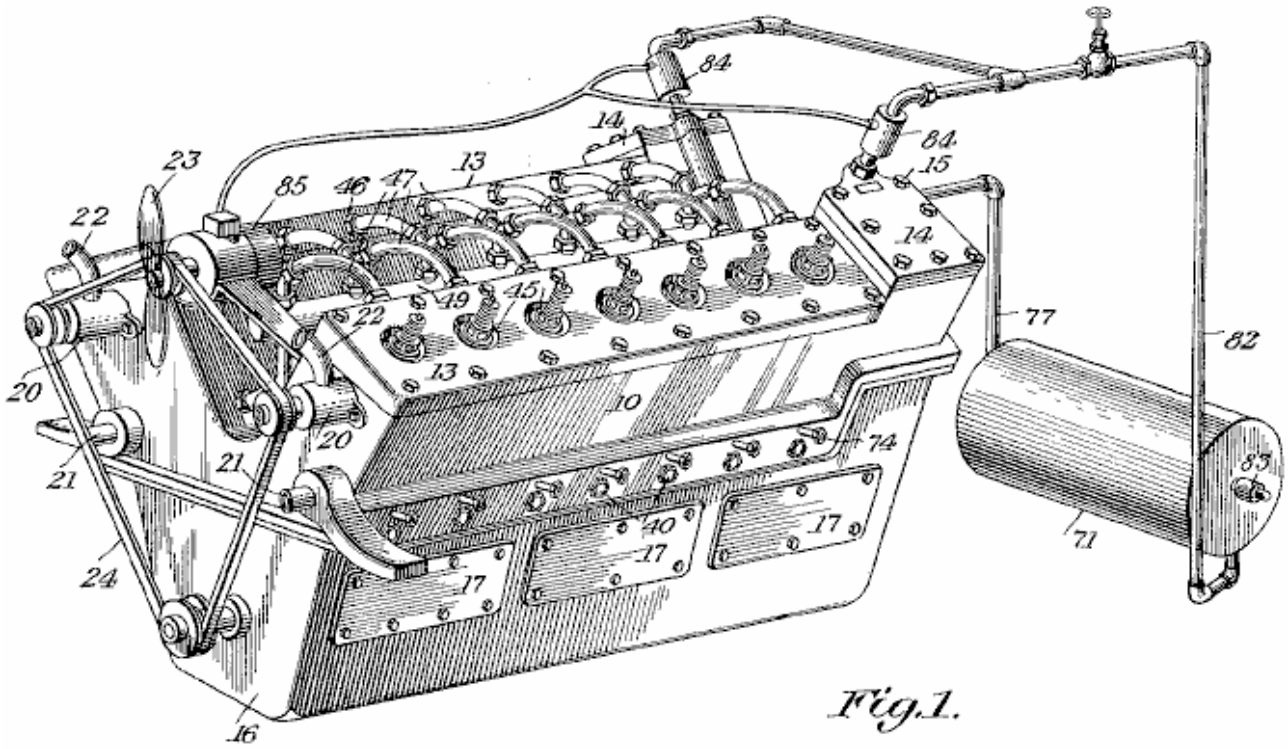
The primary object of the invention, is the provision of a compressor of this character, wherein there is arranged an automatically counterbalanced crankshaft and fluid equalisers within a storage tank, which makes it possible for the engine to operate on constant reserve tank pressure, so as to actuate additional equipment, the pistons for the engine also being automatically balanced and suspended when the engine is operating.

Another object of the invention is the provision of an engine which is operated by air under pressure, the air being supplied by compressors which are in a bank with the engine construction.

A further object of this invention is the provision of an engine of this type of novel construction as the engine and the compressors are operated from the same crankshaft, which is of the automatically balanced type, so that high efficiency is attained.

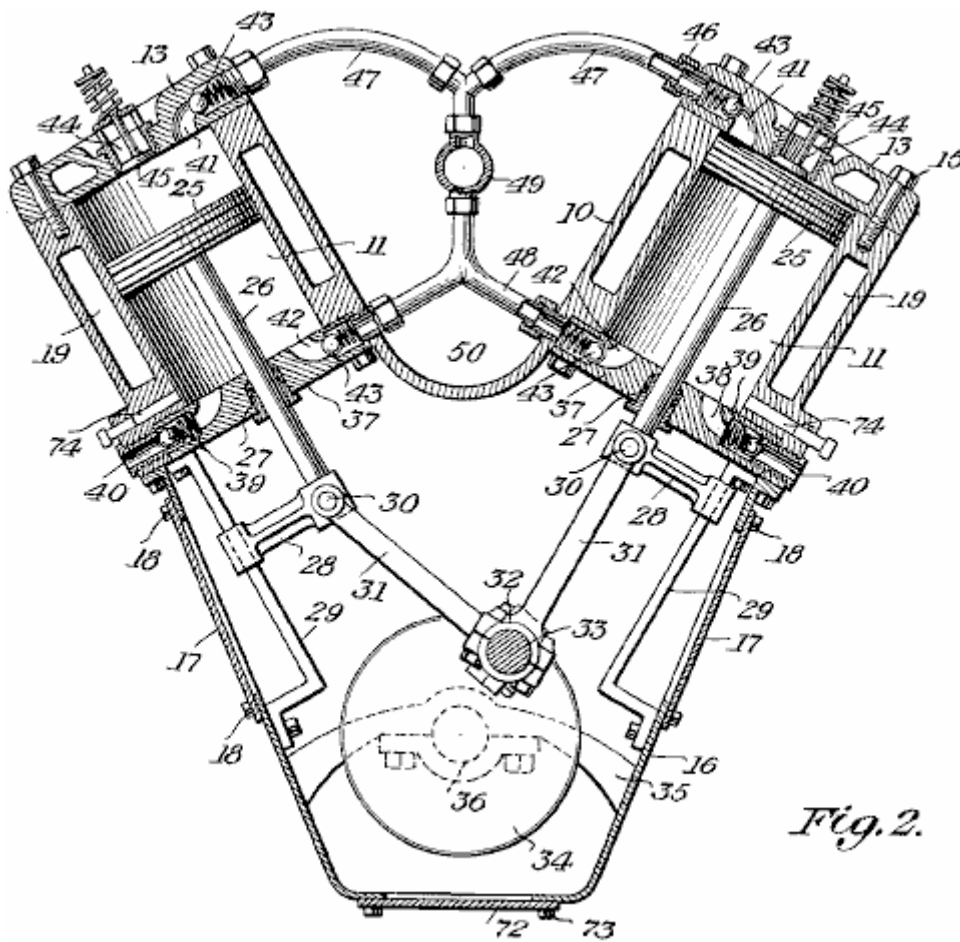
A still further object of the invention is the provision of an engine of this character which is comparatively simple in construction, thoroughly reliable and efficient in its operation, strong, durable, and inexpensive to manufacture.

With these and other objects in view, the invention consists in the features of construction, combination and arrangement of parts as will be described more fully here, illustrated in the accompanying drawings which disclose the preferred embodiment of the invention, and pointed out in the appended Claim.



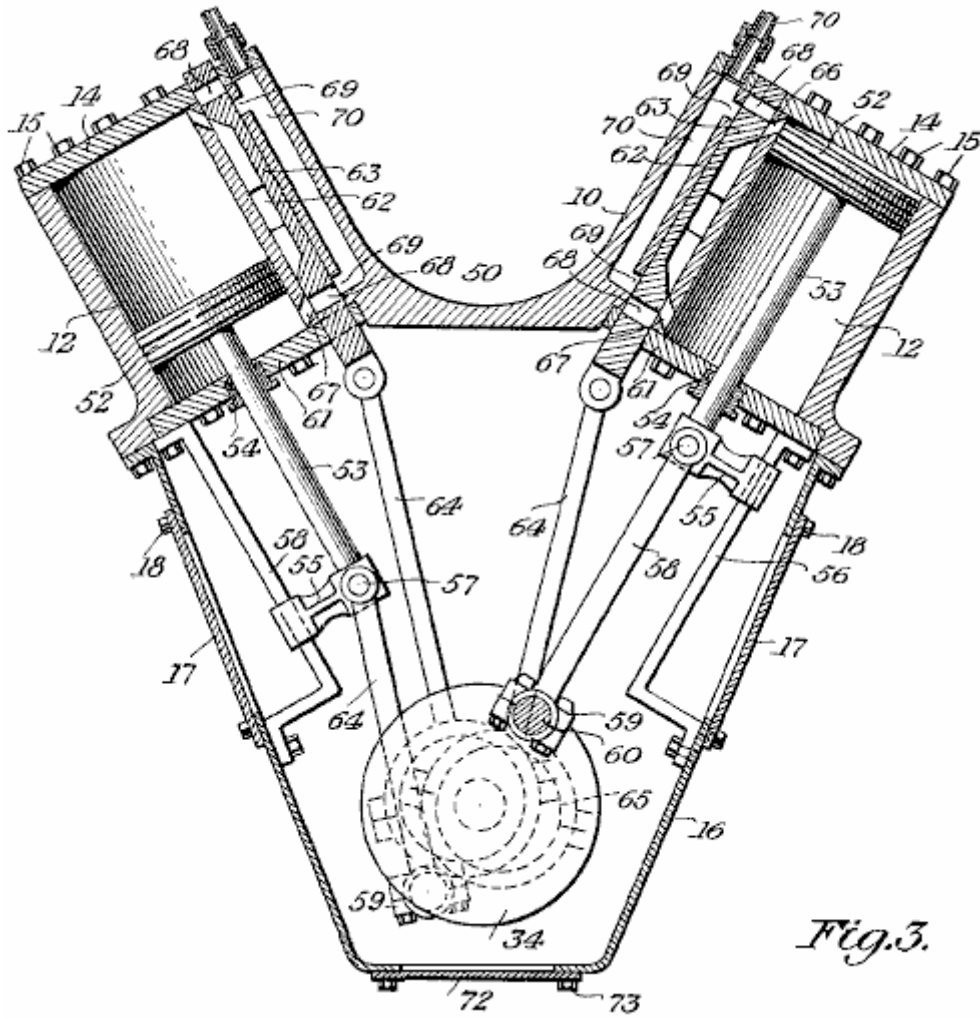
*Fig. 1.*

In the drawings, **Fig. 1** is a perspective view of the engine constructed in accordance with the invention.



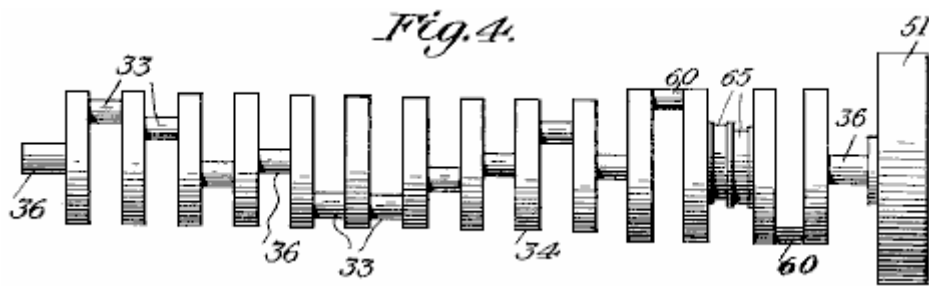
*Fig. 2.*

Fig.2 is a vertical transverse cross-section view through the compressor part of the engine.



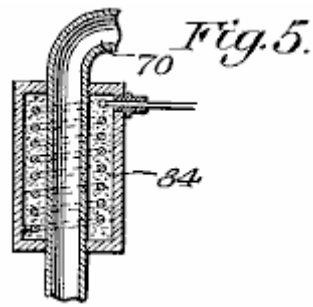
*Fig.3.*

Fig.3 is a vertical cross-sectional view through the power part of the engine.

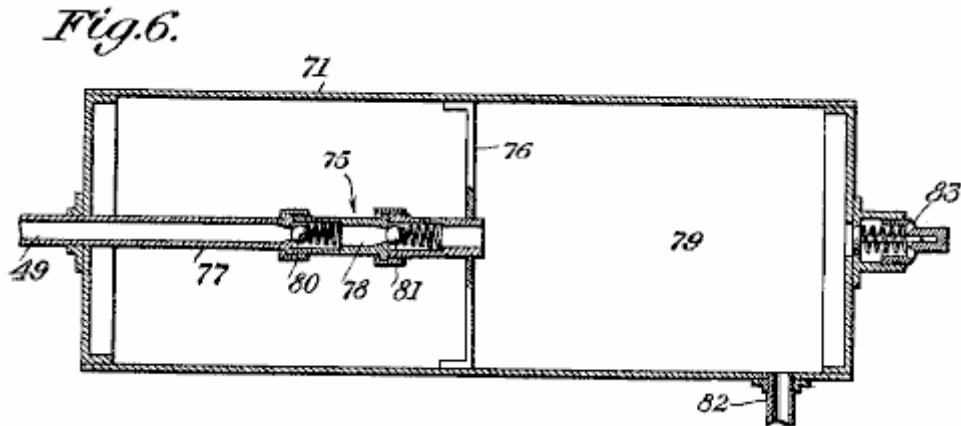


*Fig.4.*

Fig.4 is a detail elevation of the crankshaft of the engine.

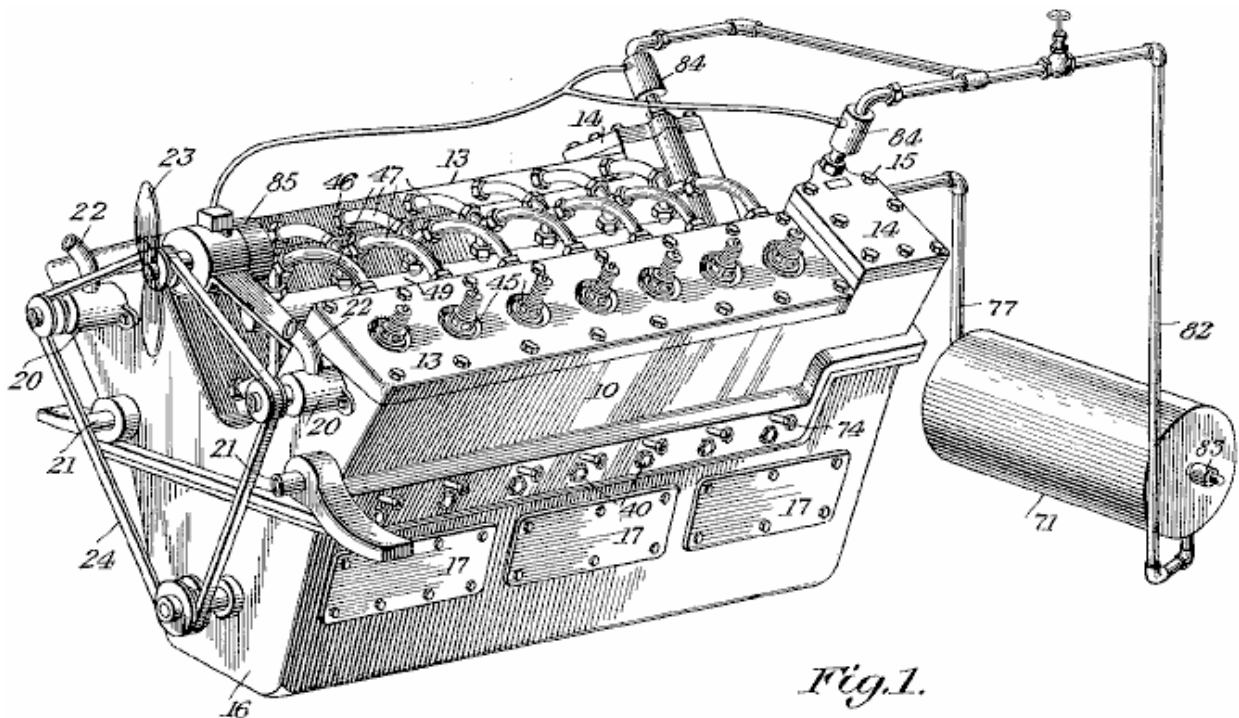


**Fig. 5** is an enlarged cross-sectional view through one of the electric heaters for the engine.



**Fig. 6** is a vertical, longitudinal, cross-sectional view through the air storage tank, including the equaliser.

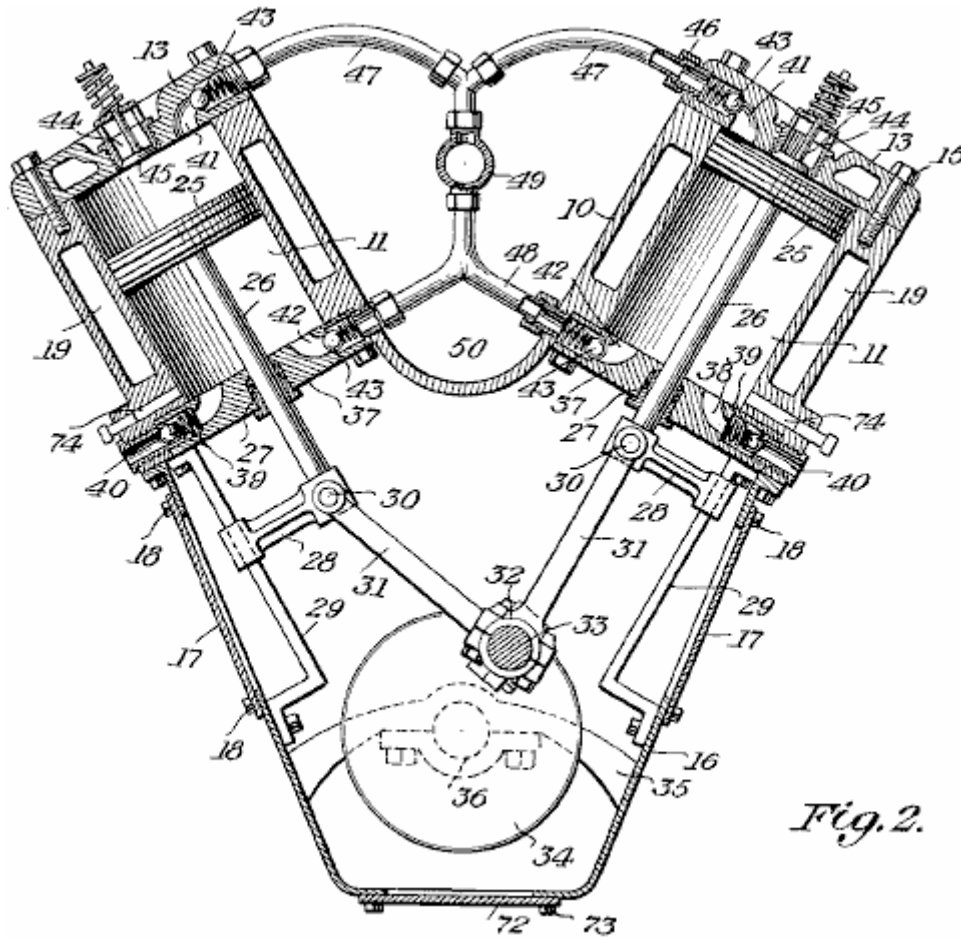
The same reference numbers are used for each individual part in every view in every drawing.



Referring to the drawings in detail, the engine in its entirety, composes a cylinder block **10** having inside it, the series of compressor cylinders **11** and the power cylinders **12**. The block **10** is of the V-type and the upper ends of the cylinders are closed off by the removable heads **13** and **14** which are held in place by

conventional head bolts 15. Beneath block 10 is the crank case 16, which has detachable plates 17 at opposite sides, held in place by fasteners 18, and seated so as to be leak proof. The block 10 is chambered to provide a water jacket 19 surrounding the cylinders, while at the forward end of the block are water pumps 20, circulating water through the inlet pipe 21 which leads into the jacket and the water exits from the jacket through the outlet pipe 22. Beside the pumps 20, is a fan 23 which is operated from the same belt 24 which drives the pumps.

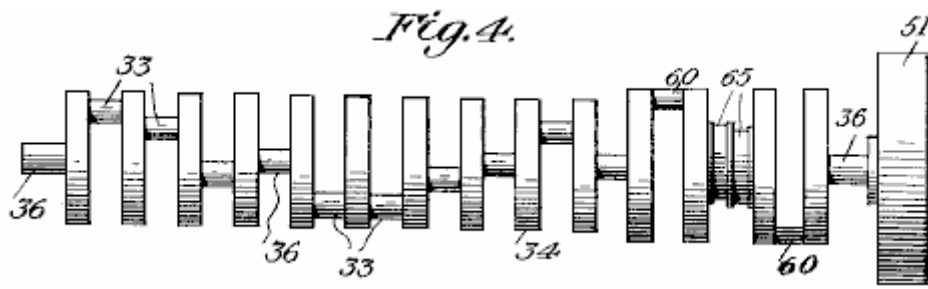
Working inside the cylinders 11, are the reciprocating pistons 25, their rods 26 sliding through packing glands 27 and fixed to crossheads 28 which slide on their mounting guides 29 which are secured to the walls of the crank case 16. These crossheads 28 are fitted with wrist pins 30, forming a pivoting connection with the connecting rods 31, which are connected to their cranks 33 by their bearings 32. The cranks 33 form part of a counter balanced crankshaft 34, which is mounted in supports 35 attached to the crank case 16, the shaft being provided with the required bearings 36.



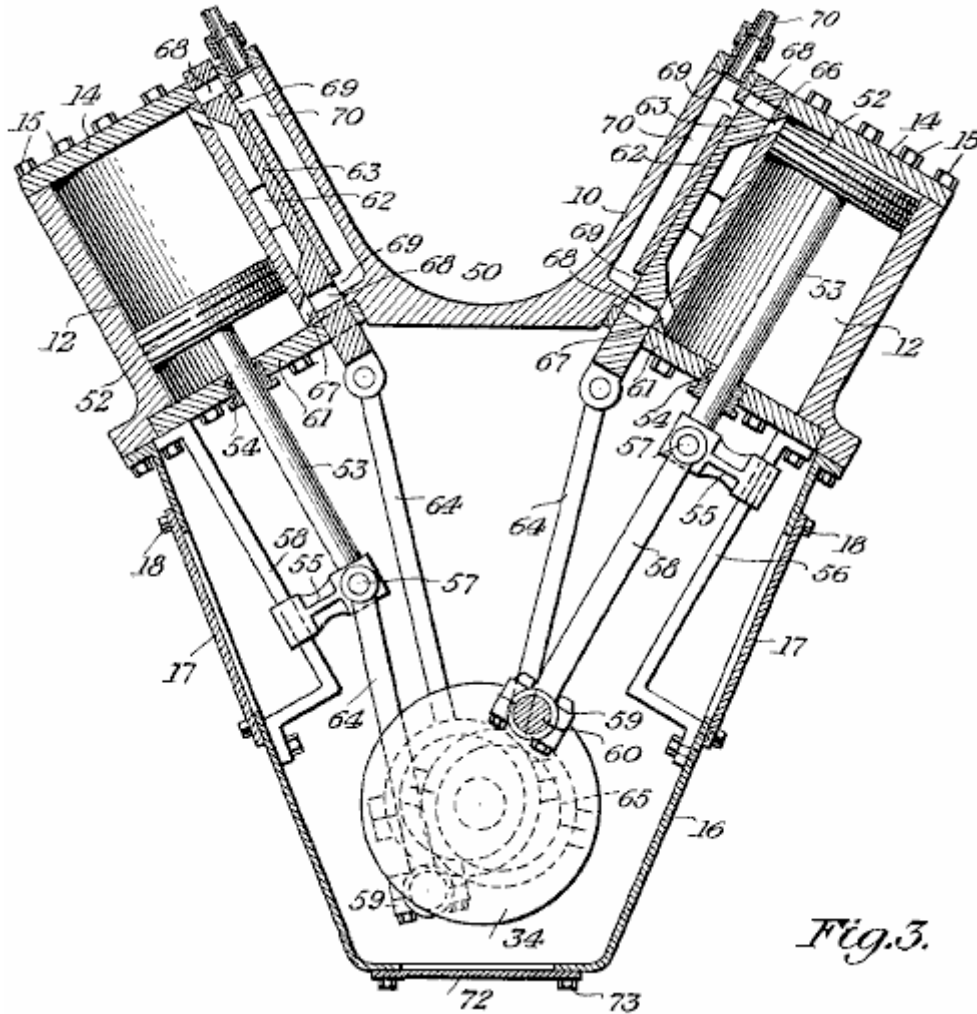
*Fig. 2.*

The inner ends of the cylinders 11 are fitted with inner end heads 37, which are provided with air intake ports 38 fitted with spring ball inlet checks 39, the air entering through passages 40 which open outside the block 10. Glands 27 are mounted in the heads 37.

The heads 13 and 37 are provided with the compressed air outlets 41 and 42, which are fitted with spring ball checks 43. The heads 13 are also provided with the central air inlets 44, which are fitted with spring checks 45. Couplings 46 attach the air outlets 41 and 42 to their outlet feed pipes 47 and 48. These pipes lead to a main conduit 49 which is located in the centre channel 50 of the block 10.



At the rear end of the block 10, mounted on shaft 36, there is a conventional flywheel 51.

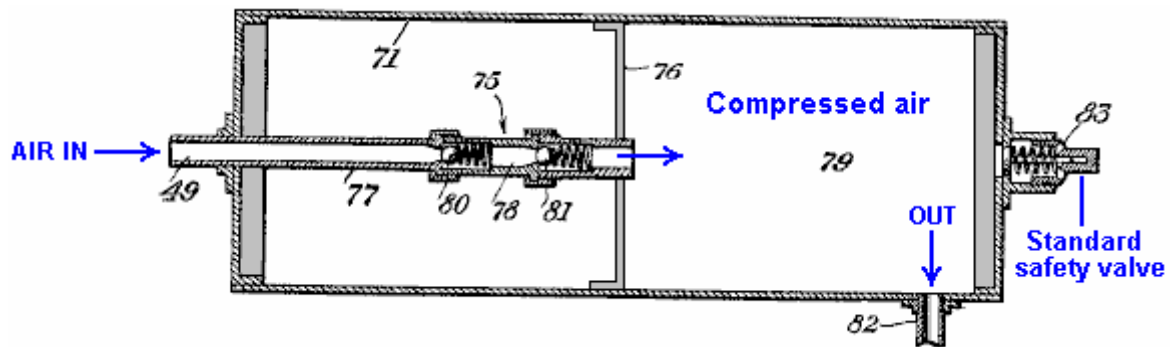


Working inside the cylinders 12 are the pistons 52, with their piston rods 53 sliding through packing glands 54 and fixed in crossheads 55 which slide along their mounting guides 56, mounted on the inner walls of the crank case 16. The crossheads 55 have wrist pins 57 which provide a pivoting joint for the connecting rods 58 which are connected by their bearings 59 to their cranks 60 of the crank shaft 34, the inner ends of the cylinders 12 being closed by the inner heads 61 and their associated glands 54.

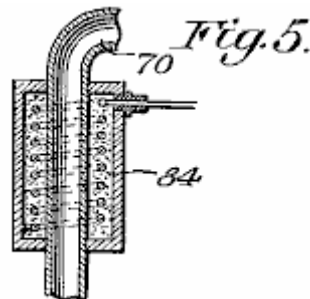
On the cylinders 12 are slide valve chests 62 in which are the slide valves 63, these being operated by throw rods 64 actuated by cams 65 and the valves controlling the admission and exhaust of air into and out of the cylinders 12, through the ports 66 and 67, and these valves 63 are provided with ports 68 for the delivery of air under pressure from the inlet passages 69 common to a pipe 70 coming from a compressed air storage tank 71.

The bottom of the crank case 16 is fitted with a removable plate 72 which is secured in place by fasteners 73, and when this plate is removed, it provides access to the crank shaft 34 and the bearings for the engine, as well as other parts inside the crank case.





Leading into the cylinders 11 are the passages 74 of a lubricating system (not shown). The compressed air storage tank 71 has inside it a double-check discharge nozzle 75, supported by member 76. Leading to this equaliser is an air inlet pipe 77 which connects through its valved section 78 to the compressed air reservoir 79. In the equaliser 75, are the spaced spring ball checks 80 and 81, one being for the inlet side and the other for the outlet side of the equaliser. This pipe 77 is connected with the main conduit 49, while a pipe 82 connects to pipe 70. The tank is also fitted with an automatic relief valve 83 and this valve can be of any approved type.



Placed around the pipes 70 which connect to the air passages 69 (Fig.3) are electric heating units 84 to heat the pressurised air to above freezing temperature when delivered from tank 71 to the cylinders 12. Supported on the block 10 is an electric generator 85 which is driven from the shaft 34 (Fig.2) through a belt 24 (Fig.1) and this generator is included in an electric circuit which also has the heaters 84 so that these will operate from current supplied by the generator.

The compressed air storage tank 71 with the equaliser is constructed so that it is possible to pump air into it while it contains an air pressure of 200 pounds per square inch while the compressors are only pumping against 15 pounds per square inch of (atmospheric) pressure. An outside air pressure source can be coupled with the tank to augment that pressure derived from the cylinders 11 of the engine.

## CLAIMS

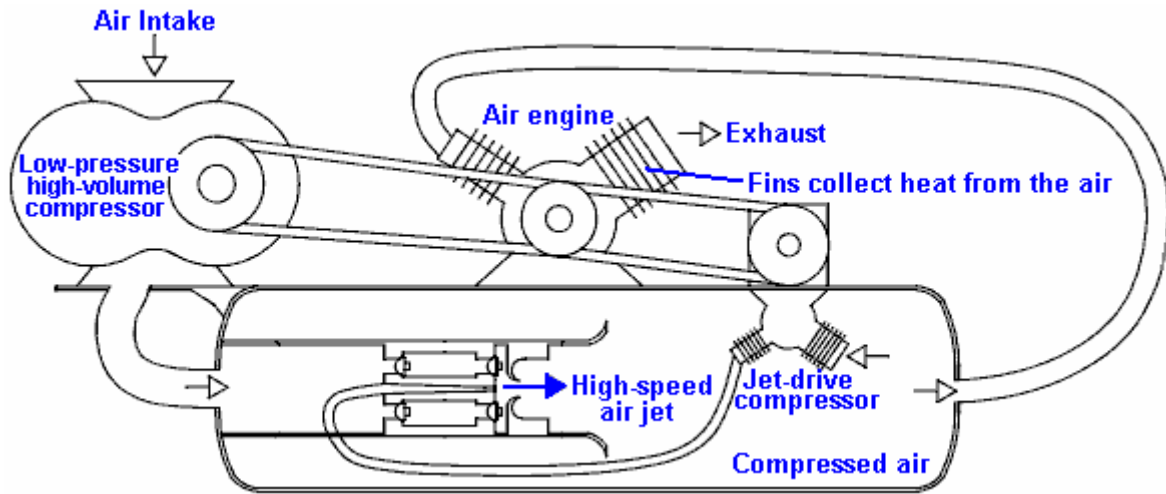
What is claimed is:

In a structure of the kind described, a V-shaped cylinder block provided with upwardly divergent cylinders, end heads fitted to said cylinders at opposite ends thereof, each head having valved inlets and outlets, a main outlet lead between the cylinders of the block for a storage tank and having lateral branches to the outlets at the inner sides of said heads, one inlet being located at the centre of each head at the outer ends of said cylinders while the remaining inlets are at the outer sides of the heads at the inner ends of said cylinders, a substantially V-shaped crank case fitted to the block beneath the cylinders, a counterbalanced crank shaft journaled in the crank case, pistons operating in the cylinders and having rods extended into the crank case, crosshead guides fitted to the interior sides of said case, crossheads connecting the rods with the guides and sliding on them and connecting rods operated by the crank shaft and pivoted at the crossheads in order to allow reciprocation of the pistons.

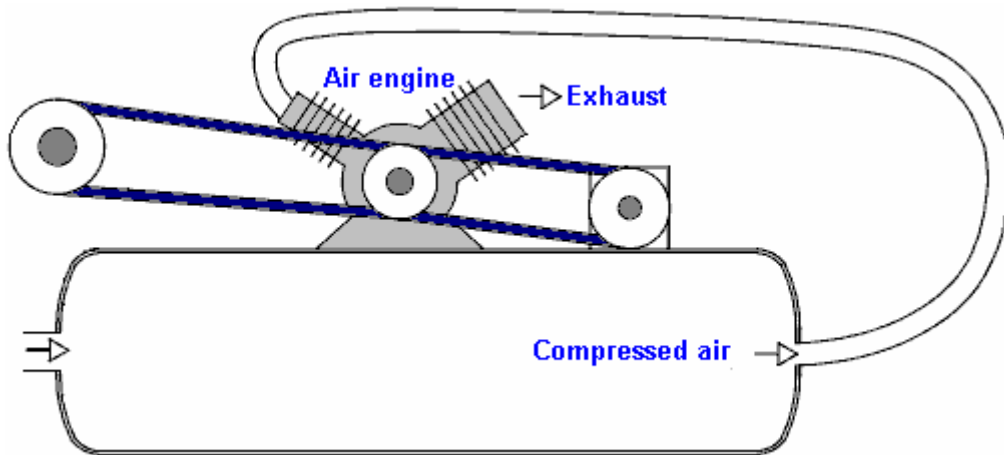
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You will notice that Bob has avoided any direct mention of the fact that his engine design is fuel-less. That sort of statement is not popular with Patent Examiners even if it is perfectly true.

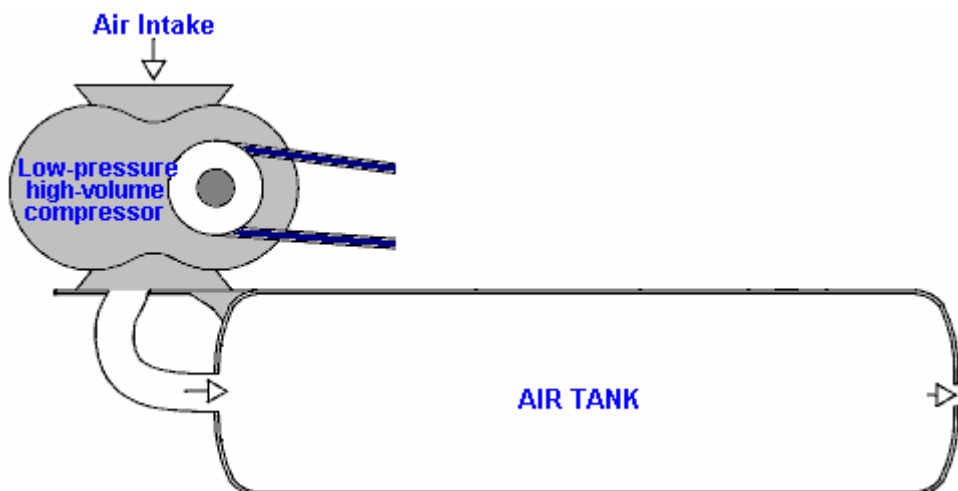
This system could do with some further explanation, so here is an idea from Scott Robertson whose web site is <http://www.aircaraccess.com/index.htm>, for a possible working compressor system using a leaf-blower:



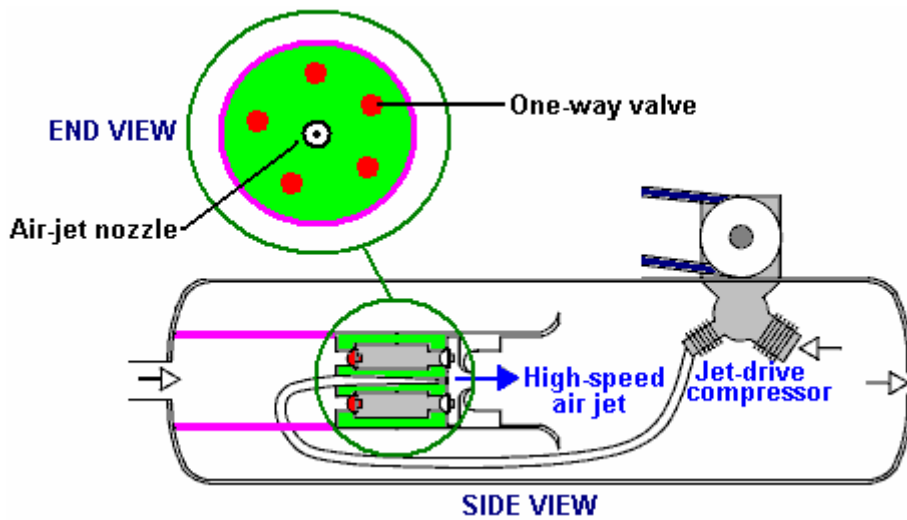
While this looks rather complicated, in reality it really isn't. Let's take the different sections in order:



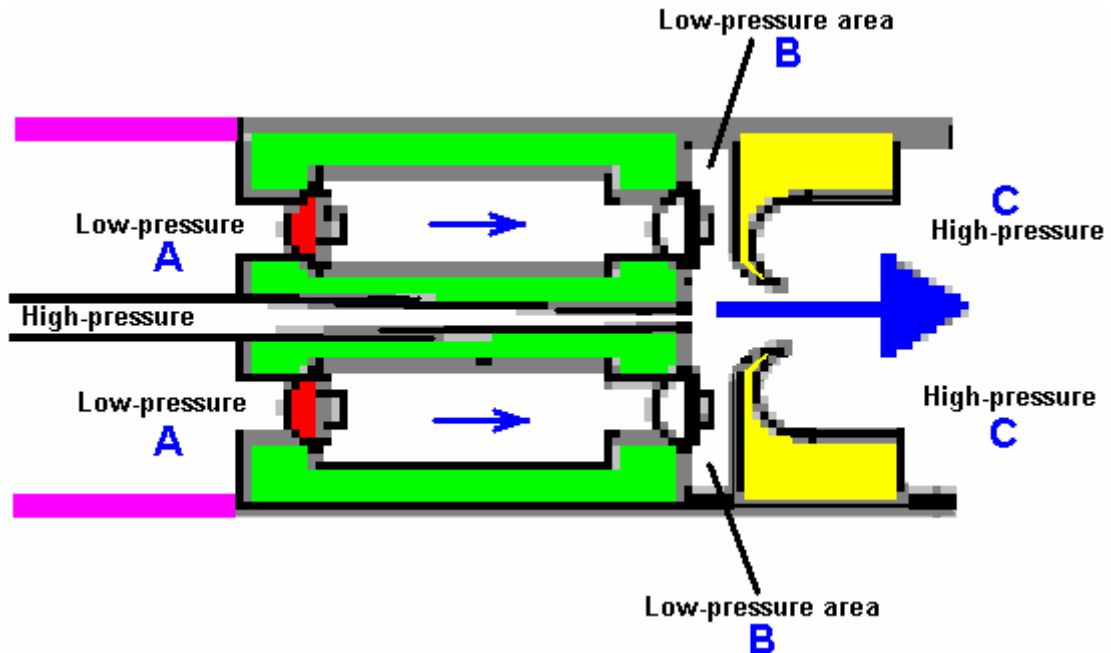
First, you have an ordinary air engine, supplied with compressed air from a pressure tank. This engine exhausts its (cold, expanded) air to the atmosphere. The engine powers two compressors which between them keep the tank full of compressed air.



The first compressor is a simple 'leaf-blower' type which produces a large volume of low-pressure air. The big question is "how do you get this large volume of low-pressure air into a tank which has high-pressure compressed air inside it?". Well this seemingly impossible task is performed by the second compressor aided by a cunning, ultra-simple design:



Here, low-pressure air is fed into the low-pressure area marked in pink. Separating it from the high-pressure area is a metal plug marked in green. Set into this plug is a ring of five one-way air valves marked in red. These one-way valves let the low-pressure air into the high-pressure area because of a high-speed jet of air produced by the 'jet-drive compressor'. At first glance, this seems impossible, but it is actually just an application of a standard Engineering technique. The high-speed air jet is directed through a specially shaped nozzle, creating a local low-pressure zone around the jet:



The low-pressure air at point "A" flows through the ring of five one-way valves into the disc-shaped low pressure area "B" and is blasted into the high-pressure area "C" by the high-power air jet ripping through the doughnut-shaped ring marked in yellow. The high-speed air jet causes the low pressure ring "B" by its rapid movement which creates a vortex due to the shape and positioning of the doughnut-shaped ring marked in yellow. This clever arrangement allows large volumes of low-pressure air to be drawn into a tank which contains high-pressure air.

You will also note that the two-stage compressor which generates this high-speed jet of air, has its working area actually inside the tank. This means that the heat of compression is used to heat the air inside the tank

and raise its pressure, enhancing the operation further. It should be borne in mind that the new air entering the system has been heated by the sun and contains the energy which powers the system.

### ***The Leroy Rogers Engine.***

The Rogers motor shown here makes no claims to spectacular operation, but in spite of that, Leroy did admit in an interview that this motor does indeed have a greater output than the applied input, provided that the motor is not left just ticking over. This motor is like the US patent 3,744,252 "Closed Motive Power System Utilising Compressed Fluids" by Eber Van Valkenburg shown below. However, the Rogers patent shown here has the distinct advantage that it uses off-the-shelf motors and readily available hardware and there is nothing really exotic or difficult about the Rogers engine that a person couldn't get from a valve supplier or get a metal fabrication company to construct.

Present day vehicle engines are under-g geared and run at fairly low revs. These same engines operate much more efficiently at higher revs, if they are given different gearing. With the Rogers motor, the air contained in the high-pressure tank is sufficient to drive the pistons up and down. The exhaust air can be captured in a buffer tank and pumped back into the high-pressure tank by a compressor with much higher gearing and much lower capacity per piston stroke. The expanded air exiting from the engine is at much lower temperature than the surrounding air. This gives it higher density and so the re-compression efficiency is raised and in addition, once back in the storage tank it's temperature rises again which boosts the pressure in the storage tank, courtesy of the heat from the local environment.

Here is a slightly re-worded copy of the Lee Rogers patent:

**Patent US 4,292,804**

**6th October 1980**

**Inventor: Leroy K. Rogers**

## **METHOD AND APPARATUS FOR OPERATING AN ENGINE ON COMPRESSED GAS**

### **ABSTRACT**

The present invention relates to a method and apparatus for operating an engine having a cylinder containing a reciprocating piston driven by a compressed gas. The apparatus comprises a source of compressed gas connected to a distributor which conveys the compressed gas to the cylinder. A valve is provided to admit compressed gas to the cylinder when the piston is in an approximately Top Dead Centre position.

In one embodiment of the present invention, the timing of the opening of the valve is advanced so that the compressed gas is admitted to the cylinder progressively further before the Top Dead Centre position of the piston as the speed of the engine increases.

In a further embodiment of the present invention, a valve actuator is provided which increases the length of time over which the valve remains open to admit compressed gas to the cylinder as the speed of the engine increases.

A still further embodiment of the present invention relates to an apparatus for adapting a conventional internal combustion engine for operation on compressed gas.

### **US Patent References:**

3,881,399	May., 1975	Sagi et al.	91/187.
3,885,387	May., 1975	Simington	60/407.
4,018,050	Apr., 1977	Murphy	60/412.

## **DESCRIPTION**

### **BACKGROUND AND SUMMARY OF THE PRESENT INVENTION**

The present invention is a method and apparatus for operating an engine using a compressed gas as the motive fluid. More particularly, the present invention relates to a apparatus for adapting a pre-existing internal combustion engine for operation on a compressed gas.

Air pollution is one of the most serious problems facing the world today. One of the major contributors to air pollution is the ordinary internal combustion engine which is used in most motor vehicles today. Various devices, including many items required by legislation, have been proposed in an attempt to limit the pollutants which an internal combustion engine exhausts to the air. However, most of these devices have met with limited success and are often both prohibitively expensive and complex. A clean alternative to the internal combustion engine is needed to power vehicles and other machinery.

A compressed gas, preferably air, would provide an ideal motive fluid for an engine, since it would eliminate the usual pollutants exhausted from an internal combustion engine. An apparatus for converting an internal combustion engine for operation on compressed air is disclosed in U.S. Pat. No. 3,885,387 issued May 27, 1975 to Simington. The Simington patent discloses an apparatus including a source of compressed air and a rotating valve actuator which opens and closes a plurality of mechanical poppet valves. The valves deliver compressed air in timed sequence to the cylinders of an engine through adapters located in the spark plug holes. However, the output speed of an engine of this type is limited by the speed of the mechanical valves and the fact that the length of time over which each of the valves remains open cannot be varied as the speed of the engine increases.

Another apparatus for converting an internal combustion engine for operation on steam or compressed air is disclosed in U.S. Pat. No. 4,102,130 issued July 25, 1978 to Stricklin. The Stricklin patent discloses a device which changes the valve timing of a conventional four stroke engine such that the intake and exhaust valves open once for every revolution of the engine instead of once every other revolution of the engine. A reversing valve is provided which delivers live steam or compressed air to the intake valves and is subsequently reversed to allow the exhaust valves to deliver the expanded steam or air to the atmosphere. A reversing valve of this type however does not provide a reliable apparatus for varying the amount of motive fluid injected into the cylinders when it is desired to increase the speed of the engine. Further, a device of the type disclosed in the Stricklin patent requires the use of multiple reversing valves if the cylinders in a multi-cylinder engine were to be fired sequentially.

Therefore, it is an object of the present invention to provide a reliable method and apparatus for operating an engine or converting an engine for operation with a compressed gas.

A further object of the present invention is to provide a method and apparatus which is effective to deliver a constantly increasing amount of compressed gas to an engine as the speed of the engine increases.

A still further object of the present invention is to provide a method and apparatus which will operate an engine using compressed gas at a speed sufficient to drive a conventional automobile at highway speeds.

It is still a further object of the present invention to provide a method and apparatus which is readily adaptable to a standard internal combustion engine, to convert the internal combustion engine for operation with a compressed gas.

Another object of the invention is to provide a method and apparatus which utilises cool expanded gas, exhausted from a compressed gas engine, to operate an air-conditioning unit and/or an oil-cooler.

These and other objects are realised by the method and apparatus of the present invention for operating an engine having at least one cylinder containing a reciprocating piston and using compressed gas as the motive fluid. The apparatus includes a source of compressed gas, a distributor connected it for conveying the compressed gas to the cylinder or cylinders. A valve is provided for admitting the compressed gas to the cylinder when the piston is in an approximately Top Dead Centre position within the cylinder. An exhaust is provided for exhausting the expanded gas from the cylinder as the piston returns to approximately the Top Dead Centre position.

In a preferred embodiment of the present invention, a device is provided for varying the duration of each engine cycle over which the valve remains open to admit compressed gas to the cylinder, dependent upon

the speed of the engine. In a further preferred embodiment of the present invention, an apparatus for advancing the timing of the opening of the valve is arranged to admit the compressed gas to the cylinder progressively further and further before the Top Dead Centre position of the piston, as the speed of the engine increases.

Further features of the present invention include a valve for controlling the amount of compressed gas admitted to the distributor. Also, a portion of the gas which has been expanded in the cylinder and exhausted through the exhaust valve, is delivered to a compressor to be compressed again and returned to the source of compressed gas. A gear train can be engaged to drive the compressor selectively at different operating speeds, depending upon the pressure maintained at the source of compressed air and/or the speed of the engine. Still further, a second portion of the exhaust gas is used to cool a lubricating fluid for the engine or to operate an air-conditioning unit.

In a preferred embodiment of the present invention, the valve for admitting compressed gas to the cylinder is operated electrically. The device for varying the duration of each engine cycle, over which the intake valve remains open, as the speed of the engine increases, comprises a rotating element whose effective length increases as the speed of the engine increases, causing a first contact on the rotating element to be electrically connected to a second contact on the rotating element, for a longer period of each engine cycle. The second contact operates the valve causing it to remain in an open position for a longer period of each engine cycle, as the speed of the engine increases.

Still further features of the present invention include an adaptor plate for supporting the distributor above the intake manifold of a conventional internal combustion engine after a carburettor has been removed to allow air to enter the cylinders of the engine through the intake manifold and conventional intake valves. Another adaptor plate is arranged over an exhaust passageway of the internal combustion engine to reduce the cross-sectional area of the exhaust passageway.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Preferred embodiments of a method and apparatus for operating an engine according to the present invention will be described with reference to the accompanying drawings in which components have the same reference numbers in each drawing.

**Fig.1** is a schematic representation of an apparatus according to the present invention arranged on an engine:

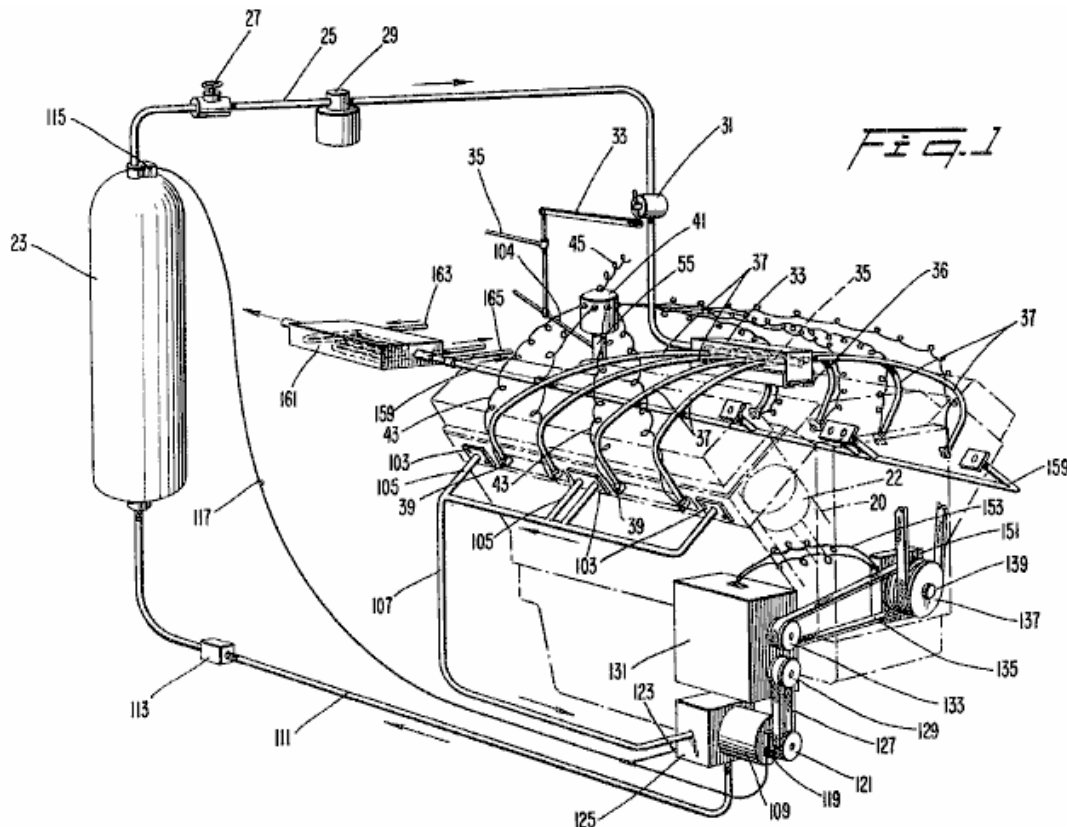


Fig.2 is a side view of one embodiment of a valve actuator according to the present invention.

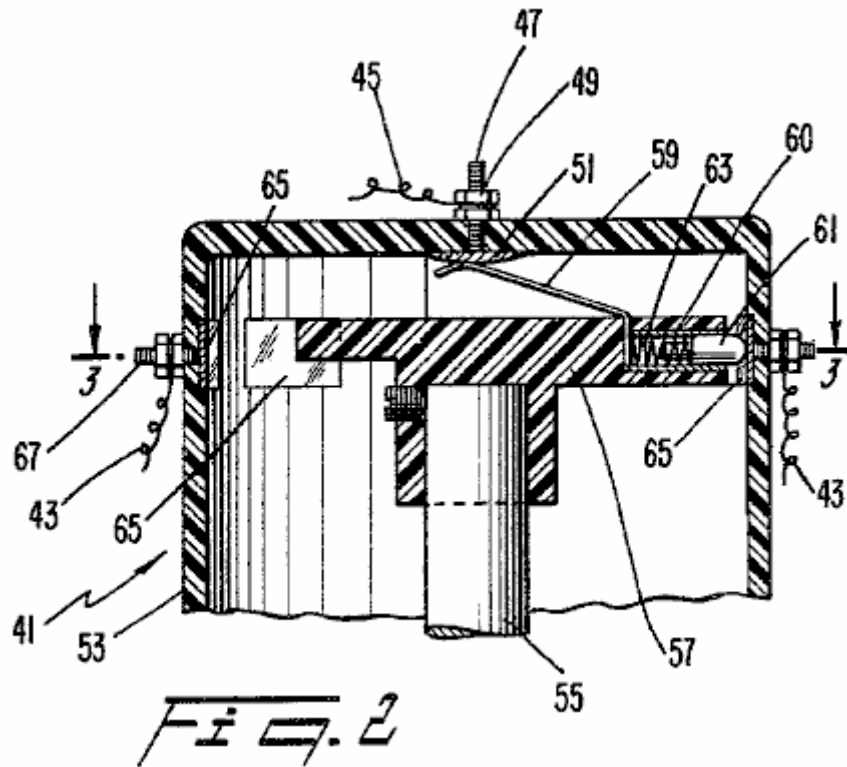


Fig.3 is a cross-sectional view taken along the line 3--3 in Fig.2.

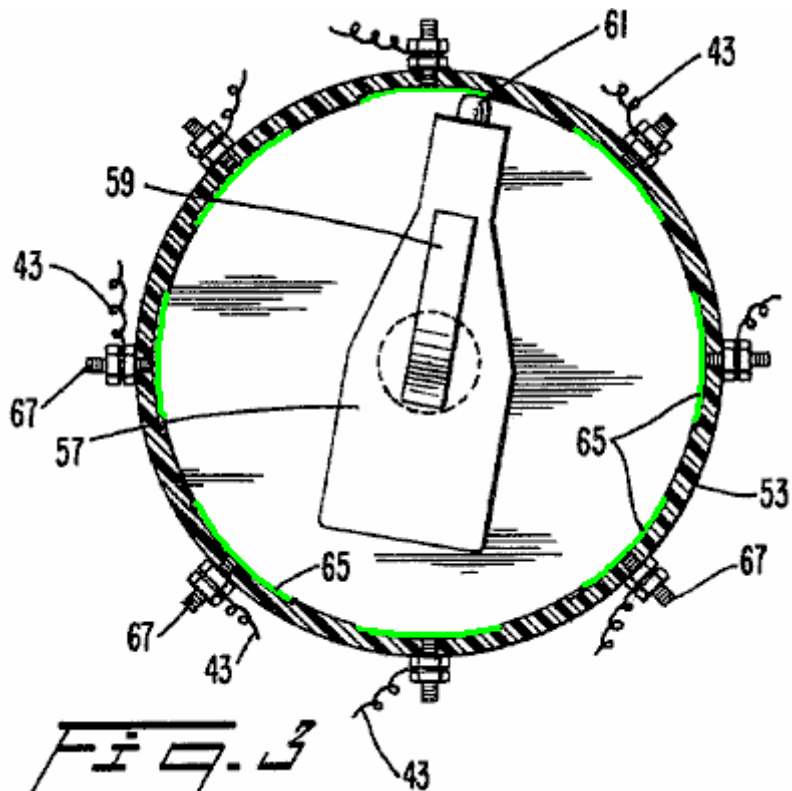


Fig.4 is a cross-sectional view of a second embodiment of a valve actuator according to the present invention.

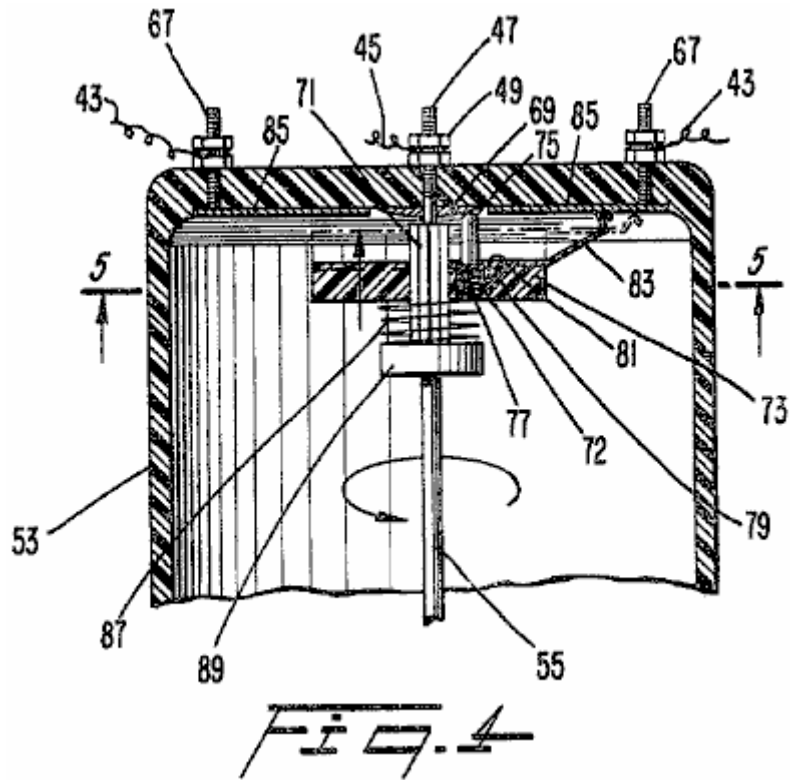


Fig.5 is a view taken along the line 5--5 in Fig.4.

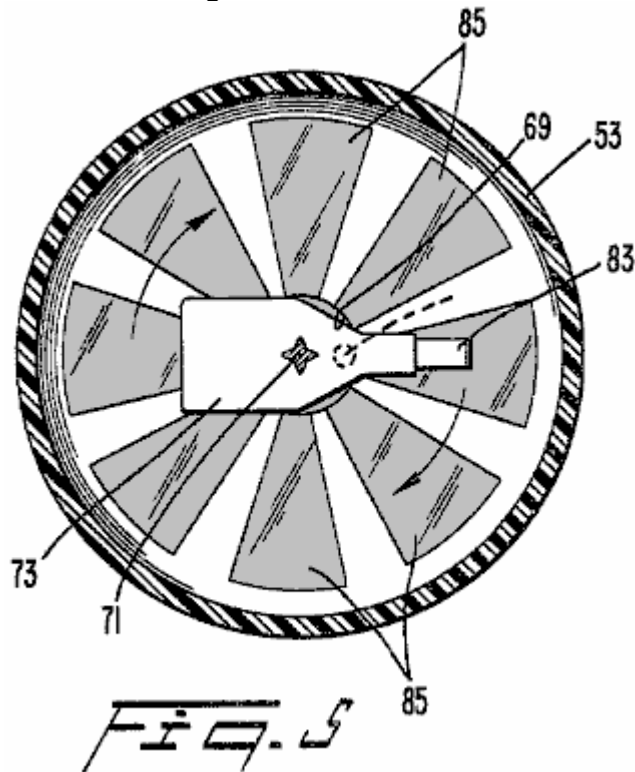




Fig.6 is a cross-sectional view of a third embodiment of a valve actuator according to the present invention;

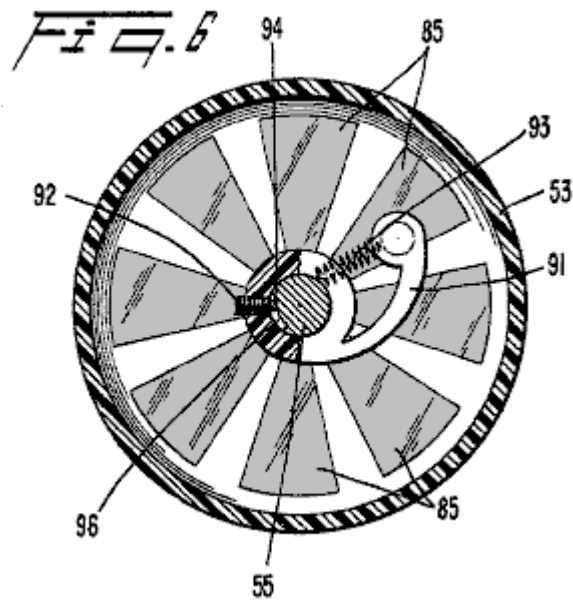
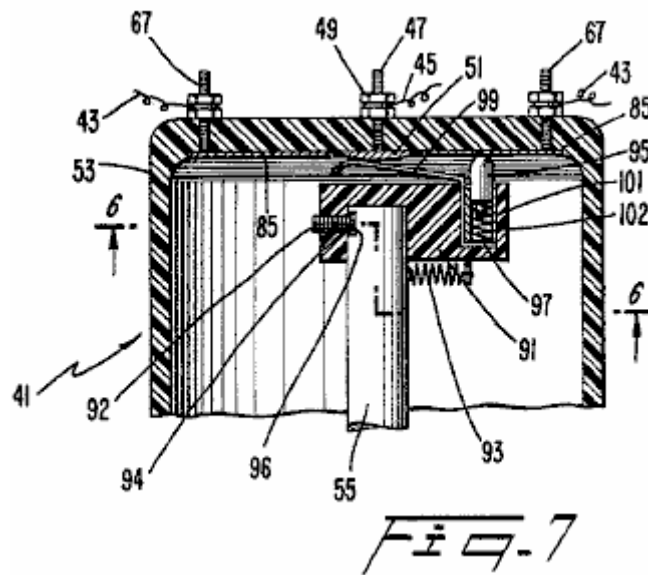
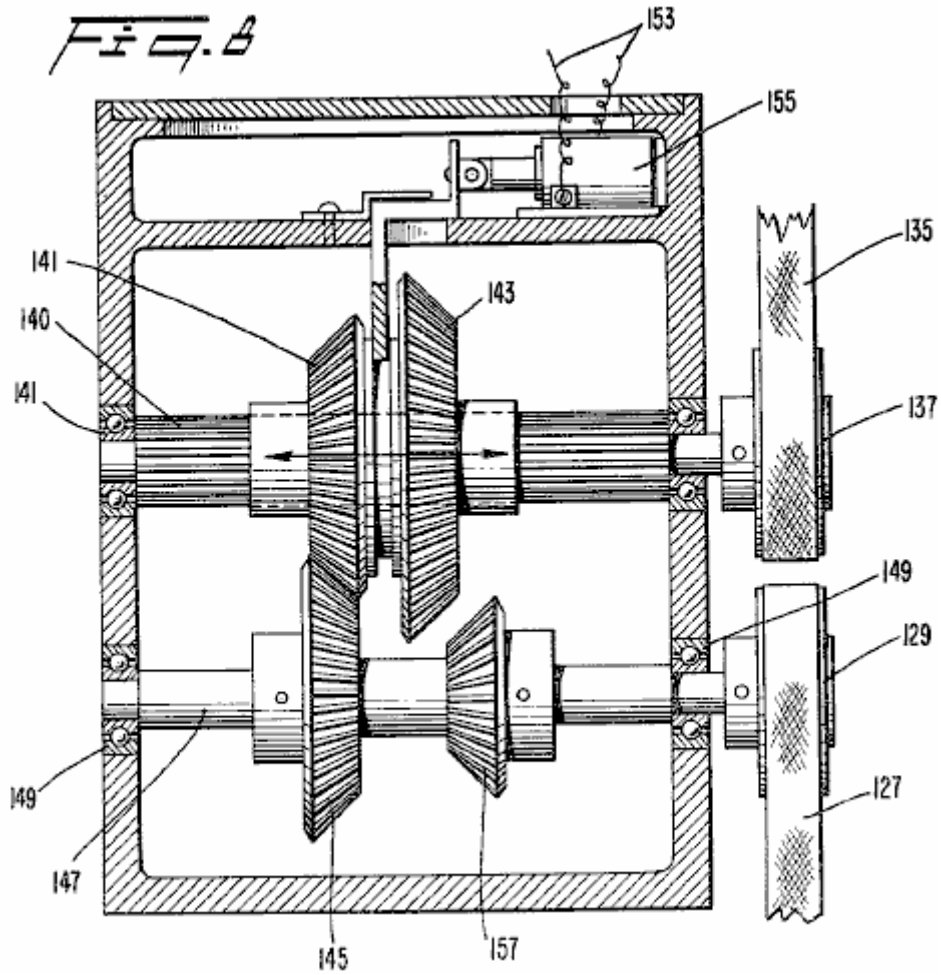


Fig.7 is a view taken along the line 7--7 in Fig.6.

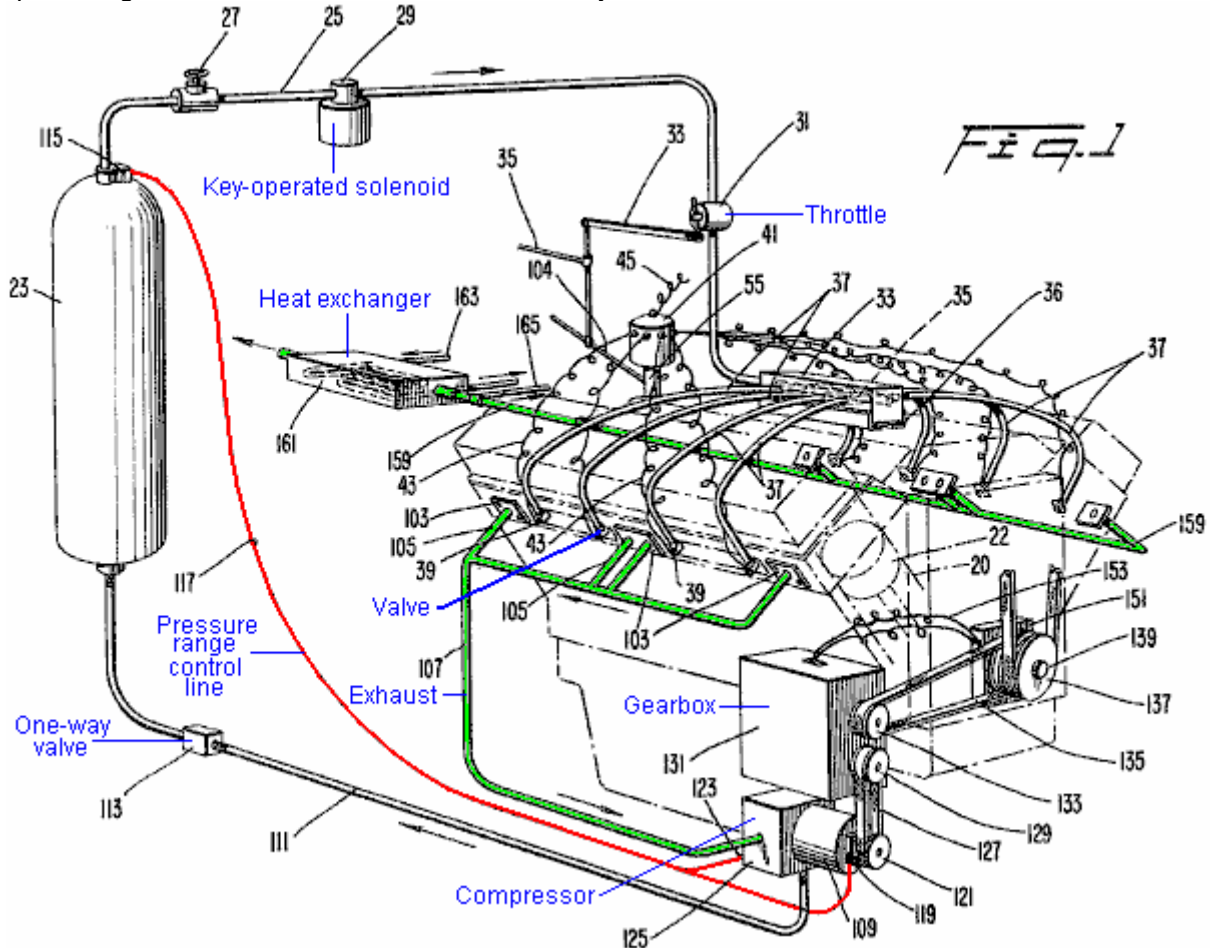


**Fig. 8** is a cross-sectional view of a gearing unit to drive a compressor according to the present invention.



## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to **Fig.1**, an engine block **21** (shown in phantom) having two banks of cylinders with each bank including cylinders **20** having pistons **22** which reciprocate in them in a conventional manner (only one of which is shown in phantom). While the illustrated engine is a V-8 engine, it will be apparent that the present invention is applicable to an engine having any number of pistons and cylinders with the V-8 engine being utilised for illustration purposes only. A compressed gas tank **23** is provided to store a compressed gas at high pressure. It may also be desirable to include a small electric or gas compressor to provide compressed gas to supplement the compressed gas held in the tank **23**. In a preferred embodiment, the compressed gas is air which can be obtained from any suitable source.



A line **25** transports the gas withdrawn from the tank **23** when a conventional shut-off valve **27** is open. In addition, a solenoid valve **29** preferably operated by a suitable key-operated engine switch (not shown) is also placed in the line **25**. In normal operation, the valve **27** is maintained open at all times with the solenoid valve **29** operating as a selective shut off valve to start and stop the engine **21**.

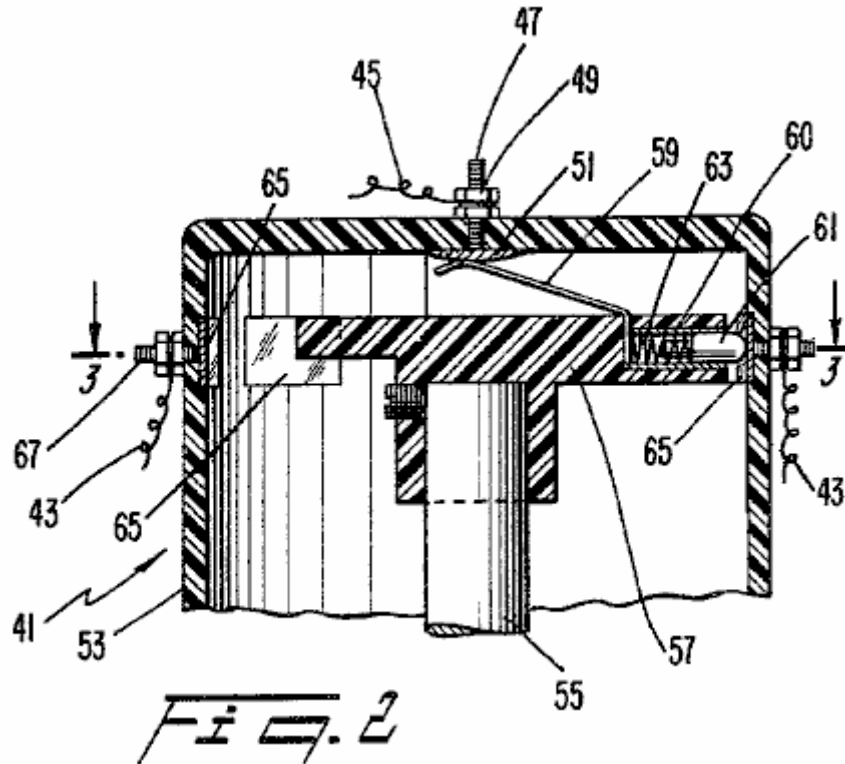
A suitable regulating valve **31** is arranged downstream of the solenoid valve **29** and is connected by a linkage **33** to a throttle linkage **35** which is operator-actuated by any suitable apparatus such as a foot pedal (not shown). The line **25** enters an end of a distributor **33** and is connected to an end of a pipe **35** which is closed at the other end. A plurality of holes, which are equal to the number of cylinders in the engine **21**, are provided on either side of the pipe **35** along the length of the pipe **35**.

When the present invention is used to adapt a conventional internal combustion engine for operation on compressed gas, an adaptor plate **36** is provided to support the distributor **33** in spaced relation from the usual intake opening in the intake manifold of the engine after a conventional carburettor has been removed. In this way, air is permitted to enter the internal combustion engine through the usual passageways and to be admitted to the cylinders through suitable intake valves (not shown). The adaptor plate **36** is attached to the engine block **21** and the distributor **33** by any suitable apparatus, e.g., bolts.

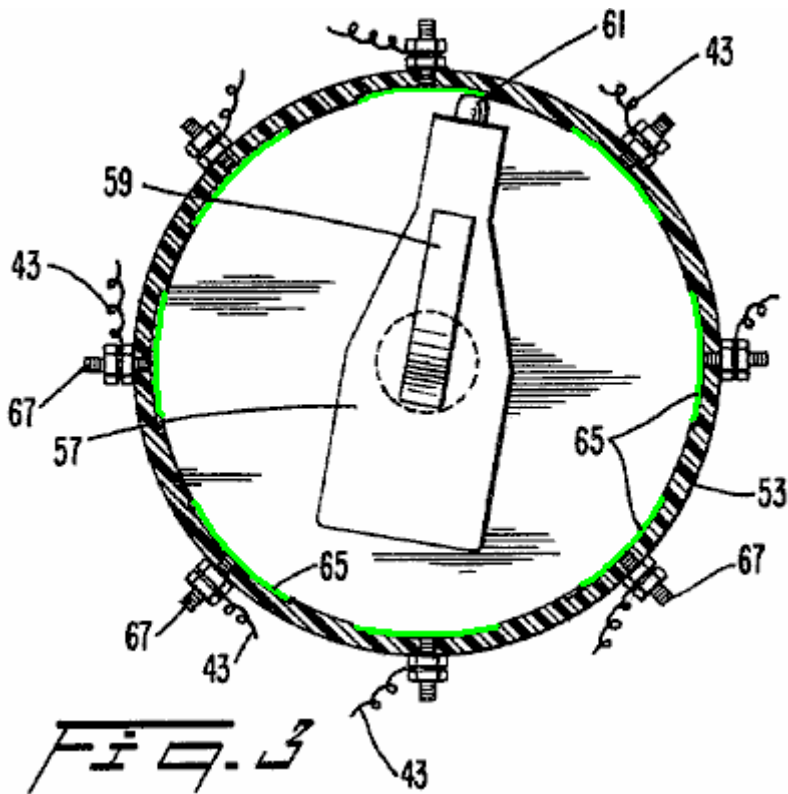
Each of the holes in the pipe **35** is connected in fluid-tight manner to a single line **37**. Each line **37** carries the compressed gas to a single cylinder **20**. In a preferred embodiment, each of the lines **37** is 1/2 inch high pressure plastic tubing attached through suitable connectors to the distributor **33** and the pipe **35**. Each of

the lines 37 is connected to a valve 39 which is secured in an opening provided near the top of each of the cylinders 20. In the case of a conversion of a standard internal combustion engine, the valves 39 can be conveniently screwed into a tapped hole in the cylinder 20 typically provided for a spark plug of the internal combustion engine. In a preferred embodiment, the valves 39 are solenoid actuated valves in order to provide a fast and reliable opening and closing of the valves 39.

Each of the valves 39 is energised by a valve actuator 41 through one of a plurality of wires 43. The valve actuator 41 is driven by a shaft of the engine similar to the drive for a conventional distributor of an internal combustion engine. That is, a shaft 55 of the valve actuator 41 is driven in synchronism with the engine 21 at one half the speed of the engine 21.



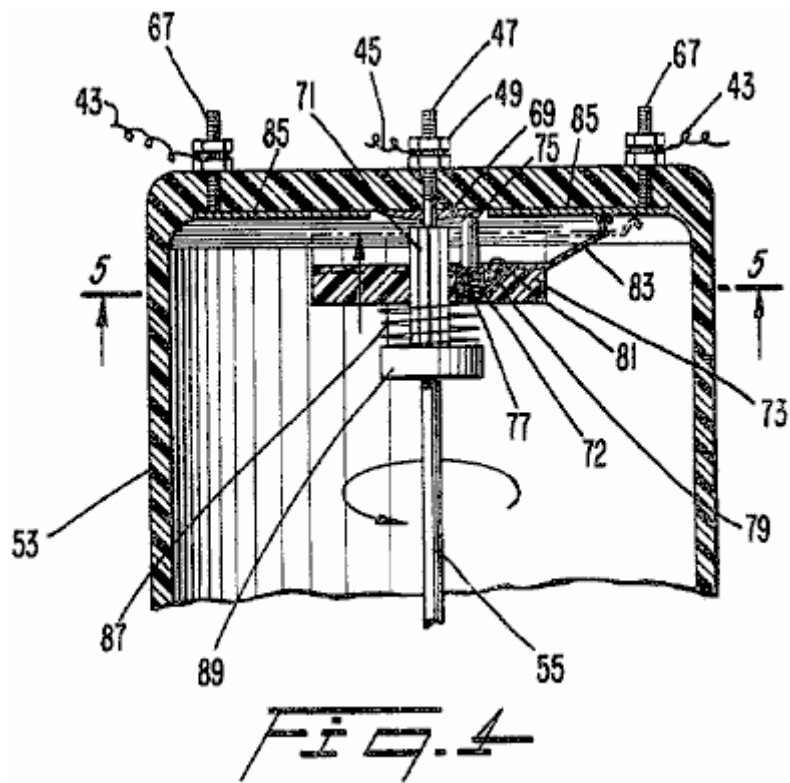
A first embodiment of the valve actuator 41 (Fig.2 and Fig.3), receives electrical power through a wire 45 which is energised in a suitable manner by a battery, and a coil if necessary (not shown) as is conventional in an internal combustion engine. The wire 45 is attached to a central post 47 by a nut 49. The post 47 is connected to a conducting plate 51 arranged in a housing 53 for the valve actuator 41. Within the housing 53, the shaft 55 has an insulating element 57 secured to an end of the shaft 55 and rotates with it when the shaft 55 is driven by the engine 21. A first end of a flexible contact 59 is continuously biased against the conducting plate 51 to receive electricity from the battery or other suitable source. The other end of the contact 59 is connected to a conducting sleeve 60 which is in constant contact with a spring biased contact 61 which is arranged within the sleeve 60. The contact 61 is pressed by a spring 63 which pushes contact 61 towards a side wall of the housing 53.



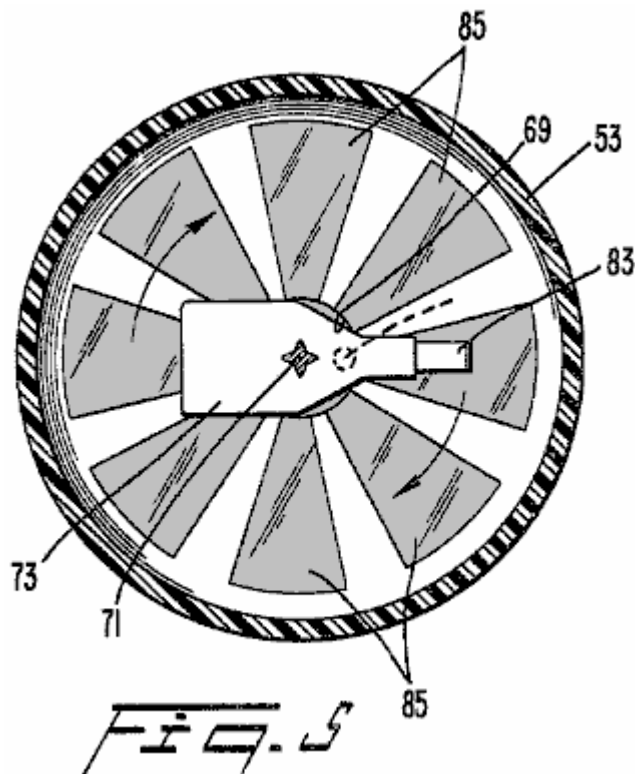
With reference to **Fig.3**, a plurality of contacts **65** are spaced from one another and are arranged around the periphery of the housing **53** at the same level as the spring biased contact **61**. Each contact **65** is electrically connected to a post **67** which extends outside of the housing **53**. The number of contacts **65** is equal to the number of cylinders in the engine **21**. One of the wires **43**, which actuate the valves **39**, is secured to each of the posts **67**.

In operation, as the shaft **55** rotates in synchronism with the engine **21**, the insulating element **57** rotates and electricity is ultimately delivered to successive pairs of the contacts **65** and wires **43** through the spring loaded contact **61** and the flexible contact **59**. In this way, each of the electrical valves **39** is activated and opened in the proper timed sequence to admit compressed gas to each of the cylinders **20** to drive the pistons **22** on a downward stroke.

The embodiment illustrated in **Fig.2** and **Fig.3** is effective in causing each of the valves **39** to remain open for a long enough period of time to admit sufficient compressed gas to each of the cylinders **20** of the engine **21** to drive the engine **21**. The length of each of the contacts **65** around the periphery of the housing **53** is sufficient to permit the speed of the engine to be increased when desired by the operator by moving the throttle linkage **35** which actuates the linkage **33** to further open the regulating valve **31** to admit more compressed gas from the tank **23** to the distributor **33**. However, it has been found that the amount of air admitted by the valves **39** when using the first embodiment of the valve actuator **41** (**Fig.2** and **Fig.3**) is substantially more than required to operate the engine **21** at an idling speed. Therefore, it may be desirable to provide a valve actuator **41** which is capable of varying the duration of each engine cycle over which the solenoid valves **39** are actuated, i.e., remain open to admit compressed gas, as the speed of the engine **21** is varied.



A second embodiment of a valve actuator 41 which is capable of varying the duration of each engine cycle over which each of the valves 39 remains open to admit compressed gas to the cylinders 20 dependent upon the speed of the engine 21 will be described with reference to Fig. 4 and Fig. 5 wherein members corresponding to those of Fig. 2 and Fig. 3 bear like reference numbers. The wire 45 from the electricity source is attached to the post 47 by the nut 49. The post 47 has an annular contact ring 69 electrically connected to an end of the post 47 and arranged within the housing 53. The shaft 55 rotates at one half the speed of the engine as in the embodiment of Fig. 2 and Fig. 3.



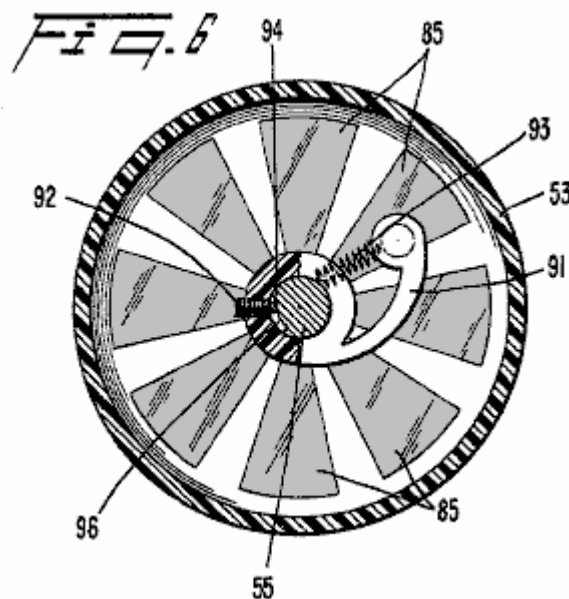
At an upper end of the shaft 55, a splined section 71 receives a sliding insulating member 73. The splined section 71 of the shaft 55 holds the insulating member 73 securely as it rotates with shaft 55 but permits the

insulating member **73** to slide axially along the length of the splined section **71**. Near the shaft **55**, a conductive sleeve **72** is arranged in a bore **81** in an upper surface of the insulating element **73** generally parallel to the splined section **71**. A contact **75**, biased towards the annular contact ring **69** by a spring **77**, is arranged within the conductive sleeve **72** and in contact with it. The conductive sleeve **72** also contacts a conductor **79** at a base of the bore **81**.

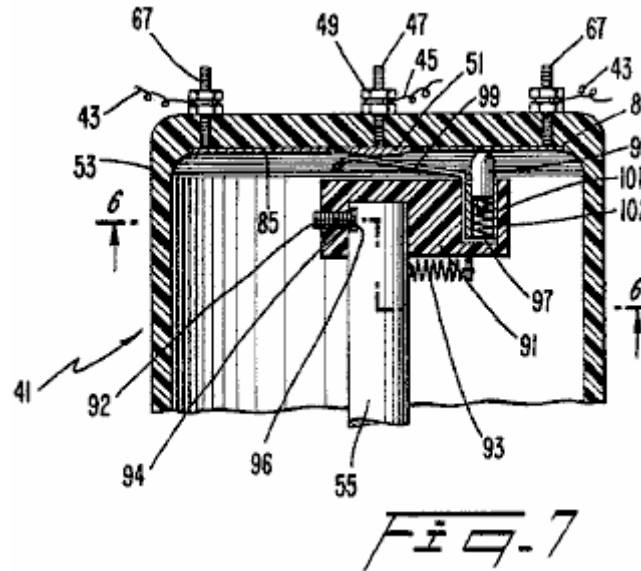
The conductor **79** extends to the upper surface of the insulating element **73** near an outer periphery of the insulating element **73** where the conductor **79** is electrically connected to a flexible contact **83**. The flexible contact **83** connects, one after the other, with a series of radial contacts **85** which are positioned on an upper inside surface of the housing **53**. A weak spring **87** arranged around the splined section **71** engages a stop member **89** secured on the shaft **55** and the insulating element **73** to slightly bias the insulating element **73** towards the upper inside surface of the housing **53** to ensure contact between the flexible contact **83** and the upper inside surface of the housing **53**. As best seen in **Fig.5**, the radial contacts **85** on the upper inside surface of the housing **53** are arranged generally in the form of radial spokes extending from the centre of the housing **53** with the number of contacts being equal to the number of cylinders **20** in the engine **21**. The number of degrees covered by each of the radial contacts **85** gradually increases as the distance from the centre of the upper inside surface of the housing **53** increases.

In operation of the device of **Fig.4** and **Fig.5**, as the shaft **55** rotates, electricity flows along a path through the wire **45** down through post **47** to the annular contact member **69** which is in constant contact with the spring biased contact **75**. The electrical current passes through the conductive sleeve **72** to the conductor **79** and then to the flexible contact **83**. As the flexible contact **83** rotates along with the insulating member **73** and the shaft **55**, the tip of the flexible contact **83** successively engages each of the radial contacts **85** on the upper inside of the housing **53**. As the speed of the shaft **55** increases, the insulating member **73** and the flexible contact **83** attached to it, move upwards along the splined section **71** of the shaft **55** due to the radial component of the splines in the direction of rotation under the influence of centrifugal force. As the insulating member **73** moves upwards, the flexible contact **83** is bent so that the tip of the contact **83** extends further outwards radially from the centre of the housing **53** (as seen in phantom lines in **Fig.4**). In other words, the effective length of the flexible contact **83** increases as the speed of the engine **21** increases.

As the flexible contact **83** is bent and the tip of the contact **83** moves outwards, the tip remains in contact with each of the radial contacts **85** for a longer period of each engine cycle due to the increased angular width of the radial contacts with increasing distance from the centre of the housing **53**. In this way, the length of time over which each of the valves **39** remains open is increased as the speed of the engine is increased. Thus, a larger quantity of compressed gas or air is injected into the cylinders as the speed increases. Conversely, as the speed decreases and the insulating member **73** moves downwards along the splined section **71**, a minimum quantity of air is injected into the cylinder due to the shorter length of the individual radial contact **85** which is in contact with the flexible contact **83**. In this way, the amount of compressed gas that is used during idling of the engine **21** is at a minimum whereas the amount of compressed gas which is required to increase the speed of the engine **21** to a level suitable to drive a vehicle on a highway is readily available.



Shown in **Fig.6** and **Fig.7**, is a third embodiment of a valve actuator **41** according to the present invention. This embodiment includes a curved insulating element **91** having its first end able to pivot, being secured by any suitable device such as screw **92** to the shaft **55** for co-rotation with the shaft **55**. The screw **92** is screwed into a tapped hole in the insulating element **91** so that a tab **94** at an end of the screw **92** engages a groove **96** provided in the shaft **55**. In this way, the insulating element **91** rotates positively with the shaft **55**. However, as the shaft **55** rotates faster, the other end **98** of the insulating element **91** is permitted to pivot outwards under the influence of centrifugal force because of the groove **96** provided in the shaft **55**. A spring **93**, connected between the second end **98** of the element **91** and the shaft **55** urges the second end of the element **91** towards the centre of the housing **53**.



A contact **99** similar to the contact **59** (Fig.2) is arranged so that one end of the contact piece **99** is in constant contact with the conducting plate **51** located centrally within the housing **53**. The other end of the contact **99** engages a conductive sleeve **101** arranged in bore **102**. A contact element **95** is arranged in the conductive sleeve **101** in constant contact with the sleeve **101**. The bore **102** is arranged generally parallel to the shaft **55** near the second end of the curved insulating element **91**. The contact **95** is biased by a spring **97** towards the upper inside surface of the housing **53** for selective contact with each of the plurality of radial contacts **85** which increase in arc length towards the outer peripheral surface of the housing **53** (**Fig.6**).

When the device shown in **Fig.6** and **Fig.7** is operating, as the shaft **55** rotates the curved insulating element **91** rotates with the shaft **55** and the second end **98** of the insulating element **91** tends to pivot about the shaft **55** due to centrifugal force. Thus, as the effective length of the contact **95** increases, i.e., as the curved insulating element **91** pivots further outwards, the number of degrees of rotation over which the contact **95** is in contact with each of the radial contacts **85** on the upper inside surface of the housing **53** increases thereby allowing each of the valves **39** to remain open for a longer period of each engine cycle, which in turn, allows more compressed gas enter the respective cylinder **20** to further increase the speed of the engine **21**.

With reference to **Fig.1**, a mechanical advance linkage **104** which is connected to the throttle linkage **35**, advances the initiation of the opening of each valve **39** such that compressed gas is injected into the respective cylinder further before the piston **22** in the respective cylinder **20** reaches a Top Dead Centre position as the speed of the engine is increased by moving the throttle linkage **35**. The advance linkage **104** is similar to a conventional standard mechanical advance employed on an internal combustion engine. In other words, the linkage **104** varies the relationship between the angular positions of a point on the shaft **55** and a point on the housing **53** containing the contacts. Alternatively, a conventional vacuum advance could also be employed. By advancing the timing of the opening of the valves **39**, the speed of the engine can more easily be increased.

The operation of the engine cycle according to the present invention will now be described. The compressed gas injected into each cylinder of the engine **21** drives the respective piston **22** downwards to rotate a conventional crankshaft (not shown). The movement of the piston downwards causes the



compressed gas to expand rapidly and cool. As the piston **22** begins to move upwards in the cylinder **20** a suitable exhaust valve (not shown), arranged to close an exhaust passageway, is opened by any suitable apparatus. The expanded gas is then expelled through the exhaust passageway. As the piston **22** begins to move downwards again, a suitable intake valve opens to admit ambient air to the cylinder. The intake valve closes and the ambient air is compressed on the subsequent upward movement of the piston until the piston reaches approximately the Top Dead Centre position at which time the compressed gas is again injected into the cylinder **20** to drive the piston **22** downwards and the cycle begins again.

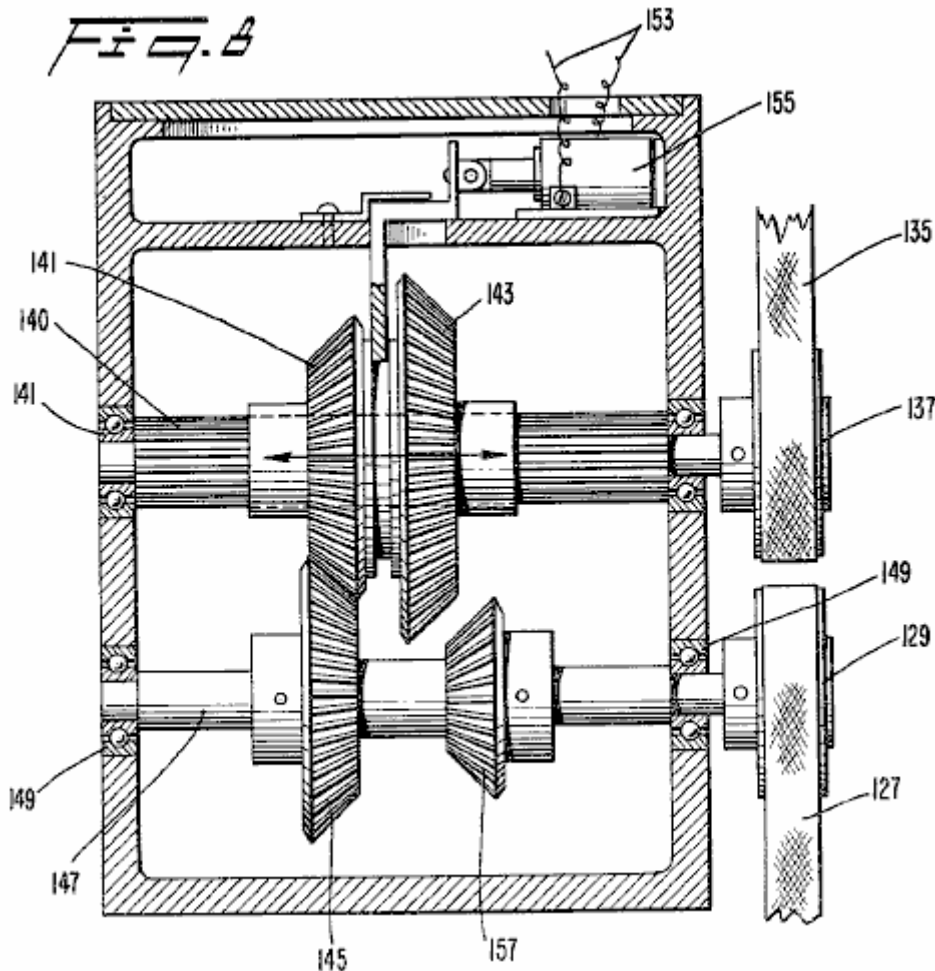
In the case of adapting a conventional internal combustion engine for operation on compressed gas, a plurality of plates **103** are arranged, preferably over an end of the exhaust passageways, in order to reduce the outlet size of the exhaust passageways of the conventional internal combustion engine. In the illustrated embodiment, a single plate having an opening in the centre is bolted to the outside exhaust passageway on each bank of the V-8 engine, while another single plate having two openings in it, is arranged with one opening over each of the interior exhaust passageways on each bank of the V-8 engine. A line **105** is suitably attached to each of the adaptor plates to carry the exhaust to an appropriate location. In a preferred embodiment, the exhaust lines **105** are made from 1.5" plastic tubing.

In a preferred embodiment, the exhaust lines **105** of one bank of the V-8 engine are collected in a line **107** and fed to an inlet of a compressor **109**. The pressure of the exhaust gas emanating from the engine **21** according to the present invention is approximately 25 p.s.i. In this way, the compressor **109** does not have to pull the exhaust into the compressor since the gas exhausted from the engine **21** is at a positive pressure. The positive pressure of the incoming fluid increases the efficiency and reduces wear on the compressor **109**. The exhaust gas is compressed in the compressor **109** and returned through a line **111** and a check valve **113** to the compressed gas storage tank **23**. The check valve **113** prevents the flow of compressed gas stored in the tank **23** back towards the compressor **109**.

A suitable pressure sensor **115** is arranged at an upper end of the tank **23** and sends a signal along a line **117** when the pressure exceeds a predetermined level and when the pressure drops below a predetermined level. The line **117** controls an electrically activated clutch **119** positioned at the front end of the compressor **109**. The clutch **119** is operated to engage and disengage the compressor **109** from a drive pulley **121**. Also, the signal carried by the line **117** activates a suitable valve **123** arranged on compressor housing **125** to exhaust the air entering the compressor housing **125** from the line **107** when the clutch **119** has disengaged the compressor **109** from the drive pulley **121**.

In a preferred embodiment, when the pressure in the tank **23** reaches approximately 600 p.s.i., the clutch **119** is disengaged and the compressor **109** is deactivated and the valve **123** is opened to exhaust the expanded gas delivered to the compressor **109** from the line **107** to the atmosphere. When the pressure within the tank **23** drops below approximately 500 p.s.i., the sensor **115** sends a signal to engage the clutch **119** and close the valve **123**, thereby operating the compressor **109** for supplying the tank **23** with compressed gas.

The pulley **121** which drives the compressor **109** through the clutch **119** is driven by a belt **127** which is driven by a pulley **129** which operates through a gear box **131**. With reference to **Fig.1** and **Fig.8**, a second pulley **133** on the gear box is driven by a belt **135** from a pulley **137** arranged on a drive shaft **139** of the engine **21**. The pulley **137** drives a splined shaft **140** which has a first gear **141** and a second larger gear **143** placed on it, which rotates with the splined shaft **140**. The splined shaft **140** permits axial movement of the gears **141** and **143** along the shaft **140**.



In normal operation (as seen in **Fig.8**), the first gear **141** engages a third gear **145** arranged on a shaft **147** which drives the pulley **129**. The shafts **140** and **147** are arranged in suitable bearings **149** positioned at each end of it. When the speed of the engine **21** drops below a predetermined level, a suitable sensor **151** responsive to the speed of the drive shaft **139** of the engine **21** generates a signal which is transmitted through a line **153** to a solenoid actuator **155** arranged within the gear box **131**. The solenoid actuator **155** moves the first and second gears **141**, **143** axially along the splined shaft **140** to the right as seen in **Fig.8** so that the second, larger gear **143** engages a fourth smaller gear **157** which is arranged on the shaft **147**. The ratio of the second gear **143** to the fourth gear **157** is preferably approximately 3 to 1.

In this way, when the speed of the engine **21** drops below the predetermined level as sensed by the sensor **151** (which predetermined level is insufficient to drive the compressor **109** at a speed sufficient to generate the 500-600 pounds of pressure which is preferably in the tank **23**), the solenoid actuator **155** is energised to slide the gears **143**, **141** axially along the splined shaft **140** so that the second, larger gear **143** engages the fourth, smaller gear **157** to drive the pulley **129** and hence the compressor **109** at a higher rate, to generate the desired pressure. When the speed of the engine increases above the predetermined level, which, in a preferred embodiment is approximately 1500 rpm, the solenoid actuator **155** is deactivated by the sensor **151** thereby moving the gears **143** and **141** to the left as seen in **Fig.8** so that the first gear **141**, engages again with the third gear **145** to effectuate a 1 to 1 ratio between the output shaft **139** of the engine **21** and the pulley **129**.

The other bank of the V-8 engine has its exhaust ports arranged with adapter plates **103** similar to those on the first bank. However, the exhaust from this bank of the engine **21** is not collected and circulated through the compressor **109**. In a preferred embodiment, a portion of the exhaust is collected in a line **159** and fed to an enlarged chamber **161**. A second fluid is fed through a line **163** into the chamber **161** to be cooled by the cool exhaust emanating from the engine **21** in the line **159**. The second fluid in the line **163** may be either transmission fluid contained in a transmission associated with the engine **21** or a portion of the oil used to lubricate the engine **21**. A second portion of the exhaust from the second bank of the V-8 engine is removed from the line **159** in a line **165** and used as a working fluid in an air conditioning system or for any other suitable use.

It should be noted that the particular arrangement utilised for collecting and distributing the gas exhausted from the engine **21** would be determined by the use for which the engine is employed. In other words, it may be advantageous to rearrange the exhaust tubing such that a larger or smaller percentage of the exhaust is routed through the compressor **109**. It should also be noted that since the exhaust lines **105** are plastic tubing, a rearrangement of the lines for a different purpose is both simple and inexpensive.

In operation of the engine of the present invention, the engine **21** is started by energising the solenoid valve **29** and any suitable starting device (not shown), e.g., a conventional electric starter as used on an internal combustion engine. Compressed gas from the full tank **23** flows through the line **25** and a variable amount of the compressed gas is admitted to the distributor **33** by controlling the regulator valve **31** through the linkage **33** and the operator actuated throttle linkage **35**. The compressed gas is distributed to each of the lines **37** which lead to the individual cylinders **20**. The compressed gas is admitted to each of the cylinders **20** in timed relationship to the position of the pistons within the cylinders by opening the valves **39** with the valve actuator **41**.

When it is desired to increase the speed of the engine, the operator moves the throttle linkage **35** which simultaneously admits a larger quantity of compressed gas to the distributor **33** from the tank **23** by further opening the regulator valve **31**. The timing of the valve actuator **41** is also advanced through the linkage **104**. Still further, as the speed of the engine **21** increases, the effective length of the rotating contact **83** (**Fig.4**) or **95** (**Fig.6**) increases thereby electrically contacting a wider portion of one of the stationary radial contacts **85** to cause each of the valves **39** to remain open for a longer period of each engine cycle to admit a larger quantity of compressed gas to each of the cylinders **20**.

As can be seen, the combination of the regulating valve **31**, the mechanical advance **104**, and the valve actuator **41**, combine to produce a compressed gas engine which is quickly and efficiently adaptable to various operating speeds. However, all three of the controls need not be employed simultaneously. For example, the mechanical advance **104** could be utilised without the benefit of one of the varying valve actuators **41** but the high speed operation of the engine may not be as efficient. By increasing the duration of each engine cycle over which each of the valves **39** remains open to admit compressed gas to each of the cylinders **20** as the speed increases, conservation of compressed gas during low speed operation and efficient high speed operation are both possible.

After the compressed gas admitted to the cylinder **20** has forced the piston **22** downwards within the cylinder to drive the shaft **139** of the engine, the piston **22** moves upwards within the cylinder **20** and forces the expanded gas out through a suitable exhaust valve (not shown) through the adapter plate **103** (if employed) and into the exhaust line **105**. The cool exhaust can then be collected in any suitable arrangement to be compressed and returned to the tank **23** or used for any desired purpose including use as a working fluid in an air conditioning system or as a coolant for oil.

When using the apparatus and method of the present invention to adapt a ordinary internal combustion engine for operation with compressed gas it can be seen that considerable savings in weight are achieved. For example, the ordinary cooling system including a radiator, fan, hoses, etc. can be eliminated since the compressed gas is cooled as it expands in the cylinder. In addition, there are no explosions within the cylinder to generate heat. Further reductions in weight are obtained by employing plastic tubing for the lines which carry the compressed gas between the distributor and the cylinders and for the exhaust lines. Once again, heavy tubing is not required since there is little or no heat generated by the engine of the present invention. In addition, the noise generated by an engine according to the present invention is considerably less than that generated by an ordinary internal combustion engine since there are no explosions taking place within the cylinders.

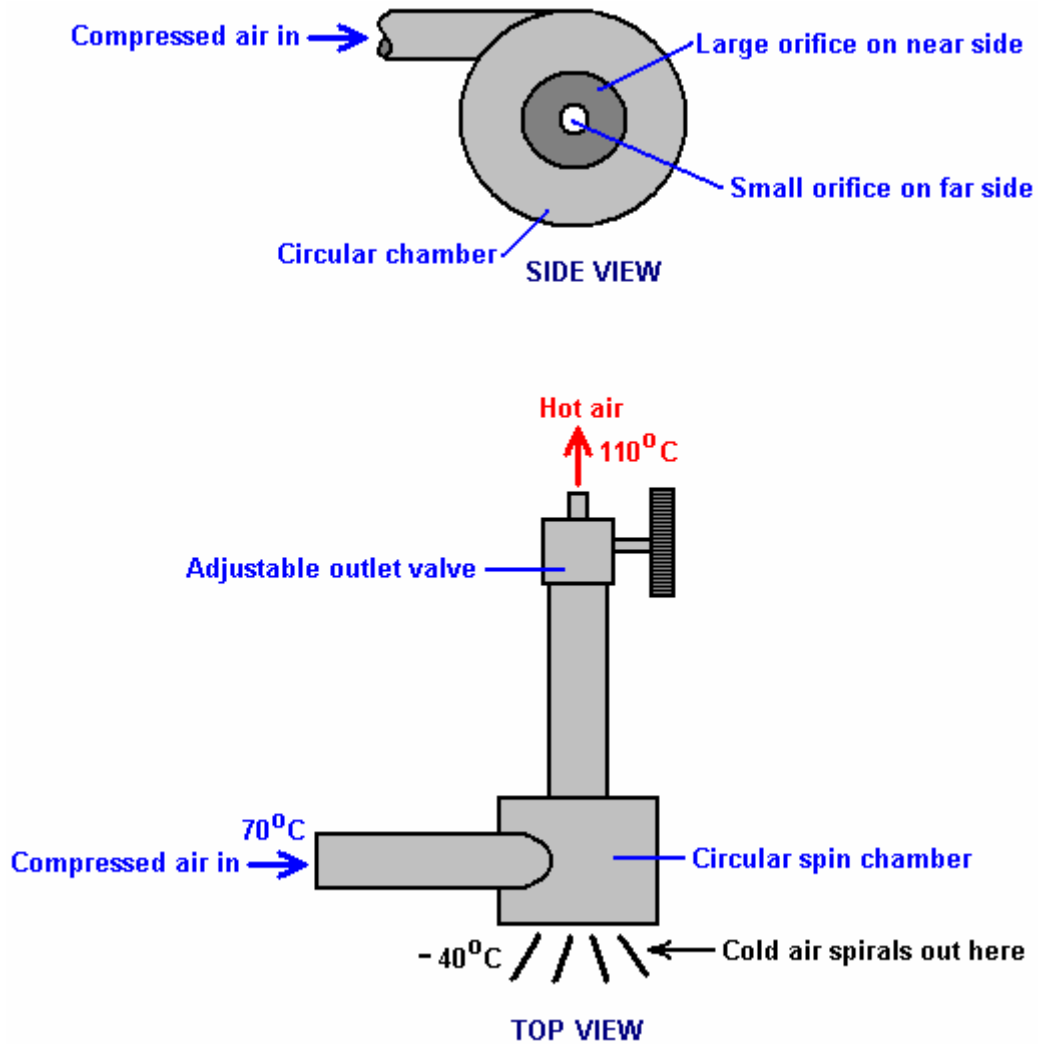
The principles of preferred embodiments of the present invention have been described in the foregoing specification. However, the invention which is intended to be protected is not to be construed as limited to the particular embodiments disclosed. The embodiments are to be regarded as illustrative rather than restrictive. Variations and changes may be made by others without departing from the spirit of the invention. Accordingly, it is expressly intended that all such variations and changes which fall within the spirit and the scope of the present invention as defined in the appended claims be embraced thereby.

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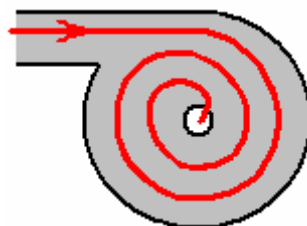
This patent shows how the practical details of running an engine on compressed air can be dealt with. What it does not show is background details of the actual energy flows and the effects of compressing air and then

letting it expand. These things are not normally encountered in our daily lives and so we do not have an immediate intuitive feel for how a system like these will operate. Take the effects of expansion. While it is quite well known that letting a compressed gas expand causes cooling, the practical effect is seldom realised.

The web site [http://www.airtxinternational.com/how\\_vortex\\_tubes\\_work.php](http://www.airtxinternational.com/how_vortex_tubes_work.php) show the details of a “vortex tube” which is a completely passive device with no moving parts:



This device does things which you would not expect. Compressed air at a temperature of, say, seventy degrees Centigrade is fed into the circular chamber where the shape of the chamber causes it to spiral rapidly as it exits the tube:



There is an energy gain in a vortex, as can be seen in a hurricane or tornado, but the really interesting thing here is the dramatic change in temperature caused by the change in pressure as the air expands. The ratio

of heat gain to heat loss is controlled by the ratio of the sizes of the openings, which is why there is an adjustable nozzle on the small opening.

The air exiting through the large opening is much higher volume than the air exiting through the small opening and it expands very rapidly, producing a massive drop in temperature. The density of this cold air is now much higher than the air entering the vortex chamber. So there has been both a drop in temperature and an increase in density. These features of the expansion are made use of in the Leroy Rogers engine design, where some of the expanded air exhaust of the engine is compressed and passed back to the main air storage tank. While the compressor does raise the air temperature as it pumps the air back into the tank, it does not reach its original temperature instantly.

This results in the air temperature inside the tank dropping as the engine operates. But, the lowered tank temperature causes an inflow of heat from its immediate environment, raising the overall tank temperature again. This warming of the chilled air causes the tank pressure to increase further, giving an energy gain, courtesy of the local environment. It is important to understand that it takes less energy to compress air than the kinetic energy which can be generated by letting that compressed air expand again. This is a practical situation, courtesy of the local environment and is not a breach of the law of Conservation of Energy. It is also a feature which has not yet been exploited to any great degree and which is just waiting to be used by any adventurous inventor or experimenter.

### ***The Eber Van Valkinburg Engine.***

Eber presents a custom engine based on these principles. His engine uses both compressed air and compressed oil to manipulate pressures within the system and provide an engine which is self-powered. Here is a slightly re-worded copy of the Eber Van Valkinburg patent:

**Patent US 3,744,252**

**10th July 1973**

**Inventor: Eber Van Valkinburg**

## **CLOSED MOTIVE POWER SYSTEM UTILISING COMPRESSED FLUIDS**

### **ABSTRACT**

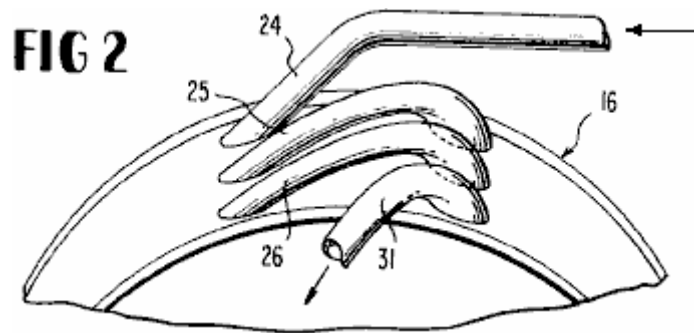
Stored energy in a compressed elastic fluid is utilised in a controlled manner to pressurise an inelastic fluid and to maintain such pressurisation. The pressurised inelastic fluid is throttled to the impeller of a prime mover. Only a portion of the output energy from the prime mover is utilised to circulate the inelastic fluid so as to maintain a nearly constant volumetric balance in the system.

### **DESCRIPTION**

The objective of the invention is to provide a closed-loop power system which utilises the expansive energy of a compressed elastic fluid, such as air, to pressurise and maintain pressurised throughout the operational cycle of the system a second non-elastic and non-compressible fluid, such as oil. The pressurised non-elastic fluid is released in a controlled manner by a throttle to the rotary impeller of a turbine or the like, having an output shaft. This shaft is coupled to a pump for the non-elastic fluid which automatically maintains the necessary circulation needed for the operation of the prime mover, and maintains a near volumetric balance in the system between the two fluids which are separated by self-adjusting free piston devices. The pump for the non-elastic fluid includes an automatic by-pass for the non-elastic fluid which eliminates the possibility of starving the pump which depends on the discharge of the non-elastic fluid at low pressure from the exhaust of the turbine. Other features and advantages of the invention will become apparent during the course of the following detailed description.

### **BRIEF DESCRIPTION OF DRAWING FIGURES**

**Fig.1** is a partly schematic cross-sectional view of a closed motive power system embodying the invention.



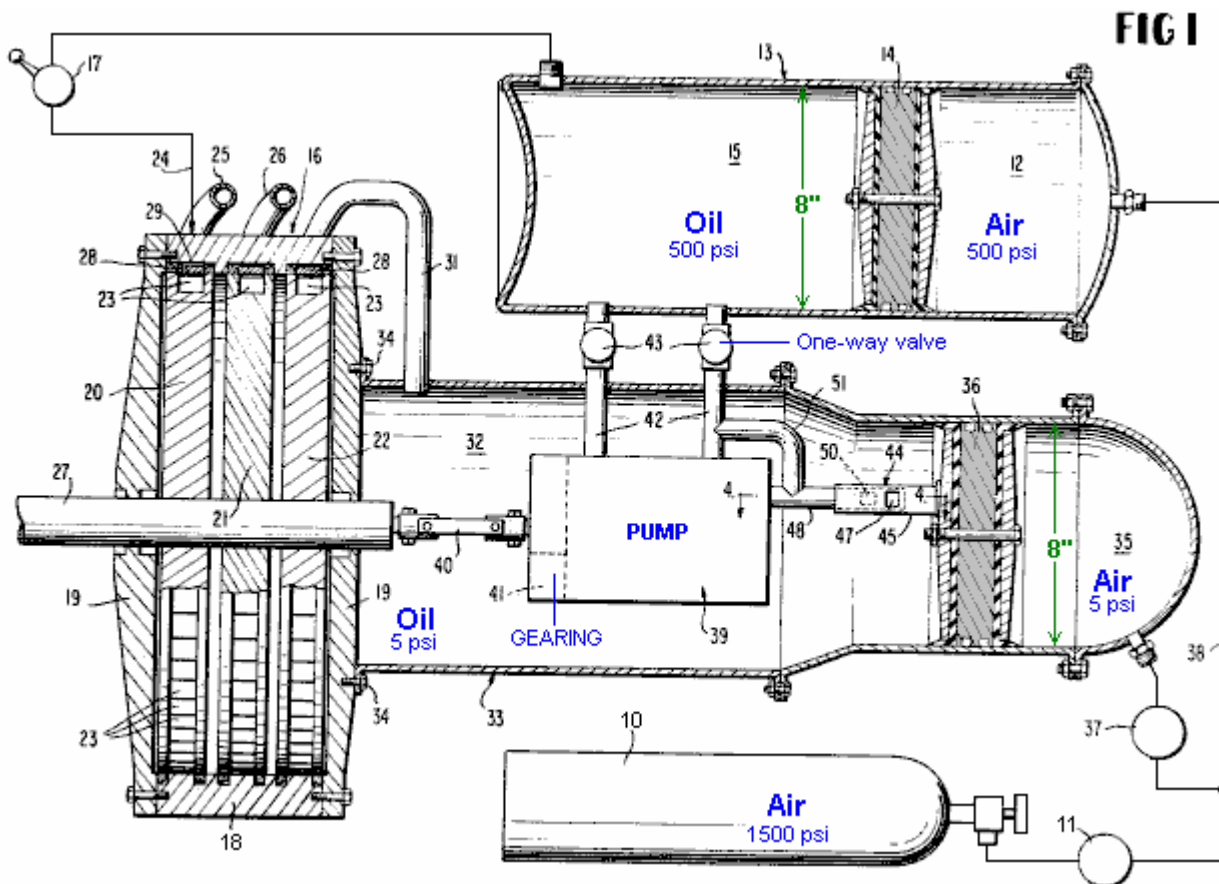
**Fig.2** is a fragmentary perspective view of a rotary prime mover utilised in the system.

**Fig.3** is an enlarged fragmentary vertical section through the prime mover taken at right angles to its rotational axis.

**Fig.4** is an enlarged fragmentary vertical section taken on line 4--4 of **Fig.1**.

**Fig.5** is a similar section taken on line 5--5 of **Fig.4**.

### DETAILED DESCRIPTION

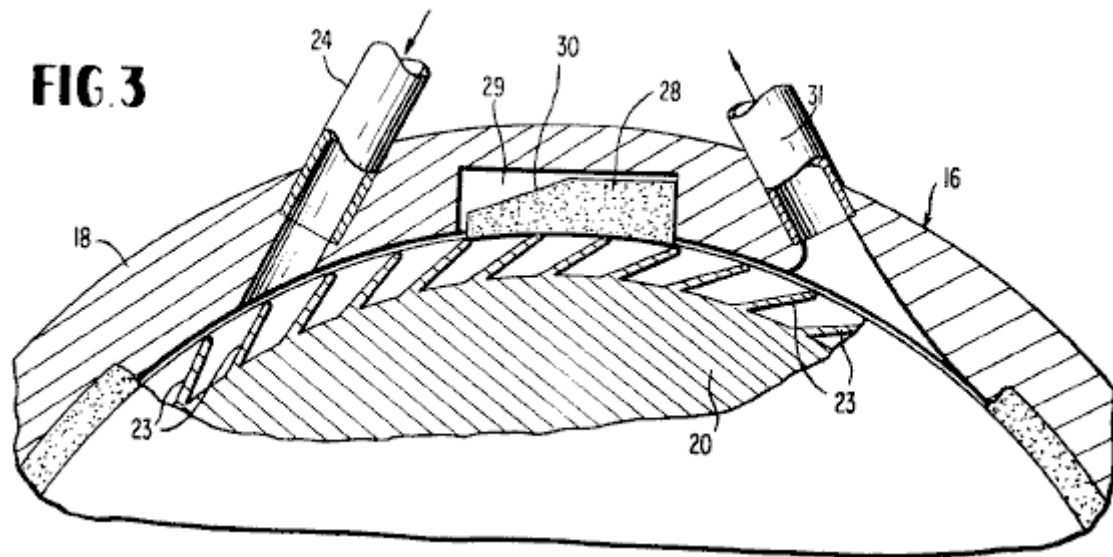


Referring to the drawings in detail, in which the same numbers refer to the same parts in each drawing, the numeral **10** designates a supply bottle or tank for a compressed elastic fluid, such as air. Preferably, the air in the bottle **10** is compressed to approximately 1,500 p.s.i. The compressed air from the bottle **10** is delivered through a suitable pressure regulating valve **11** to the chamber **12** of a high pressure tank **13** on one side of a free piston **14** in the bore of such tank. The free piston **14** separates the chamber **12** for compressed air from a second chamber **15** for an inelastic fluid, such as oil, on the opposite side of the free piston. The free piston **14** can move axially within the bore of the cylindrical tank **13** and is constantly self-adjusting there to maintain a proper volumetric balance between the two separated fluids of the system. The free piston has the ability to maintain the two fluids, air and oil, completely separated during the operation of the system.

The regulator valve **11** delivers compressed air to the chamber **12** under a pressure of approximately 500 p.s.i. The working inelastic fluid, oil, which fills the chamber **15** of high pressure tank **13** is maintained under

500 p.s.i. pressure by the expansive force of the elastic compressed air in the chamber **12** on the free piston **14**. The oil in the chamber **15** is delivered to a prime mover **16**, such as an oil turbine, through a suitable supply regulating or throttle valve **17** which controls the volume of pressurised oil delivered to the prime mover.

The turbine **16** embodies a stator consisting of a casing ring **18** and end cover plates **19** joined to it in a fluid-tight manner. It further embodies a single or plural stage impeller or rotor having bladed wheels **20**, **21** and **22** in the illustrated embodiment. The peripheral blades **23** of these turbine wheels receive the motive fluid from the pressurised chamber **15** through serially connected nozzles **24**, **25** and **26**, connected generally tangentially through the stator ring **18**, as shown in **Fig.3**. The first nozzle **24** shown schematically in **Fig.1** is connected directly with the outlet of the throttle valve **17**. The successive nozzles **25** and **26** deliver the pressurised working fluid serially to the blades **23** of the turbine wheels **21** and **22**, all of the turbine wheels being suitably coupled to a central axial output or working shaft **27** of the turbine **16**.



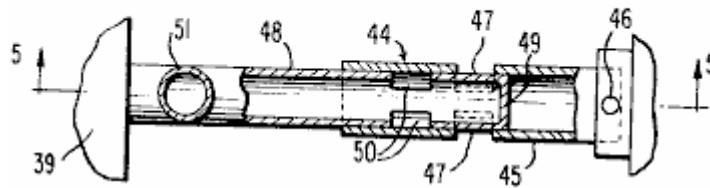
Back-pressure sealing blocks **28**, made of fibre, are contained within recesses **29** of casing ring **18** to prevent co-mingling of the working fluid and exhaust at each stage of the turbine. A back-pressure sealing block **28** is actually only required in the third stage between inlet **26** and exhaust **31**, because of the pressure distribution, but such a block can be included in each stage as shown in **Fig.1**. The top surface, including a sloping face portion **30** on each block **28**, reacts with the pressurised fluid to keep the fibre block sealed against the adjacent, bladed turbine wheel; and the longer the slope on the block to increase its top surface area, the greater will be the sealing pressure pushing it against the periphery of the wheel.

Leading from the final stage of the turbine **16** is a low-pressure working fluid exhaust nozzle **31** which delivers the working fluid, oil, into an oil supply chamber or reservoir **32** of a low pressure tank **33** which may be bolted to the adjacent end cover plate **19** of the turbine, as indicated at **34**. The oil entering the reservoir chamber **32** from the exhaust stage of the turbine is at a pressure of about 3-5 p.s.i. In a second chamber **35** of the low pressure tank **33** separated from the chamber **32** by an automatically moving or self-adjusting free piston **36**, compressed air at a balancing pressure of from 3-5 p.s.i. is maintained by a second pressure regulating valve **37**. The pressure regulating valve **37** is connected with the compressed air supply line **38** which extends from the regulating valve **11** to the high pressure chamber **12** for compressed air.

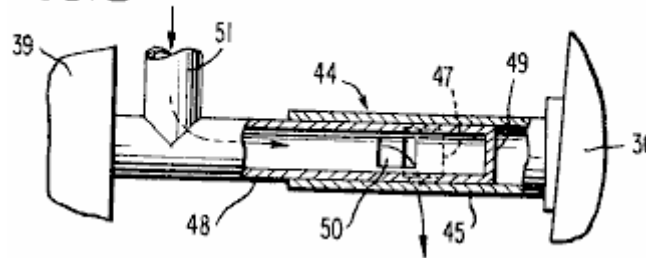
Within the chamber **32** is a gear pump **39** or the like having its input shaft connected by a coupling **40** with the turbine shaft **27**. Suitable reduction gearing **41** for the pump may be provided internally, as shown, or in any other conventional manner, to gear down the rotational speed derived from the turbine shaft. The pump **39** is supplied with the oil in the filled chamber **32** delivered by the exhaust nozzle or conduit **31** from the turbine. The pump, as illustrated, has twin outlet or delivery conduits **42** each having a back-pressure check valve **43** connected therein and each delivering a like volume of pressurised oil back to the high pressure chamber **15** at a pressure of about 500 p.s.i. The pump **39** also has twin fluid inlets. The pump employed is preferably of the type known on the market as "Hydreco Tandem Gear Pump," Model No. 151515, L12BL, or equivalent. In some models, other types of pumps could be employed including pumps having a single inlet and outlet. The illustrated pump will operate clockwise or counter-clockwise and will deliver 14.1 g.p.m.

at 1,800 r.p.m. and 1,500 p.s.i. Therefore, in the present application of the pump 39, it will be operating at considerably less than capacity and will be under no undue stress.

**FIG. 4**



**FIG. 5**



Since the pump depends for its supply of fluid on the delivery of oil at low pressure from the turbine 16 into the chamber 32, an automatically operating by-pass sleeve valve device 44 for oil is provided as indicated in Fig.1, Fig.4 and Fig.5. This device comprises an exterior sleeve or tube 45 having one end directly rigidly secured as at 46 to the movable free piston 36. This sleeve 45 is provided with slots 47 intermediate its ends. A co-acting interior sleeve 48 engages telescopically and slidably within the sleeve 45 and has a closed end wall 49 and ports or slots 50 intermediate its ends, as shown. The sleeve 48 communicates with one of the delivery conduits 42 by way of an elbow 51, and the sleeve 48 is also connected with the adjacent end of the pump 39, as shown.

As long as the chamber 32 is filled with low pressure oil sufficient to balance the low air pressure in the chamber 35 on the opposite side of free piston 36, such piston will be positioned as shown in Fig.1 and Fig.4 so that the slots 47 and 50 of the two sleeves 45 and 48 are out of registration and therefore no flow path exists through them. Under such circumstances, the oil from the chamber 32 will enter the pump and will be delivered by the two conduits 42 at the required pressure to the chamber 15. Should the supply of oil from the turbine 16 to the chamber 32 diminish so that pump 39 might not be adequately supplied, then the resulting drop in pressure in the chamber 32 will cause the free piston 36 to move to the left in Fig.1 and bring the slots 47 into registration or partial registration with the slots 50, as depicted in Fig.5. This will instantly establish a by-pass for oil from one conduit 42 back through the elbow 51 and tubes 48 and 45 and their registering slots to the oil chamber 32 to maintain this chamber filled and properly pressurised at all times. The by-pass arrangement is completely automatic and responds to a diminished supply of oil from the turbine into the chamber 32, so long as the required compressed air pressure of 3-5 p.s.i. is maintained in the chamber 35.

Briefly, in summary, the system operates as follows. The pressurised inelastic and non-compressible fluid, oil, from the chamber 15 is throttled into the turbine 16 by utilising the throttle valve 17 in a control station. The resulting rotation of the shaft 27 produces the required mechanical energy or work to power a given instrumentality, such as a propeller. A relatively small component of this work energy is utilised through the coupling 40 to drive the pump 39 which maintains the necessary volumetric flow of oil from the turbine back into the high pressure chamber 15, with the automatic by-pass 44 coming into operation whenever needed.

The ultimate source of energy for the closed power system is the compressed elastic fluid, air, in the tank or bottle 10 which through the regulating valves 11 and 37 maintains a constant air pressure in the required



degree in each of the chambers **12** and **35**. As described, the air pressure in the high pressure chamber **12** will be approximately 500 p.s.i. and in the low pressure chamber **35** will be approximately 3-5 p.s.i.

It may be observed in **Fig.1** that the tank **33** is enlarged relative to the tank **13** to compensate for the space occupied by the pump and associated components. The usable volumes of the two tanks are approximately equal.

In an operative embodiment of the invention, the two free pistons **14** and **36** and the tank bores receiving them are 8 inches in diameter. The approximate diameters of the bladed turbine wheels are 18 inches. The pump **39** is approximately 10 inches long and 5 inches in diameter. The tank **13** is about 21 inches long between its crowned end walls. The tank **33** is 10 inches in diameter adjacent to the pump **39**.

The terms and expressions which have been employed herein are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof but it is recognised that various modifications are possible within the scope of the invention claimed.

### **The Clem Engine.**

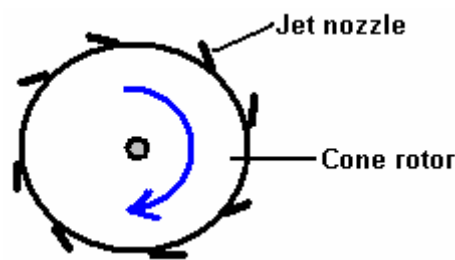
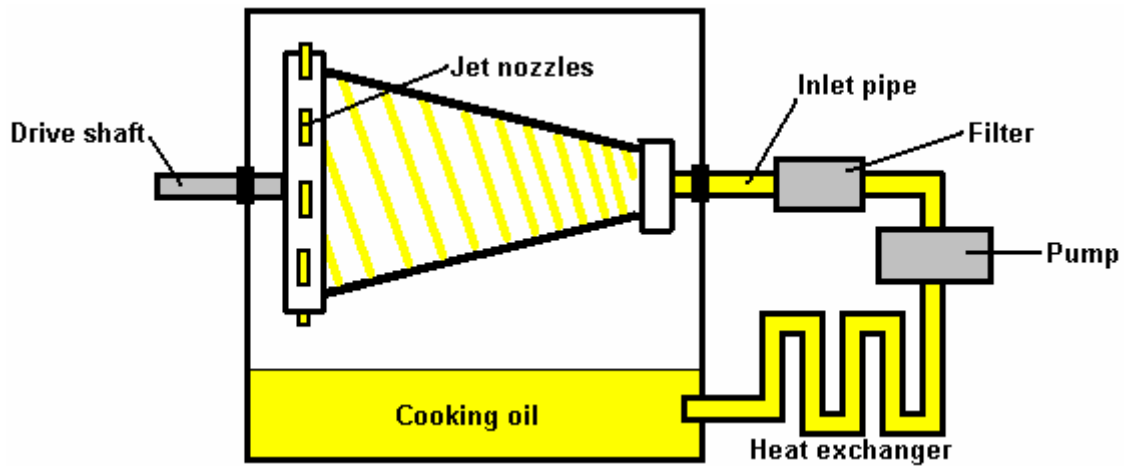
This engine is based on an entirely different principle, and one which is not spoken about very often. Hurricanes or "twisters" as they are sometimes called, are large rotating air masses of incredible power which develop in hot areas which are more than eight degrees North or South of the equator. The distance from the equator is essential as the rotation of the Earth is needed to give them their initial spin. They usually develop over water which is at a temperature of twenty-eight degrees Centigrade or higher as that allows the air to absorb enough heat energy to get started. That is why there is a distinct "hurricane season" in these areas, since at certain times of the year the ocean temperature is just not high enough to trigger a hurricane.

What is not generally realised is that a hurricane develops excess energy due to its swirling circular movement. The generation of this extra power was observed and documented by Viktor Schauburger of Austria, who also used his observations to great effect. I think that what Schauburger says makes some people uncomfortable as they seem to think that anything "unorthodox" has to be weird and too peculiar to be mentioned. This is rather strange as all that is involved here is a simple observation of how our environment actually works. A hurricane is wider at the top than at the bottom and this concentrates power at the base of the swirling mass of air. This tapered rotation is called a "vortex" which is just a simple name to describe the shape, but any mention of "vortex power" (the power at the base of this rotation) seems to make many people uncomfortable which is most peculiar.

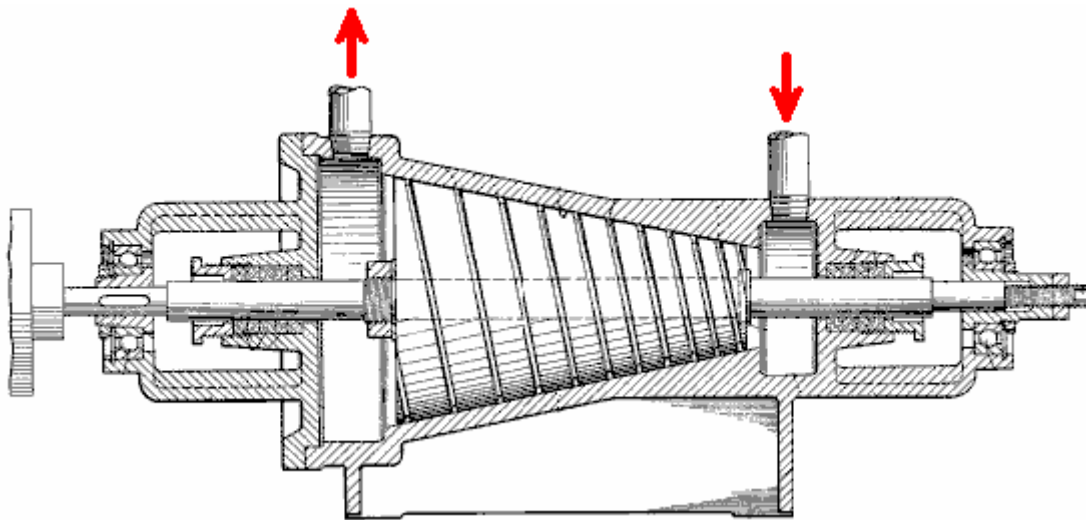
Leaving that aside, the question is "can we use this energy gain from the environment for our own purposes?". The answer may well be "Yes". Perhaps this principle is utilised by Richard Clem. In 1992, Richard Clem of Texas, demonstrated a self-powered engine of an unusual type. This engine, which he had been developing for twenty years or more, weighs about 200 pounds (90 kilos) and generated a measured 350 horsepower continuously over the full period of a nine-day self-powered test. Although this engine which runs from 1,800 to 2,300 rpm is especially suited to powering an electrical generator, Richard did install one in a car, and estimated that it would run for 150,000 miles without any need for attention and without any kind of fuel. Richard said that his prototype car had reached a speed of 105 mph. Just after receiving funding to produce his engine, Richard died suddenly and unexpectedly at about 48 years of age, the death certificate having "heart attack" written on it as the cause of death. Remarkably convenient timing for the oil companies who would have lost major amounts of money through reduced fuel sales if Richard's motor had gone into production.

The motor is unusual in that it is a rotary turbine style design which runs at a temperature of 300<sup>0</sup>F (140<sup>0</sup>C) and because of that high temperature, uses cooking oil as its operational fluid, rather than water as the oil has a much higher boiling point. To a quick glance, this looks like an impossible device as it appears to be a purely mechanical engine, which will definitely have an operating efficiency which is less than 100%.

In broad outline, the oil is pumped through a pipe and into the narrow end of the cone-shaped rotor. The engine is started by being rotated by an external starter motor until it reaches the speed at which it generates enough power to be sustain its own operation. The rapid spinning of the cone, causes the oil to run along spiral grooves cut in the inner face of the cone and exit through angled nozzles placed at the large end of the cone:



The operating pressure produced by the pump is 300 to 500 psi. Richard did not attempt to patent his engine as US Patent 3,697,190 "Truncated Conical Drag Pump" granted in 1972 as a liquid-asphalt pump is so close in detail that Richard felt that there was insufficient difference for him to be granted a patent:



There appears to be considerable scope for anyone who wishes to build or manufacture this engine and it is capable of acting as a heater as well as device for producing mechanical power. This suggests that water purification could be an additional "extra" option for this engine.

Prof. Alfred Evert of Germany has produced an analysis of the operation of the Clem Engine and turbines in this general category. His website <http://evert.de/indefte.htm> has this to say:

## 07.05. Centrifugal-Thrust-Engine

### Objectives

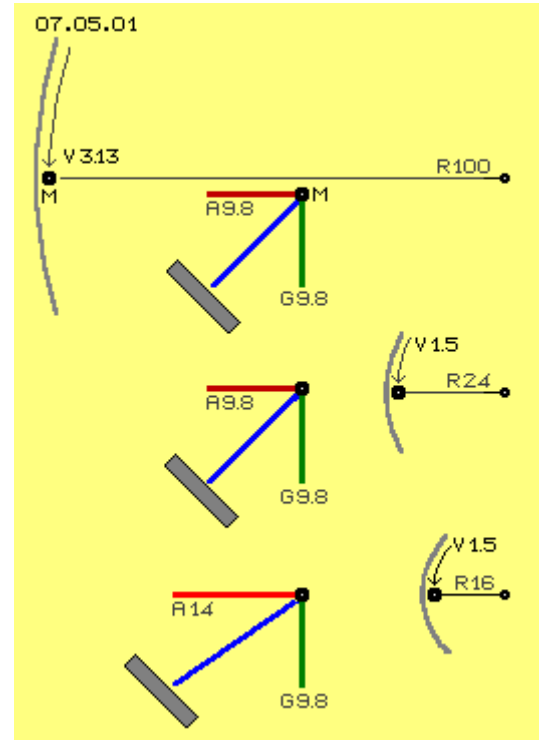
Several different versions of air-drive engines have been described in the previous chapters. One which is particularly powerful, is the “Suction-Cylinder-Engine” when driven by compressed air. Water-drive engines require a much more complex arrangement of closed circuits due to the strong centrifugal forces caused by using such a dense working-medium.

This new concept of the “Centrifugal-Thrust-Engine” shows that centrifugal forces can contribute to turning momentum. Initially, however, we need to discuss some general points of view concerning the inertia of rotating systems.

### Gravity and Centrifugal Forces

First, consider the movement of a mass (a sphere or body of water) moving in a circular path around the inside wall of a hollow cylinder. Centrifugal forces always press radially outwards while Gravitational forces always act straight downwards. **Figure 07.05.01** shows diagrams of three situations.

A partial plan view of such a cylinder is shown in grey. This cylinder has a radius of 100 cm (**R100**). Along its inner wall, mass **M** is moving at a speed of 3.13 m/s (see arrow **V3.13**). This mass is continuously pushed inwards by the cylinder. This inward acceleration **A** can be calculated by the formula Speed squared divided by Radius, in this case, with 3.13 m/s at a radius of 1 m, acceleration **A** =  $(3.13)^2 / 1 = 9.8 \text{ m/s}^2$ .



Matching that inward acceleration is the outward centrifugal force of that mass. That centrifugal force (**A9.8**) is shown as the red vector in the diagram. Gravitational acceleration is also about  $9.8 \text{ m/s}^2$ , and is shown here as the green vector (**G9.8**) in the diagram, acting vertically downwards. The resulting force is shown as the blue line in the diagram. If the cylinder wall were replaced by the inside surface of a cone with a 45 degree inclination, then the mass would rotate at the same speed, maintaining a constant height.

Now, consider the middle diagram. Here, the radius distance to the wall is only 24 cm (**R24**) and the mass is only moving at 1.5 m/s (**V1.5**). The inward, or “centripetal” acceleration produced is  $A = 1.5^2 / 0.24$  which is  $9.8 \text{ m/s}^2$  so, here again, the centrifugal force (**A9.8**) corresponds to acceleration under gravity (**G9.8**). Consequently, the diagram of the resolution of forces matches that of the previous diagram.

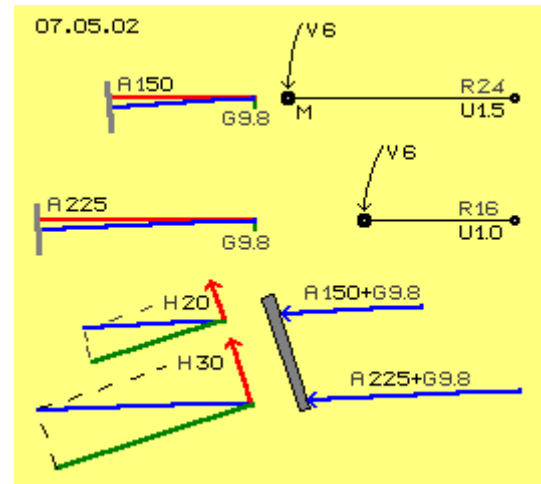
So whenever a mass completes one rotation in exactly one second, the centripetal (inward) acceleration is the same as acceleration under gravity. At a radius of 1 m, the circumference is about 3.13 m and so the speed is about 3.13 m/s for one rotation per second. At a radius of 0.24 m, the circumference is about 1.5 m and so one rotation per second requires a speed of 1.5 m/s, and so identical results are produced. Whether this happens to be a pure coincidence or due to some other cause, is discussed later in the section entitled “Aether Physics”.

In the lowest section of **Figure 07.05.01**, a rotation at this same speed of 1.5 m/s (**V1.5**), but this time at the shorter radius of, say, 16 cm (**R16**) produces a stronger inward acceleration given by  $A = 1.5^2 / 0.16$  which works out at about  $14 \text{ m/s}^2$ . As the force diagram shows, this results in the mass rotating along a circular track which is higher up than the previous tracks. This can be seen in action when coffee in a cup is being stirred vigorously.

### Lifting-Force

Now consider **Figure 07.05.02** which illustrates the effects of imposing higher rotational speeds on a mass. The radius of 24 cm (**R24**) and of 16 cm (**R16**) are now each propelled at the higher rate of 6 m/s (**V6**). The inward “centripetal” acceleration is correspondingly greater and is given by the equation  $A = v^2 / r$  which works out at about 150 m/s<sup>2</sup> (**A150**) and about 225 m/s<sup>2</sup> (**A225**) respectively.

In both of these cases, the centrifugal force is substantially greater than the gravitational force (shown as the short green near-vertical vector marked as **G9.8**) and so the resulting net forces (shown in blue in the diagram) are much closer to the horizontal than before. These masses will therefore rotate at a constant height when moving along the inner face of a cone which has much steeper walls (shown in grey).

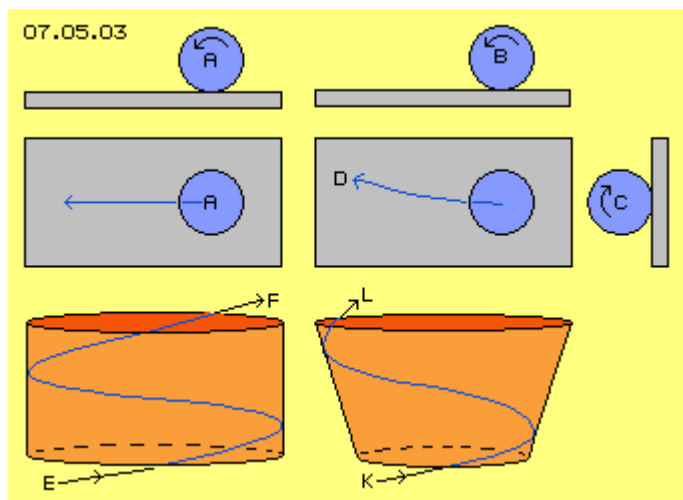


The lowest diagram of **Figure 07.05.02** shows the situation where these forces press against a less steeply sloping wall (shown in grey). The wall resists this pressure by pressing back at right angles to its surface (dark green vectors). Consequently, the remainder of the nearly horizontal centrifugal force produces an upward component (**H20** and **H30**, shown in red), parallel to the sloping face of the wall. Depending on the speed of the mass and the angle of inclination of the wall, this upward force causes an acceleration of the mass, upwards along the wall. In these examples, that acceleration is about 20 to 30 m/s<sup>2</sup>. In our example of coffee being stirred in a cup, the faster the stirring and the more angled the sides of the cup, the larger the amount of coffee which spills over the lip of the cup.

Notice that part of this centrifugal force becomes a component which acts in a direction opposite to gravity. In our example, the 6 m/s (six revolutions per second or 360 rpm), produces a lifting-force which is much greater than the force of gravity.

### Spiral Tracks

In **Figure 07.05.03**, the diagrams on the left hand side show sphere **A**, which might be a bowling ball, rolling in a straight line from right to left on a flat, horizontal surface. The plan view presented immediately below, shows that the movement of the sphere is a straight line.



However, as shown at the bottom left of the Figure, if the sphere is projected at an angle, into a vertical cylinder, then it follows an upward helical track from **E** to **F** in the diagram. The path followed is similar to a screw thread inside a nut or on the outside of a bolt. This same path would be followed if the moving object were a jet of water rather than a solid sphere.

The corresponding three diagrams on the right hand side of **Figure 07.05.03** show the situation for the sphere if instead of a vertical cylinder, it is projected into an inverted cone shape. In this instance, the path followed is a spiral curve starting at point **K** and continuing to point **L**. When this movement is shown on a flat surface, you will notice that the sphere rolls in a curve towards point **D**.

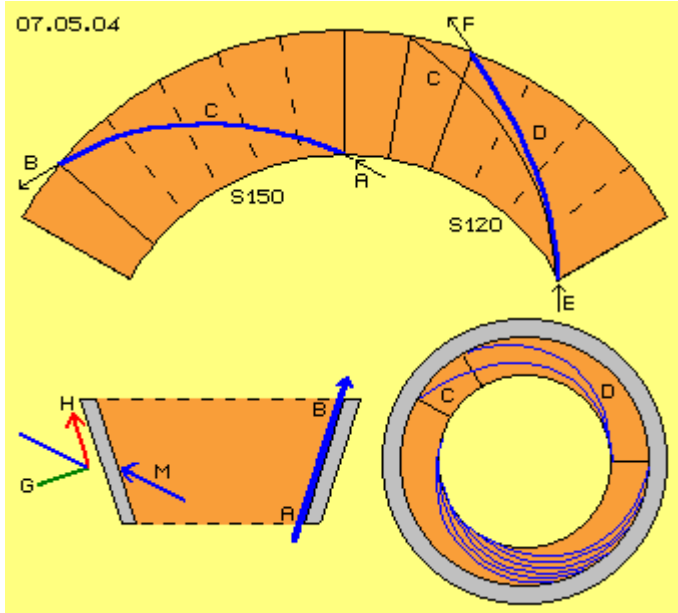
This shows clearly that there is an additional sideways force **C** acting on the sphere, causing this curved path. This has the effect that when the sphere is projected into the cone shape, it exits at point **L** with a greater upward angle than that with which it enters the cone at point **K**. This effect is also seen if a jet of water is used rather than a sphere or bowling ball. It should also be realised

that as the sphere runs upwards along the inside surface of the cone, that its path gets progressively steeper the further it rolls.

### **Steeper, Shorter and Faster**

In **Figure 07.05.04** the inner surface of the cone of **Figure 07.05.03** is shown opened out to form a flat surface. The cross-lines shown are positioned to indicate each 30 degree strip of the conical surface. If a jet of water is projected into the lower edge of the cone at point **A**, at an angle of 30 degrees, then it will exit from the top of the cone at point **B** some 150 degrees later (sector **S150**). The angle of exit is also 30 degrees and the spiral track **C**, shown in blue, is the path followed during its constant, steady rise through the cone.

The blue line **D** shows what happens when a jet of water is projected into the cone. It enters the lower edge of the cone at an angle of 30 degrees as before, but this time the water velocity is greater. As a result of this higher velocity, the water now exits from the upper edge of the cone at a steeper angle of about 35 degrees. That track **D** runs within a sector of the cone which spans only 120 degrees (**S120**) and so the track followed is shorter, steeper and covered more quickly than the jet of water flowing along the previous track **C**.



The diagram at the bottom right hand side of **Figure 07.05.02**, shows the cone as seen from the top. Track **C** with its constant rate of rise is shown, as is the steeper and shorter track **D**. The far side of the cone, shows several paths which indicate how the water flows if the angle of entry at the bottom of the cone, is increased in steps.

The diagram at the bottom left shows the cross-sectional view of the section of cone used in this discussion. It shows how the water enters at the bottom edge, moves along the inner wall and exits from the upper edge of the cone. The vector **M** shows the diagonal thrust of the water against the wall of the cone. This is the direct equivalent of the two forces **G** (against the wall) and **H** (upwards along the wall). Force **H** is much greater here than with the earlier example where the rate of upward movement was constant.

### **Provisional Result**

In this first section, only well-known facts have been mentioned. However, an understanding of these examples and their points of view will be important during the following discussion:

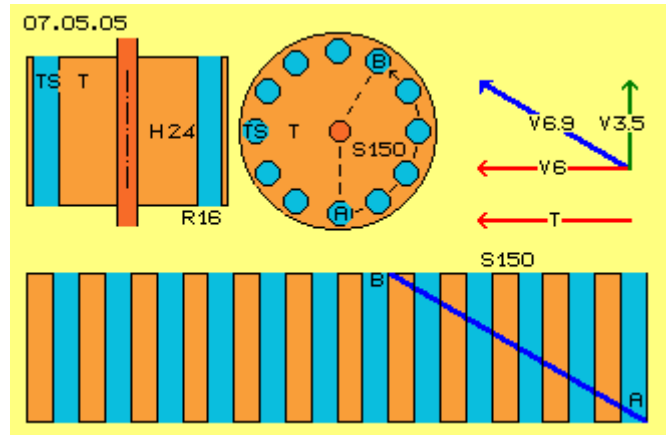
We have noted that:

- Centrifugal force equals that of gravity for one rotation per second.
- A mass at this velocity maintains a constant height on a wall inclined at 45 degrees.
- If the mass moves faster than that, it rises up the inner wall.
- The lifting force increases with increased velocity and/or wall slope and
- The track along the inner wall surface becomes increasingly steeper.
- The mass moves with increasing speed as it progresses towards the outer edge of the cone.

The “Centrifugal-Thrust-Engine” is based on the principle that a hollow cone-shaped cylinder is a ‘passive element’. Additionally, a working medium flowing along its stationary inner wall, is an ‘active element’. These key properties are now discussed in the following section:

## Rotor-Cylinder

**Figure 07.05.05** shows a representation of a turbine **T**. Initially, this is shown as a round cylinder. At the top left hand side of the diagram, a vertical cross-section is shown, and to the right of that is the view from above. The diagram at the bottom of the Figure shows the inside wall of the cylinder opened out and laid on a flat surface. The cylinder in this example has a radius of 16 cm (**R16**) and a circumference of 1 metre. Circular pipes are positioned vertically around the circumference to act in a similar way to turbine-blades (**TS** shown in blue). Here, twelve of these pipes are shown, each parallel to the system axis and running in a straight line from bottom to top.



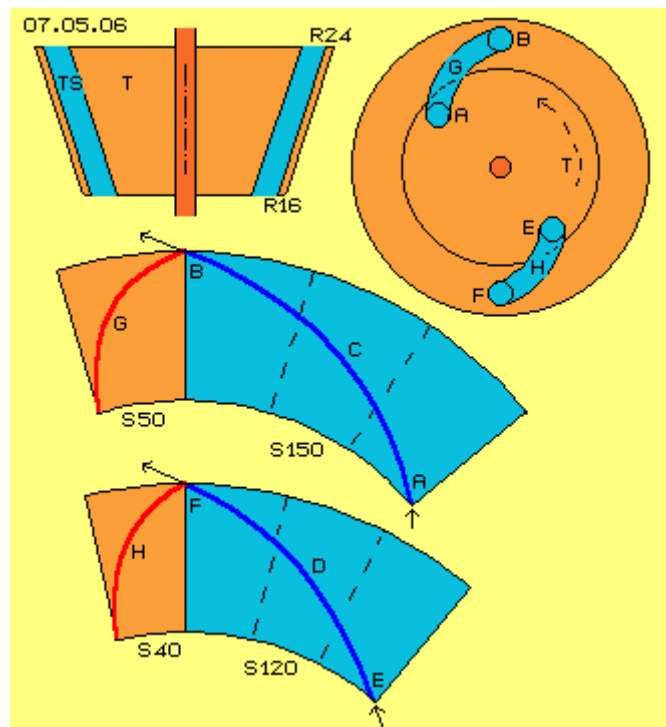
A 6 m/s jet of water enters the bottom of these pipes at an upward angle of 30 degrees. Due to the rotation of the cylinder drum, the water moves along the diagonal path **A** to **B**. As explained earlier, the water has a horizontal velocity component marked in red in the diagram as **V6**, and because of the angle of entry of the water, there is a vertical speed of about 3.5 m/s (shown in green and marked as **V3.5**). The water flowing in these pipes actually flows in a spiral path diagonally upwards, following the path shown by the blue line running from **A** to **B**. If the height of the cylinder is 24 cm (**H24**), then the water moves around through the whole of sector **S150** during its upward flow through the vertical pipes.

## Rotor-Cone

At the top left hand side of **Figure 07.05.06** a conical cylinder turbine **T** is shown. The pipes running up the inside of the cone are set with a 16 cm radius at the lower edge of the cone (**R16**) and a 24 cm radius (**R24**) at the top of the cone. These pipes therefore have a curved shape as they run up the inside face of the cone. These pipes can be thought of as performing the same function as turbine blades in a jet engine.

In the same way as before, a jet of water is fed at an upward angle of 30 degrees into the bottom of the pipes. Unlike the previous case, the jet of water does not strike the walls of the pipes at their lowest point because the water is entering parallel to a diagonal wall. In this case, as before, the overall height of the cylinder is 24 cm. The track taken by the water will be exactly the same as the previous track, running from **A** to **B** shown in the previous diagram, and again spanning a sector of 150 degrees (**S150**).

The central diagram of **Figure 07.05.06** shows the conical cylinder surface laid out flat. The dark blue curve **C** shows the path taken by the jet of water as it spirals upwards and outwards from **A** to **B**, within the sector **S150** shaded in blue. Interestingly, since the cone circumference at the outlet level is longer than at the inlet level (having 24 cm and 16 cm lengths respectively), The cone actually rotates at a greater speed than the speed of the water. This means that the water accelerates as it passes up through the curved pipes inside the cone (although that is not the intended job of any turbine).



As shown in the top right hand diagram, the pipes inside this conical turbine need to be curved backwards in the opposite direction to that in which the turbine rotates. These pipes are curved to follow the path shown in red and marked **G** which is contained within the 50 degree sector **S50**.

As stated earlier, the water flowing in these pipes presses against the outer wall, due to centrifugal force. Once the water speed is great enough, the water gets lifted upwards by its own motion. If the pipes allow that additional upward motion, then the water will exit from the top of the pipes at a more acute angle than the angle of entry at the bottom of the pipes.

The bottom diagram shows a design arrangement where the water enters at an angle of 30 degrees (point **E**), and exits at the same 30 degree angle (at point **F**). With this arrangement, the water travels along a shorter, steeper path **D** in a narrower sector of just 120 degrees (**S120**). Due to this shorter path, the pipe follows a different curve, such as the one shown in red and marked **H** in the diagram. The pipe itself, is contained in a sector of just 40 degrees (**S40**).

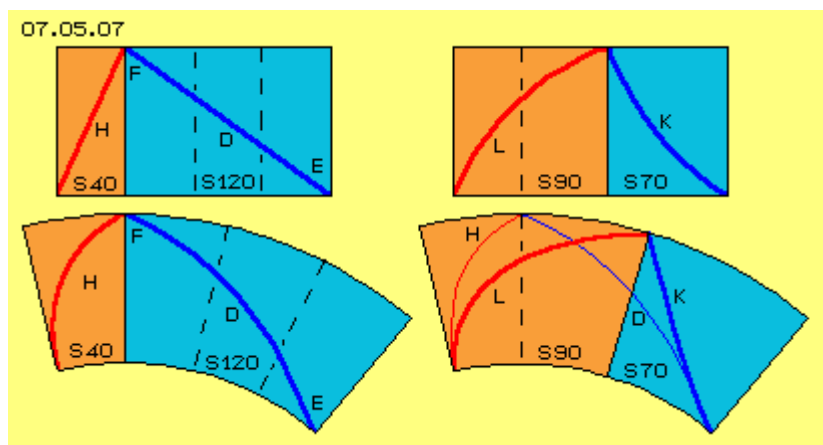
The diagram at the top right hand side of the Figure, show this short pipe run. The water enters at point **A** and flows upwards through the pipe marked **G**, to exit at point **B**. Notice that the pipe curves away from the direction of rotation. This is because the pipe acts something like a jet engine and the direction of thrust is in the opposite direction to the direction of the jet of water coming out of the pipe. The pipe shown in this illustration covers a sector of 50 degrees. However, remember that the water flowing in that pipe covers a sector of 150 degrees due to the rotation of the turbine cone. The lower pipe **H** shows the other design and it spans just 40 degrees. Water in that pipe flows upwards from **E** to **F** and passes through 120 degrees due to the rotation of the turbine cone, and it also flows faster and reaches its outlet earlier. These different pipes are only shown on a single turbine cone for illustration purposes, as any turbine construction will have all of its pipes constructed to one design or the other and not a mix of the two shapes.

### **Turbine-Blades**

On the left hand side of **Figure 07.05.07**, shown in red, is the 'neutral' track **H** of the actual water flow when crossing a cylindrical sector of 40 degrees (**S40**). Also shown in the top left hand diagram, (shown in dark blue) is the corresponding steep track **D** followed by the water when it flows across a cylindrical sector of 120 degrees (**S120**). In the lower left hand diagram, the corresponding paths for the flows across a conical turbine surface are shown.

However, if the flowing water is to be used to generate a driving force on the turbine cylinder or cone, then the diagrams on the right hand side of the Figure show the necessary arrangement. To achieve this aim, the pipes carrying the water need to be curved to a greater degree. Here, the curve of the pipes is increased by, say, an arbitrary additional 50 degrees to give a total of 90 degrees, as indicated by the curves marked **L** (shown in red) within sector **S90**.

Correspondingly, track **K** (shown in blue) is curved more sharply upwards with its sector reduced to a width of just 70 degrees (**S70**). This amount is the previous 120 degrees, reduced by our arbitrary 50 degrees. The upper right hand side diagram shows the design for a cylindrical turbine while the diagram below it shows the design for a conical turbine. The thin lines **H** and **D** show the original curves which would not apply any turning force to the turbine pipes were the water to flow through them. These paths could be called the 'neutral' tracks as they do not impart any thrust, and it takes the greater curvature shown by the thick lines to actually drive the turbine.



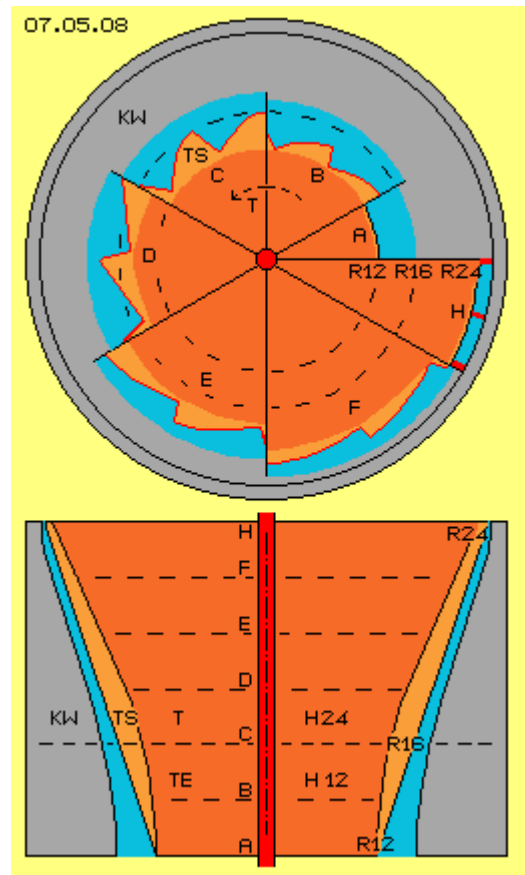
### **Cone-Wall and Cone-Turbine**

The lower section of **Figure 07.05.08** shows the cross-section of turbine **T** which has a radius of 24 cm (**R24**) at its upper edge and a radius of 16 cm (**R16**) at its lower edge and which has a height of about 24 cm (**H24**). Below the main conical turbine (shown below the dotted line) there is an inlet section marked as **TE** and which has an additional height of 12 cm (**H12**), and which tapers down to a radius of 12 cm (**R12**).

In the previous example, the general arrangement of the turbine-blades **TS** (shown in red), being curved pipes inside the turbine, was discussed. In this example, grooves are formed in the outer surface of the turbine cone. These grooves, or indentations, are open on the outside and the turbine cone is housed inside a cylindrical outer housing shown in grey and designated as **KW**. This outer wall supports an inner conical housing (not shown) and the turbine rotor revolves inside that conical housing.

Water (shown as light blue) fills the space between the turbine rotor and the outer conical housing. The water is bounded on one side by the smooth wall of the outer housing and on the other by the saw tooth shaped vertical grooves which form the turbine “blades”.

This example is needed to explain the curvature of the grooves at the surface of the cone. Unlike standard turbines, the water flows from a short radius inlet, to a much larger radius outlet. Water can't accelerate to reach the greater speed needed at the longer radius, so normal turbines have the water flowing from the longer radius inward towards the shorter radius. This causes deceleration of the water flow to generate torque. Consequently, our design here appears ‘wrong’ in conventional terms, and seems to make no sense in normal applications. This ‘wrong’ design only makes sense when using a cone-like rotor with its saw tooth-like blades.



### **Sawtooth-Blades**

Mechanical turning momentum (torque) is generated by flows which press against one side of the turbine blades. Commonly, turbines have blades where a groove is effectively created between two successive blades. In effect, the driving pressure of a turbine is applied to one face of this virtual groove. With this arrangement, the leading face represents the “pressure” side and the trailing face represents the “suction” side. The generation of torque is based on the difference of pressure between these two wall faces. This pressure difference is maximised if there is no suction side at all, that is, when there is no pressure at all on the “suction” side. This is possible along the surfaces of a cone-shaped turbine which has saw tooth-like grooves as already described.

These turbine “blades” have a pressure-side which faces in a radial direction relative to the direction of rotation. Each groove has a ‘bottom’ or inner side which faces in a tangential direction. Water flow which moves diagonally outwards effectively flows parallel to that inner face. The pressure-side plus the inner-side, form the contours of an asymmetric saw tooth shaped groove. Each inner-side extends from the inner edge of the pressure-side to the outer edge of the following pressure-side. These triangular shaped grooves effectively have no backside wall.

In **Figure 07.05.08**, the cross-sectional view shows several axial levels marked with the dotted lines **A** to **H**. The plan-view diagram shown at the top of the Figure indicates where these levels extend horizontally. At inlet level **A**, the radius is 12 cm and a ring-shaped cross-sectional surface is available for water to enter between the round turbine face and the round cone-shaped wall of the housing (drawn here across a sector of 30 degrees).

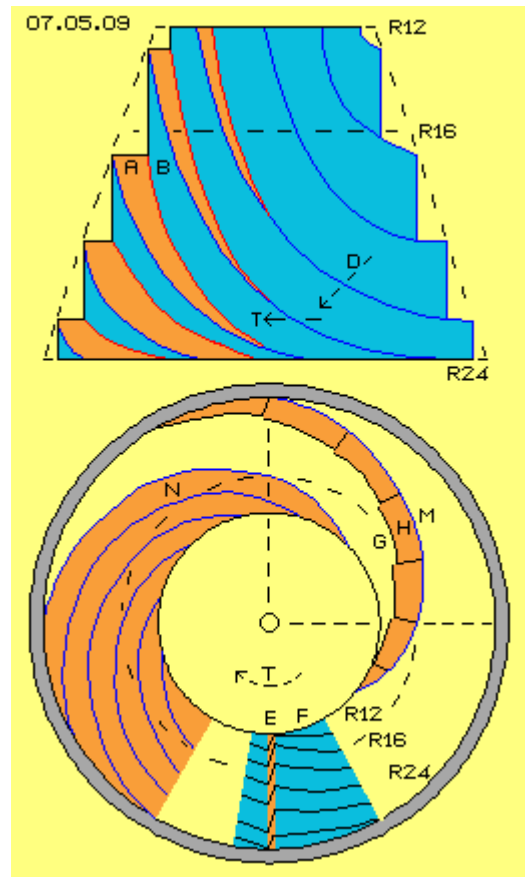


Further up, these tooth-shaped blades extend further out of the surface of the turbine cone. At point **B**, the inner edge still has a radius of nearly 12 cm, while the outer edge extends further out into the ring-shaped groove. Here for example, twelve turbine “blades” are shown, and in the 60 degree sector **B**, there are two of these “saw-teeth”.

Level **C** marks the junction between the turbine-inlet area (**TE**) to the main body of the turbine (**T**). The turbine “teeth” at this level have a radius of 16 cm and this level has the deepest grooves. This sector of 60 degrees has two of these teeth **TS**.

Further up, the outer circumference becomes greater and the notches become longer. If the cross-sectional area for water flow were to remain constant, then the notches would need to be correspondingly shallower. In sectors **D**, **E** and **F**, which again span a 60 degree sector, two turbine-blades are shown in each sector.

As sector **H** covers only 30 degrees, it contains just one tooth. At this top level, which has a radius of 24 cm, is located the turbine outlet, where water should exit, forming a homogenous flat jet. Consequently, the contours of the turbine rotor grooves should be ring-shaped. Also, the water which previous ran along the inner side of a cone-shaped wall, now is contained in a space between that wall and the inner turbine cone. These surfaces can effectively be a nozzle and this long groove can have additional divider walls (shown as thick red lines), to enlarge the pressure-surfaces in this area.



### **Winding Staircase**

**Figure 07.05.09** attempts to give the impression of the spiral arrangement of the previously described tooth-shaped notches running around the surface of the turbine cone. The cone-like mountain shape has faces **A** running all around it. These faces start at a low angle and then become steeper as they rise higher. Each of these has a vertical wall **B** alongside it, formed by the side of the next innermost face. These faces are not visible at the right hand side of the diagram as their downward slopes are hidden from view.

For clarity, in this diagram the cone is shown inverted, and so the direction of rotation appears clockwise, but in reality, when in its correct position, the rotation will be counter-clockwise. Notice in the upper diagram, that the incoming water **D** hits these faces at nearly a right-angle, providing substantial thrust in the direction of the arrows.

As the lower diagram shows the top view of the inverted cone it has the appearance of a conical hill. At points **E** and **F**, lines are marked which indicate the height of the saw tooth shaped indentations in the surface of the cone. The lines at **E** represent the pressure-side, while at **F** the inner side indicates only the slope surface and thus no ‘suction-side’ exists.

Now these indentations are not arranged to run straight down but are shifted as shown in the diagram at point **G**. Previous vertical indentations **E** now create the pressure-wall **H**, which corresponds to the previous indentation **A** in its spiral path. The inner-walls **F** of the earlier indentations thus create the surface **M** through their vertical walls **B**. In effect, the whole hill is built from these successive ‘winding staircases’, which admittedly actually don’t have any stairs. These paths spiral upwards with progressively smaller radius and increasing steepness.

At point **N** in the diagram, part of several of these spiral pathways is shown. Here, the vertical walls between them are visible only as small blue curves. The whole of the surface area of this

turbine cone is a pressure-side because of these spiral surfaces running all around it. Like diagonally falling rain, water flows all around the surfaces of that hill in its downward flow, and anywhere it is forced to turn right it generates a rotational force on the turbine cone. Remember that this machine has a cone-shaped housing which ensures that the water flows exactly in its intended path.

### Crossing Flows

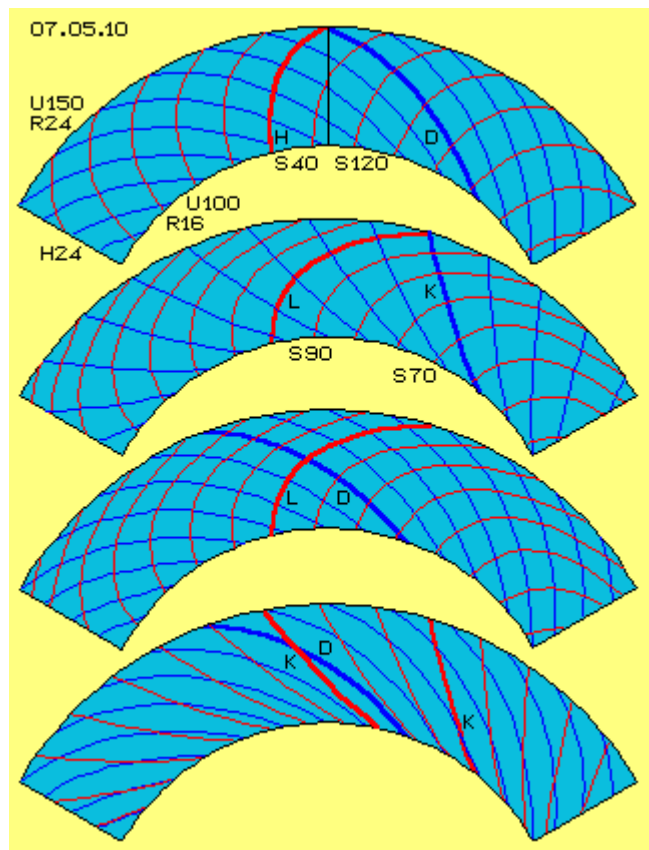
To summarise, in **Figure 07.05.10** the complete 360 degree surface of the cone is shown four times one below the other. Since the wide part of the cone has a radius of 24 cm it has a circumference of about 150 cm (**R24** and **U150**), while the narrow part has a radius of 16 cm and hence a circumference of about 100 cm (**R16** and **U100**). The length of the side-surface is about 24 cm (**H24**). Using this example with these dimensions, the upward flow is along the indentations in the cone and along the walls of the cone.

The angle of entry of the water at the narrow circumference was assumed to be 30 degrees. Maintaining this steady angle would cause the water flow to cover an angular sector of about 150 degrees, exiting at that same angle. Due to the centrifugal force of water striking the wall at an angle, an upward force is generated which causes the water to follow a steeper track and exit after crossing a sector which spans only 120 degrees or so (**S120**) and exit at an increased angle of about 35 degrees. That track **D** (drawn in blue) is shown several times in the top diagram.

Water flowing in indentations will follow this track. However, this water can't follow the faster moving wider circumference at the top of the cone. In order to achieve the 'neutral-force' track for the complete path across the cone, the indentations need to have an increased backward curvature of one third. This indentation track **H** is shown in red and is contained within a sector of 40 degrees (**S40**) and this path is also drawn several times in the top diagram.

In order to have the turbine generate a mechanical turning force, the indentations need to be curved backwards more strongly. Here, for example, that sector was extended to cover 90 degrees (**S90**) so water is channelled outwards faster, and exits after covering only 70 degrees (**S70**). In the second diagram that indentation **L** (shown in red) and water track **K** (shown in blue) are drawn several times.

The indentations of the turbine are shown here as saw tooth-like notches which are open on their outer side. This arrangement results in two separate flows: on the one hand, there is forced flow within the indentations and on the other hand there is the free flow of water on the wall of the cone. In the third diagram, these indentations **L** (shown in red) are drawn several times as are the tracks of the free-flowing water **D** (shown in blue). These two paths cross each other at an angle of about 90 degrees.



Because free-flowing water projected upwards is too slow for the turbine-surface which is moving rather fast, but the water movement will be fast enough if it flows along the indentations **L** which are curved backwards as shown in the bottom diagram. In this diagram, both track **D** (shown in blue) taken by the free-flowing water and the indentation-forced track **K** (shown in red) are shown. Again, both flows are drawn several times and it can be seen clearly that these paths cross each other at an acute angle. The free-flowing water 'brushes' across the water which is flowing

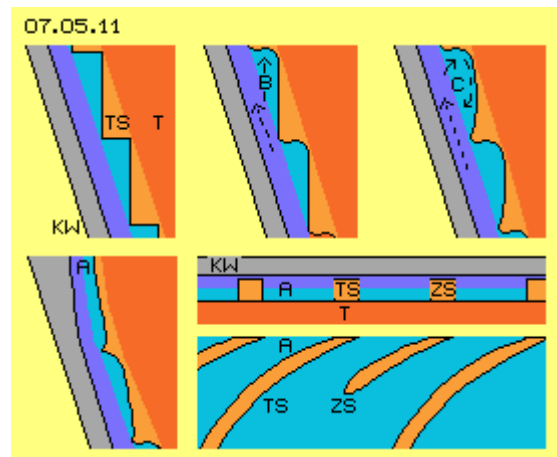
forwards in the indentations. It does this in the direction of rotation and this causes the water flowing in the indentations to start revolving.

Water within the indentations becomes redirected backwards and transfers its inertia to the pressure-sides of the indentations, thus decelerating its forward motion. This water still has centrifugal force, but the further out it progresses, the faster the pressure-sides run away ahead of it. This water which is flowing 'too slowly' can only apply pressure to the walls if they were much more strongly curved backwards, and even in that case it would only be by a small angle which would impart practically no additional turning momentum.

Also, free-flowing water can't keep up with the faster movement of the turbine at its larger exit circumference. However, the outward water flow is easily fast enough to fill the grooves with water and produce additional rotation around its longitudinal axis. This revolving-water-cylinder effectively works like a gear wheel as it applies the pressure of the free flowing water on to the pressure-sides of the grooves. The water flowing along the cone-wall is not pressed into the grooves, and so it is not redirected and its forward motion is not decelerated. So the centrifugal forces of that free-flowing water can go on contributing to the turning momentum of the turbine, but only indirectly, by driving that water-cylinder within the grooves.

### Spin inside the Grooves

Figure 07.05.11 shows sections of the area between the cone wall KW (shown in grey) and the turbine cone T. Free-flowing water moves alongside the cone wall, moving upwards and outwards. At the surface of the turbine, the turbine blades TS (light shading) are arranged in the shape of saw tooth-like notches. Water flowing within these grooves is guided outwards along the ever steepening track. Turning momentum is generated by the redirection of this part of the water flow.



On the pressure-sides of these grooves, there is also the additional pressure of the free flowing water B. This component of the water flows along a path which is not so steep and so it moves faster in the direction of rotation, i.e. it sweeps over the grooves. This generates a revolving movement C, in the water flowing inside the grooves. This increases the pressure on the pressure-sides of the grooves. So, this free-flowing component of the water flow, contributes indirectly to the turning momentum of the turbine.

The diagram at the lower left hand side of the Figure is a sketch of the outlet at the top of the turbine. The inner wall of the cone is curved slightly inwards as shown. This guides the free-flowing component of the water flow into the grooves. It should also be noted that as this part of the water is redirected, it is also decelerated which contributes further to the turning momentum of the turbine.

At the lower right hand side of the Figure, both the cross-sectional and longitudinal views of the outlet are shown. Here, the groove is no longer saw tooth-like but instead it has a constant width, and this causes the water to exit in a continuous jet. The groove here is rather wide and could well be divided by the introduction of additional blades ZS, which would allow the water pressure to be applied to a greater surface area.

To summarise; with this arrangement, not all of the water flow is forced into the grooves and immediately redirected and decelerated. The free-flowing parts of the water are allowed to move in its natural direction and under the influence of the centrifugal forces they follow a steeper path as they flow outwards and upwards. Moving along this track causes the water to cross over the water flowing in the grooves. This in turn, causes the water in the grooves to rotate as it flows upwards and this additional revolving movement add to the torque being generated by the water flow. Finally, as it nears the outlet, the free-flowing component of the water is directed into the grooves

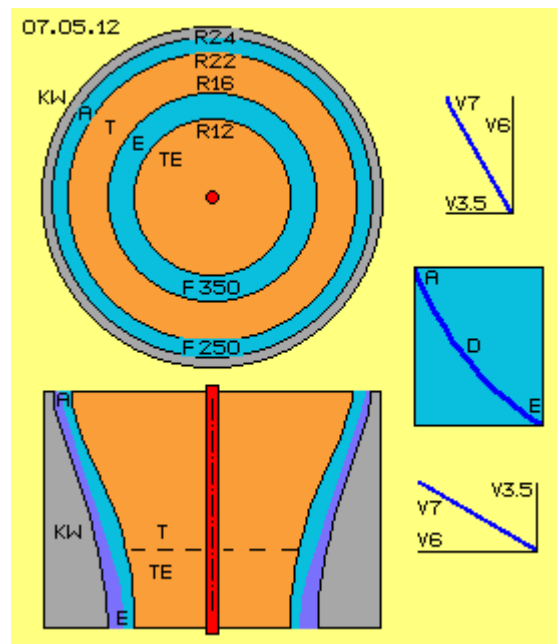
and this redirection causes a deceleration which adds even further to the rotational drive of the turbine.

One further beneficial effect which is easily overlooked, is the fact that the water in each groove forms a long stretch of rotating water. This length of rotating water rotates faster in the upper sections of the groove and a twisting vortex of this type generates a strong suction which pulls the water entering the turbine inlet, strongly upwards towards the outlet of the turbine. This has been described in detail in earlier chapters and is further discussed later on in this document.

### Cross-Sectional Surfaces

The lower diagram of **Figure 07.05.12** shows a cross-sectional view through a cone-shaped turbine **T**, which has its intake extended downwards by an additional section **TE**. Between the turbine and the conical wall **KW** (shown in grey), water flows from the intake at the bottom **E** and exits at the upper outlet **A**. This flow has two components. The first, which is shown in dark blue, flows freely along the conical wall. The second, which is shown in light blue, flows in the grooves or indentations formed by the saw tooth-like turbine "blades".

The upper diagram in the Figure shows a schematic cross-sectional representation of the plan view of this turbine. The ring-shaped water outlet **A** is shown in light-blue. This outlet is formed between the inside of the conical housing, which has a 24 cm radius at this level, and the cone which has a 22 cm radius. These are marked as **R24** and **R22** respectively, and between them a 2 cm wide outlet is formed, with a cross-sectional surface area of about 290 cm<sup>2</sup> (**F250**). Also shown in light blue, is the ring-shaped inlet **E**, formed between a radius of 16 cm and one of 12 cm (**R16** and **R12**), and so is 4 cm wide, with a cross-sectional area of about 350 cm<sup>2</sup> (**F350**).



On the right hand side of the Figure is shown the previous curve **D** (shown in dark blue), which represents the track of the water flowing in the grooves. Water enters the turbine along its lower edge, at an angle of about 30 degrees and exits from the top of the turbine at an angle of about 60 degrees. Free-flowing water also enters the underside of the turbine at a very low angle and flows upwards until near the outlet it is directed into the grooves where it also exits the turbine at that same steep angle.

In the example above, it was assumed that the inlet water speed was about 7 m/s (**V7**), i.e. entering at an angle of 30 degrees while moving in the horizontal direction at about 6 m/s (**V6**), the same speed that the turbine is moving at that level. The inlet, water has a vertical rate of movement of about 3.5 m/s (**V3.5**). If we were to assume that the water speed at the outlet is also 7 m/s, due to its steep exit angle of 60 degrees, its horizontal velocity will be only 3.5 m/s. However, it actually exits at a vertical speed of 6 m/s (see the vector-graphs).

Within pipes, the linear speed of flow is inversely proportional to the cross-sectional area of the pipe. In our particular case, due to the rotational component of motion, the flow also depends on the 'gradient' of the flows, and not just the speed of movement in the axial direction. If water exits at the top at 6 m/s through an opening with a cross-sectional area of 250 cm<sup>2</sup>, then if the inlet flow has a vertical speed of only 3.5 m/s, then it would require an inlet cross-sectional area of about 430 cm<sup>2</sup>, so our cross-sectional area of only 390 cm<sup>2</sup> is a little too small.

### Suction Effect through Centrifugal Force

It was mentioned above, that centripetal (inward) acceleration is stronger than the acceleration under gravity at relatively low speeds within a radius as narrow as this. Since centrifugal force increases with the square of the speed, the outward pressure is a multiple of the weight of the

water. With the inclination of the conical housing wall shown here, about one third of this force results in an upward push along that wall.

Because of this, the upward water flow gets shifted on to an increasingly steeper track and consequently it exits from the turbine outlet at a rather acute angle. But if the cross-sectional area of the intake is too small, then a sufficient mass of water is prevented from flowing into the turbine and the upward movement is hindered. This causes the free-flowing component of the water to move along a flatter track, which again results in increased centrifugal forces. So, finally, an inlet with too small a cross-sectional area creates enormous suction forces and the inlet water is pulled upwards very strongly.

The turbines described in previous chapters, could only use the flows generated by pumps. With an air-driven machine, it is possible to generate areas of relative void into which air particles move through their own normal molecular movements. Autonomous acceleration up to the speed of sound is possible with a minimum of input energy.

Water is not compressible, so pressure is transmitted through water immediately. Suction pressure also acts immediately with no delay. Consequently, if the water in the upper areas of the turbine is pushed upwards by centrifugal forces, these forces also exert an upward pull on the water lower down in the turbine. So unlike all of the machines described earlier, in this turbine, flows are generated based on the effects of centrifugal force alone. Experiments with similar machines has confirmed that more water was pulled upwards than gravity would have been able to move downwards when acting on the same mass of water, even when just simple cones with plane surfaces were used.

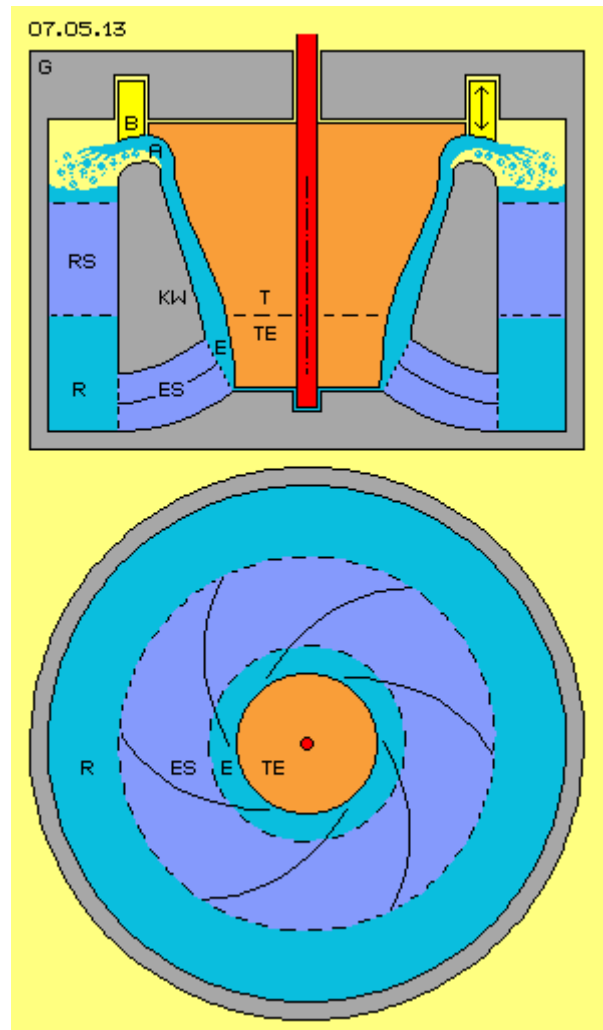
### **Pump-Turbine Hybrid**

Turbines of this type can also work as a pump. If the cone is driven around, then it will cause the surrounding water to rotate. At the housing's conical wall, water gets lifted through the centrifugal force. That 'pump' has no forward-facing surfaces and so it can't affect the pressure. The water is presented with vertical walls in close proximity to 'winding staircases' which move continuously dragging the water into rotation. The higher that the water is lifted, the greater the cone radius encountered, and the greater the centrifugal forces which it experiences.

As the rotational motion increases, the lifting force-component become stronger and the water gets pressed into the diagonal surfaces of the grooves, and the turning momentum is achieved which allows the pump to become self-powering and no longer needing any input power to continue operating. If the speed of rotation continues increasing, and turbine-mode is achieved, then, if the turbine is not loaded it will accelerate automatically until the water can't enter the inlet any faster or alternatively, until the turbine self-destructs.

### **Safety first: Avoiding Liability**

In [Figure 07.05.13](#), the previous discussed elements are shown installed in housing **G** (shown in grey) along with some additional elements. The most important new component is the 'sluice-valve' **B** (shown in yellow). This is a ring-shaped device which can be raised or lowered (as shown



on the right hand side of the diagram), to control the water flow, and if necessary, bring the device to a complete standstill in the event of uncontrolled self-acceleration.

If preferred, that control valve can be of different construction and installed elsewhere. A definite requirement of any piece of equipment of this type is the ability to guarantee complete safety during operation. It should be remembered that centrifugal forces increase with the square of the speed, which means that the rapid rotation of a mass of just one kilogram can generate a loading on the housing wall of several tons. Part of this enormously enlarged force is converted into turning momentum.

I have only described movement principles in general, and how some constructional elements could be designed. However, it must be made completely clear, that I accept no responsibility or liability for the actual construction or use of any such machines. The complete responsibility for all risks, rests solely with whoever decides to actually construct or operate any such machine.

### **Circuit**

As described in detail above, water (shown in light blue) is sucked in through inlet **E** into the area of the turbine-inlet designated **TE**. This water then flows both upwards and outwards, flowing inside saw-tooth-like turbine-grooves positioned close to the conical wall of the outer housing **KW**. Approaching the exit point, the water is deflected into a groove which runs all around the turbine cone, so that at outlet **A**, in **Figure 07.05.13** a steady, flat jet of water is ejected outwards. This water flies into the air-filled area shown shaded light yellow, and falls under gravity as indicated by the blue points. The level of the water in that backflow area **R**, is only a few centimetres below the level of outlet **A**, so water is lifted against gravity through only a small height.

The water flow exiting the turbine does so at a relatively steep angle, and that flow moves relatively slowly relative to the already spinning turbine cone. When flowing downwards, the water should generate some faster rotational movement, guided by correctly curved fins, marked here as 'backflow-stator' **RS** (shown in dark blue). The conical wall is attached to the housing by these cross-beams.

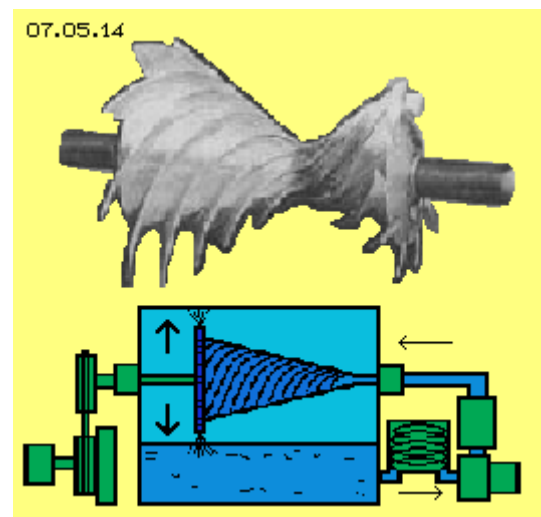
In the lower diagram, at the backflow-area, an 'inlet-stator' **ES** (shown shaded in dark blue) is marked and through these fins water is directed again into the turbine intake area. As explained earlier, suction, generated by centrifugal forces, pulls the water upwards. That water does not flow straight upwards but rotates as it moves upwards and so rotational acceleration forces are generated.

The inlet area is divided by six appropriately curved fins, as indicated in the plan-view schematic diagram at the bottom of the Figure. These conduit sections could have vertical dividers if so desired. The shape (or any equivalent design of conduit) produces the necessary rotation and angle of water flow needed at the turbine inlet.

### **Example: Mazenauer and Clem**

Experienced readers will be familiar with the engine of Hans Mazenauer and the working engine of Richard Clem. These are detailed in my "Ether-Physics" book in chapter 05.10: 'Tornado-Motor' and in my 2005 chapter entitled 'Auto-Motor'. In these, I concentrate on working out the suction-effect of twisting flow within the indentations, while here in this design of the 'Centrifugal-Thrust-Engine', enormous centrifugal forces are used.

Mazenauer did use air-driven double-cones as shown in the upper illustration of **Figure 07.05.14**. This did accelerate unaided from a stationary start right up to a speed which caused it to self-destruct. Most unfortunately, Mazenauer was financially ruined by these experiments, and so was unable to complete his work successfully. Mazenauer used a double-cone, where the large part



(shown on the left hand side of the illustration) worked as a turbine while the small part functioned as a pump. During operation, air got moved in inward-turning and outward-turning vortices, overlaid by twist flows within the grooves.

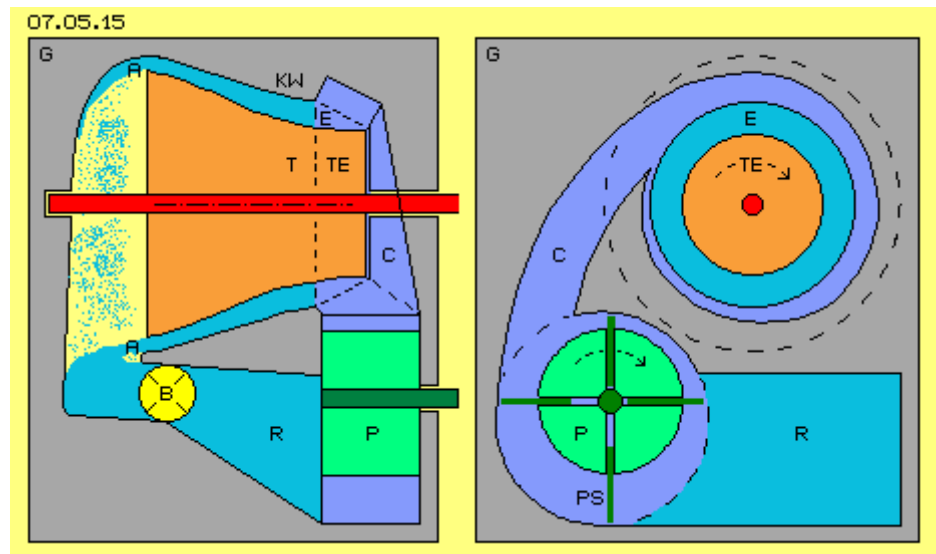
However, a pump of this type which has the driving medium flowing from the outside towards the inside will not be very effective. What is needed is a turning vortex which moves towards the turbine intake and this is better generated by stationary fins of the previously shown inlet-stator (at least when using water as working medium).

Clem based his engine design on an asphalt-pump, and without the slightest doubt, he ran his car without consuming any common fuel. Based on known sketches and pictures, he did use a cone with grooves arranged with rather small gradients (see the lower diagram). However a working-medium which flows in grooves is 'stirred' by the pattern of its own movements. While that is an advantage for heating asphalt, it meant that Clem had to dissipate surplus heat, and because of the high temperatures generated he used oil as his working medium. As shown by my analysis above, much steeper indentations combined with much better angles, generate far greater torque. In addition, Clem's grooves were rather small and did not present large surfaces with strong resistance to the driving medium.

As is the case here, the centrifugal forces of water movement is utilised, and the turning momentum is achieved by pressure applied to the turbine surfaces. For this reason, the grooves need to expose only their pressure-sides, on which flows can produce the best effect. So, unlike these examples from Mazenauer and Clem, my analysis indicates that 'grooves without suction-sides' shaped by these saw tooth-like turbine-paths, are very advantageous.

### Horizontal Shaft

When using a horizontal shaft version of an engine of this type, some additional components and details are needed to implement the design. This arrangement is an interesting variation and it can be in the form shown in **Figure 07.05.15**. Here, the conical wall **KW** (shown shaded in grey), turbine **T** and the turbine inlet **TE** are similar to those already discussed. At the outlet **A** however, water now falls downwards (as indicated by the blue dots) through the air-filled area (shaded in light yellow) into the reservoir. As in the previous example, at the outlet there is a safety-valve **B** (shown in yellow) which is installed to control the flow.



Water flows into the backflow tank **R** (shaded light blue). From there, it is guided towards inlet **E** via pump **P** (shown shaded green) and the snail-conduit **C**. This inlet-conduit is arranged diagonally, so that water enters the space between the conical housing wall and the turbine cone at the angle required for the operation of the turbine.

The pump is installed fairly low down in the water tank as it is only used when starting the turbine from standstill. Once the turbine is running, the turbine creates sufficient suction to maintain the water flow without the need for the application of any external power. The water pump just turns idly when the turbine is running, rotated by the water flow caused by the suction created by the rotation of water inside the conical turbine section. It is actually possible to boost the rotational speed of the turbine by powering the pump and thus boosting the mass flow through the turbine.

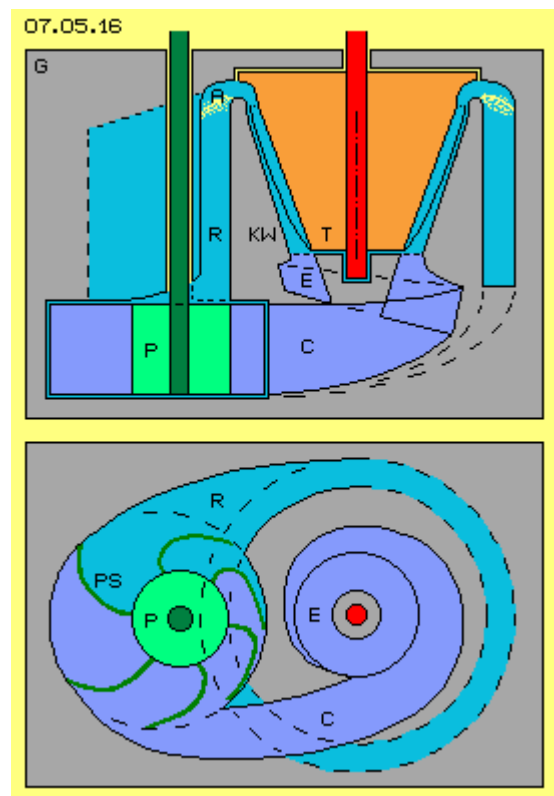
In principle, any pump could be used in this position. In this example, the schematic shows a 'slide-pump' **P** with its eccentric shaft and radial-moving pump blades **PS** (shown in dark green). The advantage of this kind of pump is that it has a precisely known volume contained within its chambers and that exact volume is transported during each revolution. Hence, the pumped volume is exactly proportional to the pump revolutions.

### Small Constructional Volumes

A turbine engine of this type with a horizontal shaft, could be installed in vehicles to provide the mechanical drive via a standard clutch and gear transmission. On the other hand, since electricity has so many different uses, this engine could readily be used to drive an electrical generator. The electricity produced by such an arrangement could readily be used for both powering a pump and its control units. Mind you, electrical generation can also be achieved quite easily with a vertical shaft turbine.

In general, we tend to think that a larger throughput volume will be needed to produce a greater level of performance. Here, however, the performance is based on centrifugal forces and inward acceleration and since these are inversely proportional to the radius, the usual idea that performance increases with increasing size, just does not apply. At any given speed, the centrifugal force at a small radius is much greater than at a large radius, and the vertical lifting component is also correspondingly stronger in smaller turbines.

The turbine **T** shown in **Figure 07.05.16**, has a wide exit-level radius of only 18 cm. The conical inner surface of the housing **KW** (shown in grey) angles downwards in a straight line to a snail-like inlet-area **E**. Water exits from the top of the turbine through outlet **A** and flows back down through the backflow-conduit **R**. This backflow winds spirally downwards and enters pump **P** (shaded green) which pushes it through conduit **C** back into the snail-like inlet at the base of the turbine. The path of the water through the turbine and subsequent backflow conduit is shown here shaded in light blue, while the water path within the pump and the turbine inlet is shaded in dark blue.



The pump shown in this schematic diagram is an impeller type of pump which operates in a similar way to the previously mentioned slide-pump where each revolution of the pump represents a known volume of water throughput. This turbine is controlled by the revolutions of the pump. When the pump is stationary it operates very nearly the same as a stop-valve. In addition, the suction produced by flow at the conical wall has an effect back through the inlet to the pump. When the turbine is running, the pump effectively acts as a 'moderator' which does not require much in the way of energy input.

It is also possible for all of the internal space of the turbine to be filled with water, including the area at outlet **A**, thus producing a completely closed circuit of water. This design of turbine could also be arranged to have a horizontal shaft. In addition, this general principle of combined movements can be applied to most variations of turbine design.

### Impossible?

We now come to the question which is often asked, namely, "why does this machine work at all?". Without any shadow of doubt, when spun at a high rate of revolutions per minute, a one-kilogram mass produces literally tons of pressure on the inner walls of a surrounding cylinder. Given cone-



shaped inner walls, there is not the slightest doubt that a flowing mass of water will press outwards from a narrow radius towards a wider radius. Also, without question, is the fact that this flow can generate mechanical turning momentum via turbine-blades as a side-effect. What needs to be determined through experiment, is the optimum energy draw-off and distance between the turbine cone and the conical inner wall of the housing. What is absolutely certain is that the turbine will not require the entire kinetic energy produced to power itself.

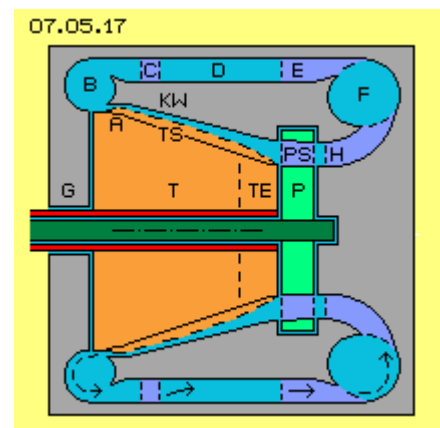
Because water has 'cohesive consistency', any flow along the conical wall produces a suction effect on the water below it. This means that the flow-pressure is like flow-suction and so produces a closed flow-circuit. Backflow must be organized with the lowest level of friction losses and should be 'force-neutral', requiring no energy input to function as required. It is important that the water being channelled to the narrow radius inlet does not oppose the centrifugal forces operating the turbine.

When these design parameters are applied, a steady circuit flow with excess energy generation is possible. The dynamic pressure of the 'water-fall' of the water (which has considerable weight) is converted into mechanical turning momentum, and after that the water must continue its flow in an 'energy-neutral' way as it is guided inwards to the inlet-area. Various constructional measurements were given in the above example of how this motion principle operates. However, it should be realised that those measurements were just presented as an illustration of the principles involved and many alternative dimensions may be used when a turbine of this type is being constructed. The following design also illustrates an effective working design.

### Outlet and Water-Cylinder

In **Figure 07.05.17**, a horizontal axis turbine **T** is shown which has tooth-like turbine-blades **TS** as part of the cone. The main cone of the turbine is extended by the turbine inlet section **TE**. Opposite these surfaces is the hollow-cone of the conical housing wall **KW** (shown in grey) and it is attached to the main housing **G** (also shown shaded in grey). Water, (shown in light blue) flows between these surfaces in a rotating motion. This physical construction and operational movement is the same as in the previous examples.

In the previous examples of construction, it was suggested that the flow along the side cone-wall was directed into the turbine grooves just before exiting from the turbine cone. For this to be effective, it is necessary to have an adequate flow in the outlet region. Only practical experiments can determine what percentage of the free-flowing water is the most effective to directed into the turbine grooves at this point. For example, this diagram shows a design of outlet **A** where all of the water at the cone wall can flow off freely. Here, cone ridges produce a smoothly curving water flow across the surface of the turbine cone.



A new constructional element in this design is shown as ring **B** which runs all the way around the upper edge of the turbine cone. Water enters this 'round pipe' tangentially and does a U-turn of some 180 degrees. Previously, it was shown that water left the outlet at an angle of about 60 degrees, so water will enter this pipe by a spiral track. No matter what the angle of entry is, the water will exit from the 'round half-pipe' tangentially because of its own motion generating centrifugal force (so, as drawn here, it will move towards the right hand side).

Sharp redirections like these ones, normally produce turbulent flows with corresponding major friction losses. This is because within any normal pipe bend, the inner flow path around the bend is much shorter than the outer flow path around the bend. But, in this case, there is no inner part of any such narrow bend, and the water keeps rotating in a cylindrical movement as it flows. Within these water-cylinders, flow layers of different radius and different turning-speeds balance out without friction. This 'all-around' pipe with the water rotating inside it, acts like a ball-bearing, so the flow from the outlet and the redirection of water towards the inlet is achieved with the minimum of frictional losses.

### ***Axial Backflow***

The conical inner wall **KW** (shaded in grey) needs to be attached to the outer parts of the housing **G** (also shown shaded grey) with spike-rods **C** (shown in dark blue). The backflow-conduit is positioned all the way around the turbine, and it has a ring-shaped cross-sectional area. The water in this conduit flows with a rotational angle of about 60 degrees, so these cross-beams should be shaped like fins to push the flow into a somewhat greater angular flow of about 75 degrees, towards the right.

The cross-sectional area of the ring-shaped backflow-conduit **D** (light blue) is relatively large, so there is little friction at its surface. Water will move relatively slowly towards the right when in that conduit. This area represents a 'buffer' for the water flow as water there can move towards the right, adjusting its rate of rotation as it flows along.

Another new constructional element here are the fins **E** (shown in dark blue), which function like a stator. Unlike the previous examples, here the flow is directed into a straight axial flow direction (from left to right without any rotation). In the backflow-conduit **D**, the water is still moving with a more or less spiral track. Consequently, the left hand ends of fins **E** should be rounded to avoid any frictional losses, while the right hand edges of these fins should end sharply.

Unlike the few cross-beams **C**, about 12 to 18 cross-beams **E** should be installed. The cross-sectional area of the conduits becomes less, so the water accelerates accordingly. Unlike the previous enlargement of the cross-sectional area, this narrowing does not affect resistance. Water is now directed parallel to the system axis by these fins **E**. The water there is not rotating around the system axis and so does not have any centrifugal force acting radially outwards from the system axis.

### ***Centripetal Backflow***

Like ring **B** which runs all the way around, we now have ring **F** (shaded in light blue). Water enters tangentially into this ring, flows radially inwards towards the system axis and then leaves this ring via conduit **H** (shaded in dark blue) towards the turbine cone. As within ring **B**, here too, the water flow in ring **F** is rotational, and here again, the relatively sharp redirection occurs without significant frictional losses, practically like a ball-bearing.

As the water moves, at all times its centrifugal force is directed on to the wall at right angles to the wall. Because of the direction of this centrifugal force, the water flows off ring **F** in a tangentially inward direction. The volume of the ring reduces the further inwards it goes but it opens further as it approaches conduit **H** allowing additional space for movement. Thus, water is directed inwards to the smaller radius at the system axis and this motion is not opposed to the direction of the centrifugal forces which are radial to the system axis.

Water from ring **F** now runs in an axial direction towards the turbine inlet. However, the inlet water needs to be rotating around the system axis when it reaches the inlet to enable the necessary centrifugal forces to be produced. Consequently, the water needs to enter the space between the turbine cone and the inside wall at an angle of about 30 degrees through the turbine inlet. That redirection of flow, (inwards and towards right side of the diagram) to become a rotational flow (around the system axis and towards the right) is achieved by conduit **H**. Fins are installed in this section, directing the water from ring **F** radially inwards. These fins are gently curved in the direction of system rotation, so water is guided by slight angular deflections towards the turbine inlet **E**, ending up with the required 30 degree angle.

### ***Pump and Control***

Before water reaches the turbine intake area, it flows through pump **P** (shaded green). Its pump-blades **PS** (dark blue) are arranged at right angles to the previously mentioned fins, to produce an angle of 60 degrees opposite to the direction on rotation of the turbine. During normal operation, this pump 'idles' within that diagonal flow. Suction of the water at conical wall reaches back diagonally through the pump to conduit **H**, and from there, radially into ring **F** and so to its inlet **E**.

So because of the resulting thrust-forces along the cone-wall, water is pushed from the turbine outlet **A** into backflow-conduit **D**. On the other hand, because of the general flow within the closed circuit, water is dragged into turbine-inlet **E**. Because the water within fins **E** and ring **F** and first part of fins **H**, is not rotating around the system axis, no centrifugal forces hinder that radially inward movement. So this redirection of water exhibits almost no resistance to the flow.

The pump has important control-functions. Under normal operation, the pump turns at the same speed as the water flow. If greater performance is required, then the pump is powered up and it accelerates the water flow, speeding up the water jet feeding the turbine inlet which immediately creates an enhanced level of thrust.

Alternatively, if the rate of rotation of the pump is reduced, the intake water jet is reduced in effectiveness, reducing the centrifugal forces, which reduces the performance of the turbine. If the pump is stopped completely, then water flows into the turbine in the reverse direction, thus lowering the turning momentum to zero.

That pump is therefore in effect, a 'control' device which starts the system, controls it's running mode, deals with brief additional performance demands and can be used to bring the system to a halt. Once more, let me point out that the system is self-accelerating provided that it is not loaded excessively. It is absolutely vital to establish the maximum rate of revolution of the turbine and to prevent this value from being exceeded. Let me again point out that this document only presents the theoretical considerations needed for the general design of such machines, however, all responsibility for any risks involved in actually producing or using any such machines resides exclusively with the people who construct or operate them.

### ***Compact and Perfect***

A turbine of the type described here might have the following dimensions: A cylinder with an outer diameter of about 60 cm. A turbine-outlet which has a radius between 18.5 cm and 20 cm and a cross-sectional area of about 180 cm<sup>2</sup>. If water exits from this outlet at 6 m/s in the axial direction, then the mass-throughput will be about 100 Kg per second (with a pipe of 15 cm diameter and water flow of 100 litres per second - about 20 Km/h). Pump-blades at the turbine inlet having a radius between 10 cm and 15 cm giving a cross-sectional area of about 360 cm<sup>2</sup> producing an axial water flow of 3.5 m/s. This throughput is achieved by a rotational rate of only 600 rpm.

Anybody can make calculations estimating the performance of this compact engine. Unlike any other known machine and unlike any of the other designs presented, this 'Centrifugal-Thrust-Engine' utilises these enormous centrifugal forces, not only for generating mechanical turning momentum but also for automatically creating a continuous, steady circulation of the working medium.

Naturally these general design principles need to be optimised until perfectly designed versions become available commercially. It is possible that all of the internal combustion engines currently in use in vehicles, will be replaced by this zero-consumption engine and, of course, a wide range of other power requirements will also be met by this design of turbine.

### ***The Papp Engine.***

The Hungarian, Josef Papp, invented an unusual engine system which genuinely appears to be very nearly "fuel-less". His design modifies an existing vehicle engine to operate on a fixed amount of gas. That is to say, the engine has no air intake and no exhaust and consequently, no inlet or exhaust valves. The engine cylinders contain a mixture of gases which have an Atomic Number below 19, specifically, 36% helium, 26% neon, 17% argon, 13% krypton, and 8% xenon by volume. The control system causes the contained gas to expand to drive the pistons down the cylinders and then contract to suck the pistons back up the cylinders. This effectively converts the engine into a one-stroke version where there are two power strokes per revolution from every cylinder.

A small amount of radioactive material is used in the engine, and I have seen it suggested that the engine should be screened to protect the user from radiation. I'm not sure that this is correct, but if it is, then it

suggests that a matter to energy conversion is indeed taking place. It seems most unlikely that the minor amount of radioactive material in the engine itself could cause any significant radiation. The patent describes the material as "low-level" which suggests to me, material no more dangerous than the luminous paint that used to be used on the hands of clocks and watches.

Suitable engines must have an even number of cylinders as they operate in pairs. Josef's first prototype was a four-cylinder, 90 horsepower Volvo engine. He removed the intake and exhaust components and replaced the engine head with his own design. During a thirty-five minute test in a closed room, the engine generated a constant 300 horsepower output at 4,000 rpm. The electrical power needed to run the engine was produced by the standard engine alternator, which was also able to charge the car battery at the same time. Interestingly, an engine of this type, quite apart from having zero pollution emissions (other than heat), is quite capable of operating under water.

Josef, a draftsman and ex-pilot, emigrated from Hungary to Canada in 1957 where he lived until his death in April 1989. There is solid evidence that Josef built an engine of over 100 horsepower (75 kilowatts) that was "fuelled" by a mixture of inert (or "noble") gases. With no exhaust or cooling system, it had huge torque even at low rpm (776 foot-pounds at only 726 rpm in one certified test). Dozens of engineers, scientists, investors and a Federal judge with an engineering background saw the engine working in closed rooms for hours. This would not have been possible if the engine had been using fossil fuel. There was absolutely no exhaust and no visible provision for any exhaust. The engine ran cool at about 60°C (140°F) on its surface, as witnessed by several reliable observers. All these people became convinced of the engine's performance. They all failed to discover a hoax. Ongoing research in the United States (totally independent of Papp) has proved conclusively that inert gases, electrically triggered in various ways, can indeed explode with fantastic violence and energy release, melting metal parts and pushing pistons with large pressure pulses. Some of the people performing this work, or who have evaluated it, are experienced plasma physicists. Contemporary laboratory work has established that inert gases can be made to explode

In a demonstration on 27th October 1968 in the Californian desert, Cecil Baumgartner, representing the top management of the TRW aerospace corporation and others witnessed the detonation of one of the engine cylinders. In full public view, just a few cubic centimetres of the inert gas mixture was injected into the cylinder using a hypodermic needle. When the gas was electrically triggered, the thick steel walls of the cylinder were burst open in a dramatic way. William White, Edmund Karig, and James Green, observers from the Naval Underseas Warfare Laboratory had earlier sealed the chamber so that Papp or others could not insert explosives as part of a hoax. In 1983, an independent certification test was carried out on one of the Papp engines.

Joseph Papp was issued three United States patents for his process and engines:

**US 3,680,431** on 1st August 1972 "Method and Means for Generating Explosive Forces" in which he states the general nature of the inert gas mixture necessary to produce explosive release of energy. He also suggests several of the triggering sources that may be involved. It appears that Papp is not offering full disclosure here, but there is no doubt that others who have examined this patent and followed its outline have already been able to obtain explosive detonations in inert gases. **Caution: Anyone who tries to duplicate this process must be very careful about safety issues.**

**US 3,670,494** on 20th June 1972 "Method and Means of Converting Atomic Energy into Utilisable Kinetic Energy" and

**US 4,428,193** on 31st January 1984 "Inert Gas Fuel, Fuel Preparation Apparatus and System for Extracting Useful Work from the Fuel". This patent shown here, is very detailed and provides information on building and operating engines of this type. It also gives considerable detail on apparatus for producing the optimum mixture of the necessary gasses.

At the time of writing, a web-based video of one of the Papp prototype engines running on a test bed, can be found at <http://video.google.com/videoplay?docid=-2850891179207690407> although it must be said that a good deal of the footage is of very poor quality, having been taken many years ago. The video is particularly interesting in that some of the demonstrations include instances where a transparent cylinder is used to show the energy explosion. Frame-by-frame operation on the original video shows energy being developed outside the cylinder as well as inside the cylinder, which does seem to suggest that the zero-point energy field is involved. I have recently been contacted by one man who attended some of the engine demonstrations run by Papp and he vouches for the fact that the engine performed exactly as described.

**US Patent 4,428,193**

**31st January 1984**

**Inventor: Josef Papp**

# **INERT GAS FUEL, FUEL PREPARATION APPARATUS AND SYSTEM FOR EXTRACTING USEFUL WORK FROM THE FUEL**

## **ABSTRACT**

An inert gas fuel consisting essentially of a precise, homogeneous mixture of helium, neon, argon, krypton and xenon. Apparatus for preparing the fuel includes a mixing chamber, tubing to allow movement of each inert gas into and through the various stages of the apparatus, a plurality of electric coils for producing magnetic fields, an ion gauge, ionises, cathode ray tubes, filters, a polarise and a high frequency generator. An engine for extracting useful work from the fuel has at least two closed cylinders for fuel, each cylinder being defined by a head and a piston. A plurality of electrodes extend into each chamber, some containing low level radioactive material. The head has a generally concave depression facing a generally semi-toroidal depression in the surface of the piston. The piston is axially movable with respect to the head from a first position to a second position and back, which linear motion is converted to rotary motion by a crankshaft. The engine's electrical system includes coils and condensers which circle each cylinder, an electric generator, and circuitry for controlling the flow of current within the system.

## **BACKGROUND OF THE INVENTION**

This invention relates to closed reciprocating engines, i.e., ones which do not require an air supply and do not emit exhaust gases, and more particularly to such engines which use inert gases as fuel. It also concerns such inert gas fuels and apparatus for preparing same.

Currently available internal combustion engines suffer from several disadvantages. They are inefficient in their utilisation of the energy present in their fuels. The fuel itself is generally a petroleum derivative with an ever-increasing price and sometimes limited availability. The burning of such fuel normally results in pollutants which are emitted into the atmosphere. These engines require oxygen and, therefore, are particularly unsuitable in environments, such as underwater or outer space, in which gaseous oxygen is relatively unavailable. Present internal combustion engines are, furthermore, relatively complex with a great number of moving parts. Larger units, such as fossil-fuel electric power plants, escape some of the disadvantages of the present internal combustion engine, but not, inter alia, those of pollution, price of fuel and availability of fuel.

Several alternative energy sources have been proposed, such as the sun (through direct solar power devices), nuclear fission and nuclear fusion. Due to the lack of public acceptance, cost, other pollutants, technical problems, and/or lack of development, these sources have not wholly solved the problem. Moreover, the preparation of fuel for nuclear fission and nuclear fusion reactors has heretofore been a complicated process requiring expensive apparatus.

## **SUMMARY OF THE INVENTION**

Among the several objects of the present invention may be noted the provision of an engine which is efficient; the provision of an engine which does not require frequent refuelling; the provision of an engine which develops no pollutants in operation; the provision of an engine which is particularly suited for use in environments devoid of free oxygen; the provision of an engine which requires no oxygen in operation; the provision of an engine having a relatively small number of moving parts; the provision of an engine of a relatively simple construction; the provision of an engine which can be used in light and heavy-duty applications; the provision of an engine which is relatively inexpensive to make and operate; the provision of a fuel which uses widely available components; the provision of a fuel which is relatively inexpensive; the provision of a fuel which is not a petroleum derivative; the provision of relatively simple and inexpensive apparatus for preparing inert gases for use as a fuel; the provision of such apparatus which mixes inert gases in precise, predetermined ratios; and the provision of such apparatus which eliminates contaminants from the inert gas mixture. Other objects and features will be in part apparent and in part pointed out hereinafter.

Briefly, in one aspect the engine of the present invention includes a head having a generally concave depression in it, the head defining one end of a chamber, a piston having a generally semi-toroidal depression in its upper surface, the piston defining the other end of the chamber, and a plurality of electrodes extending into the chamber for exciting and igniting the working fluid. The piston can move along its axis towards and away from the head, causing the volume of the chamber to alter, depending on the position of the piston relative to the head.

In another aspect, the engine of the present invention includes a head which defines one end of the chamber, a piston which defines the other end of the chamber, a plurality of magnetic coils wound around the chamber for generating magnetic fields inside the chamber, and at least four electrodes extending into the chamber for exciting and igniting the working fluid. The magnetic coils are generally coaxial with the chamber. The electrodes are generally equidistantly spaced from the axis of the chamber and are each normally positioned 90 degrees from the adjacent electrodes. Lines between opposed pairs of electrodes intersect generally on the axis of the chamber to define a focal point.

In a further aspect, the engine of the present invention includes a head which defines one end of a chamber, a piston which defines the other end of the chamber, at least two electric coils wound around the chamber for generating magnetic fields inside the chamber, and a plurality of electrodes extending into the chamber for exciting and igniting the working fluid. The electric coils are generally coaxial with the chamber. And the working fluid includes a mixture of inert gases.

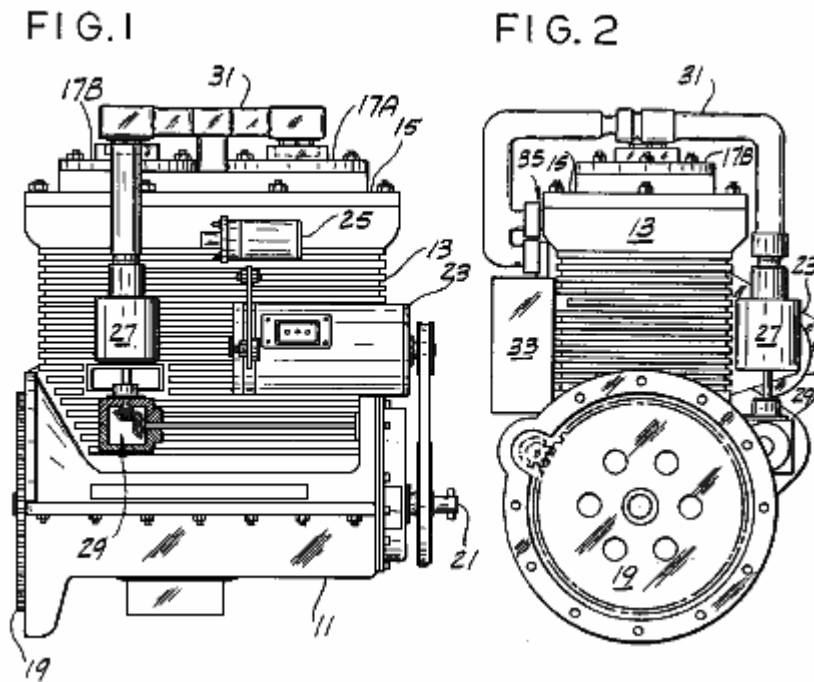
The apparatus of the present invention for preparing a mixture of inert gases for use as a fuel includes a chamber, electric coils for generating predetermined magnetic fields inside the chamber, tubing adapted to be connected to sources of preselected inert gases for flow of the gases from the sources to the chamber, and ionisers for ionising the gases.

The fuel of the present invention includes a mixture of inert gases including approximately 36% helium, approximately 26% neon, approximately 17% argon, approximately 13% krypton, and approximately 8% xenon by volume.

**BRIEF DESCRIPTION OF THE DRAWINGS**

**Fig.1** is a side elevation of an engine of this invention:

**Fig.2** is a rear elevation of an engine of this invention:



**Fig.3** is a top view of an engine of this invention:

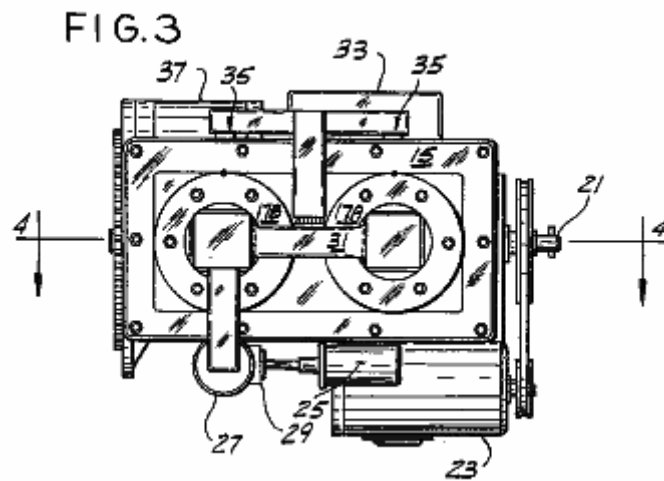


Fig.4 is a cross-sectional view generally along line 4--4 of Fig.3 of an engine of this invention:

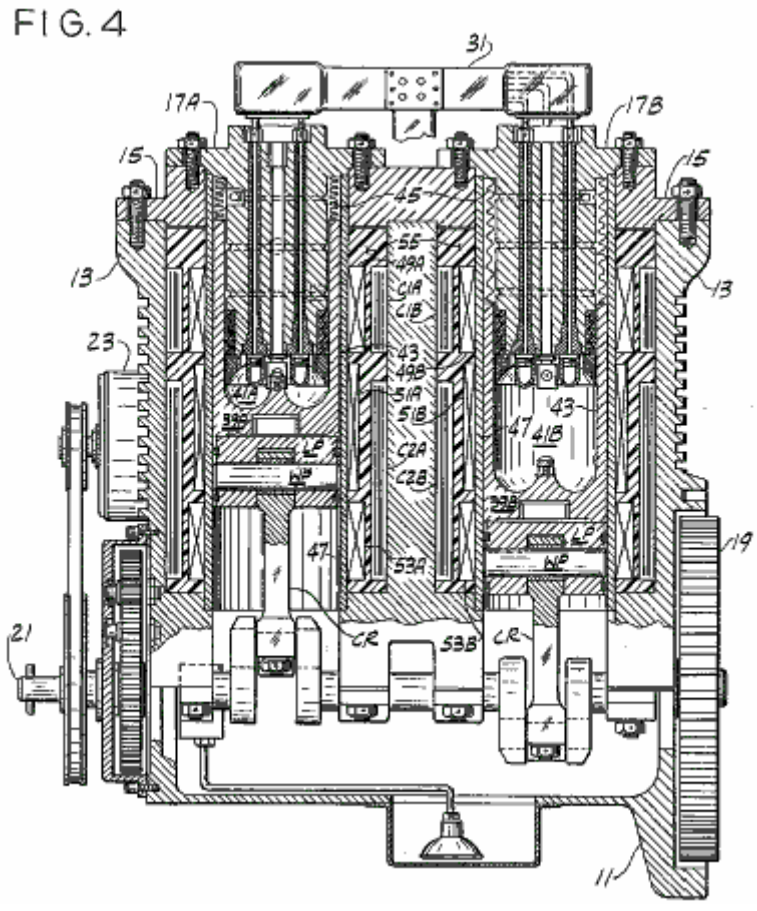




Fig.5 is a cross-sectional view of a cylinder of an engine of this invention:

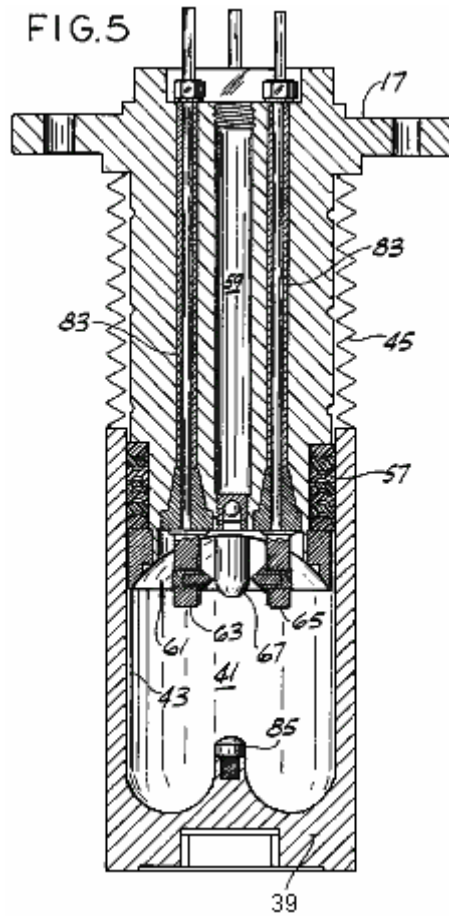


Fig.6 is a plan of the base of a cylinder head of an engine of this invention:

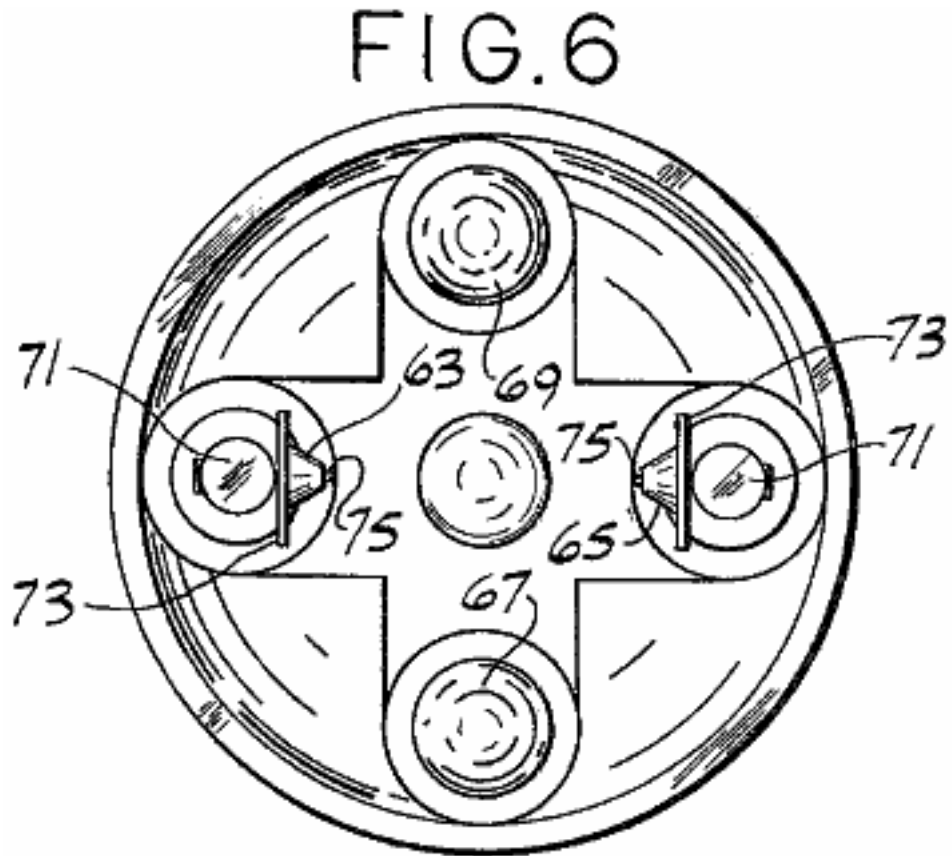
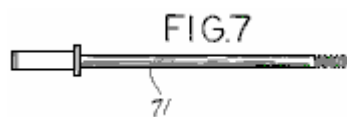
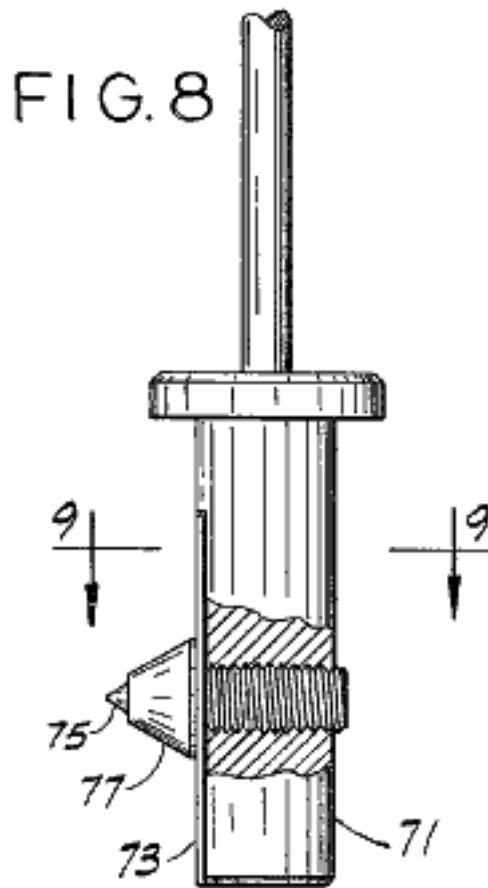


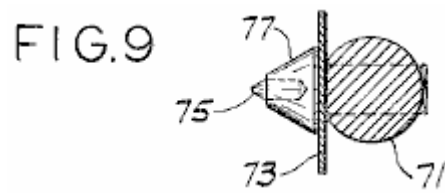
Fig.7 is an elevation of an electrode rod of an engine of this invention:



**Fig.8** is an elevation, with parts broken away, of one type of electrode used in an engine of this invention:



**Fig.9** is a view taken generally along line 9--9 of Fig.8:



**Fig.10** is a cross-sectional view of a second type of electrode used in an engine of this invention:

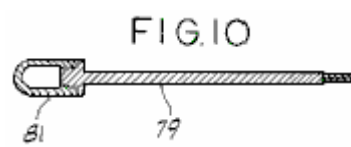


Fig.11 is a cross-sectional view similar to Fig.5 showing the piston in its uppermost position:

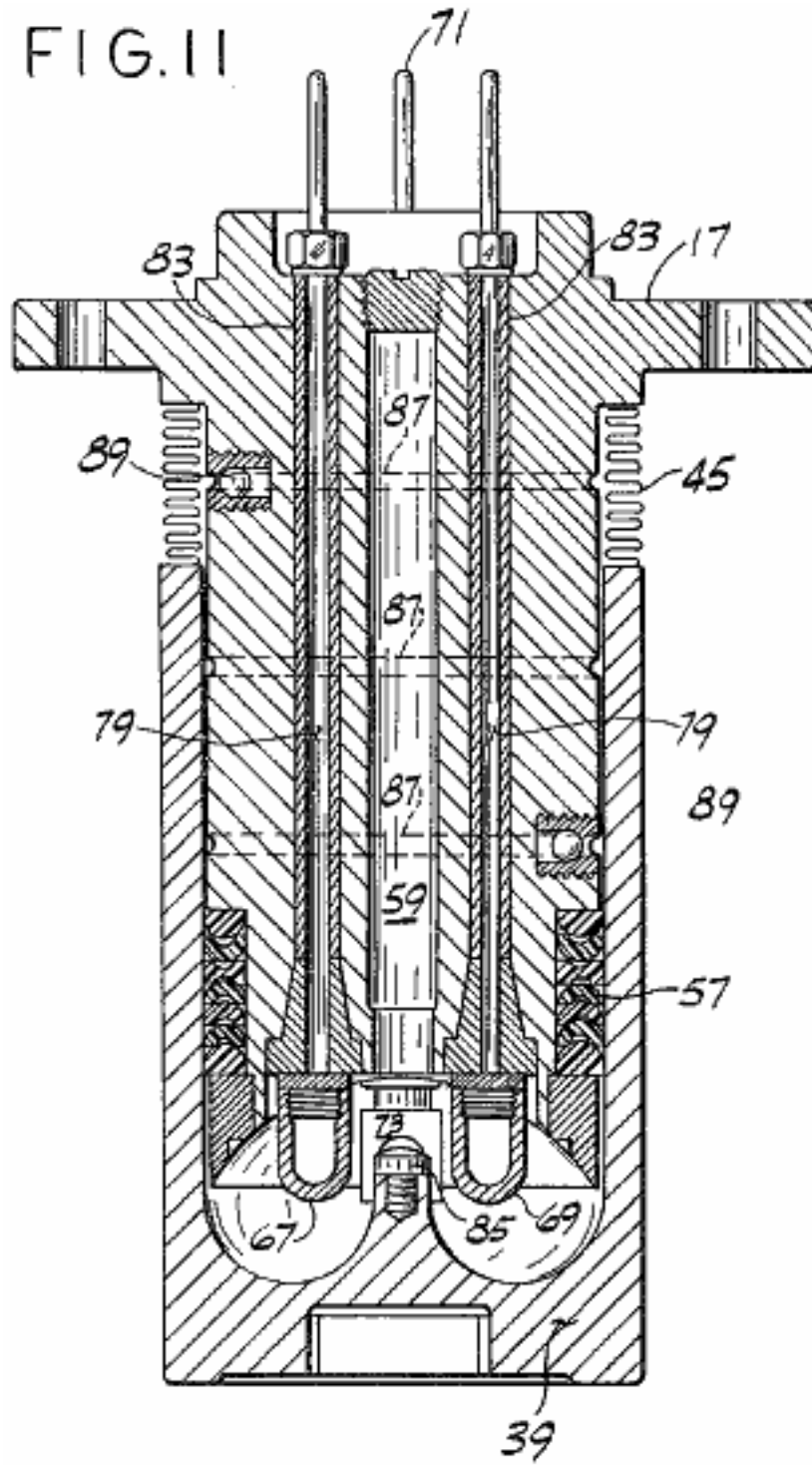


Fig.12 is a cross-sectional view similar to Fig.5 showing an alternative cylinder used in an engine of this invention:

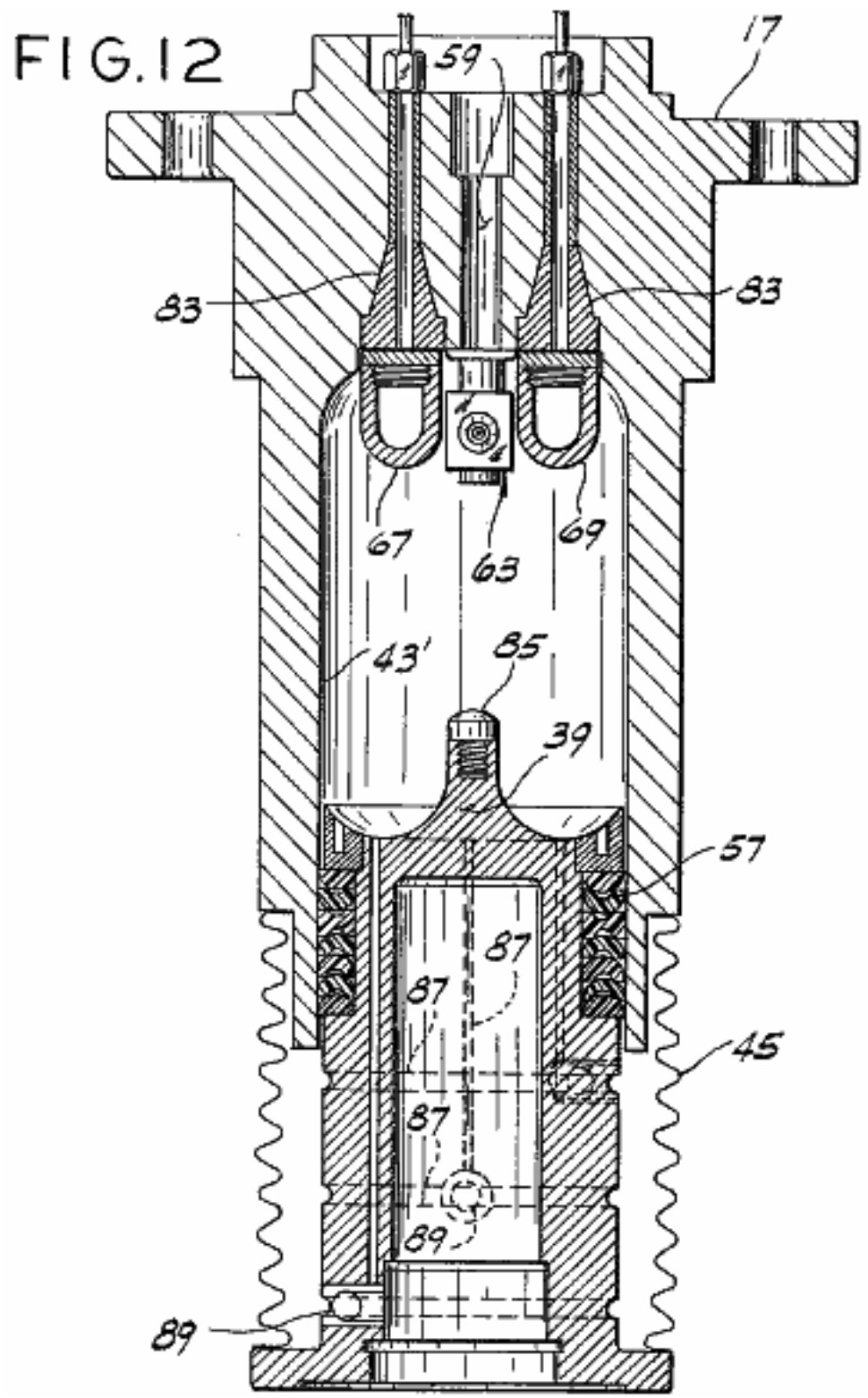


Fig.12A is a cross-sectional view similar to Fig.5 and Fig.12, but on a reduced scale and with parts broken away, showing an additional embodiment of a cylinder head used in an engine of this invention:

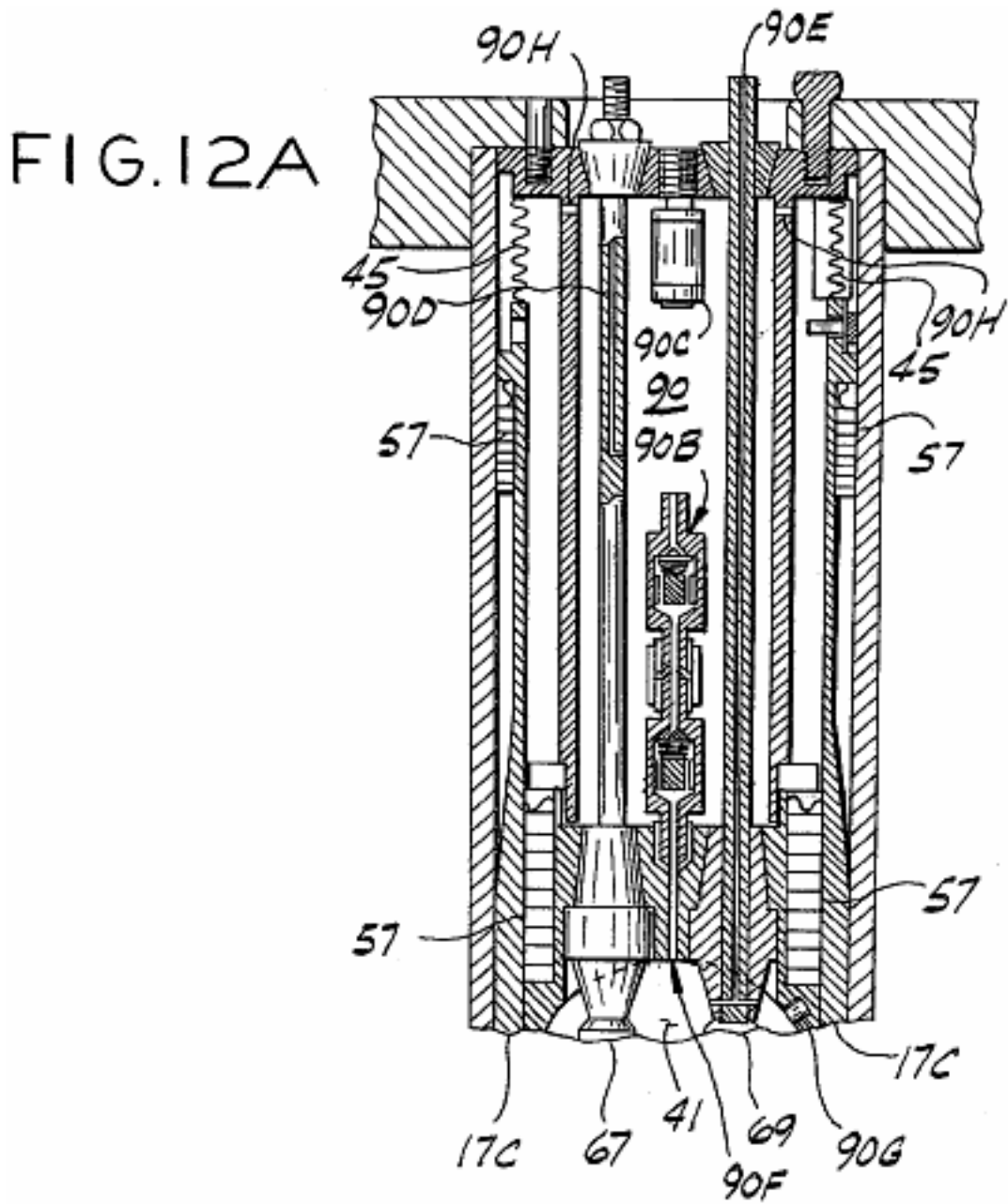


Fig.13A and Fig.13B are schematic diagrams of the electrical circuitry for an engine of this invention:

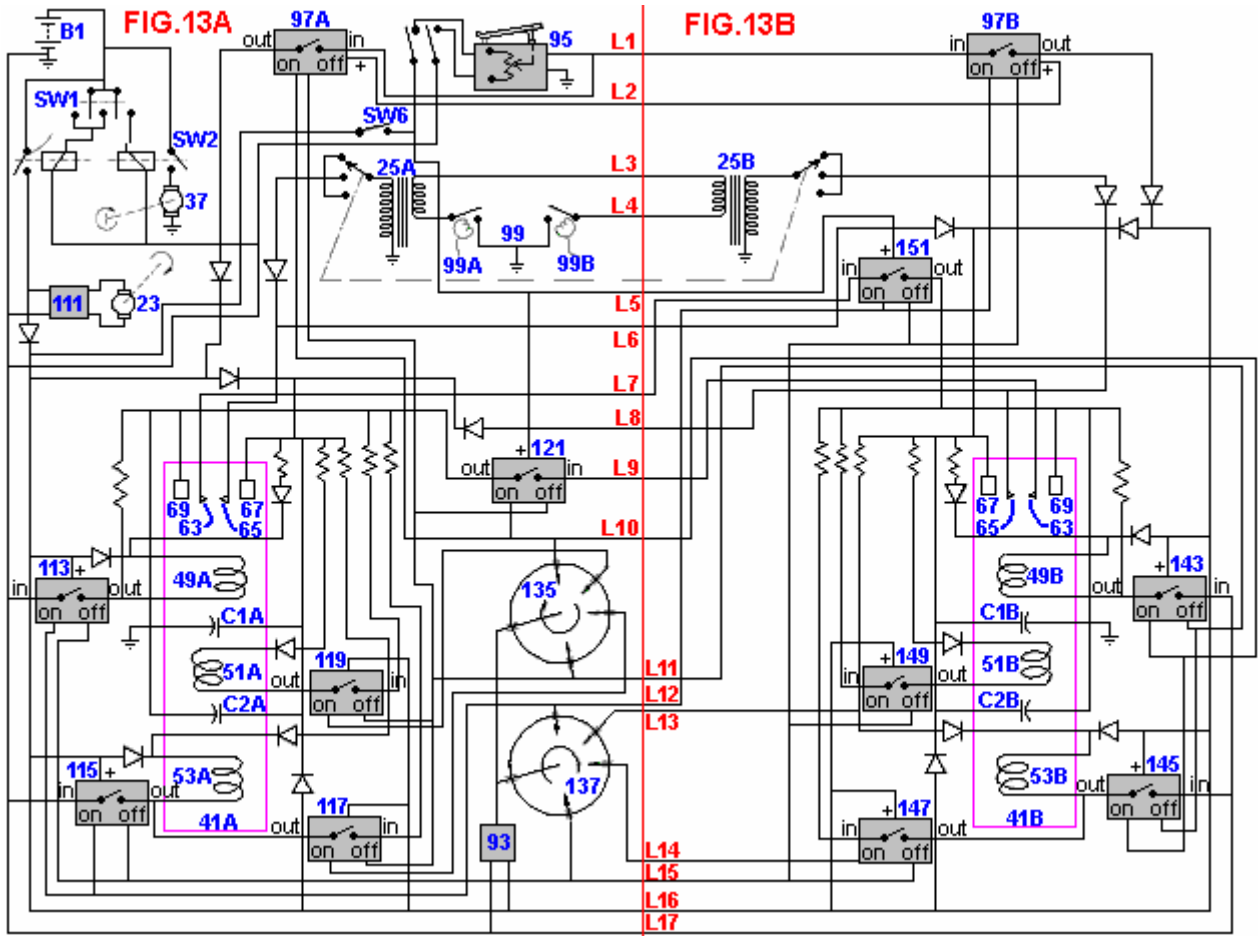


Fig.14 is a schematic diagram of an alternative high-voltage ignition system for an engine of this invention:

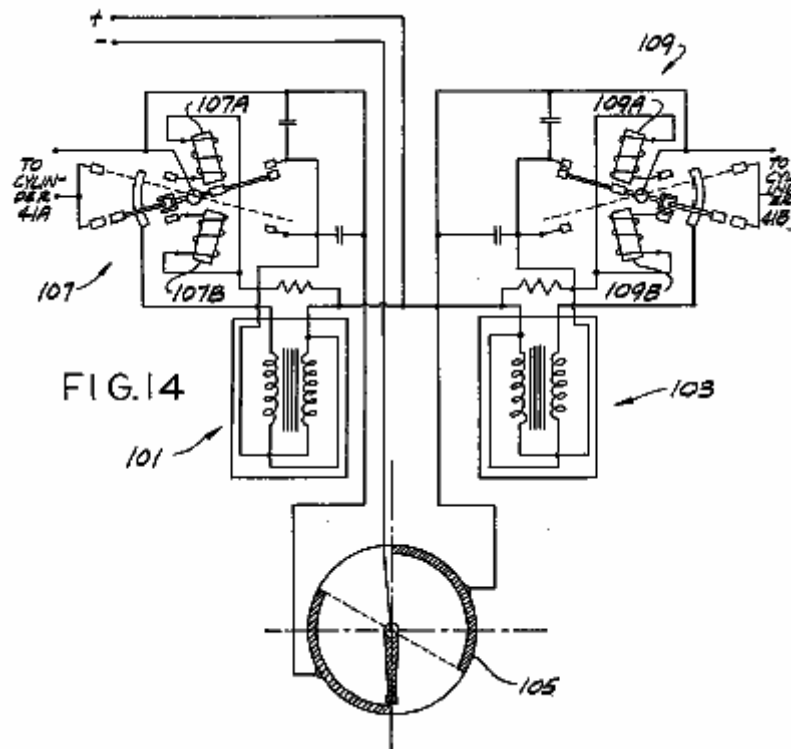
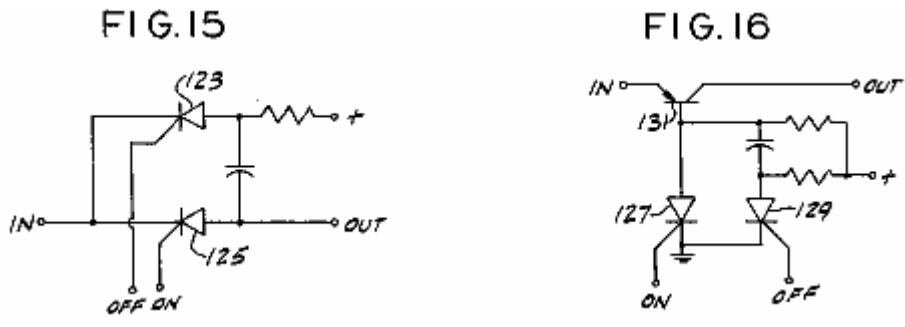
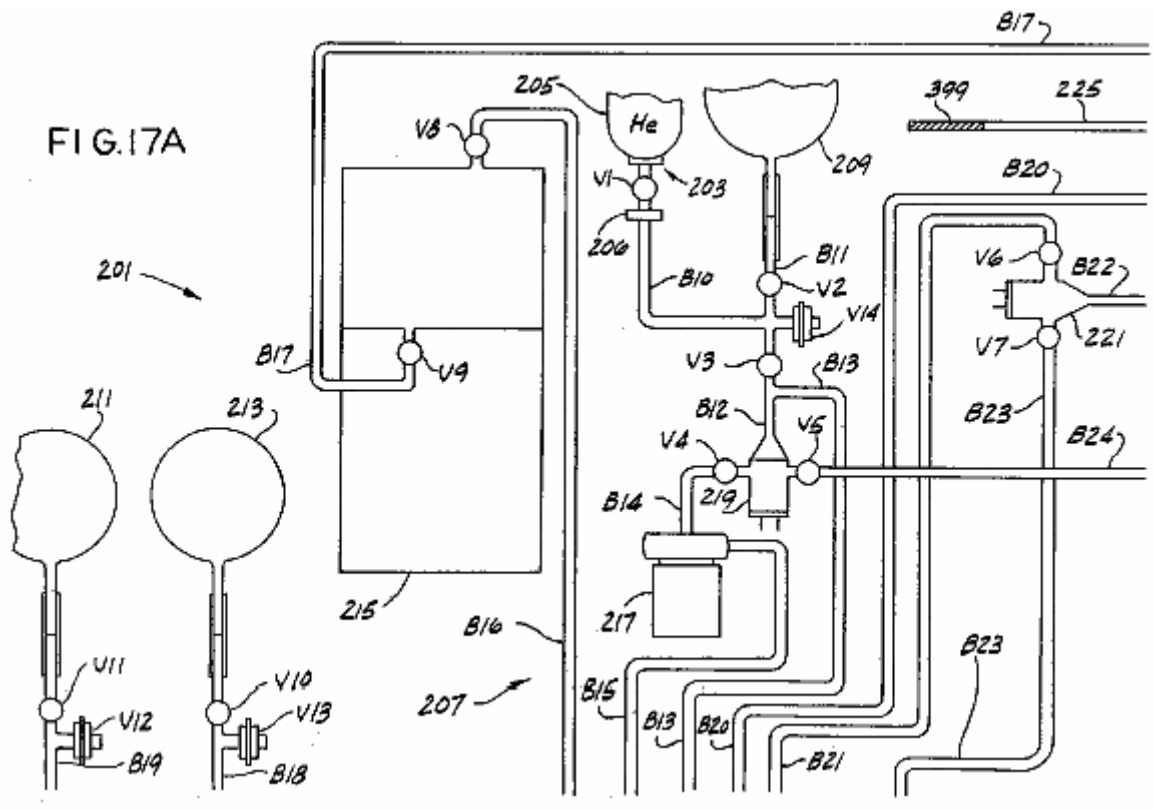


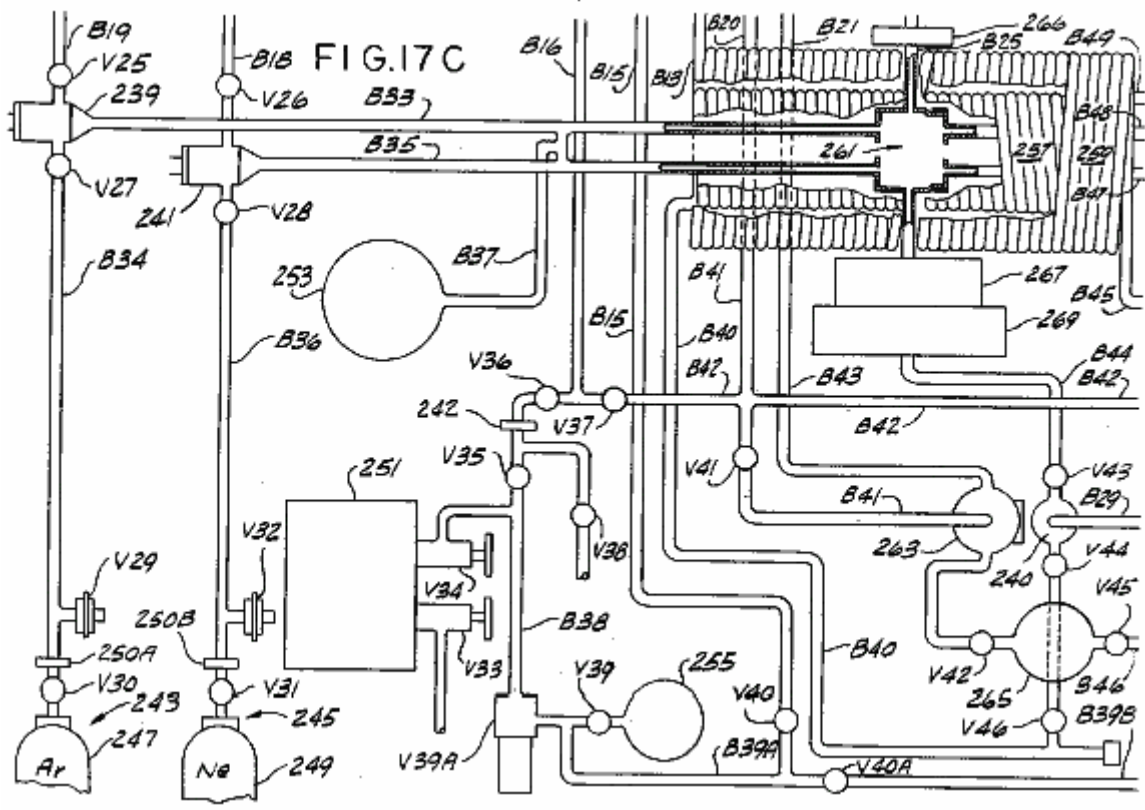
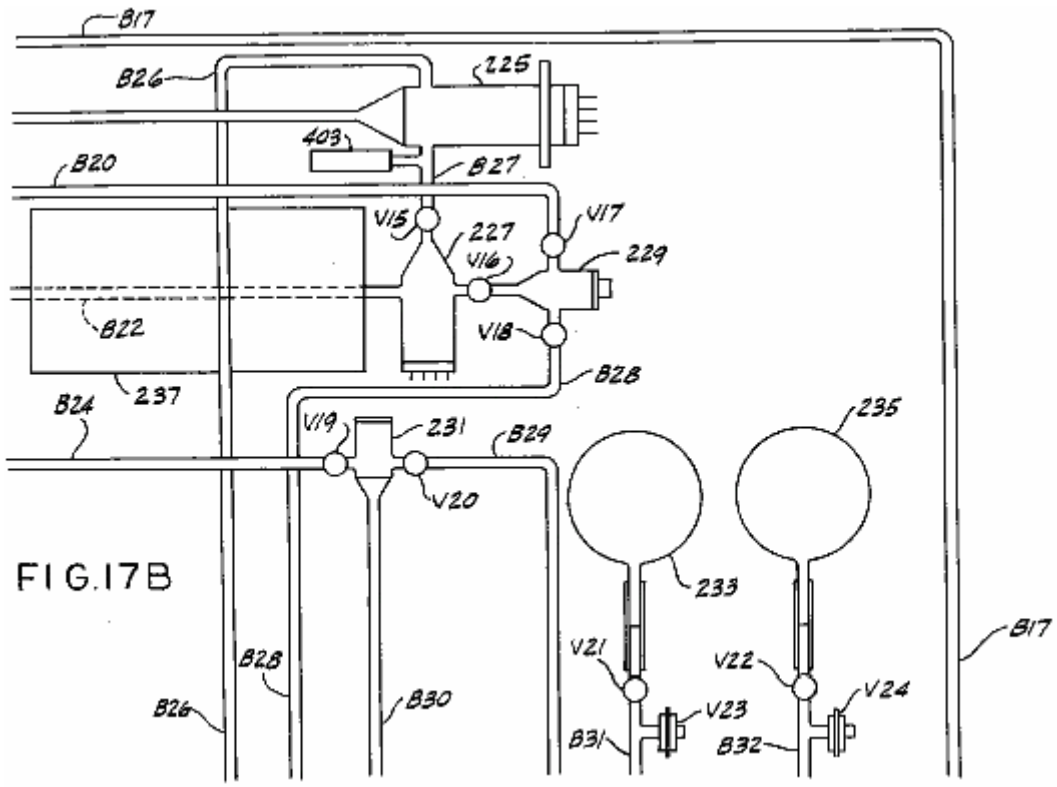
Fig.15 is a schematic diagram of an electronic switching unit for an engine of this invention:  
 Fig.16 is a schematic diagram of a regulator/electronic switching unit for an engine of this invention:



Figs.17A-17D are schematic diagrams of a fuel mixer of the present invention:







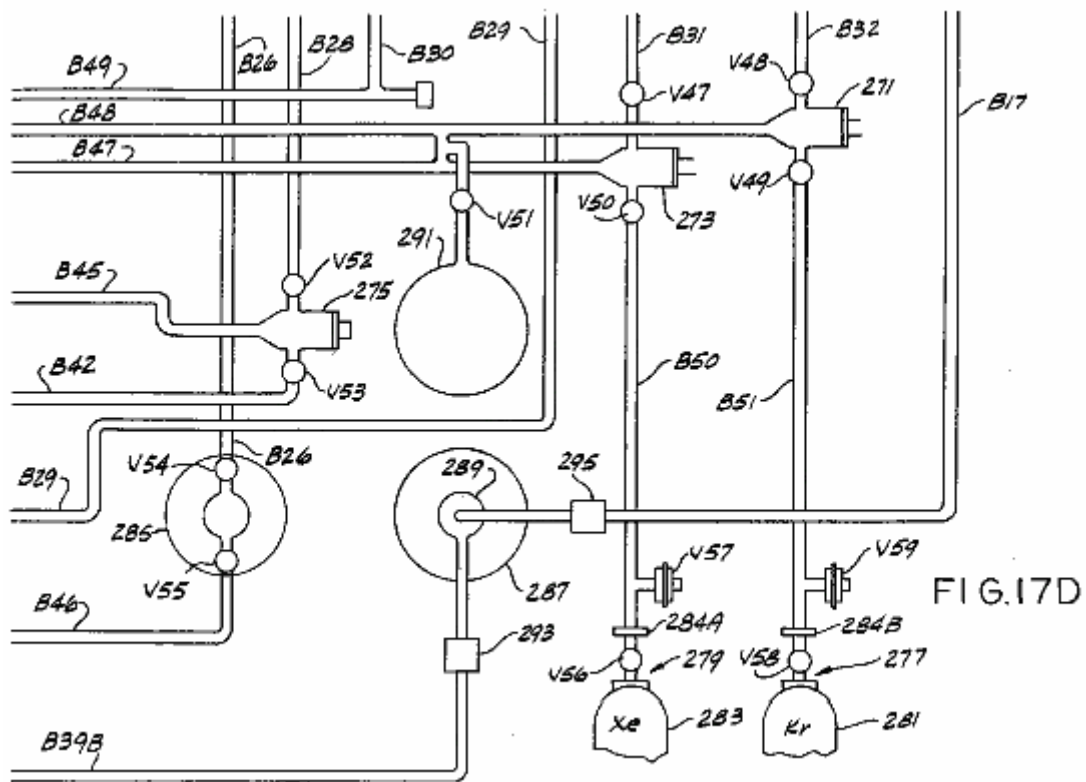
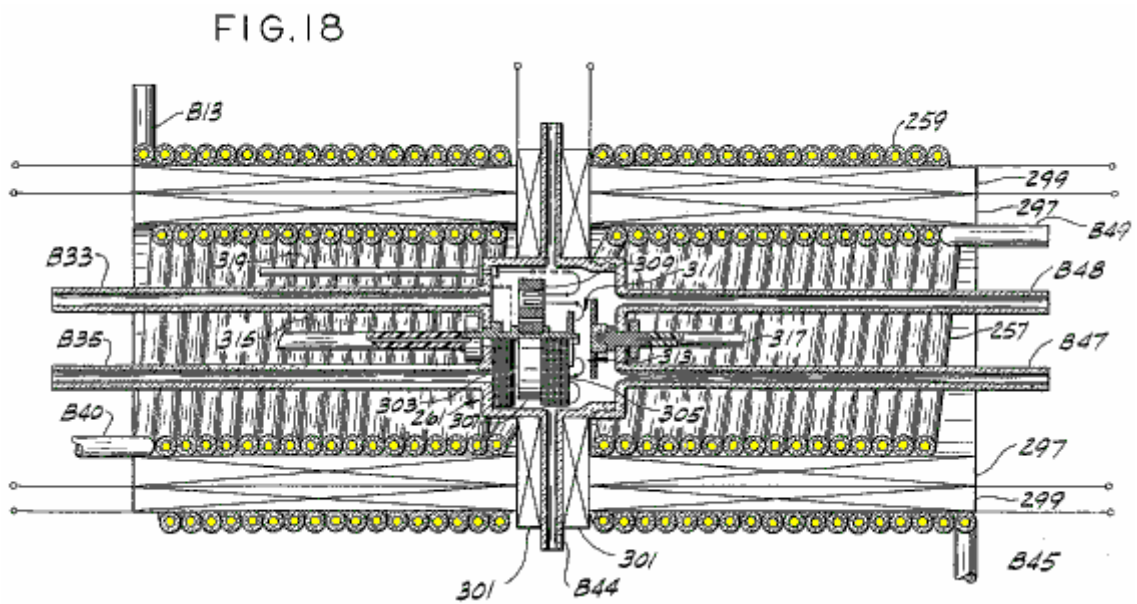


Fig.18 is a schematic diagram of the mixing chamber portion of the fuel mixer shown in Figs.17A-17D:



Figs.19A-19E are schematic diagrams of a portion of the electrical circuitry of the fuel mixer shown in Figs.17A-17D:

FIG.19A

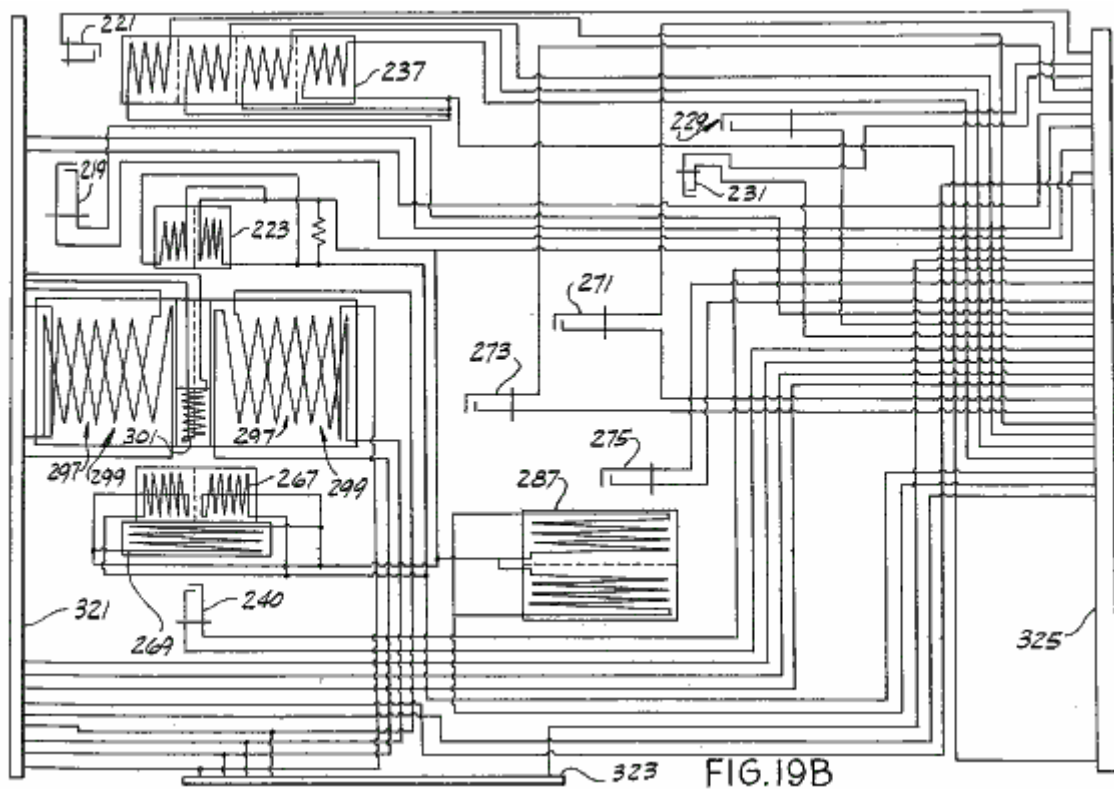
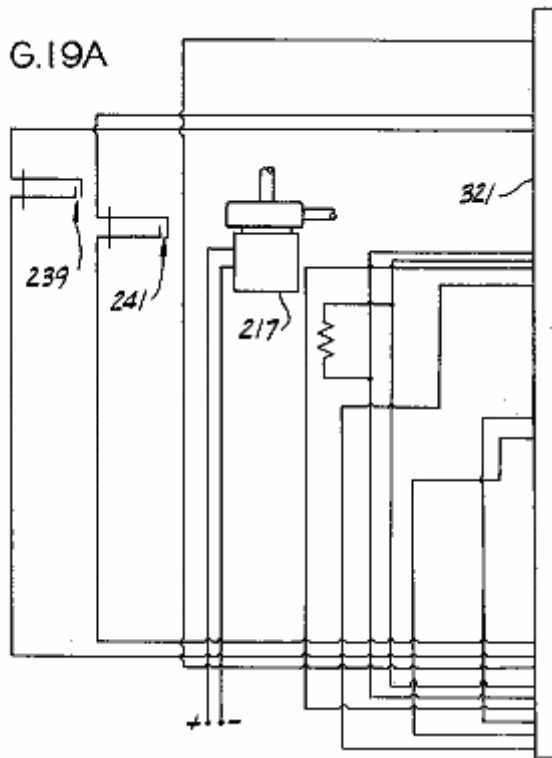


FIG.19C

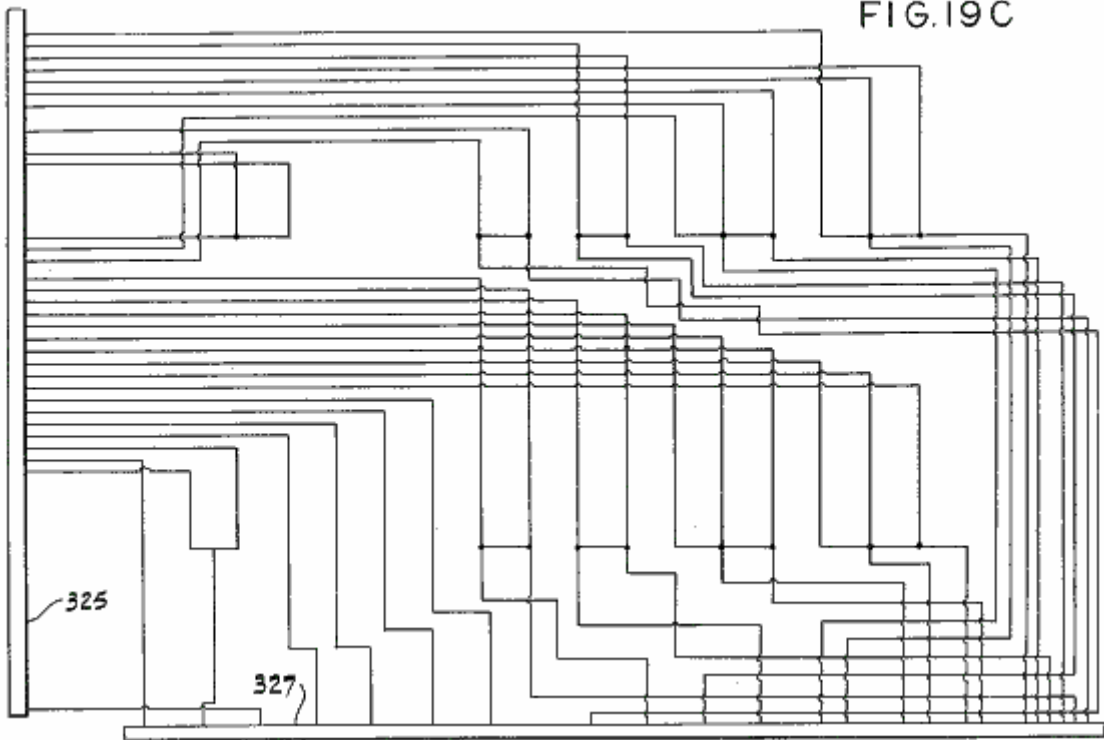
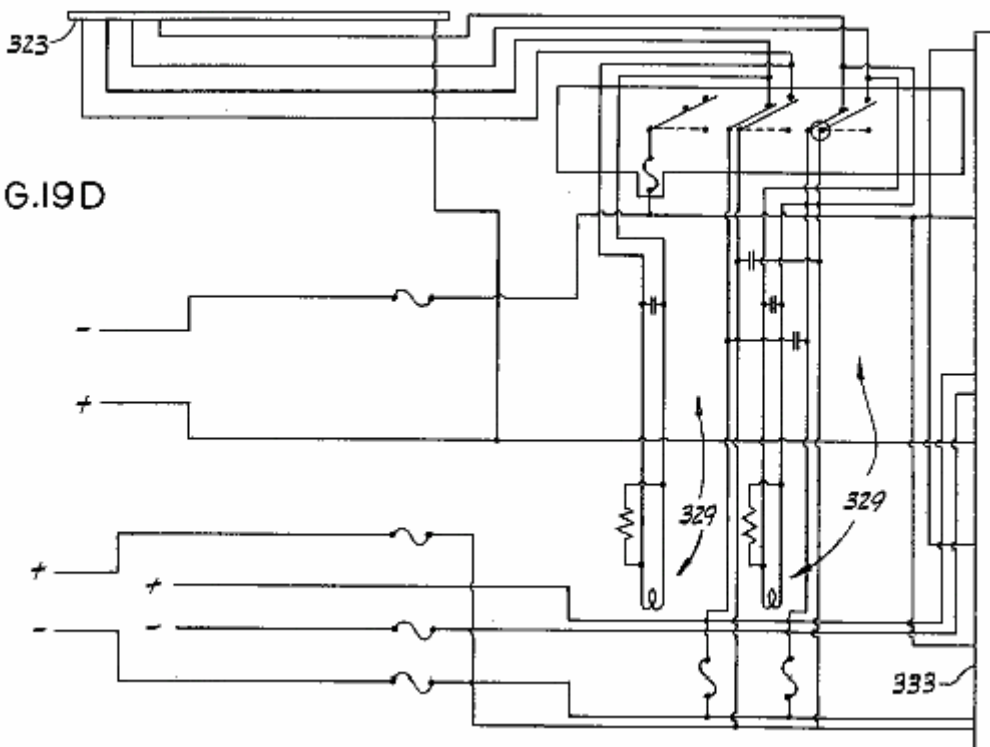
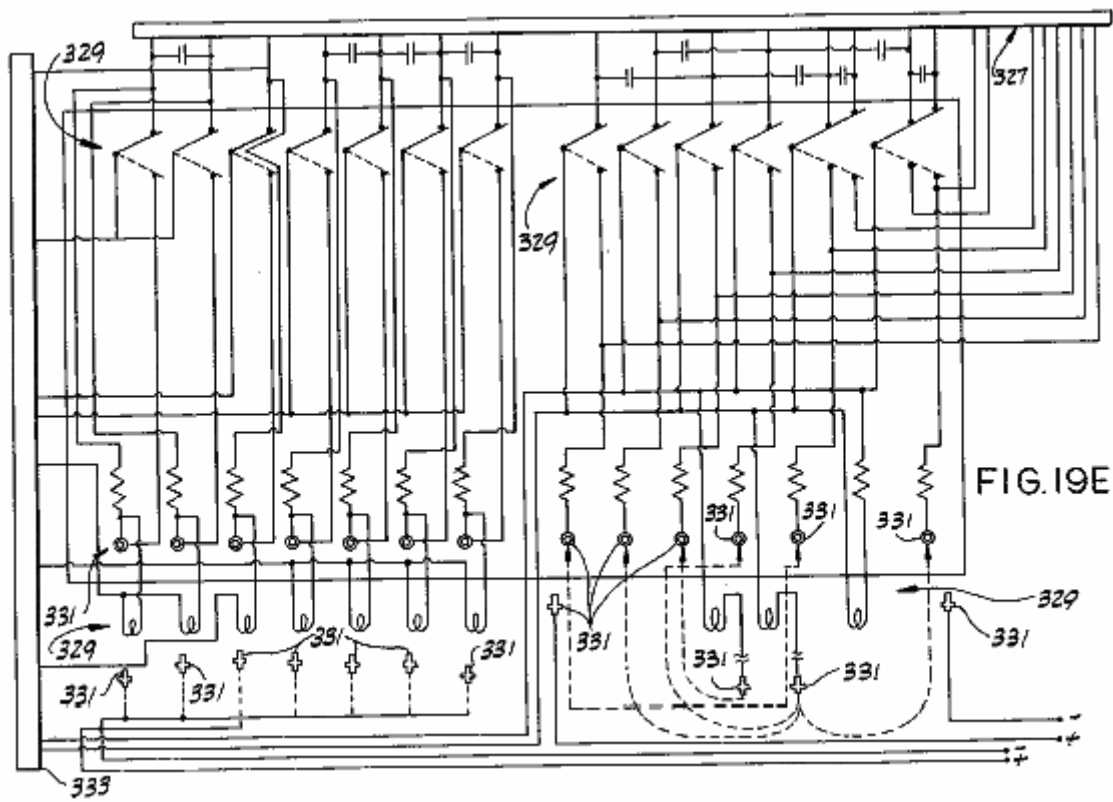


FIG.19D





Figs.20A-20F are schematic diagrams of the rest of the electrical circuitry of the fuel mixer shown in Figs.17A-17D:

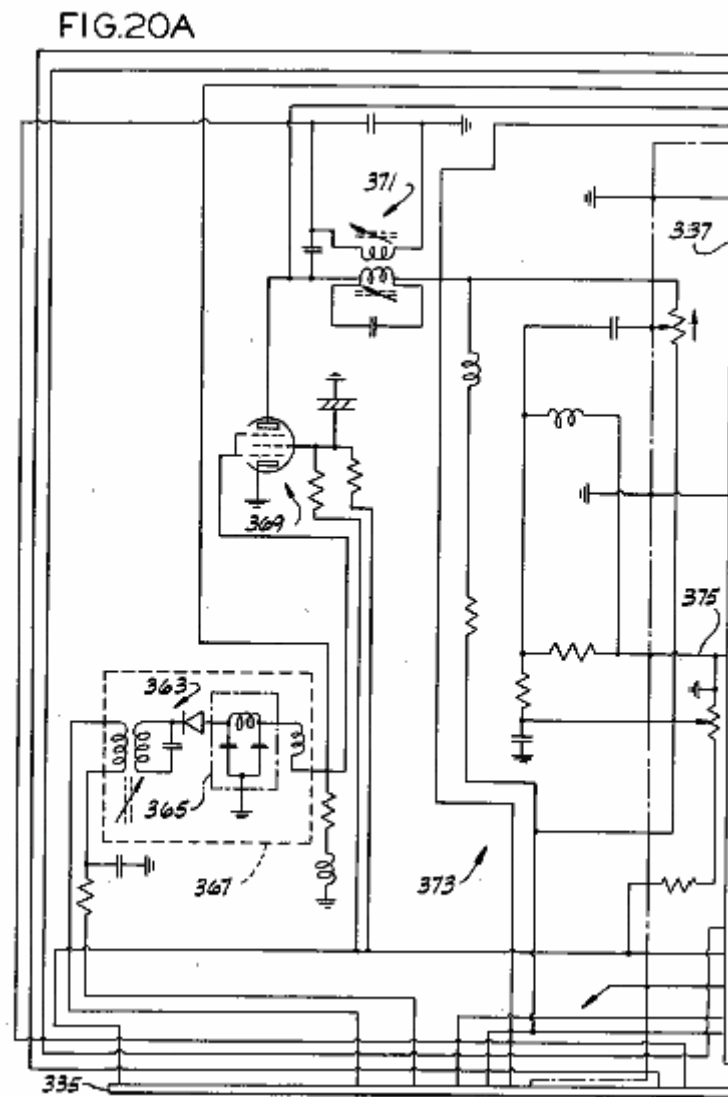


FIG. 20B

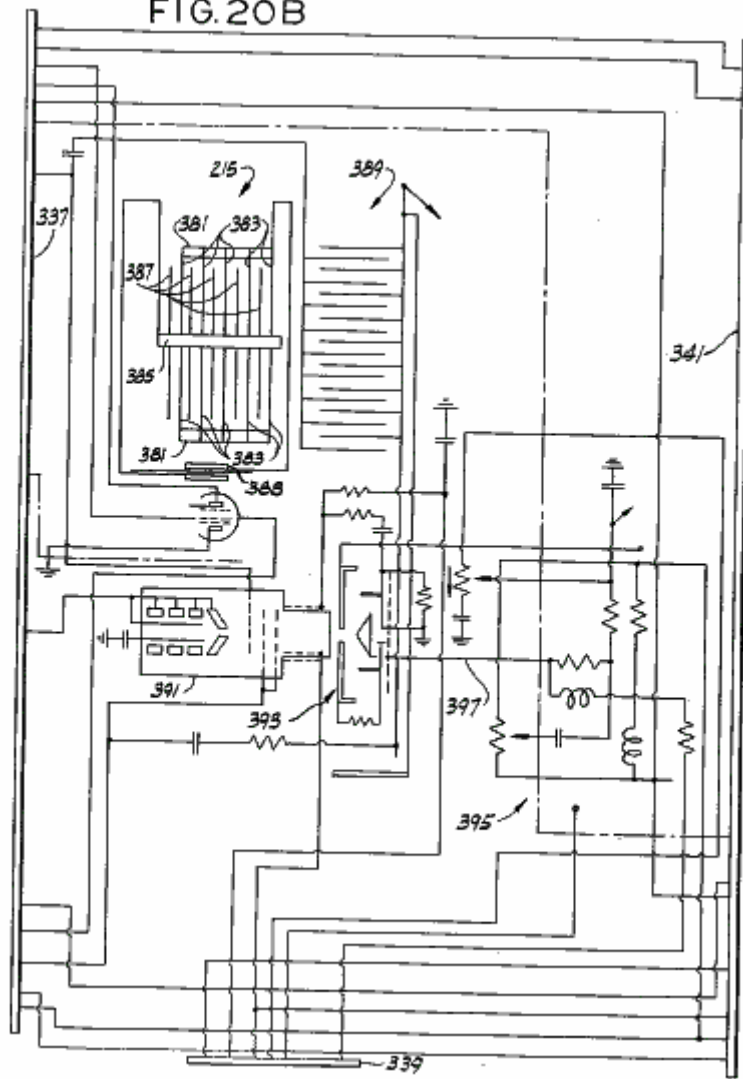
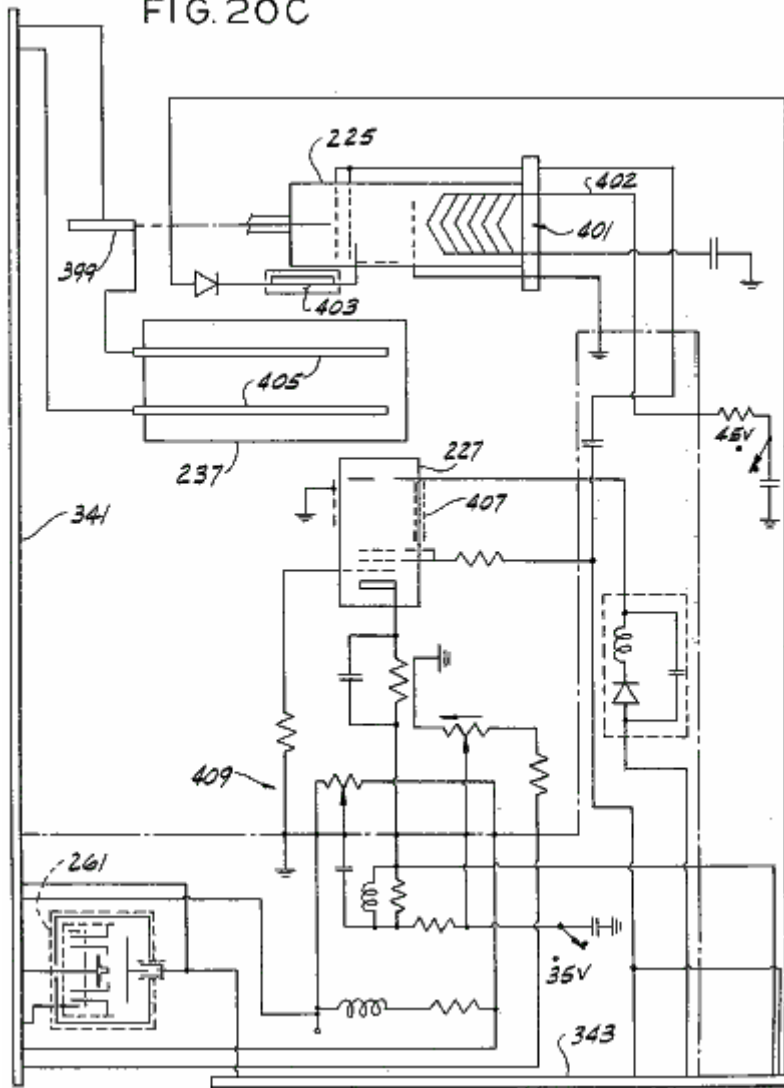


FIG. 20C





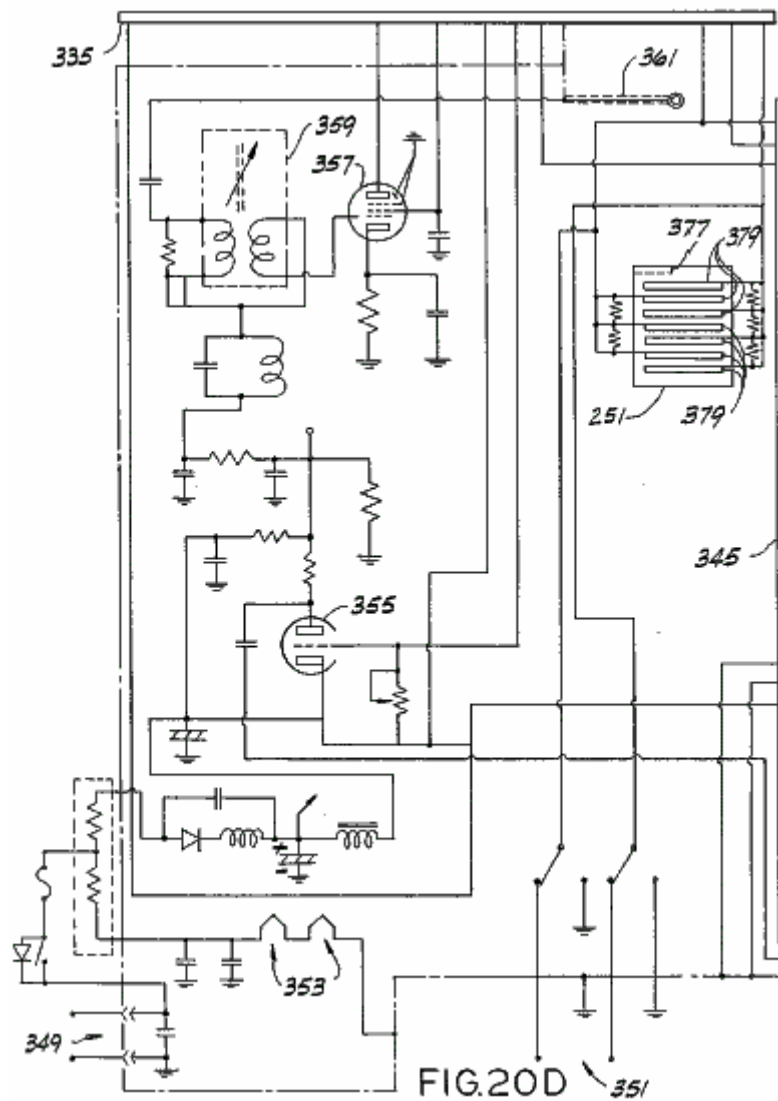
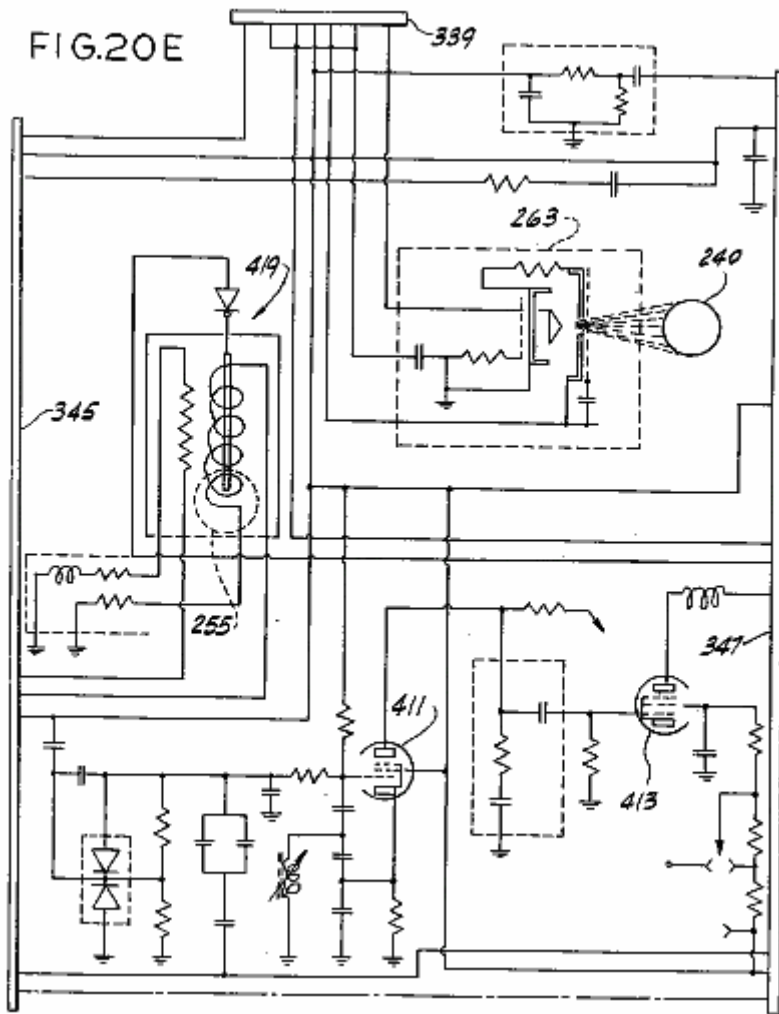


FIG.20E



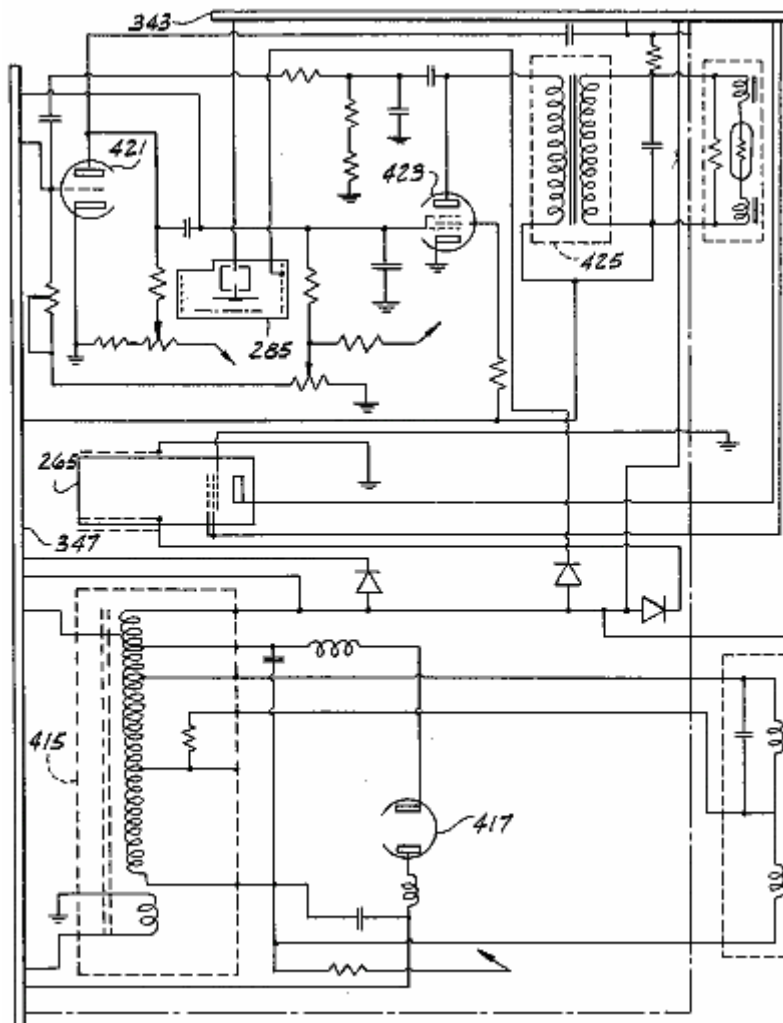


FIG. 20F

**Note:** Corresponding reference characters indicate corresponding parts throughout all of the views of the drawings.

**DESCRIPTION OF A PREFERRED EMBODIMENT**

FIG. 1

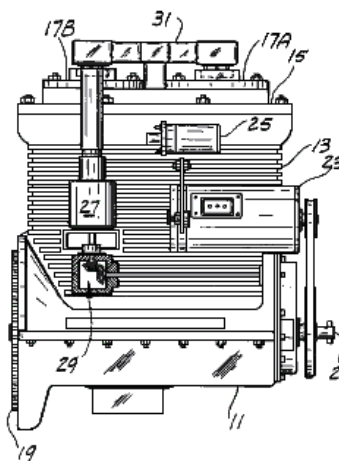
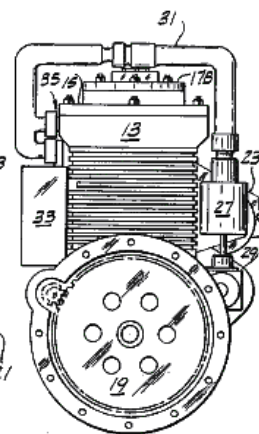
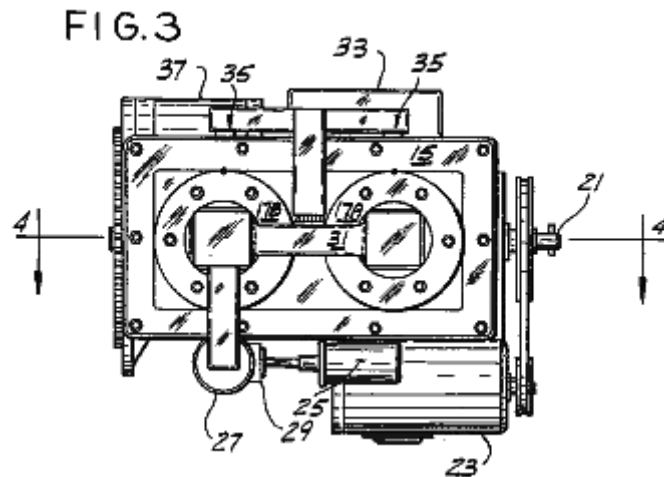


FIG. 2

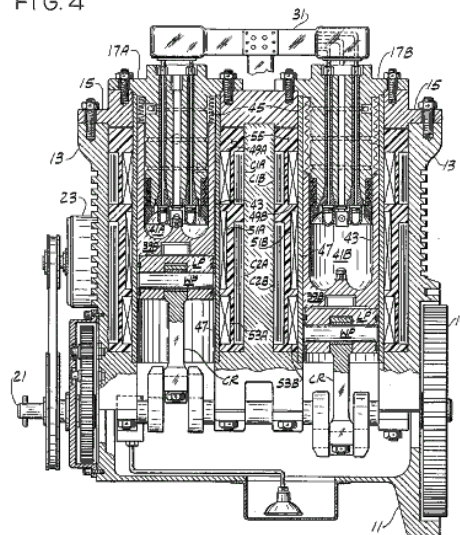


Referring to the drawings, there is shown in **Fig.1** a two-cylinder engine **11** comprising a block **13** preferably of a nonmagnetic material such as aluminium, a nonmagnetic head **15**, and a pair of cylinder heads **17A** and **17B** of a magnetisable material such as 0.1-0.3% carbon steel. Also shown in **Fig.1** is a flywheel **19** attached to a crankshaft **21**, a generator **23**, a high-voltage coil **25**, a distributor **27** attached by a gear arrangement shown in part at **29** to the crankshaft, and an electrical cable **31** which is connected to the distributor and to both cylinders. Cable **31** (see **Fig.2**) is also electrically connected to a switching unit **33** which preferably comprises a plurality of silicon controlled rectifiers (SCRs) or transistors. Also shown in **Fig.2** is a second electrical connection of the cable to the cylinders, which connection is indicated generally at **35**. Turning to **Fig.3**, there is shown a starter motor **37** as well as a clearer view of the connections **35** to each cylinder.



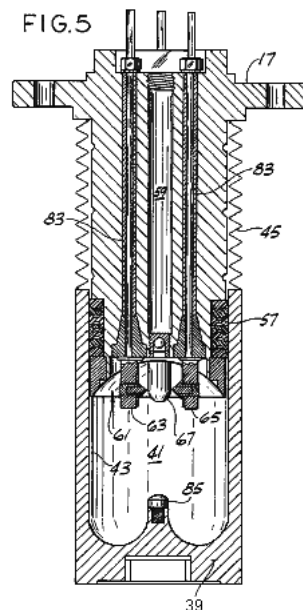
A cross section of the engine is shown in **Fig.4**. The cylinder heads have associated with them, pistons marked **39A** and **39B**, respectively, the heads and pistons define opposite ends of a pair of chambers or cylinders **41A** and **41B** respectively. The pistons are made of a magnetisable material. Although only two chambers are shown, the engine can include any number. It is preferred, however, for reasons set forth below, that there be an even number of cylinders. Pistons **39A** and **39B** move axially with respect to their corresponding heads from a first position (the position of piston **39A** in **Fig.4**) to a second position (the position of piston **39B**) and back, each piston being suitably connected to crankshaft **21**. As shown in **Fig.4**, this suitable connection can include a connecting rod **CR**, a wrist pin **WP**, and a lower piston portion or power piston **LP**. The connecting rods and/or power pistons must be of non-magnetisable material. When a split piston is used, pistons **39A** and **39B** are suitably connected to lower piston portions **LP** by bolting, spring-loaded press fitting, or the like. Pistons **39A** and **39B** are attached 180 degrees apart from each other with respect to the crankshaft so that when one piston is at top dead centre (TDC) the other will be at bottom dead centre (BDC) and vice versa. Additional pairs of cylinders may be added as desired but the pistons of each pair should be attached to the crankshaft 180 degrees from each other. Of course, the relative position of each piston with respect to its respective head determines the volume of its chamber.

FIG. 4



Integral with the piston bodies are walls **43** which form the walls of the chambers. Preferably, a set of airtight bellows **45**, of similar construction to that sold under the designation ME 197-0009-001 by the Belfab Company of Daytona Beach, Fla., are suitably secured between walls **43** and cylinder heads **17A** and **17B** respectively to form an airtight seal between each piston and its cylinder head. While walls **43** and piston **39** can be made of one magnetisable piece, a preferable and more efficient construction has walls **43** separate from piston **39** and made of a non-magnetisable material. The length of time that a given engine will run is a function of the efficacy of its sealing system. Means, such as bellows **45**, for hermetically sealing the cylinders will optimise said length of time. Such a hermetic seal should be secured between walls **43** and cylinder heads **17** to form an airtight seal between them. This seal could be the airtight bellows system shown or some other sealing system such as an oil sealing system.

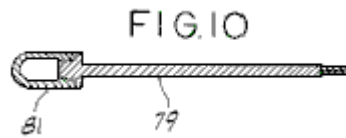
Cylinder bodies **47** (see **Fig.4**), made of nonmagnetic material such as stainless steel, extend from the point of attachment of each bellows to its cylinder head to the base of the corresponding pistons, forming sleeves for each piston in which each piston moves. Three sets of electric coils **49A**, **49B**, **51A**, **51B**, and **53A**, **53B**, are wound around sleeves **47**, and hence around chambers **41A** and **41B**, respectively, for generating magnetic fields in the chambers, those coils being generally coaxial with their respective chambers. Each of these coils has an inductance of approximately 100 mH. It is preferred that 14-19 gauge wire be used to wind these coils and that the coils be coated with a suitable coating, such as #9615 hardener from Furane Plastics, Inc., of Los Angeles, California, or the coating sold by the Epoxylite Corp. of South El Monte, California under the trade designation Epoxylite 8683. Each chamber is also surrounded by a pair of capacitors, **C1A**, **C1B** and **C2A**, **C2B** wound around it, capacitors **C1A**, **C1B** having a capacitance of approximately 1.3 microfarads and capacitors **C2A**, **C2B** having a capacitance of approximately 2.2 microfarads. The coils and capacitors are potted in hardened epoxy of fibreglass material **55**. The epoxy resin and hardener sold under the designations EPI Bond 121 and #9615 hardener by Furane Plastics, supra, are satisfactory, but other epoxy material which will remain stable at temperatures up to 200 degrees F would probably also be acceptable. It is preferred that a small amount of graphite such as that sold under the trade designation Asbury 225 by Asbury Graphite, Inc. of Rodeo, Calif., be included in the epoxy potting to prevent nuclear particles formed in the chamber from escaping from the apparatus. Ten to 15% graphite to epoxy by weight is more than enough.



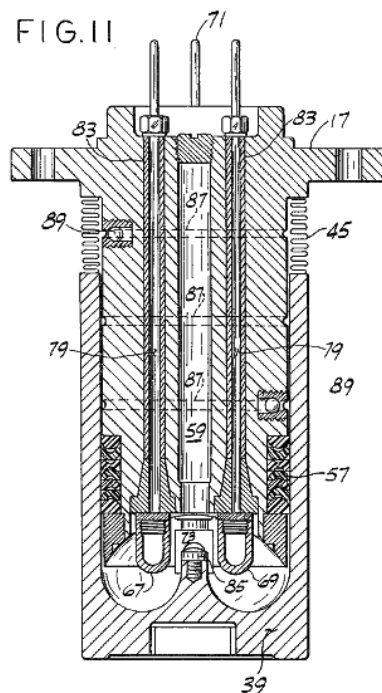
A typical cylinder is shown in section in **Fig.5**, showing the piston in its fully extended position with respect to the head and showing many details on a somewhat larger scale than that of **Fig.4**. A set of seals **57**, made of a material such as that sold under the trade designation Teflon by the DuPont Company of Delaware, is positioned between the cylinder head and wall **43** to prevent escape of the working fluid from chamber **41**. A filler tube **59** with a ball valve at its lower end is used in filling the chamber with the working fluid but is closed during operation of the engine.

The cylinder head has a generally concave depression therein, indicated at **61**, which defines the top end of the chamber. A plurality of electrodes for exciting and igniting the working fluid extend through the cylinder head into the chamber. Two of those electrodes, shown in section in **Fig.5** and labelled **63** and **65**, have tungsten points **75**, while the other two, labelled **67** and **69** (see **Fig.6** for electrode **69**) are containers called, respectively, the anode and the cathode. The electrodes are generally equidistantly spaced from the axes of their chambers and are generally coplanar to each other, their mutual plane being perpendicular to the axes of their chambers. Each electrode is positioned 90 degrees from adjacent electrodes in this embodiment

and are generally positioned so that a line from the anode to the cathode and a line between the other two electrodes intersect at a focal point generally on the axis of the chamber. The radial distance of each electrode from the focal point is fixed for a reason discussed below. The general construction of electrodes **63** and **65** is shown in **Fig.6** to **Fig.9**. These electrodes include a conductive rod **71** (see **Fig.7**) preferably of brass or copper; a conductive, generally rectangular plate **73** (see **Fig.6**, **Fig.8** and **Fig.9**); and tungsten point **75** mounted in a conductive base **77** generally at right angles to the plate (see **Fig.8** and **Fig.9**).



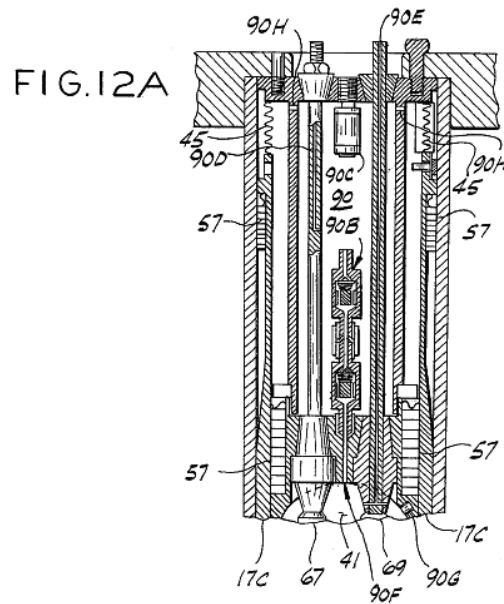
The construction of the anode and cathode is shown in **Fig.10**. Each includes a conductive rod **79** and a container **81**. The cathode container is substantially pure aluminium. If desired, aluminium alloys with, e.g., less than 5% copper, 1% manganese and 2% magnesium may be used. In one embodiment, the cathode container contains approximately four grams of thorium-232 and is filled with argon. In this same embodiment the anode container is copper or brass and contains approximately two grams of rubidium-37 and approximately three grams of phosphorus-15 hermetically sealed in mineral oil. In a second embodiment, the cathode is still aluminium, but it contains at least two grams of rubidium-37 in addition to the approximately four grams of thorium-232 in either argon or mineral oil. In this second embodiment, the anode is also aluminium and contains at least 4 grams of phosphorus-15 and at least 2 grams of thorium-232 in argon or mineral oil. Alternatively, mesothorium may be used for the thorium, strontium-38 may be used for the rubidium, and sulphur-16 may be used for the phosphorus. Rods **71** and **79** extend through cylinder head **17** to the exterior where electrical connections are made to the electrodes. Each rod is surrounded by one of four insulating sleeves **83**, the lower portion of each of which being flared outwards to seat firmly in the cylinder head.



The piston has a generally semi-toroidal depression in its upper surface (see **Fig.4**, **Fig.5** and **Fig.11**) and carries a conductive discharge point **85** of copper, brass or bronze generally along the axis of the chamber. When the piston is generally extended, the discharge point is a substantial distance from the electrodes. But when the piston is in its upper position (see **Fig.11**), the discharge point is positioned generally between all four electrodes and close to them, there being gaps between the electrodes and the discharge point. When the piston is in this upper position, the electrodes extend somewhat into the semi-toroidal depression in the piston's upper surface and the chamber is generally toroidal in shape. The volume of the chamber shown in **Fig.11** can be from approximately 6.0 cubic inches (100 cc) or larger. Given the present state of the art, 1500 cubic inches (25,000 cc) appears to be the upper limit. A plurality of ports **87** and one-way valves **89** return working fluid which escapes from the chamber back into it, so long as a sealing system such as bellows **45** is used.

An alternative cylinder head/piston arrangement is shown in **Fig.12**. The main difference between this arrangement and that of **Fig.5** is that the chamber walls, here labelled **43'** are integrally formed with the

head. As a result seals **57** are carried by the piston rather than by the head, the attachment of bellows **45** is somewhat different, and the fluid-returning valves and ports are part of the piston rather than of the head. Otherwise these arrangements are substantially the same. Preferably, the cylinders of both arrangements are hermetically sealed.



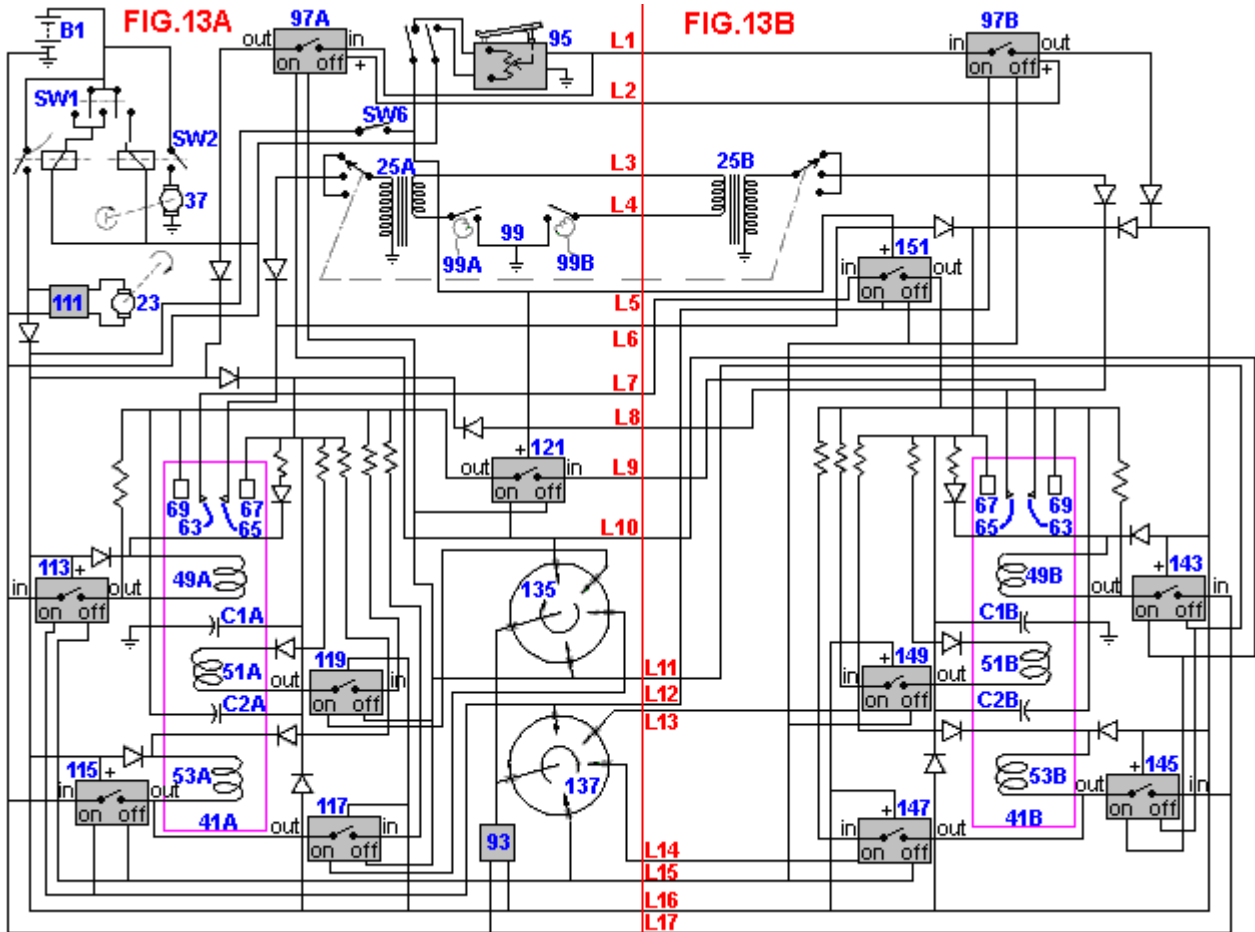
An additional embodiment of a cylinder head/piston arrangement used in the present invention is shown in **Fig.12A**. In this arrangement, a tapered sleeve **17C** mates between cylinder head **17** and piston **39**, a plurality of seals **57** are provided, and electrodes **67** and **69** have a somewhat different shape. Also, in this embodiment, a chamber **90** is provided in cylinder head **17** for storing additional working fluid, i.e., the purpose of chamber **90** is to extend the operating time between refuelling by circulating the working fluid, viz. the mixture of inert gases described, between cylinder **41** and chamber **90** as needed so that the reactions in cylinder **41** are not adversely affected. To accomplish this, this embodiment further includes a two-way circulation valve **90B**, a relief valve **90C**, and duct or passageway **90D** for evacuating and filling chamber **90**, a duct or passageway **90E** for evacuating and filling cylinder **41**, a passageway **90F** between chamber **90** and cylinder **41** in which two-way valve **90B** is disposed, a sensor **90G** and a plurality of small pressure relief holes **90H**. Relief holes **90H** serve to relieve the pressure on bellows **45** as the piston moves from BDC to TDC.

In larger engines holes **90H** should be replaced with one way valves. Two-way valve **90B** is either controlled by sensor **90G** or is manually operated, as desired, to allow the circulation of gases between chamber **90** and cylinder **41**. The sensor itself detects a condition requiring the opening or closing of valve **90B** and signals that condition to the valve. For example, sensor **90G** can measure pressure in cylinder **41** while the piston is at top dead centre. A predetermined cylinder pressure can cause a spring to compress, causing the valve to open or close as appropriate. A subsequent change in the cylinder pressure would then cause another change in the valve. Another sensor (not shown) could measure the physical location of the piston by a physical trip switch or an electric eye, or it could measure angular distance from top dead centre on the distributor or the crankshaft. The sensor must keep the gas pressure in chamber **90** at one atmosphere, plus or minus 5%, and at top dead centre, cylinder **41** should also be at that pressure. If gas is lost from the system, it is more important to maintain the proper pressure in cylinder **41**. Alternatively, a small passage between cylinder **41** and chamber **90** could function in a passive manner to satisfactorily accomplish the same result. From the above, it can be seen that this embodiment utilises the hollowed out centre of the cylinder head for storing additional working fluid, which fluid is circulated between chamber **90** and cylinder **41** through a valve system comprising valve **90B** and sensor **90G** with the moving piston causing the gases to circulate.

The electrical circuitry for engine **11** includes (see **Fig.13A**) a 24 V battery **B1**, an ignition switch **SW1**, a starter switch **SW2**, starter motor **37**, a main circuit switch **SW4**, a step-down transformer **93** (e.g., a 24 V to 3.5 V transformer), a switch **SW6** for supplying power to ignition coil **25** (shown in **Fig.13A** and **Fig.13B** as two separate ignition coils **25A** and **25B**), and various decoupling diodes.

The circuitry of **Fig.13A** also includes a high frequency voltage source or oscillator **95** for supplying rapidly varying voltage through two electronic current regulators **97A**, **97B** (see **Fig.13B** for regulator **97B**) to the anode and cathode electrodes of each cylinder, and a high-voltage distributor **99** for distributing 40,000 volt

pulses to the cylinders. Distributor **99** has two wipers **99A** and **99B** and supplies three pulses to each cylinder per cycle. Wipers **99A** and **99B** are 180 degrees out of phase with each other and each operates to supply pulses to its respective cylinder from TDC to 120 degrees thereafter. More pulses are desirable and therefore a better distributor arrangement (shown in **Fig.14**) may be used. The arrangement shown in **Fig.14** includes two ignition coils **101**, **103**, a simple distributor **105** and a pair of magnetic ignition circuits **107** and **109**, described below. Of course many other ignition systems could also be developed. For example, a single circuit might be used in place of circuits **107**, **109**, additional induction coils might be added to the ignition coils to assist in starting or a resistor could be added to the ignition coils to ensure a constant 40,000 volt output regardless of engine rpm. Also, a solid-state distributor could be used instead of the mechanical distributor labelled **99**.



Referring back to **Fig.13A**, for engines of more than 1000 hp a high frequency source **95** could be used to control engine RPM. The output frequency is controlled by a foot pedal similar to an accelerator pedal in a conventional vehicle. The output frequency varies through a range of from approximately 2.057 MHz to approximately 27.120 MHz with an output current of approximately 8.4 amps. The speed of engine **11** is controlled by the output frequency of source **95**. The high frequency current, as described below, is directed to each cylinder in turn by circuitry described below. For engines producing from 300 to 1000 hp (not shown), a high frequency source having a constant output of 27.120 MHz with a constant current of 3.4 amps which is continually supplied to all cylinders could be used. In this case an autotransformer, such as that sold under the trade designation Variac by the General Radio Company, controlled by a foot pedal varies the voltage to each cylinder from 5 to 24 volts DC at 4.5 amps, using power from the batteries or the alternator. The DC current from the Variac is switched from cylinder to cylinder by two small electronic switching units which in turn are controlled by larger electronic switching units. For the smallest engines (not shown), a high frequency generator could supply a constant output of 27.120 MHz with a constant current of 4.2 amps to the cylinders during starting only. Speed control would be achieved by a Variac as described above which controls the DC voltage supplied to the cylinders in turn within a range of from 5 to 24 volts at a current of 5.2 amps. In this case, once the engine is running, the full voltage needed to ignite the (smaller) quantity of gases is obtained from the electrodes in the other cylinder of the pair.

The circuitry of **Fig.13A** also includes the generator, a voltage regulator and relay **111**, five electronic switching units **113**, **115**, **117**, **119** and **121**, electrodes **63** and **65** associated with chamber **41A** (hereinafter



chamber **41A** is sometimes referred to as the "A" cylinder and chamber **41B** is sometimes referred to as the "B" cylinder), anode **67**, cathode **69**, magnetic coils **49A**, **51A** and **53A**, capacitors **C1A** and **C2A**, and various decoupling diodes. The electronic switching units can take a variety of forms. For example, one simple form (see **Fig.15**) includes a pair of SCRs **123** and **125**. The switching unit is connected at terminal IN to the corresponding line on the input side and at terminal OUT to the corresponding line on the output side. When a voltage of 3.5 volts is supplied from the battery through a distributor, for example, to the ON terminal, SCR **125** conducts, thereby completing a circuit through the switching unit. Conversely, when 3.5 volts is applied to the OFF terminal, SCR **123** conducts and the circuit is broken. Likewise, the circuit for regulators **97A** and **97B** (see **Fig.16**) includes two SCRs **127** and **129** and a PNP transistor **131**. In this circuit when SCR **127** is gated on, it forces transistor **131** into conduction, thereby completing the circuit through the regulator. When SCR **129** is gated on, the circuit through transistor **131** is broken. A number of other configurations may be used in place of those of **Fig.15** and **Fig.16** and not all would use SCRs. For example, one triode could be used to replace two main SCRs, or transistors could be used instead of SCRs.

A pair of low-voltage distributors **135** and **137** are also shown in **Fig.13A**. Distributors **135** and **137** provide gating pulses for the electronic switching units of **Fig.13A** and **Fig.13B**. Of course, solid-state distributors could also replace mechanical distributors **135** and **137**.

In addition, the engine circuitry includes (see **Fig.13B**) five electronic switching units **143**, **145**, **147**, **149** and **151** corresponding to units **113**, **115**, **117**, **119** and **121** of **Fig.13A**, electrodes **63** and **65** of the "B" cylinder, anode **67**, cathode **69**, electric coils **49B**, **51B** and **53B**, capacitors **C1B** and **C2B**, and various decoupling diodes. The circuitry of **Fig.13B** is generally the same as the corresponding portions of **Fig.13A**, so the description of one for the most part applies to both. Of course, if more than two cylinders are used, each pair of cylinders would have associated with them, circuitry such as that shown in **Fig.13A** and **Fig.13B**. The circuitry of **Fig.13A** is connected to that of **Fig.13B** by the lines **L1-L17**.

The working fluid and the fuel for the engine are one and the same and consist of a mixture of inert gases, which mixture consists essentially of helium, neon, argon, krypton and xenon. It is preferred that the mixture contain 35.6% helium, 26.3% neon, 16.9% argon, 12.7% krypton, and 8.5% xenon by volume, it having been calculated that this particular mixture gives the maximum operation time without refuelling. Generally, the initial mixture may contain, by volume, approximately 36% helium, approximately 26% neon, approximately 17% argon, approximately 13% krypton, and approximately 8% xenon. This mixture results from a calculation that equalises the total charge for each of the gases used after compensating for the fact that one inert gas, viz. radon, is not used. The foregoing is confirmed by a spectroscopic flashing, described below, that occurs during the mixing process. If one of the gases in the mixture has less than the prescribed percentage, it will become over-excited. Similarly, if one of the gases has more than the prescribed percentage, that gas will be under-excited. These percentages do not vary with the size of the cylinder.

Operation of the engine is as follows: At room temperature, each cylinder is filled with a one atmosphere charge of the fuel mixture of approximately 6 cubic inches (100 cc) /cylinder (in the case of the smallest engine) by means of filler tube **59**. The filler tubes are then plugged and the cylinders are installed in the engine as shown in **Fig.4**, one piston being in the fully extended position and the other being in the fully retracted position. To start the engine, the ignition and starter switches are closed, as is switch **SW6**. This causes the starter motor to crank the engine, which in turn causes the wiper arms of the distributors to rotate. The starting process begins, for example, when the pistons are in the positions shown in **Fig.4**. Ignition coil **25** and distributor **99** (see **Fig.13A**) generate a 40,000 volt pulse which is supplied to electrode **65** of chamber **41A**. Therefore, a momentary high potential exists between electrodes **63** and **65** and the plates on each. The discharge point on piston **39A** is adjacent these electrodes at this time and sparks occur between one or more of the electrodes and the discharge point to partially excite, e.g. ionise, the gaseous fuel mixture.

The gaseous fuel mixture in cylinder **41A** is further excited by magnetic fields set up in the chamber by coil **49A**. This coil is connected to the output side of electronic switching unit **121** and, through switching unit **113**, to the battery and the generator. At this time, i.e., between approximately 5 degrees before TDC and TDC, distributor **135** is supplying a gating signal to unit **121**. Any current present on the input side of unit **121**, therefore, passes through unit **121** to energise coil **49A**. Moreover, high frequency current from oscillator **95** is supplied via regulator **97A** to coil **49A**. This current passes through regulator and relay **97A** because the gating signal supplied from distributor **135** to unit **121** is also supplied to relay **97A**. The current from switching unit **121** and from oscillator **95** also is supplied to the anode and the cathode. It is calculated that this causes radioactive rays (x-rays) to flow between the anode and the cathode, thereby further exciting the gaseous mixture.

As the starter motor continues cranking, piston **39A** begins moving downward, piston **39B** begins moving upward, and the wiper arms of the distributors rotate. (Needless to say, a solid-state distributor would not rotate. The distributor could utilise photo cells, either light or reflected light, rather than contact points). After 45 degrees of rotation, distributor **135** supplies a gating pulse to electronic switching unit **119**, thereby completing a circuit through unit **119**. The input to unit **119** is connected to the same lines that supply current to coil **49A**. The completion of the circuit through unit **119**, therefore, causes coil **51A** to be energised in the same manner as coil **49A**. After an additional 45 degrees of rotation, distributor **135** gates on electronic switching unit **117** which completes a circuit to the same lines. The output terminal of unit **117** is connected to coil **53A**, and so this coil is energised when unit **117** is gated on. All three coils of the "A" cylinder remain energised and, therefore, generating magnetic fields in chamber **41A** until piston **39A** reaches BDC.

As piston **39A** moves from TDC to BDC, two additional 40,000 volt pulses (for a total of three) are supplied from distributor **99** to the "A" cylinder. These pulses are spaced approximately 60 degrees apart. If more pulses are desired, the apparatus shown in **Fig.14** may be used. In that case, the solenoids indicated generally at **107A**, **107B** and **109A**, **109B** are energised to create a number of rapid, high-voltage pulses which are supplied as indicated in **Fig.14** to the cylinders, distributor **105** operating to supply pulses to only one of the pair of cylinders at a time.

As piston **39A** reaches BDC, distributor **135** sends a pulse to the OFF terminals of electronic switching units **121**, **117** and **119**, respectively, causing all three coils **49A**, **51A** and **53A** to be de-energised. At about the same time, i.e., between approximately 5 degrees before TDC and TDC for piston **39B**, distributor **137** supplies a gating pulse to the ON terminals of electronic switching units **113** and **115**. The power inputs to units **113** and **115** come from the generator through regulator **111** and from the battery, and the outputs are directly connected to coils **49A** and **53A**. Therefore, when units **113** and **115** are gated on, coils **49A** and **53A** are reenergised. But in this part of the cycle, the coils are energised with the opposite polarity, causing a reversal in the magnetic field in chamber **41A**. Note that coil **51A** is not energised at all during this portion of the cycle. Capacitors **C1A** and **C2A** are also charged during the BDC to TDC portion of the cycle. (During the TDC to BDC portion of the cycle, these capacitors are charged and/or discharged by the same currents as are supplied to the anode and cathode since they are directly connected to them).

As piston **39A** moves upwards, electrodes **63** and **65** serve as pick-up points in order to conduct some of the current out of chamber **41A**, this current being generated by the excited gases in the chamber. This current is transferred via line **L7** to electronic switching unit **151**. The same gating pulse which gated on units **113** and **115** was also supplied from distributor **137** via line **L12** to gate on switching unit **151**, so the current from the electrodes of chamber **41A** passes through unit **151** to the anode, cathode and capacitors of chamber **41B**, as well as through switching units **147** and **149** to coils **49B**, **51B** and **53B**. Thus it can be seen that electricity generated in one cylinder during a portion of the cycle is transferred to the other cylinder to assist in the excitation of the gaseous mixture in the latter. Note that this electricity is regulated to maintain a constant in-engine current. It should be noted, that twenty four volts from the generator is always present on electrodes **63** and **65** during operation to provide for pre-excitement of the gases.

From the above it can be seen that distributors **135** and **137** in conjunction with electronic switching units **113**, **115**, **117**, **119**, **121**, **143**, **145**, **147**, **149** and **151** constitute the means for individually energising coils **49A**, **49B**, **51A**, **51B**, **53A** and **53B**. More particularly, they constitute the means to energise all the coils of a given cylinder from the other cylinder when the first cylinder's piston is moving from TDC to BDC and operate to energise only two (i.e., less than all) of the coils from the alternator when that piston is moving from BDC to TDC. Additionally, these components constitute the means for energising the coils with a given polarity when the piston of that cylinder is moving from TDC to BDC and for energising the first and third coils with the opposite polarity when that piston is moving from BDC to TDC.

As can also be seen, switching units **121** and **151** together with distributors **135** and **137** constitute the means for closing a circuit for flow of current from chamber **41A** to chamber **41B** during the BDC to TDC portion of the cycle of chamber **41A** and for closing a circuit for flow of current from chamber **41B** to chamber **41A** during the TDC to BDC portion of the cycle of chamber **41A**. Oscillator **95** constitutes the means for supplying a time varying electrical voltage to the electrodes of each cylinder, and oscillator **95**, distributors **135** and **137**, and regulators **97A** and **97B** together constitute the means for supplying the time varying voltage during a predetermined portion of the cycle of each piston. Moreover, distributor **99** together with ignition coils **25A** and **25B** constitute the means for supplying high-voltage pulses to the cylinders at predetermined times during the cycle of each piston.

The cycle of piston **39B** is exactly the same as that of piston **39A** except for the 180 degree phase

difference. For each cylinder, it is calculated that the excitation as described above causes the gases to separate into layers, the lowest atomic weight gas in the mixture, namely helium, being disposed generally in the centre of each chamber, neon forming the next layer, and so on until we reach xenon which is in physical contact with the chamber walls. The input current (power) to do this is the calculated potential of the gas mixture. Since helium is located in the centre of the chamber, the focal point of the electrode discharges and the discharges between the anode and cathode is in the helium layer when the piston is near TDC. As the piston moves slightly below TDC, the electrons from electrodes **63** and **65** will no longer strike the tip of the piston, but rather will intersect in the centre of the cylinder (this is called "focal point electron and particle collision") as will the alpha, beta and gamma rays from the anode and cathode. Of course, the helium is in this exact spot and is heavily ionised at that time. Thus the electrodes together with the source of electrical power connected thereto constitute the means for ionising the inert gas.

It is calculated that as a result of all the aforementioned interactions, an ignition discharge occurs in which the helium splits into hydrogen in a volume not larger than  $2$  or  $3 \times 10^{-6}$  cubic millimetres at a temperature of approximately 100,000,000 degrees F. Of course this temperature is confined to a very small space and the layering of the gases insulates the cylinder walls from it. Such heat excites the adjacent helium so that a plasma occurs. Consequently, there is a minute fusion reaction in the helium consisting of the energy conversion of a single helium atom, which releases sufficient energy to drive the piston in that chamber toward BDC with a force similar in magnitude to that generated in a cylinder of a conventional internal combustion engine. Electrodes **63** and **65** extend into the argon layer while each piston is in its BDC to TDC stroke so as to pick up some of the current flowing in that layer. It may take a cycle or two for the gases in the cylinders to become sufficiently excited for ignition to occur.

Once ignition does occur, the electrical operation of the engine continues as before, without the operation of the starter motor. Distributor **99** supplies three pulses per cycle (or more if the magnetic ignition system of **Fig.14** is used) to each cylinder; and distributors **135** and **137** continue to supply "on" and "off" gating pulses to the electronic switching units. The rpm of the engine is, as explained above, governed by the frequency of the current from oscillator **95** (or in the case of smaller horsepower units, by the DC voltage supplied to the cylinders from the Variac).

Because of the minute amount of fuel consumed in each cycle, it is calculated that a cylinder can run at 1200 rpm approximately 1000 hours, if not more, on a single charge of gas. Note that even at 1200 rpm, there will be intense heat occurring only 0.002% of the time. This means that input power need be applied only sporadically. This power can be supplied to a cylinder from the other cylinder of its pair by means of electronic switching units which, in the case of SCRs, are themselves triggered by low voltage (e.g. 3.5 V) current. Thus, since electrical power generated in one cylinder is used to excite the gases in the other cylinder of a pair, it is practical that the cylinders be paired as discussed above. Capacitors are, of course, used to store such energy for use during the proper portion of the cycle of each cylinder.

From the above, it should be appreciated that the engine of this invention has several advantages over presently proposed fusion reactors, such as smaller size, lower energy requirements, etc. But what are the bases of these advantages? For one, presently proposed fusion reactors use hydrogen and its isotopes as a fuel instead of inert gases. Presumably this is because hydrogen requires less excitement power. While this is true, the input power that is required in order to make hydrogen reactors operate makes the excitation power almost insignificant. For example, to keep a hydrogen reactor from short circuiting, the hydrogen gas has to be separated from the reactor walls while it is in the plasma state. This separation is accomplished by the maintenance of a near vacuum in the reactor and by the concentration of the gas in the centre of the reactor (typically a toroid) by a continuous, intense magnetic field. Accordingly, separation requires a large amount of input energy.

In the present invention, on the other hand, the greater excitation energy of the fuel is more than compensated for by the fact that the input energy for operation can be minimised by manipulation of the unique characteristics of the inert gases. First, helium is the inert gas used for fusion in the present invention. The helium is primarily isolated from the walls of the container by the layering of the other inert gases, which layering is caused by the different excitation potential (because of the different atomic weights) of the different inert gases, said excitation being caused by the action of the electrodes, anode and cathode in a magnetic field. This excitation causes the gases each to be excited in inverse proportion to their atomic numbers, the lighter gases being excited correspondingly more. Helium, therefore, forms the central core with the other four gases forming layers, in order, around the helium. The helium is secondarily isolated from the walls of the container by a modest vacuum (in comparison to the vacuum in hydrogen reactors) which is caused partially by the "choking" effect of the coils and partially by the enlargement of the combustion chamber as the piston moves from TDC to BDC. (Unexcited, the gases are at one atmosphere

at TDC). Second, argon, the middle gas of the five, is a good electrical conductor and becomes an excellent conductor when (as explained below) it is polarised during the mixing process. By placing the electrodes such that they are in the argon layer, electrical energy can be tapped from one cylinder for use in the other. During a piston's movement from BDC to TDC, the gases are caused to circulate in the cylinder by the change in the polarity of the coils, which occurs at BDC.

During such circulation, the gases remain layered, causing the argon atoms to be relatively close to each other, thereby optimising the conductivity of the argon. This conductivity optimisation is further enhanced by a mild choking effect that is due to the magnetic fields. The circulation of the highly conductive argon results in a continuous cutting of the magnetic lines of force so that the current flows through the electrodes. This production of electricity is similar to the rotating copper wire cutting the magnetic lines of force in a conventional generator except that the rotating copper wire is replaced by the rotating, highly conductive argon. The amount of electricity that can be produced in this manner is a function of how many magnetic field lines are available to be cut. If one of the coils, or all three of the coils or two adjacent coils were energised, there would be only one field with electricity produced at each end. By energising the top and the bottom coil, two separate fields are produced, with electricity produced at four points.

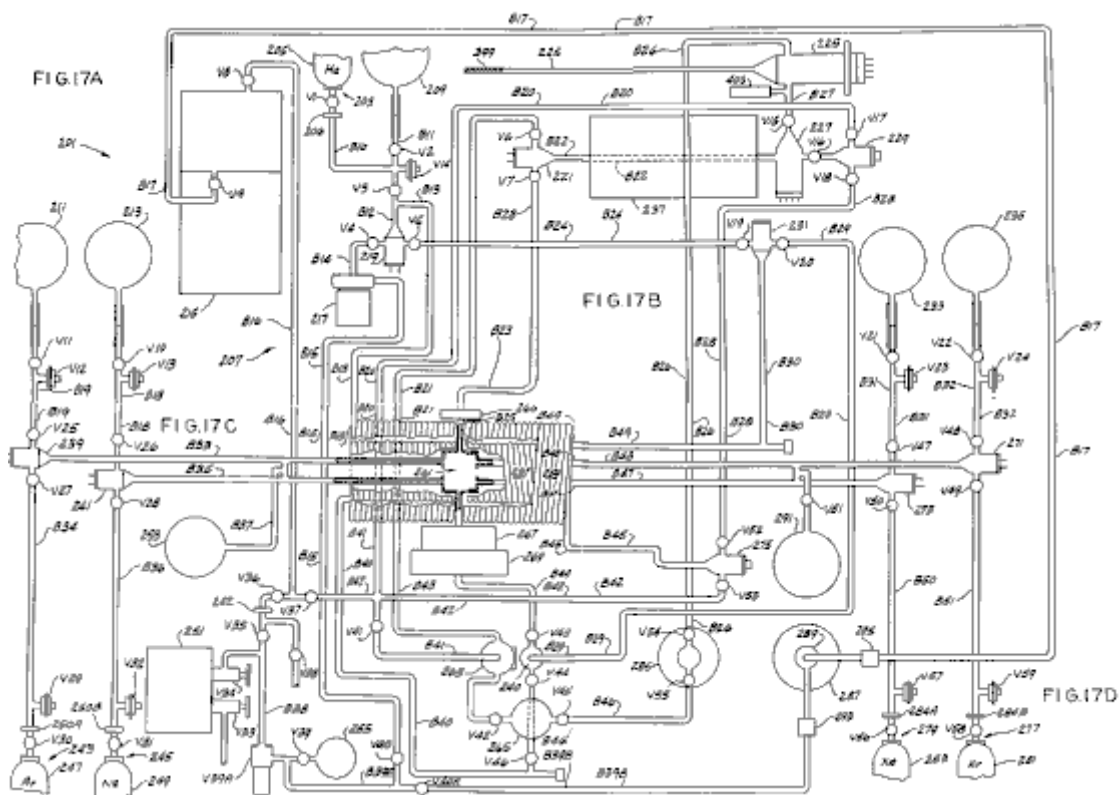
A five coil system, if there were sufficient space, would produce three fields with the top, bottom and middle coils energised. Six points for electricity production would result. The number of coils that can be installed on a given cylinder is a function of space limitations. The recombination of gas atoms during the BDC to TDC phase causes the radiation of electrical energy which also provides a minor portion of the electricity that the electrode picks up. Additional non-grounded electrodes in each cylinder would result in more electricity being tapped off. It should be noted that during the BDC to TDC phase, the anode and the cathode are also in the argon layer and, like the electrodes, they pick up electricity, which charges the capacitors around the cylinder. Third, inert gases remain a mixture and do not combine because of the completeness of the electron shells. They are therefore well suited to a cycle whereby they are continually organised and reorganised. Fourth, as the helium atoms are consumed, the other gases have the capacity to absorb the charge of the consumed gas so that the total charge of the mixture remains the same.

The second basis of these advantages of the present engine over proposed fusion reactors concerns the fact that hydrogen reactors develop heat which generates steam to turn turbines in order to generate electrical power. This requires tremendous input energy on a continuous basis. The present invention operates on a closed cycle, utilising pistons and a crankshaft which does not require a continuous plasma but rather an infrequent, short duration ( $10^{-6}$  second) plasma that therefore requires much less input energy. In the present invention, a plasma lasting longer than  $10^{-6}$  second is not necessary because sufficient pressure is generated in that time to turn the engine. A plasma of longer duration could damage the engine if the heat were sufficiently intense to be transmitted through the inert gas layers to the cylinder walls. A similar heat build-up in the engine can occur if the repetition rate is increased. Such an increase can be used to increase the horsepower per engine size but at the cost of adding a cooling system, using more expensive engine components, and increasing fuel consumption. Note that even though layers of inert gases insulate the cylinder walls, there might be some slight increase in the temperature of the gas layers after a number of cycles, i.e., after a number of ignitions.

Whereas hydrogen fusion reactors cannot directly produce power by driving a piston (because of the required vacuum), the present invention uses the layered inert gases to transmit the power from the plasma to each gas in turn until the power is applied to a piston, which can easily be translated into rotary motion. The layered gases also cushion the piston from the full force of the ignition. Moreover, the fields inside the cylinder undergoing expansion cause the gases to shrink, thereby taking up some of the pressure generated by the explosion and preventing rupturing of the cylinder walls.

Turning now to **Fig.17A** to **Fig.17D**, there is shown apparatus **201** for preparing the fuel mixture for engine **11**. For convenience apparatus **201** is called a mixer although it should be understood that the apparatus not only mixes the gases which form the fuel but also performs many other vital functions as well. The five constituent inert gases are introduced in precise, predetermined proportions. The mixer extracts, filters and neutralises the non-inert gases and other contaminants which may be found in the gas mixture. It also increases the potential capacity of gas atoms, discharges the krypton and xenon gases, polarises the argon gases, ionises the gases in a manner such that the ionisation is maintained until the gas has been utilised and otherwise prepares them for use as a fuel in engine **11**. In particular, the mixer makes the gases easier to excite during operation of the engine. Mixing does not mean an atomic or molecular combination or unification of gases because inert gases cannot chemically combine, in general, due to the completeness of the outer shell of electrons. During mixing, the various gases form a homogeneous mixture. The mixing of the five inert gases in apparatus **201** is somewhat analogous to preparing a five part liquid chemical mixture

by titration. In such a mixture, the proportions of the different chemicals are accurately determined by visually observing the end point of each reaction during titration. In apparatus **201**, a visible, spectroscopic flash of light accompanies the desired end point of the introduction of each new gas as it reaches its proper, precalculated proportion. (Each gas has its own distinctive, characteristic, spectroscopic display). The end points are theoretically calculated and are determined by pre-set voltages on each of a group of ionising heads in the apparatus, as described below.

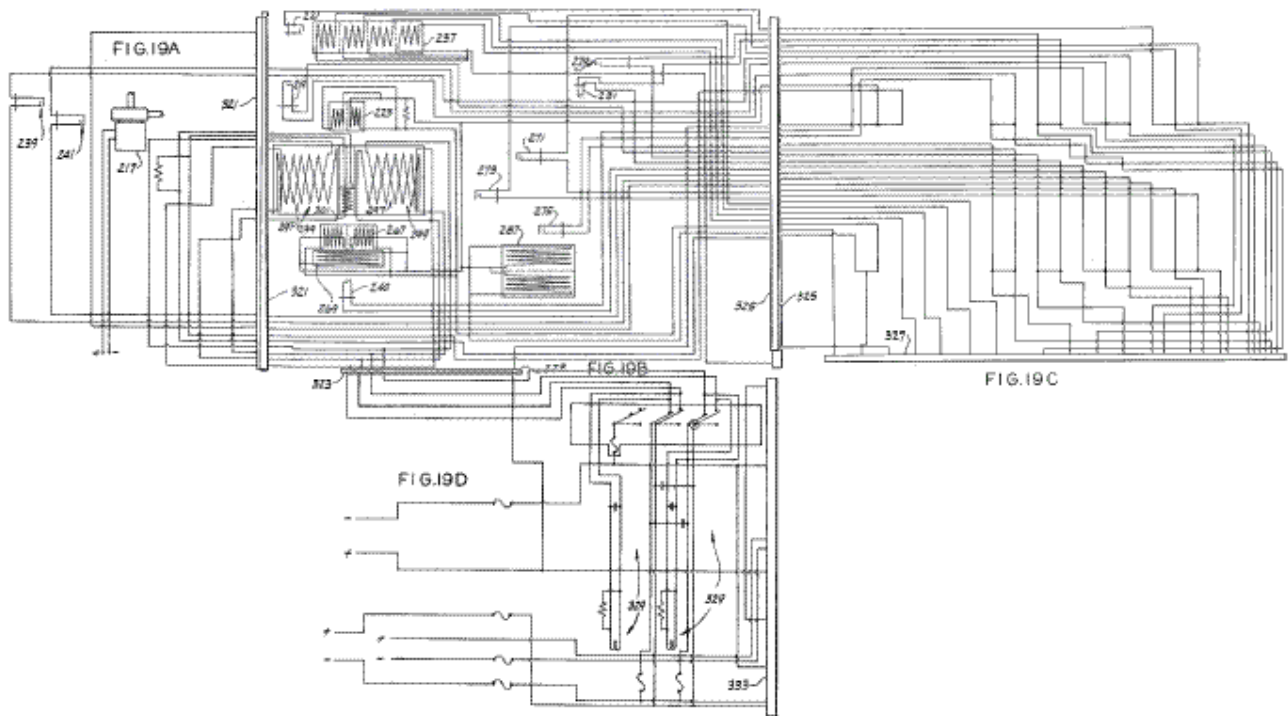


Mixer **201** includes (see **Fig.17A**) an intake port, indicated generally at **203**, which during operation is connected to a source **205** of helium gas, a gauge **206**, glass tubing **207** comprising a plurality of branches **B10-B25** for flow of the gases through the mixer, a plurality of valves **V1-V11** in the branches, which valves may be opened or closed as necessary, three gas reservoirs **209**, **211** and **213** for storing small quantities of helium, argon and neon gas respectively, an ionising and filtering unit **215** for filtering undesired non-inert gases and contaminants out of the fuel mixture, for regulating the gas atom electron charge and to absorb the free flowing electrons, a gas flow circulation pump **217**, two ionising heads **219** and **221**, and three quality control and exhaust valves **V12-V14**. The mixer also comprises (see **Fig.17B**) a high frequency discharge tube **225**, a non-directed cathode ray tube **227**, two more ionising heads **229** and **231**, two additional gas reservoirs **233** and **235** for storing small quantities of xenon and krypton, a quadruple magnetic coil **237**, a group of valves **V15-V24**, valves **V23** and **V24** being quality control and exhaust valves, and a plurality of additional glass tubing branches **B26-B32**.

Turning to **Fig.17C**, mixer **201** also includes additional ionising heads **239**, **240** and **241**, additional valves **V25-V46**, **V39A** and **V40A**, valves **V29** and **V32** being quality control and exhaust valves and valve **V39A** being a check valve, a vacuum and pressure gauge **242** between valves **V35** and **V36**, tubing branches **B34-B49** (branch **B39** consisting of two parts **B39A** and **B39B**), a pair of intake ports **243** and **245** which during operation are connected to sources **247** and **249** of argon and neon gas respectively, gauges **250A** and **250B**, a spark chamber **251**, a hydrogen and oxygen retention chamber **253** containing No. 650 steel dust in a silk filter, an ion gauge **255** (which can be an RG 75K type Ion Gauge from Glass Instruments, Inc. of Pasadena, Calif.) for removing excess inert gases from the mixture, inner and outer coils of glass tubing **257** and **259** surrounding a mixing chamber **261**, a focused x-ray tube **263** for subjecting the mixture flowing through it to 15-20 millirem alpha radiation and 120-125 millirem beta radiation, a directed cathode ray tube **265**, two twin parallel magnetic coils **266** and **267**, and a focusing magnetic coil **269**. It is important that coils **266** and **267** be immediately adjacent mixing chamber **261**. And (see **Fig.17D**) the mixer also comprises three more ionising heads **271**, **273** and **275**, two entry ports **277** and **279** which during operation are connected to sources **281** and **283** of krypton and xenon respectively, gauges **284A** and **284B**, a high frequency discharge tube **285**, a twin parallel magnetic coil **287** surrounding a polariser **289** for polarising the

argon, said polarise containing fine steel particles which are polarised by coils **287** and which in turn polarise argon, a second hydrogen retention chamber **291**, a pair of tubing branches **B50** and **B51**, two filters **293** and **295** and a plurality of valves **V47-V59**, valves **V57** and **V59** being quality control and exhaust valves.

Inner and outer glass tubing coils **257** and **259** and mixing chamber **261** are shown in cross section in **Fig.18**. Intermediate glass coils **257** and **259** are two magnetic coils **297** and **299** having an inductance of approximately 130 mH. A yoke coil **301** is positioned in a semi-circle around mixing chamber **261**. Inside mixing chamber **261** are located a pair of screens **303** and **305**, insulators **307** and **309**, and a pair of spark gaps indicated generally at **311** and **313**. A high frequency amplitude modulated source provides 120 V AC, 60 Hz, 8.4 amp, 560 watt, 27,120 to 40,000 MHz plus or minus 160 KHz current via heavily insulated wires **315** and **317** to the chamber. These wires are about twelve gauge, like those used as spark plug wires on internal combustion engines. Additionally 95 volt Direct Current is supplied via a smaller (e.g. sixteen to eighteen gauge) insulated wire **319**. As described below, the gases to be mixed and prepared flow through chamber **261** and are suitably treated therein by the action of the various fields present in the chamber.

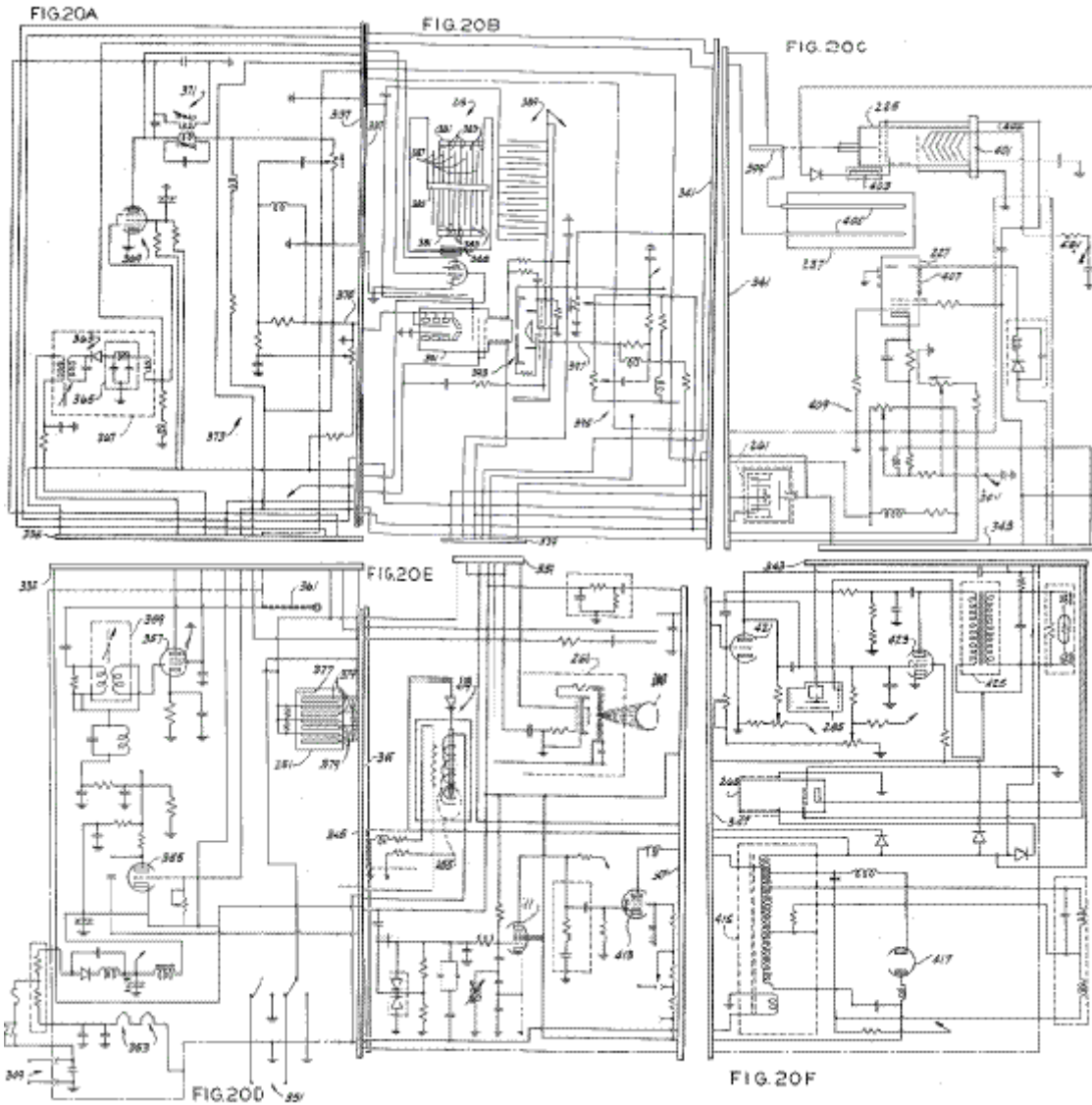


The magnetic coils, ionisation heads, and pump **217**, along with the required electrical interconnections, are schematically shown in **Fig.19A** to **Fig.19E**. More particularly, heads **239** and **241** are shown in **Fig.19A**, as is pump **217**. Each ionising head has two electrodes with a gap between them to cause ionisation of gases flowing through the head, the electrodes being connected to a source of electrical power. Pump **217** is directly connected to a source of power (either AC or DC as required by the particular pump being used). The connections between the circuitry on **Fig.19A** and that on **Fig.19B** are shown as a plug **321**, it being understood that this plug represents a suitable one-to-one connection between the lines of **Fig.19A** and those of **Fig.19B**.

The remaining ionising heads and all the magnetic coils are shown in **Fig.19B**. For clarity, the coils are shown in an unconventional form. Quadruple coil **237** (shown at the top of **Fig.19B**) has one side of each winding connected in common but the other sides are connected to different lines. Coil **223** consists of two windings in parallel. Coils **297** and **299**, the ones around the mixing chamber, are shown overlapping, it being understood that coil **297** is actually interior of coil **299**. Yoke coil **301**, as shown, extends half-way from the bottom to the top of coils **297** and **299**. Twin parallel magnetic coils **267** are connected in parallel with each other, both sides of focusing coil **269** being connected to one node of coils **267**. Likewise coils **287** are connected in parallel. The connections between the lines of **Fig.19B** and those of **Fig.19C** and **Fig.19D** are shown as plugs **323** and **325**, although other suitable one-to-one connections could certainly be made. **Fig.19C** shows the interconnecting lines between **Fig.19B** and **Fig.19E**. A plug **327** or other suitable one-to-one connections connects the lines of **Fig.19C** and **Fig.19E**.

A plurality of power sources, like the above-mentioned Variacs, of suitable voltages and currents as well as a plurality of relays **329**, and plugs **331** are shown on **Fig.19D** and **Fig.19E**. The connections between these

two Figures is shown as a plug **333**. It should be appreciated that the Variacs can be adjusted by the operator as necessary to supply the desired voltages to the aforementioned coils and ionising heads. It should also be realised that the desired relays can be closed or opened as needed by connecting or disconnecting the two parts of the corresponding plug **331**. That is, by use of plugs **331**, the operator can control the energising of the ionising heads and magnetic coils as desired. Plugs **331** are also an aid in checking to ensure that each component is in operating condition just prior to its use. Of course, the manipulation of the power sources and the relays need not be performed manually; it could be automated.



The remaining circuitry for the mixer is shown on **Fig.20A** to **Fig.20F**. For convenience, plugs **335**, **337**, **339**, **341**, **343**, **345** and **347** are shown as connecting the circuitry shown in the various Figures, although other suitable one-to-one connections may be used. The chassis of the apparatus is shown on these Figures in phantom and is grounded. The power supply for the apparatus is shown in part on **Fig.20A** and **Fig.20D** and includes an input **349** (see **Fig.20D**) which is connected to 120 volt, 60 Hz power during operation and an input **351** which is connected to the aforementioned high frequency generator or some other suitable source of approximately 27,120 MHz current. The power supply includes a pair of tuners **353**, numerous RLC circuits, a triode **355**, a pentode **357** with a ZnS screen, a variable transformer **359**, an input control **361**, a second variable transformer **363** (see **Fig.20A**) which together with a filter **365** forms a 2.0 volts (peak-to-peak) power supply **367**, a pentode **369**, a variable transformer **371**, and a resistor network indicated generally at **373**. Exemplary voltages in the power supply during operation are as follows: The anode of triode **355** is at 145 V, the control grid at 135 V and the cathode at -25 V. The voltage at the top of the right-hand winding of transformer **359** is -5 V. The anode of pentode **357** is at 143 V, the top grid is grounded (as is the ZnS screen), the bottom grid is connected to transformer **359**, and the control electrode is at 143 V. The input to supply **367** is 143 volts AC while its output, as stated above, is 2 V (peak-to-peak). The anode of pentode **369** is at 60 V, the grids at -1.5 V, the control electrode at 130 V, and the cathode is substantially at ground. The output of resistor network **373**, labelled **375**, is at 45 V.

Also shown on **Fig.20D** is spark chamber **251**. Spark chamber **251** includes a small amount of thorium, indicated at **377**, and a plurality of parallel brass plates **379**. When the gases in the mixer reach the proper ionisation, the alpha particles emitted by the thorium shown up as flashes of light in the spark chamber.

Turning now to **Fig.20B**, ionising and filtering unit **215** includes a pair of conductive supports **381** for a plurality of conductors **383**, said supports and conductors being connected to a voltage source, an insulating support **385** for additional conductors **387**, and a ZnS screen **388** which emits light when impurities are removed from the gaseous fuel mixture. Unit **215** also includes a second set of interleaved conductors indicated generally at **389**, a cold-cathode tube **391**, and an x-ray tube indicated generally at **393**. Also shown on **Fig.20B** is an RLC network **395** which has an output on a line **397** which is at 35 V, this voltage being supplied to the x-ray tube.

High frequency discharge tube **255** (see **Fig.20C**) has a conductive electrode **399** at one end to which high frequency current is applied to excite the gases in the mixer, and an electrode/heater arrangement **401** at the other, a voltage of 45 V being applied to an input **402** of the tube. It is desirable that a small quantity of mercury, indicated at **403**, be included in tube **225** to promote discharge of the helium gas. Magnetic coils **237** have disposed therein a pair of generally parallel conductors **405** to which a high frequency signal is applied. When gas flows through coils **237** and between parallel conductors **405**, therefore, it is subjected to the combination of a DC magnetic field from the coil and high frequency waves from the conductors, which conductors act as transmitting antennas. The resulting high frequency magnetic field causes the atoms to become unstable, which allows the engine to change a given atom's quantum level with much less input power than would normally be required. The volume of each gas atom will also be smaller. Also shown on **Fig.20C** is non-directed cathode ray tube **227**. The grids of tube **227** are at 145 V, the control electrode is at ground, while the anode is at 35 V to 80 V (peak-to-peak). The purpose of non-directed cathode ray tube **227** is to add photons to the gas mixture. To generate these photons, tube **227** has a two layer ZnS coating indicated generally at **407**. Chamber **261**, described above, is also shown schematically on **Fig.20C**, along with an RLC network **409**.

The power supply for the mixer (see the lower halves of **Fig.20E** and **Fig.20F**) also includes two pentodes **411** and **413**, a transformer **415**, and a diode tube **417**. The control electrode of pentode **411** is at 5 V to 40 V (peak-to-peak), the grids are at 145 V, the anode is at 100 V, and the cathode is at 8 V to 30 V (peak-to-peak). The control electrode of pentode **413** is at 115 V, while its grids and cathode are at -33 V. The anode of tube **413** is connected to transformer **415**. Also shown on **Fig.20E** are a relay **419** associated with ion gauge **255**, and focused x-ray tube **263** associated with ionisation head **240**. The upper input to tube **263** is at 45 V to 80 V (peak-to-peak).

Turning to **Fig.20F**, there is shown tubes **265** and **285**. Directed cathode ray tube **265** is a pentode connected like tube **227**. High frequency discharge tube **285** includes a phosphor screen and is connected to a high frequency source. Also shown on **Fig.20F** is a triode **421** with its anode at 30 V, its cathode at ground, and its control grid at -60 V; a pentode **423** with its anode at 135 V to 1000 V peak to peak, its cathode at ground, its control electrode at 143 V, its grids at 20 V; and a transformer **425**. It should be understood that various arrangements of electrical components other than those described above could be designed to perform the same functions.

The operation of the mixer is best understood with reference to **Fig.17A** to **Fig.17D** and is as follows: Before and during operation, the mixer, and particularly chamber **261** is kept hermetically sealed and evacuated. To begin the mixing process, helium is admitted into the mixer via intake port **203**. Then a vacuum is again drawn, by a vacuum pump (not shown) connected to valve **V38**, to flush the chamber. This flushing is repeated several times to completely cleanse the tubing branches of the mixer. The mixer is now ready. The ionisation heads next to mixing chamber **261** are connected to a voltage corresponding to approximately 36% of the calculated total ionising voltage, DC current is allowed to flow through magnetic coils **297** and **299** around chamber **261**, and high frequency current is allowed to pass through the mixing chamber. Helium is then slowly admitted, via port **203**, into the mixer. From port **203**, the helium passes through ionisation head **219** into glass tubing coil **259**. This glass coil, being outside magnetic coils **297** and **299**, is in the diverging portion of a magnetic field. The helium slowly flowing through glass coil **259** is gently excited. From coil **259**, the helium flows through branch **B45** to ionisation head **275** and from there, via branch **B28**, to ionisation head **229** (see **Fig.17B**). From head **229**, the gas flows through non-directed cathode ray tube **227** to high-frequency discharger **225**. The high frequency discharger **225**, with heating element, discharges, separates or completely neutralises the charge of any radioactive and/or cosmic particles that are in the helium atom in addition to the protons, neutrons and electrons.



The gas exits discharger **225** via branch **B26** and passes to high-frequency discharger **285**. The high frequency discharger **285**, without heating element, disturbs the frequency of oscillation which binds the gas atoms together. This prepares the helium atoms so that the electrons can more easily be split from the nucleus during the excitation and ignition process in the engine. Discharger **285** includes a phosphorus screen or deposit (similar to the coating on a cathode ray tube) which makes discharges in the tube visible. From discharger **285**, the helium passes through directed cathode ray tube **265** and focused x-ray tube **263**. Directed cathode ray tube **265** produces cathode rays which oscillate back and forth longitudinally underneath and along the gas carrying tube. After that, the helium passes successively through branch **B21**, ionisation head **221**, branch **B23**, twin parallel magnetic coil **266**, and branch **B25** into mixing chamber **261**. Helium flows slowly into and through apparatus **201**. The helium atoms become ionised as a result of excitation by magnetic force, high frequency vibrations and charge acquired from the ionisation heads. When sufficient helium has entered the apparatus, the ionisation energy (which is approximately 36% of the total) is totally absorbed. A spectroscopic flash of light in the mixing chamber signals that the precise, proper quantity of helium has been allowed to enter. The entry of helium is then immediately halted by the closing of valve **V3**.

The next step in preparing the fuel is to add neon to the mixture. The potential on the relevant ionisation heads, particularly head **241** (see **Fig.17C**), is raised by the addition of approximately 26% which results in a total of approximately 62% of the total calculated potential and valve **V31** is opened, thereby allowing neon to slowly enter the mixer via port **245**. This gas passes through branch **B36**, ionisation head **241**, and branch **B35** directly into the mixing chamber. Since the previously admitted helium is fully charged, the neon absorbs all of the increased ionisation potential. As soon as the neon acquires the additional charge, a spectroscopic flash of light occurs and the operator closes valve **V31**.

In the same manner, the potential on the ionisation heads is increased by the addition of approximately 17% for a total of approximately 79% of the total calculated potential and then valve **V30** is opened to admit argon into the mixer via port **243**. This gas passes through branch **B34**, ionisation head **239**, and branch **B33** into mixing chamber **261**. Again, when the proper amount of argon has been admitted, it emits a spectroscopic flash of light and the operator closes valve **V30**. Next, the potential on the ionisation heads is increased by the addition of approximately 13% to result in a total of approximately 92% of the total calculated potential and valve **V58** (see **Fig.17D**) is opened to admit krypton into the system. The krypton gas passes through branch **B51**, ionisation head **271** and branch **B48** into chamber **261**. Upon the emission of a spectroscopic flash of light by the gas, the operator closes valve **V58**. Finally, the potential on the ionisation heads is increased by the addition of approximately 8% which brings the ionisation potential to the full 100% of the calculated ionisation voltage and valve **V56** is opened to admit xenon into the mixer via port **279**. This gas passes through branch **B50**, ionisation head **273** and branch **B47** to the mixing chamber. When the proper amount of gas has been admitted, a spectroscopic flash of light occurs signalling the operator to close valve **V56**. Note that there are two filter/absorber units, labelled **253** and **291**. Unit **253** is connected to the neon and argon inlet branches **B33** and **B35** while unit **291** is connected to the krypton and xenon inlet branches **B47** and **B48**. These two units absorb hydrogen residue and immobilise the water vapour created when the pump circulates the gases and generates vacuum states.

After all the gases are admitted in the desired proportions, all the valves are closed. (The mixture in the mixing chamber and in the adjacent tubing is at one atmosphere pressure at this time). Once this is done, the interval valves of the system are all opened (but the inlet and outlet valves remain closed) to allow the mixture to circulate throughout the tubing as follows: branch **B44**, magnetic coils **267** and **269**, ionisation head **240**, branch **B29**, ionisation head **231**, branch **B24**, ionisation head **219**, pump **217**, branches **B15** and **B39A**, ionisation gauge **255**, branches **B38** and **B42**, ionisation head **275**, branch **B28**, ionisation head **229**, non-directed cathode ray tube **227**, quadruple magnetic coil **272**, ionisation head **221**, branch **B23**, twin parallel magnetic coil **266**, branch **B25** and mixing chamber **261**. When this circuit is initially opened, the pressure of the mixture drops 40-50% because some of the tubing had previously been under vacuum. Pump **217** is then started to cause the gases to be slowly and evenly mixed.

Because of dead space in the tubing and the reaction time of the operator, it may occur that the proportions of the gases are not exactly those set forth above. This is remedied during the circulation step. As the gas flows through ionisation gauge **255**, excess gas is removed from the mixture so that the correct proportions are obtained. To do this the grid of gauge **255** is subjected to 100% ionisation energy and is heated to approximately 165 degrees F. This temperature of 165 degrees F is related to xenon's boiling point of -165 degrees F in magnitude but is opposite in sign. Xenon is the heaviest of the five inert gases in the mixture. As the gas mixture flows through ionisation gauge **255**, the gas atoms that are in excess of their prescribed percentages are burned out of the mixture and their charge is acquired by the remaining gas atoms from the

grid of the ionisation gauge. Because the gases are under a partial vacuum, the ionisation gauge is able to adjust the gas percentages very precisely. (Note: The steps described in the last two paragraphs are repeated if the finished gases are rejected in the final quality control step described below).

The next step involves purifying the mixture so that only the five inert gases remain, absorbing any free electrons and regulating the electrical charge in the mixture. To do this, the circuit consisting of the following components is opened: Branch **B44**, magnetic coil **267**, magnetic coil **269**, ionisation head **240**, branch **B29**, ionisation head **231**, branch **B24**, ionisation head **219**, pump **217**, branches **B15** and **B39**, magnetic coil **287** (see **Fig.17D**) polariser **289**, branch **B17**, ionising and filtering unit **215**, branches **B16**, **B42**, and **B41**, x-ray tube **263**, branch **B21**, ionisation head **221**, branch **B23**, magnetic coil **266**, branch **B25**, and mixing chamber **261**. The gases should complete this circuit at least three times.

The last step required to prepare the mixture for bottling is polarisation of the argon. The circuit required to do this consists of the following components: mixing chamber **261**, branch **B44**, magnetic coil **267**, magnetic coil **269**, ionisation head **240**, cathode ray tube **265**, branch **B40**, tubing coil **257**, branches **B49** and **B30**, ionisation head **231**, branch **B24**, ionisation head **219**, pump **217**, branches **B15** and **B39**, twin parallel magnetic coil **287** (see **Fig.17D**), polariser **289**, branch **B17**, ionising and filtering unit **215**, branches **B16**, **B42** and **B20**, ionisation head **229**, cathode ray tube **227**, magnetic coil **237**, ionisation head **221**, branch **B23** and magnetic coil **266**. This too is repeated at least three times. The key to the polarisation of argon is polariser **289** and twin parallel magnetic coil **287** that encircles it. Polariser **289** is a glass bottle which is filled with finely powdered soft iron which can be easily magnetised. The filled bottle is, in effect, the iron core of the coils. The iron particles align themselves with the magnetic lines of force, which lines radiate from the centre toward the north and south poles. The ionised gas mixture is forced through the magnetised iron powder by means of pump pressure and vacuum, thereby polarising the argon gas. Filters **293** and **295** are disposed as shown in order to filter metallic particles out of the gas.

The mixture is now double-checked by means of spark chamber **251** at atmospheric pressure since the fusion reaction in the engine is started at one atmosphere. Because the gases in mixing apparatus **201** are at a partial vacuum, sufficient gases must be pumped into spark chamber **251** to attain atmospheric pressure. To do this valves **V33**, **V36** and **V40A** are closed and circulating pump **217** pumps the gases in the mixing apparatus via branches **B15** and **B39A**, through check valve **V39A** into spark chamber **251** until the vacuum and pressure gauge **242** indicates that the gases within spark chamber **251** are at atmospheric pressure. Valve **V34** is then closed. The spark chamber is similar to a cloud chamber. Six or more high capacity brass capacitor plates are spaced 1/8" to 1/4" apart in the chamber. A small plastic container holds the thorium 232. One side of the chamber is equipped with a thick glass window through which sparks in the chamber may be observed. A potential is placed on the brass plates in the chamber and the current flowing between the plates is measured. If this current exactly corresponds to the ionisation current, the mixture is acceptable. A difference of greater than 5% is not acceptable. A lesser difference can be corrected by recirculating the gas in the mixer and particularly through ionisation gauge **255** as previously described in the circulation step. A second test is then given the gases that pass the first test. A calculated high frequency current is gradually imposed on the spark chamber capacitor plates. This excitation causes neutrons to be emitted from the thorium 232 which, if the mixture is satisfactory, can be easily seen as a thin thread of light in the chamber. If the mixture is not satisfactory, light discharges cannot be seen and the high frequency circuit will short out and turn off before the desired frequency is reached.

To bottle the mixture, valve **V33** is opened and valves **V36** and **V40** are closed. During bottling polariser **289**, twin parallel magnetic coil **287**, ionisation unit **215** and ion gauge **255** are electrically energised (all electrical circuits are previously de-energised) to improve the stability of the mixture. The prepared gases are withdrawn from the mixing apparatus via branches **B24** and **B16**, ionisation unit **215**, branch **B17**, filters **293** and **295**, polariser **289**, twin parallel magnetic coil **287**, branch **B39**, ion gauge **255**, check valve **V39A**, branch **B38** and spark chamber **251**. If desired, after bottling the mixer may be exhausted by opening valves **V12**, **V13**, **V14**, **V23**, **V24**, **V29**, **V32**, **V57** and **V59**. Of course, one can also automate the fuel preparation process to be continuous so that it would never be necessary to exhaust the gas.

In operation of mixing apparatus **201**, certain operational factors must be considered. For one, no electrical devices can be on without the pump being in operation because an electrical device that is on can damage adjacent gas that is not circulating. For another, it should be noted that directed cathode ray tube **265**, non-directed cathode ray tube **227** and focused x-ray tube **263** serve different functions at different points in the mixing process. In one mode, they provide hot cathode radiation, which can occur only in a vacuum. When gases are flowing through these devices, they provide a cold cathode discharge. For example, during argon polarisation and the circulation step, focused x-ray tube **263** is under vacuum and affects the gases flowing through ionisation head **240** by way of hot cathode radiation. During the introduction of the different gases

into mixing apparatus **201** and during the recirculation step, the gases are flowing through focused x-ray tube **263**, which affects the gases by way of a cold cathode discharge.

It is preferred that each switchable electrical component in mixing apparatus **201** be wired into a separate circuit despite the fact that one of the poles of each could be commonly wired. In a common ground circuit if one device is turned on, all of the other units may also turn on because the gases in the device are conductive. In addition, if one unit on a common circuit were energised with high frequency current, the others would also be affected. In the same vein, the high frequency current cannot be used when the cathode ray tubes, the x-ray tubes or the dischargers are heated and under vacuum because the heater filaments will burn out.

Finally, the current source, the variable rectifiers and the electrical measuring instruments must be located more than ten feet from mixing apparatus **201** because the high frequency current is harmful to the rectifiers, causing them to burn out or short out.

It is hoped that a brief summary of the concepts used by the inventor in developing the above invention will be helpful to the reader, it being understood that this summary is in no way intended to limit the claims which follow or to affect their validity. The first concept is that of using an inert gas mixture at approximately one atmosphere at TDC (at ignition) as a fuel in a thermonuclear energy production process. The second concept is the layering of the various inert gases, which layering is designed to confine the input energy in the innermost layers during pre-excitement and ignition, to provide thermal insulation for the container walls during and after ignition, to transmit power resulting from the ignition through the layers in turn to the piston, to absorb the pressure generated during ignition to protect the cylinder walls, and to provide an orderly, predictable positioning of the argon layer during the BDC to TDC portion of the engine cycle. The third concept of this invention involves utilising electric current produced in one cylinder of a pair to perform functions in the other cylinder of that pair. This concept includes the sub-concepts of generating electric current by atomic recombination and of electric generation in place resulting from the rotation of layered inert gases within each cylinder because of the changed polarity of the encircling coils at BDC, from judicious placement of coils which produce magnetic field lines which are cut by a near perfect conductor (polarised argon), and from movement of said near perfect conductor through the magnetic field.

The fourth and fifth concepts of this invention are the transformation of rapid, intense, but short duration thermonuclear reactions into pressure that is transmitted from inert gas to inert gas until it creates linear kinetic energy at the piston, which energy is converted into rotary kinetic energy by a crankshaft, and the use of a shaft-driven generator to provide power to spaced field coils during the BDC to TDC portion of the cycle of each cylinder.

The sixth concept concerns adequate pre-excitement of the inert gas fuel and more particularly involves the sub-concepts of pre-exciting the fuel in the mixing process, of manipulation of the currents in the coils surrounding each cylinder, of discharging the capacitors surrounding each cylinder at predetermined times in the cycles, of causing a stream of electrical particles to flow between electrodes and a conductive discharge point on the piston, of emitting alpha, beta and gamma rays from an anode and a cathode containing low level radioactive material to the piston's discharge point, of accelerating the alpha, beta and gamma rays by the application of a high-voltage field, and of situating capacitor plates 90 degrees from the anode and cathode to slow and reflect neutrons generated during ignition. The seventh concept involves the provision of a minute, pellet-type fission ignition, the heat from which causes a minute fusion as the result of the ignition chamber shape and arrangement, as a result of the collision of the alpha, beta and gamma rays and the electrical particles at a focal point in conjunction with the discharge of the capacitors that surround the cylinder through the electrodes, and as a result of increasing the magnetic field in the direction of the movement of each piston.

### ***The Robert Britt Engine.***

Robert Britt designed a very similar engine to that of Josef Papp, and he was also awarded a US patent for an engine operating on inert gasses. William Lyne remarks that this engine design may be replicated using a Chevy "Monza" 6-cylinder engine or a Volkswagen 4-cylinder engine. The heads are removed and the new heads cast using the "pot metal" used for "pseudo chrome" automotive trim. That alloy contains aluminium, tin, zinc and possibly antimony and is particularly suitable as the insides of the cavities can be polished to the high reflectivity specified in the patents.

## **ATOMIC EXPANSION REFLEX OPTICS POWER SOURCE (AEROPS) ENGINE**

### **ABSTRACT**

An engine is provided which will greatly reduce atmospheric pollution and noise by providing a sealed system engine power source which has no exhaust nor intake ports. The engine includes a spherical hollow pressure chamber which is provided with a reflecting mirror surface. A noble gas mixture within the chamber is energised by electrodes and work is derived from the expansion of the gas mixture against a piston.

### **SUMMARY OF THE INVENTION**

An atomic expansion reflex optics power source (AEROPS) engine, having a central crankshaft surrounded by a crankcase. The crankcase has a number of cylinders and a number of pistons located within the cylinders. The pistons are connected to the crankshaft by a number of connecting rods. As the crankshaft turns, the pistons move in a reciprocating motion within the cylinders. An assembly consisting of a number of hollow spherical pressure chambers, having a number of electrodes and hollow tubes, with air-cooling fins, is mounted on the top of each cylinder. The necessary gaskets are provided as needed to seal the complete engine assemblies from atmospheric pressure. A means is provided to charge the hollow spherical pressure chamber assembly and the engine crankcase with noble gas mixtures through a series of valves and tubes. A source of medium-voltage pulses is applied to two of the electrodes extending into each of the hollow spherical pressure chambers.

When a source of high-voltage pulses is applied from an electrical rotary distributor switch to other electrodes extending into each of the hollow spherical pressure chambers in a continuous firing order, electrical discharges take place periodically in the various hollow spherical pressure chambers. When the electrical discharges take place, high energy photons are released on many different electromagnetic frequencies. The photons strike the atoms of the various mixed gases, e.g., xenon, krypton, helium and mercury, at different electromagnetic frequencies to which each is selectively sensitive, and the atoms become excited. The first photons emitted are reflected back into the mass of excited atoms by a reflecting mirror surface on the inside wall of any particular hollow spherical pressure chamber, and this triggers more photons to be released by these atoms. They are reflected likewise and strike other atoms into excitation and photon energy release. The electrons orbiting around the protons of each excited atom in any hollow spherical pressure chamber increase in speed and expand outward from centre via centrifugal force causing the atoms to enlarge in size. Consequently, a pressure wave is developed, the gases expand and the pressure of the gas increases.

As the gases expand, the increased pressure is applied to the top of the pistons in the various cylinders fired selectively by the electrical distributor. The force periodically applied to the pistons is transmitted to the connecting rods which turn the crankshaft to produce rotary power. Throttle control valves and connecting tubes form a bypass between opposing hollow spherical pressure chambers of each engine section thereby providing a means of controlling engine speed and power. The means whereby the excited atoms are returned to normal minimum energy ground-state and minimum pressure level, is provided by disrupting the electrical discharge between the medium-voltage electrodes, by cooling the atoms as they pass through a heat transfer assembly, and by the increase in the volume area above the pistons at the bottom of their power stroke. The AEROPS engine as described above provides a sealed unit power source which has no atmospheric air intake nor exhaust emission. The AEROPS engine is therefore pollution free.

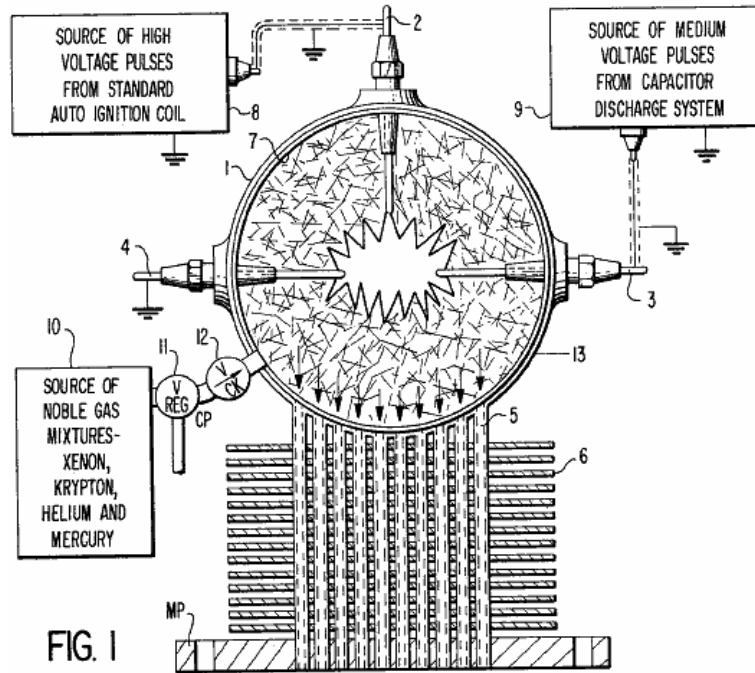
### **BRIEF OBJECTIVE OF THE INVENTION**

This invention relates to the development of an atomic expansion reflex optics power source (AEROPS) engine, having the advantages of greater safety, economy and efficiency over those disclosed in the prior art. The principal object of this invention is to provide a new engine power technology which will greatly reduce atmospheric pollution and noise, by providing a sealed system engine power source which has no exhaust nor intake ports.

Engine power is provided by expanding the atoms of various noble gas mixtures. The pressure of the gases increases periodically to drive the pistons and crankshaft in the engine to produce safe rotary power. The objects and other advantages of this invention will become better understood to those skilled in the art when viewed in light of the accompanying drawings.

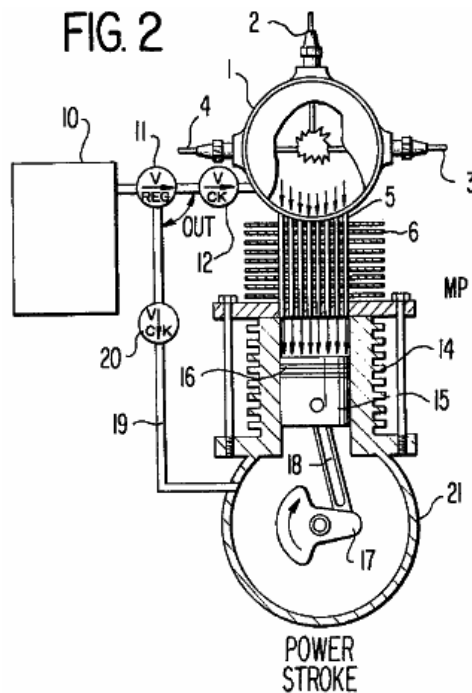
**BRIEF DESCRIPTION OF THE DRAWINGS**

**Fig.1** is an elevational view of the hollow spherical pressure chamber assembly, including sources of gas mixtures and electrical supply:



**FIG. 1**

**Fig.2** is an elevational view of the primary engine power stroke:



**FIG. 2**

**Fig.3** is an elevational view of the primary engine compression stroke:

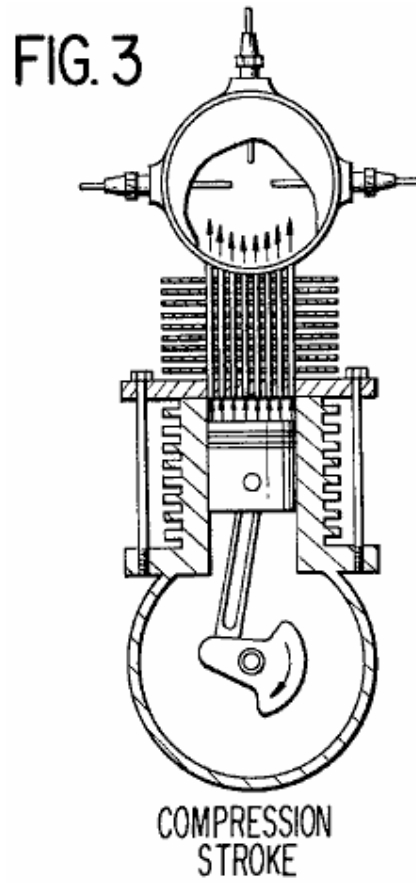


Fig.4 is a rear elevational view of a six cylinder AEROPS engine:

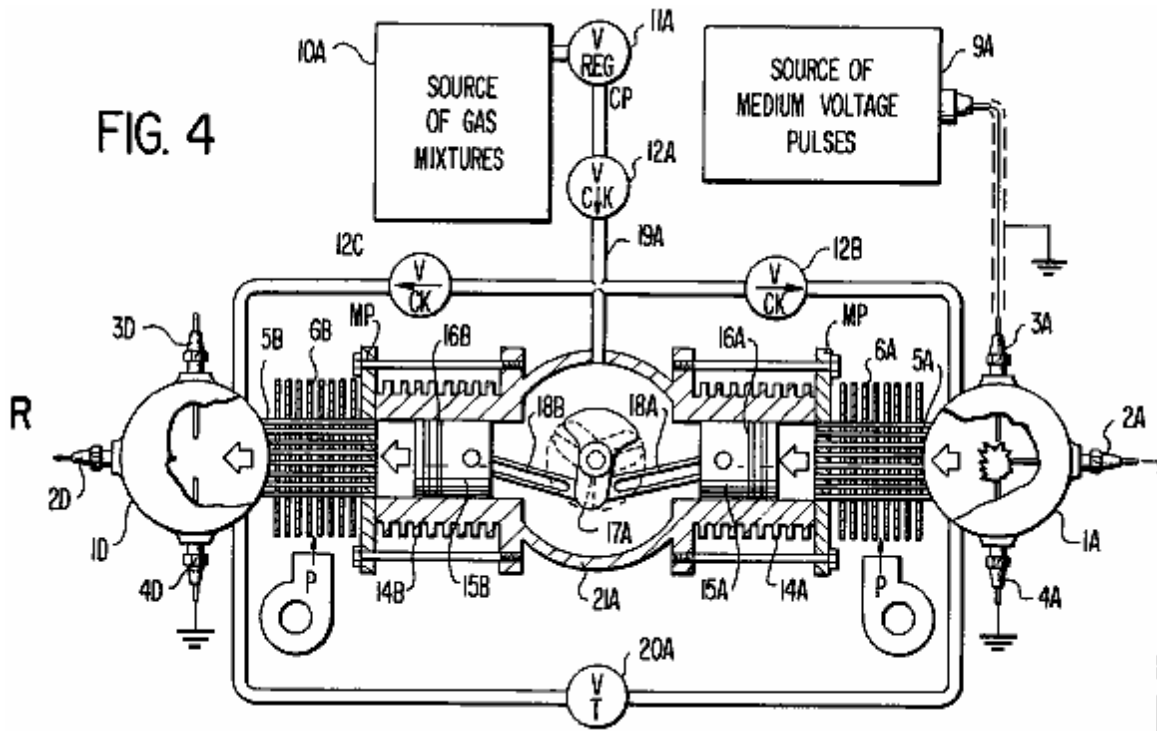


Fig.5 is a top view of the six cylinder AEROPS engine:

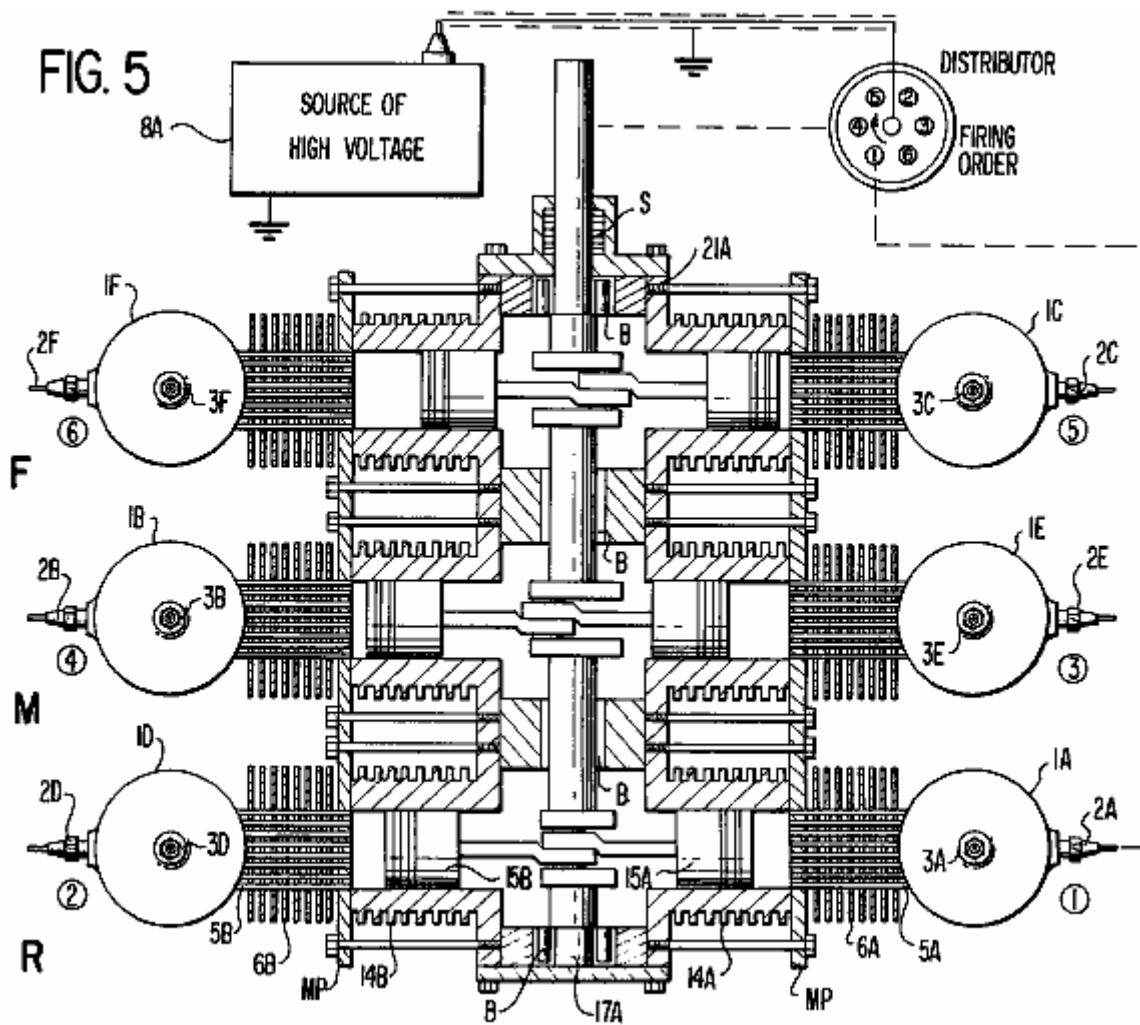




Fig.6 is an electrical schematic of the source of medium-voltage:

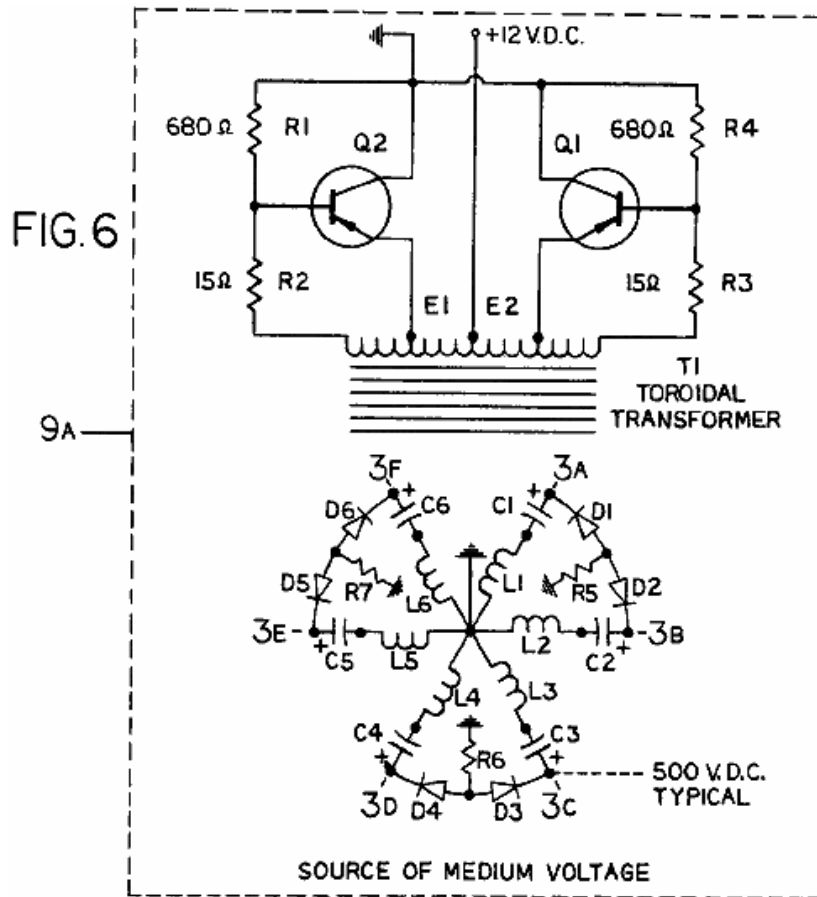
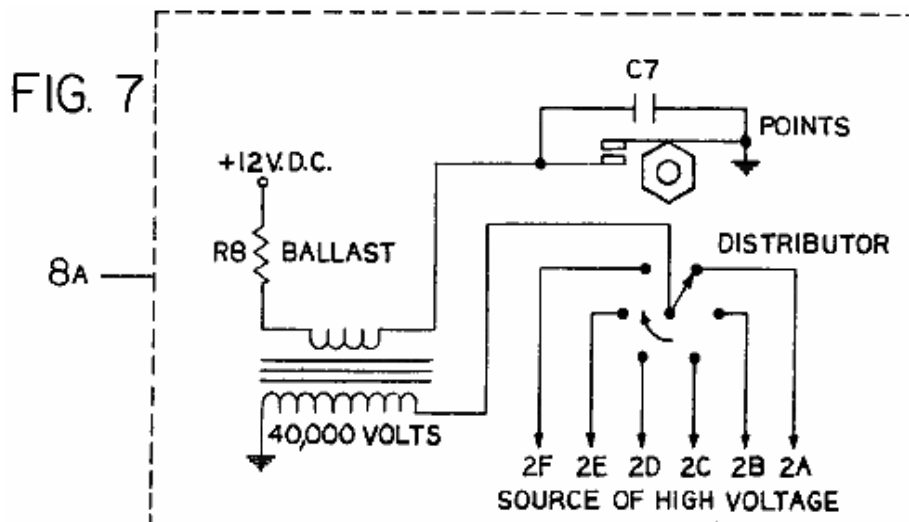
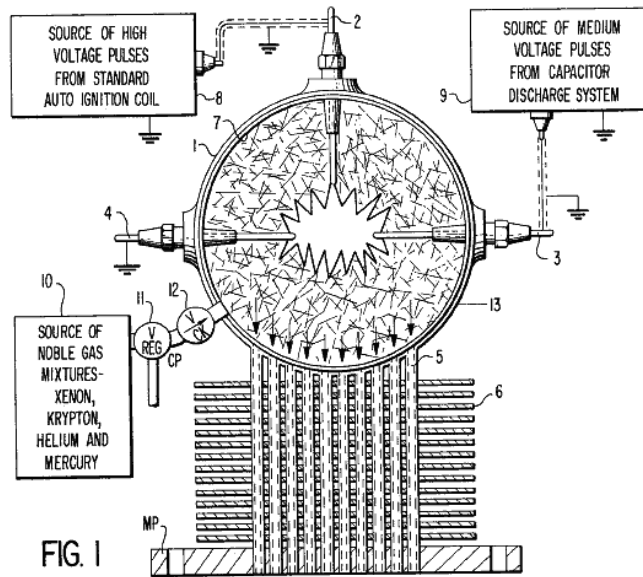


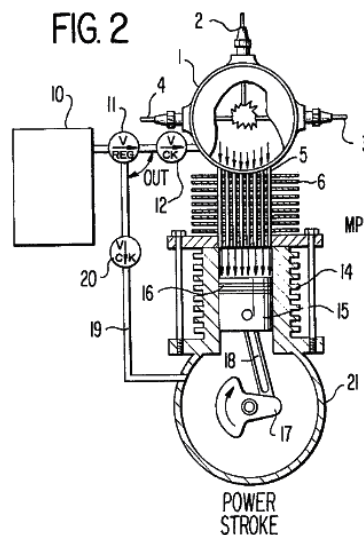
Fig.7 is an electrical schematic of the source of high-voltage:



## DETAILED DESCRIPTION



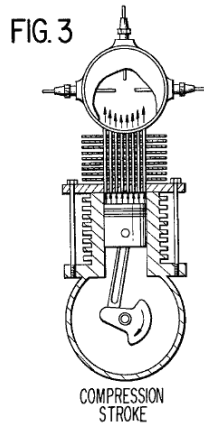
Referring to **Fig.1** of the drawings, the AEROPS engine comprises a hollow spherical pressure chamber **1** having an insulated high-voltage electrode **2** mounted on the top, an insulated medium-voltage electrode **3** mounted on the right, and an insulated common ground electrode **4** mounted on the left, as shown in this particular view. Electrodes **2**, **3** and **4** extend through the wall of the hollow spherical pressure chamber **1** and each electrode forms a pressure seal. A plurality of hollow tubes **5** arranged in a cylindrical pattern extend through the wall of the hollow spherical pressure chamber **1**, and each hollow tube is welded to the pressure chamber to form a pressure seal. The opposite ends of hollow tubes **5** extend through the mounting plate **MP** and are welded likewise to form a pressure seal. A plurality of heat transfer fins **6** are welded at intervals along the length of said hollow tubes **5**. A bright reflecting mirror surface **7** is provided on the inner wall of the hollow spherical pressure chamber **1**. A source of high-voltage **8** is periodically connected to the insulated high-voltage electrodes **2** and **4**. A source of medium-voltage **9** from a discharge capacitor is connected to the insulated medium-voltage electrodes **3** and **4**. A source of noble gas mixtures **10**, e.g., xenon, krypton, helium and mercury is applied under pressure into the hollow spherical pressure chamber **1** through pressure regulator valve **11** and check valve **12**.



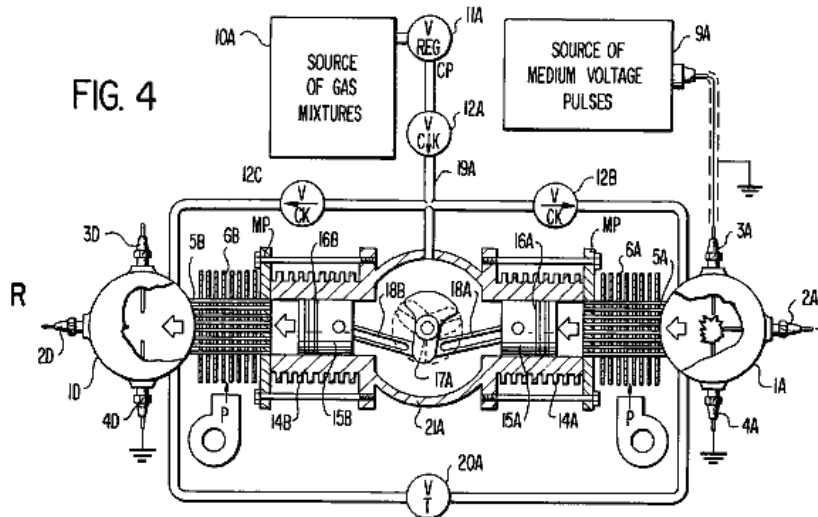
Referring now to **Fig.2** of the drawings, the complete assembly **13** shown in **Fig.1** is mounted on the top of the cylinder **14** via mounting plate **MP**. The necessary gaskets or other means are provided to seal the engine and prevent loss of gases into the atmosphere. The piston **15** located within cylinder **14** has several rings **16** which seal against the inner wall of the cylinder. The piston **15** is connected to the crankshaft **17** by connecting rod **18**. The source of noble gas mixtures **10** is applied under pressure into the crankcase **21** through pressure regulator valve **11**, check valve **12** and capillary tube **19**. The piston **15** is now balanced between equal gas pressures. Assuming that the engine is running and the piston **15** is just passing Top-

Dead-Centre (TDC), a source of medium-voltage from a capacitor discharge system **9** (Fig.6, a single typical capacitor section) is applied to electrodes **3** and **4**. A source of high-voltage pulses from a standard ignition coil **8** (such as shown in Fig.7) is applied to electrodes **2** and **4** and the gases within the hollow spherical pressure chamber **1** are ionised and made electrically conductive. An electrical discharge takes place between electrodes **3** and **4** through the gases in the hollow spherical pressure chamber **1**.

The electrical discharge releases high energy photons on many different electromagnetic frequencies. The photons strike the atoms of the various gases, e.g., xenon, krypton, helium and mercury at different electromagnetic frequencies to which each atom is selectively sensitive and the atoms of each gas become excited. The first photons emitted are reflected back into the mass of excited atoms by the reflecting mirror surface **7**. This triggers more photons to be released by these atoms, and they are reflected likewise from the mirror surface **7** and strike other atoms into excitation and more photons are released as the chain reaction progresses. The electrons orbiting around the protons of each excited atom increase in speed and expand outward in a new orbital pattern due to an increase in centrifugal force. Consequently, a pressure wave is developed in the gases as the atoms expand and the overall pressure of the gases within the hollow spherical pressure chamber **1** increases. As the gases expand they pass through the hollow tubes **5** and apply pressure on the top of piston **15**. The pressure pushes the piston **15** and the force and motion of the piston is transmitted through the connecting rod **18** to the crankshaft **17** rotating it in a clockwise direction. At this point of operation, the power stroke is completed and the capacitor in the medium-voltage capacitor discharge system **9** is discharged. The excited atoms return to normal ground state and the gases return to normal pressure level. The capacitor in the medium-voltage capacitor discharge system **9** is recharged during the time period between (TDC) power strokes.

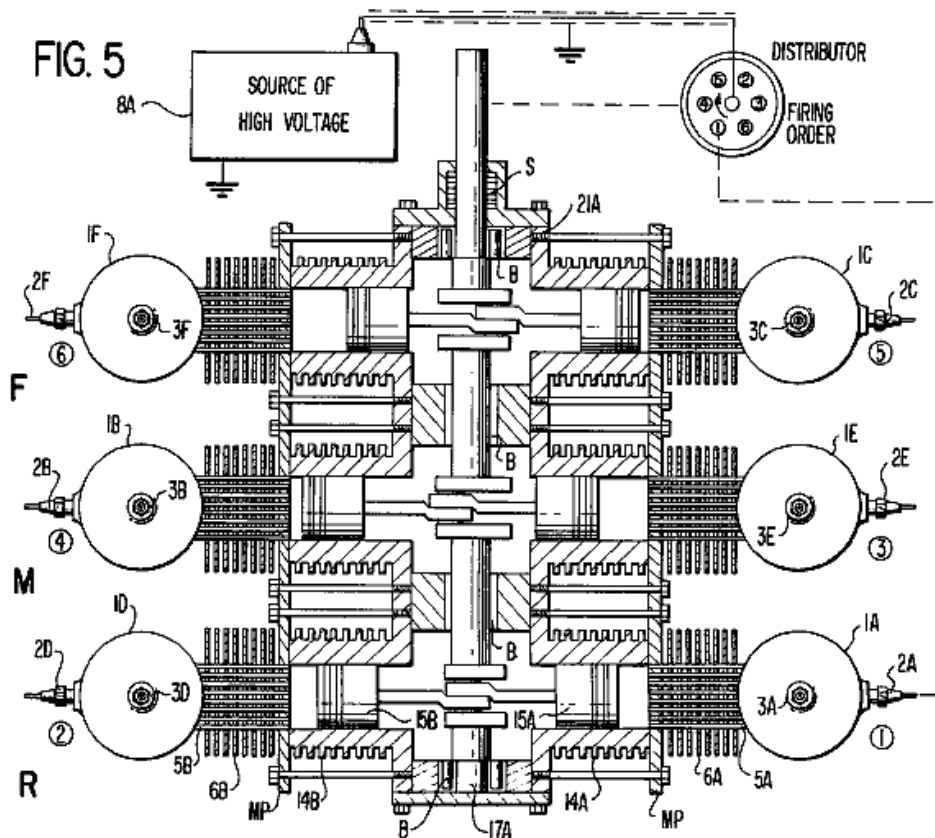


Referring now to Fig.3 of the drawings, the compression stroke of the engine is shown. In this engine cycle the gases above the piston are forced back into the hollow spherical pressure chamber through the tubes of the heat transfer assembly. The gases are cooled as the heat is conducted into the fins of the heat transfer assembly and carried away by an air blast passing through the fins. An example is shown in Fig.4, the centrifugal air pump **P** providing an air blast upon like fins.



Some of the basic elements of the invention as set forth in **Fig.1**, **Fig.2**, and **Fig.3** are now shown in **Fig.4** and **Fig.5** which show complete details of a six-cylinder horizontally-opposed AEROPS engine.

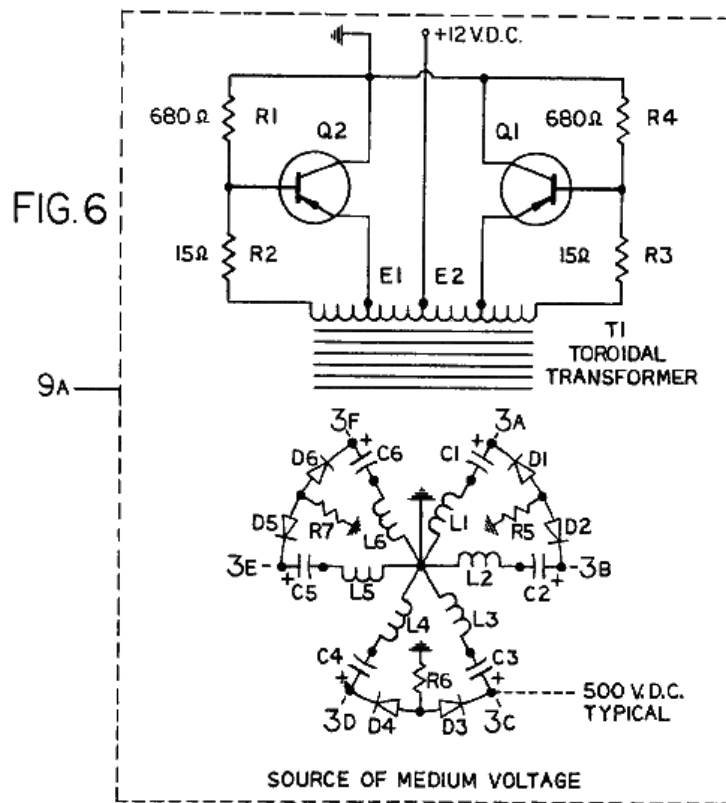
Referring now to **Fig.4** and **Fig.5** of the drawings. **Fig.4** is a view of the rear section of the engine showing the crankshaft, centre axis and two of the horizontally-opposed cylinders. In as much as the rear **R**, middle **M** and front **F** sections of the engine possess identical features, only the rear **R** engine section will be elaborated upon in detail in order to prevent repetition and in the interest of simplification. The crankshaft **17A** consists of three cranks spaced 120 degrees apart in a 360 degree circle as shown. Both connecting rods **18A** and **18B** are connected to the same crank. Their opposite ends connect to pistons **15A** and **15B**, located in cylinders **14A** and **14B** respectively. Each piston has pressure sealing rings **16A** and **16B**. The hollow spherical pressure chamber assemblies consisting of **1A** and **1D** are mounted on cylinders **14A** and **14B** via mounting plates **MP**. The necessary gaskets are provided as needed to seal the complete engine assemblies from atmospheric pressure.



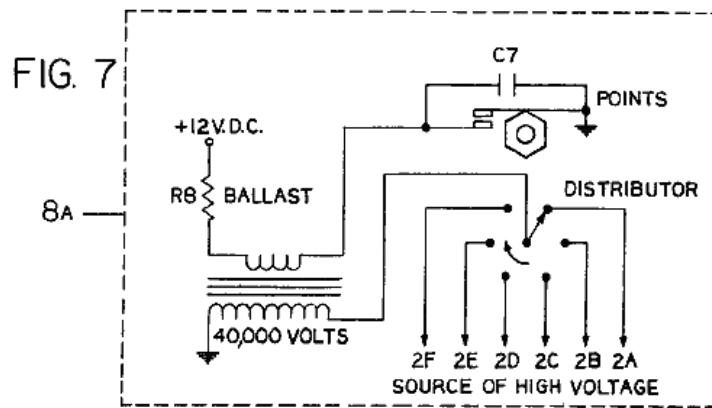
The source of gas mixtures **10A** is applied under pressure to pressure regulator valve **11A** and flows through check valve **12A**, through check valve **12B** to the hollow spherical pressure chamber **1A**, and through check valve **12C** to the hollow spherical pressure chamber **1D**. The gas flow network consisting of capillary tubes below point **19A** represents the flow of gases to the rear section **R** of the engine. The middle section **M** and the front section **F** both have gas flow networks identical to that consisting of capillary tubes below point **19A**, while the gas flow network above is common to all engine sections. Throttle valve **20A** and the connecting tubing form a variable bypass between hollow spherical pressure chambers **1A** and **1D** to control engine speed and power. Engine sections **R**, **M** and **F** each have this bypass throttle network. The three throttle valves have their control shafts ganged together. A source of medium-voltage pulses **9A** is connected to medium-voltage electrodes **3A** and **3D**. In one particular embodiment the medium-voltage is 500 volts. A source of high-voltage pulses **8A** is connected to electrode **2A** through the distributor as shown. Electrode **4A** is connected to common ground. Centrifugal air pumps **P** force air through heat transfer fins **6A** and **6B** to cool the gases flowing in the tubes **5A** and **5B**.

**Fig.5** is a top view of the AEROPS engine showing the six cylinders and crankshaft arrangement consisting of the rear **R**, middle **M** and front **F** sections. The crankshaft **17A** is mounted on bearings **B**, and a multiple shaft seal **S** is provided as well as the necessary seals at other points to prevent loss of gases into the atmosphere. The hollow spherical pressure chambers **1A**, **1B**, **1C**, **1D**, **1E** and **1F** are shown in detail with high-voltage electrodes **2A**, **2B**, **2C**, **2D**, **2E**, **2F** and medium-voltage electrodes **3A**, **3B**, **3C**, **3E** and **3F**. The common ground electrodes **4A**, **4B**, **4C**, **4D**, **4E**, **4F** are not shown in **Fig.5** but are typical of the common

ground electrodes **4A** and **4D** shown in **Fig.4**. It should be noted that the cranks on crankshaft **17A** are so arranged to provide directly opposing cylinders rather than a conventional staggered cylinder design.



**Fig.6** is an electrical schematic of the source of medium-voltage **9A**. The complete operation of the converter is explained as follows: The battery voltage 12 VDC is applied to transformer **T1**, which causes currents to pass through resistors **R1**, **R2**, **R3** and **R4**. Since it is not possible for these two paths to be exactly equal in resistance, one-half of the primary winding of **T1** will have a somewhat higher current flow. Assuming that the current through the upper half of the primary winding is slightly higher than the current through the lower half, the voltages developed in the two feedback windings (the ends connected to **R3** and **R2**) tend to turn transistor **Q2** on and transistor **Q1** off. The increased conduction of **Q2** causes additional current to flow through the lower half of the transformer primary winding. The increase in current induces voltages in the feedback windings which further drives **Q2** into conduction and **Q1** into cut-off, simultaneously transferring energy to the secondary of **T1**. When the current through the lower half of the primary winding of **T1** reaches a point where it can no longer increase due to the resistance of the primary circuit and saturation of the transformer core, the signal applied to the transistor from the feedback winding drops to zero, thereby turning **Q2** off. The current in this portion of the primary winding drops immediately, causing a collapse of the field about the windings of **T1**. This collapse in field flux, cutting across all of the windings in the transformer, develops voltages in the transformer windings that are opposite in polarity to the voltages developed by the original field. This new voltage now drives **Q2** into cut-off and drives **Q1** into conduction. The collapsing field simultaneously delivers power to the secondary windings **L1**, **L2**, **L3**, **L4**, **L5** and **L6**. The output voltage of each winding is connected through resistors **R5**, **R6** and **R7** and diode rectifiers **D1**, **D2**, **D3**, **D4**, **D5** and **D6**, respectively, whereby capacitors **C1**, **C2**, **C3**, **C4**, **C5** and **C6** are charged with a medium-voltage potential of the polarity shown. The output voltage is made available at points **3A**, **3B**, **3C**, **3D**, **3E** and **3F** which are connected to the respective medium-voltage electrodes on the engine shown in **Fig.4** and **Fig.5**.



Referring now to **Fig.7** of the drawings, a conventional "Kettering" ignition system provides a source of high-voltage pulses **8A** of approximately 40,000 volts to a distributor, which provides selective voltage output at **2A, 2B, 2C, 2D, 2E** and **2F**, which are connected to the respective high-voltage electrodes on the engine shown in **Fig.4** and **Fig.5**. The distributor is driven by the engine crankshaft **17A** (**Fig.5**) at a one to one mechanical gear ratio.

Referring again to **Fig.4** and **Fig.5** of the drawings, the operation of the engine is as follows: Assuming that a source of noble gas mixtures, e.g., xenon, krypton, helium and mercury is applied under pressure to the hollow spherical pressure chambers **1A, 1B, 1C, 1D, 1E** and **1F** and internally to the crankcase **21A** through pressure regulator valve **11A** and check valves **12A, 12B** and **12C**; and the source of medium-voltage **9A** is applied to electrodes **3A, 3B, 3C, 3D, 3E** and **3F**; and a source of high-voltage pulse **8A** is applied to electrode **2A** through the timing distributor, the gas mixtures in the hollow spherical pressure chamber **1A** is ionised and an electrical discharge occurs immediately between electrodes **3A** and **4A**.

High-energy photons are released on many different electromagnetic frequencies. The photons strike the atoms of the various gases, e.g., xenon, krypton, helium and mercury at different electromagnetic frequencies to which each is particularly sensitive and the atoms of each gas become excited. The first photons emitted are reflected back into the mass of excited atoms by the internal reflecting mirror surface on the inside wall of the hollow spherical pressure chamber **1A**. This triggers more photons to be released by these atoms and they are reflected likewise from the mirror surface and strike other atoms into excitation and more photons are released as the chain reaction progresses. The electrons orbiting around the protons of each excited atom in the hollow spherical pressure chamber **1A** increase in speed and expand outward in a new orbital pattern due to an increase in centrifugal force. Consequently, a pressure wave is developed in the gases as the atoms expand and the overall pressure of the gases within the hollow spherical pressure chamber **1A** increases.

As the gases expand they pass through the hollow tubes **5A** applying pressure on the top of piston **15A**. The pressure applied to piston **15A** is transmitted through connecting rod **18A** to the crankshaft **17A** rotating it in a clockwise direction. As the crankshaft **17A** rotates it pushes piston **15B** via connecting rod **18B** in the direction of a compression stroke, forcing the gases on the top of the piston through hollow tubes **5B** into the hollow spherical pressure chamber **1D**. As the gases pass through the hollow tubes **5A** and **5B** the heat contained in the gases is conducted into the heat transfer fins **6A** and **6B**, where it is dissipated by a blast of air passing through said fins from the centrifugal air pumps **P**. At this point of operation the power stroke of piston **15A** is completed and the capacitor in the medium-voltage capacitor discharge system **9A** is discharged. The excited atoms return to normal ground state and the gases return to normal pressure level. The capacitor in the medium-voltage capacitor discharge system **9A** is recharged during the time period between the power strokes of piston **15A**.

The above power stroke cycle occurs exactly the same in the remaining cylinders as the high-voltage firing order progresses in respect to the position of the distributor switch. In as much as the AEROPS engine delivers six power strokes per single crankshaft revolution, the crankshaft drives the distributor rotor at a one to one shaft ratio. The complete high-voltage firing order is 1, 4, 5, 2, 3, 6, whereas, the high-voltage is applied to electrodes **2A, 2B, 2C, 2D, 2E** and **2F** respectively. A means of controlling engine speed and power is provided by a plurality of throttle control valves and connecting tubes which form a bypass between opposing hollow spherical pressure chambers of each engine section.

The AEROPS engine as described above provides a sealed unit power source which has no atmospheric air intake nor exhaust emission and is therefore pollution free.

If you feel that these things are not true, then I suggest that you visit the web site of Kim Zorzi who will make you an electrical generator of commercial size (50 kilowatt and 100 kilowatt units are suggested) which operate without any fuel or power input, at [http://www.ultralightamerica.com/air\\_power.htm](http://www.ultralightamerica.com/air_power.htm) where his units are operated from compressed air.

### ***The Michael Eskeli Turbine.***

In April 1989, Michael Eskeli was annoyed by a newspaper article published in the Dallas Times Herald which commented on the failure of science to come up with alternative power systems which do not rely on petroleum products to operate. Michael responded in a letter to the Editor, stating that he holds patents for fuel-less power generators, work-free heat pumps, and other related items, 56 patents issued in the mid-70s.

Michael does hold many patents, one of which is shown in Chapter 14, as a work-free fuel-less heater. However, as I am not aware of any working prototype being shown, I must recommend that you consider the following information as “an idea” rather than a proven fact. As far as I am aware, in the 1970s, the US Patent Office did not demand to see a working prototype before granting a patent, especially if the patent related to a device based on accepted Engineering principles.

However, as Michael's claim is for self-powered devices, his claim seems too important to be ignored, prototype or no prototype, as competent people reading this may well understand the principles suggested and be in a position to build a self-powered device as a result. If that is the case, then I should really appreciate feedback information on any successful replications and the construction methods used.

As I understand it, Michael's self-powered devices are Heat Pumps where the additional energy is flowing from the heat contained in the air, courtesy of the heating effects of sunshine. Standard engineering, but with a design which utilises this available energy to provide practical mechanical output power for vehicles and electrical generators.

The Eskeli patents which I have been able to locate are:

3,650,636 Rotary Gas Compressor  
3,719,434 Rotary Ejector Compressor  
3,748,054 Reaction Turbine  
3,748,057 Rotary Compressor with Cooling  
3,758,223 Reaction Rotor Turbine  
3,761,195 Compressing Centrifuge  
3,795,461 Compressor with Cooling  
3,809,017 Heat and Steam Generator  
3,834,179 Turbine with Heating and Cooling  
3,854,841 Turbine  
3,861,147 Sealed Single-rotor Turbine  
3,874,190 Sealed Single-rotor Turbine  
3,879,152 Turbine  
3,889,471 Dual-rotor Dual-fluid Turbine  
3,895,491 Turbine with Dual Rotors  
3,919,845 Dual-fluid Single-rotor Turbine  
3,926,010 Rotary Heat Exchanger  
3,931,713 Turbine with Regeneration  
3,933,007 Compressing Centrifuge  
3,933,008 Multi-stage Heat Exchanger  
3,937,034 Gas Compressor-Expander  
3,938,336 Turbine with Heating and Cooling  
3,939,661 Power Generator  
3,949,557 Turbine  
3,961,485 Turbine with Heat Intensifier  
3,962,888 Heat Exchanger  
3,972,194 Thermodynamic Machine of the Vane Type  
3,972,203 Rotary Heat Exchanger

- 3,981,702 Heat Exchanger
- 3,986,361 Turbine with Regeneration
- 4,003,673 Fluid Pressuriser
- 4,005,587 Rotary Heat Exchanger with Cooling and Regeneration \*
- 4,012,164 Rotor with Recirculation
- 4,012,912 Turbine
- 4,030,856 Rotor with Jet Nozzles
- 4,044,824 Heat Exchanger
- 4,047,392 Dual Rotor Heat Exchanger \*
- 4,050,253 Thermodynamic Machine
- 4,057,965 Thermodynamic Machine with Step-type Heat Addition
- 4,060,989 Thermodynamic Machine with Step-type Heat Exchangers
- 4,068,975 Fluid Pressuriser
- 4,077,230 Rotary Heat Exchanger with Cooling
- 4,106,304 Thermodynamic Compressor
- 4,107,944 Heat Pump with Two Rotors \*
- 4,107,945 Thermodynamic Compressor
- 4,124,993 Refrigeration Machine
- 4,167,371 Method of Fluid Pressurisation
- 4,178,766 Thermodynamic Compressor Method
- 4,574,592 Heat Pump with Liquid-Gas working Fluid

And there are presumably 7 others not listed here, to raise the total to the 56 mentioned by Michael. I do not have the expertise to tell which of these may be self-powered just by reading the patent information, which generally does not mention anything along those lines, (the Patent Office staff not believing that COP>1 exists). Practically any of these patents might fit Michael's description, so I will pick the following patents to reproduce here:

- 4,107,944 Heat Pump with Two Rotors (continuing 4,005,587 and 4,047,392)
- 4,012,912 Turbine, and
- 3,931,713 Turbine with Regeneration

\*\*\*\*\*

**US Patent 4,107,944**

**22nd August 1978**

**Inventor: Michael Eskeli**

## **HEAT PUMP WITH TWO ROTORS**

### **ABSTRACT**

A method and apparatus for generating heating and cooling by circulating a working fluid within passageways carried by rotors, compressing the working fluid in them and removing heat from the working fluid in a heat-removal heat exchanger and adding heat into the working fluid in a heat-addition heat exchanger, all carried within the rotors. The working fluid is sealed in, and may be a suitable gas, such as nitrogen. A working fluid heat exchanger is also provided to exchange heat within the rotor between two streams of working fluid. In one arrangement, the unit uses two rotors, both rotating; in an alternate arrangement, one of the rotors may be held stationary. Applications include air conditioning and heating applications.

### **US Patent References:**

2,490,064	Thermodynamic Machine	Dec 1949	Kollsman
2,490,065	Thermodynamic Machine	Dec 1949	Kollsman
2,520,729	Machine for producing Heat Energy	Aug 1950	Kollsman
2,597,249	Thermodynamic Engine	May 1952	Kollsman
3,470,704	Thermodynamic Apparatus and Method	Oct 1969	Kantor
3,834,179	Turbine with Heating and Cooling	Sep 1974	Eskeli
3,861,147	Sealed Single-rotor Turbine	Jan 1975	Eskeli
3,889,471	Dual-rotor Dual-fluid Turbine	Jun 1975	Eskeli
3,895,491	Turbine with Dual Rotors	Jul 1975	Eskeli
3,919,845	Dual-fluid Single-rotor Turbine	Nov 1975	Eskeli
3,931,713	Turbine with Regeneration	Jan 1976	Eskeli



### **Cross References to Related Applications**

This application is a continuation-in-part application of "Dual Rotor Heat Exchanger" filed Nov. 18, 1973, Ser. No. 407,665, now U.S. Pat. No. 4,047,392.

This application also is a continuation-in-part of "Heat Pump" filed June 30, 1975, Ser. No. 591,881, now abandoned.

And this application also is a continuation-in-part of "Rotary Heat Exchanger with Cooling and Regeneration" filed Oct. 1, 1975, Ser. No. 618,456, now U.S. Pat. No. 4,005,587.

### **BACKGROUND OF THE INVENTION**

This invention relates generally to devices for heat transfer from a lower temperature to a higher temperature by using a working fluid enclosed within a centrifuge rotor as an intermediate fluid to transport the heat.

Heat pumps have been known in the past but are complex and costly, and usually use a working fluid that is evaporated and condensed, which results in poor efficiency, and thus high energy cost.

### **SUMMARY OF THE INVENTION**

It is an object of this invention to provide apparatus that is low in initial cost and has high thermal efficiency thus reducing cost of the power required to run it. It is further the object of this invention to provide a device and process wherein the losses that normally occur in bearings and seals, due to friction, are applied to the working fluid for its circulation, thus in effect eliminating the power loss due to such friction losses. Also, it is an object of this invention to provide the rotor with a working fluid heat exchanger to reduce needed rotor speeds.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

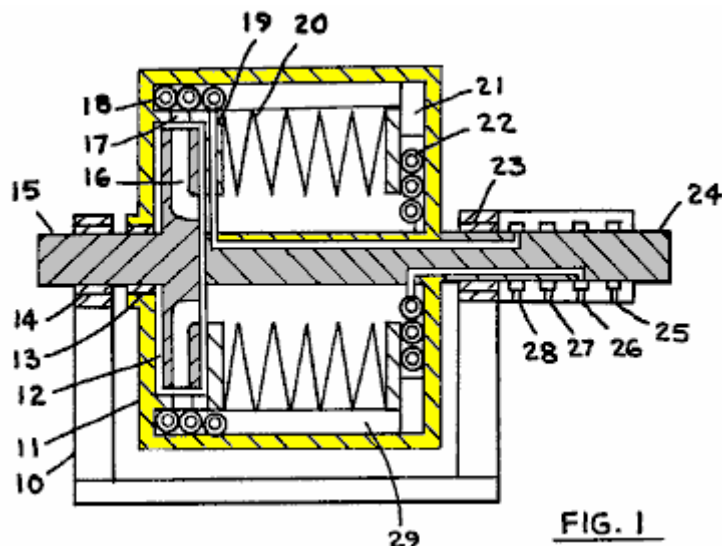


Fig.1 is a cross section of the device.

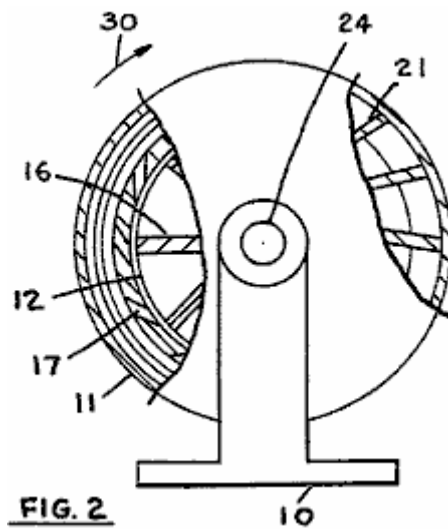


Fig.2 is an end view of the device.

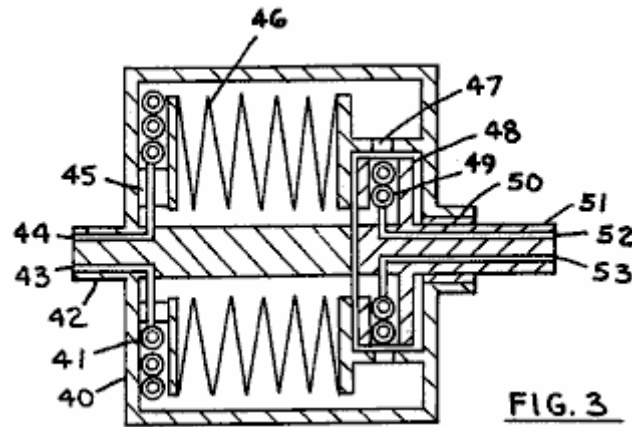


Fig.3 is an axial cross section of another form of the device.

**DESCRIPTION OF PREFERRED EMBODIMENTS**

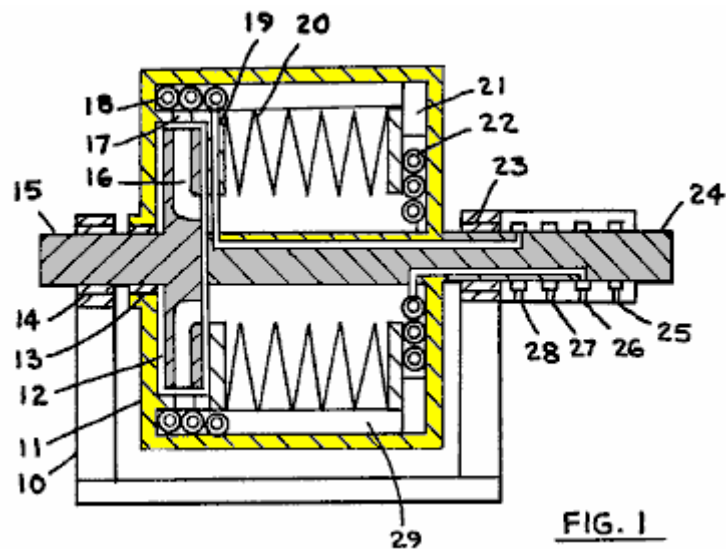
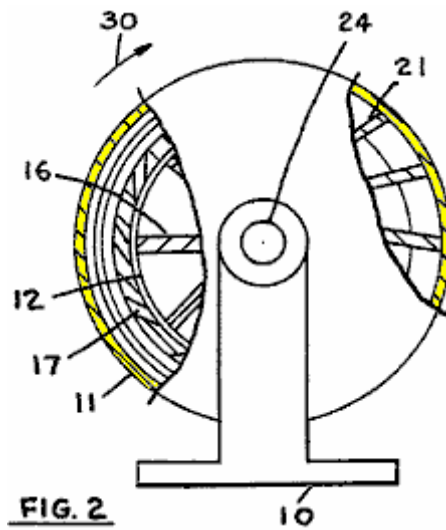
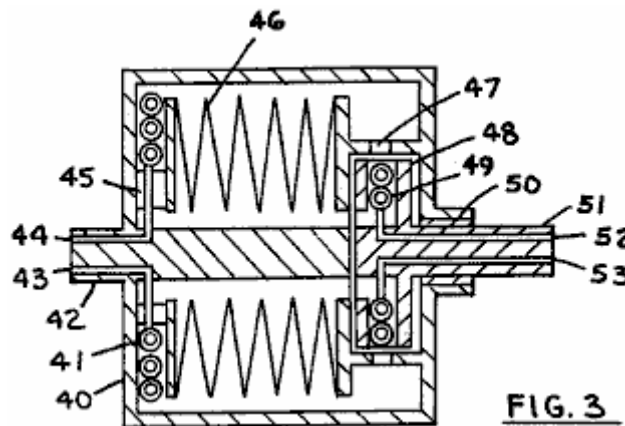


Fig.1 shows an axial cross section of the device, where 10 is the base, 11 is the first rotor, 12 is the second rotor, 13 is a seal and 14 is the bearing supporting shaft 15, 16 is fluid passage in the second rotor, 17 is the

working fluid opening which may be a nozzle, **18** is the first heat exchanger for heat removal from working fluid, **19** is first heat transfer fluid conduit, **20** is working fluid heat exchanger, in this instance formed from sheet metal like bellows, **21** are vanes, **22** is second heat exchanger for heat addition to working fluid, **23** is bearing supporting shaft **24**, **25** and **26** are entry and exit for second heat transfer fluid, **27** and **28** are entry and exit for first heat transfer fluid, and **29** is a vane in peripheral passage.



In **Fig.2**, an end view of the unit shown in **Fig.1** is illustrated. Where **10** is base, **11** is first rotor, **17** are fluid openings, **12** is second rotor, **16** are second rotor fluid passages with vanes, **30** indicates direction of rotation, **24** is first rotor shaft, and **21** are vanes.



In **Fig.3**, the rotors are arranged differently, but perform the same functions, approximately, as in the unit of **Fig.1**. Where **40** is first rotor, **41** is first heat exchanger for heat removal from first fluid, **42** is first rotor shaft, **43** and **44** are entry and exit for first heat transfer fluid, **45** is conduit, **46** is working fluid heat exchanger, **47** are fluid openings which may be nozzles, **48** is second rotor, **49** is second heat exchanger for adding heat to the working fluid, **50** is bearing and seal, **51** is second rotor shaft, **52** and **53** are entry and exit for second heat transfer fluid.

In operation, the rotors are caused to rotate and the rotor cavities are filled with a suitable working fluid, which is usually a gas, such as nitrogen, air or other gaseous or vapour substance. Referring to **Fig.1**, the second rotor rotates usually faster than the first rotor, and the working fluid is compressed by centrifugal force in passages **16**, and in the first rotor to some extent, after which heat is removed in heat exchanger **18**, with such heat then being transported by the first heat transfer fluid out of the device. The working fluid then passes along the peripheral passage **29** and releases heat in heat exchanger **20**, after which the fluid is expanded against centrifugal force in vanes **21** and in heat exchanger **22** where heat is added to the working fluid. After expansion, the working fluid passes along centre passage and receives heat from heat exchanger **20**, thus completing its work cycle.

The operation of the unit in **Fig.3** is similar, except that the second rotor usually rotates slower than the first rotor, and the second rotor may be kept stationary, if desired. Note that if the second rotor is held stationary, one may use dirty water as the second heat transfer fluid; normally, in rotating heat exchangers,

the heat transfer fluid must be free of solids, which will collect in the heat exchanger due to centrifugal force, and block the heat exchanger, and by having a stationary heat exchanger, ordinary water may be used, such as water from a cooling tower.

In the unit of **Fig.1**, the power input is normally to the second rotor, and the first rotor is allowed to rotate freely. In such usage, the rotor diameters are selected to provide, together with the friction loss in bearings, for the needed speed differential between the two rotors. With the second rotor rotating faster, necessary push for the working fluid is provided to keep the working fluid circulating. Alternately, the speed differential may be maintained by using a power transmission between the two rotors, such as a gearbox. In the unit of **Fig.3**, the second rotor speed is slower than the speed of the first rotor, and where the rotor diameters are suitable, the second rotor may be held stationary, providing needed push for the working fluid for its circulation.

The working fluid heat exchanger **20** and **46**, employ centrifugal force and varying gas density to obtain heat exchange between the two working fluid streams. Hot gas in the peripheral passage is lighter, and colder gas between the folds of the heat exchanger is colder, thus the cold gas is displaced by lighter gas by centrifugal force. Similarly, at the centre passage, cold gas at centre displaces hot gas between folds. Other types of heat exchangers may be used for the heat exchanger **20**, including heat pipes, sheet metal discs, and finned tubing filled with a liquid.

The rotor may be encased within a vacuum tank, if desired, to reduce friction on rotor outer surfaces. The use of the working fluid heat exchanger **20** will reduce required rotor speeds to obtain required temperature differentials between the two heat transfer fluids, which then reduces friction losses on the rotor, which may eliminate the need for a vacuum tank.

Various modifications of this device may be made, and different types of heat exchangers used. Also, working fluid radial passages may be curved in various directions, one being the slope for vanes shown as item **21** in **Fig.2**. By using vane slopes and sloped passages, one can adjust the amount of work exchange between the working fluid and the rotor. Nozzles **47** are usually positioned so as to discharge backwards, in order to generate some torque on the first rotor, and similar nozzles may also be used in passages **21** of the unit shown in **Fig.1**. Further, the heat exchanger **22**, of **Fig.1**, may be mounted on a stationary member, if desired, in manner shown in **Fig.3**, and heat exchanger **18** may be mounted within rotor **12**, if desired. The various components of the units may be interchanged, as desired.

## **CLAIMS**

1. In a heat pump wherein a compressible working fluid is circulated radially outwardly in a first fluid passage, said first passage contained in a first member, and radially inwardly towards centre of rotation in a second fluid passage, said second passage contained in at least one of said first and second members, said first and second members coaxially arranged, at least one of said members being supported by a shaft for rotation;  
said first and said second radial working fluid passages communicatingly connected at their respective outward ends by an outer passage and at their respective inward ends by an inner passage, said radial and outer and inner passages forming a closed loop extending at least partially through both of said members, a working fluid adapted to be circulating through said loop, means for compressing said working fluid by centrifugal force within said loop with accompanying temperature increase, first heat exchange means for cooling said working fluid after compression, said first heat exchange means being carried by one of said members, a second heat exchange means, carried by one of said members, for regeneratively exchanging heat between said working fluid within said inner and outer passages, and a third heat exchange means carried by one of said members for heating said working fluid after said heat exchange between said working fluid within said inner and outer passages.
2. The heat pump of claim 1 wherein a first heat transfer fluid is circulated within said first heat exchange means to remove heat with said first heat exchange fluid entering and leaving via conduits near the centre of rotation of said members.
3. The heat pump of claim 1 wherein a second heat transfer fluid is circulated within said third heat exchange means entering and leaving via conduits near the centre of rotation of said members.
4. The heat pump of claim 1 wherein both of said members are rotors.
5. The heat pump of claim 4 wherein the two rotors rotate at different angular speeds.
6. The heat pump of claim 1 wherein at least one of said members is a rotor.

7. The heat pump of claim 6 wherein said second heat exchange means includes a plurality of folds.
8. The heat pump of claim 7 wherein said second heat exchange means is of bellows configuration.

\*\*\*\*\*

**US Patent 4,012,912**

**22nd March 1977**

**Inventor: Michael Eskeli**

## **TURBINE**

### **ABSTRACT**

A method and apparatus for the generation of power wherein a working fluid is compressed within outward extending rotor passages, and then passed inward in other rotor passages with accompanying expansion and deceleration, with work being generated by the decelerating fluid. Heat may be added into the working fluid near the rotor periphery, and in closed rotors, heat is removed from the working fluid after expansion. A regenerator may also be used, mounted on the rotor, exchanging heat between two streams of the working fluid. During the deceleration, the working fluid passages are curved backwards, while the working fluid passages for acceleration are usually radial. The working fluid may be either a liquid or a gas, and the heating fluid and the cooling fluid may also be either a liquid or a gas.

### **US Patent References:**

3,761,195 Compressing Centrifuge	Sept 1973	Eskeli
3,834,179 Turbine with Heating and Cooling	Sept 1974	Eskeli
3,926,010 Rotary Heat Exchanger	Dec 1975	Eskeli

### **Cross References to Related Applications:**

This application is a continuation-in-part application of "Turbine," Ser. No. 566,373, filed 4-9-75 now U.S. Pat. No. 3,949,557.

### **BACKGROUND OF THE INVENTION**

This invention relates to power generators where a working fluid is circulated from a higher energy level to lower energy level, generating power.

In my earlier U.S. Pat. Nos. 3,874,190 and 3,854,841, I described a closed and open type turbines, and using centrifuge design. These turbines used forward facing nozzles within the rotor; in the apparatus disclosed here, such nozzles have been replaced by other methods.

### **SUMMARY OF THE INVENTION**

It is an object of this invention to provide a single rotor centrifuge type turbine stage, where vanes or fins, with suitable contours, are used to extract power from the working fluid, using either an open type or a closed type rotor.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

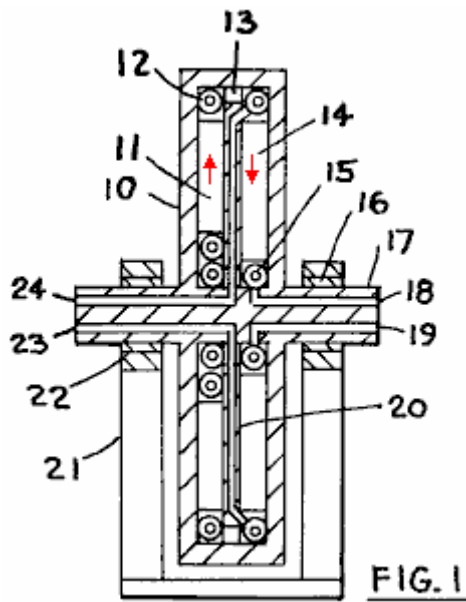


Fig.1 is a cross section and

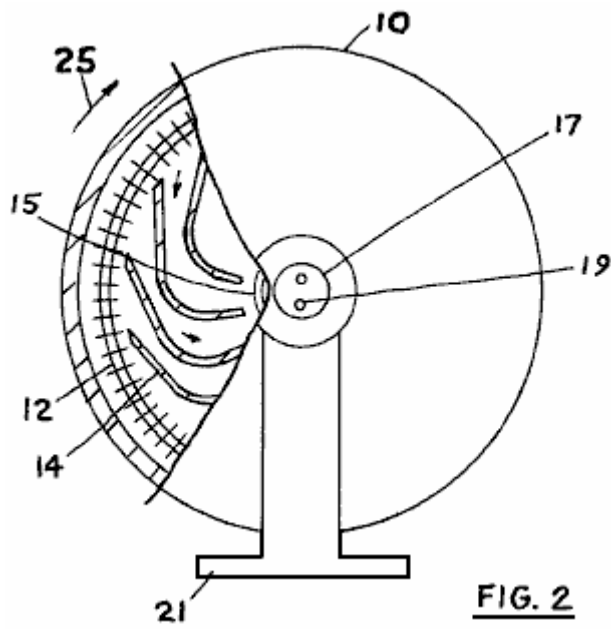


Fig.2 is an end view of a closed type rotor.

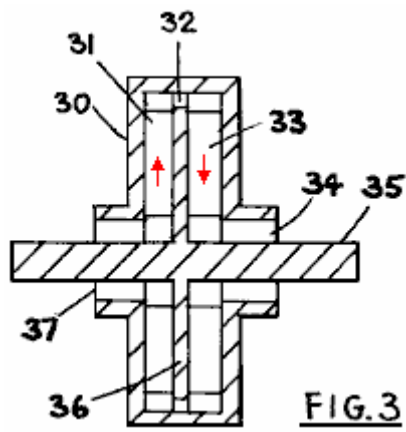


Fig.3 is a cross section and

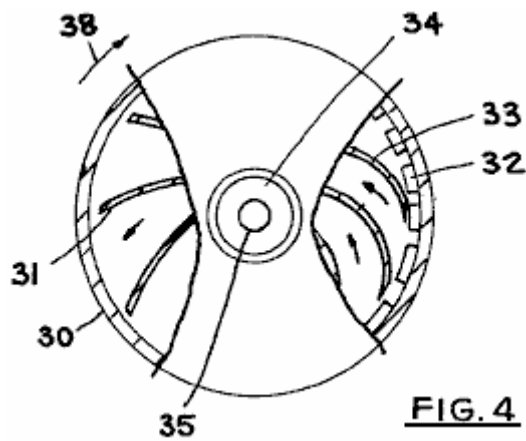


Fig.4 is an end view of an open type rotor.

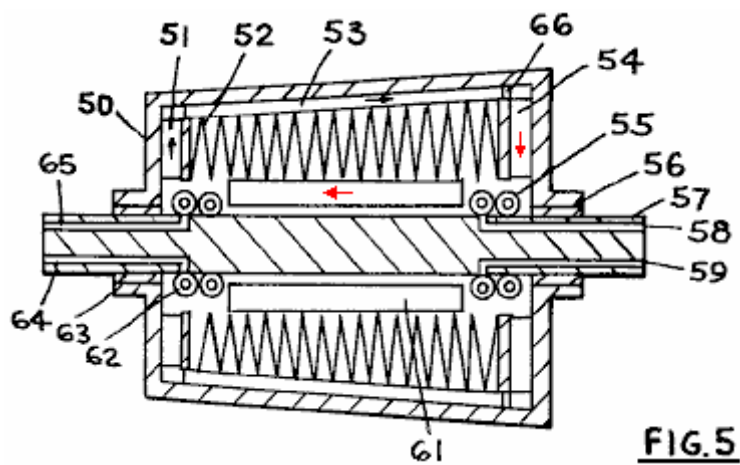
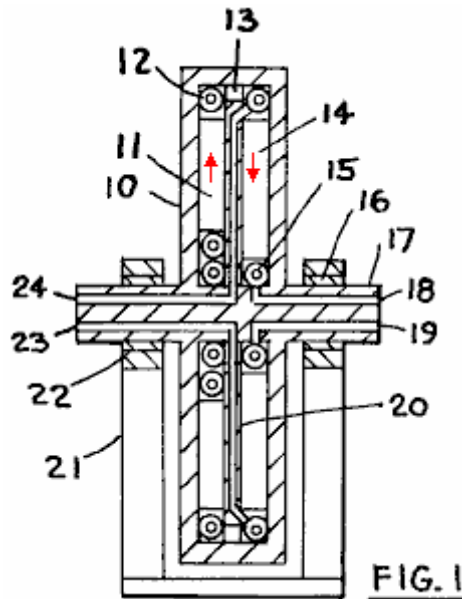
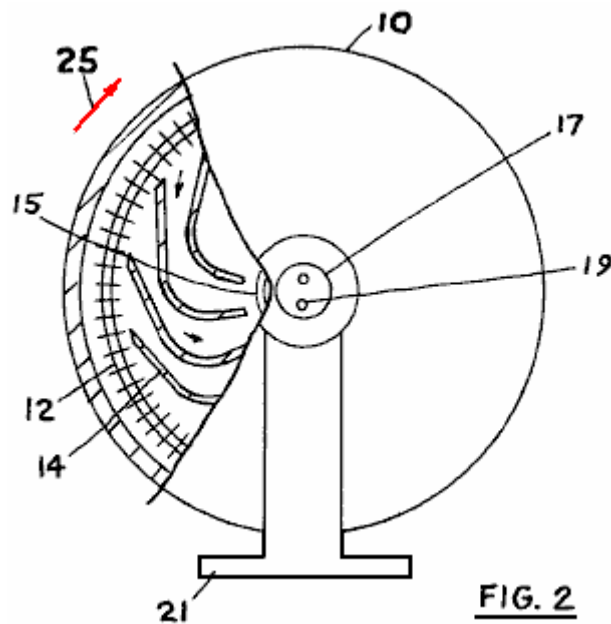


Fig.5 is a cross section of a unit using a closed type rotor and also using a regenerator.

## DESCRIPTION OF PREFERRED EMBODIMENTS

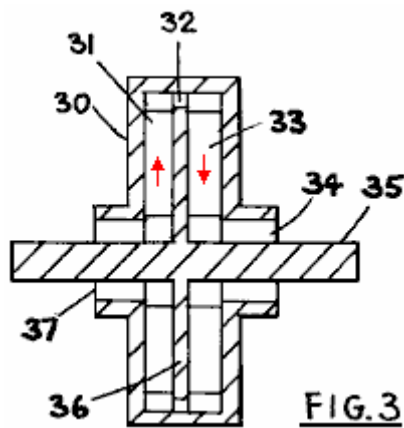


Referring to **Fig.1**, there is shown a cross section of one form of the unit. Where **10** is the rotor which is supported by bearings **16** and **22**, shaft **17** and base **21**. **12** is a heat supply heat exchanger and **15** is cooling heat exchanger, **14** and **11** are vanes or fins, **18** and **19** are coolant entry and exit, **20** is a dividing wall, **23** and **24** are heating fluid entry and exit, and **13** is a working fluid passage which may be used to regulate the flow of working fluid within the rotor.



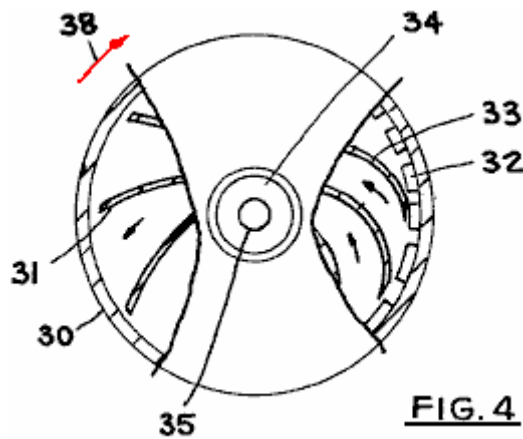
**Fig.2** is an end view of the unit shown in **Fig.1**. Where **10** is the rotor, **17** the shaft, **19** is a coolant passage, **21** is the base, **14** are vanes positioned so that they slope away from the direction of rotation as indicated by arrow **25**, while simultaneously passing the working fluid inwards, **12** is the heating heat exchanger, and **15** is the cooling heat exchanger.





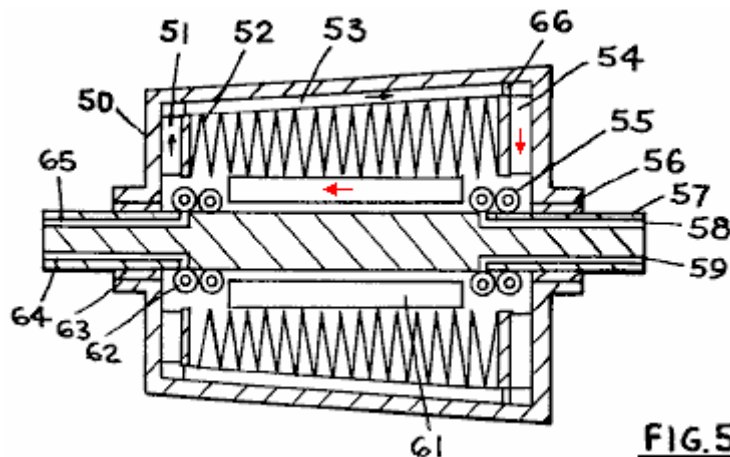
**FIG. 3**

In **Fig.3**, a rotor for a unit using open cycle is used, where the working fluid enters and leaves the rotor. Here, **30** is the rotor, **31** is the vane situated in a passage which extends outwards, **32** is the fluid passage, **33** is a vane in the passage for inward bound working fluid, **34** is the working fluid exit, **35** is the rotor shaft, **36** is a rotor internal divider and **37** is the working fluid entry into the rotor.



**FIG. 4**

**Fig.4** shows an end view of the unit of **Fig.3** where **30** is the rotor, **35** is the shaft, **31** are vanes in the passages for outward bound fluid, and are shown here to be curved backwards, when the rotor rotates in the direction shown by arrow **38**. After passing openings **32**, the working fluid passes inwards guided by vanes **33**, and then leaving via exit **34**. Vanes **33** are curved as indicated, with the curvature being away from the direction of rotation, so the working fluid provides thrust against the rotor components as it decelerates when passing inwards toward the centre of the rotor.



**FIG. 5**

In **Fig.5**, a rotor with a regenerator is shown, and also the rotor shaft is arranged so that it can be kept stationary if desired. **50** is the rotor which is supported by bearings **56** and **63** and shaft **57**. Vanes **51** may be radial or curved as desired, and vanes **54** are curved in a manner similar to vanes **33** in **Fig.4**. **52** is a

regenerative heat exchanger, exchanging heat between the working fluid streams flowing in passages **53** and **61**. Heat supply heat exchanger **55** and cooling heat exchanger **62** are attached to the shaft, so that the shaft may be kept stationary or rotated at a different speed than the rotor **50**. **58** and **59** are the entry and exit points for the heating fluid while **64** and **65** are the entry and exit points for the cooling fluid, and **66** is an opening.

When operating, the rotor rotates, and a working fluid within the rotor passes outwards in passage **11**, and is compressed by centrifugal force, and accelerated to a tangential speed that may be the same as that for the rotor periphery. In a closed rotor such as is shown in **Fig.1**, heat is added into the working fluid near the rotor periphery, and then the working fluid decelerated in the fluid passages **14** extending inwards toward rotor centre, with the passages being curved backwards away from the direction of rotation as shown in **Fig.2**. As the working fluid is decelerated in the inward extending passages, the work associated by such deceleration is transferred into the rotor and this provides the thrust and torque to rotate the rotor. After deceleration and expansion, the working fluid is cooled in heat exchanger **15** and then passed to the outward extending passages thus completing its working cycle.

The operation of the unit of **Fig.3** is similar, except that the working fluid enters the rotor via opening **37** from external sources. For the unit shown in **Fig.3**, the heat addition heat exchanger is omitted; for this unit, there is a pressure drop between entry **37** and exit **34**. A heat exchanger similar to that shown in **Fig.1**, item **12**, may be used in the unit of **Fig.3**, and then the entry and exit pressure for the working fluid may be the same, if desired.

The operation of the unit shown in **Fig.5**, is similar to that described for the other units. The rotor rotates, and by centrifugal force, compresses the working fluid in passages **51**, and then the working fluid gains heat in the regenerative heat exchanger, with the heat being supplied by another working fluid stream returning from the high temperature end of the unit. The working fluid is expanded and decelerated in passages **54** and heat is added in the heat exchanger **55**. Then the working fluid passes through the regenerative heat exchanger and then is cooled in the cooling heat exchanger and then is passed into passages **51** thus completing its cycle.

The various components of the units shown can be exchanged to make additional forms of the apparatus. As noted, the unit of **Fig.3** may be provided with a heat exchanger similar to that shown in **Fig.1** for adding heat into the working fluid near the rotor periphery. Further, a regenerator may be provided with the units of **Fig.1** and **Fig.3**, if desired, between the outward extending and the inward extending working fluid passages. Also, the cooling coil of **Fig.5**, item **62** may be eliminated, and the working fluid taken into the unit from outside the unit, if desired.

The openings **32**, **13** and **66** may be made into nozzles, if desired, and the nozzle oriented in different directions as desired. In particular, these nozzles may be positioned so as to discharge the working fluid tangentially backwards, if desired.

The regenerator of **Fig.5** is shown to be tapered. This taper may be as shown, or the taper may be made such that the regenerator portion diameter is smaller at the end which has the heat exchanger **55**, than the end which has the heat exchanger **62**. Also, the regenerator may be made without a taper.

Passages **53** and **61** are usually provided with vanes, as indicated in **Fig.5**, to prevent tangential movement of the working fluid.

Applications for this power generator are those normally encountered in power generation.

The working fluid is usually a gas for units such as those shown in **Fig.1** and **Fig.5**, but the working fluid may also be a liquid for a unit such as shown in **Fig.3**. The heating and cooling fluids may be either gases or liquids, as desired.

The heat exchangers for heating and cooling are shown to be made of finned tubing. Other forms of heat exchangers for adding heat and for removing heat may be used. The regenerative heat exchanger is shown to be made of sheet metal; other forms of heat exchangers may be also used.

## **CLAIMS**

1. In a power generating turbine, wherein a working fluid is accelerated and pressurized within a rotating rotor first outwardly extending passages, and wherein a working fluid is expanded within a rotating rotor inwardly extending second passages, with the first and the second passages being connected at their outward ends by a passage means to allow said working fluid to flow outwardly within the first passage and through said passage means and inwardly within the second passage, the improvement comprising:
  - a. a curved inwardly extending second passage, for the generation of thrust and torque on said rotating rotor, with the curvature of said curved inwardly extending passage being backward and away from the direction of rotation.
2. The turbine of claim 1 wherein a heating heat exchanger is provided to add heat into said working fluid near said passage means.
3. The turbine of claim 2 wherein the rotor of the turbine is closed and said working fluid is sealed therein, and wherein a cooling heat exchanger is provided within the rotor to remove heat from the working fluid near rotor centre, and where the inner ends of the first passages and the second passages are connected and adapted for circulation of said working fluid.
4. The turbine of claim 3 wherein a regenerative heat exchanger is provided to exchange heat between two streams of the working fluid, one of the streams being before the heat addition heat exchanger and another being after the heat addition heat exchanger, and where said regenerative heat exchanger is carried by the rotor.
5. The turbine of claim 4 wherein said heating heat exchanger is mounted on the rotor shaft, and said shaft is held stationary.

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**US Patent 3,931,713**

**13th January 1976**

**Inventor: Michael Eskeli**

## **TURBINE WITH REGENERATION**

### **ABSTRACT**

A method and apparatus for generating power by passing a motivating fluid from a higher energy level to a lower energy level by compressing the fluid in a centrifuge-type first rotor and discharging the fluid via nozzles near the periphery of the first rotor, forwards in the direction of rotation to a second rotor which is an inward flow type reaction turbine, then passing the fluid through a regeneration type heat exchanger to transfer heat from the inward bound fluid into the outward bound fluid, after which the fluid is cooled in a heat exchanger to its original temperature and is passed outward again thus completing its cycle. Heat is added to the fluid near the periphery of the second rotor, or the heat may be added near the periphery of the first rotor, or both. Additionally, the fluid may be supplied to the unit from outside source, and returned to such outside source, and the cooling may thus be eliminated from the unit. Further, the fluid entering from an outside source may be at an elevated pressure. The fluids used may be gaseous, which is normal for a closed type unit, or they may be liquids at entry for the open type unit.

### **US Patent References:**

2,490,064	Thermodynamic Machine	Dec 1949	Kollsman
2,514,875	U-passage Gas Turbine	July 1950	Kollsman
2,597,249	Thermodynamic Engine	May 1952	Kollsman
3,236,052	Closed-cycle Gas Turbines	Feb 1966	Guin
3,530,671	Regenerative Air Turbines	Sep 1970	Kolodziej

This application is a continuation-in-part application of "Turbine with Dual Rotors," Ser. No. 405,628, filed 10/11/73, and uses material of a previous U.S. Pat. No. 3,834,179, "Turbine with Heating and Cooling".

**BACKGROUND OF THE INVENTION**

This invention relates generally to devices for generating power in response to a fluid flowing from a higher energy level to a lower energy level passing through a turbine for generating the power.

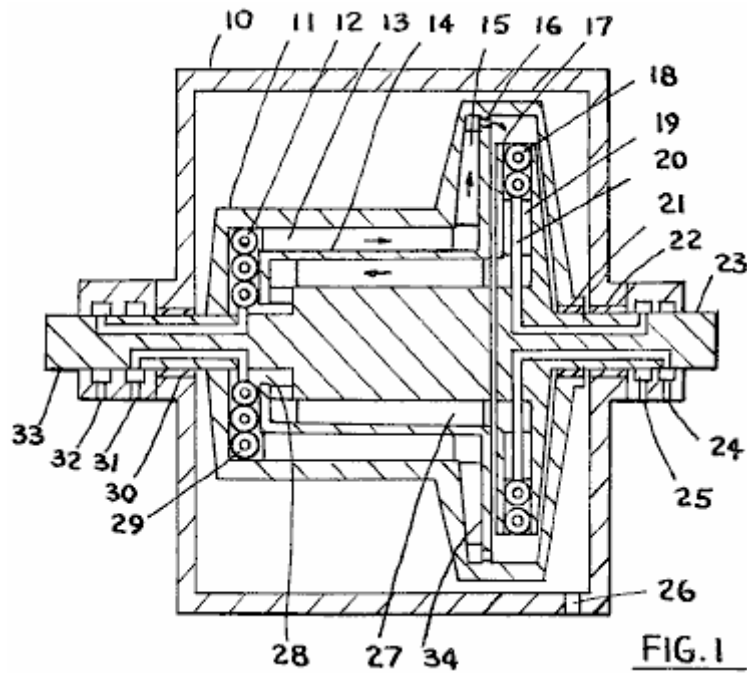
There have been various types of turbines previously, in some of which a fluid is accelerated in a single or multiple stationary nozzles and then passed to vanes mounted on a rotating rotor wheel, where the kinetic energy contained by the moving fluid is converted to power by deceleration of the fluid.

These conventional turbines normally have a high energy loss due to fluid friction, especially between rotor vanes and the fluid where the velocity differential is usually large. Also, these turbines often require complex shaped turbine vanes making the unit costly.

**SUMMARY OF THE INVENTION**

It is an object of this invention to provide a turbine for power generation in which heat is converted to power, in an efficient and economical manner, and with high thermal efficiency. It is also an object of this invention to provide a means for transferring heat from the motivating or working fluid, which is the first fluid, during its passage from rotor periphery to rotor centre into the first fluid which is passing from the rotor centre towards the rotor periphery. This heat transfer improves the efficiency of the turbine, and reduces the necessary rotational speed of the rotor, allowing less costly rotor construction.

**BRIEF DESCRIPTION OF THE DRAWINGS**



**Fig.1** is a cross section of one form of the device, and

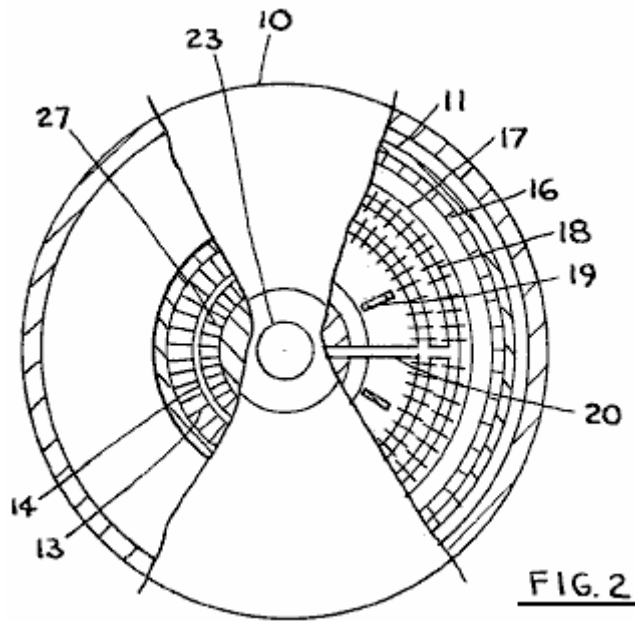


Fig.2 is an end view of the unit shown in Fig.1.

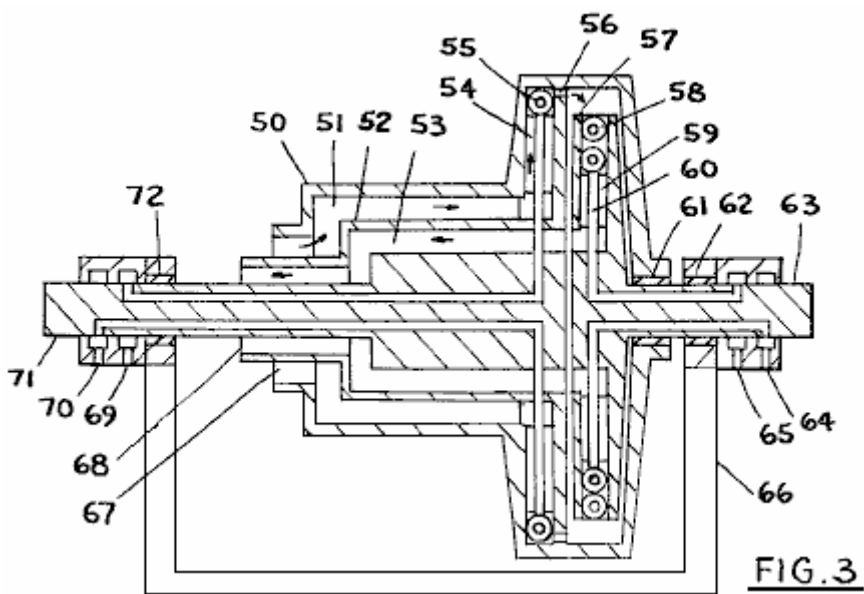


Fig.3 is a cross section of another form of the device.

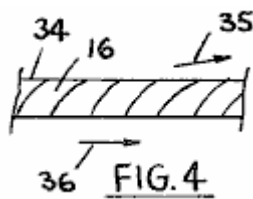
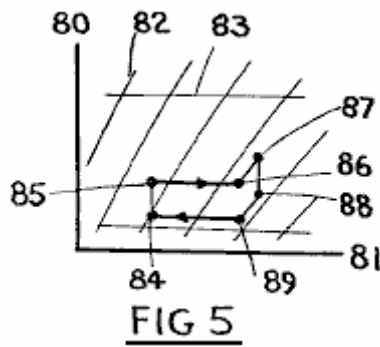
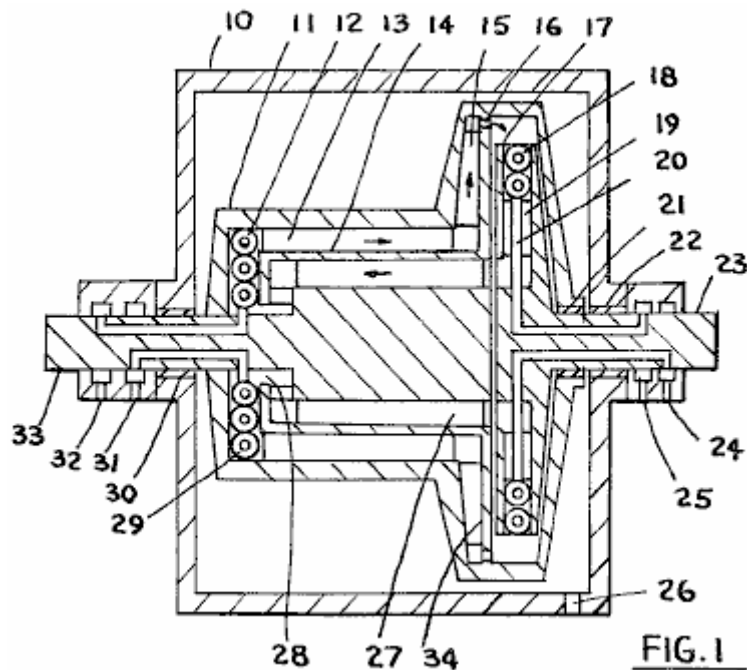


Fig.4 is a detail of rotor nozzles.



**Fig.5** is a pressure-enthalpy diagram of the first fluid with working cycle illustrated for the first fluid.

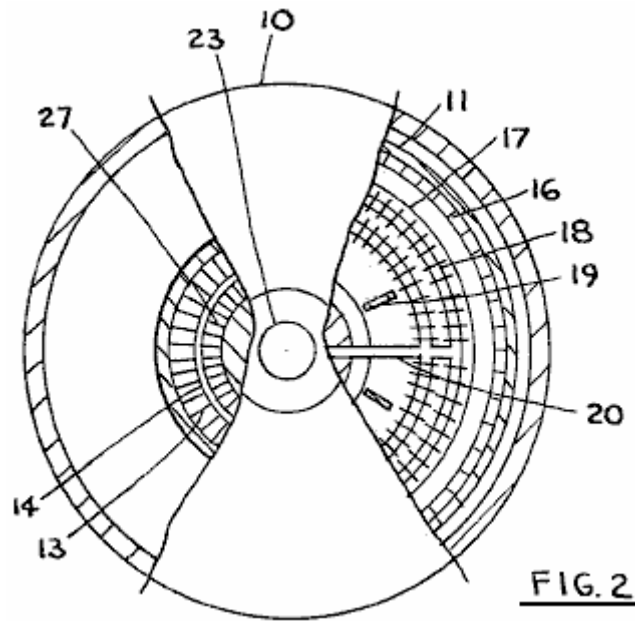
**DESCRIPTION OF THE PREFERRED EMBODIMENTS**



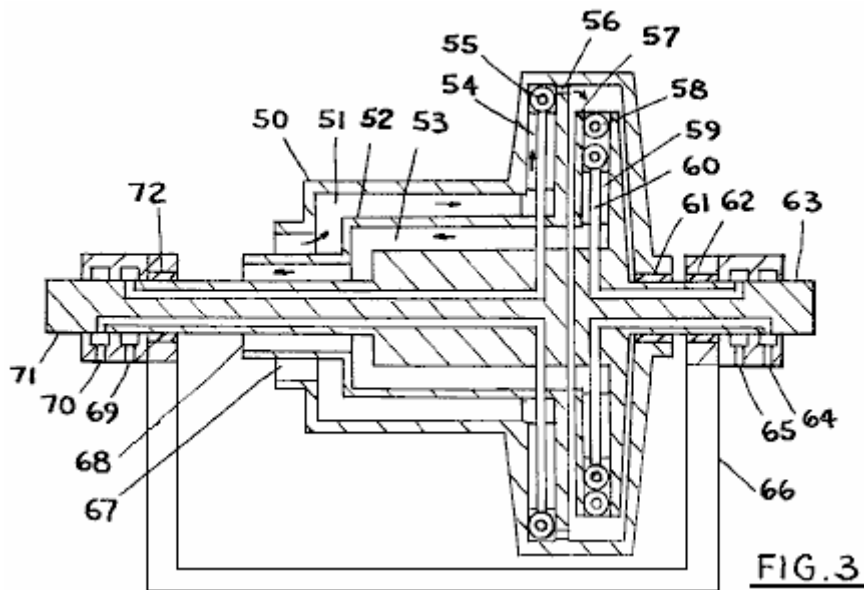
**Fig.1** shows a cross section of one form of the turbine. In this form, the first fluid is sealed within the rotor with a second fluid which supplies heat to the first fluid, and a third fluid which cools the first fluid, being circulated from external sources.

The first fluid is accelerated and compressed within the first rotor, and after discharge from the nozzles of the first rotor, into the second rotor, where it receives heat from the second fluid, and after deceleration and expansion the first fluid passes in heat exchange relationship with the first fluid flowing outward so that heat is transferred from the inward bound first fluid to the outward bound first fluid. Cooling is then provided for the first fluid to bring the first fluid temperature to an initial predetermined value.

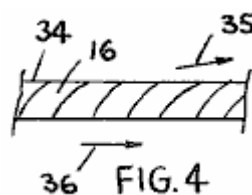
In **Fig.1**, **10** is the casing, **11** is the first rotor, **12** is the third fluid heat exchanger, **13** is the vane which also serves as a heat exchange member, **14** is a heat-conductive wall, **15** is a vane, **16** is a nozzle, **17** is the second rotor, **18** is the second fluid heat-exchanger, **19** is a vane, **20** is the second-fluid conduit, **21** is a combined bearing and seal, **22** is a combined bearing and seal, **23** is a second rotor shaft for the delivery of power, and for support of the second rotor, **24** and **25** are supply and return for the third-fluid, **26** is a vent opening in the casing into which a vacuum source may be connected, **34** is a dividing wall, **27** are vanes serving also as heat-exchange members, **28** is a first-fluid passage, **30** is a combined bearing and seal, **31** and **32** are the second-fluid entry and exit points, and **33** is the first rotor shaft.



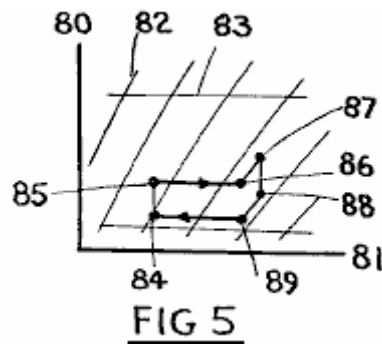
**Fig.2** shows an end view of the unit of **Fig.1** where **10** is the casing, **11** is the first rotor, **17** is the second rotor, **16** are the first-fluid nozzles, **18** is a heat exchanger, **19** are vanes, **20** is a conduit, **13**, **14** and **27** form a heat exchanger for the first-fluid and **23** is the second rotor shaft.



**Fig.3** shows another form of the turbine, where the first-fluid is supplied to the turbine from outside sources thus eliminating the third-fluid heat exchanger. **50** is the first rotor, **51**, **52** and **53** form a heat exchanger for the first-fluid, **55** and **58** are heating heat exchangers for adding heat to the first-fluid and may use a second-fluid at the same temperature or at a different temperature as the heating fluid, **54** are vanes within first rotor, **56** are first-fluid nozzles oriented to discharge forwards, **57** is the second rotor, **59** are vanes, **60** is a conduit for the second-fluid, **61**, **62** and **72** are bearings, **64**, **65**, **69** and **70** are entries and exits for the second-fluid, **63** is the second rotor shaft, **71** is first rotor shaft, **66** is the base, while **67** and **68** are the exit and entry points for the first-fluid.



**Fig.4** shows a detail of the first-fluid nozzles where **34** is wall on which nozzles **16** are mounted, **35** is the approximate direction of leaving of the first-fluid, and **36** indicates direction of rotation of first rotor.



In **Fig.5**, a pressure-enthalpy diagram for the first fluid is shown, with the working cycle for the first-fluid where **80** is the pressure axis and **81** is enthalpy axis, **82** are constant entropy lines, **83** are constant pressure lines, and for the cycle, compression with heat removal, or without heat removal, occurs from **84** to **85**, heat is added from returning first-fluid from **85** to **86**, further compression is from **86** to **87**, then expansion from **87** to **88** and **89**, and heat removal to the first-fluid from **89** to **84**, thus completing the cycle. Heat is normally added between **87** and **88**, from the second-fluid. The heat addition between **85** and **86**, and heat removal between **89** and **84** may be at constant or varying pressure as desired; pressure may be varied conveniently by increasing or decreasing the diameter of the first-fluid to first-fluid heat exchanger, making the heat exchanger tapered.

In operation, the rotors are filled to a desired pressure with a suitable first-fluid, and the first rotor is caused to rotate. The first-fluid is first compressed with heat removal, and then is passed in heat exchange relationship with the inward bound first-fluid with addition of heat, and after this the first-fluid is further compressed and accelerated and after this compression, the first-fluid is passed via nozzles mounted on the first rotor forwards in the direction of rotation, after which the first fluid enters the second rotor's inward extending passages for deceleration, with heat being added to the first-fluid in the second rotor inward passages for reduction of density of the first-fluid. After passing inwards and decelerating, the first-fluid is passed in heat exchange relationship with the outward bound first-fluid, and after that, the first-fluid may be further decelerated, and then the first-fluid enters the outward extending passages of the first rotor thus completing the cycle.

The operation of the open turbine of **Fig.3** is similar to that described, except that the first-fluid is supplied from external sources, and is then returned to said external source, with cooling then being deleted.

The work input to the first rotor is the work required to accelerate the first-fluid, and the work output by the second rotor is the work of deceleration received by the second rotor. The work output by the turbine is the work differential of these two rotors.

The rotational speed of the second rotor may be higher than the rotational speed of the first rotor. To provide for inward flow of the first fluid within the second rotor, the fluid density is reduced by adding heat to the first fluid either within the second rotor, or also within the first rotor.

The addition of heat from the inward bound first fluid to the outward bound first fluid increases the temperature of the first fluid during latter part of compression and during expansion, and thus has the effect of improving the thermal efficiency of the turbine. Also, another effect is the reduction in the needed rotational speed for the turbine rotors, thus reducing the required strength for the rotors, and making the rotors more economical to make and operate.

Working fluids for this turbine are usually gases for the first-fluid, and liquids for the second and third fluids. Gaseous second and third fluids may be also used, and the first-fluid may be a liquid in some instances. Also, the first fluid may undergo a phase change within the turbine, if so desired, when using a suitable fluid. Applications for this turbine include normal power generation service using various heat sources.

The first rotor shaft and the second rotor shaft are normally connected via a power transmission device so that a part of the power produced by the second rotor is used to rotate the first rotor. Starting of the unit is by a starting device.



The vanes of the rotors may be made curved if desired. In many instances, the first rotor vanes may be curved backward to increase compression of the first-fluid, and the vanes of the second rotor may be also curved, to improve performance, and to suit the design and fluid selected. In this connection, the fins for the heat exchangers are considered to be vanes.

The pressure-enthalpy diagram shown in **Fig.5**, is approximate only. This diagram may be varied, depending of the amount of heat added in the second rotor, or in the first rotor, and depending on the specific location of the second fluid and third fluid heat exchangers. In particular, heat may be added to the first-fluid during expansion to make the first-fluid actually increase in temperature; this will normally improve the overall thermal efficiency of the turbine. Also, heat removal by the third fluid may be conducted in places other than that shown in **Fig.1**, as desired.

It should be also noted that the heat addition to the first-fluid may be from sources other than the second fluid, and similarly, some other means may be used to cool the first-fluid other than the third fluid. Such heating sources may include electricity, or other rotors mounted in proximity to this turbine; these will not change the spirit of this invention.

The heat exchanger mechanism for transferring heat from the inward bound first-fluid to the outward bound first-fluid can also be located within the second rotor, and also the entry and exit for the first-fluid into the turbine may be within the second rotor. Such arrangements are not shown specifically in the drawings since they are considered to be within the capabilities of a skilled designer, in view of the descriptions given herein.

## **CLAIMS**

1. A turbine for generating power and comprising:
  - a. means for rotatably supporting first and second rotors;
  - b. First and second rotor shafts journaled in said support means for rotation;
  - c. first rotor means provided said first shaft for rotation therewith, said first rotor means having a first passageway for an outward bound first fluid, with said first passageway communicating at its downstream end with means for accelerating said first fluid forwardly in the direction of rotation of said first rotor means and for passing said first fluid into said second rotor means, said first rotor means further having a second passageway for inbound first fluid in close proximity to said first passageway and in communication therewith near the downstream end of said second passageway, and heat exchanger means intermediate said first and second passageways for adding heat to said outward bound first fluid from said inward bound first fluid;
  - d. second rotor means mounted on said second shaft for rotation therewith, said second rotor having further passageway means for said first fluid, said further passageway means being in fluid communication at its upstream end with said first rotor accelerating means, and in fluid communication at its downstream end with said first rotor second passageway.
2. The turbine of claim 1 wherein a heating heat exchanger is provided for adding heat to said first fluid downstream of said first passageway.
3. The turbine of claim 1 and including heat removal heat exchanger means provided downstream of said first rotor second passageway means.
4. A method of generating power comprising the following steps:
  - a. compressing a outward bound motivating fluid within a first passageway of a rotating first rotor;
  - b. accelerating and discharging said motivating fluid into a passageway of an independently rotating second rotor;
  - c. passing said motivating fluid from said second rotor passageway into a second passageway of said first rotor; and
  - d. effecting heat transfer from said motivating fluid in said first rotor second passageway to said motivating fluid in said first rotor first passageway.
5. The method of claim 4 and including the following additional step: returning said motivating fluid from the downstream end of said first rotor second passageway to the upstream end of said first rotor first passageway.
6. A method of transferring heat within a rotor, comprising the following steps:
  - a. driving an outward bound motivating fluid within a first passageway of said rotor;

- b. effecting a heat transfer between an outside source and said motivating fluid;
- c. causing said motivating fluid to be inbound within a second passageway of said rotor, proximate to said first passageway; and
- d. effecting heat transfer between said motivating fluid in said second passageway and said motivating fluid in said first passageway.

Much of this information on Michael Eskeli is taken, with the kind permission of Scott Robertson, from his web site <http://www.aircaraccess.com> .

### **Self-Powered Water-pump Generator.**

Repeated here from Chapter 2, a device which needs to be in this list of self-powered devices is the ultra simple water-jet generator. There is a video on Google which shows a self-powered electrical water-pump driven, electrical generator at the location: [http://video.google.com.au/videoplay?docid=-3577926064917175403&ei=b1\\_BSO7UDILAigKA4oCuCQ&q=self-powered+generator&vt=lf](http://video.google.com.au/videoplay?docid=-3577926064917175403&ei=b1_BSO7UDILAigKA4oCuCQ&q=self-powered+generator&vt=lf)

This is a very simple device where the jet of water from the pump is directed at a simple water-wheel which in turn, spins an electrical alternator, powering both the pump and an electric light bulb, demonstrating free-energy. What is of particular note is the utter simplicity of this device. It uses off-the-shelf parts almost exclusively and can be constructed by almost anyone.

It should be noted that the implementation shown in this video uses the most basic of turbine blades which must have a very low efficiency, and yet the output power generated is well above the level needed to sustain its own operation. Given well shaped conventional turbine blades of much higher efficiency would appear to raise the performance further, while one would think that using a Tesla Turbine with its simple discs should give a really spectacular performance. However, this may very well not be the case as the irregular, pulsed drive of the wheel will be leading-out additional energy as in the case of the Chas Campbell flywheel and the John Bedini flywheel. As it is, with its present form of construction, this device is already capable of producing additional power able to run other pieces of standard mains equipment.



This is clearly a development platform and it would benefit from having the areas which contain water, fully enclosed, and the electrical diversion from mains power to the output alternator operated by a switch.



Initially, the generator is got up to speed, driven by the mains electrical supply. Then, when it is running normally, the mains connection is removed and the motor/generator sustains itself and is also able to power at least one light bulb. The generator output is normal mains current from a standard off-the-shelf alternator. Power generation could hardly get any more simple than this.

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