

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 without 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. 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.

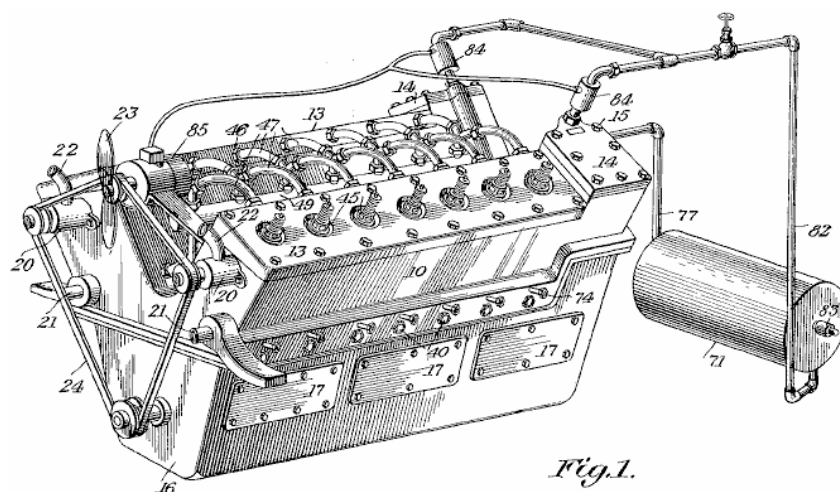
4. If compressed air is allowed to expand rapidly, there is a marked drop in temperature. The Leroy Rogers engine design, shown later in this chapter, uses this fact to create air-conditioning for a car driven by a compressed-air engine.

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.

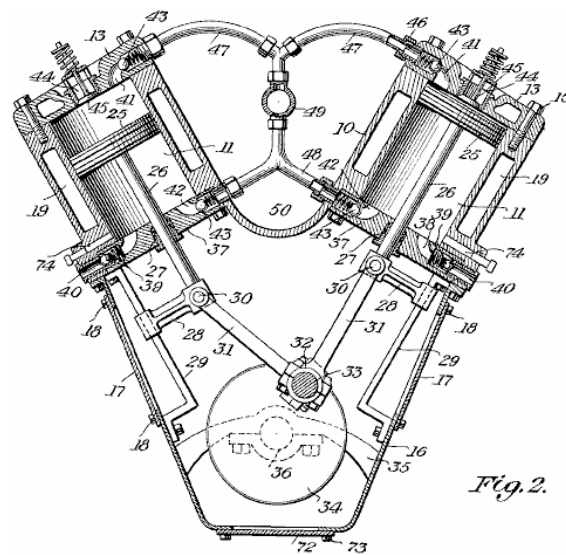
Let's check this out by taking a look at some of the engines which use these principle to provide fuel-less operation, starting with the design of Bob Neal. The full patent for Bob's design is included in the Appendix.

Bob Neal's Compressed Air Engine.

Bob Neal's design is a compressed-air operated engine and compressor where the operation of the engine keeps re-supplying the compressed air tank:



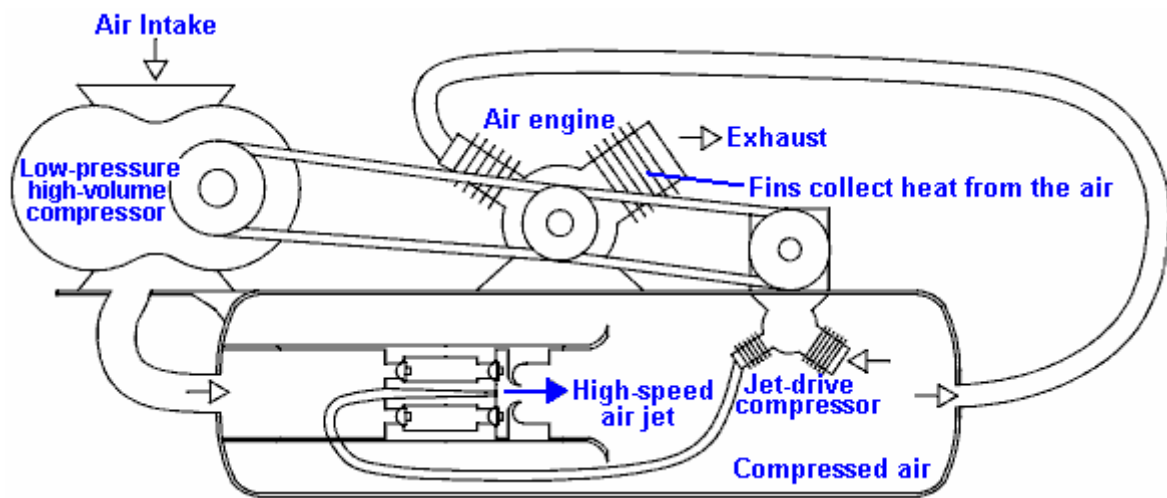
This is a perspective view of the engine and this:



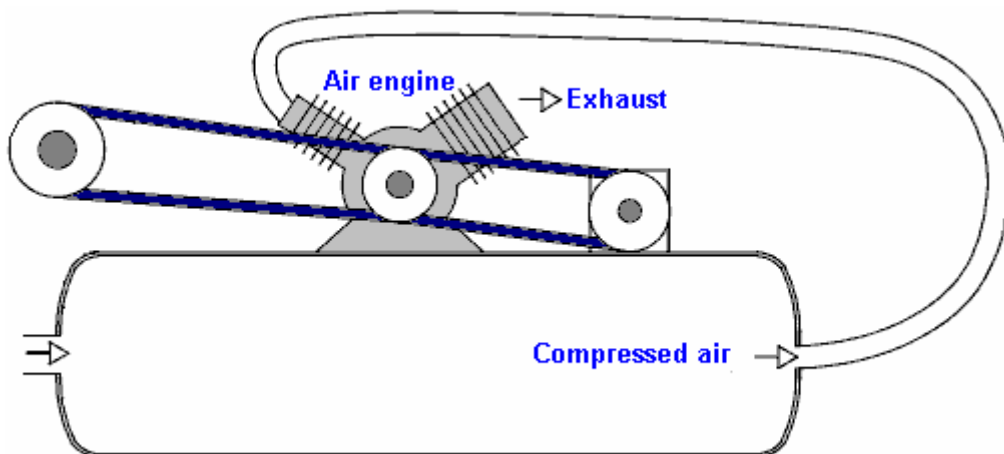
is a vertical transverse cross-section view through the compressor part of the engine. In his patent, Bob has avoided any direct mention of the fact that his engine design is fuel-less. That sort of statement is not popular with Patent Examiners even if it is perfectly true.

Scott Robertson's Compressor System.

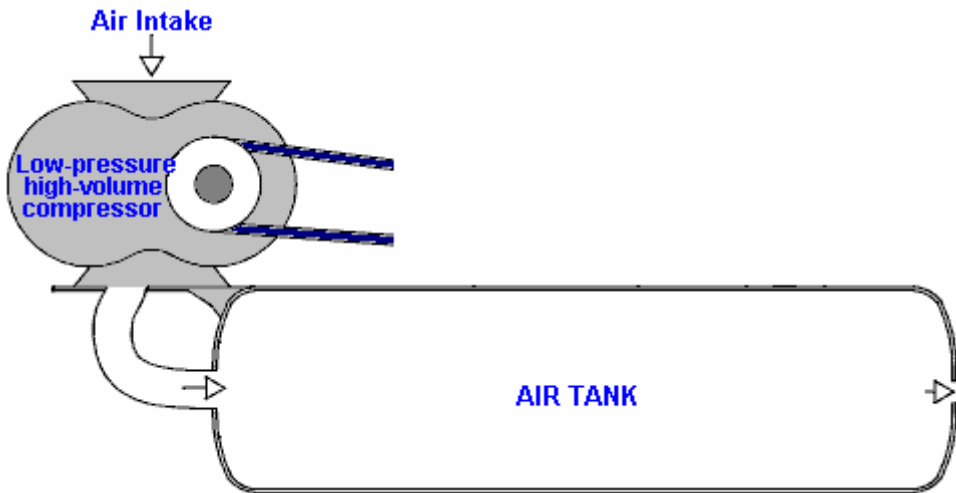
Bob Neal's system could do with some further explanation, so here is an idea from Scott Robertson whose web site is <http://www.aircaraccess.com/index.htm>, for a possible working compressor system using a leaf-blower:



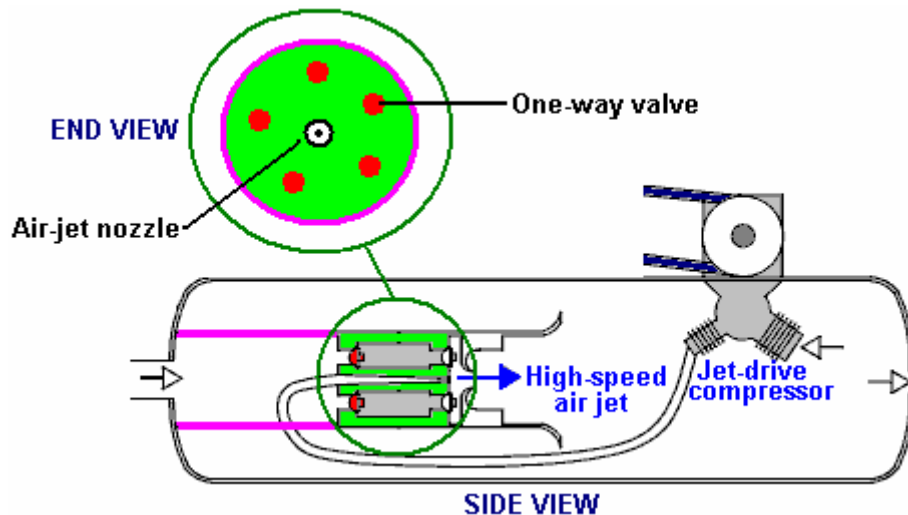
While this looks rather complicated, in reality it really isn't. Let's take the different sections in order:



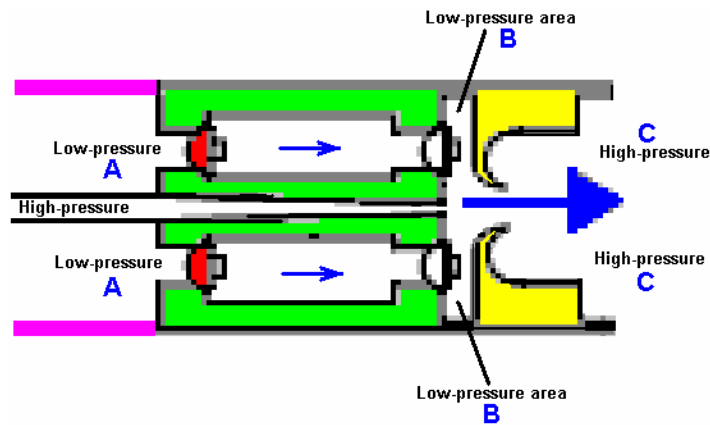
First, you have an ordinary air engine, supplied with compressed air from a pressure tank. This engine exhausts its (cold, expanded) air to the atmosphere. The engine powers two compressors which between them keep the tank full of compressed air.



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:

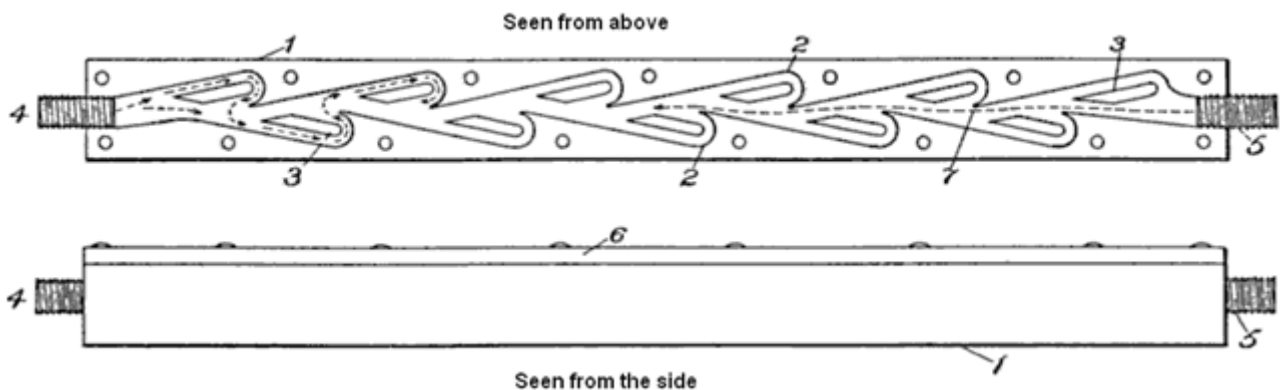


The low-pressure air at point “A” flows through the ring of five one-way valves into the disc-shaped low pressure area “B” and is blasted into the high-pressure area “C” by the high-power air jet ripping through the doughnut-shaped ring marked in yellow. The high-speed air jet causes the low pressure 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.

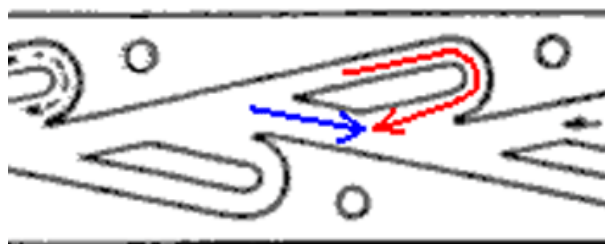
Tesla’s Motionless One-way Valve

As it is not widely publicised, many people have never heard of Nikola Tesla’s patent [1,329,559](#) of 1916 which describes a very clever physical shape which has easy passage of a fluid in one direction but very difficult flow in the opposite direction. This is the shape:



This arrangement is very clever as flow from right to left is free while flow from left to right results in a collision for every loop in the flow path. That is like this:

Seen from above



As a result of this, the larger the number of loops, the greater the flow resistance. With the eleven loops shown in the patent, the resistance to flow is more than 200 times from left to right. There are many different applications for such a fluid diode.

The Retro-fit Compressed Air Vehicle System of Leroy Rogers.

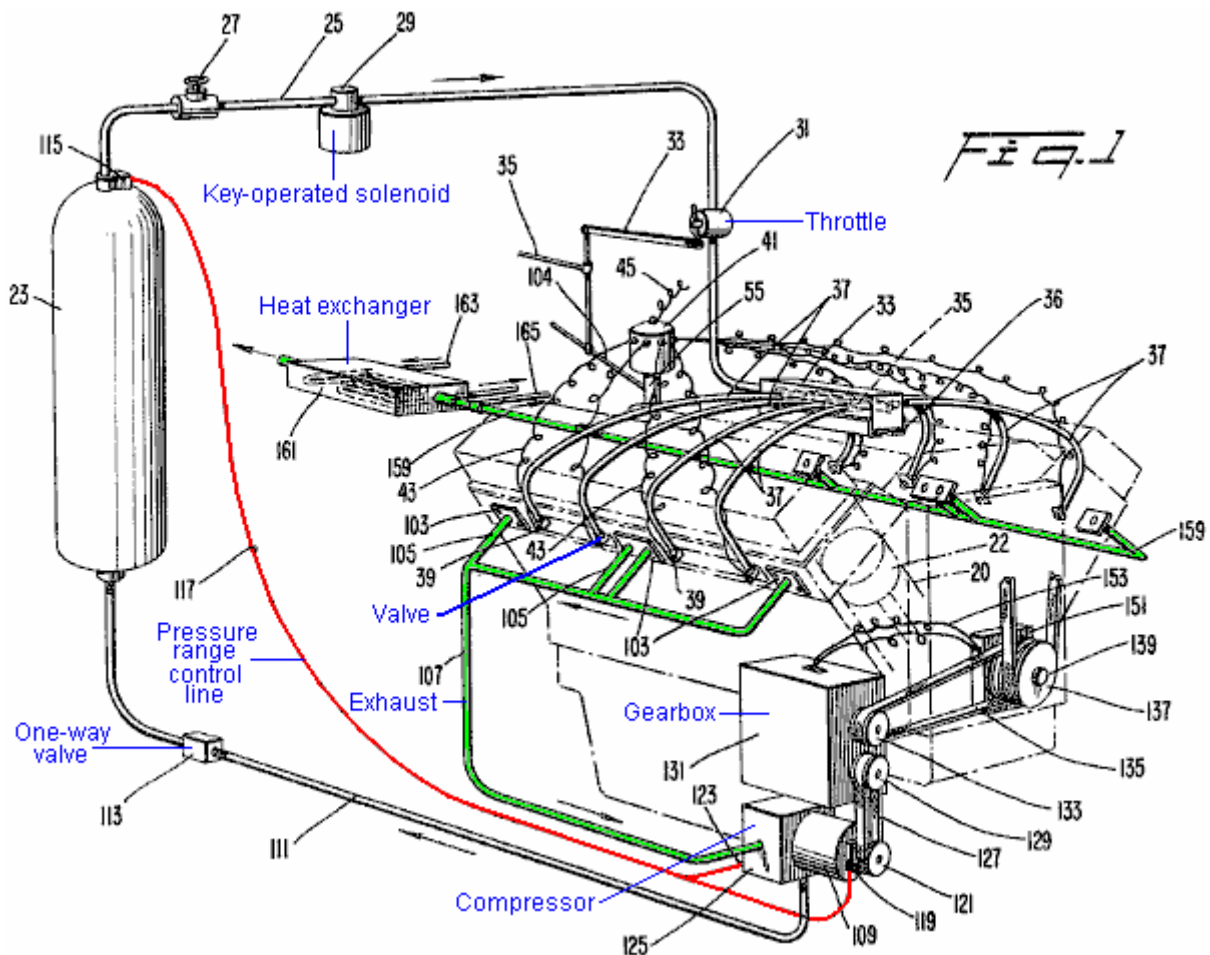
The Rogers motor shown here makes no claims to spectacular operation, but in spite of that, Leroy did admit in an interview that this motor does indeed have a greater output than the applied input, provided that the motor is not left just ticking over. This motor is like the US patent 3,744,252 "Closed 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.

However, while Leroy did state that his design was self-sustaining when going over 30 miles per hour, a key design feature is his very high performance compressor unit which he later patented as shown below. Present day vehicle engines are under-gearred 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. Air can be pumped back into the high-pressure tank by a compressor which has a 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 and if it is captured in a buffer tank and used as the input of the compressor, then recharging the air tank is more efficient, provided that the tank absorbs heat from the surrounding environment, raising its temperature inside the tank and so giving an extra boost to the tank pressure, over and above the compression provided by the compressor.

One really nice feature of Leroy's design is that he envisages it as being an adaptation of an ordinary vehicle engine and he provides a considerable amount of practical detail as to how the adaptation can be carried out.

Using a RotoVerter (as described in Chapter 2) to drive a compressor would lower the power requirements of the compressor drive to the extent that a motor adaptation of this kind should be self-sustaining. The RotoVerter provides a major energy gain in its own right and is particularly suited to driving mechanical loads such as the compressor and it particularly 'likes' constant-load applications such as a compressor.

The adapted engine shown in the patent is like this:



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 systems 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.

Leroy's compressor patent is shown here:

United States Patent 4,693,669 Supercharger for automobile engines

Inventor: Rogers Sr., Leroy K. (Rte. 13, P.O. Box 815-DD, Briarcliff Rd., Fort Myers, FL, 33908)

Publication Date: 15th September 1987

Abstract:

A supercharger for delivering supercharged air to an engine, comprising a shrouded axial compressor, a radial compressor which is located downstream of the axial compressor and a housing. The housing is comprised of four sections, including a section which is a highly converging, 'frustoconical' transition duct which favourably directs the discharge of the axial compressor to the inlet of the radial compressor and a hollow, highly convergent, exhaust cone section immediately downstream of the radial compressor which converges into the exhaust port of the supercharger. An annular flow deflector is provided for directing the discharge of the radial compressor into the exhaust cone.

Description:

Superchargers impart additional pressure to the air or the air/fuel mixture of an engine so that the cylinders receive a greater weight per unit volume of air or air/fuel mixture than would otherwise be supplied. As a result, the volumetric efficiency and power output of the engine are improved.

According to prior practices, superchargers generally comprise a single air-blower which forces air or an air/fuel mixture into the cylinders of an engine. Typically, the air-blower is driven by a gear train which is connected to the crankshaft of the engine with a gear ratio of about 6 to 1. These prior types of superchargers have been used extensively in racing engines and radial aircraft engines. However, by reason of their high operating speeds and their gear trains, these superchargers have been considered too complicated, too heavy and too costly for use with mass production engines such as are found in cars and trucks.

Recently, some car manufacturers have been offering turbocharged engines which expand to exhaust gases of the engine through a turbine to drive a centrifugal compressor. Although turbochargers are advantageous in that the turbine can deliver large amounts of power to the compressor, their extreme operating speeds require special bearings, lubrication and maintenance. In addition, turbochargers require special ducting, such as by-pass arrangements, which only add to their cost and maintenance requirements. Consequently, turbochargers are only offered as expensive options in cars.

Further, there is current interest in a new type of car engine which operates from tanks of compressed gas to effect reciprocation of its pistons. An example of such an engine can be found in the U.S. Pat. No. 4,292,804 issued to the same inventor of the present invention. In the referenced patent, at least a portion of the partially expanded exhaust gas from the cylinders is directed to a compressor where it is recompressed and then returned to the storage tanks from whence it originally came. It would be desirable that at least some, if not all of the aforementioned recompression of the exhaust gas could be achieved with a belt-driven, rotary supercharger that is easily manufactured and maintained, yet is capable of providing ample recompression.

Objects of the Invention:

Accordingly, an object of the present invention is to provide a supercharger suitable for improving the performance of engines of cars, helicopters or the like, which supercharger is inexpensive to produce and easy to maintain.

It is another object of the present invention to provide a supercharger which provides sufficient boost without resort to extreme operating speeds and accordingly avoids the costly complications associated with high speed operation.

It is yet another object of the present invention to provide a relatively compact and lightweight supercharger which is inexpensive to manufacture and maintain.

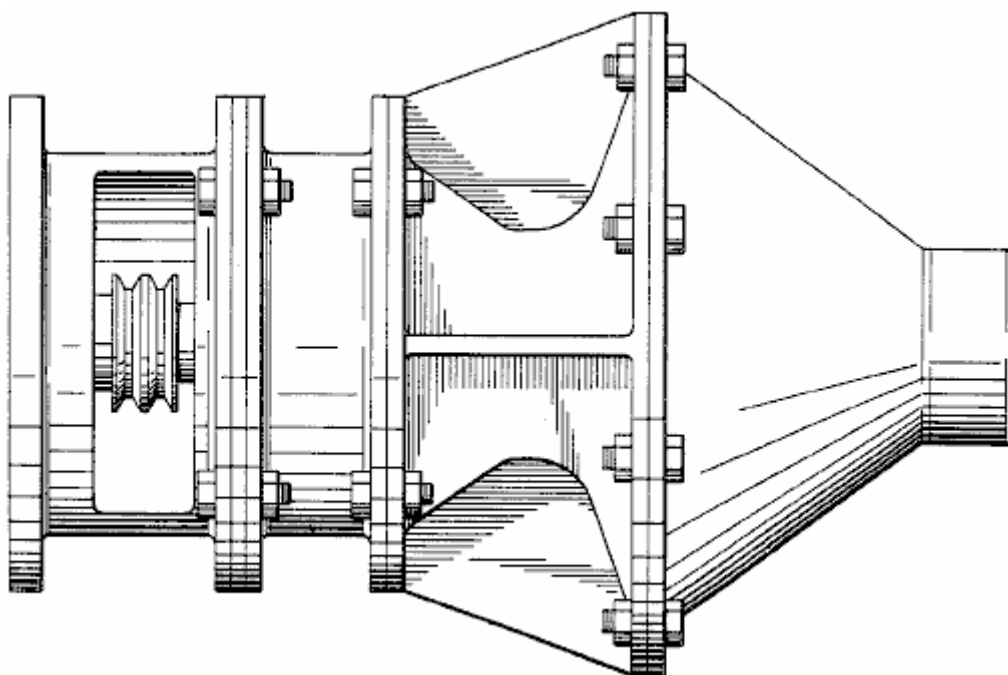
Another object of the present invention is to provide a belt-driven supercharger having a design which provides supercharging compression at relatively low operating speeds.

It is still another object of the present invention to provide a supercharger which can be quite readily disassembled and reassembled for purposes of low cost maintenance and repair.

Still another object of the present invention is to provide a supercharger which can be constructed from mass producible parts to thereby reduce the cost of its manufacture.

It is still another object of the present invention to provide a belt-driven supercharger which provides supercharging compression without resort to a larger number of compressor stages.

Yet another object of the present invention is to provide a rotary supercharger for a gas operated engine, which supercharger is easily manufactured and maintained, yet capable of providing ample recompression of the recirculating drive fluid.



Summary of the Invention:

These and other objects are achieved by the present invention which provides a supercharger comprising a housing having an inlet and an outlet, a shrouded axial compressor and a radial compressor rotatably mounted within the housing, a highly convergent shallow, frustoconical transition duct for favourably directing the discharge of the axial compressor to the inlet of the radial compressor.

In accordance with a further aspect of the invention, the above-described supercharger further comprises an exhaust cone at a location downstream of the radial compressor and a flow deflector for directing the discharge of the radial compressor to the exhaust cone.

In the preferred embodiment, the housing itself comprises four sections: a cylindrical front housing section which defines an axially directed inlet; a second, cylindrical ducting section enclosing the axial compressor; a rear housing section defining the transition duct as well as the inlet and casing for the radial compressor; and the exhaust cone section which defines at its terminus the outlet of the housing. For driving the compressor shaft, a double-tracked pulley wheel is secured to the forward end of the common shaft, which pulley wheel is adapted to receive one or more drive belts from the crank-shaft wheel of the engine. A lateral opening in the front housing section accommodates the connection with the drive belts.

With the disclosed arrangement, compression can be achieved for supercharging purposes without resort to a large number of compressor stages or high operating speeds. Additionally, the design of the disclosed supercharger avoids the need for guide vanes between the axial compressor and the radial compressor. The exhaust cone section also favourably avoids the build-up of back pressure against the radial compressor. The design is also very simple and therefore inexpensive to manufacture and maintain.

Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawing.

Brief description of the Drawings:

A preferred embodiment of the present invention is described in greater detail with reference to the accompanying drawing wherein like elements bear like reference numerals, and where: