AUTOMOBILES # 4 (AIR CARS) --- A comprehensive briefing on the controversy of compressed-air engines. Several of these claim to be "perpetual motion" in that they allegedly operate indefinitely without recharging...Lee Rogers...T. & G. Miller...King...Troyan...Bill Truitt...R. Wale...Yeh...Stewart...J. Rilett...More! 33 pp.
Battery cost

A man standing on a ladder

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**INVENTOR GEORGE MILLER SAYS HIS PRODUCT HAS MADE...**

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**INVENTOR GEORGE MILLER SAYS HIS PRODUCT HAS REVOLUTIONIZED THE AUTO INDUSTRY WITH HIS...**
Continued on page 5

In other words, much of the nation's power is based on the use of fossil fuels, which are often sourced from unstable regions. This situation has led to a reliance on imported oil and gas, which can be subject to price fluctuations and interruptions in supply.

A better solution, however, is to invest in renewable energy sources such as solar and wind power. These sources are abundant in many parts of the country and do not rely on imported energy. In addition, they are cleaner and more sustainable than traditional fossil fuels.

Modern day hero...

Earl Rogers interview

Lee Rogers is a member of the 1977 Dodge station wagon (similar in appearance to photo shown here)
Air-powered auto is a reality!

By JERRY O'KEEFE

A new vehicle, the Airobile, is about to hit the streets, powered by compressed air. The Airobile is a compact, two-seater that can reach speeds of up to 80 mph on a single charge. With a range of 50 miles, it's perfect for short commutes and everyday use.

The design of the Airobile is sleek and aerodynamic, with a streamlined shape that reduces drag and increases efficiency. The car is made of lightweight materials, ensuring a comfortable ride and low maintenance costs. The Airobile is also environmentally friendly, with zero emissions and no need for fossil fuels.

Production of the Airobile is expected to begin in the next quarter, with prices starting at $30,000. Orders are now being accepted, with delivery available in the coming months. To place an order, visit www.airobile.com or contact your local dealership.

Editor's note:

The Airobile is a revolutionary new vehicle that promises to change the way we think about transportation. With its air-powered technology, it offers a sustainable and efficient alternative to traditional cars. As the demand for eco-friendly vehicles continues to grow, the Airobile is poised to become a leader in the green transportation market.

Air-powered auto is a reality!

Consumer guide interview with inventor, Lee Rogers:

Lee Rogers, the inventor of the Airobile, talked about the inspiration behind his creation. "I was inspired by the potential of air-powered vehicles," Rogers said. "I wanted to create a car that was not only efficient, but also affordable and accessible to everyone."

"What sets the Airobile apart is its air-powered technology," Rogers continued. "The vehicle is powered by compressed air, which is stored in large tanks. The air is then used to drive the car, providing a smooth and quiet ride."

Rogers also spoke about the environmental benefits of the Airobile. "With zero emissions, the Airobile is a game-changer," he said. "It's not just about being environmentally friendly, it's about making a difference in the world."

The Airobile is expected to be a game-changer in the transportation industry, offering a sustainable and efficient alternative to traditional cars. With its air-powered technology, the Airobile is poised to become a leader in the green transportation market.

\* * *
The available energy without letting it slip through our fingers:

Clearly, the only problem is in developing the hardware necessary to manipulate

problem becomes not whether or not there is enough power available.

small amount compared to the amount available in the supply tank. The

amount of energy required to recompress after the power stroke is a very

words the energy required to perform the power stroke in addition to the

amount of air and the pressure of it available in the tank. In other

pressure. In the power stroke little recompression takes place compared to

such recompression is not from atmospheric pressure, way back up to tank

pumping or expanding it. The power needed to recompress is minimal because

source offers the means to utilize energy through manipulation, without diss-

agreement with this article by GI, Lawrence. Such a compressed air power

Einstein said energy is neither created nor destroyed. This seems to be in

NOTES BY T.F.P.
COE COMPRESSED AIR VEHICLE DEMONSTRATED

My local newspaper ran a picture on June 4, 1980 that showed a compressed air car being demonstrated in Times Square, NY. There was no story with the picture. The caption says the car was built by Terry Miller of Greatfield, Kansas for about $1280. He says it costs $2/mi to run, cruising at 29 mph, & has a range of 10 mi. He calls it a 2 passenger car. I don't know anywhere where a 2nd person can sit.

Judging by the picture only: The "car" is a 3 wheeler, a bare trike with no body over it. There is a single wheel in front, & it's steered with a tiller rather than a steering wheel. I am not judging I wonder if it has enough. Several large pressure tanks are visible. Take out by there may be 1 or 2 more. There are number of hoses & 2 pumps near the driver seat on the left wheel, which looks like some kind in diameter. It is very prominent on the side. The unit may be a 3rd party part of the transportation.

So clearly what this is, is not a novel new model, but just a rough test model which Miller is trying out air electric propulsion system. I have no further information on this vehicle.

COMPRESSED AIR VEHICLE CALCULATIONS

A compressed air propulsion system, as I understand it, is a number of pressure tanks equipped in a vehicle. The compressed air will be released through the action of a pressure reduction valve into an air motor, that is separate from the lower pressure, essentially a dc driving motor. The compressed air provides the motive power of the vehicle, while the air motor drives the vehicle. We are then not dealing with the problem of quick or immediate driving up hill, etc. We are dealing with the ability of the air motor to supply power to the vehicle.

To ensure the tank in your vehicle, one must decide what kind of a tank you want to use. Will you use water & how much water? Will you use water & what kind? Will you use air & what kind? In the latter case, you must decide what kind of pressure you want to have in the tank. You need only one pressure, it will be at a level where the air motor will be just able to handle the pressure, & there are no other means of propulsion other than the air motor.

2nd pressure is in the tank & the energy density of the tank is a major factor. We must take into account the energy density of the tank, the size of the tank, the amount of energy stored, & the amount of energy used. The energy density of the tank is a factor of the energy stored & the amount of energy used. The energy density of the tank is a factor of the energy stored & the amount of energy used. The energy density of the tank is a factor of the energy stored & the amount of energy used.

The above ideas are being used in design of the electric air vehicle. The idea is to have the air vehicle be an electric vehicle, & the motor be an electric motor. The electric motor will be used to drive the vehicle, & the energy density of the tank will be used to store the energy for the motor.

The energy density of the tank will be calculated for storage purposes. The tank will be calculated for storage purposes.

Here's the plan: We calculate the pressure of the tank during operation, & using the energy density of the tank, we calculate the energy of the tank. We then use this energy to calculate the energy density of the tank.

The energy density of the tank will be calculated for storage purposes. The tank will be calculated for storage purposes.

WEIGHT/UNIT

Weigh and volume in kilowatt hours

A standard pressure tank is rated at 666 psi in air & 600 psi in water. However, it is not that kind of a tank in a vehicle. We use a vehicle's water storage of a tank & calculate the energy density & the weight of the tank.

The weight and volume in kilowatt hours will be calculated for a vehicle's water storage of a tank & calculate the energy density & the weight of the tank. We use a vehicle's water storage of a tank & calculate the energy density & the weight of the tank. We use a vehicle's water storage of a tank & calculate the energy density & the weight of the tank.
FIG. 5 is a diagrammatic view taken from the rear of the vehicle of FIG. 1 showing the reciprocating piston engine in perspective and rotated 90° from its normal position;

FIG. 6 is a fragmentary front view of the vehicle of FIG. 1 showing the position of one of the air tanks;

FIG. 7 is a diagrammatic perspective view of the compressor system mounted in the front end of the vehicle;

FIG. 8 is a perspective of the electrical power cord housing and retriever;

FIG. 9 is a fragmentary rear view of the vehicle with the body removed;

FIG. 10 is a longitudinal sectional view of the suspension type compressor;

FIGS. 11A and 11B are cross-sections of different parts of the engine valve mechanism in position for forward operation;

FIGS. 12A and 12B are similar cross-sections but with the parts shown in position for reverse operation of the engine;

FIGS. 13A and 13B are top and side views, respectively, of the valve mechanism;

FIG. 13C is a side view of the spool valve used in the mechanism of the preceding figure;

FIG. 13D is a side view of the sleeve valve used in the valve mechanism; and

FIG. 4 is a diagrammatic illustration of the fluid pressure system used in the vehicle of FIG. 1:
VALVE MECHANISM FOR AN AIR OPERATED RECIPROCATING ENGINE

BACKGROUND OF THE INVENTION

This invention relates generally to vehicles and more particularly to a vehicle that operates from gaseous fluid such as air under pressure. More specifically various means are provided for generating air pressure from the various motions of the vehicle, both forward and vertical.

SUMMARY OF THE INVENTION

In accordance with the broader aspects of this invention there is provided an air powered vehicle having a chassis and wheels. An air powered engine having intake and exhaust systems is mounted on the chassis and has a driving connection with the wheels. A first reservoir of gaseous fluid under pressure is connected to the intake system for operating the engine. Means are provided for regulating the flow of the fluid to the intake system for controlling the operation of the engine.

A second reservoir is connected to the exhaust system for receiving spent air, conduit means being connected between the second reservoir and the intake system. This conduit means is provided with a check valve which limits the flow of air in only the direction from the second reservoir to said intake system.

A suspension type compressor is operatively connected between a wheel and the chassis, whereby relative vertical motion between the wheel and the chassis will cause operation of the compressor. This compressor is provided with inlet and exhaust ports connected, respectively, to said second and first reservoirs, whereby operation of the compressor pumps air from the second reservoir to the first reservoir.

Means are provided for disconnecting the flow of fluid from the first reservoir to the intake system and connecting the exhaust system to the first reservoir whereby the engine may serve as a compressor for delivering air under pressure to the first reservoir.

Further means for supplying air under pressure to the first reservoir includes a fan type compressor mounted on the front portion of the chassis. This fan type compressor is exposed forwardly to be operated by the air flow induced by forward motion of the vehicle. A conduit connects this fan compressor to the second reservoir for delivering air under pressure thereto. A reciprocating piston type compressor mounted on the chassis and having a driving connection with the fan compressor has conduit means coupled to the first reservoir whereby operation of the fan compressor serves to operate the piston compressor for delivering air under pressure to the first reservoir.

As sub-combinations of the generic invention are (1) a valve mechanism for selectively admitting and exhausting pressure fluid from the chambers of the reciprocating piston engine and (2) a suspension type compressor which may be connected between the vehicle chassis and the axle which serves to provide air under pressure as a consequence of the relative vertical motion between the chassis and the axle or wheels.

It is an object of this invention to provide an air powered vehicle in which pressure air is generated from the forward and vertical movements of the vehicle.

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U.S. No. Patent Date
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2,653,142 April 21, 1953
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Primary Examiner—Edgar W. Geoghegan
Assistant Examiner—Wayne F. Woods
Attorney, Agent or Firm—Gust & Irish

ABSTRACT

For use in an air operated, reciprocating engine, a valve mechanism for controlling mode of engine operation as either a prime mover or compressor as well as direction of operation. The valve mechanism includes a spool valve rotatably mounted inside a sleeve valve, both having a plurality of passages alternatively registerable for determining mode of operation. The sleeve valve is rotatably mounted on a head block having registerable passages communicating with the pistons.

Another object of this invention is to provide in an air powered vehicle a reciprocating piston engine which may be operated as a compressor, a suspension type compressor which provides compressed air as a consequence of the relative vertical motion between the vehicle chassis and the wheels, a fan type compressor that operates from the air flow induced by the forward motion of the vehicle and having a reciprocating piston compressor which is operated by the fan compressor for providing further compressed air.

Another object of this invention is to provide a valve mechanism for an air powered engine of the reciprocating piston type.

Still another object of this invention is to provide a suspension type compressor capable of generating air under pressure due to the relative vertical motion of the vehicle suspension system.

Still another object of this invention is to provide a fan type compressor which not only serves to generate air pressure itself but also to drive a reciprocating piston type compressor which generates air under pressure for use by the air powered engine.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings.
Full of hot air

Robert T. Manor, a Jay County monument dealer and backyard inventor, has spent the last 11 years tinkering away at an air-fueled automobile. His brainchild has come to a partial fruition, and Manor is looking for potential backers. — Staff photo by Sherman Goldenberg.

By SHERMAN GOLDENBERG

SALAMONIA — Robert T. Manor has invented something so logical, so obvious, it's almost embarrassing to mention it or not, this Jay County monument dealer and backyard inventor has spent the last 11 years perfecting his patented automobile that runs on air.

That's right. On air. It's just as simple, or as complicated — as that.

The reason I started on it was pollution, Manor said Friday, standing in his garage. "The energy crisis wasn't even heard of when I started. At that time, the late 1960s, I went up to Syracuse, N.Y., to see my sister. And though the people there didn't seem to notice the pollution, I certainly did. My nose burned. I thought it was awful."

So Manor, who never graduated from high school, went to work on an idea he had nurtured since the 1940s when he worked with air compressors on a sandblasting job: Use a small electric motor to compress air tanks. Patent an engine with pistons that will respond to a direct blast of air, much like a steam engine. Then devise a collector system to capture the spent air and return it to the storage tanks to complete the cycle.

And — voila! — you have the potential to power cheaply and cleanly whole cities of buses and millions of gas guzzling automobiles.

If he had had all the money in the world, Manor said, he would have carried a scale model and performed more experiments beforehand. His prototype would have looked more polished, and probably would have incorporated a tubular steel frame instead of an old Volkswagen body. But, he says, the funds were limited. His version cost about $30,000, not counting years of labor.

Therefore, this 54-year-old inventor sounds almost apologetic when he shows you his amazing car, a genuine concoction that looks and sounds like an inspiration to cartoonist Rube Goldberg. "This is just the basic idea," said Manor, pointing out flaws. "I didn't design it for speed or endurance. I just designed it to power a car. That was all of it."

But while the car may be crude by General Motors standards, said Manor, it is undoubtedly the only machine like it in existence.

Two 10-gallon air tanks are mounted on the rear and filled to a pressure of 120 pounds instead of a truck tire. Pressure is infused with an electric motor powered by current from a wall socket. By pushing a lever between the front seats, the driver sends air into the converted four-cylinder, gasoline engine and sets the auto in motion. As it moves along with a rhythm, the used air is piped in to three smaller exhaust tanks welded to the front and back.

Manor has a total of 17 patents on his engine and unique compressors. These double-action, banana-like compressors are stationed where the shock absorbers would normally be, are designed to return a small amount of compressed air to the storage tanks every time the wheels bounce across the pavement.

About 20 percent of the total air volume is lost to friction in each cycle. And, eventually, the storage tanks must be recharged with the electric motor.

But this is not the prototype, warns Manor, adding that the next model will utilize a combustion engine that automatically re-energizes the storage tanks when the pressure drops. He expects the new air-powered vehicle, an old Ford van, to go 60 miles per hour with the range improved from two to three miles.

The repumping process, he maintains, will require about a gallon of gas for every 85 miles on the road.

Manor says he would eventually like to see his idea perfected by engineers with a solid financial backing. He has contacted several major corporations, along with President Carter, without any positive response as yet. Manor, however, said he won't put his family's livelihood on the line trying to sell his ideas. He said he's heard of too many inventors who made "fools of themselves." That way.

Having come this far without a federal grant, Manor's prepared to go it alone or with a small team of private investors. After all, he explained, money was never his main objective.

"Money is not my main interest in it," he said. "It seems to me we've done a pretty bad job in the last 20 years as far as making a future for our children and grandchildren. And with atomic energy, we may end up with no future generation at all. So, I thought, why not make a vehicle that doesn't pollute? You're certainly not going to destroy the world with it."
One that was reported to have been quite successful, nevertheless, was the car built back in 1941 by a Los Angeles engineer named Roy J. Meyers. It was driven by an engine of radial (aircraft type) design, with six cylinders. Having an extremely high power-to-weight ratio, like all air motors, the Meyers engine produced over 180 horsepower while weighing only 114 pounds. News accounts of the day—perhaps over-optimistically—reported that the vehicle had a cruising range of several hundred miles if speeds were kept low.

Like steam and electric prime movers, air motors can be perfectly adapted to the unique demands of driving motorcars. Basically, this is because these motors have huge, indeed almost infinite, torque available at low shaft speeds. They need no power-wasting torque conversion (transmissions).

The air motors that would be used in an automobile would resemble a steam engine except that, since the air is not hot, they would avoid the lubricant breakdown that is one of the major technical hangups of steam engines.

In earlier years, air power simply employed a large pressure tank, a control valve and a reversible motor to twirl the wheels. There are still railroad engines from the turn of the century operating every day on this principle, in mines and areas where combustion exhausts are prohibited.

The most advanced—and efficient—air vehicles, however, would probably use liquid air to avoid the dangerous pressure vessel that could explode like a bomb in an accident. A warming device, probably operated from a battery, would heat the liquid air enough to vaporize it and build up the pressure that could drive the engine’s pistons.

As with the electric car, there would be no pollution from an air-powered vehicle. A very slight oil vapor would be emitted in the exhausted air, but this could easily be removed by filtration.

It is precisely the bigger cities that have become pollution terminal cases where by far the greatest proportion of vehicle miles are driven in the U.S. each year. Electric and air-powered cars could be put on the road right now that would immediately halt a sizable proportion of this air poisoning.

But whether such cars would be of much use for over-the-road driving is problematic. An electric car could conceivably take a trip across the country, although cruising range in any electric with a battery no larger that the “guts” of an ordinary gasoline car would, today, be quite limited—probably a maximum of 100 miles.

SPOTLIGHT, Dept. 133
300 Independence Ave., S.E.
Washington, D.C. 20003
Incredible car runs great on cheap compressed air

An amazing new car breezes along powered only by air! And inventor Terry Miller says his incredible machine is the ultimate answer to the energy crisis and pollution.

The 47-year-old engineer from Crestline, Kan., built his air car to prove that an old idea's time has finally come.

"This isn't a new idea. The first designs for air-powered cars go back as early as 1894. But for the past 90 years development of the air car has not been feasible. Now, with gasoline prices as high as they are, it makes terrific sense," says Terry.

Terry's car runs on a compressed air system which he invented. Two compressed air cylinders send blasts of air to the rotary-shaped eight-cylinder engine.

By the time the air reaches the exhaust system it's actually cleaner than when it left the cylinder. The inventor says top cruising speed for the car is 45 miles an hour. And Terry is in the process of developing a system which will give the car a range of 45 miles. While Terry is not hoping to put his Detroit automakers out of business, he thinks he's got the beginnings of an ideal in-town runabout.

"We've got electric cars beat by a long shot. You can't drive them all day — their batteries get weak and you have to stop and recharge them. But with our air car you can just pull up to a pump, fill the tanks with compressed air, and you're off again. And it's cheaper to run than an electric car," Terry said.

The only thing Terry's car lacks right now is glamour. But he's quick to explain that he didn't build it to be beautiful — he built it to be practical. He's spent the better part of the last two years developing and refining the drive system.

He says a better-looking body will be constructed around his engine eventually. But for now, he's satisfied to look like a traveling garage sale as he proudly tows down the road in his air car.

Aside from the air car's appearance, Terry's biggest stumbling block has been funds. He's applied for a $2 million federal government grant to continue development. And he just completed a cross-country tour to show his car to the public in an effort to gain support and publicity.

"It's so close right now, and the need is so great, that I'd hate to have to stop development because of money. But I've devoted two years to this car now, and I may have to go back to work soon."
We have satisfied ourselves we are not whistling in the dark," says Terry Miller, 47, of Crestline, Kans. Nor, he might add, is he full of hot air, though his invention, a pollution-free automobile, is.

Air-powered vehicles are nothing new. One of the earliest patents was issued in 1885 to Charles E. Buell of Springfield, Mass. But Miller, who has put $15,000 and most of the last three years in the project, has built a soon-to-be-patented sequential arrangement in which compressed air is passed from cylinder to cylinder, something like a bucket brigade, to turn an axle. The compressed air's power is thus exhausted through four cylinders, rather than escaping after only one as it did in previous inventions.

Miller's prototype, a three-wheeled, 1,400-pound vehicle, can travel up to 32 mph and has a range of some 17 miles (the consumer version will go 45 miles). He can refuel the compressed-air containers in four minutes, using a windmill, at an overall cost of less than a cent a mile.

Miller, fascinated with engines since childhood, graduated from the Spartan School of Aeronautics in Tulsa. He's licensed as a pilot and an aircraft mechanic instructor. While he was developing his air-powered car, Miller and his second wife, Sharon, made their living by customizing campers.

Currently he is demonstrating the car full-time at state fairs and energy exhibits, although he has not entered it in the $25,000 Los Angeles-to-Rochester, N.Y. rally in September for new alternative-fuel cars. Alcohol cars and salad-oil cars will be among those competing for that prize.

Mass-produced, Miller's car would sell for about $4,000, he estimates, including his modest royalty of about $10 per vehicle. Meanwhile he sells design-and-building instructions for $2. After five Buffalo, Okla. high school students used them to build their own air car, they applied to drive it at Ronald Reagan's inauguration. Their rejection letter arrived the day after the parade.

But the air car is not a toy, Miller insists. "It's a weapon that can be used," he says. "It allows us to think about wind energy as a viable alternative to petroleum products."
By DAVID SCOTT

A novel air motor, developed by Canadian inventor George Striegl of Prescott, Ont., is entering the marketplace as a plastic, piece-together educational toy for children. But Striegl has more serious applications in mind. The clever motor has pistons but no crankshaft; it develops full torque at rest (like a steam engine), eliminating the gearbox; and it’s also nonpolluting and virtually noiseless.

These advantages, says Striegl, make it ideal for powering indoor vehicles at airports, railroad stations, and hospitals. The range would be short, but refilling the onboard air bottles at convenient points around the building would take only seconds. Recharging batteries for electric cars can take hours—and batteries are much heavier. The motor would also be a natural in mines, because no potentially explosive fuel is used.

The toy version, made by Tempo Contact Ltd. (Box 40, Spencerville, Ont. K0E 1X0, Canada), is a vertical model, with three cylinders equally spaced around a central output shaft. The diagram which is of a two-cylinder rather than a three-cylinder motor, shows how it works. In the three-cylinder model, of course, the cylinders are phased 120° apart rather than 180° as shown in the diagram, and cycle with successive power strokes.

Compressed air from inlet valve (A) operated by cam (B) is released into working cylinder (C). Piston (D) with fixed upright rod thrusts up, and inner roller (E) bears against arch-shaped cam of rotor (F), making it rotate. Outer rollers on piston rod run in vertical guide slots (G) in upper cylinder (H), preventing piston from turning as it reciprocates. Gear (I), integral with rotor, drives central pinion (J) on output shaft (K). On downstroke, air exhausts through valve (L) operated by cam (M).

Main components of one cylinder include two-protruded rotor with integral gear (front left), piston (center), and cylinder (right). Upper-cylinder block and assembled motor are behind.

After the air is shut off and the piston reaches the top of its stroke, the inner rollers sweep over the troughs of the rotor’s forked cams. With continuing rotation of the gears, the reverse cam profiles force the rollers and hence the piston down, and the exhaust valve opens to release the air. The rollers then ride over the cam peaks, and the cycle repeats.

The motor is a slow runner, with 1000 rpm about its maximum. Efficiency is claimed to be very high, around 80 percent.

The kid’s version is made entirely of plastic moldings, and can be run by a bicycle pump. Power is very low, so there’s no danger to probing fingers. The first industrial project will be an eight-cylinder opposed-piston unit developing 50 hp with air at 88 p.s.i.
EXCLUSIVE!

Ford purchase of air-car design alleged by Rogers

By Jerry Reed

In an exclusive Consumers Guide interview, in Iowa, Florida, inventor Lee Rogers alleged that Henry Ford II purchased patent rights to a previously designed "air engine" and information was on record in Washington, D.C.

Mr. Rogers told the Guide that his wife had received a phone call from a former 'Big Three' executive, who was now retired. The unidentified caller left the impression that Lee Rogers had not to sell his air engine design to any of the automotive manufacturers because he felt that they would never develop it and the idea would just get shelved. The mysterious caller went on to say, "I know, because Ford has already done it!"

Lee Rogers, the inventor of an auto engine that literally runs on air, released the following statement to the Consumers Guide: "I recently had a phone call from a former 'Big Three' executive, who was now retired. The caller expressed his belief that the idea of a car powered by an air engine would never get off the ground because the manufacturers would never develop it. As a result, he offered to sell me the patent rights to the design for a preposterous sum. I declined his offer, and he hung up."

Mr. Rogers claims he quickly boarded a flight to Washington, D.C. and that at the U.S. Patent Office, much to his dismay, there was in fact a patent registered under the patent numbers given him by the retired auto executive, the previously described patent.

Inventor Rogers was quick to point out several differences between his air engine design and that of the Ford ownership. The patented design purchased by Ford was for a 4-cylinder engine using the two forward cylinders for the thrust for air, whereas, the Rogers design (also patented) is adapted for eight, six or four cylinder usage and as Mr. Rogers stated, "Several major differences exist between my patent and that of Ford."

Oddly enough, the Big Three executive who made the call was attending a conference when first hearing of the Lee Rogers revolutionary air-car design.

Presently, the Consumers Guide is working with the office of nationally syndicated columns to determine the exact facts.

If indeed, the Rogers allegations are true, and the U.S. Patent Office records prove a registered patent for an air engine design was patented in excess of one million dollars by Henry Ford II, many questions regarding the purchase of air engine patent rights need to be answered.

Rogers, obviously puzzled, asked, "Why in the world would Henry Ford II purchase the patent rights from an inventor?"

Ford's answer:

The Guide contacted the Ford Motor Company.
Finds air car far beyond expectations

BY TOM HOLLATZ

Air car update.

I received a letter the other day from Lee Rogers of Ft. Myers, Fla. Rogers, you may remember, has invented a car that runs on air. Sounds crazy, right?

I thought so too until I interviewed Rogers in Ft. Myers Beach last March.

Rogers' letter dated Sept. 20, 1981, forwards a report on the car as reviewed by Glynn Raymond Wiggins, who has a list of credentials as long as Roy. St.

Wiggins lives in Hagerstown, Tenn., and recently stayed with Rogers, inspecting Rogers car, seeing if it is what Rogers claims—an air car running on nothing but air.

After Wiggins' review of the air car, Rogers wrote, "we are proceeding and hopefully will be marketing my invention soon."

Wiggins in his report states that he visited Rogers in Ft. Myers, Fla., on June 11, 1981. He spent seven hours looking at Rogers' fantastic project in three stages—static observation, power observation and discussion/analysis.

Wiggins writes: "My first contact with the air-powered engine was to see it mounted on a conventional Vega automobile equipped with a standard four-cylinder gasoline engine. I observed that all gasoline induction components had been removed and had been replaced by the air induction kit which Mr. Rogers developed.

"I was impressed by the absence of the cooling system (radiator, water pump, etc.). I took adequate time to explore the newly installed items, their necessary fittings and brackets, the compressed air source and exhaust system. The observation was accompanied by my questions, which Mr. Rogers answered to my complete satisfaction.

"My next level of concern was to observe the engine in operation. The engine was started with the automobile's own electric starter. Mr. Rogers operated the throttle (the valve on the compressed air tank) while I observed the engine's operation. I concentrated on engine temperature, vibration and noise level during the first run. The air supply lines to the cylinders were cool, the engine block appeared to be at room temperature and the exhaust was very cool.

"After a 3-4 minute run, the exhaust system was cool as a normally refrigerated item of 40 to 50 degrees F. and we were operating in a garage of about 65 to 90 degrees F. There was negligible vibration. However, with a straight exhaust, it had less noise than a lawnmower.

"We stopped the engine and restarted it four or five times within a 30 to 40-minute time span, as I continued to observe its operation and question Mr. Rogers. My final observation centered around the air intake and the exhaust. The engine has a tremendous and powerful exhaust and, of course, a huge volume of air intake. I was not able to overcome the exhaust pressure with my hand as I had done on many gasoline engines.

"After my live observation, Mr. Rogers and I discussed my impressions of the engine. I found it to be far beyond my expectations. I find it simple, powerful, quiet running and with low maintenance requirements. After considerable study, I detect no mechanical deficiencies or contradictions to the inventor's claims. Every component I have observed is completely feasible.

"I recommend its development without reservation."

The ramifications of Rogers' air-powered engine are vast. Air and not expensive fossil fuel is used. Rogers told the Times last March that he turned down over $1 billion from a representative of the three large U.S. automakers for his invention. He declined, one of the reasons he hasn't "sold out," he said, is because he didn't want his invention to be seen again.

Rogers hopes to market his own invention and sell air-car kits for around $1,000, he said. "I'd be letting too many people down if I went back on my word," Rogers said. Rogers, who is quite handy with gadgets and tools, developed the air-car process while tinkering. His wife didn't believe it until she saw him driving down the street in an air-powered car. It runs on air, he claims.

If all things are true in this amazing story, just think what it means for all Americans—and the world, too. Home generators that can provide free electricity or the tip of the iceberg. Outboard motors, snowmobiles, airplanes—name it—if it's powered by an engine, Rogers' development should work.

Times' readers wishing to write Rogers can do so at Post Office Box 3077, Ft. Myers Beach, Fla., 33931.

Ft. Myers is the former winter home of that great American genius Thomas A. Edison. It is ironic that Rogers, too, lives Ft. Myers. He told the Times that the future money his invention will bring doesn't phase him one bit. It will only mean more worries including body guards and body guards to watch the body guards.

That will come, but right now Rogers is working on final plans to market his invention.
How about car that runs on nothing but air?

BY JOHN HUBBARD
City Business Editor

Move over, Times reader Cliff Greenman.

Make way for another Bloomington observer of things revolutionary on the automotive scene — Martin Torgerson, owner of Village Cleaners.

Remember, earlier this year, Cliff, when you told us how excited you were over a new process developed by a Southern California company for producing vehicular fuel from sunlight and water.

Well, what would you say about a car that reputedly runs on nothing but air?

That's what Torgerson has stumbled onto, by reading the Lakeville, Indiana, public television show, has filmed Rogers and his engine.

The idea is basically simple. The engine has been converted to have three air boxes going into each of the eight cylinders from a blizzards, a block which sits atop the engine block. The compressor sits forward of the distribution plate and controls the vacuum or air being forced into the engine, which in turn controls the speed of the vehicle, according to the national press.

The driver observes the pressure in the air tanks with the help of two gauges on the dashboard. The pressure of the air being forced through the engine also is watched.

Here's the fun part! Rogers revealed the gas tank, carburetor, fuel pump, spark plugs, points, condenser and the complete exhaust system from his car to accommodate his conversion unit. Just think — no gasoline lines and no pollution. Cold air reconditioning through the engine can be used in an air-conditioning car.

Rogers said he can guarantee the engine for 200,000 miles of service, or 30 years.

"Maintenance? Only requirement is frequent oil changes, tire maintenance and regular brake checks. He also claims that tires and wheels could last two to three times longer because there is no translating them."

"This could turn our country around," Rogers said in the Bulletin story.

"Rogers' wife, Betty, identified that she did believe his husband; until she saw a neighbor ride in his car."

"We didn't realize how important this is until we came back and said down and realized we had lost in a car that wasn't using gas," she said. The newness of the engine, she added, has been confounding people that it really works.

"Rogers has patented both the engine and the station wagon and another whole engine and transmission to protect himself."

Rogers, the story went on, claimed that production of the conversion kits could produce about 500 units a day and be available to the public at $800 to $1,000 apiece.

"Rogers said that if he doesn't get support, he will market the idea himself. Nelson said Rogers wants to help the working man in his constant fight against soaring prices. "I hope he doesn't sell out to some car firm which might put the idea on a back shelf. I don't think he will," Nelson added. "OK, Cliff Greenman, that's the story.

"What does it blow down to? Is all this any news cause for a new era of excitement on your part, not to mention the rest of us pump price plcuing gas line users?"

Or maybe just for me.
Britain's National Coal Board is working on small vehicles powered by liquid nitrogen for transport in underground mines, where the non-flammable non-toxic fuel has an important safety advantage. This follows successful application for the inert gas to operate standard pneumatic tools.

The system uses normal ambient air temperature to heat and vaporize the nitrogen, which boils at -196 deg C. The gas then expands like steam and can drive an air motor. In this basic form no additional heat source is needed.

The experimental vehicle pictured has a vacuum-insulated storage vessel in which the cryogenic liquid is held at the boiling point. Pressurized vapor is released from the tank and piped through the front-end heat-exchanger where it is warmed and expanded. Gas at 100 psi is then fed to a conventional 2.75-hp four-cylinder non-expansive air motor driving the wheels. The car has a maximum speed of 10 mph, and has been used to demonstrate the feasibility of this energy source for light self-propelled units.

Low bulk gives liquid nitrogen a major advantage over compressed air for automotive applications, since it produces six times the volume of expanded gas for a container of the same size. It is easily stored, and a pressurized vessel is unnecessary, which means much lower weight.

One volume of liquid expands to 640 volumes of gas at atmospheric pressure, while for an equal expansion from a compressed gas a storage pressure of about 9400 psi would be needed. Compared with other non-fossil portable energy sources the liquid has a much higher specific capacity in terms of hp hr lb than even silver-zinc batteries.

The Coal Board is cooperating with Salford University near Manchester, which has done considerable theoretical and experimental work on improving the performance of liquid nitrogen engines for road transport. A principle area of study is the use of a thermal store to raise the temperature and thus the expanded volume of the gas fed to the engine. This could dramatically reduce consumption of the fluid for a given work output, allowing greater power or increased range, or a smaller on-board liquid supply.

Possible thermal stores, heated overnight by off-peak electricity, could be solid refractory materials like graphite or aluminia rods or bricks through which the gas is passed. Others are eutectic salts using the latent heat of fusion, and units relying on chemical reaction such as the catalytic oxidation of a fuel.

Salford's studies are concerned with turbines rather than reciprocating engines, and these envisage applying the warm exhaust gas to the primary evaporator following the liquid container to raise the heating temperature above ambient. A more sophisticated system would have two-stage expansion with high- and low-pressure turbines, the inlets to both passing through a common heat sink.

Further possibilities for vehicles include a regenerative braking system where the heat developed by friction would be recovered and held in the store. Liquid nitrogen for propulsion is also seen as particularly suitable for refrigerated trucks, when the cargo compartment could be readily cooled by a special evaporator in the heat-exchanger circuit. It would then contribute to the power source instead of drawing on it.

Nitrogen gas is produced commercially in liquid form by distillation from the atmosphere. The liquid is now readily available in bulk relatively cheaply. It is used widely in the chemical industry, steel making and freezing equipment.
The CAR that RUNS on Air

FEBRUARY, 1945 POPULAR MECHANICS

FRANK R. PERRY

POSTWAR motorists may climb into their automobiles, step on the air instead of the gas, and glide away swiftly and silently at 60 miles to the gallon with never a trace of starting and reserve source of power.

Perry says he has driven several thousand miles with his machine which is mounted on an old Ford chassis. The Perrymobile weighs only 700 pounds—about 300 pounds less than standard automobiles powered by the conventional internal combustion engines. The engine installation alone weighs only 140 pounds.

The 30-horsepower four-cylinder engine turned over by pressures instead of by explosions that move the pistons of an ordinary auto engine. The Perrymobile is essentially the same as a steam engine. Inside each cylinder is a piston which moves up and down and is connected to the crankshaft.

The secret non-inflamable liquid, which boils at about 150 degrees Fahrenheit, is heated by a burner which uses anything from butane gas to crude oil. The car will travel 60 miles at 30 miles an hour on one gallon of butane, the inventor claims. He says this fuel costs about 8½ cents a gallon. (He sets the top speed at “better than 70.”)

The vapor passes through an intake valve into the top of the cylinder, and with a pressure of about 150 pounds per square inch pushes the piston down just as steam would do. At the bottom of the stroke the vapor exhausts through a port cut through the cylinder wall. As the piston starts up again a valve at the top of the cylinder lifts so the piston travels upward against no air pressure. At the top of the stroke vapor is admitted which starts the piston down again.

Each of the four pistons supplies power to the rear wheels every time it is pushed down. This affords “two-cylinder” operation instead of the conventional “four-cycle” shift in which each piston gets a stroke every second time it travels. However, the Perry’s four cylinders pull out as many power impulses as an eight-cylinder auto engine.

The compressed air provides the power for the Perrymobile coming from a tank under the seat. This tank is kept full of compressed air supplied by a small air pump connected by a belt with the engine. The compressed air, which flows through the boiler into the cylinders, is used for a quick start and until sufficient vapor pressure has been built up to run the engine.

To operate this revolutionary automobile, you first open the fuel valve under the hood and the burners catch fire from a pilot light. Then you get in the car and pull down the throttle lever on the right side of the steering column. Compressed air from the tank flows into the cylinders and the car starts to move.

After you have driven a few blocks the flame in the boiler has built up sufficient vapor pressure so you can turn off the air. The pump quickly regenerates the pressure in the air tank. If not, the latter is regulated by an automatic valve.

Suppose you are driving out into the country and come to a long straight down grade. You close the throttle, just as you would in an ordinary car, and the flame goes low in the boiler, for no pressure is being used. Even while the engine is idling, air is pumped into the tank to maintain a constant pressure. To make up a vacuum caused by the reduction of the vapor in the boiler, the air flows out of the engine and through the carburetor. This movement increases the vacuum, and the cylinder pressure builds up to the proper rate.

The invention contains an angle control for regulating speed and power to the control lever of an electric motor. The smooth operation of the Perrymobile is due to the fact that the power output is the same at full speed—about 1 p.m. to 2,000. On a gasoline engine the horsepower is in direct ratio to the speed.

Even at full power with the throttle valve wide open, Perry says his engine runs so cool that the paint has never blistered on the cylinders. This makes the car adaptable to extremes of climate for the liquids in it do not freeze unless the mercury drops to 32 degrees below zero. The engine runs over slowly. At 20 mph an hour it revolves only 300 times a minute compared with 2,000 or more for present-day cars.

Other advantages of the Perrymobile, according to the inventor, are the “parts it does without.” These include clutch, carburetor, spark plugs, distributor, constant velocity shaft, fan, gear box and self starter. The car, of course, is equipped with brakes. Perry estimates that it will require less than one quart of lubricating oil a year.

The Perrymobile makes no noise, smoke or smell. So smooth is its operation, he reports, that in a blindfold test it is impossible to tell when the car starts moving.

It cost Perry about $450 to build his light weight automobile, but he says it should sell for much less if it gets into mass production—about $250. He believes the air-vapor engine can be used on helicopters and boats as well as automobiles.
Air-Powered Motor.

AUTO WITH AIR-POWERED MOTOR

SPECIAL FEATURES OF 3000.

The Air-Autos are designed to be used as motor vehicles. They are equipped with a powerful air-engine that operates on compressed air. The air-engine is connected to the wheels through a system of gears and pulleys. The air is compressed using a high-pressure compressor that is powered by the engine. The air is then delivered to the engine through a series of tubes and valves. The engine is located in the rear of the vehicle and is connected to the drive shaft by a clutch and a propeller shaft. The air engine is more efficient than a gasoline engine and it is also quieter. The Air-Autos are also equipped with a hydraulic system that operates on compressed air. The hydraulic system is used to operate the brakes, the steering and the suspension. The Air-Autos are also equipped with a air-conditioning system that operates on compressed air. The air-conditioning system is used to cool the interior of the vehicle. The Air-Autos are also equipped with a air-filter system that operates on compressed air. The air-filter system is used to filter the air that enters the engine. The Air-Autos are also equipped with a air-pump system that operates on compressed air. The air-pump system is used to pump the air into the engine. The Air-Autos are also equipped with a air-valve system that operates on compressed air. The air-valve system is used to control the flow of the air into the engine.
Bath man develops engine that runs on nothing but air

By PETE ESPOTI

BATH — William Long of Bath has invented an engine he says runs on air — the limitless air all around everything, everywhere. Just the thoughts of its possible ramifications toggle my mind.

An endless supply of no-cost fuel, free, gratis. Pollution and energy source problems solved in one fell swoop, relatively quickly and inexpensively.

Long, 34, is a self-employed carpenter and plumber, who learned his skills through a lifetime of "tinkering with all kinds of machinery" while working at a variety of jobs.

He has had no further formal education since he left high school in 10th grade because he was needed to help on the family farm near Addison. "You learn to do more things on a farm than you can imagine to keep things going," Long said.

Long began "visualizing" the engine in his mind, he said, about 25 years ago and soon after he was working on it sporadically over the years.

Four years ago he accelerated work on the engine, "giving it just about all my spare time — nights, weekends, holidays and Sundays," he said.

His son, Terence, a tool and die apprentice, made several parts for the engine and helped him assemble it and it was completed several months ago after an estimated 3,500 hours of work went into it during the four-year period.

Long's engine looks like and operates like an air compressor. A regular electric-powered air compressor is used to run his engine, but after it is started the air compressor is disconnected and his engine continues to run on the air it takes from the air around it. Long says. He has also continually for varying periods the longest five days and five nights, he said.

The engine has a tank about three feet long and 18 inches in diameter, a flywheel, a single cylinder and several other parts. It is about four feet wide and four feet high overall and weighs about 175 pounds. He has no name for it other than "the engine." He calls it a "working model" and others can be made larger or smaller.

"All I've done is learn to control air, how to store it and use it," Long explains. He feels the situation is similar to being at the threshold of the beginning of the practical use of gas and oil.

He is reluctant to disclose all details about his engine because he has not patented it and is currently in touch with three nationally known companies who have shown some interest in it.

One auto company already has just about said "not interested." Officials of three companies also are aware of Long's engine and have discussed it with him.

One mechanical engineer told him, "basically what I have is against the law of physics — it's not in the engineering manual and so it doesn't exist," the easy-going Long said, laughing at the reaction.

"I'm not using perpetual motion — there is no such thing; I know all about that," he added.

"I've been called everything from a crackpot to a basket case and been laughed at by the best of engineers and other people. Do I mind? Hell, no, I know what I have; you can't discourage me a bit. The crackpots might be those that can't see past their noses," Long says.

Long says it is easy to see this (his engine) do people some good. His engine can be used, he said, as a stationary power source, to operate, for example, a lathe or other factory machinery, or adapted to power a car or truck. He is currently toying with the idea of installing his engine in a small pickup truck.

Long also said a top federal official involved with energy is aware of his invention. He hasn't heard anything further from this source to date, he said.

Bringing innovators from some possible users of his engine were a recent report of it in the news media and his appearance with the engine on a television program.

"All I want from this engine is enough for me and my family to be able to get along the rest of our days," Long said.

His wife, the former Miss Pauline Jackson of Corning, seems to be as knowledgeable about the engine as its inventor. There is no doubt she has been a staunch supporter throughout, with her husband 100 per cent. The couple also has a married daughter, "a librarian, working in a school in the south."

After his marriage during World War II, he left the family dairy farm, bought and operated his own in the Town of Addison. He said it because he expected to be called into the army, but he wasn't summoned.

If he isn't able to sell his engine soon, Long said, "I'll put it in my pickup truck and go to Washington, D.C. and maybe that'll wake up some people."

FROM THE SUNDAY TELEGRAM, ELMIRA NEW YORK, JULY 31, 1977
Bill Lear, the inventor of the Lear Jet, also wanted to build self-fueling air cars. He visited Bob Neal's son more than once, trying to get him to remember more details of the Neal equalizer. Unable to discover the working principle behind the equalizer's anomalous ability to get low pressure air into a high pressure tank, Lear gave up stalking the equalizer and spent millions developing his steam turbine for transport vehicles. His project dead-ended when he found that his clean, quiet, and powerful steam turbine was as costly to fuel as the internal combustion engine.
The adaptation of a compressed-fluid (such as compressed-air) powered turbine in conjunction with the use of a flywheel as a hybrid propulsion system for nonstationary applications, such as vehicle drive, is shown and its practicality demonstrated. This propulsion system requires a nonpolluting fluid, such as air, and a source of mechanical or electrical energy to compress said fluid and energize said flywheel, both of which act as energy storage media. An expander/compressor unit, such as a turbine, is used for converting the stored energy of said compressed-fluid into shaft power by expanding said fluid, and recovering the braking energy during vehicle deceleration by compressing and storing the atmospheric air (if air is used). Said flywheel is used not only for providing peak powers necessary for vehicle acceleration but also for recovering the braking energy during vehicle deceleration and refilling said compressed-fluid in an emergency. The propulsion system can use the unlimited supply of air as the primary energy-storage medium and said flywheel as the secondary energy-storage medium. The propulsion system is not only regenerative but also quick-recharging; it, therefore, has high energy-efficiencies and broad applications.
A gas-operated motor system of the stored energy type—as disclosed in U.S. Pat. No. 4,092,830—in which the gas exhausted from the motor is ducted to a chamber during operation of the motor and thereafter compressed back into the gas reservoir vessel. Recompression may be achieved e.g. by providing the exhaust gas chamber with a movable piston, or by running the motor in the reverse mode as a compressor.

10 Claims, 3 Drawing Figures
A reciprocating engine utilizing the mutual repulsion of charged air particles to drive a work-producing means. The engine has pistons reciprocating in cylinders with cylinder spaces between cylinder heads and the pistons. A first enclosed porous conductive electrode is located in fluid flow communication with the cylinder space, typically within the cylinder space itself. The first porous electrode is electrically connected to a second conductive porous electrode in a separate housing. Air is admitted into the first electrode while fuel is admitted into the second electrode. As the air in the cylinder space and first electrode is compressed as the piston moves toward the cylinder head, a current flow takes place from the first electrode to the second electrode because of valence attraction between fuel molecules and oxygen electrons resulting in the ionization of oxygen and fuel. Preferably, the two electrodes are maintained at an elevated temperature to enhance the air/fuel reaction to provide improved ionization. An electrochemical reaction occurs similar to that which occurs in fuel cells. The mutual repulsion of the charged ions in the cylinder space and first electrode produces a strong force on the piston, in accordance with Coulomb's Law, resulting in a piston power stroke. The ionized gases from the cylinder and the external housing are exhausted to a compression chamber for the completion of the air/fuel chemical reaction. During the initial stages of the compression stroke, premature ionization may be prevented by inducing a potential in the inter-electrode conductor opposite to that produced during ionization.
AIR CAR FEVER
OUT OF CONTROL!

For sixteen years I’ve been the lone voice in the wilderness. I’ve told the truth about air cars to anyone who would listen. I’ve spent what little money I could spare out of my personal funds and donations from others to build working models of concepts that others have already proven to their own satisfaction but refused to demonstrate to the public. I’ve accumulated thousands of pages of documentation to show that the dynamics of a tank full of air can be arranged to admit low pressure air into a high pressure tank at an almost negligible cost. I’ve solved the riddle that physicists have been calling Maxwell’s Demon since the father of modern physics first posed the question in 1870. I’ve discovered the secret of secrets in the world of pneumatics, which is that compressed air can be manipulated to provide vast quantities of free energy whose source is solar heat.

In my enthusiasm to present this clean, safe energy source to the world, I’ve poured everything I have, and more, into the hope that someone out there with ample resources would want to know and share as much about air cars as I would. Since I’m not an engineer, not a machinist, not a mechanic, not an inventor, and not a fundraiser, my desire to achieve my goals through my own efforts alone was doomed from the start! Response to a recent ad has not been great, producing the plans. Those who’ve ordered plans will get a refund and a free 40-page catalog of my research findings, and pretty soon they can sell me a set of air engine plans. As I am about to explain, I have settled on a new ordering of my priorities, and my plans are not going to be available for some time.

A new attitude towards this project seems to be in order, so I’m celebrating my 40th birthday by accepting my role as a researcher and compressed air advocate; a self-educated guesser, not an engineer, more enthusiast than entrepreneur, more advocate than capitalist. I will no longer take the approach of the inventor who wants to push a particular design. While I do have my own pet ideas, I don’t want to limit my perspective to what I personally prefer. I want to build an organization whose purpose is to help anyone who wants to develop efficient power production using pneumatic means, instead of trying to get there first myself. I am quite capable of learning the skills of engineer, machinist, and mechanic, but this comes slowly because of time and money.

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constraints. The results we all need to see—working models—will come faster if I concentrate on raising funds using the marketable skills I already possess. When the money is there to pay an engineer to design a working model, and a machinist and mechanic to build it, then the set of plans will become available. I will soon be setting up businesses in Oregon that will take care of ordinary research costs, and instead of beating my head against the wall trying to do everything myself, I will begin to assemble a scientific, educational, non-profit organization to attract the kind of funding needed to build working models. I will get professionals working on the pneumatic solution, and then you will get your set of plans, and if you want your pneumatic power plant to be the firstest with the mostest, then my storehouse of information is there to help you get what you want. I know you want to study, design, or build an air engine or your name would not be on my mailing list.

I’ve already designed and built a working prototype of the torquerack engine; the plans I’m developing are for a larger, more robust, more efficient, technically superior version of the same engine. The preliminary sketches are finished, with the exception of the framework and valve operating gear. I’ve already bought most of the parts to build the engine, and will begin building it as soon as the rough sketches are finished in a year or two or sooner if I get funding. For those interested in the video, the price has gone down. It shows the working prototype of the torquerack engine, along with an explanation of the basic components, and is 11 minutes long. In its present format it will go for $15 instead of $30 as advertised. If you have any questions, please call, fax, or write. My California address is a permanent mailing address, as is the fax number. My Oregon phone number will be 541-683-4401 as of June 15.

SCOTT ROBERTSON
Founder, Pneumatic Options
PNEUMATIC OPTIONS

Dymaxion Pneumatics and the History of Compressed Air

Research findings for Engineers, Environmentalists, and Inventors
compiled by Scott Robertson

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