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TITLE:

AUTOMOBILES # 7

(Miscellaneous)

025-AU7 AUTOMOBILES # 7 (MISCELL. ARTICLES) --- Dozens more curiosity-arousing & attention-grabbing articles including: super safe cars..super engine prototypes...Wood-fuel powered cars...Acetylene power..."Irol" fuel..Suspensions.."Danger Meter" for your windshield (helps prevent misjudgments)..

20 pp

Emulsifiers—chemicals that allow water and gasoline to mix thoroughly—are essential to making watered fuel efficient. Here Ewbank weighs them out.

Mix gas with water for more mpg?

Here's the latest in the decades-old quest to mix fuel and water for economy and low emissions

By ROBERT WESTGATE

Water in your gas?

For years oil companies and drying-additive manufacturers have lectured us about the dangers of water in our gas tanks. However, water may soon replace the tiger.

High-test gas, emission-control devices, and catalytic mufflers might even become as extinct as the Edsel if a new, revolutionary emulsified fuel—containing up to 30 percent water—proves successful, *and* is marketed by the oil companies.

That's the claim made by Walter Ewbank, professor of aerospace, mechanical, and nuclear engineering at the University of Oklahoma. Since 1965, Ewbank has been experimenting with emulsifying processes that enable water and gasoline—proverbial non-mixers—to be thoroughly blended and to produce several important advantages in your car's engine.

Idea not new

Experiments aimed at emulsifying gasoline and water in an attempt to extract more of the potential energy in the fuel began at least 40 years ago. Traditionally, experimenters used emulsifying agents—chemicals that keep the separated particles of gas and water from separating.

In a newer project, inventor Eric Cottell has demonstrated an ultrasonic device that emulsifies the gas and water just before they enter the combustion chamber. [PS, Nov. '72].

Professor Ewbank's process is a refinement of an earlier one developed by Charles Belknap of Highland Park, Mich. In 1924, Belknap patented a fuel consisting of water, kerosene, gasoline, and an emulsifying agent. The mixture was agitated and forced through a homogenizing valve at about 4000 psi.

Officials at Exxon said experiments with mixtures similar to Belknap's were abandoned because the emulsion was not stable at extreme temperatures—the ingredients separated out. Ewbank's fuel consists primarily of gasoline, water, and various emulsifying agents that allow the two to mix. It does not become unstable at extreme temperatures.

Lower emissions, better mileage

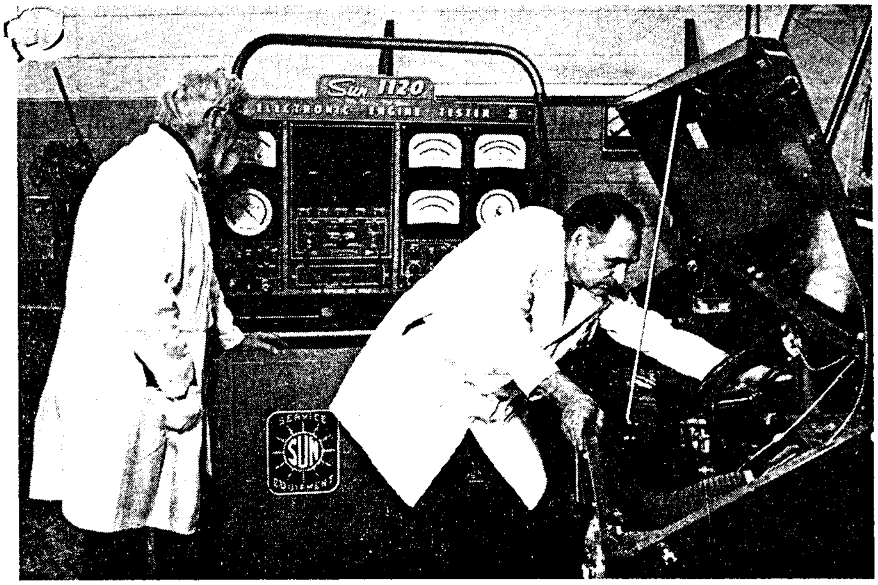
Fuel-water emulsions produce lower emissions and better gas mileage because they bring into play several well-known effects. First, the water acts as a coolant. The lowered combustion temperatures permit using a leaner air-fuel mixture without exhaust-valve burning or knocking—thus reducing emissions and producing more power per unit of fuel.

Second, while the evaporated water cools during compression stroke, it adds mass during the power stroke. Ewbank says a 30 percent improvement in thermal efficiency is "theoretically possible."

But does the gas-water mix damage an engine? Ewbank's 1967 Dodge wagon now has more than 102,000 miles on its odometer—about 10,000 miles with his mix—and it has never had a major overhaul. Ewbank said he's disassembled the motor to see if the mix had caused any damage. It hadn't.

He's also used his fuel for 3000-4000 miles in a 1973 VW with fuel injection and 3000-4000 miles in a 1973 Dodge Dart with a rebuilt carburetor. Water proportions in the mix tested in these two cars were as high as 50 percent. He says that EPA emissions standards were met or exceeded without control devices after the cars were warmed up.

Continued



Postal trucks are run on dynamometer while emission levels are precisely measured, before they're put into service. Engines are tuned before testing.

his mixes has passed the EPA hydrocarbon emission standards in an EPA-type test of a simulated typical commuter trip including a cold start. Most of the high, serious HC emissions occur when a vehicle is started.

But Ewbank's 1973 Dodge—with the mix and without controls—did pass the 1975 cold-start standards for CO and NO_x. It met none of the 1975 standards while burning unwatered gas with the 1973 control devices.

Last November, the California Air Resources Board conducted emission tests on a 1970 Chevrolet at its El Monte lab, using a 14.4 percent water mixture.

The average emissions of hydrocarbons, carbon monoxide, and nitrogen oxide were lowered by the use of the mixture, compared to emissions when using a baseline test fuel (Indolene) in the hot-start tests. Emissions of CO and NO_x also were reduced when using the mixture in cold-start tests. However, both hydrocarbon emissions and the hydrocarbon reactivity ratio increased in this case. A 1973 Plymouth Duster (factory certified at 2.1 gm/mile HC, 22.0 gm/mile CO, and 2.3 gm/mile NO_x) was hot-start tested with a fuel watered 30 percent by Automotive Environmental Systems, Inc., Westminster, Calif. The resulting emission rates were much lower: 0.334 HC, 1.91 CO and 0.328 NO_x.

Some engineers believe the HC rate could be lowered further by using more volatile additives. Even lower HC emissions might result from using one of the new hydrocarbonless synthetic oils in the crankcase. No cold-weather starting problems have been experienced so far by the test center or the Norman Post Office—where the temperatures dropped to zero degrees—but the engines of the test vehicles have been well tuned and new, well-charged batteries have been used.

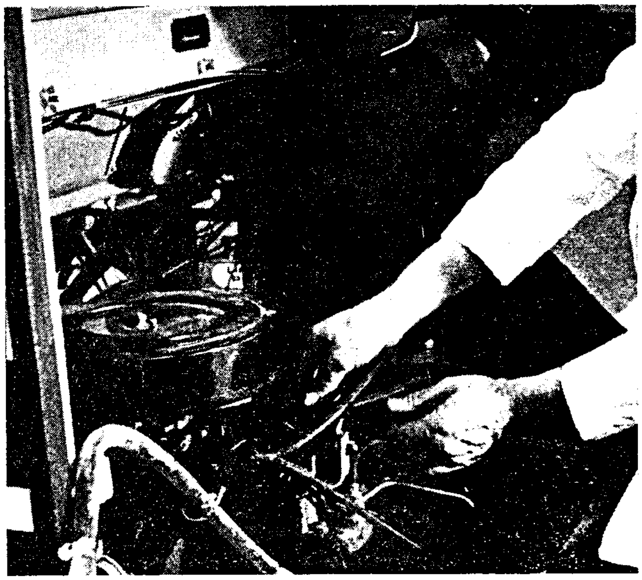
Water damage?

Possible damage to the internal parts of the engine, the muffler, and tailpipe from the excess water produced by the fuel mix is an unknown. Ewbank claims that since a gallon of gasoline produces a gallon of water in burning, the exhaust system already is saturated and no further damage is possible. His station wagon showed no corrosion damage after 10,000 miles with the mix. Other engineers are not so sure, and even Ewbank admits a 50,000-mile endurance run will be necessary to prove these points.

The mix tends to separate over long periods of time. An earlier mix was dropped because it separated after six to eight weeks, but Ewbank hopes a newer mix will have an eight- to 10-month shelf life. This separation tendency could be a serious drawback in a service station storage tank or in a car used infrequently.

Will you be buying watered gas soon? Not for several years, at least. A lot of questions remain unanswered. And a lot of problems still need solving. PS

Fuel is weighed during emission testing to determine exact amount consumed. Hose from container feeds gas to carb.



Emission controls are disconnected in test vehicles using fuel mix. Except at startups, mix burns exceptionally clean.

Car owners might expect the following, Ewbank says, if his fuel is marketed:

- Seven to 15 percent better mileage, depending on the proportion of water.
- Savings from removing fuel-wasting emission-control devices.
- Savings when cars with high-compression engines are designed to use the fuel. The low test (89.4 to 91 octane) mix acts like high test (100 octane) unwatered gas. Lead can be entirely eliminated, too; another saving.
- Possibly cheaper fuel cost. However, Ewbank doubts the actual price of the new fuel would be more than a cent or two less to the consumer than normal gas. The water and additives would cost approximately one cent a gallon—about the present cost of lead. Manufacturing costs might be five to 10 percent lower, but taxes and distribution could eat up the difference, he predicts.

In-service trial

Since November, 1973, the U.S. Postal Service has been testing the mix in four of its vehicles to determine if it really provides better fuel mileage and reduces exhaust emissions. Blair L. Wildermuth, director of the Postal Service's Maintenance Technical Support Center in Norman, Okla., says, "We want to know if the fuel will be cost-effective for the 100,000 vehicles we own and the 124,000 we lease. Even if we get only five percent better mileage, and can eliminate the emission controls and catalytic mufflers, it will be valuable for us." He estimated that the controls and mufflers will cost at least $130 a year extra per vehicle, plus the cost of replacements when needed.

Incomplete tests have been performed with two ¼-ton jeeps and two ½-ton trucks without emission-control devices. When using a mixture containing about 13 percent water, the vehicles get about three mpg better mileage than similar vehicles using normal gasoline plus 1973 devices. The trucks burning the mix also passed 1975 EPA emission standards without controls—once they were warmed up—whereas the other trucks, with emission-control systems and using normal gas, did not.

Test procedures

The professor delivers his emulsion to the Oklahoma campus, where Ben Barrow, an automotive equipment specialist, mixes it with regular gas. Barrow first puts the trucks through a long series of tests on a dynamometer for about 150 miles, followed by a stop-and-go, simulated delivery route over 108 miles of city streets, an expressway, and pot-holed country roads.

But first the vehicles are tuned to manufacturer's specifications with a Sun analyzer and run on regular gasoline. A variety of readings—vacuum, rpm, mpg, CO, HC, NO_x—are taken on the Sun and three other emission analyzers.

Speed is then lowered to 30 mph at eight hp and new readings are taken. The trucks are then switched over to the mix (weighed to the hundredth of a pound and kept apart from the truck's regular fuel tank in a five gallon Jerry can), returned, and tested in a similar manner to the normal fuel test. The only differences in engine operation are much lower emission levels.

Problems

As with any new process, all is not clear sailing with Ewbank's fuel mix. Problems exist. Some have been solved; other questions remain unanswered. Some of them are: Water apparently reduces the volatility of the mix, producing harder starts, and higher-than-normal initial hydrocarbon emissions than with unwatered gas. This has been partly corrected by adding higher-volatility (18-pound Reid vapor pressure) gasoline, much as refineries do for customers in wet, cold climates.

These cold-start emission levels must be lowered if the mix is to meet 1975 standards without catalytic mufflers and even an air pump. The 13 percent mix easily passed these standards in state-inspection-type tests made by the Postal Service *after* engines were warmed up by running the vehicles for 10 miles on a dynamometer at 48 mph at 24 hp. (No figures are available yet on a 30 percent mix, also being tested by the Postal Service.)

Ewbank admits that when not using a catalytic converter, none of

Continued

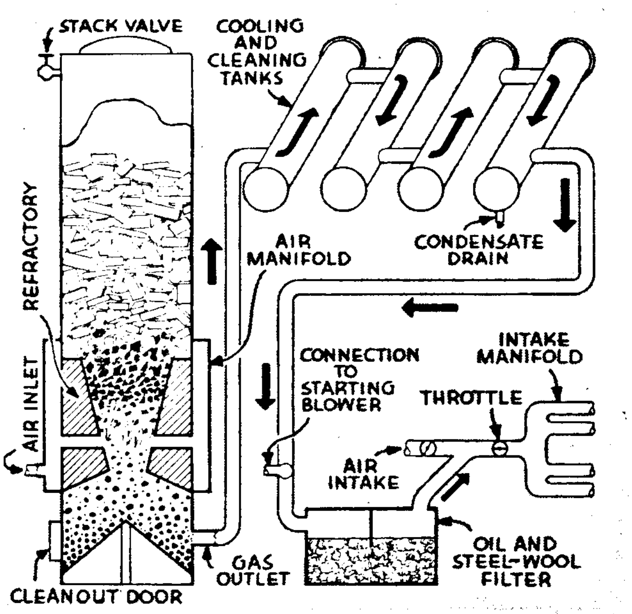
"Fill her up with half a cord of oak..."

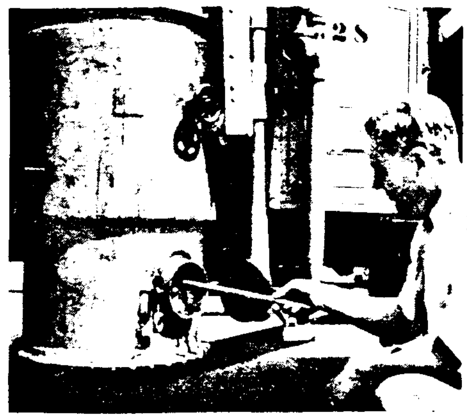
Can We Use Wood to Beat the

HARDWOOD chips are now driving the first solid-fuel trucks to appear on American highways. The standard gasoline motors of these trucks have been converted to the use of producer gas, a mixture composed of hydrogen, methane, carbon monoxide, carbon dioxide, and various tar gases. Pictured on this page is an experimental conversion made by the Rheingold Brewery of New York City, and believed to be among the first efforts in this country to adapt producer gas for use in commercial vehicles.

Under ordinary driving conditions, wood is added to the gas producer

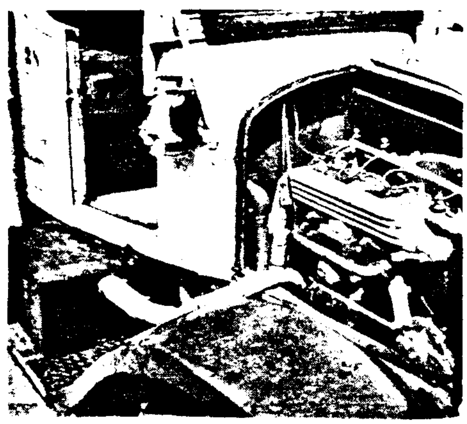
Brewery superintendent Herman Reese adds wood to the hopper of the first truck he converted. Below, a diagram of the producer

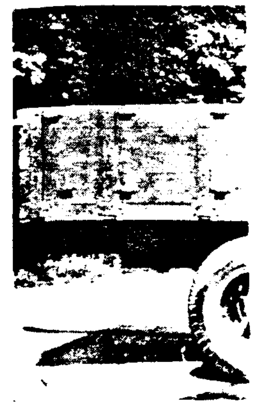




Chunks of charcoal-like ash are removed from the generator daily through a cleanout door

Before it enters the motor, the gas is mixed with air by the perforated valve on the pipe





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se Wood to Beat the Gasoline Shortage?

ARDWOOD chips are now driving the first solid-fuel trucks to ar on American highways. The lard gasoline motors of these ks have been converted to the f producer gas, a mixture com- l of hydrogen, methane, carbon oxide, carbon dioxide, and vari- ar gases. Pictured on this page experimental conversion made he Rheingold Brewery of New City, and believed to be among first efforts in this country to t producer gas for use in com- ial vehicles.

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of charcoal-like ash are removed from erator daily through a cleanout door

enters the motor, the gas is mixed by the perforated valve on the pipe

Gas generated by wood chips is the fuel which powers this truck of the U. S. Forest Products Laboratory

every 50 to 60 miles. Hardwood, cut into chips less than 4" in length to prevent arching or pocketing in the generator, is used in preference to softwood such as pine because it leaves fewer tars and gummy residues. Even so, the cooling tanks and filters on the vehicle must be cleaned every 900 miles, and motor overhauls are in order every 5,000 to 8,000 miles.

Technical studies indicate that about 1.76 lb. of wood are required per horsepower hour. Gas producers fueled by coal or coke are more efficient, but they are much larger and more complicated. With wood, if no major changes are made in converting the engine, the maximum horsepower is about 70 percent of that on gasoline, provided that the spark is advanced and the fire is properly managed. But if the compression ratio of the motor is increased (producer gas knocks less readily than gasoline), horsepower can be pushed up to 85 or 90 percent of the gasoline rating. In general, tests show that substantially more gear-shifting is needed with producer gas.

When a cold start is to be made, wood is added from the top of the hopper and an electric fan is attached to the gas offtake pipe so as to suck a current of air through the producer. Ten minutes after the wood is lighted, the generator manufactures enough gas to run the truck. Starting the engine on gasoline will create sufficient suction to build up the fire, but this takes much longer.

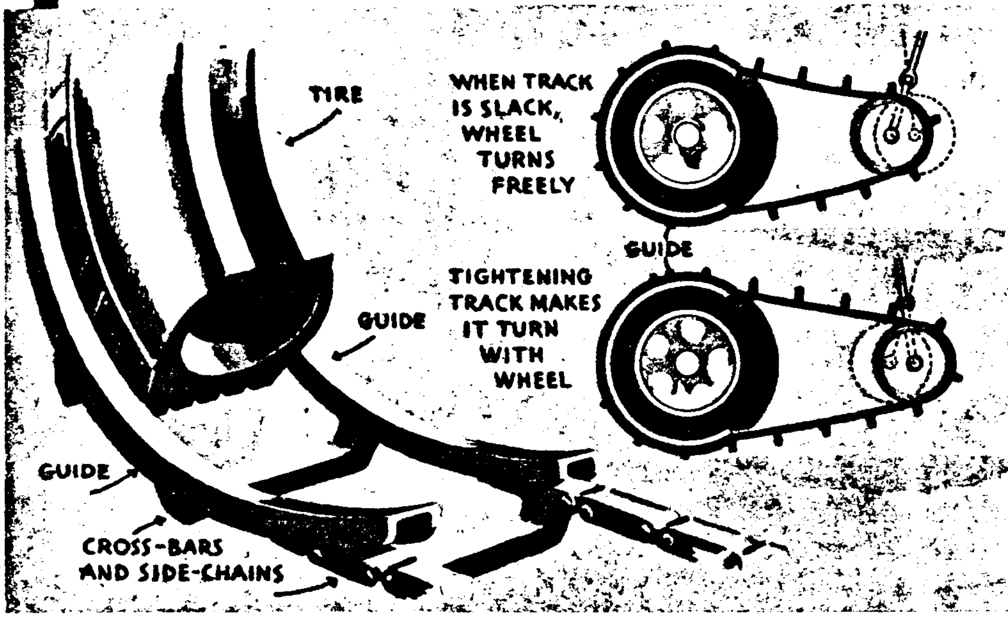
As shown in the schematic drawing, the gas producer is a downdraft type. Air is supplied to the fire—within the conical walls of the refractory, or gas-generating area—by five air nozzles which run through the firebrick from the outer air jacket. The gas, produced by partial combustion of the fuel, flows out the offtake pipe to four cleaning and cooling tanks, fitted with baffles and connected in series. As it is cooled the gas becomes denser (under Boyle's Law) and hence more B.T.U.'s are supplied to the motor at each intake stroke.

A condensate trap is provided at the end of the fourth cooling tank to catch any moisture deposited by the gas, which next passes through a steel-wool filter and oil bath in a tank on the running board. Just before the gas pipe reaches the intake manifold, a valve admits air to the gas, at about a one-to-one ratio, and the mixture is then fed past the throttle to the motor.

During stand-by periods with the motor off, the stack valve at the top of the producer is opened, giving enough air to keep the fire going. This valve is also used to release excess gases at the end of the day. A dashboard control affords a means of varying the amount of air mixed with the gas as it enters the motor; the correct setting changes frequently with the behavior of the fire and the speed of the engine. In practice, the driver controls speed with the throttle and intermittently readjusts the air-gas mixture for best performance. Direct linkage of the two controls is not practicable.

Whether such vehicles, long familiar in Europe, will succeed in replacing conventional trucks in this country depends in large part on whether gasoline shortages become more acute. Certainly the indications are that reduced power and more frequent servicing lay heavy handicaps on producer gas in free competition with gasoline.

Nonskid System. For traction on slippery surfaces, the tire "chain," or track, diagrammed below can be put into action by merely pulling a lever. When the track is not in use, spring-loaded guides mounted on the axle hold it away from the tire, which then is free to run on the roadway through a gap left in the track's crossbars. Pulling the lever moves an idler pulley that tightens the track's guides against the wheel. The upper right-hand drawing shows the track in its free-turning position, tire resting on the ground; drawing below it, wheel as it turns the track. It was invented by C. W. Hunter, of Bryn Mawr, Pa.



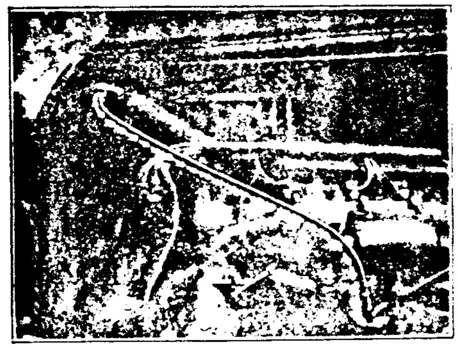
Water Vaporizer Designed to Eliminate Carbon

A SIMPLE water-vapor device connecting the radiator and intake manifold is designed to prevent carbon formation in automobile cylinders and to dissolve old carbon deposits.

It consists of a connection to the water discharge pipe near the radiator, an automatic valve installed in the gasoline intake manifold, above the butterfly valve, and a length of small copper tubing joining the two fittings.

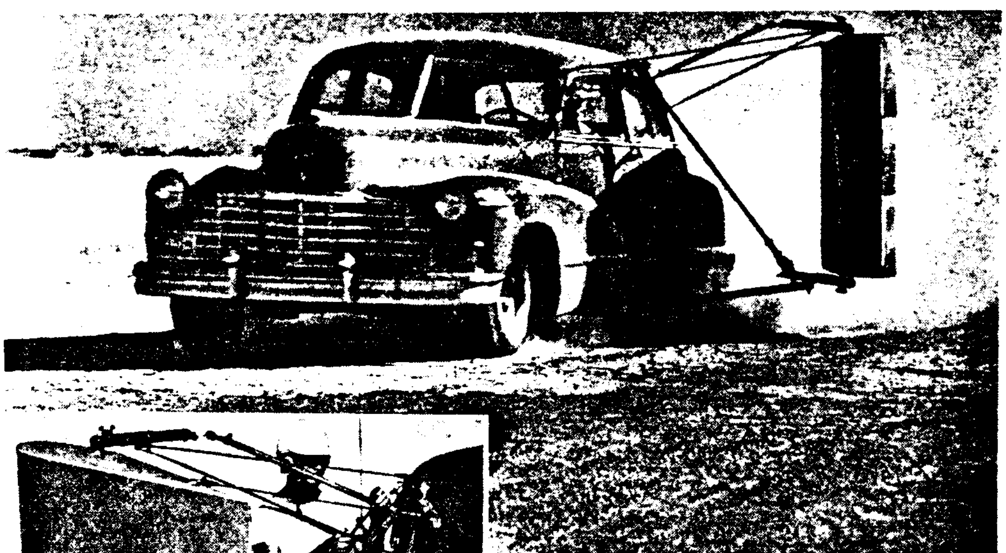
Through four small holes in the body of the automatic valve, air is mixed with the water in order to vaporize it. The water is taken from the circulating system so that no extra tank is necessary, the amount being regulated automatically by the speed of the engine. It is shut off automatically when the engine stops.

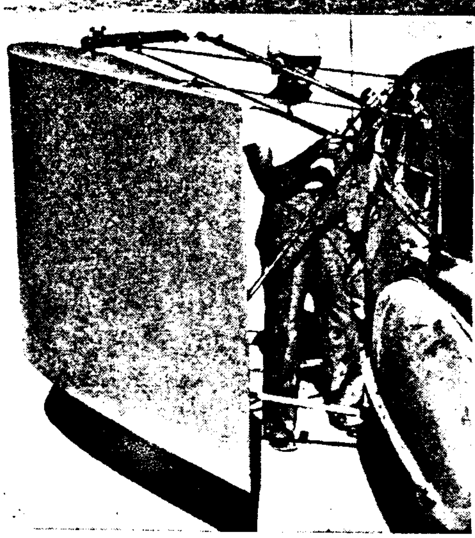
The distinctive feature about the device is its simplicity.



Arrows indicate radiator-manifold connection

Sept 24

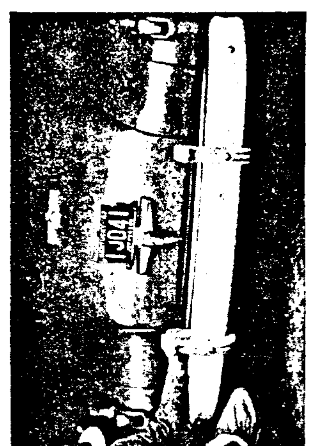




Auto Sprouts a Wing. It's not a style for the everyday motorist—but it's a style that will do the everyday motorist a lot of good. The car above with the fin sticking out at its side is testing United States Rubber Co. tires on the bed of a dry lake near Lancaster, Calif. As can be seen at the left, the fin is a section of an airplane wing. It exerts inward thrust to offset centrifugal force on curves and allows the car to rip around a five-mile circular track at 90 m.p.h. as if it were on a straightaway.

WOODEN BUMPERS made of laminated maple bonded with a resin adhesive, like the one at the left, have been subjected to tests that indicate they will withstand an even greater shock than comparable steel bumpers. As an additional advantage, it is claimed for the wooden bumpers that they can be polished very quickly if scratched. Even chunks chipped out of them can be replaced and the scars hidden beneath a new finish. The weight of the laminated type is slightly less than that of steel bumpers.

Feb. '44 P.S.



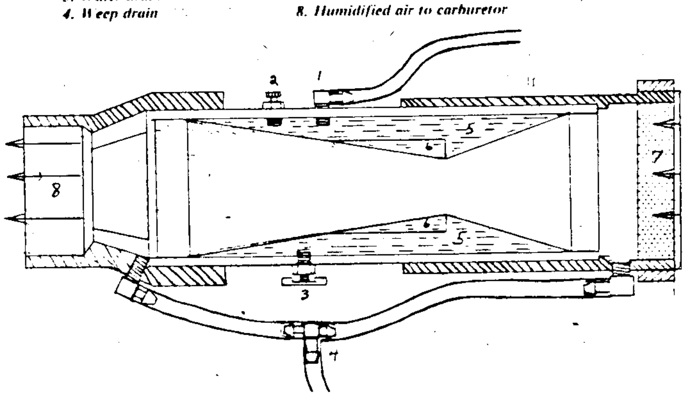
More good reports on Charlie Brown's Power Pak humidifier for saving gasoline and getting better performance from your auto: New accolades pouring in make this device the most consistant of all the gas-saving, clean-air promising gadgets so far investigated.

There are a lot of gadgets and gimmicks advertised that promise to give you X-percent better mileage and to keep your clunker's exhaust from polluting the atmosphere...claims are one thing, performance is another! So far the simple humidifier designed by a Florida group headed by retired Air Force colonel Charlie Brown (mailing address: 8801 S. W. 116th St., Miami, Florida, 33176) is the only device I can happily report has not had a single detractor. The Power-Pak is so simple it must be embarrasing to Detroit's braintrust. It is nothing more than a ceramic circle or venturi shape and a water drip system. The water drips onto the ceramic, the porous ceramic naturally shapes the water into molecular-sized droplets which mix with the incoming air and humidify it before it mixes with the fuel in the carburetor. Everybody knows cars run better in fog or light rain!

Anyway, Bob Beaver of the magazine 1001 Truck & Van Ideas has tested the Power Pak in his gas-guzzling van. Here's what Beaver wrote at the end of his article in the November 78 issue:

"After 600 miles of continuous use (with the van's air-conditioning

1. Water supply hose
2. Air Vent
3. Water drain
4. Weep drain
5. Water
6. Venturi-area of maximum humidification
7. Air Filter
8. Humidified air to carburetor



operating) the Power Pak has resulted in an increase of 1.9 miles per gallon, increased performance and lower emission levels. It should deserve serious consideration by any Van or RV owner because it will greatly lower your fuel costs..."

And then there is this letter from Exchanger Dale Scott of Seattle, Washington:

"Dear Tom Valentine, Last year I wrote to Charlie Brown and ordered a Power Pak. Well it took me to August of this year to install it on my car. I feel that my car has some added power,.but at the time I was having problems keeping water in the Power Pak. I wrote to Mr. Brown and he immediately sent me an additional clamp and a bottle container, that I broke. I installed them and took a trip. My mileage went from 22 miles per gallon to 26 miles per gallon! Mr. Brown has been more than prompt in replying to all my letters and questions. A very pleasant, helpful person."

The original Power Pak was a ceramic ring that fits into the air cleaner compartment over the carburetor; now Charlie has a venturi/shape design that attaches to air intake systems (see drawing above).

• Several of the inventors offered variations on automobile mechanisms. Pete Mize, 52, of Comanche, Texas, has created a nonhydraulic, infinitely-variable-speed transmission that he hopes will interest electric-car manufacturers. Horst Kossel, 51, of Shrewsbury, Massachusetts, displayed his "continuous-combustion piston turbine," in which two eight-piston banks are connected to a "wobble-plate" that operates the drive shaft. A rotating "combustion chamber" attached to the shaft momentarily connects each cylinder with the adjacent one. This allows the burning gases in one cylinder to ignite the gases in the next, thus providing uninterrupted combustion. The RAM-Z, a third automotive entry, represents 23 years of tinkering by Charles Ramsey, 42, of Dunkirk, Indiana. In an ordinary auto engine, only

Horst Kossel, of Shrewsbury, Massachusetts, with a model of his Paradox "continous-combustion piston turbine," a radical departure in automobile engines

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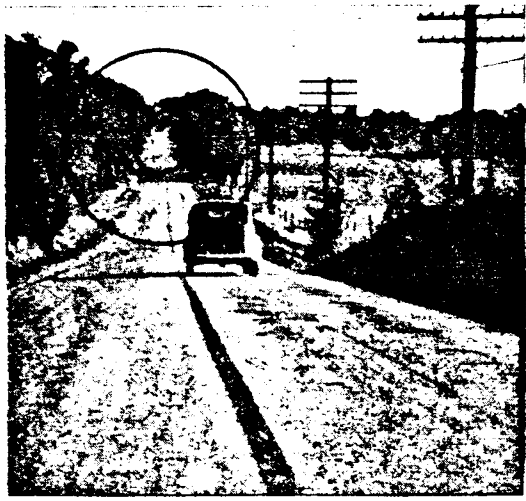
one stroke of every four in a piston's movement produces power; each cylinder of the RAM-Z has a double-headed piston that delivers power on each stroke.

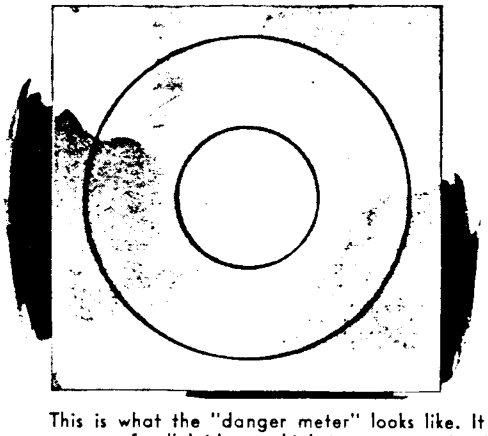


How the "danger meter" is used. Here the road, at the farthest point visible, lies inside the small circle. It is safe to pass

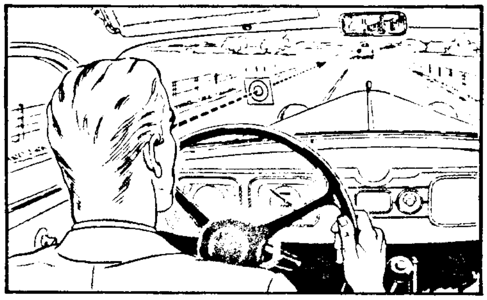
Now, you can still see far enough ahead for safety, but there are oncoming cars outside of the smaller circle. Don't try to pass until the road ahead is clear

Pop Sci. May '40

Make a "Danger Meter"



This is what the "danger meter" looks like. It is a square of celluloid, on which two concentric circles are drawn with India ink. Size of the circles depends on the distance from your eyes to the windshield, in accordance with tables on page 56. It is affixed to the windshield as illustrated below

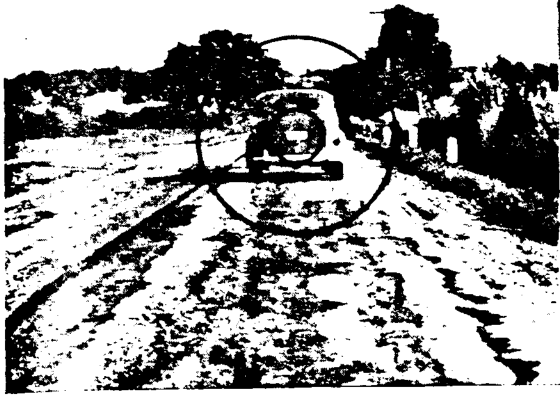


"AM I following too closely behind that car? Would it be safe to try to pass him now?" How often, while driving, have you asked yourself those questions? The accuracy of your split-second decision may mean the difference between safety and a disastrous wreck. Here is a simple "range finder" that you can make and put on your windshield to help you estimate distances and cultivate sure-fire judgment.

Passing a slower car on the road, when another car is coming toward you, calls for accurate judgment. It is a matter of split-second timing. Meeting at a mile a minute each, cars eat up the distance between them at the rate of 176 feet a second. If a driver going sixty miles an hour attempts to go around a car going forty, the swing-out, the passing, and the swing-back will take seven and one half seconds, even though the swing-out is started only 100 feet behind and the cut-in is completed 100 feet ahead of the slower car. In those seven and one half seconds the meeting cars will have traveled 1,320 feet toward each other.

In other words, if a driver travels at sixty miles an hour, he must have a quarter of a mile of clear road ahead before it is safe to try to pass a slower car. It is reasonable to expect a sixty-mile-an-hour speed in the cars that come toward you on the roads outside the cities. At slower speeds, the danger is proportionately less.

Curves, hills, and night driving cause most head-on collisions, because many drivers attempt to pass at times and places where



Judging safe distance for following. If the car ahead looks smaller than the large circle of the "danger meter," you have a margin of safety for sudden stops

If you see this, you're much too close. The car ahead now looks larger than the large circle. This means that you are less than 100 feet behind the car—too close for comfort if the driver should happen to slam on the brakes

for Your Car

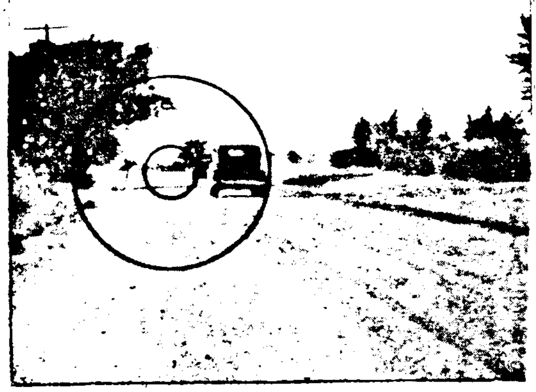
By
WILLIAM F. STEUBER
SAFETY DIVISION, MOTOR VEHICLE DEPT. OF WIS.

they cannot see far enough ahead to be sure they have room to use the left lane before an approaching car is upon them. To give the driver a means of judging whether he lacks that necessary quarter mile of clear road is a purely mechanical problem.

The farther away an object is, the smaller it appears. In fact, we estimate how far distant an object is by noticing how large it looks. This use of perspective is the basis upon which you can make a "danger meter" to tell you when it is safe to pass the slower car ahead.

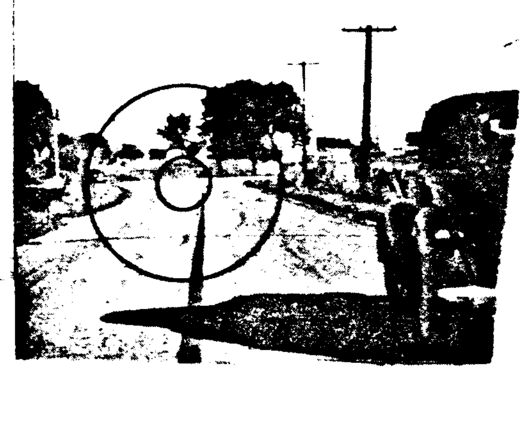
The "danger meter" is simply two concentric circles drawn upon celluloid and affixed to the windshield directly ahead of the driver with cellulose tape. As the driver travels along the highway, the scene ahead appears as shown in the illustrations. When he wants to pass the car ahead, a quick glance through the "danger meter" tells him if danger is too close to risk passing. If the edges of the road ahead at the farthest visible point lie outside the rim of the small circle, the driver is too close to a curve or a hill to take a chance on passing.

Likewise, even though the "danger meter" shows the road ahead at a point so far away that the edges of the road appear to lie well inside the small circle, there still may be



Passing on hills causes many collisions. Here the road, at the farthest point visible, overlaps the small circle of the "danger meter." You cannot see the road far enough ahead to make it safe to try passing the car in front

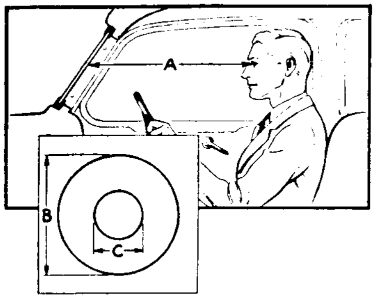
This time it's a curve. Again, the road seems wider than the small circle, at the farthest point you can see. Your windshield range finder is warning you to get back into line and stay there until you see what's around that curve



danger. If there are approaching cars between the driver and the farthest visible point, it is obvious that it is not safe to overtake the car ahead. Also, the road must be fully visible between the driver and the farthest point of the road in sight. If there is a sharp dip ahead, it may hide an approaching car.

The larger circle is designed to tell the driver when he is following another car too closely. If the car ahead, when sighted through the "danger meter," appears larger than the large circle, the driver is following too closely for safety if the car ahead should stop suddenly. When the driver stays far enough behind so that the car ahead appears completely within the large circle, there will be a safe stopping distance between the driver's car and the car ahead.

The "danger meter" is designed for quarter-mile visibility for passing and for an even 100-foot clearance in following another car. To make one for your car, take a two-inch square of clear celluloid. Have a friend measure the distance from your eyes to the windshield at a point directly in line with your eyes when you sit comfortably behind the wheel. This distance (Table "A") measured in inches will tell you, from Table "B," how large to make the large circle, while table "C" will tell you what size



DIMENSIONS FOR "DANGER METER"

A	B	C
16"	1"	3/8"
17"	1"	3/8"
18"	1 1/8"	3/8"
19"	1 1/8"	3/8"
20"	1 1/4"	1/2"
21"	1 1/4"	1/2"
22"	1 3/8"	1/2"
23"	1 3/8"	1/2"
24"	1 1/2"	1/2"
25"	1 1/2"	5/8"
26"	1 5/8"	5/8"
27"	1 5/8"	5/8"
28"	1 3/4"	5/8"
29"	1 3/4"	5/8"
30"	1 7/8"	3/4"

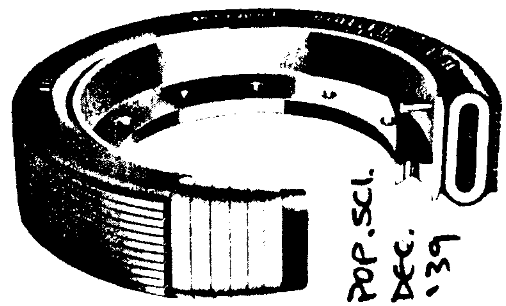
to make the small circle.

Both circles should be drawn using the same center, both should be made with black India ink. The inner circle tells whether you have a clear road for passing, the outer circle tells whether you are allowing a safe distance between you and the car ahead. The small variation for eye distance shows that the accuracy of the "danger meter" is not vitally affected by the driver's shifting forward and back in his seat.

Do not use the "danger meter" as a gun sight. Staring through it might cause you to fail to see dangers approaching from the side. Merely glance through it quickly to apraise your position. At other times it is so inconspicuous that it will in no way interfere with your vision. Being transparent, it does not violate state laws that prohibit stickers on the windshield.

Many head-on collisions occur at night or in fog. The device is as effective at such times as in ordinary daytime driving.

Proper use of the "danger meter" will give you a sense of security when you drive. Two or three weeks' use of it will educate you into an accurate concept of distance judgment. Head-on collisions can be reduced when drivers know when and where it is dangerous to overtake and pass.



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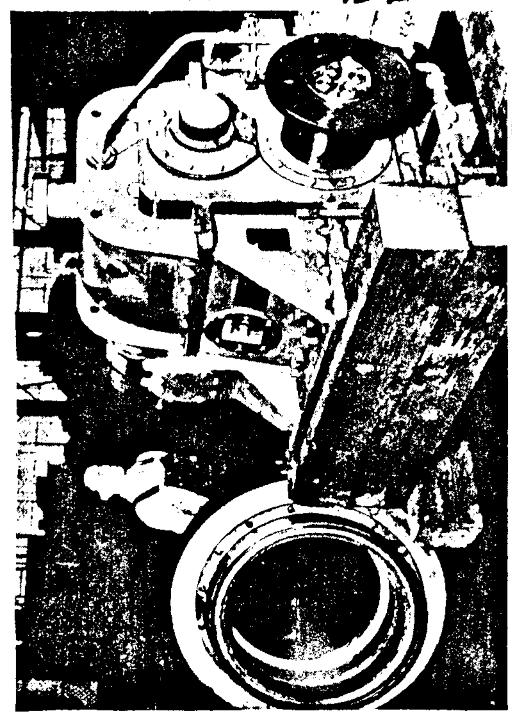
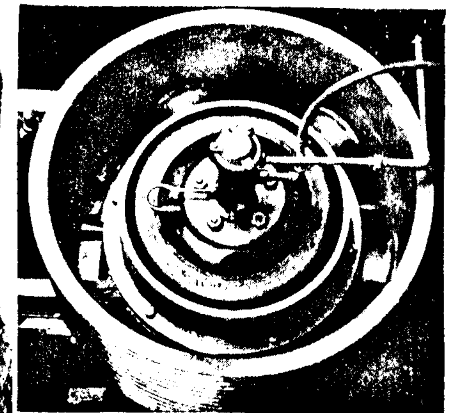


A heavy gear housing equipped with the new clutch. At the right, above, note the tirelike tread and construction

New Tirelike Clutch Works by Inflation

RESEARCH at an Akron, Ohio, tire factory has resulted in the perfection of a radically new rubber clutch for Diesel and marine engines. Tirelike in shape and construction, the new clutch is operated by air pressure instead of the usual levers and springs. Air forced into the clutch inflates the rubber doughnut and causes it to make perfect contact with the inside of a metal cylinder which serves as the clutch plate. In recent tests, a towboat fitted with the new unit was changed rapidly from full speed ahead to full astern 1,400 times, with no appreciable wear.



External details of the clutch are shown here. The air line that inflates the rubber casing enters at the central shaft

Invention Excites Industry

A Nevada inventor has come up with a process combining gasoline with water that promises to revolutionize the auto industry.

EXCLUSIVE TO THE SPOTLIGHT

BY ANDREW ARNOLD

There's good news on the horizon for American automobile owners: A new technology [illegible] Nevada inventor Rudolf Gunnerman will allow cars to travel more than twice as far on a gallon of fuel priced at half of today's rate.

This breakthrough—consisting of a method to burn in internal combustion engines a fuel mixture of 55 percent water and 45 percent gasoline by weight, hence the name A-55—reduces harmful emissions as well. Carbon dioxide is cut in half and nitrogen oxide drops nearly 40 percent. Total emissions, due to more efficient combustion, are cut by 90 percent.

"It's not too good to be true," Gunnerman told The SPOTLIGHT. "It's new, but it's fact. Everything has been tested by Stanford Research International (SRI), an arm of Stanford University in California. A-55 uses a water/gas shift to produce hydrogen. It can be done with virtually no power.

"Before, if someone had the fuel, they wouldn't have had the car to run it in," he added. "And if they had the car, they wouldn't have had the fuel. It took a number of new disciplines to accomplish this." The chief breakthrough is a new emulsification process that combines the water and gasoline.

Two industry newsletters, the *Bloomberg Business Report* and the *Oil Market Listener*, have featured in-depth coverage of Gunnerman's process. Gunnerman, a recent immigrant from Germany, has been approached by representatives of major oil companies as well as the military for information on adapting his process to their uses.

SPOTLIGHT readers in Reno,

(See INVENTION, Page 3)

Inventio

(Continued From Page 1)

Nevada will have the opportunity to see how the fuel works this month as seven red-, white-, and blue-striped, modified American cars drive approximately 20,000 miles in a test run.

The modifications include the installation of a harmless, long-lived nickel catalyst in the engine combustion chamber. The price of retrofitting existing autos would be about $1,700.

Gunnerman said A-55 modifications may keep the price of cars down in the future as production costs, due to reduced need for antipollution control, air filtering and cooling equipment, are figured in.

To date the SRI has given a test car modified to run on A-55 flying colors. SRI tested a converted 1989 six-cylinder Ford Taurus. The Ford showed an average of 37 miles per gallon of fuel, with some test scores near 50 mpg under differing driving conditions.

A similar but unmodified control car tested an average 14.7 mpg on standard fuel.

The inventor, president of Reno-based Starbright Inc., said he expects to have a fleet of existing cars ready to test A-55 in limited market areas. "We hope to build an infrastructure to make the fuel [available to the] public," Gunnerman said.

Once the infrastructure is laid, an as-yet-unnamed manufacturer has plans to have models of A-55 fueled cars on the market by the end of the year, Gunnerman said.

"We are able to have the fuel infrastructure in place by that time," Gunnerman said. "The first manufacturer will use the total country as a test market."

If the A-55 process is adopted widely it is expected to reduce U.S. reliance on crude oil imports and could have significant reductions on pollution emissions, according to experts.

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Emulsions as Fuels

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Amer. Soc. Mech. Engr.

J. DOOHER R. GENBERG R. LIPPMAN

T. MORRONE S. MOON D. WRIGHT

INTRODUCTION

Adding water to fuel has been used in the past to increase octane ratings of gasoline, to reduce nitrogen oxide emissions in gas turbines, and particulate emissions in oil furnaces.

For the past two years, Adelphi University has been investigating the combustion properties of ultrasonically generated emulsified fuels. Initial experiments have been conducted on combustion of water-oil emulsions in boiler furnaces, using water tube boilers rated at about 25 x 10^6 Btu/hr. The experiments have revealed a sizeable potential for significant increases in boiler efficiency (15 to 20 percent), as well as a dramatic reduction in soot carried in the flue gas. The estimate of the increase in the boiler efficiency was based on a degree-day comparison with a similar loading period the previous year, as well as a spot check on the CO_2 levels and stack temperatures in the flue.

Our preliminary findings indicate that, during combustion, the internal water droplets vaporize, causing mini-explosion of the fuel drops, leading to a much finer atomization and a very thorough mixing of air and fuel. This allows complete combustion with much less air and a dramatic reduction in soot production. Less excess air means that less heat is carried out the stack by the exhaust gases. In addition, the reduction of soot keeps the boiler heat transfer surfaces clean and, therefore, more efficient. We are also investigating the possibility that the system allows more effective radiative heat transfer from the flame to the boiler tubes. What these improved combustion characteristics mean in a practical sense is that a boiler furnace, which ordinarily becomes less efficient with usage, can operate over extended periods of time close to design efficiency. Other data also confirms these findings. Recent tests at the EPA Laboratories in Research Triangle Park, North Carolina, have confirmed a soot reduction of 80 to 90 percent (1).[1] Earlier results by Shearer and Traine in France, by the Battelle Memorial Institute, and at Adelphi University have revealed a dramatic reduction in soot concentrations in boiler furnaces (2-4). In the Soviet Union, fuel emulsions have been used extensively since the 1950's in order to obtain improved combustion in boiler furnaces, both in ships and in stationary power plants (5).

Internal Combustion Engines

There are also applications of emulsified fuels in internal combustion engines. It has long been evident that the injection of water into combustion engines improves performance (e.g., in World Warr II, it was general practice to increase bomber range by injecting water into engine fuel). As early as 1947, the addition of finely atomized water (or ethyl or methyl alcohol) to spark ignition (SI) engines was recognized as a method of eliminating hard knock (premature detonation). Indeed, the NASA Program Sp-273 revealed that water injection knock suppression results in an increase in power output and decrease in engine coolant requirements.

The addition of water permits leaner (air-fuel) ratios, since reduced combustion temperatures limit exhaust valve burning and engine overheating. Leaner ratios permit reduction of CO emissions. The reduction of combustion zone temperatures will also reduce NO_x emissions. The presence of water yields more expansive work in the power stroke per unit of fuel used. In a sense, the water permits the engine to act, in part, like a steam engine. The cooler combustion temperatures can also reduce cylinder wall losses. The net result is improved engine efficiency.

The demonstrated increase in octane number due to the presence of water will make it possible to use a higher compression ratio on engines, as well as increase gasoline yield per barrel of fuel oil. The knock suppressant character of water addition is also of significance, since it permits use of low octane fuels, and eliminates tetra-ethyl lead as an anti-knock additive.

The use of emulsions provides perhaps the

[1] Numbers in parentheses designate References at end of paper.

Table 1 Tymponic Field-Tests of Effect of Water-Oil Emissions on Boiler Thermal Efficiency

(Average over 20 tests)

Fuel Oil Combustion			Emulsion Combustion			$\frac{\Delta\eta_T}{\eta_T}$
CO_2	T_s	η_T	CO_2	T_s	η_T	
8.1	448.	77.65	12.4	369.	86.1	10.8%

simplest controlled method of adding water to the combustion zone in the right amount, and at the proper time in the engine cycle.

The Use of Coal in Emulsions

Another form of emulsion fuel is a mixture of coal, water and oil, which can substitute as a liquid fuel in oil-fired furnaces. This is an improvement on the colloidal suspensions of coal and oil which have been used in the past. As far back as World War I, work at the Kodak research laboratories showed that a colloidal fuel of coal dust and oil could be burned successfully in ship boilers. A concentration of 31 percent coal in oil was burned on the USS Gem in 1918. Due to the increase in specific gravity, fire risk was diminished, since the fuel proved heavier than water. The Kodak research established that the fuel could be stabilized for a number of months by the addition of resin soaps as surfactants (6).

In the years 1920-1930, experiments were undertaken in Germany, England, and the U.S.A. to produce coal-oil suspensions from coal of varying granular classes and differing types of oil (with or without additives). For applications to transportation of coal, there has been extensive work in many countries on coal-oil suspensions, as well as coal-water slurries.

In Essen, Germany, research has demonstrated the economic feasibility of using a coal-water slurry as fuel in water tube boilers for electric power generation. This boiler was initially designed to burn pulverized coal. Such a slurry could not be used in most conventional oil-fired furnaces because of the relatively long burning times of pulverized coal particles (7).

The most extensive research to date on the combustion of coal, water, and oil suspensions was carried out in Germany from 1966-1968. Despite the conclusion that the mixture was a feasible and economical fuel, it was never used in the practical system. The work was essentially laboratory exploration, and it is uncertain that the mixture was tested in a conventional boiler (8). In a subsequent section of this paper, we will discuss the technical aspects of these emulsion fuels.

WATER-OIL EMULSION RESEARCH

In order to understand the effect of using emulsions as fuel, Adelphi University has, for the past two years, engaged in a two-pronged program of both practical field tests of combustion systems and basic research on the physics and chemistry of emulsions during combustion, as well as the basic structure of the emulsions themselves. The practical tests can be characterized as:

1 Statistical analysis of field tests in which stack losses were monitored
2 Controlled efficiency studies on an instrumented boiler furnace.

Reports on the results of field tests have been obtained from the Tymponic Corporation, manufacturers of the ultrasonic fuel emulsion system which has been studied at Adelphi (9). These field tests, while indicative of generally improved boiler performance and reduction of soot levels through the use of emulsions in boiler furnaces, must be supplemented by controlled efficiency studies if the findings are to be definitive. Table 1 shows the average results of 20 field tests. The average efficiency increase shows up as approximately 10 percent. The increase in CO_2 levels indicate that emulsion fuels require less excess air than the conventional liquid fuel sprays for a given furnace system, an important factor in the average 10 percent increase in efficiency shown in the tables. The reduction in stack temperatures are an indication of improved heat transfer characteristics for emulsion fuel sprays. It would appear that the removal of soot from the combustion gases keeps the heat transfer surfaces relatively clean and, therefore, more efficient

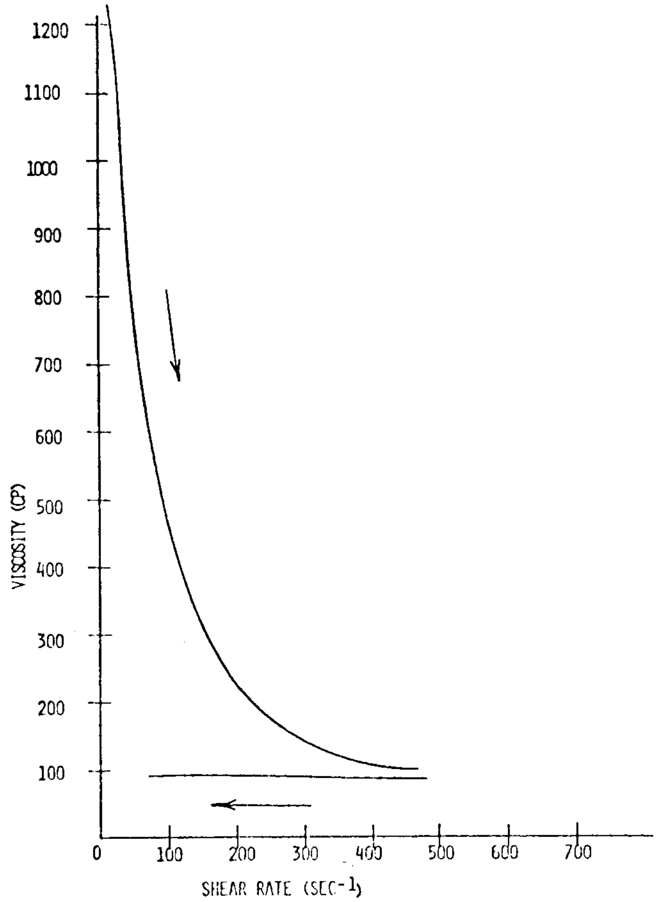

Fig. 1 Viscosity curve for coal-oil-water emulsion

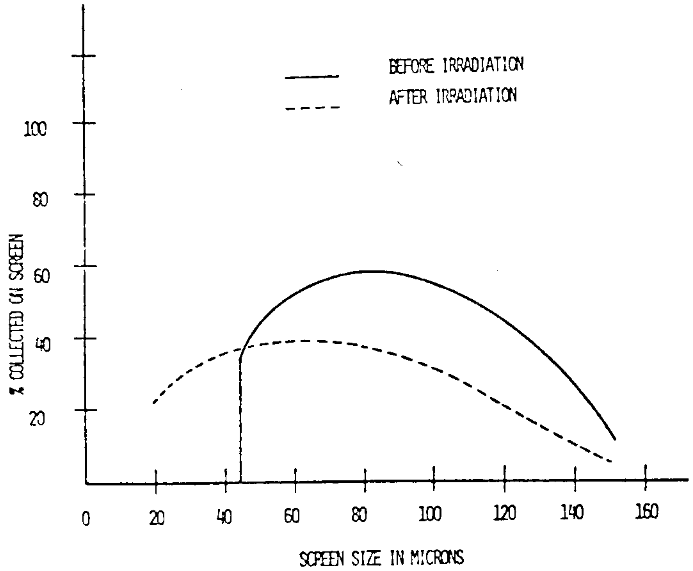

Fig. 2 Effect of ultrasonic irradiation on coal particle size

than a system using pure fuel oil. The question as to whether the radiative transfer from the combustion of an emulsion fuel spray is enhanced over that of an oil spray of equal Btu content is open. However, we do have indications of such an effect from infra-red photos taken in our laboratories (Slide 1).

Another advantage to the use of emulsion fuels is the dramatic reduction in soot emissions from the stack. It may be possible to satisfy environmental requirements by emulsifying heavy fuel oils with water; by themselves, these oils produce generally unacceptable levels of soot.

Theory of Exploding Drops

The emulsion drop can be characterized as a compound drop, consisting of a number of smaller drops of one material, surrounded by a second substance. If the smaller drops have a lower boiling point than the surrounding material, an "explosion" may take place when the compound drop is heated. By explosion, we mean a process in which the drop is broken into fragments.

We would like to describe the physical processes involved when a water-oil emulsion drop undergoes combustion. It will initially be surrounded by a diffusion flame, from which heat will be transferred into the drop. The water will begin to vaporize before the bulk of the oil. The vaporization will usually occur at superheat temperatures above the normal boiling point. The degree of superheating is a function of the purity of the water, raising the boiling point to 200 to 250 C with the absence of impurities.

Superheated boiling or spontaneous nucleation is known to occur "explosively" (10). A number of considerations are important to understanding of the explosive breakup of a drop. The considerable stored energy in the superheated drop will be used partly for vaporization of the water, and partly to impart kinetic energy to the oil. About 10 percent of stored energy is converted to kinetic energy, which is about 50 calories per gram for superheated water. If we consider a simple configuration of a 100 micron oil drop containing a 5 micron water drop under superheat conditions, then approximately 0.3 ergs will be converted to kinetic energy. This is at least 20 times as great as the surface energy of the drop, which is given by the product of the surface tension and the surface area of the drop.

From energetic considerations alone, it is clear that this process has the potential to explode the drop. In order for an explosion to take place, this kinetic energy must be imparted to the drop in a time which is short compared to the relaxation time of the drop. If the opposite occurs, the vapor may break through the surface and escape, instead of breaking the drop.

The relaxation time of the drop is approximately the period of capillary waves in the oil. If we take the wavelength of the oscillations as the radius of the drop, the relaxation time is

$$t_r = \frac{1}{\sqrt{2\pi}} \left(\frac{\rho}{\alpha}\right)^{\frac{1}{2}} \gamma^{3/2}$$

where α is the surface tension and ρ is the density. For a 100-micron oil drop, t_r has a numerical value of 10^{-4} sec. We will now estimate the time it takes to impart considerable kinetic energy to the drop.

For the average acceleration of the surrounding oil, we use the expression

$$a = \frac{4\pi \; r^2 p}{M}$$

where the pressure, p, is taken as the superheat pressure of 40 atm, r is the water drop radius of 5 microns, and M is the mass of the surrounding oil. Putting in the appropriate values, we find the time it takes to expand the water vapor to the oil drop radius of 100 microns is 10^{-5} sec. Under these conditions, the explosion is very likely to occur. If heat flows at a reasonable rate into the evaporating water drop, explosions can occur without superheating. We can satisfy the criteria for explosion if the heat flow to water drop is not inhibited by vapor pockets. The argument is as follows: the temperature of the surface of the oil drop will range over the values of the boiling points of the various volitiles. If the internal water drop is not at superheat temperatures, the temperature difference between the oil drop surface and the water drop surface can be 200 C. In this case, heat will flow into the water at a rate of 3.7×10^5 ergs/sec, 10 percent of which is available for drop breakup. In a time 1/10 of the relaxation time, 0.37 ergs will be delivered to the surrounding oil, which should be sufficient to break the drop.

To gain insight into the fragmentation process, we have applied hydrodynamic stability theory. An outline of our preliminary results follow:

1 Analysis of simplified models, i.e., spherically symmetric compound drops.
   (a) dynamics of bubble expansion, using hydrodynamic equations, i.e., continuity, Navier-Stokes, equation of state, heat-flow equation. The output of these calculations are:
      (i) expansion velocity as a function of time of a spherical shell of oil; 10 to 20 m/sec.
      (ii) internal vapor pressure as a function of time; 10 to 40 atm, maximum pressure.
   (b) analysis of drop breakup, estimating the drop breakup time by using the pressure and velocity information rom (a) to determine the wavelength of maximum growth of instability. (The physical picture we are taking is a spherical shell of oil undergoing expansion which is broken up by the rapid onset of hydrodynamic instabilities.) The velocity of penetration of vapor through the oil is one output of these calculations. The fragment size will be correlated with the wavelength of the dominant instability. The fragment velocity is correlated with the velocity of the oil at which breakup occurs.

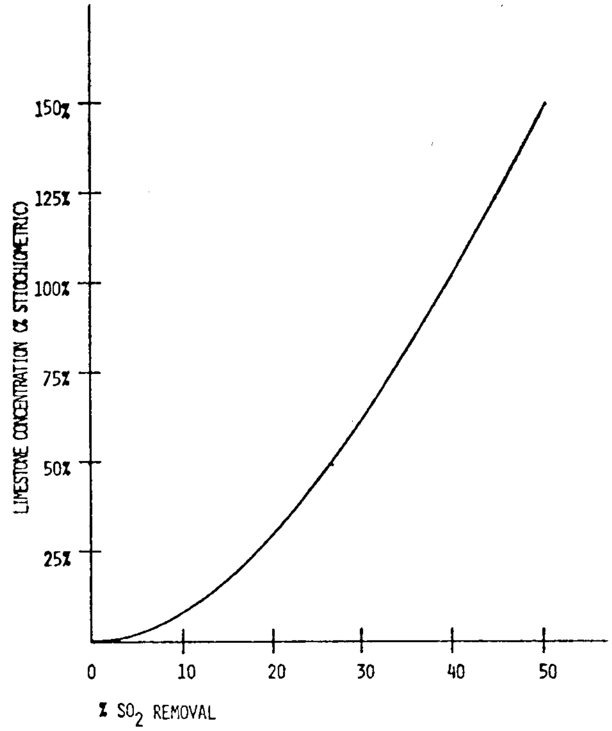

Fig. 3 Effect of limestone on SO_2 removal

Experimental Results on Exploding Drops

Initial experiments to determine some of the important parameters of the exploding drops were conducted by suspending drops of both pure oil and emulsions on a small syringe in the open atmosphere, igniting them with a gas pilot, and photographing the subsequent combustion, using 35-mm camera and a high speed strobe. Preliminary results indicate the following:

1 The pure oil drop burns in the usual way, with no disruption
2 The emulsion drops explode violently into many small high-velocity fragments
3 Secondary and tertiary explosions of the larger fragments were observed
4 Preliminary estimate of the velocity of the fragments indicated an average velocity of approximately 50 m/sec
5 Many fragments on the order of 1 micron or less were noted
6 Burning times of emulsion drops were reduced by at least 50 percent over those of pure oil drops.

The emulsions used were made ultrasonically with 20-kHz waves and a fairly uniform dispersed phase drop distribution of one to ten microns. The continuous phase was No. 2 fuel oil. No surfactant was used. It is clear that the effect of the mini-explosions was very pronounced in our experiments, and is expected to have a significant impact on the combustion properties, as is already indicated by our efficiency studies in actual boilers.

Another compound fuel under study at the Adelphi Center is an emulsion formed of coal, water and oil. The fuel is prepared by mixing approximately 50 percent pulverized coal in an ultrasonically generated emulsion of water and oil (one part water, four parts oil). Fig. 1 shows the dependence of the viscosity on shear rate for this fuel, which has sufficiently low viscosity at the shear rates used in atomizing. The fuel has many months stability, a phenomenon which we believe is caused by two factors; (a) stabilizing of the water and oil emulsion by minute coal particles at the water-oil interface, and (b) reduction in sedimentation rate of the larger coal particles by collisions with the water drops.

The combustion characteristics are very similar to those of a liquid fuel spray, as shown by slides 3 and 4. Finally, we have found that 50 percent of sulfur dioxide can be removed by the addition of pulverized limestone to the fuel. Fig. 2 represents the results of sulfur dioxide removal where the combustion gases are analyzed by modification of the procedure developed by Goksøyr and Ross, which allows for continuous gas sampling (11). In the analysis, gas is passed through 150 ml of 3 percent H_2O_2 solution which is titrated with 0.16 NaOH. Any oil in the H_2O_2 is first removed by ether. Limestone concentrations were varied from approximately 0.38 to 1.2 stoichiometric calcium oxide/sulfur ratios. The results are summarized in Fig. 3.

A final point of interest was the reduction in coal particle size caused by collapsing coal cavitation bubbles when the coal-water-oil mixture was irradiated with sound. This shows promise in reducing burning time, improving combustion characteristics for pulverized coal. Mini-explosions of these emulsion droplets were also observed, using the previously described experimental photographic techniques (slide 5). This method of burning coal would appear promising, especially as a coal conversion technique.

To summarize our findings to date, we believe that higher efficiency and lower pollutant emissions can be obtained by using emulsion fuels in a wide range of applications.

ACKNOWLEDGMENT

We wish to thank Dr. Joseph L. Katz for suggesting to us spontaneous combustion as a possible mechanism. We also wish to thank E. C. Cottell for technical discussions on emulsions and their use in combustion process.

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Fuel vaporizing kit lets engines run on everything from gas to manure!

(continued from page 72)

sense. It took five years to get the first prototype because it started in a backyard. So many people, engineers, mechanics and fund-raisers have donated time to its development. I can't say exactly what the original investors have put into it but I would say it's well over $2 million."

The company will subcontract out the production of the engine kits and has had talks with possible manufacturers but no definitive agreements have been reached. Officials expect the kits to make a big splash when they finally go into production and are made available. "The market is vast," said Smith. "There will be a demand."

Allred agreed. "Selling them will be no problem," he added.

Only time will tell whether Sedona is going to be a penny market glitch breaking through to the plus side of the bottom line or just another penny twitch that folds up as the realities of making money unfold before it.

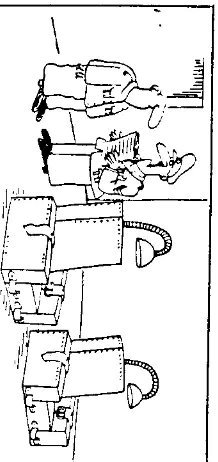
For additional information, contact: Sedona Corp., P.O. Box 44339, Denver, Colorado 80201, phone 303-629-1233. Research Center: P.O. Box 2225, Sedona, Arizona 86336, phone 602-282-1660.

For more information on engine development and fuel systems, pick up copies of:

- *Gasoline Crisis Answers* by Jim Jackson. Price $12.28.
- *The Elusive 100-mpg Carburetor* by Larry Wagner. Price: $15.93.
- *Secret of 100-mpg Automobile* by Tom O'Brien. Price: $12.85.

The publications are available through UGG Farmers Library, *Grainews*, Box 6600, Winnipeg, Man. R3C 3A7.

Brad Dennis is a combustion engineer in St. Paul, Minn.

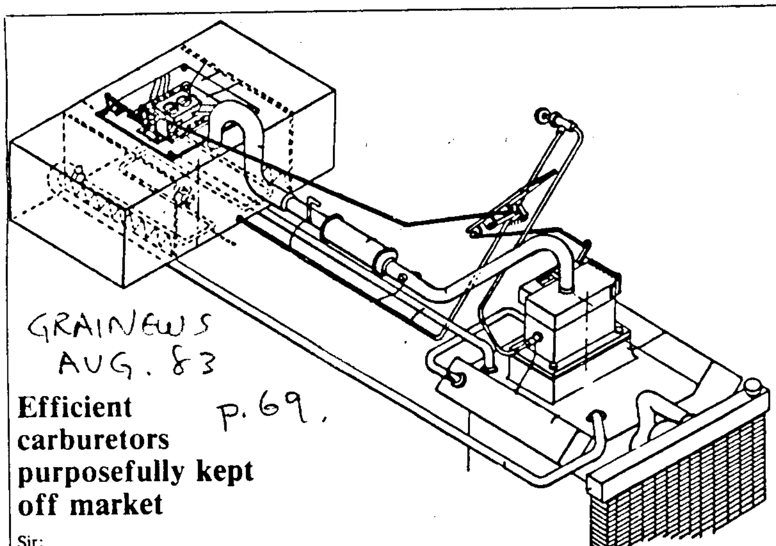


"Smoking or non-smoking?"

Grainews, May 9, 1985

GRAINEWS
AUG. 83
p. 69.

Efficient carburetors purposefully kept off market



The Ogle carburetor

Sir:

This is in regard to Lyle Walker's reply to my letter in the May, 1983 *Grainews*. Back at Regina Agribition held at the end of November, 1980, I saw the Pogue carburetor at the UGG display booth. UGG's personnel said it would be tested by one of UGG *Grainews* contributing editors on a Ford flathead V8 and then results would be published in *Grainews*.

It was a crudely made looking Pogue carburetor, unlike the mostly refined ones I've seen pictures of in Pogue's patents. Even Brad Dennis flew to Winnipeg to see Ivan Piniuta, back in early 1980, when Ivan found the above carburetor, but then lost interest when he saw it was different than the one in the Pogue patent. I remember, in Brad Dennis' column in the January, 1982 *Grainews*, he wanted a newer, much refined patented Pogue carburetor 2,026,798.

After looking back through letters with Brad Dennis, I find he states export vehicles have a red tag on the carburetors, marked "For Export Use Only," meaning they gave far better gas mileage than genuine, used North American carburetors. *In my letter to Lyle* Walker, I should have mentioned the colour of the tag. Sorry for any inconvenience to Dennis.

To *Grainews* readers who didn't purchase three books *Grainews has for sale — The Elusive 100 M.P.G. Carburetor* by Larry D. Wagner, *The Secret of the 100 M.P.G. Automobile* by Thomas O'Brien, and *Gasoline Crisis Answers* by Ambassador Jackson — buy them and you will find what has not been known by anyone.

On page 87 of Larry Wagner's book, he writes about an ex engineer from Detroit who says, after testing new vehicles, rather than pay $1.50 a gallon for gasoline for testing thousands of vehicles, they put on some type of carburetor that attains a tremendous increase in miles per gallon. The ex engineer says it was very difficult to distinguish between the conventional and super-mileage carburetor by outside appearance.

Oh, yes, there is truth when you hear of statements that, after buying a vehicle, the owner finds he is getting extraordinary mileage, all of which occurs in vehicle shipping mix-ups.

Wagner states, in Tacoma, Washington, he knows of two individuals who have bought the above vehicles and found themselves getting 75 to 80 miles per gallon. I have heard, from numerous individuals, that, back in Oshawa, Ont., a man bought a 1974 Chrysler car, and found he was burning hardly any gas and getting up to 1000 miles on a tankful of gas. Also, some years back, in New Brunswick, a Chevrolet car, 230 or 250 on-line 6-cylinder, was getting 60 miles per gallon.

Two years ago in Saskatoon, Sask., a 1981 Chevrolet Impala, 305-cubic inch, V8, automatic transmission, registered 50 miles per gallon. In Iowa a few years back, a mid-sized Chevrolet was getting 40 to 50 miles per gallon until, under company instructions, the Iowa car dealer called the vehicle back and the carburetor, or calibration, was altered, and the vehicle went back to conventional gas mileage.

Concerning that 3-ton truck that a farmer in the Moose Jaw area bought, I heard, from residents, it was getting from 20 to 25 miles per gallon, where a conventional carburetor was getting 8 mpg.

Of course, the reason is dollars and cents are the name of the game for not mass-producing them, and not the answer "not acceptable under varying conditions." Today, technology exists, or has for years back, to overcome "varying conditions."

If anyone bases their arguments on conventional fuel systems, inventor Tom Ogle can see why people would doubt his Ogle system. It works completely differently. It works on energy taken out of gasoline. The normal carburetor takes fuel out of the gas tank. With Ogle's system, the gas is left in the tank and "*fumes*" from the gas are taken out. The fumes are the extreme key, or magic explosive, part of gasoline. The problem is everyone kept thinking the carburetor was indispensable to the cycle. With Ogle's system, it isn't.

Tom Ogle was asked about the safety of his system, particularly the gas tank where gasoline was heated to generate *fumes*.

Ogle stated that his fuel system is safer than those installed on current models. His redesigned tank is so thick — ½-inch sheet steel — that it couldn't explode. All was figured on a computer.

A conventional tank would explode at 240,000 to 250,000 lbs of pressure, while Ogle's tank would endure 360,000 lbs, with total fuel tank capactiy of three gallons of gas. In case of backfire, *fumes* would be vented to the atmosphere via a safety valve installed in aircraft hoses that connect the fuel tank to the engine. If engine pressure drops, the safety valve goes into action and vents the *fumes* outside the system.

Ogle worked on his system over the past five years, not an easy task. There were many times he wanted to quit. In place of the carburetor, Ogle designed a black box that replaced the carburetor. It's through the black box that *fumes* are *filtered* a final time before being injected straight into the cylinders. Air is mixed with fumes at the fuel tank and the engine.

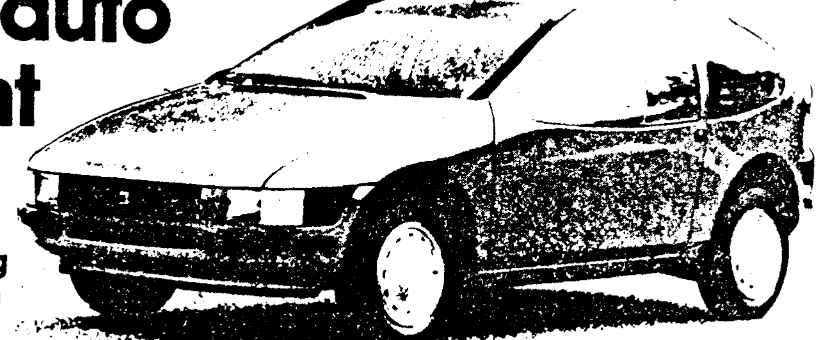
Ogle did what should have been done decades ago. He eliminated the inefficient liquid gasoline-flow carburetor and achieved what gasoline internal engine combustion was supposed to do all along: operate off *fumes*.

In Ogle's fuel system, exhaust pollution from petrochemical pollutants was reduced to near zero.

To readers of *Grainews* who want an Ogle p tent, send a $5 Canadian money order to *Grainews* for an individual patent. *Grainews* readers should refer back to Brad Dennis' August, 1982 column on Ogle.

John Butuk
Insinger, Sask.

A trilogy on auto development



GM produces 95-mpg car, Peugeot produces 5-passenger car in the 56-mpg range but the World Petroleum Congress says: 'Not yet!'

Figure 1

Far-out engines

BY BRAD DENNIS

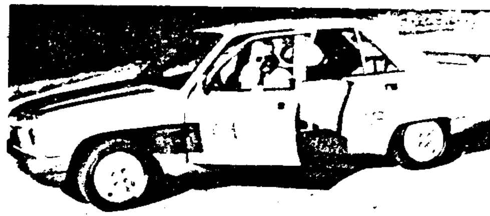


Figure 2

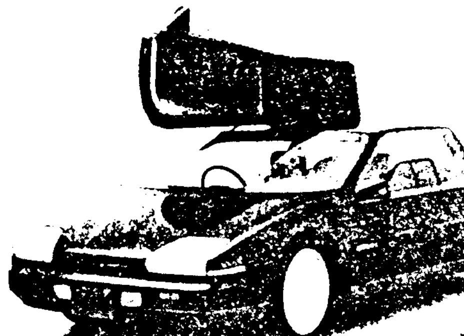


Figure 3

Real gains in fuel economy could be introduced into the system: Figure 1 is a GM factory-ready, 95-mpg commuter car; Figure 2 is the Vera, a 5-passenger Peugeot rated 56 mpg at a constant 56 mph; Figure 3 is Nissan's gas turbine which experts label a 21st century vehicle.

Well, it's that time of the month again in which to see what kind of gains in our transportation world could exist if only the free hand of the marketplace actually existed.

I am not trying to be cynical about the business world but I am trying to illustrate to the readers of this column that real gains in fuel economy or engine technology do exist and could quite easily be introduced into the system if only allowed.

Now on to the business of telling the truth and not holding any bars back. The proof this month involves a GM factory-ready 95-mpg commuter car that is guesstimated to sell in the price range of $3500 to $4000 (U.S.). Next a 5-passenger Peugeot that is providing 56-mpg figures.

Last is a report from the World Petroleum Congress deciding with decision-makers from Detroit that there will be no major changes in the engines used or the type of fuel used for at least another 25 years. I do not know what dictionary you use, but in mine that comes up as control of the type of fuel, the price, and especially the fleet average mpg.

Get your popcorn ready because we are going to the new economy car showing. Oh, by the way, you cannot buy any of these cars until fuel prices double or triple and the tax bases are adjusted for the drop in gasoline consumption that these cars bring about.

95-mpg commuter car from GM

In Figure 1 is the TPC (2-passenger commuter), GM's micromini engineering prototype that resembles the tiny cars produced in Japan. (High mileage minis are not produced in North America because they consume too little an amount of fuel.) On EPA test cycles with two passengers and 44 pounds of cargo, this vehicle produces mileage figures of 69 mpg in the city driving loop and *95 mpg on the highway circuit.*

The front-wheel drive TPC is powered by an aluminum 3-cylinder 0.8-liter (48.8-cubic inch) gasoline engine linked to a 5-speed transaxle.

Most of the body is high-strength thin-gauge steel but the doors, front end, and, four wheel drum brakes are aluminum. The suspension system consists of transverse reinforced fiberglass.

As small as it is (33 inches shorter and 5 inches narrower than a Chevette), there is ample room inside. GM claims the front-seat area has more room than a Chevette.

The TPC's drag coefficient is 0.31, thanks to its smooth underbody, flush glass integral air dam, and flush wheel covers and tires. Interior air ventilation exhausts from beneath a roof extension over the top of the rear hatchback. The design keeps the airflow closer to the car's rear and reduces drag.

GM has no plans to market the car. However, some of its features could show up in future vehicles.

Comment: There should be two points made here to again make you very upset with the types of programmed production from our auto makers.

• Here is absolute proof of high-mileage technology put into real-life existence for the consumer to benefit by reducing the aggregate demand for overpriced fuel.

If this were put into effect there would be more disposable spending to benefit world economies, as well as our standard of living. But, is this car produced? No.

• The second point is a continuance of the first, with reference rationale being cars of this mileage nature are being sold by Mitsubishi and Suzuki in Japan at a cost of $2500 to $3200 U.S., and that's for a brand-new automobile.

The refusal by our auto manufacturers to produce this type of item is the fact there is very little profit margin in this type of vehicle as compared to a much larger, less fuel-efficient car, and that is what the *bottom line* is all about.

Peugeot Vera achieves 60 mpg

"You don't have to rethink the whole car to improve fuel economy by one-third," said Henri Saintigny, a test engineer at Peugeot's proving grounds. "This car which we call Vera (Figure 2) has the same passenger compartment as the production-model 305 (not sold in North America), and is the same overall shape with the same general layout, but burns one-third less fuel."

5 How is it done? In brief: by taking lightweight construction to new lengths, and by reducing aerodynamic drag through clever detailing.

Performance of the Vera at Peugeot's vast Belchamp proving grounds checked out to be quite interesting. Acceleration from 0 to 60 mph took 14.4 seconds while reaching a top speed of 97 mph.

The most surprising thing about the Vera is that it looks so normal. There's no rocket nose or stretched tail to spoil the Vera's looks and practical dimensions (just 170 inches overall). Yet, there is a rear wing, but it's there to prevent airflow separation and reduce tail end lift.

Peugeot specialists worked in the St. Cyr wind tunnel to drop the car's drag coefficient (Cd) from a mediocre 0.44 to a laudable 0.318. To achieve this, they retained the standard windshield and rear-window angles from the 305 GL, but both are flush-mounted for smooth airflow. A front spoiler, integral with the bumper, is good for a 0.015 improvement in the drag rating by deflecting air and controlling its flow under the car.

The rear-door sills and fenders form fairings to shield part of the rear tires, while the rears of the front fenders are formed inward to direct air from the engine compartment along the sides of the car. Flush-mounted covers also direct airflow over the wheels.

The Vera drives like a normal car, although it is perhaps slightly noisier than the well-silenced 305 GL. No shortcuts have been taken with seating comfort or the smooth and well-damped ride.

Okay, but how about the weight reductions? "We knew we were going to save a lot of weight," Saintigny explained, "So, we decided to use a smaller and lighter engine. That gave us additional, ripple-effect weight reductions throughout."

Peugeot chose the 64-cubic inch (one liter) engine from the little 104 model (not sold in North America either) instead of the 83-cubic inch (1.3-liter) unit from the 305. Both are aluminum 4 cylinder designs, but using the smaller block saved nearly 40 pounds.

In addition, Peugeot fitted a lighter flywheel, an aluminum radiator, a plastic camshaft cover, a magnesium carburetor body and a thin-sheet stainless steel exhaust manifold, all of which saved another 35 pounds.

The engine was modified to make it more efficient than the standard 104 unit. The compression ratio was raised to 10.2:1, and the engine now produces 63 hp at a low 4500 rpm. The 305 GL engine puts out 65 hp but at 6000 rpm.

Two camshaft bearings were eliminated to further reduce power-robbing internal friction. Lighter valve springs were installed and camshaft timing was altered to minimize valve overlap. The engine was generally optimized for high torque at low rpm so it could pull the "longer" economy gearing of the optional 5-speed transaxle from the 104, which was adopted for the Vera.

To lighten it, the body shell was made with high-strength steel inserts in critical areas, while unstressed parts were made of plastic or aluminum. Both left doors, for instance, are plastic and both rights are aluminum, giving Peugeot the chance to simultaneously evaluate both.

The front bucket seat frames are plastic. There's a plastic support bracket for the control pedals, and the brake master cylinder is aluminum. Experimental Michelin plastic wheels and low-profile TR-E tires save an additional 8½ pounds per wheel assembly. Complete with fuel, oil and water, the Vera weighs just 1632 pounds, 408 pounds less than the 305 GL.

How does all of the development affect fuel economy? In the European urban driving cycle, the Vera is rated at 37.3 mpg; at a constant 56 mph, 56 mpg; and cruising at 74.5 mph, 42 mpg. That's a full third better than the 305 GL sedan.

Peugeot makes it clear that the Vera is just a design study. It would be too costly to build, but you can expect features from it to show up on Peugeot models as early as 1983.

The important point to remember in reference to this design development is — there was a one-third gain in fuel economy with simple design

(continued on page 81)

missing

Brad Dennis is a combustion engineer in St. Paul, Minn.

With these three strikes against you — you're out, Detroit!

Three new carburetors prove Detroit is not giving us its best

Carburetors, emissions and mileage — Detroit says what we are presently using is *state of the art*.

I say if this is the state of the art, then these guys must be living in the Neandrathal Age. The fuel systems presented here show there are endless ways to supply fuel to an engine, and some much more efficient than what one sees when one opens the hood of the present-day confusion bin.

Now, you don't think that, at this point in the game, I am going to slow down on my stabs at the big guys, do you? The only thing that upsets me is that I have heard from everyone but those who really need to know the facts — the law-makers.

This month will be another study of more and different carburetors, but now I have loaded my information gun a little differently. The politicians are finally getting into the act. They are now getting information about fuels and engines that has never been presented before. They are finally realizing that controlling carburetors, thus controlling mileage as a fleet average, controls a large section of our economies — millions of dollars wasted purposely.

So, let's get on with this new information that will make you mad enough to pound your fist on the table for being such a fool for playing in this fuel money con game.

The first device is called the Webster-Heise vapor valve. It is an inexpensive retrofit item that could cut the present fuel consumption bill by 40 per cent.

1. The Webster-Heise vapor valve

This is a promising new device that reportedly improves fuel economy for gasoline engines, reduces pollutants dramatically and increases engine power. It is getting a thorough review by the media as well as causing more than eyebrow-raising by key members of the Congressional Energy Committee.

Sherwood Webster and Richard Heise have developed an engine valve that vaporizes gasoline in a superior way — compared to what Detroit is now sending out of the factories — so a more complete combustion takes place.

Remember those vapor carb articles in the past two years, especially on Charles Nelson Pogue? It now appears as though politicians are finally taking note of the economic and environmental *benefits* these vapor fuel systems can bring about. Too bad they are over 50 years late.

The Webster-Heise valve has been tested formally six times at laboratories recognized by the Environmental Protection Agency, producing favorable results each and every time!

A summary of the test results showed that the Webster-Heise valve can:

- reduce engine octane requirements by at least 10 or more points.
- reduce gasoline consumption by as much as 40 per cent.
- reduce the formation of oxides of nitrogen (NO) by as much as 45 per cent.
- reduce the formation of carbon monoxide (CO) by as much as 20 per cent.
- reduce the formation of unburned hydrocarbons (HC) by as much as 10 per cent.
- increase torque by as much as 20 per cent.
- eliminate stalling and flooding, especially on cold starts.
- reduce the formation of carbon and gas dilution deposits that can and do cause premature wear and tear on engines and lubricants.
- require no maintenance.

Far-out engines

BY BRAD DENNIS

The valve has so far been tested only on automobiles. But David Lindahl, analyst with the Congressional Research Service (CRS) who has studied the device, says the unit can be used on virtually every gasoline engine.

The CRS study was ordered by Senator Robert Stafford (Republican, Vermont), chairman of the Environmental and Public Works Committee and a central figure in debate over continuation of the Clean Air Act.

If the Webster-Heise valve is installed on mass-produced autos, the current emission restrictions could easily be met. This could also help out the escalating costs of poorly designed, expensive emissions equipment presently used.

The valve is now under test by the National Highway Traffic Safety Administration (NHTSA) in an effort to match earlier tests conducted by private labs. NHTSA became involved at the suggestion of representatives James Broyhill (rep N.C.) and Edward Madigan (rep Ill.), both members of the House Energy and Commerce Committee.

The two Arizona inventors began developing their valve in 1978. After three years of experimentation, test results were presented to the President's Task Force on Regulatory Relief, chaired by Vice-President George Bush. Task Force counsel C. Boyden Gray reviewed the findings and recommended the device to the Congressional Energy Committee.

The Webster-Heise valve was *not* enthusiastically received by the car-makers nor the oil industry. Standard Oil of Ohio expressed an initial interest and urged the Ford Motor Company to test the device as part of a joint project. Ford later conducted the tests on its own, according to the CRS report. The results were favorable. But problems reportedly developed when the engine operated above 3,000 rpm. Webster offered to adjust the valve, but Ford declined and ended the tests. Helpful, weren't they?

Webster was officially told, "It is Ford's opinion that the Webster-Heise device is not the most appropriate means of eliminating the necessity for carburetor heat" and that "the device is not of interest to Ford at this time."

Most analysts, including the report's author, Lindahl, and Energy Committee counsel, Mason, agree the valve is still experimental. Both believe it is potentially revolutionary for auto and truck makers, and deserves a very serious study, considering the ramifications if put into operation, and it could save hundreds of millions of dollars of fuel.

Transportation Secretary Drew Lewis concurs, noting: "It could present a significant technological breakthrough with respect to pollution control, fuel economy and unnecessary costs of refining fuels to reach specific octane ratings."

The Chrysler Corporation is interested in the Webster-Heise valve and is providing the NHTSA with a car to be used in its tests.

The inventors will license the valve to any U.S. corporation and will provide at least a three-year moratorium on its use in foreign vehicles imported into the U.S.

Figure 1: Inventor Abbey installs one of his carburetors on a postal vehicle. View of partially disassembled Abbey carb shows special spools suspended in barrels by springs and levers.

The device, according to the CRS study could be retrofitted to any gasoline engine and would sell for less than $100 per unit.

The second new carburetor is a retooling of an existing type of carburetor, so low-cost remanufacturing can produce a variable venturi carburetor that is 30 per cent more fuel-efficient than what we now have (Figure 1).

2. Abbey's variable venturi carburetor.

Harold Abbey's high efficiency variable venturi carburetor delivers 30 per cent improved mileage and reduces exhaust emissions without the need for anti-pollution equipment. These are the major claims for a "variable venturi" carburetor developed by a Holmdel, New Jersey inventor. The device is currently being field tested on U.S. postal service vehicles in the New York City area.

Abbey, president of Digama Enterprises and known around the post office garage on Manhattan's West 34th Street as "the carburetor guy," claims tests on New York-area postal trucks prove his invention can increase gasoline engine fuel efficiency 30 per cent and more, and reduce emissions with EGR systems, catalytic converters or electronic controls.

Abbey, a professional engineer who holds several patents on his system, claims the fuel-efficiency improvement on his carburetor makes gasoline engines just about as fuel economical as small diesels. Furthermore, he says he has been able to adapt his idea to a number of different carburetor designs, including a pressurized, floatless model.

For a June 14, 1982 post office test, Abbey installed one of his carburetors in place of a 4-bbl Rochester on a U.S. postal service van. The truck, equipped with a GM 350-cid engine and automatic transmission, has a 12,000-pound GWV rating. The driver took it on a stop-and-go route from Manhattan to Exit 11 on the New Jersey Turnpike, for a total of 82 miles. Normally, the truck gets 3 to 4 mpg. With the Abbey carburetor, the truck produced 9.11 mpg.

This kind of mileage increase deserves attention from governments and businesses for current cost of transportation is far too high to let current inefficiencies continue.

For a June 28, 1982 demonstration, a Ford C-600 truck was used. Abbey installed one of his 2-bbl carburetors in place of the standard 4-bbl unit. The 21,200-pound GVW truck was taken on a 67-mile city and highway run, and turned in 5.6 mpg. The truck with a rebuilt 361-cid V8 under the hood normally gets 2 to 3 mpg.

According to Abbey, the key to the increased fuel efficiency is his carburetor's precise control of the air-fuel ratio — not only at cruising speeds but during idle, low speed and accelerating in the "high-efficiency venturi environment."

Abbey concedes that fuel injection, which sprays fuel in combustion zones, and throttle body injection, which intermittently sprays fuel at the throttle plates in the central air stream, do approximate proper air-fuel ratios "on a quantitative basis." But he says they fail to "uniformly" dispense, atomize and vaporize the fuel for maximum mileage and lower emissions.

Abbey says he investigated ways to perfect an automatic venturi system. His solution is embodied in precision-machined spool-like cylinders suspended in the air stream of a carburetor's barrels. Movement of the spools is automatically controlled within the air stream by a system of springs and levers.

The superior atomizing efficiency is maintained throughout an engine's entire rpm range. "The spools rise and fall about ⅓ inch, adjusting venturi throat area to maintain a precise metering vacuum."

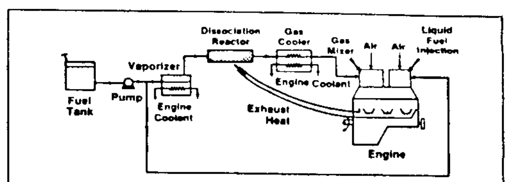


Figure 2: In SERI's methanol/hydrogen Citation, liquid methanol is pumped to a vaporizer where engine coolant boils it. The vapor flows to a dissociation reactor, in which a catalyst and exhaust heat produce the reaction CH_3OH + heat = 2H + CO. The hydrogen-rich gas is cooled and then mixed with intake air for combustion. This process combines the convenience of methanol with the efficiency of hydrogen.

Abbey explains this principle enables the U.S. postal service test vehicles to hold a much more accurate air-fuel ratio through the entire operating range. "The improved engine efficiency is what accounts for the improved fuel mileage and lower emissions," says Abbey.

The last carburetor is a vaporizer using methanol as the fuel to be vaporized and converted to release the enormous energy of hydrogen that is contained within all fuels. It sounds complicated but really it's not. Simply put, this system converts liquid methanol to a vapor, sends it through a catalyst to release the hydrogen which then propels the engine (Figure 2).

3. Methanol vaporizer.

The Solar Energy Research Institute (SERI) at Golden, Colorado has opened a new field in alternative fuels. It is testing a Chevy-Citation running on a hydrogen/carbon monoxide gas mixture derived from methanol.

Now, methanol, as we all

(continued on page 79)

not available

Brad Dennis is a combustion engineer in St. Paul, Minn.

Here's proof Detroit can build a higher mileage car

GM and Ford have plans for cars that go up to 90 miles on a gallon of gasoline

Far-out engines

BY BRAD DENNIS

We all know we are experiencing a technical revolution. Most of us have a tough time relating this to something we can understand, except when the information pertains to our automobiles. The public seems to understand the automobile better than any other instrument we use.

The thing I cannot understand is that, with all of this common sense about cars, how can most of us be fooled year after year with the shuffle of numbers about fuel mileage technology and miles-per-gallon quotes. When, in fact, there is less efficiency (horsepower per cubic inch of engine) than there was 20 years ago. For example, Chevy 327 c.i. produces 325 hp and the 427 c.i., 425 hp. Both these engines are from the 1960s.

Virtually every Japanese motorcycle engine built is over 1 hp per cubic inch of engine. Many engines are 1.5 hp per c.i. This proves we have the technology to produce efficiency but not necessarily for the high fuel-consuming automobile.

What is all of this leading up to?

There are five points that seem to prove Detroit has the ability to produce much higher mileage vehicles right now but, for some reason (and I think all of us know what that is), they refuse to produce this high-mileage engine until fuel price goes up further.

Study the following arguments of my hypothesis and you may come up with the same conclusion — something is not kosher in motortown Detroit.

Point No 1: The Ford stratified "Proco" engine

For the past few years, Ford engineers have been fudging around with a series of new stratified engines called the Proco series. Ford began looking at the gas-guzzling V-8s that were in current production and tried to come up with an alternative for improved fuel mileage still retain as much existing tooling as possible. So came the "PROgrammed COmbustion" engine instead of following the rest of the manufacturers with a transference to the diesel line.

Brad Dennis is a combustion engineer in St. Paul, Minn.

In principle, the Proco was a stratified charge powerplant, a sort of gasoline version of the diesel (see Figures 1 and 2).

All tests were done with the 5.0 litre V-8, which was fitted with direct fuel injection and operated through a process a precisely measured amount of fuel was introduced to the combustion chamber exactly at the right time. Fuel induction was processed through direct fuel injection instead of a carburetor, so the fuel and air particles could be delivered as a misty cloud.

From there, the piston, with a special combustion chamber in its dome, served to control the motion of the air and to spread the fuel charge as well as the flame travel from the dual spark plugs. This would ensure a more complete combustion process which amounts to a fuel savings of 20 per cent over that of the conventional carbureted V-8 engine.

Proco has an air-fuel ratio range from 20:1 to 24:1, depending on conditions. This is quite different from the conventional carbureted engines we use today which are around 14:1. The mix, however, at the Proco spark plug is 14:1 and gradually leans out to perhaps 100:1 or more at the extreme distant points from the plug. The Proco compression ratio is 11.7:1, but the engine runs on low-octane fuel without difficulty.

Except for having spark ignition, Proco is very close in operation to a diesel. The difference in economy of the two engine designs comes from the difference in the energy content in the fuels.

Results are so good that apparently Ford Motor Co. is dropping investment dollars in a development program towards that of diesel production. Proco engines are hoped to be in production by 1984. Ford states that mileage figures will be 20 per cent greater for the Proco over that of the conventional spark ignition carbureted engines.

What should result from this effort is a full-sized automobile that achieves over 30 mpg on the highway and an average of 25 mpg (that is, 4,000-lb + cars with 300 + c.i. engines).

With the entrance of the Proco stratified engine, there will now be two lean burn stratified chargers, the first is the successful Honda CVCC engine, which has been on the market for nine years and is a regular gas burner with none of the standard emission controls that Detroit engines supposedly must have.

All of this was leaked through manuscript and line drawing. The fact is illustrations of the actual engines had never been seen — until now. Now it's too late.

You and I will never see the intended in V-8 form, but the principle can be applied to smaller displacement engines, such as the V-6 engines Ford is now building.

To protect the engineering secrets of the Proco designs, the following ignominious demise of Proco engines illustrates the ridiculous intelligence of those great ones of Detroit. The engines were smashed with heavy hammers some time in January of 1981 in the back room of a Western American Ford dealership. All were taken from 1980 full-sized station wagons, which were their test cars for the new motors. After the photos were taken, the cast iron was sledge-hammered to death by Ford reps (see Figure 3).

Does this illustrate senselessness or the concern about this type of technology getting to the general public? Remember, the Proco design lets a spark ignition engine operate at the same efficiency of a diesel.

What would happen to our fleet mileage figures if all new 4-cylinder cars now obtained mpg figures similar to that of diesel cars? I know there would be a lot less gasoline sold annually.

Point No. 2: GM's 90-mpg auto is done, but you can't buy it. I wonder why?

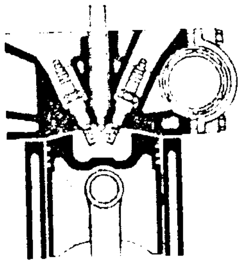
Although this production unit will probably be somewhat changed from this model (see Figure 4), the three-cylinder commuter car is certainly on its way. This example features an all-glass hatch, rear-mounted five-speed transmission and about 60 to 70 mpg at highway speeds. Under conditions of steady state 30 mph, the little toddler can register a flat 86 mpg.

This car, or its offspring, will probably be built on the European S-body (to appear in Spain in 1982-83). The displacement for the three-cylinder gasoline engine will be in the range of 1.5 to 1.9 litres.

Note: This report is from 1981. The car has yet to appear and I don't plan on seeing it for a couple of years or until we are standing in gas lines again. This proves high-mileage technology exists but will not be introduced until the controlling price of fuel goes up as well.

Point No. 3: Ford's high-mileage cars also achieve 60 mpg city

Ford has undertaken a full-scale commuter car program, one that will yield 60 mpg in the city (Figure 5). If all goes well, the new line will be introduced in the 1986 model year. The cars will be built on a mini-car platform and will carry two to four passengers.

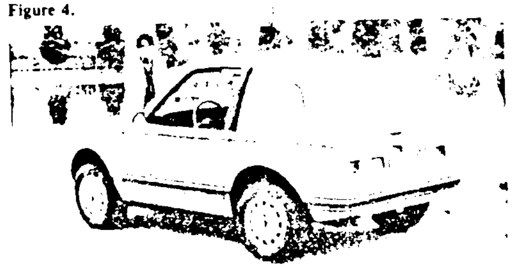


Figures 1 and 2: Proco is Ford's gamble for the future. Rear view of engine shows large valve covers and positions of two spark plugs per cylinder. View also shows throttle plate, which is open in all but idle conditions. Cutaway cylinder shows combustion chamber in piston's crown. Note piston comes right up to cylinder head.

Figure 3.

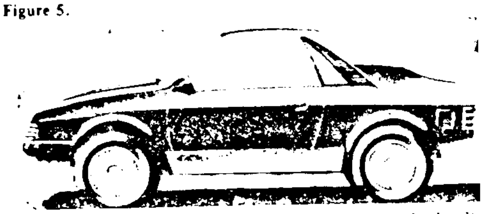
After photos of the Proco engine were taken, the cast iron was sledge-hammered by Ford reps.

Figure 4.



A three-cylinder commuter car built by GM.

Figure 5.



Ford's new commuter car model, it will yield 60 mpg in the city.

Weights of these beauties will be about 1,500 pounds for the four-seater and 1,300 pounds for the two-seater. Bodies will probably be made from fiberglass and be settled on an 85-inch (4-passenger) or 73-inch (2-passenger) wheel base. Track width should be around 4 feet.

Ford may purchase some of the components for this series from the Japanese (Toyo Kogyo and possibly Toyota), and that would probably include the power plants. At this time, there is talk of a three-cylinder displacing less than one litre. The drivetrain should be a five-speed overdrive transaxle. These cars will go head to head with the GM P-car and the front-wheel-drive S-car.

Point No. 4: Ford's 85-mpg 7-passenger Aerovan could be a big hit

The following is a press release from Sept. 26, 1981. It shows the capabilities of auto companies when they really need to produce a fuel-efficient vehicle in a depressed auto market. I hope this makes you as upset about this phoney oil crisis and the redundant lame excuses that Detroit gives on how difficult it is to produce a high-mileage utility van.

Ford Motor Co. has produced a seven-passenger Aerovan which, according to them, will take until the late 1980s to produce. Even though the van has unique aerodynamic lines and up-to-date styling, it does one thing very well which would make the van an instant success in even a depression economy: The Aerovan achieves 85 mpg on diesel and 70 mpg on gasoline. Keep this in mind. These figures are from Ford Motor Co.

The point is, if this kind of mileage can be achieved with a seven-passenger van, what kind of mileage can be accomplished with small compacts using the same type of technology?

Note: Have you noticed the lack of concern over fleet average mileage improvements

(continued on page 60)

not available

Update on Texaco Controlled-Combustion Engine

Here's a brief update on one of the engines I discussed last year. The engine is the Texaco Controlled-Combustion Process (TCCP).

As you may recall, the TCCP engine was developed by oil experts almost 40 years ago. The system proved doubling gas mileage was not that difficult, it is simply a matter of design. Keep in mind that the TCCP was an old design that didn't have the computer science integrated into it that is available today. If we use today's technology on this design, I have a strong belief that improvements could be achieved beyond what testing has shown.

Then why is this engine being kept from the public?

I let you be the judge and derive your own answers to this perplexing question. I am only the one that reports the facts.

Early one morning last fall (1981), two dark-brown, snub-nosed United Parcel Services (UPS) vans, engines throbbing quietly, stood mysteriously poised at the end of a remote, unused airport runway in upstate New York. Testing was about to begin to prove that a long-ignored engine concept was and always has been valid after all.

The identical vans, typical of the 30,000 vehicles UPS calls "packages cars," were both powered by proven but conventional 292-cu.in. General Motors gasoline truck engines. One, however, was modified to use the Texaco Controlled-Combustion System (TCCS) — Figure 1.

First proposed nearly 40 years ago, the TCCS was an early stratified charge engine. It uses directed, richer air-fuel mixtures to promote more complete combustion of a weaker mixture. Although it has proven considerable promise and obviously has distinct advantages, the engine has remained in limbo.

Why? And why, after so many years, has a giant fleet operator like UPS suddenly taken up testing and development? Further, why weren't diesels or one of the newer stratified-charge engine types — such as Honda's successful CVCC or Ford's stillborn PROCO — of interest? To get the answers, one must talk to the engineers inside this project.

The results of the independent airport testing (independent meaning without the help of the auto industry) were very impressive. There were no tire-smoking starts or screaming curves. Two 8,000-pound vans carrying 4,000-pound payloads don't exactly produce heart-pounding road tests. Instead, there was day after day of repetitious starts, stops, idling and acceleration, with the drivers periodically changing seats. In the end, however, the Texaco engine achieved over 35 per cent better fuel economy than the standard GM engine.

Later, the same vans ran identical courses of city delivery and highway driving. Again, the mileage gains for the TCCS engine were startling. They ranged from spectacular 142 per cent increase at idling to 38.1 per cent increase in delivery operations.

But that wasn't all. While the TCCS van ran most of the test on gasoline, it also ran other tests — equally successfully — on diesel, JP-4 (jet fuel), and many other unconventional fuels, thus giving these delivery vans multi-fuel capacity.

The story behind those snub-nosed trucks is really the story of two men, two companies and combined engineering faith.

Bill Tierney, Texaco's dedicated and single-minded product manager for automotive developments, has preached for years that refining high octane gasoline and high centane diesel fuel is just plain inefficient in terms of getting the greatest possible miles from each barrel of crude oil. True, premium fuels offer more miles per gallon of refined fuel, Tierney emphasized that producing them wastes much precious refinery energy.

BRAD DENNIS

ENGINES

Even in the early 1940s, he and Texaco felt that wasting fuel to pamper finicky gasoline and diesel engines was folly of the worst sort. So he began development of an engine with swirling turbulence, timed fuel injection and a new special ignition system. That combination makes the TCCS engine indifferent to octane or centane ratings. In fact, it can burn fluids you'd never think of as fuels.

Tierney quickly ticks off the stumbling blocks that have arisen each time the TCCS seems ready to be produced. In recent years, these have been the various results of hasty scrambles by Detroit to cut emissions, improve fuel economy or squeeze a few more years out of existing engines and tooling. Each situation demanded so much money and engineering time, pressed by such urgency, that manpower and lab facilities weren't available to seriously investigate any new combustion system.

Detroit hasn't had its eyes closed, however. Chrysler began investigating the TCCS engine years ago. Engines with similar characteristics have been explored by both GM and Ford. Ford's PROCO system, unfortunately, was designed for the rapidly disappearing V-8. Its effects on the small fours and sixes are minimal, unlike Honda's successful — but different — stratified charge technique. Detroit engineer may not have had their eyes closed to this engine development, but they certainly haven't had their heart into its progress either. Four years of developmental time for such a great advance in engine technology is plenty but 40 years of dragging their feet is absurd!

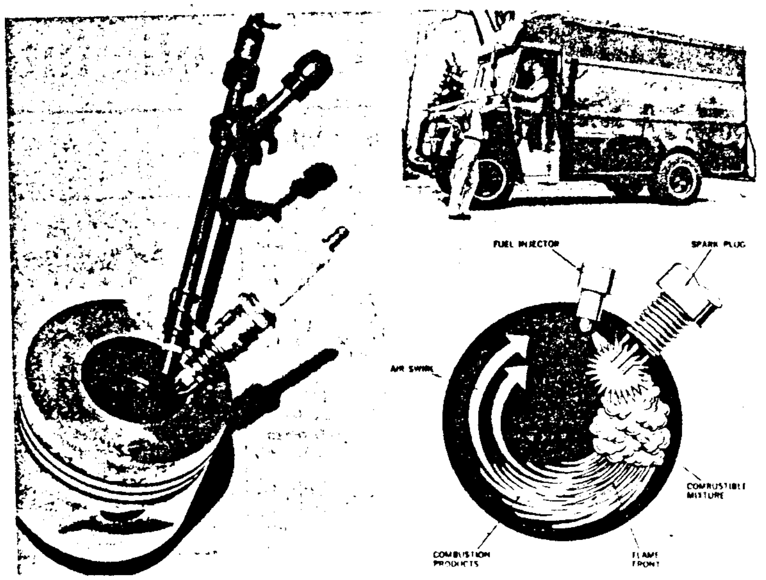


Figure 1. Closely spaced injector and spark plug create a flame front in the piston's dished area (above). Swirling air and continued fuel injection after spark termination feed the stationary flame front (diagram above), burning the fuel at a controlled rate, and eliminating octane/cetane requirements. Top photo shows Bill Tierney (standing) and Jim Lewis with one of the UPS test vans.

FIGURE 2. ESTIMATED FUEL SAVINGS — TCCP VS. GENERAL MOTORS.

Assume: Delivery vans get 10 miles per gallon and are used 200 miles per day. There are 33,000 vans in the UPS fleet.

Thus, GM 292 produces:
1. 200/day ÷ 10/gallon = 20 gallons per day.
2. 20 gallons x $1.25 gal. cost = $25 per day per van.
3. $25/van x 33,000 van = $825,000 fuel cost per day.

Vs. TCCP engine: improvement in mileage = 35% 13.5 mpg.
1. 200/day ÷ 13.5/gallon = 14.81 gallons per day.
2. 14.81 gallons x $1.25 gal. cost = $18.52 per day per van.
3. $18.52/ van x 33,000 vans = $611,160 fuel cost per day.

Estimated cost savings: $825,000 - 611,160 = $213,840 per day. $213,840 x 312 working days (UPS works on Saturday) = $66,718,080 a year.

In other words, there is a $6.48 a day fuel savings per van ($25 - 18.52 = $6.48).

Or the pay-back of the installation of the TCCP engine will be recovered in *328 days* — just slightly over a year ($2,125 cost of the engine — divided by the savings per day of $6.48 = 327.93 days).

After this one year of cost pay-back, the company should recognize a $66,718,080 a year improvement in their profit picture. No wonder the company took this project into their own hands to get the job done.

Through a giant's eyes

When you're a giant like UPS and have struggled through two fake fuel shortages, you look ahead not only at the rising costs of gasoline but also at the very real prospect that future synthetic or shale-derived fuels will vary greatly in quality. So, you'll need an engine that will run on whatever comes along, is inexpensive to maintain, and can meet some special demands that diesels cannot.

"Detroit wasn't doing anything, so we had to," says Jim Lewis, UPS's automotive engineer. Fortunately, both he and Tierney felt that UPS's thousands of GM's 292s could be converted to TCCS.

Although he is an optimistic man, Lewis has plenty of reason to worry. The company had made many conversions in the past, to diesels, and every time, the initial and maintenance costs had sky-rocketed — although the engines themselves were reliable.

But the TCCS looks good on paper. Where a new diesel engine would cost $4,000, plus a new transmission and many drive-train modifications, a new GM 292 short block (no cylinder head or accessories) would only cost $450. Totally modified to TCCS, it would cost $2,125. Better still, it wouldn't weigh any more and could be dropped right into old bolt holes with only minor changes (Figure 2).

UPS contracted with the English firm of Ricardo Consulting Engineers to do the engineering. Finally, when two complete engines were assembled, one went into Texaco's dynamometer, the other into a truck.

While the other characteristics for the original engine and the TCCS are almost identical, fuel consumption swings impressively in favor of the Texaco engine. In the field, Lewis says performance is about equal. "We've had drag races and the outcome depends on the driver."

The big advantage

Although the Texaco-engine marriage to the UPS truck appears a happy one, the engine's real future is in the widely varying fuels yet to come — fuels that contemporary stratified-charge engines can't use. Tierney says that diverse, easier-to-refine fuels are perfectly suitable, especially JP-4. That opens the possibility of running on the interface fuels — "slops," as he calls them — that result from mixing petroleum products end-to-end in pipelines. About all that can be done with such slops today is to sell them to a small refinery for reseparating.

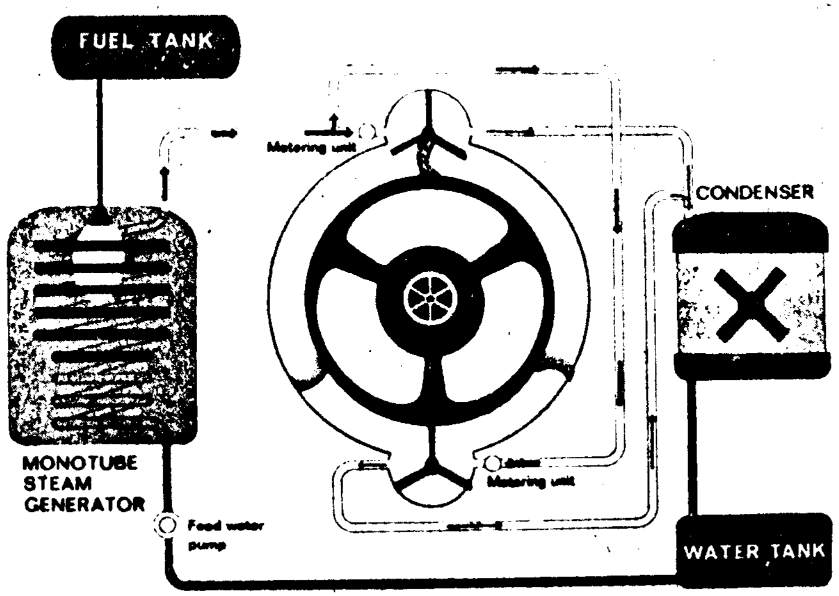
Right now, whether the Cinderella switch from the mundane GM 292 to the exciting TCCS, reverts from the coach to pumpkin at the stroke of midnight seems to hinge mainly on government "tampering" regulations. Government restrictions are always getting in the way of progressive changes, thus costing those companies creating the changes millions in red tape. Governments need to get out of the automotive business and let it progress at its own rate.

Tampering means that an approved engine has been altered. This automatically makes that engine illegal. So, even though the TCCS engine has demonstrated remarkable fuel savings and its emissions levels more than pass the requirements of all states that test for them, it is still technically in violation.

So far, under a hard-won, two-year special exemption, four TCCS engines have been tested. Ten more are under construction and 500 more are planned if all goes well.

Remember the quote from the first article on this engine from the Ford executive director, Mr. Raviolo. "Engineering changes take time but enough testing has been done and the TCCS engine will be in production in the 1960s."

Brad Dennis is a combustion engineer in St. Paul, Minn.



A batch of ingenious inventions picked from the international exhibition by European Editor David Scott

Rotary steam engine has three circular "pistons" spaced 120° apart. A pair of three-vane valves control the exhaust outlets. They divide the cylinder into two sections, where each fresh charge of steam is contained between one vane and a passing piston. Expansion in that chamber continues for about a third of a revolution. The following piston in that section then starts its cycle, while its leading face expels steam trapped in the previous chamber, when the opposite exhaust valve opens 60° later. The engine delivers six power strokes for one rotation of the output shaft. Advantages claimed are simplicity, vibration-free running, and smooth power delivery.

No April Fools' joke: Engine runs on water

(continued from page 1)

by Frances Cornish with the help of the International Energy Commission, originally with the United Nations.

A fully engineered generator would easily fit under a car hood. "At present, it takes up about a cubic foot, but we should be able to get that down to a 20 cm cube," Cornish says.

The gas tank could be used to hold the water for the generator. Other modifications required to convert a gas-driven car would be a special inlet for the gas and a new alternator to supply the hydrogen generator as well as the usual car electrical system.

Performance is claimed to be as good as a gas fuelled car, apart from minor delays in starting if the generator has been out of use for some time. A kilogram reel of wire would give around five hours driving, with a water consumption of a few gallons.

Despite the dramatic cost savings, Cornish is cautious about the immediate prospects for the generator. "Fuel is heavily taxed, and if our system caught on, no doubt it would be taxed, too," he says.

"It took years for liquid petroleum gas to make much impact as a fuel, even though it was cheaper. But the low pollution is a big advantage.

"I don't want to see the generator licensed to a single motor manufacturer. I would like it to be available to anyone who wants to fit it to his car. I'd be pleased to see a market penetration of 10 per cent over the next 10 to 15 years," Cornish says. —J.C.

High brake lights found superior

Cars with brake lights mounted at eye level and activated when you take your foot off the accelerator (rather than by the brake pedal) would be safer to drive, according to John Crosley and Merrill J. Allen of Indiana University. The reaction time of drivers following a test vehicle was cut in half with the lights, letting them stop an average of two car lengths farther away at 65 m.p.h.

General Motors' coal-burning turbine engine

Far-out engines

BY BRAD DENNIS

Sometime in the future, you may pull into a service station and ask the attendant to "fill 'er up" with coal instead of gasoline, gasohol or some tanked gaseous fuel.

But, never fear. It doesn't mean you will have to carry a shovel in your car, and stop every now and then to heave a few shovelfuls of anthracite into a firebox.

The coal is in a very fine powder that flows automatically into a turbine engine which runs as smoothly and efficiently as a liquid-fueled diesel or a gasoline-powered car.

The coal-powered car is no idle dream of some mad garage inventor. General Motors already has an experimental coal-fueled engine, called the AGT-5. It has been installed into a production vehicle for testing.

Meanwhile, other companies are taking hard looks at coal as an automotive fuel of the future. For example, a Conoco spokesman reveals the company is now planning research to develop a coal-based liquid fuel. The project, still in the "drawing board" stage, is too new for any further elaboration at this time.

In any case, the re-evaluation that an internal combustion engine can, in fact, run on solid rather than liquid fuel is especially intriguing because, superficially at least, it seems so impractical. In light of the increasing cost of petroleum-based fuels and the eventual depletion of cost-effective petroleum reserves, the abundant coal reserves look ever more attractive as alternate fuels.

Coal can be used as is, except for pulverization or solvent refining, or it may be converted into liquid fuels including synthetic oil, distillate, gasoline/diesel fuel and methanol.

Chart 1 shows the percentage of energy available after processing. Note that powdered coal retains the highest available energy — a remarkable 95 per cent — which is even significantly higher than for solvent-refined powdered coal.

The key to powder power as it is related to automotive fuel came with the recent development of powdered coal having extremely small particle sizes. It was the availability of such small-particle-sized coal that fired the imaginations of GM engineers and led to the invention of a prototype solid-coal-fueled turbine car engine (Figure 1).

In the past, powdered coal has been produced in the size range of 50 to 75 microns but it is much too large for use in existing oil-fired utility boilers and automobile engines. There was a need of finer coal that would burn more like a liquid fuel. Recently, the coal industry found a way to further pulverize coal so it is even finer than powdered sugar. Average particle sizes in the order of three microns are now feasible.

Just how small is a three-micron particle?

It takes 1000 microns to make a millimeter, and 25.4 millimeters to make an inch. Thus, a simple calculation reveals that 25,400 three-micron coal particles placed side by side would form a line only one inch long!

The extremely small particle size is important because the total surface area is greatly increased as a solid is pulverized into ever tinier particles. It is this increased surface area that makes the powder far more combustible than larger chunks of the same material; in this case, coal.

The reason a combustible material of *any* type (gasoline included) becomes more combustible as its particle size is reduced is that oxygen can get to larger surface areas to effect faster oxidation or burning.

Let's assume we have a one-cubic inch chunk of coal and pulverize it into particles having a three-micron diameter. To make calculations easier, assume the particles are perfect spheres. A small cube of coal having only six square inches of surface area would yield more than one trillion, 159 billion particles, which would have a total surface area of about 50,812 square inches! Small wonder it burns so easily.

Other advantages are gained when the coal is finely pulverized. In particular, it is possible to remove a large portion of the ash and sulfur in the coal to cut atmospheric pollution, and to reduce erosion and the formation of deposits on the interior parts of the turbine. A "solvent refining" process is used to lower the ash and sulfur content before the coal is pulverized.

Cost savings are anticipated if the powdered-coal automotive fuel system can be perfected. It's claimed that the price of coal in the form of a cleaned fine powder is about *one-half* the current price of the equivalent energy in gasoline! Another advantage of powdered coal, according to the coal industry, is the small capital investment required to process it compared with that needed to produce liquid fuels from coal. The method of distribution to consumers would need to be worked out, but GM envisions it would be similar to the bulk liquid fuel distribution system used today.

The AGT-5 turbine, developed by General Motors, was first demonstrated in June, 1981. Installed in a production vehicle, it is comparable in output to a small V-8 engine, although it weighs considerbly less.

The engine is equipped with an on-board computer to control combustion to achieve fuel economy nearly equivalent to that of a small gasoline V-8. It's said the driver and passengers experienced no noticeable difference in the AGT-5 fueled by powdered coal compared to running it with liquid fuel.

The finely powdered coal is stored in a fuel tank located in the engine compartment above the right front wheel. That location should permit larger luggage space in the rear of the vehicle and eliminate the need of long fuel lines. A metering fuel pump, aided by an engine-driven air compressor, transports the powder in a steady stream from the tank to the engine. Mechanical vibrators in the fuel tank assure smoothly controlled flow of powdered coal to the engine.

The combustion system of the AGT-5 consists of a turbine burner, a fuel-injection nozzle and an ignition system. A liquid fuel pilot, ignited by an electric spark, in turn ignites the powder as it enters the burner. A small amount of liquid fuel is stored on board for the pilot.

If you study the engine flow chart, you'll notice there is a small electric compressor attached to a reservoir fitted with a pressure switch and solenoid switch. This provides enough compressed air to get the coal powder flowing during the start-up period. Thereafter, a second air compressor attached to the turbine provides the compressed air used to transport the coal from the fuel tank to the turbine. This air passes through a cooler before it is recycled back to the air compressor (Figure 2).

Well, there you go. The boys from Detroit can construct a technical advancement instead of creating complicated add-ons to the outdated internal piston drive engine. There is a serious need to develop this design further and that has to do with the fuel supply itself. Research information that I have compiled indicates today's current reserves of coal, at present demands, could supply us with energy for the next 2500 years Remember, this is the year 1984. □

Brad Dennis is a combustion engineer in St. Paul, Minn.

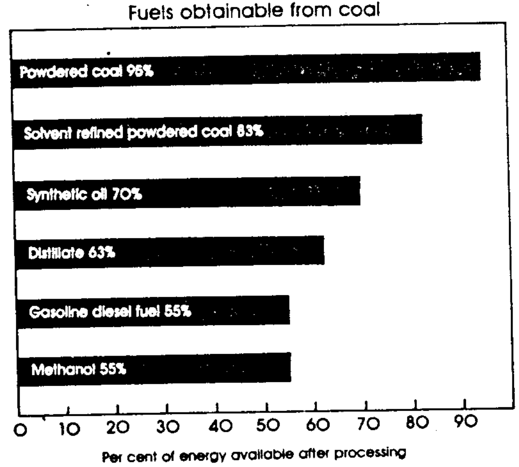


Chart 1. Coal-burning turbine. The chart shows the variety of fuels that can be obtained from coal.

Figure 1. GM's AGT-5 turbine burns powdered coal.

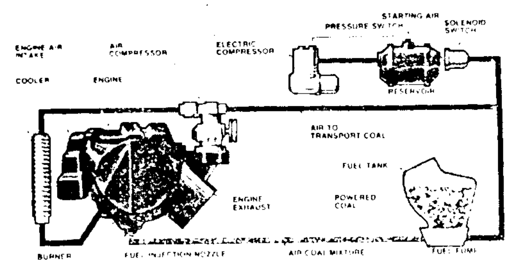
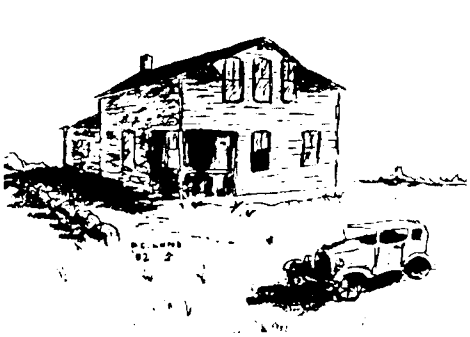


Figure 2. Flow chart showing how powdered coal is moved from storage tank to the turbine engine.

Country memories

By D.C. Lund, Taber, Alberta



"Things looked good when Mom and Dad bought the big house and the new car. Then the market for grain started dropping and for several years it was too dry to raise any good crops anyways.

"By working for the CPR, Dad was able to hang on to the house and part of the farm, but it was so bad they couldn't afford gas or repairs for the big car Dad was so proud of. Dad had to ride a horse to go to work and, if he took the family, he hooked the team to the car and drove to town that way. There were lots of nice cars being pulled by a team of horses — 'Bennett Wagons' they called them, but I guess it wasn't really the prime minister's fault."

D.C. Lund lives near Taber, Alta. and breeds Welsh Black and Simmental cattle.

R. SCHAFFRANKE REPORT:

The last observation, in connection with the newly developed "plasma ignition" system BAUR, (a novel high-energy, capacitor-discharge ignition system for all spark plug ungines) in Europe has shown such dramatic results that the planned introduction of the antiquated U.S. catalytic converter in the car exhaust systems for Western Europe might be cancelled.

A development in West Germany replaces the conventional spark ignition (with the help of special condensers and plugs) by "plasma ignition", increasing ignition power from 20-100 mW, to 24,000 mW and ignition temperature between electrodes from 2,500 degress C., to more than 6,000 degrees C.

This unusually effective and economic combustion process permits also the injection of water for additional energy yield, about one part H_2O to fifteen parts of gasoline. This combination in turn allows use of considerable leaner fuel/air mixture, the introduction of the so called lean engine technique.

The combination of fuel-magnet, plus plasma ignition (for spark plug engines only) plus water vapor injection leads to the following results:

1. Drastic reduction of fuel consumption.
2. Reduction of harmful exhaust emissions.
3. Much extended engine and exhaust system life.

The entrance into these practical applications was provided by spinoffs from the space program as well as from the use of "shelved technology" from the U.S.A. and from Europe. Even a Canadian invention, the air-intake-atomizer of the late Andrew Maguire, belongs to this category. Since the new technology can also applied, in part at least, to home and industrial heating units using carbohydrogen fuel, as well as to heavy machinery and ship engines, the potential export value of such a private research institute in this area could indeed be very substantial.

Big-name, long-established companies have long abdicated the main part of their research initiative to government planners and we no longer can look to them for leadership. Some time ago, a U.S. Senate Committee revealed that of the 61 most important inventions since the turn of the century, 40 were created by individual inventors!

They were not conceived in the "think-tanks" of mammoth organizations, but by single individuals not connected with the scientific establishment.

The spectre raised by allowing these developments to slip through the fingers of American technology and industry is both disturbing and even tragic in terms of U.S. technological leadership and prestige for peacetime technology applications.

Alas, it also presents a golden opportunity to smaller, more openminded countries for spectacular breakthroughs of global importance in the field of truly innovative energy technology, especially for so-called Third World countries which cannot afford today's high prices for oil and oil products dictated by energy cartels.

Experimental, commerical magnet fuel units for all gasoline and diesel engines can be ordered for engines up to 2 liters (most compact cars), only $32.00 ppd.
For all larger engines, including diesels and trucks, $36 ppd.

These magnet fuel units are based on patent 4,372,852, issued 2-8-83, titled Magnetic Device for Treating Hydrocarbon Fuels. The units are manufactured by the largest magnet producer on the West Coast. They have to be inserted into the fuel line close to the carburetor or diesel injector pump. Complete with instructions.

Order from: R.S.
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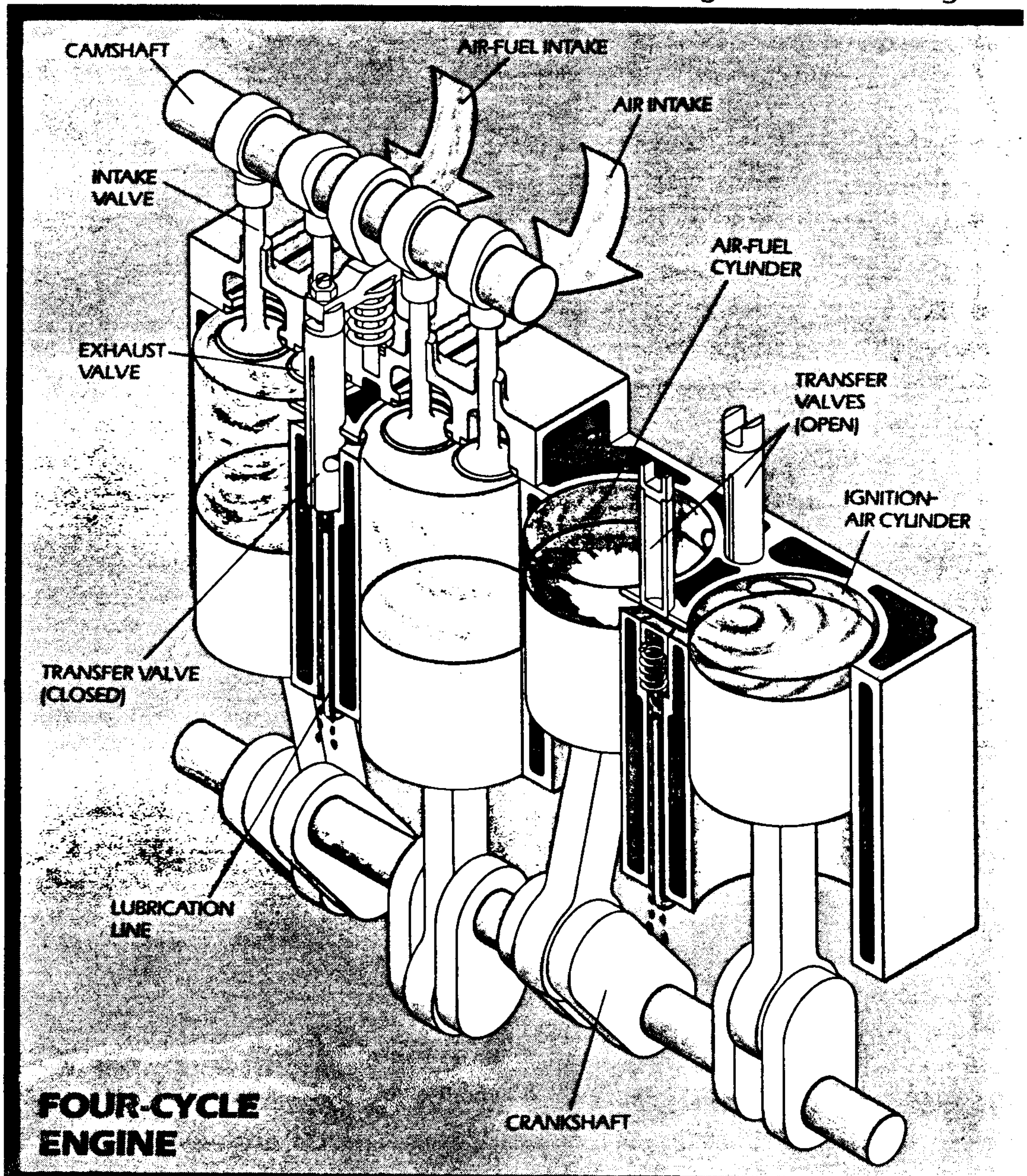
NEW CYCLE,

The gasoline and diesel engines were both patented
next great breakthrough in



Simplest Gerace engine is an in-line Four in which alternating cylinders compress air only (as in a diesel engine) and an air-fuel mixture (as in a gasoline engine). When the highly compressed air becomes hot enough to ignite the fuel, transfer valves between adjoining cylinders open, allowing combustion to take place. The ignition-air piston leads the air-fuel piston by 40° of crankshaft rotation. Except for the transfer valves, all other engine hardware is conventional.

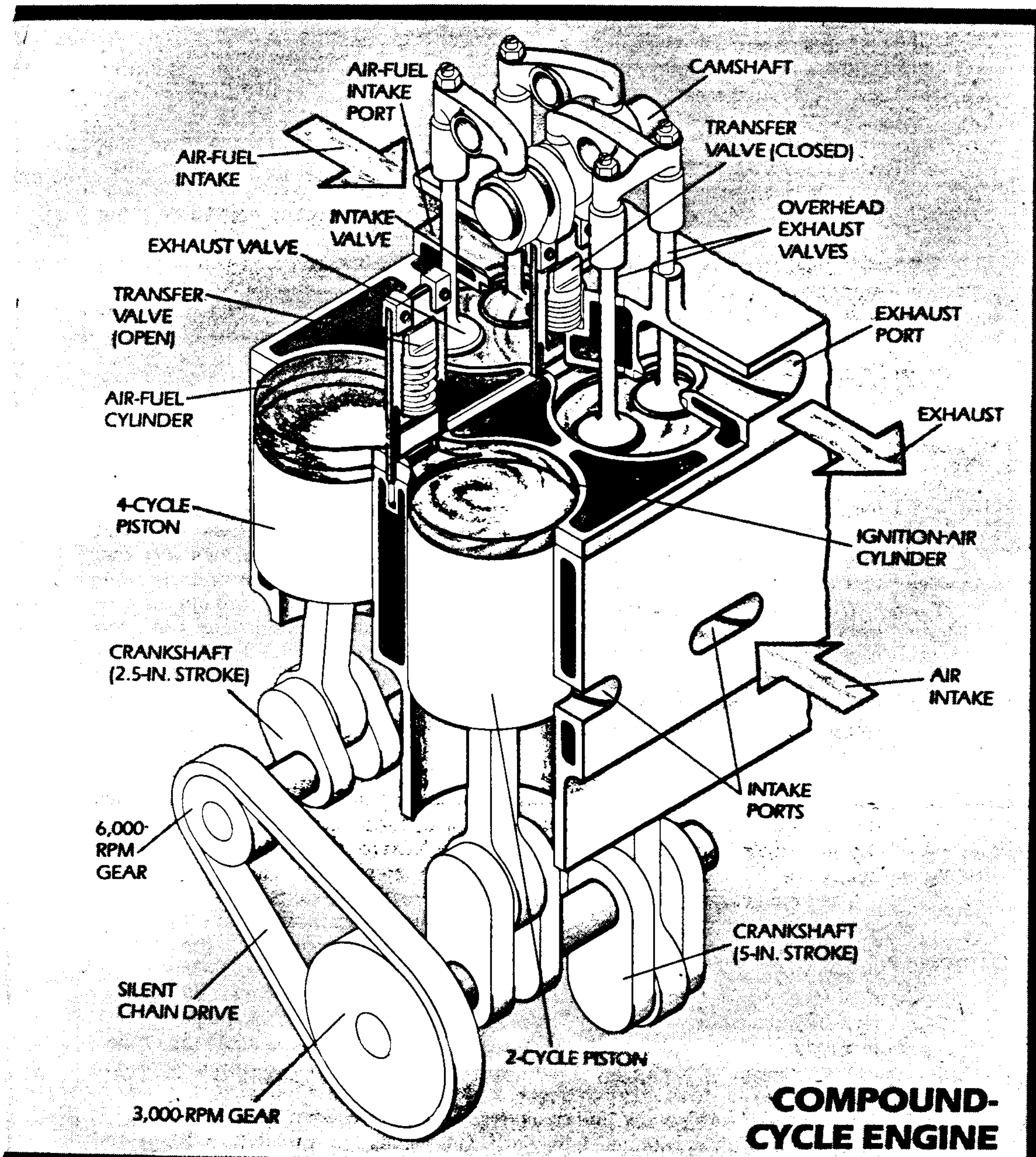
BY MARK WALLACH
Illustrations by Robert Rothe

The gasoline engine was patented in 1866, the diesel in 1892. PM has just had an exclusive preview of the Gerace engine, the first real breakthrough in internal combustion design in this century. The U.S. Patent Office has issued Anthony Gerace a process patent not just for another mechanical variation on the gasoline or diesel themes, but on a whole new combustion cycle. To fully understand the Gerace cycle, a little history is in order:

In the beginning there was steam, and it was good. The external combustion engine was crude, but it did its job and pulled the 19th century into the industrial age. External combustion is almost a forgotten term now, but at one time that was the only engine available

NEW ENGINE

in the 19th century. The Gerace engine may be the
piston engine technology.



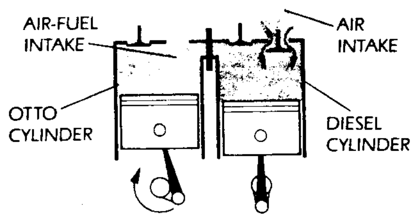
A more complex variation on the Gerace cycle is proposed in this Square-Four engine. Here, the air-only pistons operate on a two-stroke cycle at half the speed of the four-stroke air-fuel pistons. Side intake ports and overhead exhaust valves are adapted from a common industrial diesel design. The parallel crankshafts are linked by a "silent" chain drive similar to that used in some GM front-drive transaxles. The process patent covers any and all mechanical means of achieving the Gerace cycle.

after the water wheel. Water boilers heated by coal or wood developed steam that was piped to a cylinder and piston. The expanding steam drove the piston down and a connecting rod and crankshaft turned a flywheel. The steam was admitted to the cylinder by a sliding valve operated by a young boy pulling a rope back and forth.

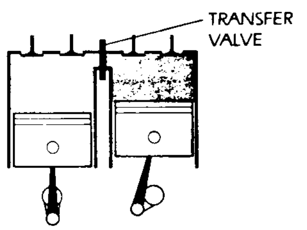
One boy, being lazy, designed a mechanical linkage to do the job for him automatically. His name was James Watt and his invention allowed the steam engine to operate at higher speeds and become the prime mover in the industrial revolution after 1840.

The burst of creative talent that followed the development of the steam engine ushered in a golden age of invention with countless tinkerers burning the midnight oil inventing. That oil was kerosene and other high-end petroleum products from Pennsylvania wells, which were

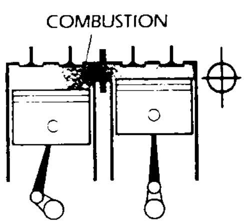
The Gerace Cycle



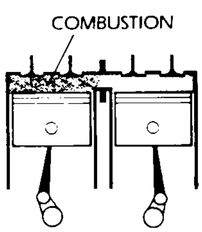
1 Otto cylinder draws in air-fuel mixture while diesel cylinder draws in air only.



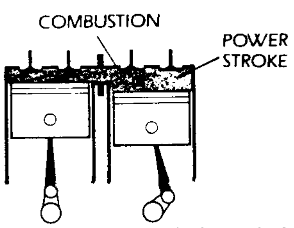
2 Both cylinders begin compression strokes while the transfer valve is closed.



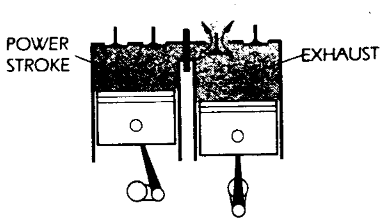
3 Combustion begins when transfer valve opens and hot air meets air-fuel mixture.



4 Combustion continues across Otto cylinder as diesel cylinder begins its descent.



5 Expanding gases travel back through the transfer valve and into the diesel cylinder.



6 Transfer valve closes; exhaust stroke begins in diesel, followed by Otto cylinder.

originally drilled for water but accidentally hit sub-surface oil deposits. Some distillates were lightweight and very fluid. When put in a confined space, they could burn instantaneously and explosively.

Otto and diesel cycles

The process, when finally developed, was called "internal combustion." The words describe the process completely. The sliding steam valves were not compatible with the new combustible fluids, but all of the basic engine components were there: cylinder, piston, connecting rod, crankshaft and flywheel. An idea whose time had come was put together into a brilliant concept by Nikolaus August Otto in 1866. His concept, the "Otto cycle," had two valves in each cylinder and the familiar four-stroke cycle of intake, compression, power and exhaust.

If the fuel mixture burned in the Otto cycle produces more force than that needed to operate the valves, rotate the crankshaft and overcome the friction of the various moving parts, then the surplus force can be used to operate machines. The four-stroke Otto engine has dominated all other engine types because of its ability to be engineered to user requirements from power generators to racing cars.

When air is compressed it gets hot because the molecules rapidly collide in a confined space. Rudolf Diesel used this basic physics law to increase the compression ratio of an engine and compress only air with a piston. At maximum compression, fuel oil was injected into the combustion chamber and the heat of the air started burning the oil. The piston was pushed down by the expanding gases and power was applied to the crankshaft.

The high compression ratio and mechanical shock of the burning oil made the diesel engine slow-turning and very heavy, but using cheap oil that was a byproduct of gasoline refining made it perfect for ships, power stations, trucks and industrial applications. Diesel cars are popular in countries where gasoline is heavily taxed.

Over the years, many mechanical designs have been patented following the basic Otto and diesel principles, including two-stroke variations of both cycles, the Wankel engine, swash plate rotary engines, engines with two pistons in each cylinder, Chrysler's 30-cylinder tank engine, radial aircraft engines with 18 cylinders, and rotary aircraft engines that have the crankshaft bolted to the firewall and the cylinders rotating around it!

The Gerace engine is different from all the rest preceding it for over 100 years. Tony Gerace, a machine designer from Towson, Md., has looked at the Otto and diesel cycles from a new viewpoint and has been issued a process patent for the "Gerace cycle." The granting of a patent does not in itself guarantee success, only that the concept is new, unique and has not been done before. The elegance of the Gerace cycle combines design details of the past with the potential to be the engine of the 21st century in many shapes and configurations.

Hybrid cycle at work

In its simplest form, the cycle uses two cylinders side by side and a common crankshaft with traditional connecting rods, pistons and valves. One piston leads the other by 40° of crankshaft rotation. The lead piston is in a cylinder that compresses only air, like a diesel engine, and the trailing piston is in a cylinder that compresses fuel and air like an Otto engine. Between the two cylinder heads is a passage blocked by a slider valve, similar to those used in steam engines. Gerace calls it a transfer valve.

The compression ratio of the diesel cylinder is 20:1, the Otto cylinder, 8:1. The diesel piston reaches top dead center first, the air becomes very hot, the transfer valve opens and the high-pressure hot air flows through the connecting passage and into the Otto chamber. The hot air starts the mixture burning. The diesel piston begins its downward stroke while the rising Otto piston forces the expanding gases back through the transfer passage to mix with the remaining air in the diesel cylinder. This interaction of the pistons allows the mixture to burn in a chamber of constant volume, utilizing all the latent energy in the fuel.

After both pistons have begun their power strokes, the transfer valve closes. When the pistons reach the ends of their strokes, the exhaust valves in both cylinders open to expel the burned gases as both pistons begin to rise. When the pistons reach the top of their strokes, the exhaust valves close, the intakes open and the cycle starts again.

Why is this engine so interesting? It has solved several limiting design and thermodynamic problems that have perplexed engineers for years.

Normally, the fuel/air ratios that can be burned in an Otto cycle engine are quite narrow. If there's too much fuel, there's not enough air to support combustion. Too little fuel and the mixture will not burn. With the air/fuel mixture premixed in the Otto cylinder of the Gerace engine, almost any mixture ratio will burn due to the hot air igniter.

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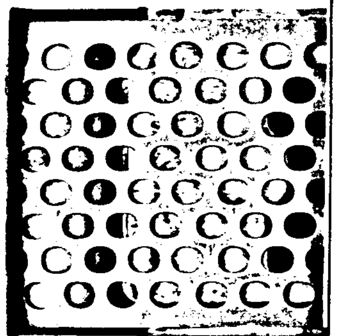


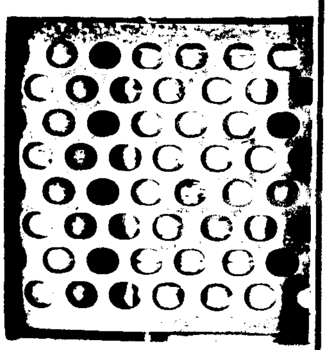
NEW CYCLE, NEW ENGINE

(Continued from page 92)

The ability to increase the thermodynamics efficiency by consuming all of the fuel gives a higher output with little or no pollution. Cheaper grades of fuel can be made to burn, down to powdered coal. As envisioned, the engine does not use diesel-type, high-pressure fuel injection, electrical spark ignition, high-octane fuel or lead additives.

Realizing the concept

The current status of the project is beyond theory. That was proven by computer analysis to be valid, and reviews by engineering teams confirm its advantages. A test engine is being built from standard industrial diesel components. There is no interest in going public with stock offerings or quick-buck "investment" schemes. For the 17-year life of its process patent, the Gerace Cycle Group will have a lock on any mechanical means used to achieve the Gerace cycle, and the blue-sky engineering types are taking it to the limit, first spinning out variations of common in-line designs employing familiar gasoline engine hardware. In wilder permutations, one cylinder of each pair operates in two-cycle mode while the other turns at half speed through four cycles (see illustration on page 90). The design was then extended into opposed-piston units in which the piston crowns become the combustion chambers. The ultimate design has its cylinders arranged in a circle. The connecting rods push against a rotating disc with a wavy cam contour. This package is likely to have aircraft applications.



The Gerace cycle needs much development work to operate as envisioned. One of the major questions is the design of the transfer valve. It has to sit in an almost leak proof chamber, open quickly to allow the very hot air into the Otto cylinder, take extremes of temperature and resist wear. Water and oil cooling should keep temperatures below those of today's exhaust valves. With all of the aerospace materials and wear-resistant coatings now available, the problem can be resolved.

The Patent Office is filled with designs that could not be made to work because the necessary materials were not available. The Gerace engine has luckily emerged at a time when all of the help and material is available thanks to a research program being developed with the aid of Johns Hopkins University in Maryland.

The development of a prototype is a slow step-by-step program. Since the work has no precedent, it's a change-one-thing-at-a-time job. This takes time and money, and again the Gerace cycle

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NEW CYCLE, NEW ENGINE

(Continued from page 134)

is lucky to be developed by a technical group and not a commercial company pressed for quick results.

The two-cylinder test engine now under construction uses major components from a large two-stroke diesel engine with overhead exhaust valves. Since the parts are stressed for diesel loads, the Otto cycle cylinders will be able to operate without undue stress. The cylinder head is being modified to connect the two combustion chambers with a transfer valve, whose timing can be varied for further experimentation. Testing should start this fall and PM will be there to cover it.

Application possibilities

The aircraft use of the Gerace engine has interesting possibilities for a piston engine with no ignition system that could run on jet-type fuel. It would give higher performance and run quieter than conventional engines. A muffled version holds the hope of silent operation for military use, in police helicopters or in commercial flights over populated areas. Business aircraft with quiet props and engines may be possible using lower-cost fuels.

Operating costs of stationary engines running 24 hours a day year after year become very important. Saving even pennies per hour can make a new engine attractive. Gerace believes that a clean coal-burning engine would be an ideal alternative for nuclear power plants. He is presently working on an engine for locomotives, ships and stationary power plants that could burn dry powdered coal.

The conversion of fuel into energy is presently restricted to narrow bands of fuels that will burn in conventional engines. Any liquid fuel, and even powdered fuels such as coal or wood dust, can be made to rapidly burn in the Gerace cycle. If the fuel has a high ignition level, then the compression of the diesel cylinder is raised to get the charge burning. Detroit engineers who've seen Gerace's patent note that the added manufacturing cost of the transfer valves will be offset by the lack of an ignition system. The use of lubricating fuels could also extend engine life and reduce maintenance.

The engine's final destiny may have little to do with its design, only economics and the availability of fuel in the 21st century. It took decades for the Otto and diesel engines to be developed into useful machines, and they are still being perfected today. If the Gerace cycle proves more powerful, cheaper to operate and has the running life of today's four-cycle engines, then it will be the prime mover of the 21st century. PM

Fuel vaporizing kit lets engines run on everything from gas to manure!

Far-out engines

BY BRAD DENNIS

The research facilities of Sedona Corp. are just off the runway in a converted airplane hanger. The young firm's architects have struck out on a business venture that, if successful, will make Sedona the corporate embodiment of its city's mystic 'glitches.'

The firm will try to reduce the impact of two major disruptive influences in our lives, air pollution and oil dependence. It's an area in which most everyone can stand to be 'rejuvenated.'

Sedona is a classic penny stock company. The firm has no earnings, no sales and no manufacturing or marketing capabilities. But, from the way its founders talk, they are moving forward on all fronts. The firm does have a glitzy story, a prototype, a set of optimistic leaders and promoters. They all get a twinkle in their eye when they speak of how vast the potential market will be.

Sedona went public through a shell corporation in August and is boasting of a revolutionary new technology they say will slay one of the great monsters of modern times — the gasoline engine. The beast that pollutes our precious air while consuming our most precious resource is about to go into battle with Sedona's VIP (vapor injected power converter). It's a patented automotive engine conversion kit.

The kit replaces the intake manifold, fuel and electric system of a car and lets the standard gasoline engine run on any one of several fuels including natural gas, butane, propane, gasoline and low-grade alcohol. No hardware adjustments beyond the flick of a switch are required to shift from one to another.

They say it will also run on such fuels as sunflower seed oil, soybean oil and liquified cow manure but the more exotic energy sources are not expected to provide major markets.

In its 15c2-11 form filed with the Securities and Exchange Commission, the firm states its engine kit is now in the late stages of development and will "reduce fuel costs, increase mileage by up to 60 per cent and prolong engine life."

Sedona's balance sheet is basically made up of costs, a patent in which the firm paid about $5 million recently and $500,000 cash. A group of four unnamed investors put up most of the money for the patent purchase. President Harold Allred said, "Sedona can count on its benefactors to put it through an expected period of nine more months before production begins.

"We have established a line of credit for additional funds that we might need," he said. "We also have been promised funding on an as — if and when — needed basis."

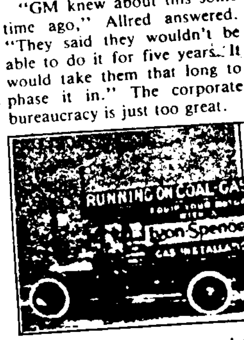
The company's four financial backers received 28 million shares for their $4.9 million contribution to the Sedona balance sheet.

Most of the money went for the acquisition of U.S. and Canadian manufacturing and marketing rights for the kit which were purchased from Mixel N.V., a Netherland Antilles corporation.

Mixel purchased the patent from New Providence Trust BWI for $8.5 million last May. Providence purchased the technology from inventor Rod Smith. Sedona also has a 1-year option to purchase the patent outright. There are a total of 51 million shares outstanding, with a float of 11 million. The 40 million restricted shares are tied up until August, 1986.

The questions are: Is this conversion kit really the answer to pollution and fuel problems? Are the markets so large and, if so, why haven't the research labs of Ford, GM or Mercedes Benz come up with a similar system?

"GM knew about this some time ago," Allred answered. "They said they wouldn't be able to do it for five years. It would take them that long to phase it in." The corporate bureaucracy is just too great.



Before natural gas was used to power vehicles in the 1920s, coal gas was used.

One knowledgeable penny investor who has seen the VIP and investigated the Sedona story said, "If it's a scam, it's a damn good one."

Dean Anderson, president of Inovion Corp., is also designing a high-performance engine at his firm. When asked about the viability of such an engine modification kit, he said, "It's hard to say. Even if I saw it, I couldn't necessarily say one way or the other. It's one of those things where it's easier for them to make it work and then show the world. Even then, they may have a technology that is hard to protect.

"We have a patent but it's safe to say there might be a way around it, but it won't hurt our company, because it will take years for someone to develop a similar system and even then, they won't be able to dent the market. They would probably move into the field with a new car product. That would still leave all the other new cars and all the used cars."

Simply put, the Sedona kits will be designed to improve on the versatility and efficiency of the relatively prehistoric fuel-burning processes of the modern-day engine.

"A widely known but well-kept secret is the fact that today's internal combustion engine is 30-per cent efficient at best," — the firm states in its 15c2-11. "In addition to improper vaporization of the fuel, the design of today's engine is another major drawback. Invented more than 100 years ago, it still is designed to operate on the same theory. For the most part, it remains unchanged and has not reaped the benefits of modern technological discoveries."

The VIP System takes the gaseous fuels and delivers them to each cylinder by sequential injection. The special injectors are designed for the viscosity and pressures of various fuels, and are controlled by an on-board microprocessor. The computer monitors revolutions per minute, acceleration and five other engine readings to guide performance.

"By monitoring various engine functions it has the ability to control timing, fuel distribution and other important functions so as to constantly operate at optimum performance under a variety of conditions," the Sedona 15c2-11 states.

Allred added, "It's like having a mechanic under the hood tuning the engine at all times."

The stated advantages of the engine kit are longer life, less frequent oil changes, less maintenance, less air pollution and the availability of an abundant fuel — natural gas.

The raw gas that frequently accompanies oil finds is targeted as the primary fuel for use with the converter because it is cheaper, cleaner, less dangerous and more plentiful than gasoline.

It has been used in Italy, Canada, France, Great Britain and Australia. It is now being introduced into the USA by the American Gas Association, the Aluminum Corp. of America (which makes lightweight aluminum natural gas storage cylinders) and a number of regional gas utility companies.

The gas companies have been developing their natural gas vehicle program for about three years now, said Dave Pearce, the coordinator of the compressed natural gas (CNG) vehicle program for Wisconsin Gas.

"It is the only area that offers a whole new load for the industry," Pearce said. "It is a constant load and is not seasonal. It allows for better utilization of existing distribution systems. In short, it makes sense for us to pursue. We are just getting through the birthing stage now."

Thus far, the thrust of the utilities conversion efforts has been directed toward fleet users because individual car owners have no way of fueling up. But small, consumer-sized compressors have now come to the market and utilities are making refueling stations available to the public. Still, fleets that can justify the installation of $100,000 refueling stations remain the most promising domestic market for the product to date.

Sedona fuel vaporizer

The V.I.P. engine conversion kit is shown attached to a Cadillac engine (right). The 1985 Cadillac Seville pictured above is equipped with the V.I.P. system for actual road testing.

Pearce has converted four fleets of school buses and several pilot programs for industry and government organizations. The East Ohio Gas Company has 755 vehicles converted and reports it will save $500,000 a year.

In certain countries, including Canada, many gas stations carry natural gas pumps and the government has made a big push toward conversion. The Canadian government gives extensive tax credit for conversions of vehicles and the installation of natural gas refueling equipment. All U.S. state owned vehicles will be converted to natural gas operation within a year, beginning Jan. 1 of this year.

"We were in Canada recently," Allred said. "I was amazed at how much more receptive to it they are there. They see the big picture, they've lived with it for a time and they say we get the economy but we really don't get the power. In a basic conversion, there is generally a 10-per cent loss in power. When we say we can give them that power, they understand what it means.

"A cab company called Black Top Cabs has converted its fleet." He added, "We rode in one and the cabbie told me it costs $18 to go 200 miles compared to $42 with gas. The owner of the cab company said he saves $34,000 from tax credits and savings on maintenance."

Currently available natural gas conversions allow vehicles to get the same mileage as they would on gas. Savings arise from natural gas cost of about 66 cents a therm, a measurement roughly equivalent to a gallon of gas.

The average price of a standard conversion is between $1200 and $1500 which is earned back within two to four years, according to research.

The key to the Sedona kit will be how well it improves on the efficiencies of fuel use. Allred said he plans to sell the units for $2000 to $3000. Initially, the product will be adapted to the Cadillac engines and sold through new-car dealers as an optional, after-market conversion kit.

Sedona's success will hinge on how it improves on mileage in vehicles that run on both natural gas and regular gas. The inventor of the VIP System, Smith, now a consultant with Sedona is not saying exactly how well his engine will perform, instead he's going to let the Environmental Protection Agency (EPA) do his talking for him.

Within the next three months the product will be placed in 10 vehicles and tested by an EPA testing facility at Santa Clara University in the U.S. Smith would say only that he expects a substantial increase in performance and decrease in pollutants for engines run on natural gas.

The Sedona team realizes that its product and claims strain the limits of believability. To combat the skeptics they've put a prototype on a trailer and now wheel it around to various parts of the country.

When Allred displays the modified Cadillac engine, he does so as a magician might. His manner seems to say nothing up my sleeve, as he plugs the engine into three types of gases and two liquid fuels. Curious nonbelievers sniff the various gases, and after running the engine on gas and alcohol, Allred drains a small ration of each one from the engine for all to examine.

Allred, a Chevrolet, Oldsmobile and Pontiac dealer in the Sedona area, met up with inventor Smith seven years ago, when Smith needed $10,000 to continue to develop a more efficient fuel system for high-performance boat racing. "The problem we started with was how to get more fuel and more horsepower out of less fuel storage," Smith said. When the inventor's initial research had tapped out all available sources of cash he came to Allred.

"I know automobiles and this just clicked right away," Allred said. "They all thought I was crazy but I could see it made

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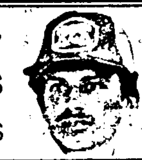
Smokey's new hot vapourizing engine creates heat in Detroit

Far-out engines



BY BRAD DENNIS

What engine is smoother than an electric motor, meets all emission standards without electronic equipment, produces 2 horsepower per cubic inch of engine, can deliver 60 miles per gallon and only weighs 170 pounds?

Well, it's the development by a researcher I've written about in previous articles — Smokey Yunick.

This article updates the status of Smokey's Hot Vapor Fuel System. That's right hot vapor fuel. I've hammered at this theory in a number of articles for over two years.

This little motor really is a GM V-6 engine block cut down to a V-2 cylinder. It's turbocharged and feeds hot air and vaporized fuel to its cylinders. One of the most unique aspects of this design, as well as having GM engineers talking to themselves, is that this hot vapor system operates so there's no detonation (see Figure 3).

The first thing that strikes you about this engine is its size. "Seventy-eight cubic inches and 170 pounds," says Smokey. Another surprising thing. There's *no* cooling fan. In fact, there are only two quarts of water in the entire system, including the tiny radiator.

Smokey calls it his "Phase I adiabatic engine." Adiabatic is an engineering term that refers to any process in which there's no gain nor loss of heat.

A completely adiabatic engine isn't possible, but, the closer you get, the higher the engine's efficiency and the better the fuel mileage. In other words, the less heat energy generated by the burning fuel that you throw away through the exhaust and cooling systems (much like the vehicles we all drive today), the more energy there's available to move the car.

The secret is in the plumbing

Despite its obviously sophisticated makeup, the engine is surprisingly simple. Don't look for exotic materials, novel mechanical linkages or unique structures. You won't find them.

Although the experimental engine is hand-welded from aluminum, that isn't the way a production unit would be made.

The accessories, including the carburetor, are mostly pickups from around his shop. There are no electronic devices. Smokey prefers to avoid them. So, his engines run with simple carburetor and breaker points. Yet, the system fully meets all emission standards. Consequently, manufacturers could eliminate all those expensive, ridiculous converters and air pumps.

The secret of the engine's remarkable performance is its unique three-stage heat recovery system, which accounts for the strange-looking plumbing.

Brad Dennis is a combustion engineer in St. Paul, Minn.

Figure 1a.

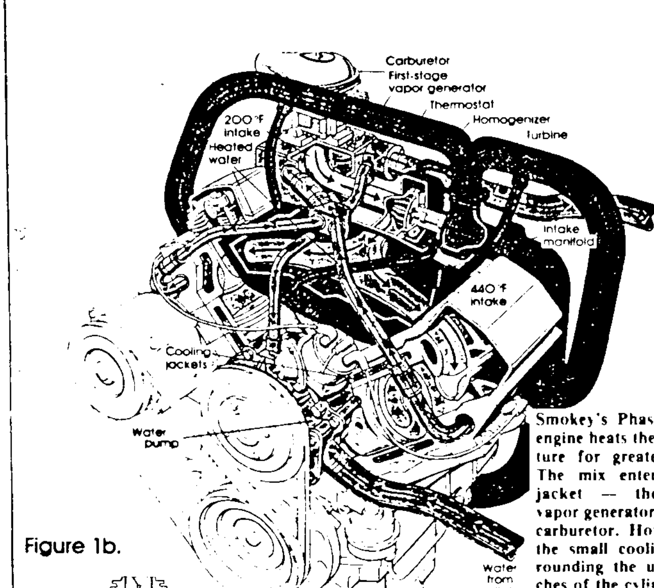
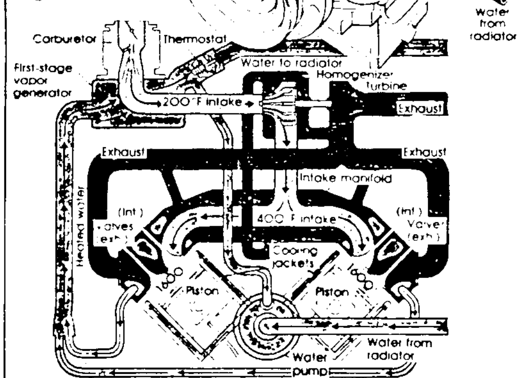


Figure 1b.



Smokey's Phase I adiabatic engine heats the air-fuel mixture for greater efficiency. The mix enters a boxlike jacket — the first-stage vapor generator — below the carburetor. Hot water from the small cooling area surrounding the upper 2½ inches of the cylinders and the cylinder head is pumped into the first-stage vapor generator by the water pump. From there, it goes to the tiny radiator. (When the engine is cold, the thermostat directs the water back to the water pump via a bypass line.) The mixture leaves the generator at about 200 degrees Fahrenheit. The second heat addition occurs at the homogenizer side of the exhaust-driven turbo, where hot exhaust gas is piped into a jacket surrounding the housing. Still more heat is added, also by exhaust gas, when the charge passes into the jacketed intake manifold. At this point the mixture has reached a temperature of 440 degrees Fahrenheit.

In essence, Smokey uses part of what would be waste heat in a conventional engine to preheat the air-fuel mixture before it reaches the cylinders for combustion.

To understand how this system works, follow Figure 1 through the cooling jacket lines from the cylinder heads to a boxlike structure under the carburetor (this device is just a heat exchanger). Smokey calls this the first-stage vapor generator. All the air-fuel mix from the carburetor passes through it and is heated to over 200 degrees Fahrenheit. This increases fuel vaporization for much smoother operation.

At this point, Smokey begins to cut across the grain of accepted induction and combustion theory, or at least he's now writing a new chapter: Remember, normally, intake charge temperatures rarely exceed 130 degrees Fahrenheit.

Smokey's innovation has a slightly different twist than most vapor carburetion designs. He incorporates a small turbocharger which he calls a homogenizer. The compressor side of this unit is jacketed with a metal envelope. A pipe from the exhaust system vents hot gases into the envelope. This heats the intake charge even further.

Smokey's engine introduces a hot charge into the chamber, so there's less chance for the mixture in contact with the walls to cool below its burn temperature.

The third and final preheating takes place in the intake manifold. Smokey describes it as "a shell over a shell, a heat exchanger or a superheater."

By the time the mix passes through the heated manifold, its temperature has reached 440 degrees Fahrenheit.

Smokey explains the second function of the homogenizer this way: "When the intake mix confronts this high temperature, it begins to expand. The tendency without the homogenizer would be to back out of the carburetor. It's the homogenizer's job to hold about half a pound of pressure on the manifold. It acts as a one-way valve."

Smokey described his tests with fuel vaporization: "On the flow bench and on the dynamometer, we'd pull out a sample of air-fuel mixed by the standard carburetor, and you couldn't punch a stopwatch fast enough before the mixture started to separate into a liquid and air again. But, when the mixture goes through the entire heated process and then through the homogenizer, it's 20 minutes before it starts to settle out."

This is the reason why heated vaporizing systems produce a drastic reduction in unburned hydrocarbons and carbon monoxide, which are the two major emission problems in autos. They are caused primarily by two things: charge stratification and surface quenching.

Stratification occurs when the fuel mixture separates into two distinct lean and rich combinations or layers. The homogenizer prevents this by creating a uniform concentration of fuel in the charge.

Surface quenching occurs because the temperature of the combustion chamber wall is lower than that required for combustion. This cools the mixture in contact with the surface below its burn temperature. Thus, combustion remains incomplete and the unburned hydrocarbons are expelled with the spent gases.

What everyone, including the major car engineers, would like to know is why Smokey's engine doesn't destroy itself with abnormal combustion or detonation.

Detonation occurs when either the temperature or the pressure in a combustion chamber is too high. Inside the hot chamber reactions become so rapid that uncontrolled, often destructive, combustion begins to occur in parts of the chamber rather than smooth, progressive burning. These rapid reactions produce high-frequency pressure waves that beat against the combustion chamber walls, causing the vibrations we know as knock or ping.

The high-temperature mixture in Smokey's engine should cause severe and damaging detonation. The only way to reduce this condition would be to reduce the temperature and/or pressure, or at least use a higher octane fuel.

At least this is the only way we've ever been trained to think. That's right! We've been led down a narrow path of engineering expertise, without being allowed to design other methods simply because the engineering manuals say, "That's not possible." Smokey defies commonly accepted thermodynamic theory by adding heat, pressurizing and running on regular unleaded gasoline, and his engine won't detonate.

The engineers from Detroit are confused about why this motor doesn't detonate. It's quite simple: If the air and fuel are both heated and thoroughly vaporized into a homogeneously heated mixture, there can be no disassociated liquid fuel particles; hence no detonation.

In its simplest form, if the fuel in is a true vapor state and can be held that way before combustion, there can be no detonation. The fuel in a true vapor state has a much higher resistance to ping, while still using a low grade of fuel.

Smokey's contradiction of all conventional theories on detonation and fuel behavior have stirred enough excitement to bring top executives and engineers from Ford, GM and Chrysler, as well as from several foreign builders. Most of the top-level executives from the big three have driven the car with Smokey's hot vapor engine and, since some of the test drives, there have been checks for as much as $200,000 for short-term options on the design.

Smokey's problem with these contracts was the unwillingness of interested companies to com-

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not available

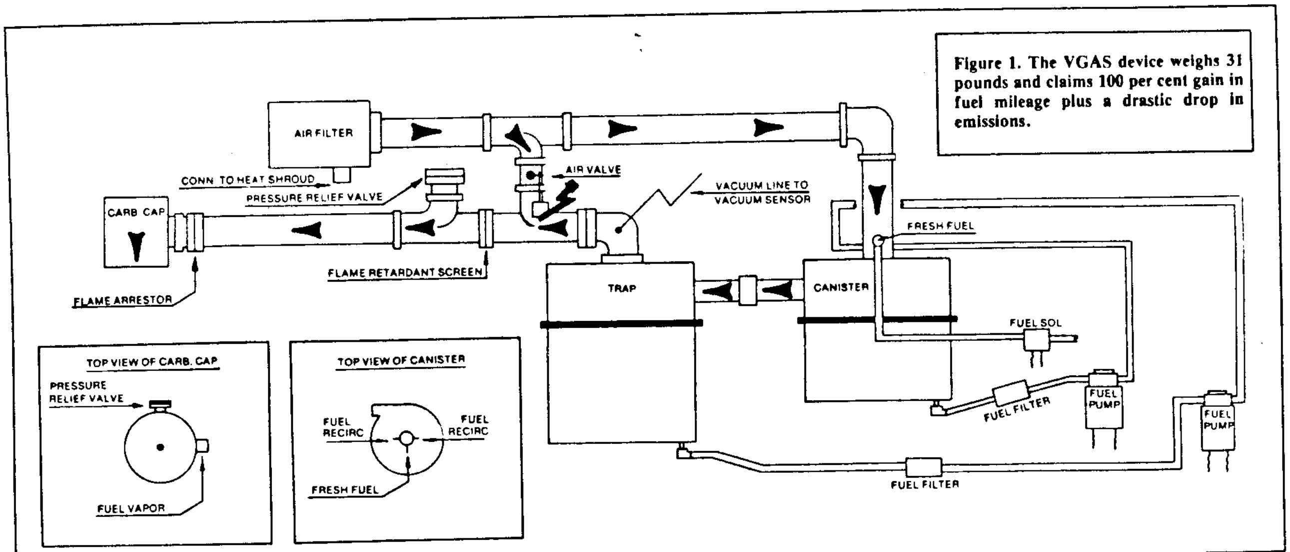


Figure 1. The VGAS device weighs 31 pounds and claims 100 per cent gain in fuel mileage plus a drastic drop in emissions.

A vapour fuel system is now in the works

Far-out engines

BY BRAD DENNIS

There are those of us who still tout the vapor principle as being far superior to what Detroit is presently producing. It finally looks as though a computerized vapor fuel system will enter the market which proves the Pogue vapor carburetor theory is a valid one.

Two firms came very close to breaking into the market place (or should I say, against the bureaucrats) with their systems: Advanced Fuel Systems, Seattle, Washington, which is based on Tom Ogle's patent and the Flex Vaporizing system in Nevada. To this day, however, there is not one vaporizing system available.

This time the story might change. A small firm in Ohio has progressed further in achieving the goal of a practical vapor fuel system and it appears to be the most cost effective systems yet developed.

The company is V.G.A.S. and stands for Vaporizing Gasoline Aspiration Systems.

VGAS has spent the last five years perfecting a vapor fuel system that offers a 100 per cent gain in fuel mileage and a drastic drop in emissions. The corporation has spent better than $1.5 million on this project and are expected to mass produce and market these vapor systems worldwide. Presently there are some 330 US dealer-installers who promote and field test the VGAS system (Figure 1).

The system weighs 31 pounds. It is expected to retail for between $400 and $500. Installation takes two to three hours. VGAS is conducting two-day training sessions for installers.

While the system makes conventional liquid carburetors osbolete and unnecessary, vehicles can convert back to their old carburetor with a switch on the dashboard.

It has been tested at temperatures between 95 to 18°F.

Brad Dennis is a combustion engineer in St. Paul, Minn.

The firm has developed the concept, to the point of having computer-programmed-mass produced systems applicable to just about any internal combustion engine made in Detroit. And the systems are in the price range most people can afford (Figure 2).

Now for you who follow the information in this column on vaporizers, and have done some research on your own, it is common knowledge there is a tremendous number of vapor carburetor or system patents worldwide. None of these 18,000 or more patents have found its way on to the marketplace. The problem of control, gasoline chemical fragment separation, had always been the reason why these systems didn't work. But with a micro-processor, the task of controlling the multi-fraction separation of the fuel in the vaporizing process can easily be overcome. The advantage of this system is its adaptibility to auto engines, marine, and stationary for irrigation or electrical generation.

So let's take a deeper look at what VGAS is all about and what it plans to do with their high mileage vapor system.

The president of VGAS Inc. will shortly announce to the news media throughout Ohio and Pennsylvania that after an investment of more than five years and $1.5 million in research and development of a revolutionary new gas-saving device, his company will launch into mass production of the device.

"We're going for it now and that's it. Everything is opening up for us," said Jackson.

Production of the VGAS device, the focus of much speculation, interest and controversy in the area during the last couple of years began a few days ago at Ra-Mill Industires, a Wooster-based firm owned by Ralph Miller, with which VGAS has entered into a joint venture agreement for the manufacture of the vapors gasoline aspiration system.

Jackson emphasized the VGAS system will not be sold on an install-it-yourself basis because of its sophistication. It will have to be installed by the retailer from whom it is purchased. Jackson said the company will have one installer-retailer nationwide for every 10,000 people. The company's plans call for the recruitment program to stretch into 10 states before the end of the year, including Alabama, Florida, Indiana, New York, North Carolina, South Carolina, Oklahoma and Texas.

Jackson said the company has tens of thousands of orders for the device logged over the past three years. He said these people have received letters saying the system is now available. Advertising for the system will begin shortly but will rely on word-of-mouth to boost both sales and the company's reputation.

Recently employment at the VGAS plant located at 3448 Columbus Road has jumped from 14 to 21 and plans call for a doubling in size of the present 5960-square-foot facility in the near future to provide adequate space for high volume production of the system. The VGAS headquarters occupies a seven-acre parcel which Jackson says will provide adequate space for expansion.

Jackson sees VGAS continuing in the research and development field. Work is proceeding already on the next generation of the device, which will see a further miniaturization.

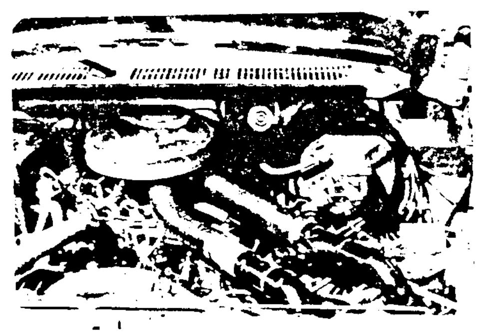
The VGAS device in its most ideal form would replace the carburetor altogether and occupy no more space than that on the engine.

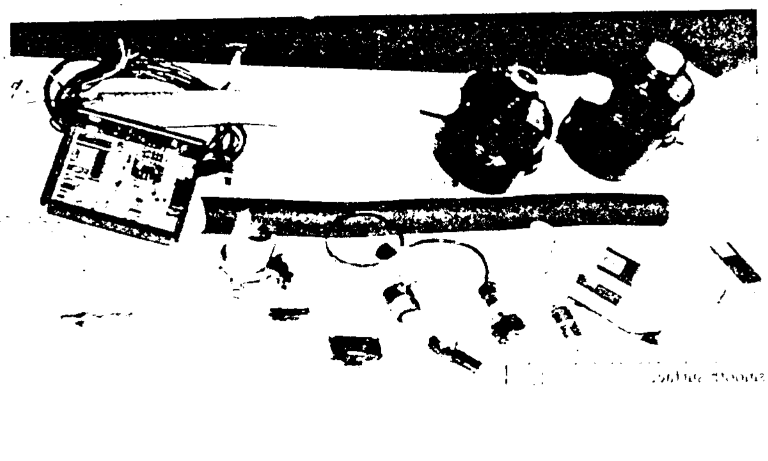
What does Jackson say about those who have been outspoken in their criticism of this device?

"You'll never make a believer of everyone," he says with a shrug. "Right now, we're going on very well without these people. They can say what they want just as long as they don't get in our road."

(continued on page 52)

Figure 2. Advantage of this system is its adaptability to auto engines.





VGAS vapor fuel system

(continued from page 51)

At present, Ra-Mill is producing 1000 units a week, but projections call for production to climb to 1000 units a day within four months. "Production is being kept deliberately low at the outset in case a recall would be necessary as happens frequently with new products. But if the devices perform as 300,000 miles of testing indicates it will, production will be speeded up shortly," he says.

The VGAS president continues his claim of two years ago, that his device will potentially double the mileage of any gasoline-powered vehicle, subsequently cutting fuel costs in half. "The device works at its optimum on traditional "Gas-Hogs" like Lincolns, Cadillacs, other large cars, pick-up trucks and four-wheel-drive vehicles. The device's efficiency is already equipped with numerous gas-saving devices, and on large motor homes."

Jackson claims that in every case the device will easily pay for itself in fuel savings.

The VGAS system operates by converting liquid gasoline to a vaporous mixture of gasoline and air, which is fed to the engine as needed through a system of temperature controls and vacuum passageways - via a microprocessor which constantly monitors engine demand.

Jackson estimates cost and installation of the system to be about $400. He says the device will retail for about $350, with the two-and-a-half hour installation accounting for the remainder of the cost.

A major aspect of VGAS's marketing strategy is to distribute the system through a trained installer-retailer network. As of this month, 350 installer-retailers from throughout Ohio and Pennsylvania, as far away as Iowa, Nebraska, Idaho and Colorado have come to Wooster's Ramada Inn to attend intensive two-day training sessions on installing and servicing the device.

We waited a long time before the entrance of a vapor computer-controlled high-mileage system on the market and it looks as though this firm could make it.

For those of you who have studied those out-of-date brake specific fuel comsumption curves — a fancy name for measuring how much an engine uses in fuel for a given demand or load — and saying that vapor fuel systems cannot increase mileage or decrease consumption, you had better make room for a new chapter which rates vapor systems, or throw the old books in the corner.

VGAS hopes the vapor system they have designed will become OEM fuel systems in the not-to-distant future. That'll shock the hell out of the oil industry as well as the stock exchanges.

Gasoline analyst Dan Lundberg claims the U.S. sold $80 billion worth of gasoline last year. If only a 10 per cent reduction in consumption were effected by the VGAS system, this could result in a $8 billion loss to the aggregate oil industry.

I think the days of the windfall profit might be over.

If you'd like more information on VGAS, write Tom Stidd or Ken Jackson at 3448 Columbus Road, Wooster, Ohio 44681 or call (216) 264-1124.

The following high-mileage books are available from UGG Farmers Library:

Gas Crisis by James Jackson (price: $12.28);

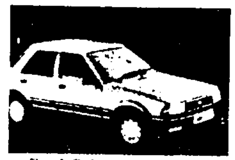
The Elusive 100-MPG Automobile by Larry D. Wagner (price: 15.93);

The Secret of the 100-MPG Automobile by Thomas O'Brien (price: 12.87).

Write to UGG Farmers Library, Box 6600, Winnipeg, Man. R3C 3A7.

Ford Orion — 70 mpg

This is only a small piece of data to add support to my thesis that Detroit is *not* giving us their best technology. The Ford 4-door, diesel-operated Orion car is not sold in Canada or the U.S. but is sold in Europe where gasoline is $2.80 or higher. The point of this simply is — the Orion car gets *70 miles per gallon*. Why isn't this car available in our countries? Big money and big politics control when and where the high mileage technology goes. The cars of this size domestically produced achieve only half this mileage. This should make you mad as hell.



Ford Orion — 70 mpg

"I dreamed all night that I was winterizing machinery and now I'm too tired to winterize machinery."

Roy Baker
Maple, Ont.

MAR. 31 '84

High mileage carbs

GRAINEWS

Sir:

In the Jan. 30 *Grainews*, reader John Gutuk mentioned a book written by Larry D. Wagner. This book was entitled "The Elusive High Mileage Carburetor." This book appears to be almost as elusive as the carburetor. I wonder if you could direct me to where I might obtain a copy of this publication as I am quite interested in what was referred to as the "simple system" in it.

Meantime, please keep up the excellent work in the *Grainews*.

J.A. Gunn
Moose Jaw, Sask.

Sir:

In your Jan. 30 edition of *Grainews* a letter from Mr. John Gutuk of Insinger, Sask. refers to a book "The Elusive High Mileage Carburetor" by Larry D. Wagner.

I would greatly appreciate your letting me know where the book can be obtained.

Since I am a licensed mechanic and work for UGG in its Calgary shop, I am constantly trying to keep abreast of technological changes and advancements.

I would also like to hear more about the "Fish Carburetor" referred to in the same paper in a letter from William Pylatuk of Watson, Sask.

D.A. Maquire
Calgary, Alta.

Sir:

I subscribed to *Grainews* recently and I sure enjoy it as it is a very interesting and informative paper. As for the idea of publishing *Grainews* twice a month, I am all for it.

I would like more information on those high mileage carburetors by Larry D. Wagner and the Fish carburetor.

Edwin J. Kravik
Ferintosh, Alta.

Sir:

My compliments to *Grainews* for a splendid paper.

In your Jan. 30 *Grainews* there is reference to the high-mileage carburetor.

Could I have more information on this?

Thank you.

Elias B. Hofer
Fort Saskatchewan, Alta.

Sir:

Your paper is great. I love the cartoons and the excellent information, as well as the readability of the paper. It's dandy.

I am interested in the "simple system carburetion" referred to in the Jan. 30 issue.

Ed Kettenbach
Calgary, Alta.

This is only a sampling of a large number of letters on this subject. UGG's Farmers Library stocks *The Elusive 100 mpg Carburetor* by Larry Wagner ($15.93); *Gasoline Crisis Answers* by Ambassador Jackson ($12.28) and *The Secret of the 100 mpg Automobile* by Thomas O'Brien ($12.85). All are available from UGG farmers Library, Box 6600, Winnipeg, Man. R3C 3A7.

An article on the Fish Carburetor was written by Brad Dennis on March, 1983. A reprint is available for 50 cents.—Ed.

Unemploym...

To vaporize or not to vaporize?

That is the question and here is the answer

Far-out engines

BY BRAD DENNIS

We are being programmed into believing the technical advancements Detroit has given us are real breakthroughs of major progress. However, most of you are aware of my negative opinion of these so-called breakthroughs.

To be perfectly honest, Detroit has not changed a single major element of the automobile in 40 years, at least. True, electronics have come into the picture but only to cut the cost of manufacturing and for consistency in operations.

The main component of an automobile is the fuel-delivery system. It's better known as the carburetor. This device is also called the energy waster, or pocketbook destroyer. This fuel faucet that sits atop your car's engine wastes about 80 to 90 per cent of the fuel energy that goes through it by poor fuel preparation and allocation.

The only way to cure this polluting, money-guzzling waste is to use an alternative method of fuel delivery. One alternate system is a prevaporization of the fuel to deliver only the necessary amount of energy the motor needs to operate. And the public needs to be made aware of such a system.

The rationale for this education process is that, in the 100 years the internal combustion engine has been used, there is, to this day, not one manufactured vapor fuel system available for the mass markets. There are companies just entering the field with computer-controlled vapor systems, which will be available shortly.

So, if Detroit refuses to build vapor systems and our colleges refuse to instruct on the advanced technology, I feel obligated to share the information I have gathered on the subject.

Well, maybe, I won't. I think I will let someone else who has probably done more work in this area than I have. He is Larry Wagner, author of *The Elusive 100 MPG Carburetor*.

Wagner explains how and why the vapor principle is so superior over the present-day technology. So, take off your blinders and observe the vapor fuel system principle in action.

Wagner's vapor fuel system analysis

You've heard that vaporizing gasoline offers higher gas mileage in our automobiles.

Some of us accept the theory as true, without understanding the rationale for just why vapor would offer such an increase. Others will turn blue in the face and argue that this theory is nothing but hogwash. They base their opinions on just a little truth or understanding of the concept.

There are a few that really do know and have seen the vapor theory in application. They also understand how and why fuel vaporization increases efficiency. The surprising thing about the vapor theory is that it is so darn simple.

Researchers argue that you cannot increase the amount of heat (BTUs) offered in a given volume of gasoline by vaporizing it. This is true, Wagner says.

"I only suggest that we utilize more of the valuable heat offered by gasoline and create less waste," he goes on. "We know that, at best, 80 to 90 per cent of the chemical heat energy is now wasted in the standard internal combustion engine. This is a ridiculous amount of waste in consideration of today's drastic need to be efficient."

Wagner explains, "During the combustion stroke in an internal combustion engine, the fuel has very little time to burn and offer its heat for work output.

"With this in mind, consider the time it takes a cup of liquid gasoline to burn. One cup of liquid gasoline contains about 9000 BTUs of heat. If the fuel were set before you to burn or oxidize at the chemical's own rate, it would produce a dull, flickering flame that would last for about an hour, until the fuel was gone.

"If the same cup of gasoline were completely vaporized to a dry gas and confined to a container that had enough air to support a complete burn, and this mixture was ignited, an explosion with the force of a large bomb would result."

Have we created more heat? Wagner answers with an emphatic "No.

"We have still utilized 9000 BTUs of heat. We have only accelerated its burn rate. Consider the flickering flame of the liquid gasoline. If 9000 BTUs of heat were given totally over a period of an hour, then 150 BTUs (1/60 of 9000) of heat was given off per minute, or 2½ BTUs per second."

When the vapor exploded, how much time was used? Wagner answers, "Much less than one full second. So, for the sake of this example, let us be generous and say that it did take one full second. That is 9000 BTUs of heat given off in one second compared to the liquid in the cup which gave off 2.5 BTUs per second.

"Now, consider how much time fuel has to burn when the engine is turning at 2500 rpm. It has all of 1/82 or less of a second to convert from a liquid to a gas, intermix with oxygen and burn to completion. Most of the real-world running situations leave the fuel with even less time to vaporize.

"The prevaporizing of gasoline theory should now become quite clear. If the fuel has 1/82 of a second, or less, to vaporize and mix with outside air and burn, then, in fact, only a small portion of the fuel is burned. The majority of the fuel carbonizes after the combustion stroke, continues while the piston starts its trek downward, through the exhaust stroke, past the exhaust valves and will continue to burn through the exhaust system until the fuel finally uses up its limited supply of oxidizing heat.

"The unburned fuel will now leave the car in the form of hydrocarbons and carbon monoxide which is unburned and partially burned fuel particles.

So, why on earth are we using a liquid fuel? Wagner answers, "If we placed the proper amount of heat in the cylinder for the net result of pushing a piston for work output, in the form of a dry gas vapor, then the fuel would do its intended task and burn during the combustion stroke and not afterwards. The vapor burns instantly with no lingering, after burning or air contamination.

Another result of the vapor burn is there are no liquid gas dilutions contaminating the oil supply. Thus, you have eliminated the acids that normally accumulate in the oil and decrease engine life."

What actually happens in the cylinder to cause the piston to be pushed downward?

Wagner answers, "It is not an explosion of fuel, as many think, but it is a temperature-rise reaction of the air when the fuel is burned. Such as when lightning passes through air, the air expands at a fantastic rate. The air seems to explode, leaving thunder as a result.

"When the air in your car's cylinder is heated quickly, it expands, creating a thundering air pressure. This great air pressure (about 500 psi) pushes the piston downward."

The last point that researchers argue against vaporizing theories is that leaning fuel flow creates too much heat and, therefore, burns the valves.

This is *only* true when the carburetion system pours in liquid fuel in an outrageous amount. This is exactly how Detroit produces fuel systems and fools the public with programmed information that says that huge amounts of fuel must be poured into every internal combustion engine for it to run properly.

Since more than five times the heat the engine needs to function is admitted in the form of slow-burning liquid fuel, the engine must be cooled by the heat-absorbing ability of that extra liquid fuel already in the cylinder at the time of combustion. This because, after the combustion phase of the engine's cycle, there is this abundance of fuel after burning all the way into the exhaust system.

The liquid fuel droplets in the cylinders that do not offer their heat to combustion because they are not in a vapor form soak up some of the extra heat that a liquid fuel system pours in. The liquid fuel that soaks up this extra heat will not vaporize until after the combustion stroke and it is well into the exhaust system.

If you lean the fuel flow while using a liquid carburetion or injection system, this cooling effect is lessened and, therefore, the valves and pistons are exposed to more heat.

Summarizing: An over-rich fuel supply is needed in today's cars to cool the engine because of the liquid fuel system designs purchased from Detroit.

These systems were and always have been intended to operate at extreme low efficiency. There is absolutely no way to avoid this compounded problem as long as a liquid spray of gasoline is used instead of a dry gas vapor. Vaporized gasoline is the only way to cure this situation.

If vapor is used, liquid fuel will not be needed to cool the combustion because only the amount of heat that is needed to raise the air pressure in the cylinder is introduced. And no more. The vapor burns during the combustion stroke and the heat from combustion is soaked up by the air, not by the extra fuel nor by the heat exchange of the engine block or exhaust system.

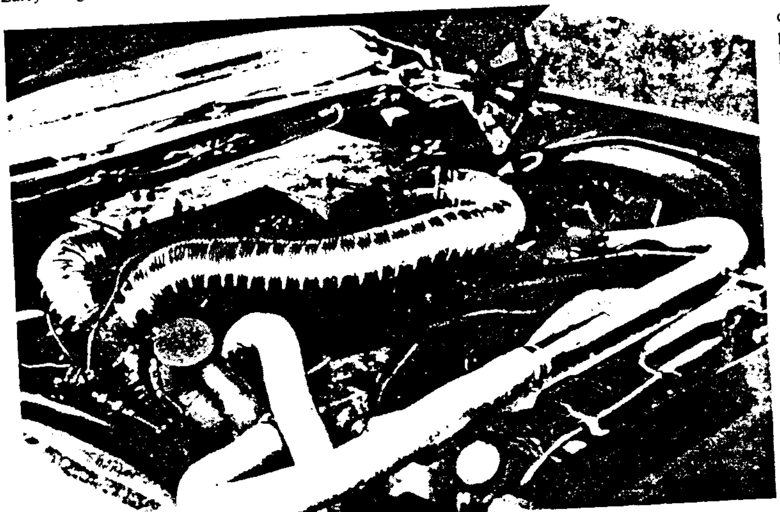
The end result: There are no hydrocarbons or carbon monoxide and a much cooler running engine that operates on far less fuel because so much of the waste has been eliminated. It is great to have faith that gasoline vaporization increases fuel mileage. It is much better to understand why.

They didn't teach you this information in school because at least one out of six people is involved in the auto industry and, if the auto's waste is drastically reduced, so are many jobs!

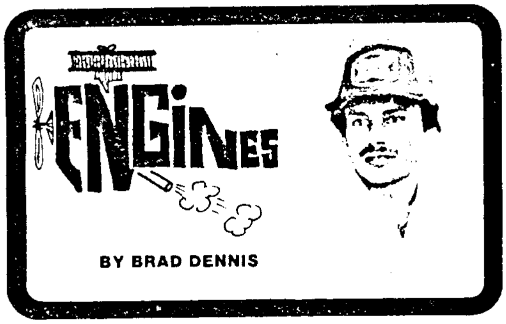
For more information, diagrams on sample systems or additional answers to the vapor principle, contact: UGG Farmers Library for copies of *The Elusive 100 MPG Carburetor* by Larry Wagner (Price: $15.93), *The Secrets of the 100 MPG Automobile* by Tom O'Brien (Price: $12.89) and *Gasoline Crisis Answers* by James Jackson, director of the National Car Drivers Association (Price: $12.28).

You can contact Larry Wagner directly at Carburetion Technology, 6316-128th East, Puyallup, Washington, USA 98371. □

Brad Dennis is a combustion engineer in St. Paul, Minn.



This is one of the systems Larry Wagner used to test his theory of vaporizing fuel before it was mixed with air and introduced to the combustion chamber. The fuel air induction and exhaust systems can be seen in the photo.



Install a fuel preheater to improve car performance

It is possible to improve your automobile's mileage by at least 10 per cent and possibly by 40 per cent at a cost of $15 and two hours' time.

This month, instead of looking at extravagant engine designs that are years from production, this article will be on a gas-saving instrument that really works. The device is called a fuel preheater. Also, this article will illustrate how to build your own fuel preheater for less than $20.

Brad Dennis is a combustion engineer in St. Paul, Minn.

A fuel preheater is economical to build, pays for itself in a month's time, is built on proven scientific data, is an absolute necessity for diesel- and alcohol-powered cars, and offers extreme benefits for gasoline engine cars.

Fuel preheaters are not new. The principle goes back to 1916 and some may go back even farther. Gasoline and other hydrocarbon fuels expand in volume and vaporize easier when heated.

The American Petroleum Industry (API) tests show gasoline will expand about 13 per cent when heated from zero or sub-zero temps to about 200 degrees (F). That means when you start with 10 gallons of fuel and heat it to about 200 degrees, you then have 11.3 gallons.

As internal combustion engines use volume of fuel/air mixtures and since you have increased the volume of the liquid before it enters the carburetion system, there is now a net gain of 10 per cent *min.* in gas mileage.

Additional gains in mileage now come from carburetor jet down-sizing and increases in ignition timing now possible with the heated fuel. These changes will not cause detonation as long as the fuel is heated. These modifications can result in 25 to 40 per cent increase in miles per gallon.

For alcohol carburetion, the expansion principle still holds. Alcohol has to be preheated to 160 to 180 degrees (F) because of the chemical characteristics of this fuel. Ethanol and methanol have higher flash points than gasoline. This means they are not as volatile in cold climates, so preheating is an absolute need for alcohol carburetion to operate to any degree of efficiency.

Diesel cars are increasing in popularity because of their higher thermal efficiency. But they do have one major problem in that the owners must use fuel additives in colder weather to maintain operation. These fuel additives do a poor job, are costly and are only a temporary cure.

Fact is, diesel cars will not operate in sub-zero weather without fuel heaters or additives. Wax particles and water crystals are formed in the injector tips thus cutting off fuel flow and stopping the engine. With the use of fuel heaters, number two fuel can be used all year round instead of using the higher priced number one fuel. This is both a savings in fuel price and additive costs.

There is one minor drawback with these units—the possibility of fuel pump vapor lock during summer operation. This problem is solved easily with a temperature control valve used in the assembly. Any inexpensive water valve can control this thermal heat exchanger so the fuel is not overheated. Try to keep the fuel temp at between 150 to 180 degrees F.

When doing carb-jet down-sizing, check with your local mechanic so the job is done right. Many carb-jet replacement parts can be purchased at motorcycle parts supply houses since auto houses do not seem to have such a wide variety of jet sizes available.

You can also purchase a fuel preheater but they are priced at $110 to $150, which I feel is a rip-off for a $10 to $15 item—not more than $20 with a water control valve.

These preheaters will be entering the marketplace at an increasing rate because of new test results that document the fact that fuel heaters do increase mileage and reduce emissions. California Air Research Board (CARB) is finally releasing data in favor of fuel heaters which should increase their popularity in the marketplace and bring down the cost to the consumer.

I suggest three things when building your fuel heater:

- Use copper because of its ease to work with and its excellent transfer properties.

- Use an inexpensive fuel pressure regulator between the heater and the stock carburetor. The regulator should be set at 2 to 3 psi. Tests have shown that heated fuels will creep out passages in the carburetor unless kept under low pressure. **WARNING: Do not use fuel regulator with fuel injection systems.**

- Check so that the heated fuel is between 150 to 180 degrees.

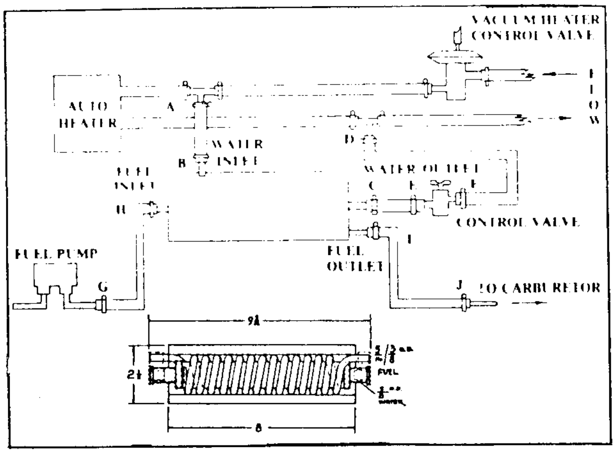
When installing a fuel preheater in individual automobiles, you will find some cars can take higher temperature gasoline than others. To set the individual car correctly, use a water temp gauge and sensor to adjust the water control valve to the highest-setting. Good luck!

Pogue carburetion is probably the most talked about carburetor system in reference to mileage gains. Remember heating the fuel was the basic premise of the Pogue system to increase miles per gallon.

A fuel preheater you can build and install

The Magnafuel Preheater

Hot gas into a carburetor requires the heating of gasoline after the fuel pump and before it enters the carburetor. Gasoline temperature as it *enters* the carburetor is heated to the 150 to 180 degree F. range. In some cases, hotter temperatures may work also. Reducing jet size may be advisable *after* the first several tests.



INSTALLATION INSTRUCTIONS:

Step 1. Lay out your job before starting. Have your tools and clamps ready. Start with clean hands.
- Put drop cloth on fender.
- Remove radiator cap.
- Drain radiator below heater hoses.

Step 2. Mount fuel unit.
- With air cleaner housing still on the carburetor, select the best mounting location for the unit, preferably below the top of radiator. Be sure the mounting straps have a secure surface to be mounted to hold unit in place.

Step 3. Install mounting straps.
- Mark and cut slits to thread mounting straps through. Make sure that slits are at least one-inch apart.
- Be sure to place screwhead of all clamps so they are accessible.

Step 4. Hook up water system.
- Determine which heater hose is the inlet and outlet.

(1) The heater hose that comes out of the block is used for the inlet side of the fuel unit (B). This hose usually has the heater control valve in it.

(2) The heater hose that goes into the water pump or radiator (depending on type and year of vehicle) is used for the outlet side of the unit (C).

- Place "T" in the inlet heater hose between the heater control valve and the heater. Be sure to put clamps on hoses and tighten at this time.
- Cut and install hose beteen (A) and (B). Be sure to put clamps on and tighten. Note: inlet is on side of heater unit.
- Place "T" in the outlet heater hose and clamp.
- Install control valve (C and E). Valve should be as near to unit as possible (not more than 3 to 4 inches from unit).
- Cut and install hose from control valve to "T." Be sure to tighten clamps (F and D).

Step 5. Hook up fuel line.
- Cut fuel line as close to the carburetor as possible. Do not cut fuel line before the fuel pump.
- Install fuel line hose as shown in (G) and (H). Note: the fuel inlet on the fuel unit is on the same end as the water inlet.
- Install fuel line hose as shown in (I) and (J).

Step 6. Finish installation.
- Refill radiator and add antifreeze. The heater unit holds about 2½ quarts of fluid.
- Check all clamps and fittings to make sure they are tight.
- Start engine.
- Open control valve all the way to allow unit to fill.
- While unit is filling check timing.
- After unit is full, shut valve OFF and open one full turn. Road test vehicle.

Step 7. Road test.
- Choose a course five miles long. Stop mid-way and check temperature of unit, which should be between 150 to 180 degrees. Make adjustment if needed, after returning to installation centre.
- Check temperature again with pyrometer.
- Recheck radiator level. Tighten clamps.
- Clean windshield and remove grease and fingerprints from hood.

C.I.A. carburetor investigation analysis

Far-out engines

BY BRAD DENNIS

Do those amazing vapor carburetors work? Are they better than what is currently being used? And is there truth to the statements made by so many inventors that there are vast improvements in fuel mileage to be achieved if only the manufacturers would produce these fuel systems?

This article will attempt to answer those questions. About a year ago, I did a similar article with some interesting evidence on vapor carburetors. Now the supporting data is becoming strong enough so that politicians are finally taking a stand on this issue.

Larry Wagenr — author of *The Elusive 100 MPG Carburetor*, has accomplished much in the past year.

The vapor carburetor inventors of today, as well as yesterday, have one interesting aspect in common. They never sneak around the corner and whisper at you by saying, "Hey, you wanna buy this miracle carburetor?"

Instead they go through the system by trying to patent the device and put on demonstrations to show how vapor systems should work. Not only are these inventors showing their designs at usually a large expense to their pocket books, but they generally never get a chance to market the systems. If they could, the free hand of the marketplace would determine the success or failure of their efforts, and produce the carburetor as a reliable product or a hoax.

One such inventor who is bucking the system is Larry Wagner, an inventor and author.

Two years ago Wagner questioned: "What is the truth about vapor carburetors?" To try to answer the question, he designed his own system and was successful in his first test. This just shows how simple it is to construct one of these test systems.

I have talked with many people who have tried to design their own devices, but only to fail, because of not thoroughly thinking out their project, or just giving up too soon. Wagner has not only dedicated the time, money and effort to prove this theory, but now goes about the country driving his vapor carbureted car to those that are interested in seeing the system operate. (See Figure 1)

Wagner installed a dual-fuel savings system on his 1974 Buick 455-cubic inch engine and now claims to be getting 40 miles per gallon from a car that, when it came from the factory, only got 10 to 13 mpg.

The system looks like a complicated vacuum hose design, that one could get dizzy from trying to analyze where the fuel goes in and where it comes out. But, Wagner of Carburetion Technology Enterprises, will show you without any hidden aspect how the vaporizing principle works, how simple the designs can be, and how you can increase the mileage, while reducing harmful emissions.

Wagner, who is a former jet engine mechanic, said his 1974 Buick LeSabre, which used to get 10 to 13 mpg, now gets 35 to 40 mpg with his new system. There was also a public demonstration on a one-ton 1975 Ford 352 CL truck engine which achieved 80 mpg. Now this mileage test was not just the hopeful figure of a wishful inventor, but was documented by a number of people who observed the test on an international speedway in Washington State.

Since these developments, Wagner has sponsored a campaign to demonstrate we are not getting the mileage we should, because of Detroit's refusal to produce fuel efficient systems.

Note: These type of systems can be adapted to any gasoline engine except air-cooled models.

During one of Wagner's demonstrations, a Tacoma, Washington television newscaster asked to drive the car and see for himself, to see if there was validity to the claims. Newscaster, Bill Boyd drove the car back and forth to work for two days: "In a total of 80 miles of driving, the needle never even came off the full mark of the fuel gauge."

"I drove the car to work down Federal Way and the system increases the mileage marketablely," he reported.

If you try to argue with a graduate of a college, taught the formal lines of thermal dynamics, or a related field, chances are he will angrily thump his text book loudly, stating that it is impossible to change the amount of BTU's in a gallon of gasoline. So you have to explain to them you are not changing any physical laws, hence, the amount of chemical energy in a given amount of fuel stays the same. What these vaporizing fuel systems do accomplish, is the slower burning rate per power stroke of the engine, that is a fact.

"You have to understand that if there is an international conspiracy to keep us from producing and/or buying fuel systems that increase fleet fuel mileage, that the powers are certainly not going to allow our formal education process to instruct this technology," Wagner says.

"First of all, we are not claiming to change the amount of BTU's in a given amount of gasoline. We are changing the rate of burn of that fuel in the bore. It is obvious that if you burn a cup of gasoline contained within the boundaries of that cup, that the fuel will burn slowly, because only the fuel exposed to the air or the surface area will burn. If you spill the cup of gas on a table, so there is a lot of surface area or a lot of the fuel is exposed to the air, the fuel will burn at a very fast inefficient rate, just like your liquid carburetor from Detroit.

"By vaporizing the fuel, you can now burn the majority of the fuel in the cylinder, where it was intended to burn, instead of having abnormally high cylinder temperatures, or being very fuel-rich for the volume of air and fuel delivered. Some solid proof of the current liquid fuel delivery systems inefficiencies, is the fact there is an overly large radiator to dump wasted heat energy into the atmosphere, and the exhaust system which contains temperatures as high as 1600 F. Now, it is quite evident that if a business were to operate in the real world with these types of losses in energy management, it would be broke in a very short order. Unless your inefficiencies in your business happened to be the direct compliment of some other industry, such as oil industries' dependency on the high volume sales of gasoline product. Any system that offers double the fuel mileage from the conventional method has to be a vaporizer."

The idea of vapor fuel systems have been around since the inception of the internal combustion engine, but a 100 years later, there is not yet one vapor carburetor company. Not one single person, of the hundreds who have tried to manufacture a system, have been successful.

Many of us suspect the oil companies and auto companies are in collusion, in an effort to maintain an orderly market for oil products, and one only needs to go through a patent library or your own public library and study engineering journals or magazines to find strong support of your hypothisis.

I know for myself that the existence of high mileage fuel system technology is a *fact*, and anyone who claims this a nonsense is not only a programmed pawn, but apparently cannot think for themselves.

Larry Wagner does not work alone in his effort to educate the public about this technology. His associate is also someone you will recognize from past articles, James Jackson, of the National Car Drivers Association and author of *The Gas Crisis Book*. If you remember last year's article, there was a space blacked out on the discussion of high mileage fuel systems. This time I will again include that information, and when compared to the data from Larry Wagner, it becomes quite interesting. Read it and see what you think.

This is an abstract. A complete copy of the bulletin is available. Write to High Mileage Carburetor, *Grainews*.

For more information on the plans of Wagner's system, you can write to him at: Carburetion Technology Enterprises; Box 964; Tacoma, Washington. For those who need more proof of this technology, order both of the following books — *The Elusive 100 MPG Carburetor ($15.54)* and *The Gas Crisis* ($11.97) from the *Grainews*.

Next month: Surprise! There is a company who is trying to break into the market now with a computer programmed vapor fuel system. Don't miss it, they may be stopped by regulations, yet. □

Brad Dennis is a combustion engineer in St. Paul, Minn.

The high-mileage carburetor

Why isn't it on the market?

A message from: *The National Car Drivers' Association of America*

Pass the facts please

The fact is, the high-mileage carburetor does exist. A carburetion system, designed to power a large-size V-8 automobile, over 115 mpg of gasoline, has recently been developed.

This carburetion system meets all pollution standards. It is reliable and safe. It is not expensive. We could go on and on describing its benefits.

Question

Why isn't this high-mileage carburetion system on the market?

The answer is simple and direct; yet the answer is very difficult for some to accept and understand

A government agency has told the carburetor company to keep their invention off the market'

The supposed reason is that this invention would drastically upset the oil companies pricing and distribution structure.

There have been other high-mileage carburetion systems developed in the past.

Question

Are oil and automobile companies buying them today?

We knew, for example, high-mileage carburetor patent number 3,957,024, dated May 18, 1976, was assigned to "Shell Oil Company, Houston, Texas," and vapor carburetor patent number 3,851,633, dated Dec. 3, 1974, was assigned to "General Motors Corporation, Detroit, Mich."

These are two examples of many and raise many questions.

Summary

The plain truth is, there is an oil/energy monopoly in this country. Basing our oil prices at OPEC's artificially high price level is simple proof of monopolistic pricing.

Opinions vary as to who is behind this monopoly. We have our opinion, you undoubtedly have yours.

One thing is for certain. Our public officials are elected to represent us and protect us from harmful monopolies through enforcement of the anti-trust, anti-monopoly laws. Their performance on this score in the past has been less than successful.

Officials of the carburetor company referred to earlier are thoroughly discouraged. They believe massive public support is needed. Not just public support for a high-mileage carburetor . . . everyone would want such a device. But a union of organized car drivers is needed.

This of course is the very purpose of the National Car Drivers' Association of America.

NCDA members and friends have developed a modified version of this carburetion system. Its performance is very satisfactory on a wide variety of vehicles. It is a very simple, safe and inexpensive system to build. many are reporting 50 per cent to 100 per cent mpg increase (some even more)

The National Car Drivers' Association of America (NCDA) is a nonprofit corporation recognized nationally as a well-formulated voice speaking out *against* energy manipulation and *for* economical energy in America.

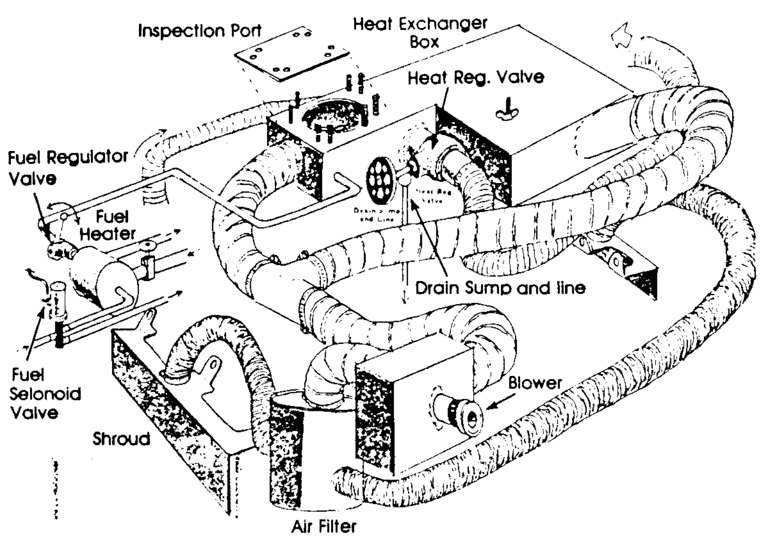


Figure 1