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20 pp
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 emulsifying 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 5000-6000 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\textsubscript{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\textsubscript{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\textsubscript{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\textsubscript{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.
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 1/4-ton jeeps and two 1/2-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,—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 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...
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 every 50 to 60 miles. The producer gas is supplied to the firebox by four air nozzles, with 600 lb. of wood burned per hour. Gas producers are more efficient than gasoline motors. In the machine being tested, the maximum percent of that on a gallon of gasoline is 450. With a spark advancing the maximum, the increase in the mixture is substantial.

When a cold start is made, the producer gas is ignited, the engine begins to turn. But it leaves fewer fumes, 8,000 miles. Before it enters the motor, the gas is mixed with air by the perforated valve on the pipe.
ARDWOOD chips are now driving the first solid-fuel trucks to run on American highways. The hard gasoline motors of these 44s have been converted to the producer gas, a mixture composed of hydrogen, methane, carbon dioxide, carbon monoxide, and various gases. Pictured on this page is experimental conversion made at the Rheingold Brewery of New York City, and believed to be among 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 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 400 miles, and motor overhauls are in order every 5,000 to 6,000 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-oftake 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 oftake 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-wood 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.

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.

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.

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.
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 consistent 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 honestly report has not had a single detractor. The Power-Pak is so simple it must be embarrassing to Detroit's braintrust. It is the only device I can happily report has not had a single detractor. The Power Pak Humidifier is designed by a Florida group headed by retired Air Force Colonel Charlie Brown. The Power Pak is simple and no one has had a single detractor.

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Anyway, Bob Beaver of the magazine 1000 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:

"Before 600 miles of continuous use (with the van's air-conditioning 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).
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.

Make a "Danger Meter"

"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...
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
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.
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 Nevada inventor, Rudolf Gunnerman, will have the opportunity this month to see how the fuel works 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."

"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.

In the future, it is likely that many cars will run on a combination of gasoline and water. The process involves the removal of harmful elements from gasoline and the addition of water, resulting in a cleaner-burning fuel.

Gunnerman's process has been tested and validated by independent laboratories, and the inventor expects to have a commercial product available within the next few years.
Emulsions as Fuels

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 CO₂ 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).  

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 War 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 5527J 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 NOₓ 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
The 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 Tymphonic 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 CO₂ 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.

Table 1  Tymphonic Field Tests of Effect of Water-Oil Emissions on Boiler Thermal Efficiency (Average over 20 tests)

<table>
<thead>
<tr>
<th>Fuel Oil Combustion</th>
<th>Emulsion Combustion</th>
<th>( \Delta \eta )</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ ( T_s ) ( \eta )</td>
<td>CO₂ ( T_s ) ( \eta )</td>
<td>( \Delta \eta )</td>
</tr>
<tr>
<td>6.1 448 77.65</td>
<td>12.4 369 86.1</td>
<td>10.8%</td>
</tr>
</tbody>
</table>
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

\[ t_r = \frac{1}{\sqrt{2\pi}} \left( \frac{\rho}{\sigma} \right)^{1/2} \gamma^{3/2} \]

where \( \sigma \) is the surface tension and \( \rho \) 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 volatiles. 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 \( 3.7 \times 10^5 \) 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.
2. 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.
3. Analysis of drop breakup, estimating the drop breakup time by using the pressure and velocity information from (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 instability.) 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.

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 Goksyr and Ross, which allows for continuous gas sampling.

In the analysis, gas is passed through 150 ml of 3 percent H₂O₂ solution which is titrated with 0.16 NaOH. Any oil in the H₂O₂ is first removed by ether. Limestone concentrations were varied from approximately 0.35 to 1.2 stochiometric 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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Sir:

Efficient e. 61

the Pogue carburetor at the May, 1982 Groiner's display booth. UGC's would be published in a Groiner's column.

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 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 mass-producing them, and the straight answer "not acceptable under varying conditions." Today technology, tests, 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 work on his system in as much as he is the black box that replaced the carburetor. It's through the black box that the fumes are filtered a final time side the system.

Ogle did what should have been done decades ago. He eliminated the inefficient liquid gasoline-flow carburetor and achieved what gasoline internal combustion engines did not. He worked complete systems 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 Groiner's who want an Ogle patent, send a $5 Canadian money order to Groiner's for an individual patent.

John Burak
Innsbruck, Sask.

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The Ogle carburetor

he made 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 letters to Lyle Walker, I should have mentioned the colour of the tag. Sorry for any inconvenience to Dennis.

To Groiner's readers who didn't purchase three books Groiner has for sale — The Elusive 100 M.P.G. 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 add 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 complete 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 keeps thinking the carburetor itself is the answer to pollution. 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 — 4-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 capacity 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 the fumes are filtered a final time before being injected straight into the cylinders. Air is mixed with gasoline, fed to 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 combustion engines did not. He worked complete systems 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 Groiner's who want an Ogle patent, send a $5 Canadian money order to Groiner's for an individual patent.
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!'

We'll, 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 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 possibly 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 guaranteed to sell in the price range of $900 to $6000 (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 I mean that must come as control of the type of fuel, the price, and especially the first average mpg.

Get your popcorn ready because we are going to the new economy car this evening. Oh, by the way, you cannot buy any of these cars until fuel prices double or triple and some 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's 95-mpg commuter car. GM's micromini engineering prototype that resembles the tiny cars produced in Japan. (High mileages minutes 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, the vehicle produces mileage figures of 69 mpg in the city, 85 mpg on the highway.

The front-wheel drive TPC is powered by an aluminum 3-cylinder, 0.6-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 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 aware of 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 enjoy 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?

The second point is a culmination of the first, with reference rationale being cars of this type to be produced by Mitsubishi and Suzuki in Japan at a cost of $2500 to $3000 U.S. and the lack of it 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 Saminiety, an engine test engineer at Peugeot's proving ground.

"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."

"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 rocker noise, no 5-inch wheelbase, no practical dimensions. But it has a rear wing, but it's there to prevent airflow separation and reduce rear end lift.

Peugeot specialists worked in the St. Cyr wind tunnel to drop the car's drag coefficient (CD) from a mediocre 0.64 to a laudable 0.31. To achieve this, they retained the standard wind shield and rear-window design, but dropped both front and rear fuel-efficient fans. The Vera is made with high-strength steel, but is plastic and both rights are aluminum. Experimental Michelin plastic wheels and low-profile TR-E tires save an additional 11% pounds per wheel assembly. Complete with fuel, oil and water, the Vera weighs just 1632 pounds, 408 pounds less than the 305 GL.

Peugeot makes it clear that the Vera is not 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.

Figure 3 is a report from the EPA. This car is a 2-passenger Peugeot 305 GL in 56 mpg at a constant 56 mph. Figure 4 is Nissans gass absorbers which experts label a 21st century vehicle.
Three new carburetors prove Detroit is not giving us its best

Carburetors, emissions and mileage - Detroit says we are presently using in a state of the art.

I say if this is the state of the art, then these guys must be living in a backward feudal age. The fuel systems presented here show there are endless ways to improve on this, and we have some much more efficient than what some ones use and when one opens the page of the present-day confusion button.

Now, you don't think that, at this time, we can't go around the going to slow down on my stabs at the big guys, do you? The only thing that upset 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 interested in the act. They are now getting information about fuels and engines that has never been heard of before. They are finally realizing that controlling carburetors, thus controlling fuel and lubricant, controls a large section of our country and millions of dollars wasted pursuant.

So, let's get on with this new information and what may be mad enough to pound your fist on the table for bringing such a fool for this fuel money game.

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

1. The Webster-Heise valve

This is a promising new device that reportedly improves fuel economy for gasoline engines. It reduces engine octane requirements by at least 10 or more. It reduces engine octane requirements by at least 10 or more.

The Webster-Heise valve is installed on mass-produced autos, the current emission restrictions could easily be met. This could also help out the existing cars and its high efficiency reduces costs and expenses equipment presently used. The valve was under test by the National Highway Traffic Safety Administration (NHTSA) in an effort to match earlier tests conducted by private labs. NHTSA became involved in the testing because of the suggestions of representatives James Broihly (N.C.) and Edward Madigan (Ill.), both members of the House Energy and Commerce Committee. The Valve was then under test by the National Highway Traffic Safety Administration (NHTSA) in an effort to match earlier tests conducted by private labs.

2. The Webster-Heise valve

The Webster-Heise valve was 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.
- reduce engine octane requirements by at least 10 or more.
- reduce engine combustion by as much as 60 per cent.
- reduce the formation of carbides by as much as 60 per cent.
- reduce the formation of carbon monoxide (CO) by as much as 60 per cent.
- increase torque by as much as 60 per cent.
- lower fuel costs by 60 per cent.

The Webster-Heise valve was developed by Sherwood Webster and Richard Heise in St. Paul, Minn. It was found that the Webster-Heise valve could:

- reduce the formation of carbides, which cause deposition problems and can cause a premature wear on engine parts.
- reduce the formation of carbon monoxide (CO) by as much as 60 per cent.
- increase torque by as much as 60 per cent.
- require no maintenance.

The valve has so far been tested on only one or two test cars. But Ford, Lincoln, a month or two, is on the verge of putting it into operation, and it could save hundreds of millions of dollars of fuel.

Transportation Secretary Drew Lewis, noting: "It could present a significant technological breakthrough with respect to the economic control, fuel economy and unnecessary costs of refining fuels to reduce specific rating octane numbers."

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 for a nominal amount. The two Arizona inventors are hoping their valve, which they call "High Efficiency Venturi Carburator" will soon be manufactured in the U.S.

The device, according to the CRS study, was 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 production. It is manufactured by a variable venturi carburetor that is 30 per cent more fuel-efficient than what we have now (Figure 1).

2. Aaby's variable venturi carburetor

Harold Abbey's high efficiency variable venturi carburetor is designed to provide additional mileage and reduces exhaust emissions without the need for a separate electronic control.

Dr. Lewis concurs, noting: "The CRS study was ordered by its having a potential for reducing pollution at a very low cost." He says he would recommend the device to the companies, adding: "It's a very promising idea, and it's not just the first step in a new field of research."
**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 not had a chance to relate 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 public cannot understand in that, with all of this common sense about cars, how can anyone do the next 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 425 c.i., 425 hp. Both these engines are from the 1960s. Actually 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 efficiently 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's inability to produce much higher mileage vehicles right now but, for some reason, I think all of us know what that is, they refuse to produce this high-milage 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 yet closer in motorized Detroit. (Figure 1 and 2).

**Point No.1: The Ford stratified "Proco" engine**

In principle, the Proco was a stratified charge powerplant, acott of the variations of the diesel (see Figures 1 and 2). All tests were done with the 5.8-litre V-8, which was fitted with direct fuel injection and operated through a process of precisely measured amounts of fuel was introduced to the combustion chamber exactly at the right time and in the right amount. All 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 so that amounts of fuel savings of 20 per cent over that of the conventional carbureted V-8 engine.

Proco has an air-fuel fuel ratio range from 201 to 241 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 goes up to perhaps 10:1 or more at the extreme distant points from the plug. The Proco compression ratio is 11:7:1, but the engine runs on low-octante fuel without difficulty.

Except for having spark ignitions, 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 engine.

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 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 engine have not been seen — until now. Now it's too late.

You and I will never see the intended Proco 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 sometime in January of 1981 in the back room of a Western Ford dealership. All were taken from 1980 full-sized station wagons, which were then sent to the new motor. After the photos were taken, the cast iron was shedged-hammered to death by Ford reps (see Figure 3).

Does this illustrate seriousness of 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 the 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 engine is done, but how can I buy it? I wonder why.**

Although this production unit would be somewhat changed from the model (see Figure 4), the three-cylinder commuter car is certainly on its way with small compacts using the all-glass hatch, rear-mounted five-speed transmission and achieving 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 5-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 cannot 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 achieve 60 mpg in the 1986 model year. The cars will be built on a commerical platform and will carry two to four passengers.

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 a 110-inch (4-passengers) 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 drive-train should be a five-speed overdrive transmission. 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 phone oil crisis and the redundant lane 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 an even 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 cost for lower average mileage improvements (continued on page 60).
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 (CSCP).

As you may recall, the CSCP engine was developed over 40 years ago. The system proved doubling gas mileage above that seen by today's technology. I have a strong belief that improvements could be achieved beyond what testing has shown. Then why is this engine being kept from public use? 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 in 1961, two dark-brown, snub-nosed United Parcel Service (UPS) trucks stood idling quietly, waiting patiently for the end of a remote, unusual air transportation run in our new engine test facility in upstate New York. Testing was about to begin in order to prove that a long-range engine concept was always and has been valid after all. The identical vans, typical of the 30,000 vehicles UPS calls "packages cars," were built by proven conventional 292-cid General Motors gasoline engine truck manufacturers (Fig. 1). Why? Why not use the Texaco Controlled-Combustion System (CSCP)?

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

Why? Why not? After so many years, has a giant first opportunity gone to UPS, suddenly taken up testing and development? Further, why weren't developers or one of the newer stratified-charge engine types such as Honda's successful CVCC, Toyota's 71-cid Turbo PROCO, CO - of interest? To get the answers, one must talk to the engineers inside that project.

The results of the independent airport testing (independent meaning without the help of the auto industry) were ever impressive. There were no tire-squealing parts or screaming curves. Two 8,000-pound vans carrying 4,000 pounds of payload didn't exactly produce heart-pounding road tests. Instead, there was discussion of minimum stops, idling and acceleration, with the drivers preferring changing speeds. In the end, however, the Texaco engine achieved over 35 per cent better fuel economy than the standard GM engine.

Later, the UPS vans ran in real-world courses of city delivery and highway driving. Again, the mileage gains from the CSCP engine were startling. They ranged from spectacular 142 per cent increase in idle fuel economy to 38 per cent increase in delivery operations.

But that wasn't all. While the CSCP 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 capability.

The story behind these snub-nosed trucks is really the story of two men, two companies and combined engineering talent. Bill Tierney, Texaco's dedicated and single-minded project manager for automotive developments, has preached for years that refining high-chlorinated gasoline and high-turbulence 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.

Thru a giant's eyes

When you're a giant like UPS and have struggled through two fuel shortages, you look upon not only at the rising costs of gasoline but also at the very real prospect that future synthetic and shale-derived fuels "will grow greatly in quality. So, you must be a bit of a sales job that will run on whatever comes along, be inexpensive to maintain, and can more use to demand that diesel can.

Detroit hasn't had its eyes closed, however. Chrysler began working the Texaco engine years ago. Engines with similar characteristics have been tested on both GM and Ford. Ford's PROCO system, unfortunately, was designed for the manifold-combustion V-8. Its effects on the small fours and sixes are minimal, unlike Chrysler's success. But different - stratified charge technique.Detroit engineers may not have been closed to this engine development, but they certainly haven't had their heart felt for it. Four years of developmental time for such a great advance in engine technology is plenty but 40 years of dragging their feet is absurd!

The big advantage

Although the Texaco-engine marriage to the UPS truck appears a happy one, the engine's engine fuel is just not ready yet. One problem is the fuels yet to come - fuels that contemporary stratified charge engines can't use. Tierney says that diverse, easier-to-refine fuels are perfect for engines that don't rely on the complex fuel injection systems required by in-line gasoline engines. Almost all can be done with such slop that today is so fast to them to sell them to a small refinery for reprocessing.

Right now, the Cinderella switch from the Landwind GM 292 to the existing CSCP, without the ability to run the stroke of midnight seems to hinge mainly on government regulations. Government restrictions are always getting in the way of progessive changes; thus casting those companies creating the changes millions of red tape. Government still need to get out of the automotive business and let it progress at its own rate.

Tuning means that an approved engine has been altered. This automatically means 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 have tested it, it is still technically in violation.

So far, under a hard-won, two-year special exemption, four TCCS engines have been tested. Ten more were assembled, and another 50 more are planned if all goes well. Remember the same from the first article on this engine from the Ford executive director, Mr. S. Racou: "They change take time but enough testing has been done and the TCCS engine will be in production in the 1969s."

*Graine, January 1982

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BRAD DENNIS

**ENGINES**

**FIGURE 2: ESTIMATED FUEL SAVINGS - TCCS VS. GENERAL MOTORS.**

**ASSUMED DELIVERY VANS: 10 MILES PER GALLON AND ARE PAID $25 PER DAY.**

**TODAY'S ENGINE**

- 100,000 hrs. = $250,000 fuel cost per year.
- 10% improvement = $25,000 fuel cost per year.
- 20% improvement = $50,000 fuel cost per year.
- 30% improvement = $75,000 fuel cost per year.
- 40% improvement = $100,000 fuel cost per year.

**TODAY'S ENGINE IMPROVEMENT: 20%**

**ESTIMATED SAVINGS:** $250,000 - $150,000 = $100,000 per year.

**TODAY'S ENGINE IMPROVEMENT: 30%**

**ESTIMATED SAVINGS:** $375,000 - $225,000 = $150,000 per year.

**TODAY'S ENGINE IMPROVEMENT: 40%**

**ESTIMATED SAVINGS:** $500,000 - $300,000 = $200,000 per year.

**TODAY'S ENGINE IMPROVEMENT: 50%**

**ESTIMATED SAVINGS:** $625,000 - $375,000 = $250,000 per year.
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.

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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-powered 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-powered car, apart from minor delays in starting if the generator has been out of use for some time. A kilogram 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, I 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.

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General Motors' coal-burning turbine engine

Far-out engines

BY BRAD DENNIS

Sometimes in the future, you may pull into a service station and ask the attendant to "fill'er up" with coal instead of gasoline, asodol 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 as it 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-burning engine, called the AGT-5. It has been installed in 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 of 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 resources, the abundant coal reserves look ever more attractive as alternate fuels.

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

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

The key to powderizing coal as it is related to automotive fuel is the recent development of powdered coal having extremely small particle size. It was the availability of such small-particle-sized coal that fired the imagination of GM engineers and led to the invention of a prototype solid-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 liquid fuel.

Recently, the coal industry found a way to further pulverize coal so that it is much finer than powdered sugar. Average particle sizes in the order of three microns are now possible. Just how small is a three-micron particle?

It takes 9.036 billion microns to make a millimeter, and 25.4 millimeters to make an inch. Thus, a simple calculation reveals that 24.0 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 finer 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 residue 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 developed. 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 reason for 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. And, because there is a method of distribution to consumers, it would be worked out, but cost analysis would be similar to the bulk liquid fuel distribution system used today.

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

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 anywhere."

"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 go a house to work and, if he shook the family, he booked the ton 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.

Grainews, February 9, 1984

Page nineteen
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 engines) 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 degrees 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 H2O 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.
Box 1156
Young Harris, GA 30582
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
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.


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.

The Gerace engine is different from 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 intake opens and the cycle starts again.

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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.

(Please turn to page 134)
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 (Please turn to page 139)

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

Far-out engines

BY BRAD DENNIS

Most of the money went for the development of U.S. and Canadian manufacturing and marketing rights for the kit. The kits were purchased from Mixel NV, a Netherlands Antilles company.

Mixel purchased the patent from New Providence Trust BWI for $3.5 million late May. Providence purchased the technology from inventor Rod Smith. Providence has a 5-year internal license on the kit. Providence has 55 million shares outstanding and 11.4 million. The 40 million reserved shares are tied up in options. The questions are: Is this commercial? Is the kit really ready for a commercial runout and fuel problems? Are the markets so large and, if so, why aren't the revenue laboratories for U.S. and Canada? Does the company have all the required power convertor? Is it a patented and innovative new system?

The kit replaces the intake manifold and fuel injection system of a car and lets the standard gasoline engine run on anything from gas to manure. The kit is liquid fuel and burns the methane gas released from the decomposition of animal manure. The kit is designed for use in a car engine and is connected to the engine's fuel system.

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

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

Dean Anderson, president of Inova Gas, is also designing a high-performance engine for his company. When asked about the viability of such an engine, he said, "It's a hard sale even if I saw it, couldn't be said another way or the other. It's not impossible, but it's not as easy as it seems. And even when they have the technology, there are other factors to be considered."

We have a patent on the kit but it's safe to say there might be a way around it. But we can't hurt our company, because it will take many years for someone to develop a similar system. And except for that, we won't be able to get the market. They would prove it to the market with a new car product. That would still involve all the other new cars and all the used cars.

constant load and is not seasonable. It allows for better utilization of existing distribution systems. In short, it makes the process more efficient.

The key to the Sedona kit will be how much it improves on the efficiency of fuel. "To sell fuel in the $2000 to $3000, we need to sell units for $2000 to $3000 to the market and are making revenue sharing available to the public. Still, fleets that can justify the installation of $10,000 in fuel stations will have the most promising domestic market for the product to date.

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 school buses and several pilot cars for the city. The gas companies say the city is considering a large-scale conversion program.

The raw gas that frequently accompanies oil is taken out of the tank, cleaned by a catalytic converter, and is then used for natural gas. The gas is then used for a variety of purposes, including heating and cooking.

The Environmental Protection Agency (EPA) has been working on reducing the amount of pollutants and emissions in vehicles. The use of natural gas has been found to be cleaner and more efficient than using traditional fossil fuels. The use of natural gas in vehicles can help reduce air pollution and improve fuel efficiency.

Sedona's success will hinge on its ability to make a product that runs on both natural gas and regular fuel. Sedona's founder and chief executive officer, Rod Smith, is a consultant with Sedona. He said, "We will not be able to do this alone. We need to work with other companies."
Smokey’s new hot vaporizing engine creates heat in Detroit

What engine is not only better 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. The engineer treated at this theory in a number of articles over two years.

The theory: An engine really is a GM V-8 engine block cut down to a V-2 cylinder. Its turbocharged and feeds hot air and vaporized fuel to its cylinders. One of the most unique aspects of the design, as well as having GM engineers talking to themselves, is that this hot vapor system operates so there’s no detonation (see Figure 1a).

The first thing that strikes you about this engine is its size. "Smokey’s 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 1 adiabatic engine." Adiabatic is a word that means that it refers to any process in which there’s no gain or loss of heat. Contragulations, not an 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 produced in the burning fuel that you throw away through the exhaust and cooling systems (most of the vehicles we all drive today), the more energy you get 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 only aluminum that would be made.

The accessories, including the carburetor, are mostly a picking-up from standard automotive. 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.

In essence, Smokey uses part of what would be waste heat as 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 bockshell 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 now writing a new chapter: Remember, normally, intake charge temperatures rarely exceed 100 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 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 normal 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’s Phase 1 adiabatic engine heats the air-fuel mixture for greater efficiency. The second-stage jacket — the first-stage vapor generator — below the homogenizer is where the vapor carburetion design comes into play. The small cooling area surrounding the upper 2½ inches of the cylinder head is pumped by 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 the hot exhaust gas is piped into a jacket surrounding the housing. 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. Detonation occurs when the fuel mixture expands too rapidly, typically, fouls the combustion system, vents the charge to the exhaust system, and his engine won’t detonate.

The engineers from Detroit are concerned about why this motor doesn’t detonate. It’s quite simple. If the air and fuel are both heated and then vaporized into a homogenously heated mixture, there can be no noxious and liquid particles; hence no detonation.

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

Smokey’s hot vapor fuel system is based on a new approach to combustion, one that’s in complete contrast to all conventional theories on detonation and fuel behavior. There are no electronic devices. Smokey has done enough research to bring top engineers and engineers from Ford, GM and Chrysler as well as several foreign builders. Most of the top-level executives from the big three manufacturers have been compared to the Smokey’s hot vapor engine and, since the introduction of the engines, there have been many for as much as $200,000 for short-term leases on the engines.

Smokey’s problem with these contracts was the unwillingness of interested companies to commit (continued on page 32)
A vapour fuel system is now in the works

The company is V.G.A.S and stands for Vaporizing Gasoline Aspiration Systems. V.G.A.S has spent the last five years perfecting a vapour 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 vapour systems worldwide. Presently there are some 220 US dealers-installers who promote and field test the V.G.A.S system (Figure 1).

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

While the system makes conventional liquid carburetors obsolete 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 189.

Far-out engines
BY BRAD DENNIS

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 parents worldwide. None of these 10,000 or more parents have found its way on to the marketplace. The problem of control, gasoline chemical fragment separation, has 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 adaptability to auto engines, marine, and stationary for irrigation or electrical generation.

So let's take a deeper look at what V.G.A.S is all about and what it plans to do with this high mileage vapour system.

The president of V.G.A.S 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 V.G.A.S 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 Industries, a Wooster-based firm owned by Ralph Miller, with which V.G.A.S has entered into a joint venture agreement for the manufacture of the vapors gasoline aspiration system.

Jackson emphasized the V.G.A.S 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 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 V.G.A.S plant located at 3448 Columbus Road has jumped from 14 to 21 and plans call for a doubling in size of the present 9600-square-foot facility in the near future to provide adequate space for high volume production of the system. The V.G.A.S headquarters occupies a seven-acre parcel which Jackson said will provide adequate space for expansion.

Jackson sees V.G.A.S 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 V.G.A.S 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 haven't 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)
Sir:

I subscribed to Grainews recently and I must say that I enjoy it. I would like to hear more about high mileage carburators by Tom Soid and the Fish carburator referred to in your Jan. 30 issue. There is a reference to the high mileage carburator in your Jan. 30 issue. Could I have more information on this subject? Thank you.

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Elias B. Hofer
Fort Saskatchewan, Alta.
To vaporize or not to vaporize?

That is the question and here is the answer.

We are being programmed into believing that technical advancements Detroit has given us are real breakthroughs of major proportion. However, many 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 are being used in the picture but only to cut the cost of manufacturing and for consistency in operation.

The main component of an automobile is the fuel-delivery system. It's better known as the carburetor. This device is also called the engine water, or pocketbook destroyer. This fuel fault that saps 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. This alternate system is a pre-ignition 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 this: In the 100 years that internal combustion engine has been used there, is, to this day, not one manufacturer, not one car company, that enters the field with computer-controlled, computerized systems, which will be valuable shortly.

So, if Detroit refuses to build vapor systems and our colleges refuse to instruct on the advanced fuel system methods, it's the duty of every one of us to share the information I have and make it known. So, if Detroit refuses to build vapor systems and our colleges refuse to instruct on the advanced fuel system methods, it's the duty of every one of us to share the information I have and make it known.

Wagner's vapor fuel system analysis

You've heard that vaporizing gasoline offers higher mileage and increased performance. Some of us accept the theory as true, without understanding the rationale for just why vaporizing gasoline 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 don't 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 simple to understand.

Researchers argue that you cannot increase the amount of heat (BTUs) produced in a given volume of gasoline by vaporizing it. This is true. I only suggest that we utilize more of the valuable heat offered by gasoline and create less waste. So, we have a large and obvious reduction in the amount of exhaust gases and therefore, we have reduced emissions. Therefore, the increase in the afterburn of waste in 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. Thus, 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, the heat would not 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. "The same cup of gasoline was 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 flammability limit of the liquid gasoline. If 9000 BTUs of heat were given total over a period of an hour, then 150 BTUs of heat were given off per minute, or 2.5 BTUs per second."

When the vapor exploded, how much time was used? Wagner asks. "Much less than one full second. For, so the sake of this example, let us be generous and say that it didn't take 9000 BTUs of heat given off in one second compared to the liquid second per second."

Now, consider how much heat is there when the engine is turning at 2500 rpm. It has all of ¾ 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 vaporizing of gasoline-line theory should now become quite clear. If the fuel heat of ¾ 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 carburetor after the combustion stroke, continues while the piston starts its track down, through the exhaust stroke and will continue to burn through the exhaust system until the fuel finally uses up its limited supply of oxidizing heat. "The unburnt fuel will now leave the car in the form of hydrocarbons and carbon monoxide which is an unburned and partially burned fuel particle. So, why on earth are we using a liquid fuel? Wagner answers. "If we placed the proper amount of heat in the cylinder, the fuel would do its intended task and burn during the combustion stroke and not after. Another result of vaporizing the fuel is that there are no liquid gas emissions concerning the oil in the oil.

Thus, you have saved the acids that normally accumulate in the oil and increase 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 people think, but it is a temperature-reaction explosion of the air when the fuel is burned. When lightning passes through the air, it expands and becomes a plasma. The air seems to be heated, leaping thunder as a result."

"When the air in your car's cylinder is heated, it expands, creating a thundering air pressure. This great air pressure (about 300 psi) pushes the piston downward."

Elusive 100 MPG Carburator

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

This is only true when the carburetion system is set in an outrageous manner. This is exactly how Detroit produces the 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 sloshing liquid fuel, the engine must be cooled by the heat-absorbing ability of that extra liquid fuel already in the chamber. The fuel air induction and exhaust systems can be seen in the photos.

Far-out engines

BY BRAD DENNIS

Barrett 100 MPG Carburator

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 engineer.

This theory and these studies show that the fuel air induction and exhaust systems can be seen in the photos.

Summary:

An electric fuel delivery system is needed in today's cars to cool the engine because the liquid fuel is not used and is returned to the manufacturer, purchased from Detroit. These systems were always have been used to improve engines and the efficiency. Detroit is not using this technology as an alternative to extreme low efficiency. There is absolutely no reason for this problem on this long as a liquid spray of gasoline is used instead of a dry vapor. Wagner is the only way to cure this situation.

If vapor is used, liquid fuel will not be needed to cool the combustion because the amount of heat needed to raise the air pressure in the cylinder is introduced. The fuel burns during the combustion stroke and the heat from combustion is trapped by the oil in the engine block or exhaust system.

The end result: There are no hydrocarbons or carbon monoxide running engine that operates on far less fuel because the waste has been eliminated. It is great to have that gasoline vaporization fuel miser saved much time 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 industry is drastically reduced, so are many jobs!

For more information, diagrams on sample systems or additional answers to the vapor principle, contact: DAG, Turbomotive Division of The Elusive 100 MPG Carburator by Larry Wagner, 19411 N. 46th East, Suite 515, The Secretary of 100 MPG Automobile by Tom O'Brien (Price: $12.81) and Gasoline Crisis Answers by James Jackson, director of the National Car Drivers Association.

You can contact Larry Wagner directly at Carburetion Engineer, Inc., 184 Puyallup, Washington, USA 98371.
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.

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 hydrocarbons 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 have 11.3 gallons.

As internal combustion engines use volume of fuel/mixture. Once you've increased the volume of the liquid before it enters the carburetor system, there's now a net gain of 10 per cent min. in gas mileage.

Additional gains in mileage now come from carburetor jet downsizing and increased octane 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 carburetors, the expansion principle still holds.

Alcohol has to be heated 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're not as volatile in cold climates, so preheating is an absolute need for alcohol carburetor to operate to any degree of efficiency.

Detroit 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 that cut 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 cost 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 downsizing, check with your local mechanic. They may not do it right. Many jet replacement parts can be purchased at motorcycle shops since auto houses do not seem to have such a wide variety of jet sizes available.

You can also purchase a fuel regulator but this is priced at $100 to $150, which fuel is a ripoff 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 neat test results that document the fact that fuel heaters do increase mileage and reduce emissions. California Air Research Board (CARB) is finally releasing figures in favor of fuel heaters which should increase their popularity in the marketplace and bring down the cost to the consumer.

I suggest trying the 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 F.

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.

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 the 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 slots to thread mounting straps through. Make sure that slots are at least one-inch apart.
- Be sure to place screwhead on clamps so they are accessible.

Step 4. Hook up water system.

- Determine which heat hose is the inlet and outlet.
- (1) The heat 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 heat 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 outlet heater hose between the heater control valve and the heater. Be sure to put clamps on hoses and tighten at this time.

Note: inlet 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.

Step 5. Hook up fuel line.

- Cut fuel line 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 21/4 quarts of fluids.
- Check all clamps and fittings to make sure they are tight.
- 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.

- Drive a course five miles long. Stop mid-way and check temperature of unit, which should be between 150 to 180 degrees. Make adjustments if needed, after returning to installation center.
- Check temperature again with thermometer.
- 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

D o those amazing vapor carburetor 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 these questions. About a year ago, I did a similar article with some interesting evidence on vapor carburetors. Now the supporting data is strong enough so that politicians and others are finally taking a stand supporting data is becoming strong enough so that politicians are finally taking a stand supporting data is becoming stronger than ever.

Larry Wagner, the inventor 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, but they never try to explain to the public what their system is. Why? They fear that the marketplace will determine the success or failure of their effort. If you sell me a vapor carburetor as a reliable product or a hoax, I think it is only fair to let you know what you are buying at the end of the sales talk.

Two years ago Wagner questioned, "What is the truth about vaporized fuel engines?" I tried to answer the question, he designed his own system and went on to do his first test. This 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 systems, but they all 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 he also sold a book about the country driving his vapor carburetor car to those that are interested in seeing the system operate. (See Figure 1)

Wagner installed a dual-fuel system in his 1974 Buick LeSabre, which used to get 13 mpg, now gets 35 mpg with his new system. There was also a public demonstration on a one-ton 1975 Ford 352 C1 truck engine which achieved 80 mpg. Now the catalyst was not just the hopeful figure of a wistful inventor, but was documented by a number of people who observed the test on an international speedway in Washington State.

Since then 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. Now, there is a type of system that 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 it was as simple as the claims. Newscaster, Bill Boyd drove the car back and forth for two days. In total of 80 miles of driving, the needle never even came off the full mark of the fuel gage.

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

If you try to argue with a graduate of a college, taught the formal lines of thermal dynamics, or a related field, Wagner, who is a former teacher, will angrily thump his text book loudly, stating that it is impossible to change any physical laws, hence, the amount of chemical energy in a given amount of fuel is the same. The amount of vaporizing fuels systems do accomplish, is the slower burning rate per power stroke of the engine, that is a fact.

You have to understand that there is an international conspiracy to keep us from producing and/or burning fuel that increases fleet fuel mileage, that the powers are certainly not going to allow us to change the 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 if you burn a gallon of gasoline contained within the boundaries of that 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 article. A complete copy of the bulletin is available. Write to High Mileage Carburetor, Grainews, 9893.

Larry Wagner does not work alone in his efforts to educate the public about this technology. His associate is also someone who will recognize you from past articles. Janis Jackson, of the National Car Drivers Association and author of The Gas Crisis Book, if you remember last year's article, there was a high mileage carburetor.

The high-mileage carburetor

Why isn't it on the market?

A message from The Natural Car Drivers' Association of America

Pass the facts please

The fact is, the high-mileage carburetor does exist. A carburetor system was designed to produce a large horsepower automobile, over 150 mpg of gasoline, has recently been developed. This carburetor system meets all pollution standards. It is reliable and fuel efficient and can be adapted so that it can be used on describing benefits.

Question

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

The answer is simple and direct, yet the answer is very difficult for some to face and understand. A gentleman friend has told the carburetor company to keep their invention secret. Not this time, not this company.

The supposed reason that this invention would dramatically alter the oil Companies pricing and distribution structure.

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

Question

Are oil and automobile companies buying them up?

We know, for example, high-mileage carburetor patent number 3,970,204, dated May 18, 1976, was assigned to "Shell Oil Company, Houston, Texas," and vapor carburetor patent number 3,951,636, dated Dec. 3, 1974, was assigned to "General Motors Corporation, Detroit, Mich."

There are two examples of many and raise many questions.

Summary

This is a true fact, it is an old-enough monopoly in this country. Being an old-enough monopoly protects us from probable new cars and all the new cars that may upset these monopolies. This performance on the test seen in this article has been less than successful.

Oil companies who have tried to market this technology, related to earlier as thoroughly discouraged. They believe massive public support is needed. But just public support for a high-mileage carburetor wouldn't work with the oil industry. You are as well under the gun to get the answer you have won.

This is of course the very purpose of the National Car Drivers' Association of America. Those who inventors, friends and friends have developed a modified version of the carburetor system in performance as satisfactory on a wide variety of vehicles. It is very cheap and is inexpensive to build, many are reporting 50 to 80 mpg or more.

The National Car Drivers' Association of America (NCDA) is a composite corporation recognized nationally as a well-organized voice speaking our energy manipulation and economical energy in America.