INVENTING OUR WAY OUT OF THE FUEL CRISIS

By

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Although there is a fuel shortage in America, caused by courtesy of the Department of Energy, there is no shortage of inventive genius in this country that can help us solve the problem. In fact, there are so many possible solutions to the energy crunch that, at this point, it is impossible to predict which one or ones will ultimately prevail. One thing seems certain: that the really dramatic breakthroughs in automotive invention will not come from the big corporations. There seems to be an inordinate amount of caution on the part of the Big Three that tends to discourage risk taking or any pioneering efforts to produce that miracle engine that can go 100 miles on a gallon.

Why? Because these are large corporations, run by ultra-cautious corporate managers, with a half-dozen regulatory agencies breathing down their backs and Ralph Nader standing at the ready to rake them over the coals should the miracle car be "unsafe." Then there are those thousands of stockholders waiting for their dividend checks who may not appreciate a billion-dollar retooling

investment to produce a radically new car that may not sell. And there are the unions who are deadly afraid of any technological innovations that may eliminate their jobs, even if they would save the consumer lots of money. And last, there are the oil companies wielding their financial power whenever necessary to "help" the automobile industry clean up exhaust emissions in ways that, naturally, increase gasoline consumption.

All of this has tended to create a kind of spiritual depression among Detroit engineers, a defensiveness caused by the greatly publicized recalls and the constant accusatory federal finger penalizing them whenever their cars fall short of the new mandated standards. So caution builds upon caution, and the result is that the auto makers do only what they have to do to meet federal standards and stay competitive. In short, all of the pressures, regulatory requirements, criticisms, penalties, and court cases have taken the fun out of being inventive.

There seems to be an implicit understanding among the governmental regulatory agencies, the auto makers, and the oil companies to maintain a sort of status quo. It allows for slow, controlled, incremental improvement, mandated by government, but nothing radical or dramatic. Maybe it's the paralysis of bigness, or the checkmating of vested interests on a vast chess board of competing political and industrial power groups. Altogether, it creates an atmosphere in which an inventor, who may threaten someone's vested interest, or create new regulation, has a tough time getting his product to market. Only the large corporations, with millions to invest in advertising and marketing, can get a product to the mass market. So the individual entrepreneur has a rough road to travel, no matter how worthwhile his invention.

A number of factors determine whether or not a new invention makes it: the perserverence and intelligence of the inventor, his access to capital, his

ability to produce and market the product, the strength of the competition, the opposition or encouragement from vested interests, the obstructions of bureaucracy, the obstacles of federal regulations, the possible granting of tax incentives, the decisions of large corporations, and finally, consumer acceptance. The system has become an obstacle course for the creative individual. Mastering the system is not easy. So unless that creativity is channeled and controlled through some large corporation, it has little chance of reaching the mass market. Yet, since our system does have all kinds of cracks and crannies in it, the inventive, with the help of the media, can always get a hearing somewhere. But a hearing alone often leads nowhere, and the public, excited by the publicity, is left in a state of suspension. The media feeds on the momentary and sensational. It rarely follows up on these promising inventions to find out why they never wind up in a car you can buy.

Despite all of this, the fuel crisis has brought about a period of great inventive ferment, somewhat similar to that at the beginning of the automotive age, when there were steam cars, electric cars, and internal combustion cars all vying for the acceptance of the consumer. The internal combustion car won out because it provided the most convenience and dependability at the lowest cost. And because gasoline was so cheap and plentiful, there was little need at the time for auto makers to worry about fuel efficiency. So they made big, heavy, luxurious cars that pleased the public but consumed a lot of gas. As for pollution, we had to wait until the Age of Smog before the public began to appreciate the seriousness of the air pollution problem. The result was the Clean Air Act of 1966 which forced auto manufacturers to find ways to clean up auto emissions. It also marked the beginning of federal regulation of the auto industry.

It's interesting to note that the Clean Air Act made the auto industry, not

the oil companies, responsible for the noxious emissions created by fossil fuels. The oil companies were not required to develop a cleaner fuel -- an alcohol-gasoline mix, for example — even though it was the fuel, not the car, that was causing the problem. So the burden fell on the auto industry to clean up Big Oil's dirty fossil fuel. And quite a burden it has been.

And now that gasoline is no longer cheap or plentiful, fuel economy is the auto industry's newest imperative. The federal government has already mandated that Detroit must improve the gas mileage of its cars, and Detroit has dutifully responded by improving gas mileage slowly and steadily with each model year. Detroit has subtly shifted its inventive response from consumer demand to government mandate.

The result of all of this is that the really dramatic gas-saving breakthroughs are coming out of the workshops and garages of individual inventors and tinkerers who are responding to consumer demand rather than bureaucratic mandate. Some of these inventors have gotten a good deal of media publicity and built up hopes of a technological miracle in the making.

Detroit is naturally skeptical about all of this. In their defensive posture they couldn't hardly be anything else. One engineer in the Big Three told me: "Within present technology such miracles are not possible. Sure, we could build a car that could get 100 miles per gallon, but would the EPA certify it? This is a regulated industry. And would the public want it if it didn't have the comfort and dependability expected of one of our cars? A car that we produce has to stand up to all kinds of driving conditions. It has to meet strict federal standards, or the government fines the hell out of us. Above all, it's got to be sellable. If we can't sell it, we're out of business."

But what about those stories of big car companies quashing the miracle carburetor that will get 50 miles a gallon? "Ridiculous," answers the engineer.

"We'd like nothing better than to put it to our competitors. We'll kiss the carburetor that improves gas mileage by even two miles! The trouble is that when any of these inventions are put to the test, they don't pan out."

Yet, the public is suspicious. They're not impressed with what Detroit has done to develop catalytic converters that a lot of drivers don't like, or air bags, or seat-belt buzzers that annoy the hell out of people, or cushionable bumpers and other such contrivances. That's what Detroit's engineers have been spending much of their time doing: meeting the newest federal emissions, safety, and fuel-economy standards. And they're happy if they can just meet these standards. They're sick of being Ralph Nader's bad guys.

So no one can deny that Detroit is trying. "We've left no stone unturned," another engineer told me. "The government has much more money than we have. Yet with all their encouragement of inventors, they haven't come up with any miracles." Good point, I thought. Like the cure for cancer or the reading problem. Whenever government starts pouring money into a problem the miracle cure suddenly becomes more remote than ever.

Yet miracles is what America is made of. To go from the Wright brothers to the Boeing 747 in less than a hundred years is a miracle. To go from the Model T to the Granada in about fifty is another miracle. We Americans are like spoiled children. We want more. For example, where's that Chrysler turbine car we heard so much about in the sixties? I used to drool over it at the auto shows as the attractive model in toreador pants pointed out its features. How come the automobile industry hasn't yet made it to the jet age?

I hunted down and phoned George J. Huebner, the now-retired engineer who headed up Chrysler's turbine program, to find out why the turbine revolution never came off.

"The turbine car engine is a lot more complicated than a jet engine on a plane," he explained. "The tolerances are extremely fine and you need special alloys that can take the high temperatures. It's not the kind of engine that can be slapped together easily. Even so, we were ready to go ahead with it until Congress passed the Clean Air Act of 1966. Chrysler had to choose between bringing out a new power plant, with all the uncertainties involved in such an expensive undertaking, or cleaning up the internal combustion engine to meet the new government standards. Management chose to do the latter. I happen to believe that they made a mistake and should have gone ahead with the turbine. But then I'm prejudiced."

Huebner didn't mention that a big oil company had bought an interest in Chrysler at about that time and helped convince the board of directors that cleaning up the noxious emissions from fossil fuel was more important than developing a turbine car that could operate on any fuel. So the threshold change, the turbine revolution, was sacrificed on the altar of the industrial status quo.

According to Huebner the decision was tragic for Chrysler. The company lost its big opportunity to go one better than GM and Ford -- which it could have done by inaugurating the turbine age -- and became an abject follower of trends instead of a creator. It was the last chance Detroit had to take any big risks before the onset of government regulation. Today, Chysler is still experimenting with turbines under an $11.5 million D.O.E. grant. But the engineers know that it's just for show. Chrysler couldn't produce a turbine car for

the public even if it wanted to. It doesn't have the billions required for retooling. An interesting sidelight: When the government gave Chrysler thegrant, they said they wanted a turbine developed for a compact car, not a big luxury car. But Chrysler didn't think they could do it without violating some federal regulations on car design. So the D.O.E. told the designers not to worry about the federal regulations, to be creative and produce an exciting futuristic looking car. Something to look at, to whet the public's appetite, but nothing they'd ever get to buy. Meanwhile, Heubner believes that sooner or later some auto maker will bring out a turbine car and that it will probably come from Japan or Europe.

It is probable that had Chrysler gone turbine in 1966, the rest of the industry would have followed suit. That alone would have done more to solve the pollution problem than the Clean Air Act of 1966, for the turbine was a lot less polluting than the internal combustion engine to begin with. Also, with the turbine, the consumer would have saved billions of dollars in maintenance and repair costs. The internal combustion engine, with its complex cooling system and hundreds of moving parts, is a mechanic's gold mine and a car owner's nightmare. It is also probable that the development and marketing of the turbine would have saved us from the present fuel crunch, for the turbine could run on any liquid fuel.

A good case can be made that government interference in automotive development has, in the long run, created more problems than it has solved, for it has forced auto makers to make their decisions according to federal requirements rather than market demands. The market has a way of solving seemingly insoluble problems through dramatic innovation and invention. The freer the market, the more likely the problems will be solved sooner and at lower cost to the consumer than would be the case with government interference. Powerful consumer lobbies can provide much better protection for the public than federal regulatory agencies that have cozy relationships with the industries they are supposedly regulating. The Department of Energy is a case in point. It is largely staffed by people from the oil industry and therefore has a natural bias in favor of fossil fuels.

Meanwhile, individual inventors, seeing the fuel crunch as a golden opportunity to strike it rich and/or help their fellow man, have come up with some ingenious

fuel-saving innovations. For example, a former NASA scientist, Vincent Carmen of Portland, Oregon, has invented a system that just about doubles the gasoline mileage of any car in urban traffic. The system is called IST, Inertial Storage Transmission. It capitalizes on the fact that vehicles effectively waste almost as much energy in slowing down or braking as they do in speeding up. Mr. Carmen has developed a system that enables the car to store up this "inertial energy" in the form of hydraulic fluid pressure in the Inertial Storage Transmission. In the IST, the "back pressure" of de-acceleration is stored up in an "accumulation tank." Two pump motors are then mounted on the drive wheels of the vehicle. When pressurized oil is released from the tank, the rear wheels of the car start up without any help from the engine. The internal combustion engine is programmed to "kick out" whenever the accumulator pressure is such as to provide enough drive to start up, and "kick out" whenever speed is reached. Even when the car is idle for weeks, the pressure in the "accumulator" remains, and, when you want to start it, you don't have to turn the key. Just release the hydraulic pressure which will power the car until it gets up to full speed. Carmen estimates that the IST can cut fuel consumption as much as 50 percent in urban driving and thereby also reduce urban pollution by up to 75 percent. If all American cars were equipped with IST systems, the potential fuel savings could amount to as much as 30 billion gallons of gasoline a year. Mr. Carmen's company is Global Scientific Consultants, 10728 N. E. Halsey D-34, Portland, Oregon 97220.

Another promising invention is called the Meccatherm, developed by John Evans of Sharon, Connecticut (Mecca Development, Inc.). The Meccatherm is a self-enclosed automotive cooling system that maintains the whole internal combustion engine at a constant heat of 200 degrees, while conventional cooling systems allow temperatures to vary from 140 degrees at the bottom of the engine to 190 degrees at the top.

The uniform temperature, Evans maintains, allows the spark from the spark plug to push the piston the entire length of the cylinder. The "longer life" of the spark allows the gasoline to burn more completely, which improves mileage and cuts down on emissions. Evans estimates that his system can improve mileage by about 35 percent.

Can you imagine how much gas one could save by combinging the IST and the Meccaderm in one car? To that might be added a long-lasting spark plug invented by a laser engineer in Waltham by the name of Harry Franks. The plug's electrode is made of a super alloy that does not deteriorate or corrode like that of an ordinary spark plug. Therefore, it maintains permanently the same high fuel efficiency you get with new spark plugs. Franks estimates that one could get from 5 to 10 percent better mileage just by using his plugs. He spent more than a year trying to get the Department of Energy to test his plugs for mileage efficiency. But the D.O.E. decided that the fuel saved was not enough to warrant federal interest. This is peculiar since President Carter has stated on several occasions that a 5 percent reduction in gas consumption would do a lot to relieve the fuel shortage. Franks has been producing the plugs since 1976 and they are available to the consumer at Laser Nucleonics, Inc., 123 Moody Street, Waltham, Mass. 02154.

All of these inventions put into one car would just about double a car's fuel efficency. But it may take years before any of these innovations find their way into Detroit's models. Much will depend on how successful the inventors are in selling their ideas to the big companies. Franks tried to sell his spark plug to one of the big plug manufacturers but was told that they were quite happy with the cheap, short-lived plug they were already selling. Why change to something better but more expensive when what you are now selling has no competition and is making

and whether or not they ~~are~~ weigh too much ~~weighed~~, take up too much space, or are too expensive

big bucks? The market economy is moved by money, not altruism. Only if Franks, through his own marketing efforts, makes a serious dent in the regular spark plug market will the present manufacturers be forced to come up with something better.

Most inventors are not terribly good businessmen, which is one of the reasons why they have so much trouble getting their products to the consumer. Few of them have the productive or marketing genius of a Henry Ford. But, often, great ideas attract imaginative venture capitalists. The dream of making millions is what makes entrepreneurs knock themselves out getting a product to market. But it's all very risky, because a better idea may suddenly pop up elsewhere. Take the case of Edward P. LaForce of Richard, Vermont, and his brother Robert, inventors of the LaForce Engine. In 1974 the brothers demonstrated a new internal combustion engine that almost doubled the mileage of an ordinary car. In trying to bring the engine to market the inventors ran afoul of the Securities and Exchange Commission, the Environmental Protection Agency, various and sundry tax collectors and creditors. Their ineptness as businessmen delayed getting their invention to market.

They finally put their invention in the hands of Richard P. Chipperfield, president of MP-G Ltd. of Bradford, R. I. How does the LaForce engine work? The process involves atomizing the fuel to extremes, separating the lighter fuel ends from the heavy ends, preheating the heavy ends to about 800 degrees fahrenheit, and keeping the fuel-air mixtures swirling at extreme speeds to prevent recombination of heavy and light ends and thus ensure complete combustion. The result is greater power at lower engine speeds and clean combustion.

The MP-G company plans to market the LaForce technology to fleet operators rather than the engines themselves. For a flat 10 percent above cost, MP-G will send its technicians to a fleet owner's shop and supervise engine modifications

by the fleet owner's own personnel.

"You don't start a business to launch a crusade," Chipperfield recently said in a press interview. "You start one to make a profit. We're going to be capitalists and make a buck."

If any automaker wants the LaForce engine, MP-G would be willing to license the technology for about $20 a car. But so far the Big Three have expressed little interest in the LaForce idea.

Meanwhile, an even better idea hit the front pages in April 1979. It was reported that Ralph Moody, a master race-car mechanic who used to build race cars for the Ford Motor Company, and his partner Mike Shetley, had developed a car engine that could get 80 miles per gallon. Moody and Shetley ran a firm in Oak Hill, Florida, called Old Car Reproductions, Inc. It was while tinkering with a diesel engine that Moody found he could increase its fuel economy dramatically. He decided to build a demonstration model. He took a Mercury Capri and put a modified small diesel engine in it (a Perkins 109-cid irrigation-pump shelf model). He made some internal modifications so that it would run slower and cooler. He added a turbocharger built for him in Tampa, and designed an improved transmission and rear end.

Moody began testing his engine package in late 1978. He got an astounding 80 miles per gallon while cruising at a steady 45 miles per hour. In April 1979 he brought the Mercury Capri to the well-equipped automotive lab of Daytona Beach Community College for independent testing.

"I felt skepticism, an awful lot of skepticism about Moody's claim," recalled Bill Gordon, head of the college's automotive division. Gordon ran shop and road tests. The tests, including a 120-mile run to Titusville, Florida, and back, showed between 82.6 and 84.6 miles per gallon. The hydrocarbons and carbon monoxide

produced were well within the E.P.A.'s emission standards.

"It does everything they said it'd do and more," reported Gordon. "They've taken on the job of a factory team of 500 engineers and done it themselves."

In May, Moody and Shetley took the "Moodymobile" to Washington and demonstrated it before Congressmen. Eleven of the legislators reportedly placed orders for the car when and if it ever reached production. Moody and Shetley also appeared before a Senate Energy Committee hearing. When they were asked why Detroit hadn't come up with anything quite as dramatic as their invention, they said they didn't know. They did know that German and Japanese automakers were way ahead of Detroit and were producing diesel engines that approached the Moody version in mileage rating. Volkswagen had already announced that it was coming out with a diesel Rabbit that could get 45 miles per gallon of No. 2 diesel oil. People were lining up to buy it. But suddenly, in early June, there developed a ~~shortage~~ shortage of diesel fuel because of D.O.E. allocation policies. Potential diesel buyers began to wonder what good it would be to have a diesel car that could get 45 miles to the gallon if you couldn't get the gallon.

After their Washington visit, Moody and Shetley applied for E.P.A. certification testing so that they could begin producing their car. But the E.P.A. demanded confidential information about the engine's design before it would begin testing it. Shetley received a telegram from the E.P.A. asking 16 questions about the design of the car.

"The first 13 are easy," Shetley told reporters when he received the questionnaire, "even though I think they have nothing to do with emissions testing. Like they want to know whose fuel I'm using. It really doesn't matter whose fuel you use as long as it's No. 2 diesel fuel. Another one is 'How do you start the car?' That's easy,"

Shetley said. "You start with a key." But, he said, then there are questions about the car's gear ratio and other areas.

"We've already told them we aren't going to give them that information. They're trade secrets. The E.P.A. says it will keep that information secret but I don't believe that statement."

Shetley had hoped that the E.P.A. testing could begin soon so that he and Moody could begin producing the first 6,000 cars. The testing consists of a 4000-mile engine break-in on a track at the E.P.A.'s testing facility at Ann Arbor, Michigan. A 50,000-mile engine test is required by the E.P.A. before production can begin on more than 6,000 units. ~~(But now no one seems to know at all if the tests will be conducted at all.)~~

What were the E.P.A.'s response to Shetley's objections? Ernie Rosenberg, an E.P.A. spokesman in Washington told reporters, "All we're looking for is an adequate description of the test vehicle so when we look at a production vehicle we can tell if it's covered by certification. All the information we get is considered trade secrets. There's never been a leak from E.P.A. We give full protection."

Would you trust the E.P.A. or any other bureaucratic agency with your trade secrets? Moody and Shetley merely reflect a growing popular American conviction that no one in Washington, or big oil, or the big three auto makers can be trusted. ~~So Moody and Shetley may have to have their car produced outside the United States.~~

Meanwhile, what are the big three doing to produce more fuel efficient cars? Nothing terribly dramatic. Gas mileage has been improved on all of Detroit's production models, but only modestly, just enough to meet federal standards. Apparently Detroit is not yet convinced that there is a genuine fuel crisis. Maybe the summer of '79 will give them the sense of urgency needed to produce ~~their own version of the Moodymobile. But so far they've done little in the new~~

Meanwhile, Moody and Shetley, who apparently don't trust each other, split up and have gone separate ways. Shetley has produced a new diesel car that gets 110 miles per gallon at 45 mph according to a test conducted in July at the automotive department of Brevard Community College in Cocoa, Florida. The car is called the American Dream and, at the time of this writing, was on tour, with a stop scheduled in Detroit.

What can we expect from Detroit? I spent an hour on the phone with Charles Heinen, Chrysler's director of research and materials engineering, who's been in the industry for 45 years. Heinen attended the Boston Conference held in February 1979 at which Brock Adams, Secretary of the Department of Transportation, called for the reinvention of the car.

"It was a good conference," said Heinen, "an open engineering conference. Not rigged. People were really listening. The problem is that the auto industry has already re-invented the car several times over — by evolution, not revolution. The cars people drive today are the results of billions and billions of dollars of research and development over a long period of time."

But why can't Detroit do something dramatic to increase gas mileage, I asked. After all, we've gone to the moon, we've built an atomic bomb. How come we can't come up with a car that will go 100 miles on a gallon of gas?

"Well, you could prove on paper, within existing technology, that it was possible to go to the moon. And Einstein proved the same for the atomic bomb. But you can't produce a car that will get 100 miles per gallon and do everything else you want it to do. You can't do it on paper. Not within present technology. Sure, a Moody can produce a prototype that will go 100 miles per gallon, because that's all he has to think about. And if he brings his car here, you can be sure that I'll look at it. But we have to relate any invention to everything else in the car. We're in the business of developing a total car and the only sure

way we know of increasing gas mileage is by reducing the weight and size of the car. So we've worked on developing lighter materials, lighter metals. We've also developed computerized engine control so that the car can adjust to changing driving conditions." and use fuel more efficiently.

I suggested that there was no sense of urgency in Detroit concerning the fuel crisis. Didn't they believe that there was a fuel shortage? Their unsold big cars gave the impression that they were caught unaware.

Heinen's response was interesting: "There is no actual shortage of fuel. According to the figures, there's as much fuel in the U. S. today as there was a year ago. There's a mismanagement of distribution. That gives the impression of a shortage."

But a driver waiting on a gas line was confronted with a real shortage, not an impression. What about the diesel, I asked. With the VW Rabbit diesel and Moody's diesel showing so much promise, why wasn't Detroit going diesel more vigorously?

"We've got a beautiful diesel engine waiting to be put into some of our models," (Heinen said) "But it won't pass present EPA certification standards. Detroit will go diesel only when the EPA lets it."

The impression I got from all of my conversations was that Detroit did not want to be panicked into do anything that required great investment and radical innovation. They would stick to the tried and true method of working on the total car, improving what could be improved within present technology, conforming as best as possible to the regulations they were foreqd to live with, responding to the marketplace and the competition as ingeniously as they could.

As for new engines, they were proceeding as cautiously as possible.

engine department. GM sank 700 million dollars in trying to produce a viable production model of the Wankel rotary engine, but gave up. The Wankel would have given a smoother ride than the piston engine, but it offered no great improvement in gas mileage. As for the diesel, GM has begun to offer some diesel models, but none with the performance of the Moodymobile or Shelley's American Dream.

Meanwhile, Ford has been tinkering with a 60-year-old idea: an engine that runs on only half its cylinders under certain conditions to save gasoline. The innovation was supposed to have been ready for 1979 as an extra-cost option on some of Ford's light trucks. The 6-cylinder engine would be equipped with a series of electronic and mechanical gadgets that would cut off operation of three cylinders while the car was cruising at about 45 miles an hour where full power wasn't needed. The system would provide a 10 percent gas mileage gain. Hardly enough to get excited about in the summer of '79.

No one seriously believes in the steam car as a viable alternative to the internal combustion engine. Its problems simply defy a low-cost solution. Battery-powered vehicles may become useful as short-distance shuttle buses at airports and on large campuses. But battery power is impractical for distance driving. An electric-internal combustion combination is a possibility. Then there is the Stirling engine, invented in 1816 by Robert Stirling, a Scottish minister. It is an external combustion engine with a flame that provides a constant even heat to the working fluid within the compression chamber. The fluid, either hydrogren gas or helium, cycles back and forth and drives the pistons up and down to generate power for the wheels. A regenerator located inside the engine stores heat and later returns it to the working fluid. This way, the amount of heat drawn from the combustor is small and fuel economy results.

The Stirling engine has a number of attractive advantages. It provides about 30 percent better fuel economy than the internal combustion engine. It can use any

kind of liquid fuel, its exhaust is low in pollutants, and it provides a quiet vibration-free ride. But it is too big, too heavy, and too expensive. Some consider it a relic of the industrial revolution. Nevertheless, the D.O.E. is funding a Stirling engine development program at Mechanical Technology, Inc., Latham, New York. A viable Stirling engine for passenger cars is expected to emerge by 1985.

Then there is Roger Billings' space-age hydrogen car. Billings, a 30-year-old Utah Mormon, is a futurist who sees hydrogen as the fuel to replace oil when the wells finally run dry in ten or twenty years. Billings became interested in hydrogen as a high school student when he watched a lab demonstration of water being separated into hydrogen and oxygen. When he saw that hydrogen gas when burned gave off an exhaust of pure clean water vapor, he set out to create a pollution-free car using hydrogen as its fuel. In 1972, while a graduate student at Brigham Young University, Billings entered a hydrogen-powered Volkswagen car in the U. S. National Urban Vehicle Design Competition and won first prize.

Nevertheless, he was told by the experts that hydrogen could never become a viable fuel. So he set out to prove them wrong. He experimented with hydrogen until he found ways in which it could be used safely and economically. To continue his work on hydrogen, Billings formed the Billings Energy Corporation at Provo, Utah, which has become a multi-million dollar energy lab. The company has received over $2 million in research contracts and grants from private industry around the world. Japan is particularly interested in hydrogen power because it must import 99.6 percent of its oil. ~~Is the Japanese interested in hydrogen power? If it is, it is well-advised.~~

So there is no lack of ingenuity and inventiveness at work in America finding ways to solve our energy crisis. ~~But what we will probably get is the kind of~~

And the e is always the possibility of a technological breakthrough, even in Detroit where such breakthroughs are not unknown. Yet, one has the feeling that the breakthrough may occur in Japan or Europe before it occurs here.

On the other hand, while writing this article and coming face to face with the difficulties involved in producing any of the alternatives — steam, electric, turbine, or hydrogen — I've developed a greater respect for the often maligned internal combustion engine. Considering how ~~people use it and abuse~~ the average driver uses and abuses it, it has served us well for a good many years. The world's having a hard time coming up with a replacement that performs as well for the same price. And the reason why the manufacturers like it so much is that it can be slapped together by today's semi-skilled, ~~workforce~~ less-than-dedicated workforce, by the millions. In fact, one gets the feeling that if the automobile were indeed ~~xxxx~~ re-invented, it would, in all ~~likelihood~~ likelihood, turn out to be ~~another~~ the internal combustion engine. Maybe I say this because I've never driven in anything else. But maybe, also, the internal combustion engine is the best available at this moment in history at a price that everyone can afford. As for mileage, it's going to get better because that's what the customers want. How much better? That will be determined by all of the forces at play — and a few laws of nature, federal mandates notwithstanding.