If Gasoline Engine Goes, What Next?

by WALTER O. KOEHLER

For the first time in more than half a century, the gasoline-fueled piston engines faces a serious threat to its existence. A measure to ban all gasoline-powered cars from the roads of California by 1975 passed the Senate there, then died in the Assembly. Similar auto pollution legislation has been proposed in Congress. To encourage the development of alternate sources of power, the Department of Health, Education and Welfare has proposed a five-year program costing $45-million.

Despite development of crankcase ventilation systems and exhaust-emission-control devices, the automobile engine is still considered by most authorities to be the largest single source of air pollution. Some engineers doubt the gasoline engine can meet the exhaust-emission standards scheduled to take effect in 1975.

Should the gasoline engine be banned, what form of power would take its place? The electric, the hybrid electric, the steamer and the gas turbine appear to be the leading candidates.

Electric cars offer the advantages of fume-free, noiseless operation, relatively simple construction and ease of driving. Right now, industry has the technical ability to produce a small runabout suitable for local shopping trips and short-distance commuting.

Before a satisfactory car for general family use can be produced, there must be a major breakthrough in the design and construction of storage batteries. In its present form, the storage battery is a heavy, expensive power source that provides limited speed, hill-climbing ability and cruising range.

Experimental Model

One experimental electric car is a conversion of an imported four-door sedan. In its standard form, powered by a gasoline engine, the car weighs about 1,800 pounds, has a top speed around 80 m.p.h. and can travel at least 250 miles between fuel stops. Converted to battery power it weighs 4,100 pounds, maximum speed is reduced to 65 m.p.h. and the extreme cruising range at moderate speed is 60 miles. When the car is run at higher speed or in hilly country, cruising range is sharply reduced. Recharging takes about seven hours.

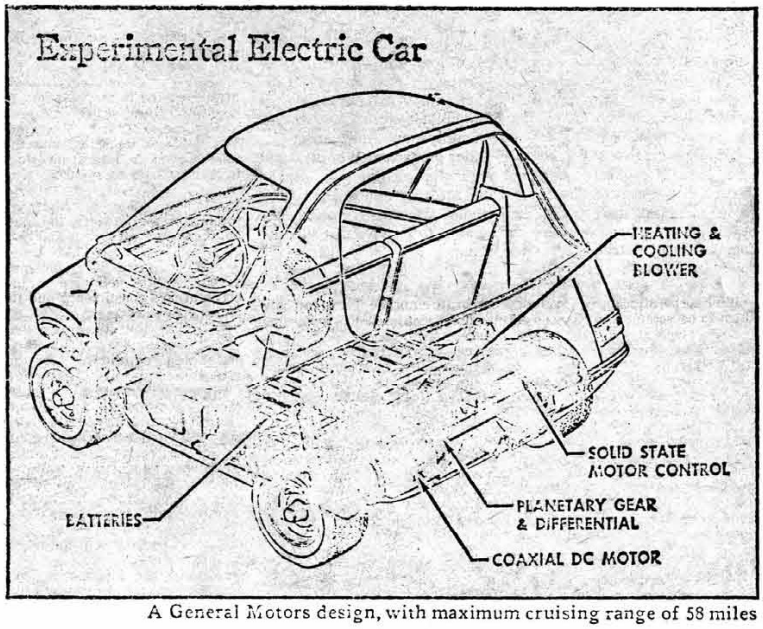
Scientists are working on new batteries with such combinations as zinc-air, nickel-zinc and lithium-chloride fused salt. Some provide more power within a given space and weight, but at a reduction in cruising range. Others give more range but less power.

Several Hybrids

To gain the advantages of the electric car, while minimizing its drawbacks, General Motors engineers designed several hybrid electric automobiles. One employs a Stirling-cycle engine, a design that dates back more than 150 years. Like a steam engine, the Stirling is an external-combustion power-plant. There is no burning fuel inside the cylinder. Instead, the working fluid, usually hydrogen or helium, is heated by an external burner, which can use almost any type of fuel.

In the Stirling engine, the working fluid is used over and over. Pistons transfer it from the cool part of the cylinder to the hot part and back again. As the compressed and heated fluid expands, it produces power. After its useful energy has been extracted, it is again heated and compressed to repeat the cycle. Only the gases from the burner escape to the atmosphere. As a result, noise and air pollution are minimized. In its present form, however, the engine lacks flexibility.

G. M. engineers have also produced an experimental hybrid vehicle, the Stir-Lec II. Mounted in an Opel sedan, the small Stirling engine drives an alternator to charge the batteries. Power to propel the car is provided by a 20-horsepower electric motor. Top speed is 60 miles an hour, but the car is designed to cruise at 30 miles an hour. At this speed, the Stirling engine produces just enough power to keep the batteries charged. At higher speed, the motor is drawing reserve power from the batteries. The maximum range at 30 miles an hour is 150 miles.



A General Motors design, with maximum cruising range of 58 miles

Another G. M. hybrid employs a 12-cubic-inch gasoline engine (a typical compact car has an engine with a piston displacement of about 200 cubic inches) connected through an electromagnetic clutch to a direct-current electric motor. When taking off, the car accelerates to 10 miles an hour under electric power supplied by a 72-volt battery pack. At 20 miles an hour running under gasoline power. For maximum acceleration, the electric motor cuts in automatically to assist the gasoline engine. The car's top speed is only 35 miles an hour and its maximum cruising range is 150 miles.

As for steam power, it gives smoothness, high torque at low speed and silence that cannot be matched by the gasoline engine. But lubrication is a problem. At the extreme temperatures and pressures necessary to make the steam engine competitive in horsepower and fuel economy, lubricating oil simply decomposes. And in cold weather, freezing of the water is a serious problem.

Both Ford and G.M. expect to have gas turbines in production in 1971.

The Main Advantages

The turbines' principal advantages are high power in a light, compact package, smooth operation resulting from the absence of reciprocating parts, clean exhaust and the ability to operate on a variety of fuels. The main problems are high cost, poor fuel mileage and poor throttle response.

The basic design of the turbine is simple. A compressor compresses the incoming air. Then fuel is added and the mixture is ignited by an electric spark. As soon as combustion starts, it is self-sustaining and the ignition can be shut off.

The burning gases strike the blades of a first-stage turbine, which drives the compressor. The hot gases then flow to the power turbine, geared to the driving wheels of the vehicle.

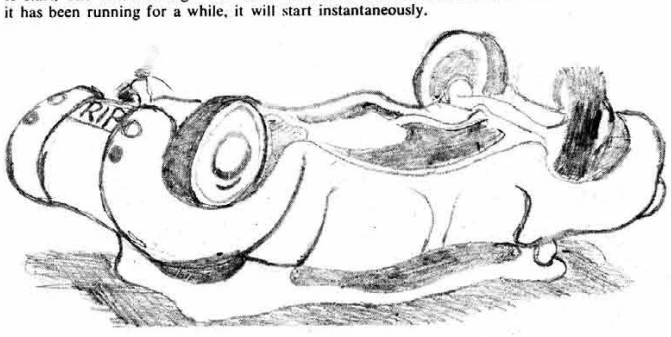
If the gas turbine can be built cheaply enough, small enough and fast enough, the gasoline engine might join that growing list of things that never would be missed.

Up with steam

As much as GM, Ford, Chrysler would like the public to think that the use of steam power for transportation is impossible (stating such arguments as the steam engine is "too complex, too costly, too bulky, takes too long to start, not efficient," etc.), Sam Miner and the Williams brothers, inventors of the Williams Steam Car, have found that steam vehicles can now match, and often exceed the performance of the smog-spouting internal combustion engines.

Comparisons showed that steam engines had the following advantages:

1. Steam engines are simpler since they have no air cleaner, muffler, elaborate exhause control devices, engine block cooling system, fuel injection system, distributor, carburetor, starter motor, or transmission.
2. Steam engines, able to use low-octane, non-leaded fuels, burn this fuel at atmospheric pressure and thereby practically eliminate unburned emissions.
3. Steam engines are economical; the Williams Car gets approximately 18-20 miles per gallon using non-leaded kerosene.
4. Contrary to common beliefs, steam engines do not require a long time to start. The Williams engine can start from dead cold in 30 seconds, and if it has been running for a while, it will start instantaneously.



"And Yet We Turn Our Backs"

by Tim Michaels

While gazing wistfully from G.C.C. down the plywood highway, it occurred to me that some answers to pollution might be found in the antiseptic building attached to the western end of it.

Next I set out to find a science or engineering person and, without offending, ask him what is being done to eliminate pollution by that division of the University. I did find such a person and herewith some of his observations.

Science and engineering must not be separated from the rest of humanity, that it will be a joint effort which finally overcomes the darkening skies and waters. To some degree science and engineering depend on public attitudes. The more receptive the public is to talk of impending disaster the more dollars flow to block it. There are answers available now for those who wish to spend a little of the money they earned at the expense of the earth.

I nodded in agreement here and pressed forward. "This is all well and true, but what is being done here at UH?"

You need money in the laboratory and you need money to get projects from the lab into general use. The public as a whole just isn't scared enough to provide the kind of money we need yet.

"Yes, but what is being accomplished here to aid the Hartford area or the campus? I understand that because of the dam on the Hog river, deposits are building up in our pond, that it will be just a cess pool in a few years."

Well, we are doing studies—every year we do studies on the Hog river. You are right—it is getting worse. We also are receiving money from the government to study the effects of pesticides concentration in cells.

"Don't we already know the effects of pesticides in cells?"

Well, yes, but we're doing this study...