Plug-in Cars Will Give Commuters a Charge

Gas stations may be replaced with electric outlets and noisy engines with quiet motors when cars are powered by electric batteries now under development

By Jonathan Eberhart

➤ AS YOU back out of the garage on your way to work, a prong on the front of your car detaches itself from a socket in the wall. When you park at your destination, the prong is driven into another socket, this time in what otherwise appears to be an ordinary parking meter.

The rest of your driving routine is not unusual, except—no gas stations.

The milk routes of England and the golf courses of the U.S. already see heavy traffic in vehicles that are the forerunners of such an idea. The secret: electricity. The source: batteries.

There are problems, of course. The British electric milk carts are slow; golf carts are even slower and most have barely enough power for two rounds of golf—hardly the commuter's dream.

In fact, even with a 500-pound battery of the conventional variety, an average American compact car with an electric motor would last for about 10 miles of driving around in city traffic before it stopped dead, Dr. J. E. Goldman, director of Ford Motor Co.'s scientific research laboratory, said.

A silver-zinc battery is more than three times as efficient, but it would be almost prohibitively expensive in passenger-car sizes. In addition, it wears out, as do most batteries, from being charged and discharged over and over again.

Now, however, thanks to the holes in a new form of aluminum oxide crystal, batteries are being developed that may offer eight times the range and 15 times the efficiency to the charged-up commuters and shoppers of tomorrow.

The closest thing to a miles-per-gallon figure for a battery is called energy density, measured in kilowatt-hours of power per pound of battery weight. Today's lead-acid car batteries have an energy density of about 10. The exotic nickel-cadmium and silver-cadmium batteries used in hearing aids, portable radios and other miniaturized electronic equipment rate about 14 and 24, respectively. Even silver-zinc only gets a 50.

A new battery, just announced by Ford and still literally in the test-tube stage (the prototypes are all built in glass vials), has a "conservative" rating of 150, Dr. Goldman reported. Driving downtown in that electric compact, the battery would be good for at least 82 miles, while at a steady 40 mph the car could travel 132 miles without recharging.

The battery is just the opposite of the version in today's cars. Instead of having solid electrodes immersed in a bath of sulfuric acid, it has liquid electrodes (liquid sodium and conducting sulfur) separated by a solid ceramic made of aluminum oxide.

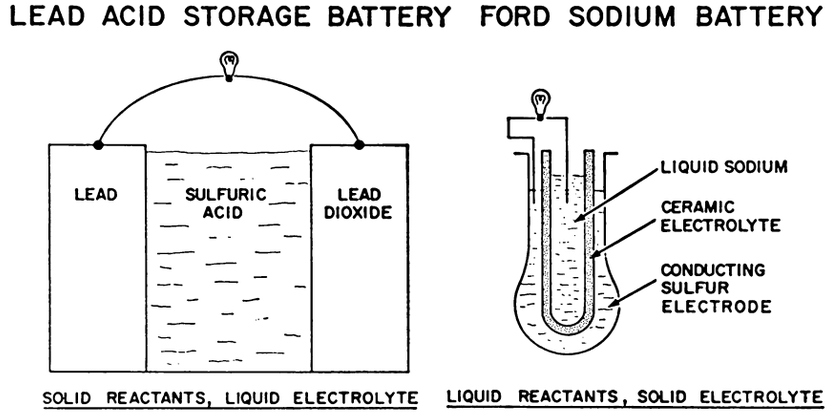
Because of the unique shape of the ceramic crystals, which resulted from basic research that had nothing to do with batteries, only sodium ions can pass through the ceramic. These ions are formed when an external circuit such as an electric motor "steals" an electron from a sodium atom, leaving it as an ion. The ion goes through the ceramic and combines with the sulfur, producing the chemical reaction that is the source of the battery's power.

The battery reportedly does not deteriorate from repeated charging, and its storage life is apparently indefinite, though its development was so recent that scientists are not yet sure. When it becomes standardized, says Dr. Goldman, it may ultimately outlast the cars it is used in.

In addition, it is cheap. "Our hearts fill with glee when we think of sodium," Dr. Goldman says. Detroit, hub of the auto industry, sits on deposits of the stuff, and all the salt in the U.S. is a usable source. Sulfur is no more of a problem.

There is actually little comparison with present car batteries, since the sodium-sulfur cell will not be doing the same job. While today's battery, which is constantly being recharged by the generator, needs relatively little power to start the car's internal combustion engine, a battery that must run the entire car by itself needs 30,000 or 40,000 watts on tap.

Stoking up a battery with 30 kw would seem to require quite a bit of recharging time. Not so, according to Dr. Neil Weber, co-inventor with Dr.



Ford

ELECTRIC CARS—Electric autos of the future may well be powered by the new battery shown at right, which is predicted to offer 15 times the energy density of today's battery (left). Ford Motor Co. attributes the birth of the device to the development of the aluminum oxide ceramic that makes up the electrolyte.

Joseph T. Kummer of the FoMoCo battery. It could be 60% recharged in about two hours, and completely recharged "easily" overnight, without the need for special, heavy-duty wiring.

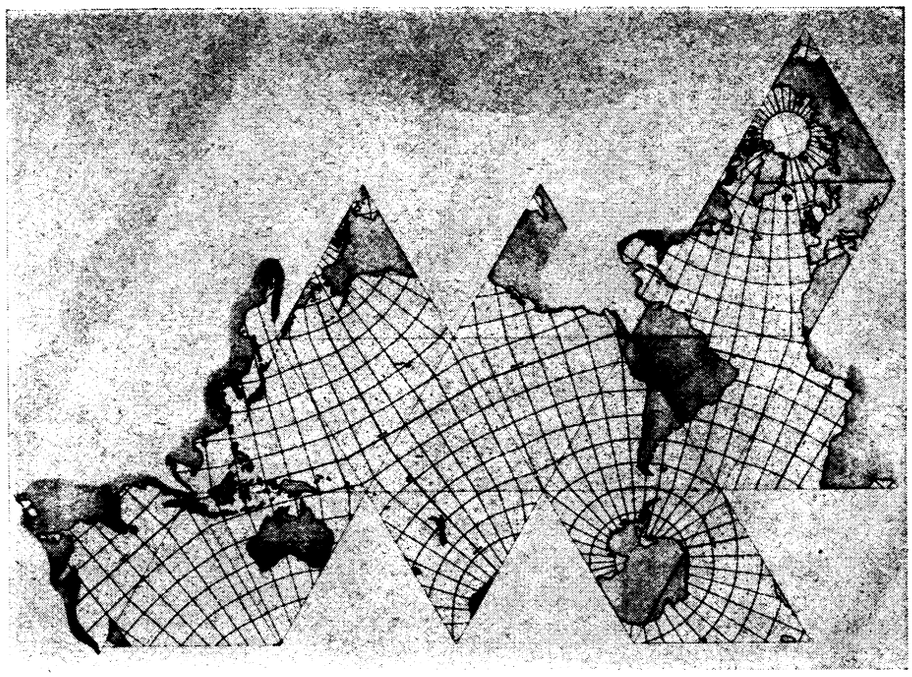
There have been electric cars before, some of which are now eagerly-sought antiques. Others have been tested from time to time by various electric and power companies, to whom they were lent for the purpose by the manufacturers. All, however, have been severely limited in performance by their batteries.

Two prototypes are now being built by Ford of England, one of which will remain there while the other is shipped to the U.S. for evaluation. Intended as low-speed, limited-range vehicles for either suburban errand-running or downtown operation in crowded cities, the vehicles will be little more than hopped-up golf carts.

Since they are intended primarily to test the motor and vehicle concepts, rather than new power sources, they will first be fitted with conventional lead-acid batteries. Not until late 1968 will large enough sodium-sulfur batteries be available.

About six feet long and four feet wide, the cars will hold two adults and two children.

They should be running by next spring.



Lockheed-California Company

"FORECAST" MAP—A new map projection that "flattens" the earth and its oceans with minimum distortion will be used for wave forecasting throughout the world. It accurately converts the globe into 20 triangular map segments joined together in this icosahedral-gnomonic projection. →

TECHNOLOGY

New 'Window' for Planes

See Front Cover

➤ SOME DAY a pilot may fly from New York to Los Angeles without ever looking through the windshield of his plane.

Instead he will rely on the "eyes" of a tiny computer that generates synthetic pictures of the ground, clouds and other objects on a television screen in front of him.

The computer determines how these objects should look to the pilot on the basis of altitude, speed and attitude of the plane in the air.

Designed by General Electric Company's Electronics Laboratory in Syracuse, N.Y., the computed display system is now being used on the ground to train astronauts and pilots at the Houston Manned Space Flight Center and the U.S. Navy Missile Center at Pt. Magu, Calif.

As the astronaut or pilot moves the control stick in his ground training vehicle, he watches the television screen. Objects grow larger as he "flies" closer, the ground falls away as he "takes off" or the deck of an aircraft carrier looms ahead as he prepares to "land." He can even crash a few times to get the feel of it.

The picture, although composed of computer-made symbols, is in the same perspective as if the pilot were looking out the window. It changes constantly as the plane moves.

The symbols can give the pilot additional information, such as direction. Clouds, for example, may be represented as arrows pointing north. By checking the position of the arrows on the screen, the pilot learns his direction.

In addition to training pilots and astronauts and simulating flight, the computed display systems can be applied to the design and evaluation of new aircraft and spacecraft.

The National Aeronautics and Space Administration uses its display to evaluate new space guidance and control systems, while the Navy's is used to investigate the control and information requirements of future high performance aircraft.

In the cover photograph, the clouds are seen as airplane-shaped symbols headed toward the viewer. The "L's" at the bottom represent land and also help the pilot judge the direction in which the airplane is moving. The black box to the left is the computer's representation of the aircraft carrier on which the plane will "land."

(Cover photograph by General Electric.)