FVEAA NEWSLETTER

November 1984

MEETING NOTICE

The Fox Valley Electric Auto Association will meet on the third Friday of November (Nov. 16) at 7:30 p.m. in the Mid-America Federal Savings building located at 250 E. Roosevelt Rd. in Wheaton, Ill.

At this meeting, we will have a discussion concerning electric autos. Also we will have some show & tell items which will be of interest.

Election of new officers.

Parts for sale.

Coffee, tea &

Door prize

Membership renewal time.

EV Production Planned For India

Plans to manufacture 15,000 electric vehicles a year in India have been announced recently.

Electricars, Cableform, and Electric Construction, all well-known British firms, have signed a cooperation contract worth approximately $8-million with Chatelec, the Indian electric vehicle company.

Work has already started on the factory, near Bombay. It will build buses, industrial transporters and other electric vehicles. Production is scheduled to begin next year.

Electricars will also supply a demonstration fleet of 210 vehicles and fill an advisory role while the production gets under way. Cableform is to provide information on electronic and other control gear. Electric Construction will be advising on electric motors. The companies are to supply parts in the first two years of the project.

India is promoting electric vehicles because it wants to cut its dependence on imported energy. Oil imports used up more than half of its foreign exchange last year. □

EV Battery By German Firm

Reports from West Germany indicate that Brown Boveri & Cie is believed to have a practical sodium-sulphur EV battery after some ten years of work on its development.

Several vehicle manufacturers in West Germany are being contacted regarding building cars incorporating the BBC system. Tests with converted Volkswagen vehicles are reported as very successful.

Cars in the VW class are expected to have a range of about 250km at a continuing speed of 100 km/h. Acceleration would be 0-50km/h in 7 seconds. Top speed is reported to be 130km/h.

It is noted, however, that production which incorporates the new BBC system with the sodium-sulphur battery is not expected until 1990 and, as yet, there are no indications of what vehicle manufacturers will actually put the vehicles into production. □

FVEAA

fox valley electric auto association inc.

624 Pershing St. Wheaton, Ill. 60187

Rev Apr 1984

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MEMBERSHIP

A membership in the Fox Valley Electric Auto Association (FVEAA) is open to everyone. Currently there is only one grade of membership regardless of the members degree of participation in association activities. Membership in the FVEAA is contingent upon payment of the annual membership fee. The membership fee can only be waived by special vote of the Board of Directors. Each member in the FVEAA receives a copy of the FVEAA Newsletter each month. They are also entitled to attend and vote at all association meetings.

All memberships in the FVEAA run from November 1 to October 31 of the following year. The dues are $15.00 per year payable at the November meeting. New members joining after November shall pay $1.25 for each month remaining before the following November.

The following form may be used to apply for membership or to renew one.

Date ______________

APPLICATION FOR MEMBERSHIP OR RENEWAL

NAME ________________________________

ADDRESS ________________________________

CITY ____________________ STATE __________ ZIP __________

- ☐ Just interested in Electric Vehicles
- ☐ I have an Electric Car
- ☐ I wish to build an Electric Car

Amount enclosed $ ________ for ______ months.

Mail to: Mr. Jack T. Cahill, FVEAA Tres.
1 S 736 Vista Ave.
Lombard, Il. 60148

BATTERY PERFORMANCE AT LOW TEMPERATURES

The ability of a lead-acid battery to deliver electrical energy is reduced at low temperatures. Most EV operators using their vehicles in the winter have become aware of this. DOE test program participants have reported the following operating problems at low temperatures:

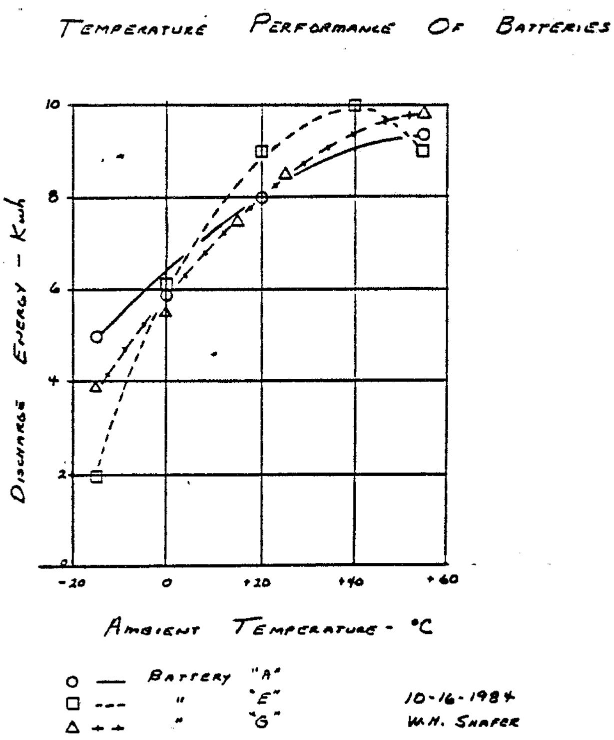
1. Reduced vehicle range
2. Higher energy use
3. Charging difficulty
4. Cell mismatching
5. Frequent failures

The extent of battery performance decline has been measured by a series of laboratory controlled experiments on three commercially-available EV batteries. Results were reported by Alabama University in 3 DOE publications. The figure below was prepared from this data.

It illustrates how the ability of a 96-volt EV battery pack to deliver energy changes with temperature. Note that battery temperature behavior changes with design. Battery "E" at -16C has an 80% decline from maximum, but has the highest capacity at +40C.

Battery maximum discharge energy is delivered when cells are +40 to 55C.

Another useful result of the test was determination of a battery's thermal constant. The constant is the time necessary to change the battery temperature by 63% of the original difference between battery and environment. The constant for a typical EV battery was found to be 30 hours.

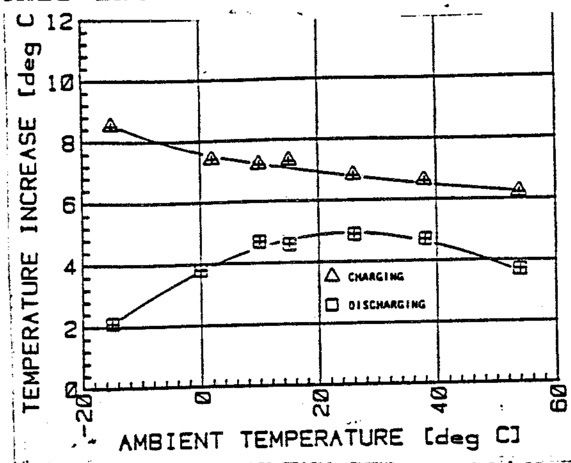


This is useful information for EV owners who plan to use their cars during the winter. If it starts out fully-charged from a heated garage, the car can sit for 9 hours in a cold parking lot with only a modest loss of starting temperature. Of course, it would also help to enclose the battery assembly in a styrofoam jacket to reduce heat loss. The jacket must have ventilation provisions to avoid explosive build-up of electrolytically-produced hydrogen & oxygen.

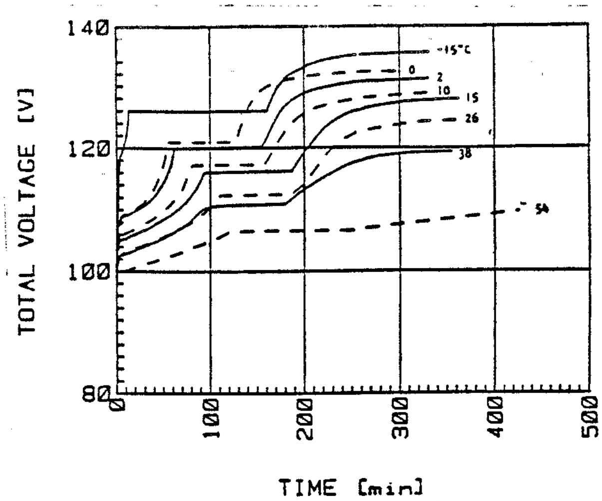
BATTERY PERFORMANCE AT LOW TEMPERATURES (CONT'D)

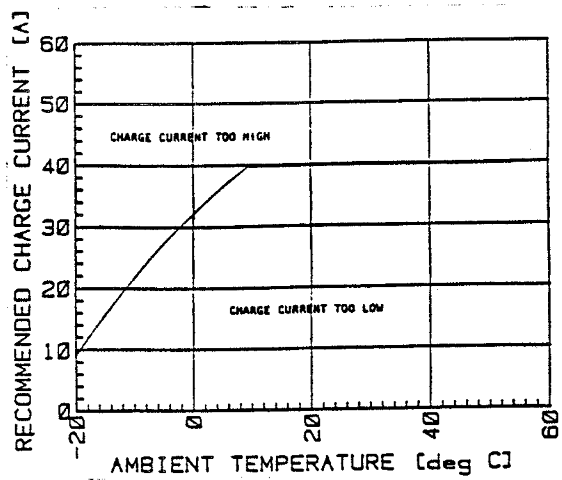
If the car is not kept in a heated garage, the styrofoam enclosure could be heated by a hair blower or other similar device that is thermostatically-controlled to maintain an optimum cell temperature of about 40C.

Battery temperature increases during charging and discharge operations. The magnitude of this increase was also a test result and is charted on the accompanying figure. The charge current was a constant 40 Amps for 6 hours. The discharge current was 120 Amps for 2 hours. In the test, it was found that a battery needs about 5-7 watts per cell to keep warm at ambient temperatures lower than 0C. A 6-Amp trickle charge produces 5-12 watts per cell, but may cause unnecessary gassing and water loss.



A most-important finding from the test is the necessity of adjusting charger voltage to compensate for ambient temperatures. As temperature decreases, the end-of-charge voltage increases. The next two charts show the change in this voltage with temperature and the recommended adjustment of charge current with temperature.



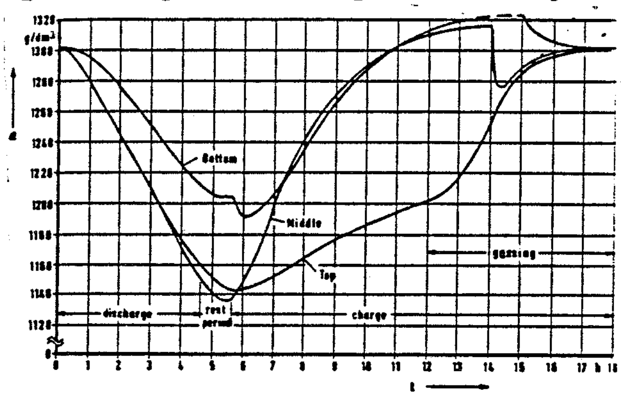


If you are determined to use your car during the winter, you can extend the life of your battery by observing the principles stated above.

William H. Shafer
19 October, 1984

ELECTROLYTE STRATIFICATION IN BATTERIES

Electrolyte in the cell of an EV battery does not ususally have the same top-bottom specific gravity (SG). This has been experimentally determined. The accompanying figure illustrates the variation of electrolyte density during a battery discharge-charge cycle.



Electrolyte density distribution during a recharge/ discharge cycle without electrolyte pump

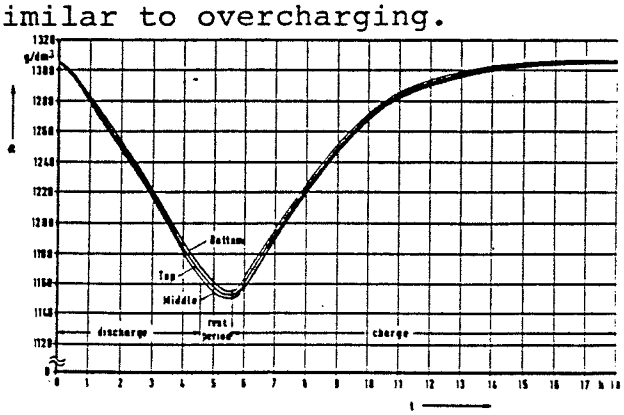
Electrolyte stratification produces several undesirable effects which can shorten battery life. The part of an individual plate structure at the bottom immersed in denser fluid will experience a higher positive plate grid corrosion rate. The stratification also causes increased sulfation of each plate bottom. Both these effects shorten battery life.

The usual method for overcoming electrolyte stratification is battery overcharge. The electrolyte is agitated by the electrolysis of water to produce hydrogen and oxygen. The evolving gas bubbles rising to the surface cause mixing.

Overcharge can have a bad effect on battery life however. It causes formation of "mud" from the material shed off the plates and leads to short circuits. Overcharge also raises the cell temperature which, in turn, hastens grid corrosion. The optimum overcharge depends on a particular battery, ambient temperature, and a balance between electrolyte mixing and plate shedding. If you don't often have to add water, a cell may be undercharged and have stratification. If you add water too often, you may be unnecessarily shortning cell life.

Mechanical means for electrolyte mixing have been developed. Most-recently, these have been air-bubblers. In one type which was added to a standard EV battery, four small (3-4 mm diameter) Teflon tubes were inserted into each cell thru holes drilled in the battery case top. These were connected to an air manifold and a 3-gallon air tank which was supplied with filtered air at 3 psi. The bubbles rising from the tubes which are open at the bottom caused mixing in a manner similar to overcharging.

In another version developed by HAGAN each cell is built with a thin air-supply hose inside a wider tube open at both top and bottom. As bubbles rise in the concentric tube arrangement, electrolyte is mixed.Compare the two figures on this page.



Electrolyte density distribution during a recharge/ discharge cycle with continuously operating electrolyte pump

ELECTROLYTE STRATIFICATION IN BATTERIES (CONTINUED)

Batteries commercially-available from Globe incorporate an air-driven electrolyte pulsing system in each cell to eliminate stratification.

With mechanical agitation, overcharge is unnecessary. This increases battery efficiency by about 10% and capacity by about 25% at +40C.

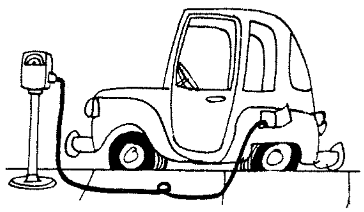
Since the EV batteries now in use do not have mechanical agitation, overcharge is the only way to achieve electrolyte mixing. Lucas Chloride (Britian) has identified five phases of a battery charging cycle. Phase 1 is called bulk charging in which withdrawn energy is replaced, generally at the charger's constant-current limit. Phase 2 is the so-called taper charge. Phase 3 is the equalization period where fully-charged cells begin to gas as the weaker cells continue to accept charge. Phase 4 is where all cells produce gas and experience mixing. Phase 5 is the so-called trickle charge which maintains the cell in a fully-charged condition.

The EV owner can maximize battery life by observing and recording the onset of gassing in each cell. Correction of stratification can be achieved by shifting to phase 5 charging about an hour after the onset of gassing in the last cell, providing there is not one particularly weak cell which would result in severe overcharging of the other cells.

William H. Shafer
27 October, 1984

FOR SALE Elcar - complete - or will seperate. Needs differential - can use Citicar rear-end.

Chassis with fiberglass body - $175 - 10 Trojan batteries 105 amp less than 800 miles on them - $275 - Lestermatic battery charger 48V & 12V - $135 - Electronic speed controller (by Dave Lambert) 48V - $495 6 horsepower G E series wound 48V motor - 4400 RPM - $295 If interested, call :
Donald Kubick 249 Arlington Heights Rd.
Elk Grove Village, Ill. 60007 Phone 437-0453



Fuel-cell power for electric cars

The solid-polymer-electrolyte fuel cell powered the Gemini spacecraft flights in 1963. Now it's being considered as an economical alternate energy source for automobiles.

By JOHN CONWAY

A battery powers an electric motor; the motor turns the wheels for clean, efficient, gasoline-free transportation. That's the marvelously simple concept of an electric car, but it is still far from reality.

A new power source is needed. Conventional wet cells are expensive. Also, because they use a liquid electrolyte, they're prone to corrosion and leakage, which limits their life expectancy and makes them potentially hazardous in an accident. Though many new sources are under study [PS, Oct. '80, April '81], perhaps a relatively old idea—the solid-polymer-electrolyte (SPE) fuel cell—may be the answer.

"The SPE fuel cell has been under development since the mid-1950s," says L. J. Nuttall of General Electric's Aircraft Equipment Division. "But only now has it been considered an economical alternative to the gasoline-turbine or internal-combustion engine."

The SPE fuel cell powered the early Gemini spaceflights. Its solid electrolyte is safe and virtually corrosion-free, giving it a life expectancy that far exceeds the 5,000 hours needed for a passenger car.

Nuttall and his associate, James F. McElroy, believe that newer designs can create a less-expensive cell that meets the power, size, and weight requirements for small cars. But they warn that although research and testing at GE under a contract with the Los Alamos National Lab show great promise, much remains to be done.

Inside the cell

To make a battery (or a cell within a battery), two dissimilar, electrochemically active materials are needed to form the anode and cathode terminals. In a lead-acid battery, for example, lead and lead dioxide are used. As one terminal gives up electrons, the other accepts them, and ions are passed internally through an electrolyte—sulfuric acid—to complete the circuit.

In an SPE fuel cell, hydrogen and oxygen are the active materials, and a solid ion-exchange membrane forms the sole electrolyte. Because no liquid is used, leakage and corrosion are eliminated.

The electrolyte is a solid sheet of plastic somewhat similar to the silicon compound used to coat cookware. Sulfonating the plastic gives it the ability to conduct hydrogen ions. And because the sheet is solid, it can provide a high electrical efficiency and serve as a barrier between the hydro-

Continued

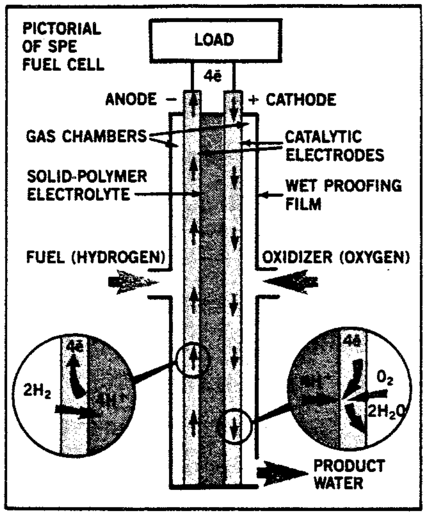
gen and oxygen reactant gases as well.

The hydrogen required by the cell is created by heating dry methanol stored aboard as fuel for the vehicle. The heat required comes from the cell itself.

"A small amount of hydrogen and oxygen is stored aboard the vehicle for start-up," explains Nuttall. "The reaction within the fuel cell produces waste heat and water. The dry methanol is then vaporized by this heat and passed through a catalytic cracker, which dissociates it into hydrogen and carbon monoxide. It's then humidified with the product water to form a three-to-one ratio of steam to carbon for use in a shift reactor. The reactor converts the carbon monoxide into carbon dioxide and water."

The mixture delivered to the fuel cell is approximately 75 percent hydrogen, 25 percent carbon dioxide, and less than 0.2 percent carbon monoxide. Most of the hydrogen is consumed by the fuel cell in producing the electrical power for propulsion of the vehicle. A small amount of hydrogen and carbon dioxide is combined with primary combustion air to fuel the burner used in the methanol cracking.

A compressor provides the 150-psi air pressure for the cathode reaction. But because it's powered by expansion of the cathode exhaust gas and the waste heat generated by the system, there is no need for external power.



The cells have been tested for more than 60,000 hours with little change in performance. Simulated testing (performed on a computer) of the cell in a General Motors X-car and a GE-Chrysler Electric Test Vehicle have coupled the fuel cell with a 20-horsepower electric motor. The cell performed well enough (zero-to-50-mph acceleration times of 12.1 and 10.2 seconds and fuel consumption equivalent to 55 and 66 mpg of gasoline, respectively) to compare favorably with diesel and spark-ignition versions of the X-car.

The top speeds attained in the tests (70 to 80 mph) were determined by the motor and controller characteristics and by the final drive ratio. But, says Nuttall, "Research shows the fuel cell can provide enough power for substantially higher speeds."

Both Nuttall and McElroy caution, however, that cost is still a factor in determining the ultimate feasibility of the fuel cell for use in an automobile.

"For the SPE fuel cell to be competitive," says McElroy, "it must have a capital cost considerably less than $200 per kilowatt." Nuttall and McElroy believe that significant savings will come by reducing the amount of platinum (used as a catalyst) from eight grams per square foot down to 0.75, and by changing the electrolyte film. (It's now good for 100,000 hours of use when only 5,000 hours are needed.) But that will also take time.

While McElroy says, "A power plant that will meet the performance, size, weight, and cost objectives of the auto makers is possible," Nuttall adds, "It will take several more years of comprehensive development effort." PS

Tire Rotation Is Overlooked And Misunderstood Economy Measure

There are so many other maintenance and upkeep considerations to keep track of in owning an automobile, van, camper or pickup that tire rotation has become an increasingly overlooked and neglected practice. Yet tire and automobile manufacturers all recommend it.

A suggested rotation schedule is included in every Volkswagen Owner's Manual. Basically, the recommendation is to rotate radial belted tires every 7,000 miles, and bias ply tires every 3,500 miles. For exact instructions and information regarding rotation on your VW, please see your Owner's Manual and follow the specific directions given there.

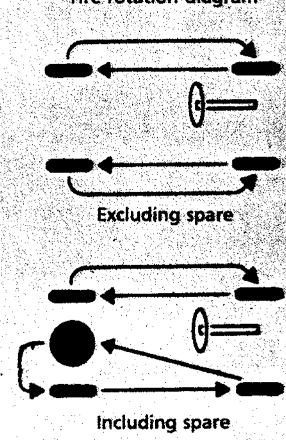
In addition, you are advised to inspect your tires visually every 2,000 miles for wear and damage. If you notice uneven or substantial wear, your wheels might need alignment or tires should be balanced or replaced.

The accompanying drawing indicates how tires should be rotated, including or excluding the spare tire. Notice that tires must always remain on the same side of the vehicle. This is a significant change from many years ago, when tires were rotated diagonally, causing them to change direction of travel upon each rotation procedure.

Wheel bolts should be torqued* (tightened) diagonally and tire pressure checked, to be adjusted if incorrect.

The purpose of tire rotation is two fold: (1) economy and (2) handling. Although an expense to you unless you do it yourself, rotation prolongs tire life. It also assists in maintaining good roadability.

Tire rotation diagram



*See your Volkswagen Manual for specific torque specifications.