F.V.E.A.A. NEWSLETTER

SEPTEMBER 1985

MEETING NOTICE

THE NEXT MEETING WILL BE FRIDAY SEPT. 20th, at MID AMERICA FEDERAL SAVINGS 250 E. ROOSEVELT RD. WHEATON, ILLINOIS. - TIME - 7:30 P.M.

HAMFESTS 1985

The following is a list of the hamfests for the balance of the 1985 season. Have a good time.

Sept. 21 & 22, 1985
SuPerfest '85
Exposition Gardens
Peoria, Ill.

Sept. 28 & 29, 1985
Radio Expo '85
Lake County Fairgrounds
Grayslake, Ill.

October 21, 1985
Chicago Citizens R.L.
No. Shore Am. Leg. Pst. 21
6040 N. Clark, Chicago, Ill.

November 3, 1985
Late Fall Hamfest
Lake County Fairgrounds
Grayslake, Ill.

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FOX VALLEY ELECTRIC AUTO ASSOCIATION
624 PERSHING ST. WHEATON, ILL. 60187

Q: Is it OK to add acid to weak cell if it does not come up after normal leveling charge.?

A: No, the BCI Manual says <u>never</u> add acid after a battery has been in use. Failure is usually caused by physical deterioration of internal components, more acid can only accellerate the process.

EXIDE EV BATTERY FACTS

WATERING: Lead-acid batteries consume water during charging and require "topping up" periodically. The frequency of this service depends on use and temperature. Only deionized or distilled water should be used and topping up should be performed immediately after a full charge while gas bubbles are still trapped between plates and separators. As a battery ages, the frequency of watering increases. Never, under any circumstances, allow the electrolyte level to fall below the tops of the plates; and never add acid—just water. As a general rule for heavy, daily use, EV batteries should be checked every two weeks for proper levels of electrolyte.

Q: Which is best; batteries in series for higher voltage or batteries in parallel with lower voltage?

A: Since power drives the vehicle and power is amps X volts it follows the higher the voltage the lower the current. High currents not only limit your range but also can shorten battery life. If you drive conservatively, keep the current low high voltage is better. If you have a lead foot like me, when I accelerate, climp a hill, and anytime the amps go high It's good to know the batteries are in parallel.

With lower voltage, regeneration is simplified, easy to control, and holds up at lower speeds. With low voltage you can use a simple speed controller.

P=IE

FIRST CLASS

F.V.E.A.A.

SEPT. 1985

LETTER FROM THE PRESIDENT

DEAR FELLOW MEMBERS :

WE HAVE ARRIVED ONCE AGAIN AT THAT MEMORABLE DATE WHEN WE MUST SELECT NEW OFFICERS FOR OUR CLUB.

AS PER RESOLUTION ADOPTED AT THE AUGUST, 1985 REGULAR MEETING, THE PRESENT BOARD OF DIRECTORS, ACTING AS A NOMINATING COMMITTEE, IS RECOMMENDING THE FOLLOWING SLATE OF CANDIDATES :

FOR :	PRESIDENT -----	
	VICE PRESIDENT -----	
	SECRETARY -----	GEORGE ZARINS
	TREASURER -----	VLADIMIR VANA
	DIRECTOR AT LARGE ----	JOE POLLARD
	PROPERTY CUSTODIAN ---	DANA MOCK

[JOHN EMDE HAS AGREED TO CONTINUE AS COPY BOY, EDITOR AND PUBLISHER OF OUR NEWSLETTER.]

AS YOU HAVE NO DOUBT NOTICED, THE POSITIONS OF **PRESIDENT** AND **VICE PRESIDENT** ARE VACANT. THIS WILL NECESSITATE NOMINATIONS FROM THE FLOOR. I WOULD HOPE THAT BEFORE THE MEETING SOME OF YOU COULD GET TOGETHER AND COME UP WITH TWO PERSONABLE, ENERGETIC AND WEALTHY PEOPLE WHO WILL BE WILLING TO SERVE IN THESE POSITIONS FOR THE COMING YEAR.

ALSO AT THIS MONTH'S MEETING, WE PLAN TO ASK SOME OF OUR NEWER MEMBERS TO TELL US OF THEIR PLANS FOR ELECTRIC CARS, AND PERHAPS SOMETHING OF THEIR PERSONAL BACKGROUNDS.

SEE YOU THERE !

DANA MOCK

CUT UR LOSSES

MEASURING EV PERFORMANCE

by Gary Jackson

One problem which every EVer faces sooner or later is how to improve the range and speed of his EV. Basically there are 2 approaches: Add batteries (the brute force approach) or improve the efficiency of the EV. One problem with improving EV efficiency is how to measure what you have done. In other words, how do you know that you've done any good? No one wants to drive around for hours until his batteries run down, only to discover that the "improvement" he made had no effect on overall performance. The method discussed here allows a straightforward method of evaluating power losses in the EV vehicle.

The Coasting method described here is very simple. As a coasting car slowsdown, its kinetic energy, which is related to speed, decreases because this energy is being used to overcome losses such as wind, bearing friction, tire rolling resistance, etc. By measuring the time it takes to slowdown 5 mph, one can calculate te total power losses of the vehicle which the motor and drivetrain must overcome.

Unfortunately, as with many simple ideas, the implementation isen't always so straightforward. In order to obtain an accurate measurement of vehicle losses, certain precautions must be taken. First, unless you have access to an airport runway or speedway at 6 a.m., there is usually a wind and an incline to introduce error in the measurement. Second, in order to obtain reproducible results, the test conditions must not vary. This means that the EV should be properly warmed up each time a series of runs is made. Also, no significant changes should be made to the EV during the runs, i.e. don't add a passenger, change tire pressure, etc. during a run.

With the cautions mentioned above, here's how the methodworks.

1. Select a reasonably flat road with plenty of space at either end to get up to speed. Runs are made in both directions to eliminate any error due to incline or wind.

2. Select a time of day when any wind is either small or constant. This assures that the wind factor will cancel in the calculations.

3. Warm up the car for each series of runs. This is important to assure reproducible results.

$. Select a point to start coasting. Run the car up to the desired speed, put it in neutral (if desired), and start timing at the selected coast point.

5. Measure the time it takes for the car to lose 5 mph. Repeat this test in the opposite direction, trying to end that coast at about the same point where the original coast started.

After the desired data has been obtained, the power losses can be calculated by this formula:

$$P_{loss} = .0454 \times W \times S_{av} \times S_{inc} \times \left(\frac{1}{t_{up}} + \frac{1}{t_{down}} \right)$$
watts.

W = Total weight in pounds of car, driver, passenge

S_{av} = Average speed in mph = $\frac{1}{2}(S_{initial} + S_{final})$

S_{inc} = Speed loss in mph = $S_{initial} - S_{final}$

t_{up} = Time in seconds to go from $S_{initial}$ to S_{fina} "up" incline

t_{down} = Time in the opposite(down) direction.

By repeating this test at serveral speeds, you can obtain a graph similar to that shown in Fig. 1

How can this data be used? First of all, it can be used to evaluate improvements that you make in your car. For instance, from Fig. 1 I determined that my car was much too inefficient. Consequently I changed to radial tires, added 30W oil to the manual transmission, and carefully realigned the front end. The results, which I could now quantify, are shown in Fig. 1. I had improved losses by approximately 25%. The second use of this data is that you can calculate the efficiency of your motor/drivetrain. EVs are idealy suited for this because input power can easily measured using a voltmeter and ampmeter. Thus the efficiency of the EV at any speed can be determined by:

$$Eff = 100 \times \frac{P_{loss}(\text{watts})}{V_{motor} \times I_{motor}} \ \%$$

Let's illustrate the method with an example. Suppose it takes a car and driver, weighing 2000lbs total, 10 seconds going East on Lovelorn Ave. Going West and again coasting from 30mph to 25mph it takes him 15 seconds. The power loss, which the motor and drivetrain must overcome, is calculated to be:

$$P_{loss} = .0454 \times 2000 \times 27.5 \times 5 \times \left(\frac{1}{10} + \frac{1}{15} \right)$$
$$= 2081 \text{ watts}$$

Con't

PERFORMANCE CON'T

Now, this dedicated EV'er wants the efficiency of his motor under dynamic conditions. He again drives east on Lovelorn Ave. at 27.5mph without coasting and measures 46V and 65A. He repeats this test going West and measures 46V and 55A. Hence his efficiency is:

$$\text{Eff} = 100 \times \frac{2081 \text{ watts}}{46 \times \frac{1}{2}(55+65)} = 75\ \%$$

By using the coasting method to determine EV losses, the EV'er has at his hands a versatile method to characterize his vehicle. It should be noted that large laboratories obtain the same data, albeit more accurately, by much more eleborate means using expensive apparatus such as wind tunnels, scale models, dynomometers, and test tracks.

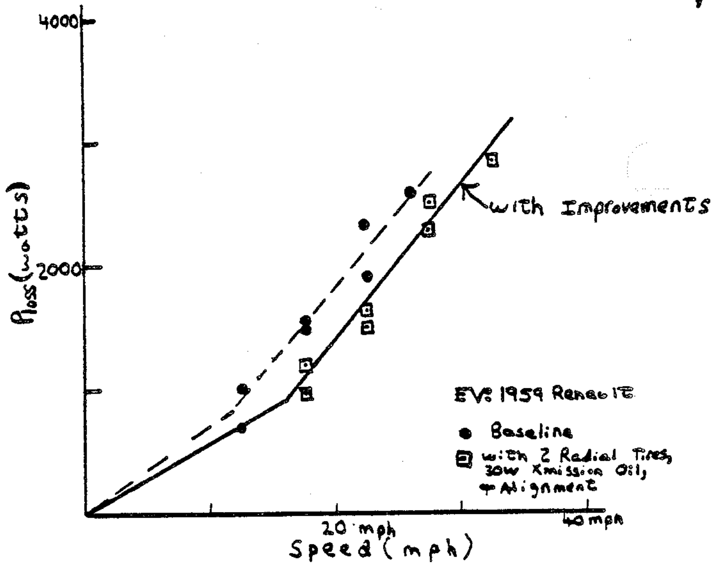


Fig. 1 P_{loss} as a Function of Speed

World's First 168 mile Electric Car

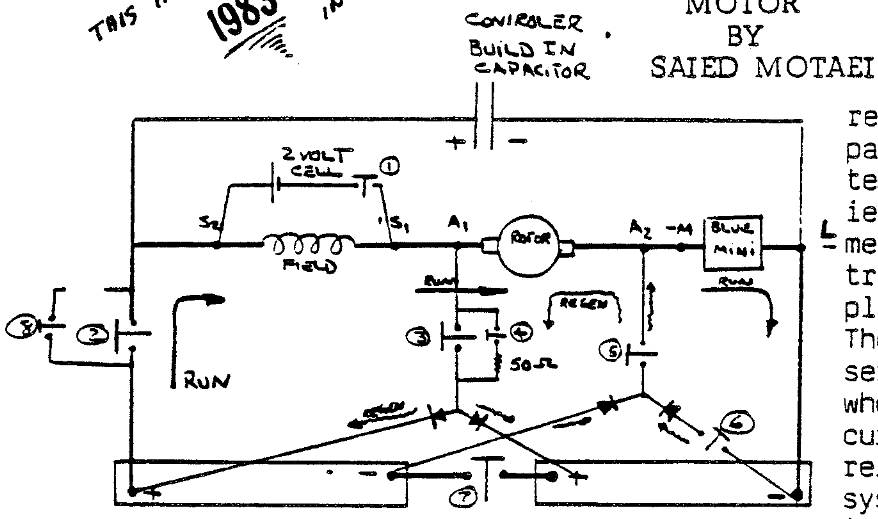
Saied Motaei "THE CHAMP"

168 MILES!!, Battery acid recirculation system, Battery insulation, Series Motor Regeneration System, High Pressure Tiers, Battery Monitoring System Voltage & Temperature of each battery., Weight Reduction Methods.

THIS HAPPENED IN: 1983 USING 32 BATTERIES IN A FIAT!

SQUEEZING RE GENERATION FROM A SERIES MOTOR BY SAIED MOTAEI

ONE OF HIS TRICKS



MOTOR : PRESTOLITE (SERIES)

CONTROLER : BLUE MINI SES

RUN : CONTACTOR

1 OPEN —TIME→ 3, 4, 5, 6 OPEN —TIME→ 7, 8 CLOSE → 2 CLOSE

REGEN

2, 7, 8 OPEN —TIME→ 4, 5, 6 CLOSE —TIME→ 3 CLOSE —TIME→ 1 CLOSE

When you add 900lbs. of batteries and remove the compression of the ICE ON ANY COMpact car you are overloading the braking system by at least 100%. Most of you with series motors(Prestolite or others) even the commercial people have not gone to the extra trouble and expense of installing the complex circuits necessary to achieve regeneration. The the problem isthat the current in the series winding is reversed for regenerating when the motor is driven. The series field current must be reversed either by a DPDT relay(or relays) or by the teaser Battery system shown here. Since the series field is a very short piece of very large wire it takes a very small voltage to reverse the current as shown in the circuit. Saied has also added a simple diode switching system with 4 diodes and 1 relay to parr. the batteries in the regenerative mode. Since the current is directly proportional to the voltage the generator is feeding into this double the current, therefore doubling the braking.

Text by Clarence

Progress Reported on 'SUPERBATTERY'

Research scientists working on "**superbatteries**" for electric vehicles and storage of off-peak electrical energy are optimistic that the successful development of one or more of several systems is within reach.

Recent substantial progress toward more durable, efficient and economical battery systems was described by Elton J. Cairns at the Sixth DOE Battery and Electrochemical Contractors' Conference sponsored by the U.S. Department of Energy in Washington, D.C.

Cairns, an associate director of Lawrence Berkeley Laboratory and head of the Berkeley Electrochemical Research Center, said "recent progress in several research efforts offer the promise of true breakthroughs for the development of superbatteries."

The research arm of the DOE electrochemical energy storage program, the Technology Base Research Project, is managed by the University of California's Lawrence Berkeley Laboratory.

"This DOE program offers the potential for major petroleum savings if substantial penetration into commercial markets can be realized," said Cairns. "The main focus is on electrochemical storage and conversion systems that offer the attractive combination of high performance and low life-cycle costs necessary to compete with existing petroleum-consuming devices."

As an example of promising projects, Cairns cited Rockwell International Corporation's fabrication of a special ceramic electrolyte made of sodium-aluminum oxide and toughened with zirconium oxide that shows great promise for use as the solid electrolyte in high temperature (300-degree Celsius) sodium/sulfur batteries.

"The material has much greater strength than the pure sodium-aluminum oxide electrolyte, and its conductivity is acceptable," said Cairns. "Independent acoustic-emission testing at the Lawrence Berkeley Laboratory has revealed a greatly improved resistance to cracking of the ceramic, which has been a troublesome problem with the electrolyte now employed in sodium/sulfur batteries."

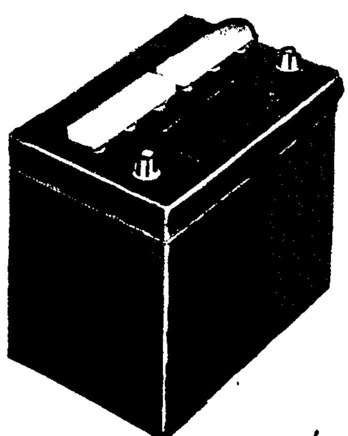
Cairns said another major success in high temperature batteries is the achievement of more than one thousand discharge-recharge cycles with lithium-aluminum/iron sulfide cells developed and tested by Argonne National Laboratory and Eagle-Picher Industries, Inc. These cells offer 100 Watt-hours per kilogram and excellent ability to withstand freeze-thaw cycles.

The exploratory development of rechargeable lithium/sulfur dioxide/cupric chloride cells, conducted by Duracell International, Inc., was also mentioned as a project having "great promise." Cairns said recent tests have shown the system to be capable of specific energies as high as 120 Watt-hours per kilogram, and the cells have held up through more than 200 full-discharge-recharge cycles.

"In keeping with DOE's on-going technology transfer effort," said Cairns, "several of the electrochemical energy storage program's projects have been transferred to the private sector. For example, a cooperative project conducted by DOE, ELTECH Systems, Inc., and Case Western Reserve University was recently completed after only four years of work.

"It developed cost-effective air electrodes for use in chlorine/caustic cells. These new electrodes offer a one-volt reduction—approximately 30 percent—in chlorine-caustic cell voltage, which translates into major savings for this electrical energy-intensive industry. One-year lifetimes have already been demonstrated in a commercial cell."

Several new research projects have been initiated this year, said Cairns. An industrial prime contractor, ELTECH Systems, Inc., of Chardon, Ohio, has been named prime subcontractor for development of the mechanically rechargeable aluminum/air battery. Gould, Inc., of Rolling Meadows, Ill., has initiated a project to develop iron disulfide positive electrodes for use in high-performance rechargeable molten-salt cells. This system, Cairns explained, offers performance comparable to the sodium/sulfur battery, and its low-cost materials, ease of construction and superior freeze-thaw capabilities are very attractive.



F. V. E. A. A.

Installing Batteries

- Before installing a battery, clean the cable connections.
- Be sure cables are not worn, frayed or cracked. Damaged cables will not do an adequate job of delivering power. Replace them if necessary.

Charging Batteries

- Check the battery's state of charge, and recharge it if the state of charge has dropped below 75 percent.
- The condition of conventional batteries can be checked with a hydrometer. However, because some maintenance-free batteries do not offer easy access to the electrolyte, an open-circuit voltage test or load test are required to measure their condition.
- Three tips to remember when conducting open-circuit voltage tests:

  ONE: Batteries should be at rest at least two minutes before open-circuit readings are taken.

  TWO: Be sure the voltmeter is in good condition because there can be as little as a one-volt difference between a fully charged and a completely discharged 12-volt battery.

  THREE: If the battery has been charged just prior to testing (by the alternator, for instance), it probably has developed a surface charge that can influence the open-circuit reading. Surface charges can be removed by turning on the vehicle headlights for one minute. After turning off the lights, wait 30 seconds before testing the battery.
- If using the load-testing option, remember that a battery must be at least 75 percent charged (equivalent to a 1.230 specific gravity reading or 12.45 open-circuit volts) in order for the test to be accurate. Be sure to read the manufacturer's instructions since load testers come in a variety of styles. The accompanying chart should help.
- Most important, be cautious when working around batteries. During the charging process, batteries generate a highly explosive concentration of hydrogen gas. So, charge batteries in an area with good ventilation, and keep sparks and flames away. Wear eye guards. And, if possible, locate the charging area near a washing facility.

Handling Batteries in Storage

- Check the state of charge of stored batteries every 30 to 45 days, and recharge them when capacity falls below 75 percent. The reason: all batteries self-discharge, even when in storage. Batteries that stay partially discharged over long periods develop a varnish-like sulfate coating on their negative plates. making it difficult to ever return them to full charge again.

ENERGY CORNER

By John Hogan
Director of
Communications Services
Commonwealth Edison
Company

Some experts claim that electric heating costs more than gas heating. Other experts insist that gas can and will cost more than electricity, because gas rates have escalated faster than electric rates since the early '70's and may continue to do so because of deregulation. Who's right?

Though somewhat contradictory, the existing facts suggest that the price difference between gas and electricity is not as great as many believe. In fact, residential customers who use over 400 kilowatthours a month, in non-summer seasons, benefit from lower rates: more electricity means lower bills relative to energy use. Though all-electric homes may seem to present the customer with one large bill, a gas bill plus an electric bill may generate a surprisingly similar total, sometimes without the benefit of reduced electric rates.

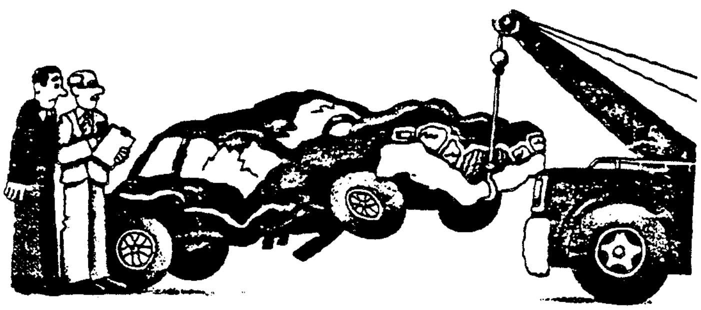
Before home-seekers automatically choose a gas-and-electric-home, over an all-electric home, they might consider factors other than existing energy rates. Electric heating, for instance, is quiet, clean, and comfortable; it requires less maintenance and provides a greater variety of economical systems than gas heating.

The electric heat pump provides the most energy efficient heating system to date. Other systems include ceiling cables, wall panel heaters, and through-the-wall units--all of which allow residents to adjust the temperature in each room, and thereby save money by keeping less-used rooms at lower temperatures.

Both heating and cooking are cleaner and safer with electricity than gas. The Electric Power Research Institute conducted a study of indoor air pollution which revealed significantly higher levels of carbon monoxide and nitrous oxide in gas-serviced dwellings than in all-electric homes. Because they produce no fumes, all-electric systems do not soil draperies or furniture. Furthermore, the lack of open flames in these homes insures a safer and cleaner environment, while microwave ovens allow energy savings of up to 75% over conventional cooking.

Homes with electric heating retain more natural humidity than gas-heated residences. Also, most electric systems respond immediately to thermostat controls, eliminating the discomfort of waiting for a cold room to warm up.

Of course, both gas and electricity benefit customers in different ways. The prospective homebuyer should note every option before deciding on an energy system. Tight construction means lower bills, since escaping air means escaping heat and moisture. With energy-saving techniques and proper construction, the all-electric home becomes an investment for the future--



I remember a conversation several years ago with a representative of the National Highway Traffic Safety Administration and I thought he was kidding. NHTSA had crashed an electric vehicle into a concrete wall at 35 mph and he was concerned because there was a lot of smoke after the crash. Even though no fire resulted from the crushed batteries, NHTSA was concerned about public safety if a battery powered vehicle was in a wreck.

Frankly, I would be VERY concerned about any passenger in any vehicle smashing into a concrete wall at 35 mph, but whether 16 heavy duty batteries presented more hazards than 18 gallons of gasoline is a rather moot point.

It is a shameful waste of money to slam a brand new automobile into a concrete wall, but NHTSA tries to rationalize this extravagance by denouncing the vehicle manufacturers. They report, "front seat occupants in car A would have more serious injuries than occupants in car C." Well, it is a good thing they use dummies to simulate people, because that is what they think we are to believe anyone is going to step out of a 35 mph collision and join their friends for tea.

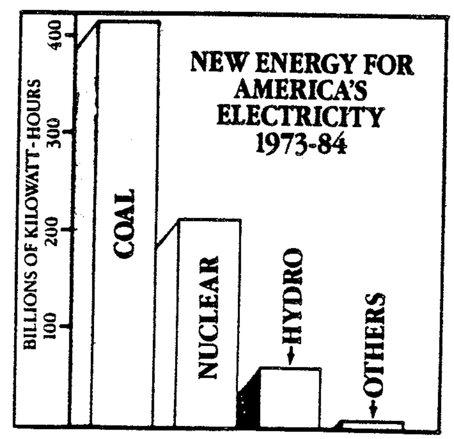
Celwyn E. Hopkins

The key to energy independence

The growing supply of electricity from U.S. coal and nuclear also reduces our dependence on *imported* energy.

But we're still a long way from energy independence. America is paying over a billion dollars every week for foreign oil. Last year's "energy deficit" topped $50 billion.

Greater use of domestic electricity sources means fewer U.S. dollars sent abroad. Nuclear power and coal can meet the country's growing electrical needs *and* help reduce our dependence on foreign oil.



Coal and nuclear energy have provided over 90% of all the new electricity added to our energy supply since 1973. This has enabled utilities to reduce their consumption of more costly oil and natural gas. Source: Energy Information Administration/U.S. Dept. of Energy.

Tom Swift lives

For nine years FORBES has been waiting hopefully at the curb for the electric car. A 1976 cover story proclaimed that the new federal plan to develop electric cars "just might turn on the electric-car switch at last." By 1978 the Energy Research & Development Administration had signed contracts for two designs, and Congress had provided $30 million for 165 cars for private use—at AT&T, New York's Consolidated Edison, Long Island Lighting Co., Florida's Disney World and a Pennsauken, N.J. dealer who offered to sell or lease 25 cars to individuals and small companies. Another 35 were for U.S. agencies. A year later some electric vehicles (EVs) were actually on the road. The federal budget grew from $37.5 million in fiscal 1979 to $41 million for 1980. General Motors talked of an electric car with a GM label by the mid-Eighties, but management had changed and the prospect looked dim (FORBES, *Oct. 7, 1980*).

Nevertheless, the electric car is still alive. The Cupertino, Calif.-based Electric Vehicle Development Corp.—a joint effort that includes 30 private electric utilities and the Tennessee Valley Authority—drove into the picture in November 1983. The EVDC, far from developing cars, is developing markets. Beginning this summer it will sell a GM electric van, currently called the Bedford, made in Great Britain in a joint project between Lucas-Chloride EV Systems, Ltd. and the British government. Its electric motor, battery and controls were developed by Lucas-Chloride, and six U.S. utilities have agreed to buy between three and ten vehicles each, at $20,000 a shot. The cars run for 50 to 60 miles per charge at up to 55 miles per hour, says Jerry Mader, EVDC president, and carry 2,200 pounds, including the driver.

GM's electric car
Still coming, but still alive.

At present, EVDC is targeting the vans for the 2.4-million-unit U.S. commercial fleet market, where it figures it could potentially corner perhaps 600,000 units. (Servicing cars for individual owners will be a problem until GM has set up a national network.) EVDC will import the first 30 electric vans this summer. It plans to bring in 400 to 600 more in 1986, at $18,000 each. By 1987, says Oreste Bevilacqua, an EVDC consultant, the price per van should drop to under $16,000, and if mileage improves by 20% over that period, EVDC's potential market could increase to about 800,000 vans.

The trouble is that the vans' "life-cycle cost" is still not quite competitive. Bevilacqua says they now cost about 48 cents per mile over an eight-year life, compared with 39 cents per mile for conventional automobiles. But at a cost of $16,000 or less, that would drop to 41 cents, which would compete. Beyond the utilities, EVDC sees its potential customers including the likes of AT&T, GTE, the Postal Service and United Air Lines. Tom Swift may make it yet.

Battery Bike

A new battery bike launched by a West Yorkshire father and son team is powered by a battery specially developed by CBS Group of Liverpool, Britain's largest independent manufacturer of lead-acid batteries.

The *Booster bike*, designed and manufactured by Booster Electric Vehicles of Huddersfield, literally gets its boost from a specially designed unit from CBS's GKP range of small electric vehicle batteries.

The GKP 28 can be recharged overnight on any small 4-amp-type charger and will give around 300 life cycles. Battery cells are designed to withstand a vigorous charge/discharge cycle and top vents are flame-retardant and leak-proof.

Actual size of the GKP 28 battery, which weighs only a little over 10 kilos, is 176mm long, by 134mm wide and 233mm high. It is housed in a weatherproof battery bag behind the bicycle saddle, which can also be used to store a charger.

The Booster bike itself was designed by university lecturer Alan Baker and is manufactured and marketed by his son, Peter, a qualified production engineer. It is aimed primarily at shoppers—and, since it conforms with the new powered-bike laws introduced last year, at the 14+ youngsters who want some experience of powered riding before they become eligible for "real" motorbikes.

The bike is ridden in the normal way, and when power assistance is required a button on the handlebar is pressed. The motor is then switched on and, by means of a simple device invented by Alan Baker, a drive roller automatically makes contact with and drives the front wheel. When the button is released, or if the speed exceeds 15mph, the drive roller moves out of contact with the tire. A removable key isolating switch enables the button to be immobilized.

Two models are initially being manufactured—a deluxe version with a 3-speed gear hub, ammeter and battery condition meter; and a standard version with a single speed hub and no instrumentation. Both bicycles can be folded and carried in a car boot (trunk) with the battery removed. The cycles are provided with an efficient rear stand; and various extras are offered, such as a shopping basket and battery charger.

For information contact CBS Ltd., Kirkdale House, Sefton Lane Industrial Estate, Sefton Lane, Maghull, Liverpool L318B2.

Safety

Trust your shoulder belt. It may feel "too" comfortable or "too" loose, but it can do its job—prevent injury or save your life.

"The three-point belt system, available in nearly every car on the road, is designed to give passengers freedom of movement," says the Motor Vehicle Manufacturers Association.

A little slack in the shoulder belt section will not diminish the efficiency of the system, according to MVMA. A simple rule: The slack can be as much as a fist-sized distance from your breastbone.

Although the belt allows freedom of movement, it locks tight on very sudden stops or impacts.

* * *

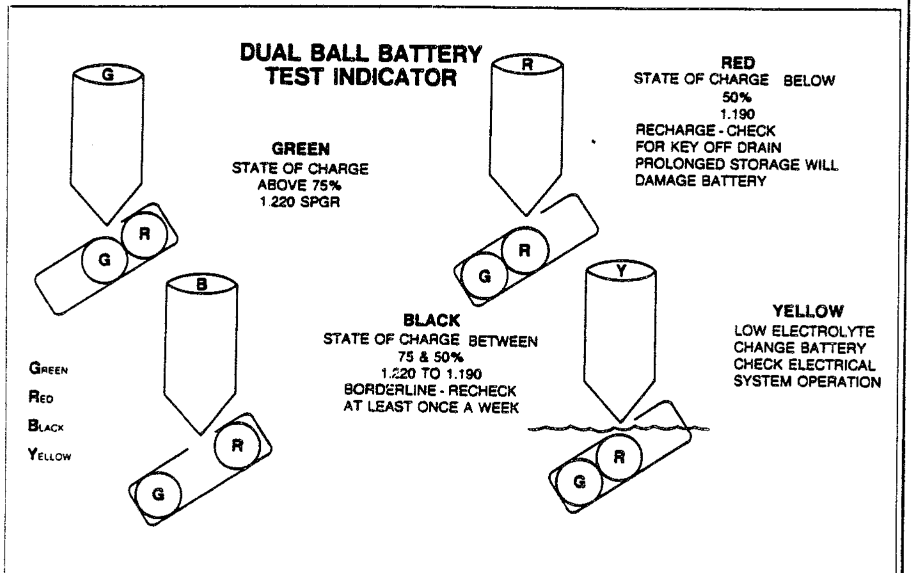


FIGURE 1

During the 1985 model year domestic Chrysler Corp. cars and trucks will be equipped with a dual ball battery state of charge indicator. The new test indicator will function similar to the present indicator, but will have an added red indicator ball that will appear when the battery state of charge drops below 50 percent (Figure 1). Also, when the red ball appears, the battery state of charge is no longer adequate to assure reliable starting.

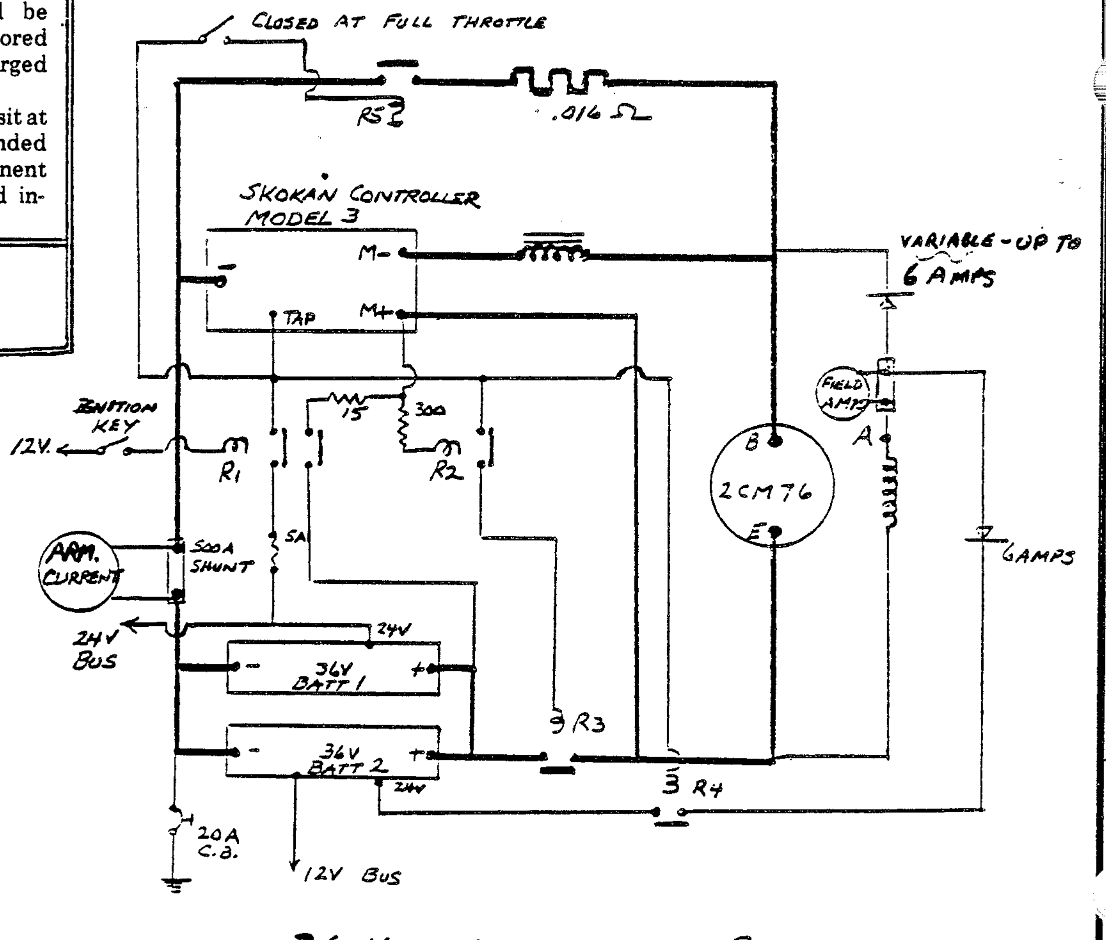
Battery state of charge should be checked on vehicles that have been stored for extended periods of time and charged if found to be inadequate.

NOTE: Batteries that are allowed to sit at a low state of charge for an extended period of time will suffer permanent damage as a result of sulfation and internal corrosion.

ITEMS AVAILABLE FROM THE CLUB

"PARTS" FOR SALE ↓

ELCAR PARTS
Chassis with fiberglass body --- 100.00
10 Trojan batteries,
less than 800 miles on them --- 200.00
Lester batt. chgr. 48v & 12v --- 100.00
Lambert transistor controller --- 400.00
6 H.P. GE series wnd. 48v Mtr. - 150.00
Don Kubick 437 - 0453
249 Arlington Heights Rd.
Elk Grove Village, Ill. 60007



36 VOLT CIRCUIT WITH PROPORTIONAL FIELD AND CONTROLLER BYPASS

LEE HEMSTREET 6/30/84