OAK PARK IL 603
PM
17 JUN
1996

Ferryboat 19
32 USA

Fox Valley Electric Auto Association
1522 Clinton Place
River Forest, IL 60305-1208

John Emde
6542 Fairmount Avenue
Downers Grove IL 60516-2919

Address Correction Requested

NEXT MEETING: Friday, June 21at 8 PM will be back in Room K-161 at the College of Dupage, SW corner of 22nd Street & Lambert Road in Glen Ellen

DISCUSSION TOPICS - 1. Ecostar Report 2. Project Status 3 . June 28 Exhibit 4.Future Projects

MEMBERSHIP INFORMATION

Any person interested in electric cars is welcome to join the FVEAA. The cost for a full year's dues is $20 that will entitle the member to receive our monthly Newsletter that contains useful information about electric car components, construction, policies and events. Dues for new members joining in May will be $ 12.

To obtain information about the FVEAA, you may contact either President Woods or Vice President Shafer:

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PRESEZ

The next meeting we will back to our usual location in Room 161 at the College of Dupage. It will feature a progress report by Virginia Tong from ComEd about their two year experience with the Ford Ecostar. We will also have an update report on our Nissan project, a review of our Downer's Grove Exhibit on June 30, and Bill Shafer will lead a discussion of projects we could consider starting do followin completion of the Nissan project.

The turnout for our May meeting in Ed Meyer's hangar was well-attended and encouraging for continuation of club projects. Thanks to all participants.

KEN

MINUTES OF MAY 17 MEETING

The meeting at Ed Meyer's place in Bolingbrook, the Nissan worksite, was called to order by President Woods at 8PM. Fifteen members and seven guests attended.

The minutes were approved as published and Treasurer Corel reported the savings account remains at $ 2289.35 with $ 2876.88 in checking for a total of $ 5166.79.

Project Manager Munroe presented an update on the Nissan conversion. Member Emde suggested placing the gel cells in a vertical position within the regular racks. Member Stockberger donated laminate sheeting material necessary to insulate the battery terminals from the rack. The next major task is to install cabling between the front and rear battery packs in three arrays of 120 volts each. This will require the installation of blocking diodes between each bank to prevent discharging between parallel-connected arrays.

Member Ken Meyers has the controller wired and is working on the circuit board. He also will donate galvanometer-type, edgewise ammeter and voltmeter which is expected to be better than the proposed adaptation of existing dash-mounted instruments that utilize bimetal mechanism.

Member Mock's work on the charger was interrupted by car trouble during his trip to Kentucky. We also need additional information on the temperature sensor furnished with the motor.

Member Ed Meyer reported that he showed the Club Nissan to a fellow member of an "Old Man's Car Club", Ron Lynch. Ron is a divisional executive with Nissan and was interested in our project.

Ed will ask if we can purchase the Maxima springs needed for the rear suspension at a reduced cost from Nissan.

Ed also reported that his former employer, AT&T will donate a 96-volt battery charger for our project. This is a rack-mounted equipment, much too large for on-board. It could be used as a DC source for high-rate charging at the Nissan home base. This will require a DC receptacle to be added to the 120 and 240-volt units on the car.

Member Irwin Singh presented a bench-top demonstration of his fractional horsepower controller for a permanent magnet motor. This setup could be used for an electric bicycle or scooter. His controller includes a microcontroller with programmable inputs.

Member Bob Barett has been discussing the conversion of an 82 Cadillac for possible police applications. He asked for persons to assist on this endeavor.

President Woods reported on Earth Day participation. Jerry Mitchell reported interest in his car exhibited at Highland Park. Ken found the Northwestern students at his alma-mater mostly ignored the exhibits there. Evidently they were hurrying to the lakefront.

Member Delmonico reported he has leaf springs and suspension boosters for a car requiring these for a conversion. Member Stockberger stated he has aluminum plate for sale at scrap prices.

The meeting was adjourned at 10:10 PM.

Submitted by Secretary Dave Aarvold.

FROM OTHER EV NEWSLETTERS

EEVC (The Eastern Group) in their May Newsletter featured the American Honda announcement of the Honda EV. This 4-place, 3500-pound vehicle has 95% new components, making it close to a purpose-built EV. It uses a 280-volt NiMH battery, a DC brushless motor, and 1-speed transmission to provide an 80-mile range, 80+ mph top speed, and 0-60 mph in 18.7 seconds. They also reported on their participation in Earth Day. Like the FVEAA experience, there was not a tremendous concern for the earth or electric cars.

There was an interesting article on Amerigon's (A Monrovia CA firm) to jointly develop and produce EVs for India. They envision a $ 6000 car that will incorporate an energy management system for cooling and heating the vehicle.

Their EEVC on recent advances in lead-acid battery charging is reproduced in this newsletter for the information of FVEAA members.

EV Circuit (Our Ottawa friends) in their Mar/April Newsletter announced plans for an electric car show in Toronto in June. The new editors for their Newsletter are Richard and Micheline Lane. He has written several articles in previous issues about his EV conversions. They report that British Columbia and auto dealers there are considering a deal to buy and scrap old, high-polluting cars. As many as 10,000 of these cars would be issued gross polluter certificates during periodic inspections. A holder of such a document could use it as a $ 750 payment on purchase of a brand new car from the participating dealers.

The 1996 Michigan High School Electrathon Competition in their Newsletters # 18 & 19 reported on the results of the first race at Coopersville High School on April 27. Twenty two high schools from all over Michigan entered vehicles. Lake Orion, near Detroit, had the two top winners, completing 103 and 102 laps around the athletic track in Coopersville, a distance of over 32 miles. A good achievement for a pair of Exide 22NF batteries that make up the 24-volt system. They also reported in the first national Electrathon were 24 vehicles from nine states and Canada competed. Six were from Michigan.

The Maine Sun, the quarterly Newsletter from the Maine Group in their Spring issue featured an analysis of the National Electrical Code requirements applying to homes with solar-derived electrical energy. Also included was a progress report on their experiment of combining solar with production of distilled water.

SEVA, the Sacramento CA organization, in their April issue featured the first of a series of articles on the basic electrical technology of electric vehicles written by Eckhardt Schroeder. FVEAA members interested in this subject should check out the newsletter from Librarian Ed Meyer. In the President's Message, Mark Bahlke noted he has accumulated 20,000 miles on his EV in two years of use. It gives PRO-EVers solid ground to stand on.

Their June issue has Part 2 of the basic technology subject. It also mentions work on their club car, a 1960 Renault that requires work to get it on the road.

VEVA, the Vancouver group in their May newsletter contains a description of Eric Jelinski's conversion of a 1984 Datsun pickup. The issue also summarized a New York Times article entitled, "How America Perpetuates Its Gas Crisis". The issue includes a description of Daimler-Benz' hydrogen car the company is developing cooperatively with Ballard Power System who will provide the polymer cell fuel cell. Production is targeted four years from now, depending on test experience. VEVA is also participating in the Electrathon Canada event planned for June 3.

GLEAN May issue of EV News was another information-filled document. It included articles on Honda and Toyota EV plans, EV car rental in Florida offered by Alamo, an account of the GM stockholder annual report that EV's on its frontpage, an account of high school competitions, and a Bob Wing report on the 1996 APS Electric Event.

EVAA Maps Out Charging Sites for Electric Vehicles

Atlanta, GA -- Electric Vehicle Association of the Americas (EVAA) today announced its preliminary findings on the number of electric vehicle (EV) charging outlets and locations in the United States. Based on telephone interviews and mail-in surveys, EVAA has identified 888 non-residential charging outlets in 219 locations across the country.

Charging sites were identified in 23 states. Of the total outlets, 642 -- or 72 percent -- are located throughout California. The next highest concentration of EV charging sites is in Georgia, with 36 locations.

"The presence of sites other than home garages where drivers can recharge their electric vehicles is one measure of a city becoming EV-ready," commented Robert Hayden, EVAA executive director. "While most of the recharging is expected to be done overnight at home, many drivers will also want the convenience of recharging while they're shopping, working or traveling."

Of the total number of EV non-residential charging facilities found, 43 are public stations, 7 are clearly identified as "public-access" (meaning that they are accessible by prior arrangement) and 169 are private.

EVAA also found that conductive charging sites account for 90 percent of the total EV charging facilities currently available, while inductive charging units are featured at the remaining locations. Conductive charging utilizes a standard plug and outlet, with metal-to-metal contact, while inductive chargers transfer power to the batteries through a magnetic connection, with no direct contact.

Hayden also noted that the ratio of EVs to non-residential EV charging sites is about 11 to 1. Last year, EVAA identified approximately 2,100 EVs in its first national EV count. "This is an emerging transportation technology, and we are now seeing only the very first commercial stages of vehicles and chargers," Hayden said. "EVAA will continue to track their growth through yearly tabulations."

A Market Brief detailing EVAA's methodology and findings for U.S. sites will be finalized and distributed by early 1996, Hayden said. "We hope to include Canadian stations in the next iteration." EVAA also will develop an *EV Charging Site Directory* based on the information obtained through surveys.

THE NISSAN CONVERSION PROJECT - MAY, 1996

The Project Manager, Bob Munroe, reports the following tasks need to be done to complete the Project. He would like to hear from any member who wishes to assist. Call him at (708) 584-6057. The May Balance Sheet on the next page indicates the project is financially in good shape thanks to the willingness of members to build rather than purchase a controller, battery charger, and the donated materials. It would be desirable for the club to set a completion date at the next meeting. **Let's get the car on the road for testing!**

Mount gel cells, connect cables and run four power cables from trunk batteries to motor compartment.

Install and connect 120 volt terminal block, Fuse, and contactor to terminate at controller.

Recommend and procure and install heavier springs for rear suspension system.

Mount vacuum tank under front battery rack. Complete and test vacuum and brake system.

Install auxiliary battery, (gel cell?), trace out and connect to car cabling for lights horn etc.

Trace out and utilize ignition switch inter-lock for "NO START" if clutch not depressed.

Complete instrument panel meters and dash mount Ammeter. Reinstall instrument panel and dash components.

Construct battery charger for 120 volt, and 96 volt batteries.Mount in trunk and connect to input plug.

Complete controller and mount on brackets in motor compartment.

Complete and fit splash panels in grill and under motor compartment.

Reinstall headlights and test and check all lights on car.

Strip and paint Towing yoke.

Paint wheels, and either touch up body paint or make decision on what painting to do on car body.

Clean up interior of car, Shampoo upholstery and clean up generally.

Decide on tires for car.

Have a check made on car to assess safety concerns. Label and identify all operating switches, connections, and operating procedures.

Record and publish all results of test runs and operation.

FOX VALLEY ELECTRIC AUTO ASSOCIATION

(NISSAN CONVERSION PROJECT)

Report Date 05-27-96

Balance Sheet

Expenses					Income		
1	Car procurement	$	550.00	1	Sale of unused engine components	$	120.00
2	Tow bar attachment	$	75.00	2	Sale of Certificates	$	4,200.00
3	Repair body rust	$	40.00 Estimate	3	Authorized transfer from treasury	$	2,000.00
4	Paint	$	138.00 Estimate	4		$	
5	Motor	$	1,654.00	5		$	
6	Controller (Club built)	$	350.00 Estimate	6		$	
7	Battery (trial)	$	100.00	7		$	
8	Battery (Permanent)	$	639.20 Estimate	8		$	
9	Main Charger (Ken Myers)	$	150.00 Estimate	9		$	
10	Suspension Upgrade	$	150.00 Estimate	10		$	
11	Motor adapter plate	$	114.66	11		$	
12	Machined plate	$	200.00	12		$	
13	Broach to cut keyway	$	51.55	13		$	
14	Machine steel Hub	$	320.00	14		$	
15	Lifting eyebolt	$	4.10	15		$	
16	Misc. Nuts & bolts	$	17.22	16		$	
17	Power cable 2/0	$	48.00	17		$	
18	Clutch Disc	$	32.59	18		$	
19	Tow bar nuts and bolts	$	6.41	19		$	
20	Steering wheel & Ign. Sw.	$	50.00	20		$	
21	Motor shock mount	$	24.70	21		$	
22	Master relay	$	- Owned	22		$	
23	Circuit breaker	$	- Owned	23		$	
24	Pot-box (Dana Mock)	$	- Owned	24		$	
25	Auxiliary battery	$	65.00 Estimate	25		$	
26	Vacuum assist (brakes)	$	20.00	26		$	
27	DC-DC Converter	$	450.00 Estimate	27		$	
28	Electrical Meters	$	- Owned	28		$	
29	Heater	$	125.00 Estimate	29		$	
30	Splash pan	$	25.00 Estimate	30		$	
31	Seat Reupholstery	$	97.39	31		$	
32	Door pins & bushings	$	28.05	32		$	
33	Tire replacement	$	240.00 Estimate	33		$	
34	Headlight Repl. Assembly	$	75.00 Estimate	34		$	
35	Rear Spring Repl.	$	70.00 Estimate	35		$	
36	Licensing	$	28.00 Estimate	36	Over-recovery	$	-381.13
	Total expenditure	$	5,938.87		Total income	$	5,938.87
	Original Estimate	$	7,000.00				

RECENT ADVANCES IN LEAD-ACID BATTERY CHARGING

While a great deal of attention is being paid to such battery types as nickel-metal hydride and nickel cadmium, most of us are fated to stay with lead-acid, at least for a while, for reasons of cost and availability. But that doesn't mean the we're stuck with old technology. Increasingly, we're seeing new types of Pb-acid batteries used in EVs, and many of them differ significantly from the familiar flooded-cell golf cart units we've been used to. The new batteries often have better performance than the old type, and never need any water. But along with their advantages comes a caution: charging methods that work with regular batteries may or may not be optimum for the new types.

Electronic equipment manufacturers, spurred on by the ever-growing market for portable electronic equipment (laptop computers, camcorders, cell phones, etc.) are coming up with charging circuits that in some cases can be applied almost directly to EV propulsion batteries. This article will take a look at the charging profiles these new devices use.

The old way

The traditional way to charge flooded cells was to apply a constant voltage (sometimes modified by a current limit) until the charging current dropped to a set level, and then going to a (lower) constant current to finish. Everything was controlled by the instantaneous voltage or current level. Every once in a while the battery was deliberately overcharged, to bring all cells to the same state of charge. The resultant gassing also helped to stir and destratify the electrolyte.

Newer methods

These methods aren't always appropriate with sealed (recombinant) lead-acid batteries. For one thing, it's not a good idea to drive them into gassing, because they may vent and lose electrolyte. In addition, if they go into high-rate oxygen-hydrogen recombination, they can get pretty hot. What's needed is a device—preferably an integrated circuit—that will implement a highly-controlled charging profile for these modern batteries.

Probably the most sophisticated charge controller IC we've seen is the bq2031, from Benchmarq Microelectronics (Carrollton, TX). This device gives a choice of three different charging profiles, all of which provide a high current until the battery is about 80% charged and then a lower current to top it off. This is generally followed by a float period (which might not be needed in EV applications. The three charging profiles are two-step voltage, two-step current, and pulsed current. They were outlined in a paper entitled *Improved Lead-Acid Battery Management Technique*, by Stephen P. Sacarisen and Jehangir Parvereshi, presented at the Southcon '95 conference in March.

Two-Step Voltage charging

In Two-Step Voltage charging *(Fig. 1)*, the battery is first given a constant (high) current until its voltage reaches a threshold set by the battery manufacturer (generally between 2.45 and 2.5 volts per cell). The unit then holds that voltage and allows the current to drop as the battery continues to charge. When the current drops to some set minimum, the system switches to a float voltage specified by the battery manufacturer.

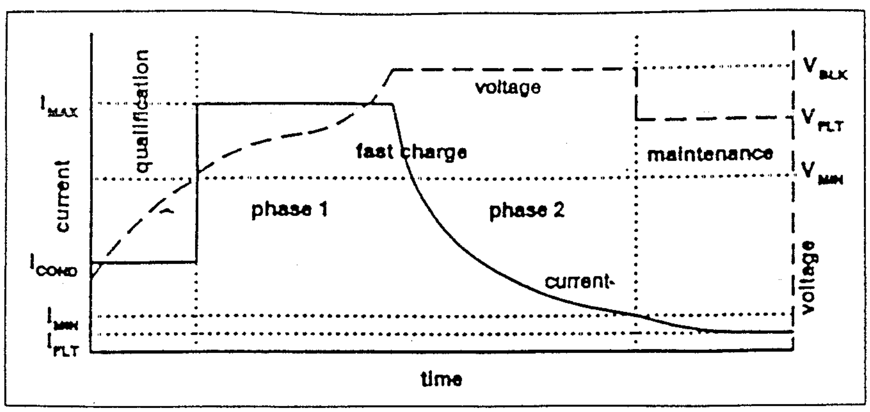

Fig. 1: Two-step voltage algorithm

THIS ARTICLE WAS ORIGINALLY PUBLISHED ON PAGES 4-6 IN THE MAY ISSUE OF THE EEVC (EASTERN ELECTRIC VEHICLE CLUB) NEWSLETTER. It is reproduced here for members of the Fox Valley Electric Auto Association.

Two-Step Current charging

In Two-Step Current charging *(Fig. 2)*, the battery is first given a constant (high) current until either of two things happens: the voltage reaches the same threshold as in the previous method, or the rate of voltage rise begins to decrease. The system then switches to a succession of short, high-current pulses that average to some specified maintenance current.

The rate-of-rise method is unique to Benchmarq. It's based on the fact that when a sealed battery is charged *(Fig. 3)*, the voltage rises steadily or at an increasing rate until oxygen generated at the positive plate and hydrogen generated at the negative plate begin to recombine. At that point, the voltage begins to rise more slowly (the second time derivative goes negative, for calculus fans). Shortly after this occurs, the temperature and internal pressure begin to rise. This change in voltage slope is an excellent indicator, because it is independent of the actual battery voltage, which varies with both temperature and the age of the battery. As batteries age, for example, their voltage declines; if charge termination were set just on the basis of voltage, it could cause overcharging of old batteries and undercharging of new ones.

Pulsed Current

Pulsed Current charging *(Fig. 4)* begins just like Two-Step Voltage charging, with high current applied until the voltage reaches a set threshold. Current then stops, and voltage is monitored. The voltage gradually decays, and when it reaches the float voltage, the high current comes back on until the voltage again reaches the cutoff value.

We received a lot of material from Benchmarq explaining all this, but they left out one thing: How to decide which method is best for your application, although they imply that the third one has advantages in that it reduces the charging time during maintenance, which should reduce positive grid corrosion and electrolyte drying.

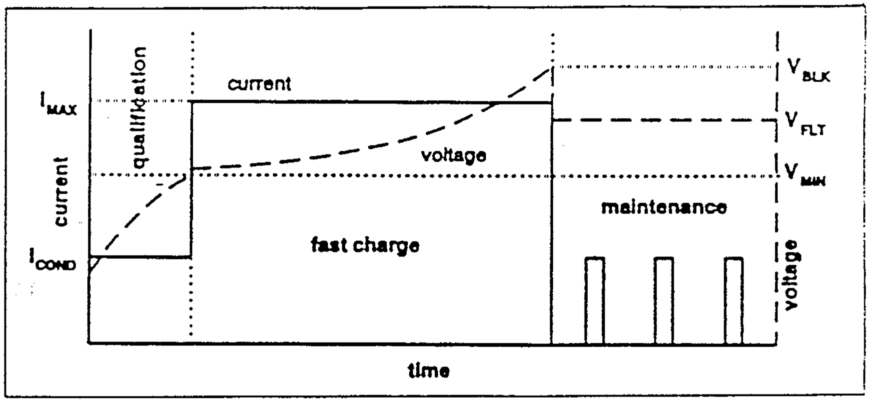

Fig. 2: Two-step current algorithm

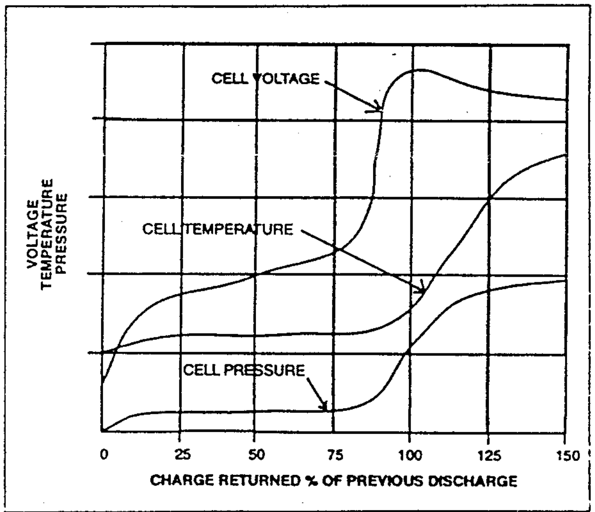

Fig. 3: Typical relationship of cell voltage, pressure, and temperature during constant-current charging.

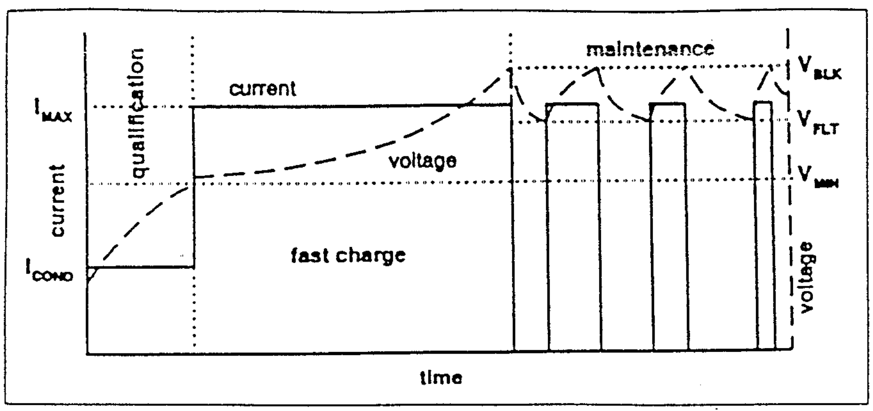

Fig. 4: Pulsed current algorithm.