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, April 18 at 7:30PM in Room K-161 at the College of DuPage, SW corner of 22nd Street & Lambert Road in Glen Ellen

DISCUSSION TOPICS - 1. Nissan update. 2. Future see-and-drive meeting. 3. Owners Manual update. 4. Open topics.

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 April will be $ 14.

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

President - Ken Woods
1264 Harvest Court
Naperville, IL 60564-8956
(630) 420-1118
E-mail Casa Zeus2@aol.com

Vice President & Editor - Bill Shafer
1522 Clinton Place
River Forest, IL 60305-1208
(708) 771-5202
E-mail WHShafer@aol.com

APRIL 1997 PRESSEZ

A glitch appeared in the Curtis Controller on the Club Nissan. KTA Services, the supplier, has authorized return to Curtis for warrranty repair or replacement. Car insurance has been extended for another six months. We need to set the see-and-drive date and procedure for members to examine the car and have an opportunity to drive it before we auction the vehicle, as approved last January. Finally Member Andy Redpath will give us an update on the status of the Owner's Manual. It appears that most of the meeting will be taken up with matters related to the Nissan.

KEN

MINUTES OF MARCH 21 MEETING

The meeting at the College of DuPage was called to order at 7:34 by President Woods. Sixteen members attended. Treasurer Corel reported $ 2322.42 in the savings and $1640 in the checking account. Two Participation Shares were redeemed.

President Woods sent a follow-up letter to the Nissan Regional Manager reoffering a tutorial. This option expires in June when the car will be auctioned. Shafer noted that Nissan will introduce their "Prairie Joy" electric car in Japan and there may be a corporate policy conflict between our conversion and the factory-developed car.

Member Andy Redpath led a discussion of the Owners Manual draft copy. He reported the project is 80% complete. It has 11 pages of diagrams general information, component data, and maintenance recommendations.

Member John Emde has kept the car at his shop since the Auto Show. He reported that after a maintenance charge, the system failed to function. John detected a smell of burned insulation when the hood was opened, but no obvious damage was evident. An "autopsy" session was scheduled for next Tuesday.

Editor's Note - Six members at the session noted a slight smoke deposit on equipment next to one end of the controller. A subsequent analysis showed the controller had failed internally. The unit has been returned to the manufacturer for repair, a process that will require three weeks.

Member Bob Barrett reported on his attendance at the Environ-97 conference. He donated two accelerometers.

President Woods announced several requests for a public display of an FVEAA car, including Northern Illinois University (DeKalb) on Earth Day, April 22, Beecher on May 10, and the next Heritage Fest in Downers Grove. Shafer noted that we have gained few new members from past public displays such as these, There was a suggestion the FVEAA repeat a tutorial similar to those held at Femilab or a Triton. This will be discussed in more detail later.

Treasurer Corel announced availability of 5 amp, 15-volt adjustable output power supplies if anyone might find these useful.

Member Krajnovitch updated progress on his OMNI conversion. He will need a battery charger in about three weeks. Member Ed Meyer volunteered to provide one for his project. Member Emde suggested using a standard ceramic strip heater element installed in the heater box. The 96-volt battery should be adequate.

Member Shafer led a discussion about battery recharging. He noted it takes about the same amount of time to go from a 40 to 80% charge level as it does to go from 80% to full charge.

Member Ed Meyer reported an article from the Carnegie-Mellon alumni publication that reported severe disciplinary measures have been taken against two graduate students who produced and released a "Lead Recycling article" without following a required peer review process and ok to publish using the institution name.

The meeting was adjourned at 10:14

Submitted by Secretary Dave Aarvold.

RECENT ARTICLES ABOUT ELECTRIC VEHICLES

More on flywheel development appeared in the March 7 issue of AUTOWEEK, Page 15 and the March 30 issue of the Chicago Sun-Times on Page 70-A. (See the August 97 and October 97 issues of the FVEAA Newsletter for information). The two new articles concern the further work of Rosen Motors. The Capstone turbine-generator is identified as a 165-pound unit running at 96,000 rpm to furnish 400 volts to a drive system. The turbine is fueled by regular, unleaded gasoline. Flywheels are levitated by a combination of permanent magnets and "vernier" electromagnets that adjust for varying forces up to 4 g's encountered during driving (such as hitting a pothole). Additional protection is provided by backup mechanical bearings. The objective is to produce a flywheel that will coast for 1000 hours while the car is standing idle. Each spinning flywheel can store one kWh of electrical energy. Power rating is 200 kw.

During the first test drive a Saturn coupe fitted with the system traveled for two hours with a top speed of 40 mph. Further development plans include building 25 additional test vehicles, including conversion of a Mercedes E320. Estimated equivalent mileage is expected to be between 45-80 mpg. The program extends to 2003, with commercial availability by 2010.

More on GM's EV-1 appeared in the April issue of Road & Track (R&T)on Page 80, in the April issue of Popular Science (PS), and the November 4, 1996 issue of IW. New information from these sources include a interior noise level of 41 dBA for the EV-1 compared with 38 dBA for a Lexus LS-400. Electronics and cooling apparatus sound is responsible. At 60 mph, the EV-1 generates 71 dBA, about the same as a Lincoln Continental. A full-charge freeway test achieved 67 miles, less than the advertised 90 miles. EPA steady-speed range tests at 45 mph achieved 135 miles. In city driving with an average 19 mph speed, the range was also 67 miles. PS conclusion - that the car could be a sensible alternative for single-occupant sport-utility and minivans. The R&T conclusion - the EV-1 cant' be taken too seriously to solve our pollution and transportation troubles, but it represents a good effort. IW notes that turning a dc potential energy into a controlled ac to run the motor is a huge technological achievement. Other innovative features include servo-applied rear braking system (no hydraulics), an impressive amount of circuitry for 5-400 volt systems, seven microprocessors, and heat pump for climate control. These innovations are likely to find their way into conventional cars long before an electric car becomes commercial.

EV-1 Sales were the subject of three articles in the **Daily Herald on 3/15, Sun Publications on 3/21, Naperville Sun on 3/21, and from the Internet on 3/18.** The articles, probably from the same GM Press Release, noted that Saturn dealerships leased 76 in December, 48 in January, and 31 in February for a total of 155. Production has not slowed however. Closing a lease may require eight to ten hours with each customer over a 2-3 week period. About 80% of the 703 initial prospects declined to lease the car.

Sun World, a solar-energy publication, in the March issue noted Honda's winning entry in the World Solar Challenge was equipped with a solar array made in Australia that developed 1900 watts, enough to give the car a 90km/hr(59 mph) cruising speed.

RECENT ARTICLES ABOUT ELECTRIC VEHICLES - Concluded

The Wall Street Journal on page A12 of the March 26 edition reported that Toyota will offer hybrid-electric cars in Japan this year. The electric motor provides all power up to 22 mph, Above this speed, a 1.6-liter engine takes over. The hybrid battery is about 17% the weight of the usual battery-powered electric car. Mileage is expected to be about 36 mpg.

Auto applications of fuel cells were discussed on page 12 of the March 3 issue of AUTOWEEK. The proton exchange membrane (PEM) cell seems best for auto applications. In this cell, oxygen from the air and hydrogen gas stored in cylinders at 3600 psi are combined in platinum-catalyst membranes acting as the electrolyte to produce electricity. **Breakthrough Technologies Institute homepage on the Web** provides a brief description of six different fuel cell types and Frequently Asked Questions (FAQ) about these devices.

AUTONEWS and several other publications had stories about a converted Lotus Elise powered by a 300-volt nicad battery, standard 1.2 volt aircraft starter cells. Two brushless dc motors, each weighing 28.6 pounds and producing 100 HP, are mounted on the frame to drive the original axles. The British firm ZYTEK making the conversion said the car is intended to maintain the company's presence in electric vehicle developments. Twelve vehicles will be built and available only to automobile companies.

The Electric Car Arrives - Again is the headline for an article on page 19 in the March/April issue of World*Watch. The article recounts the early dominance of electric cars in the 1890's that lasted until the appearance of the self-starter and the gasoline car development effort that followed. They estimate there are about 7500 "engineless carriages" in use worldwide today. The article describes the research by AeroVironment under a GM contract that resulted in the IMPACT prototype for the EV-1. The California Zero-Emission Vehicle (ZEV) requirement adopted started the present activity. Auto industry lobbyists, joined by the oil industry, began a bitter fight to roll back the legislation, and partially succeeded.

Even though the energy-weight ratio of lead-acid batteries has been cut by over 60% over the past decade, the limited range of battery-powered cars causes them to be greeted with skepticism. So too does the initial price of about $ 40,000 for the initial EV commercial offerings by major manufacturers in the US..

European manufacturers are taking a different approach. The PIVCO by Norwegian consortium will cost about $10,000 with a production volume of 10,000 units annually. It is intended only for use in inner city areas and quick rentals at rail stations. Peugeot plans to sell 25% of the anticipated 100,000 EV market expected by 2000. Last year it produced more than 4000 units.

Tax incentives are a major part of governmental encouragement of EVs, including the UK that has a goal of 200,000 electric cars by 2000. Asian countries have adopted a similar strategy. Thailand offers tax exemption for the electric version of the infamous, and ubiquitous, two cycle "Tuk-tuks" that are notorious polluters. The customer will provide the ultimate test of the tax incentive approach.

FROM OTHER EV NEWSLETTERS

EEVC, the Eastern Group in their March Newsletter had a description of restoration of a G-van and a double-ended bus formerly in service in Minneapolis. President Oliver Parry had Part II of his essay on development of electric cars.

Electric Grand Prix in Rochester NY in their Apr-June issue featured two pages of summaries on EV articles appearing in the CALSTART publication. A subscription to the CALSTART for $ 125/year, e-mail calstart@calstart.org. or Phone 1-888-565-5600. They also had a two page summary of EV articles in the "Current Events" publication of the Electric Auto Association. The EAA address is 2710 St Giles Lane, Mountain View, CA 94040. The most interesting was an announcement that Optima will start marketing the 12-volt "Yellow Top" deep cycle batteries.

Global Electric Auto News March publication, as usual, has a 25-page magazine packed with useful information. It features a detailed description of Zytek's Elise - a converted Lotus, Chrysler's Fuel Cell project, an account of the battle in New York to rescind their ZEV requirement similar to the California mandate, a record range run by BAT, and Honda's plan to lease their 4-passenger EV PLUS. In addition to all of these, there are many smaller articles on a variety of subjects.

Clarence Ellers in the Jan-Feb issue of World Electric Transportation lists the five domestic manufacturers offering commercial electric cars. He also mentions Aslin World Corp of America who offers a manual transmission **without a clutch.** The Alsin address is 2001 Butterfield Road, Suite 1450 in Downers Grove, phone (708) 515-5150

VEVA, The Vancouver Bunch in their March Newsletter has an article on Zytek's Elise, an article that Ballard Fuel Cells are going into the Delphi-Chrysler project. There is an article on a new Advanced DC "super 9" motor that has 12 brushes, dual cooling fans, a longer armature providing more torque, and a 65-bar commutator that is rated for 192 volts. A report from APS, the Arizona sponsor of the yearly race in Phoenix, that their study indicates that rapid charging can increase battery life. Charge times as low as 10 minutes were included in the study. Former editor Bill Glazier had a two-page compilation of various subjects.

NISSAN INNOVATIONS

The remaining pages of this Newsletter will describe innovations used on the FVEAA conversion of a 1990 NISSAN. These were devised by Member Ed Meyer. He wants to preface the following presentations with this disclaimer.

March 22, 1997
The designs contained in this information packet of the "Zeroth order" prototypes intended for testing purposes only. Whereas many circuits have survived over 1000 miles of testing, many subsequent features of improvements are planned. These range from automatic to safety features of operation.

DISCLAIMER (Concluded)

As a reminder, the intent of the temporary battery charger was to determine if the car would operate. That is to provide power on a temporary purposes just long enough for testing purposes.

The final plan was always to have the "Battery Charging Committee" and the DC-DC Converter Committee to share the responsibilities of the final designs. I would like this action completed prior to selling the car to an individual.

Respectfully,

Dr. Edward E. Meyer, P. E.

Device I Main Line Charger - Prototype design (Not intended for final production)

Magnetic isolation from the ac supply circuit is preferable to ground fault detectors used for transformerless chargers. This design uses a toroid, layer-wound core to provide this isolation.. The toroid couples the ac supply circuit for the charger. A power transformer utilizes two windings. One is used as an autotransformer to reduce charging current for deep-cycle batteries having undergone extreme discharge. The other is used as a regulator to reverse bias the toroid. As the battery terminal voltage increases during charging, the flux draw from the autotransformer will diminish. As this occurs the reverse bias winding coupled to the toroid will oppose magnetic flux established by the ac input circuit. The net result is to regulate (taper) the charging rate as the cells recover.

Manual Control Switches:

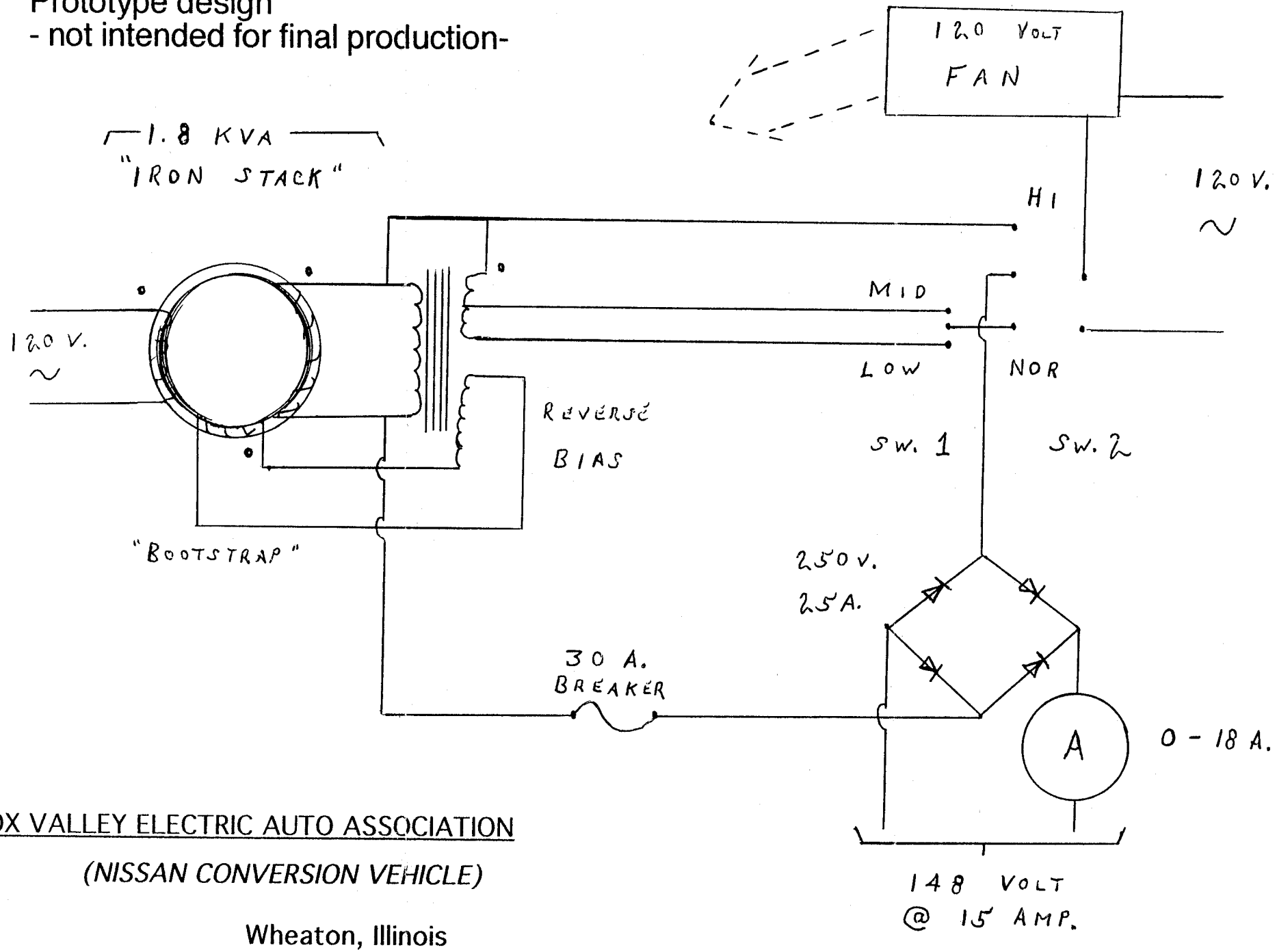
Switch 1 serves to select winding taps on the main power transformer. It allows two choices of charge rate and final voltage value: namely - Low: 136 volts and - Mid: 142 volts. These values correspond to 13.6 and 14.2 volts per 13 volt battery.

Switch 2 serves to allow normal charging rates to occur under control of switch 1 and high position for "equalizing" the battery string, 14.8 volts per 12 volt cell. The remaining function is to cut off the ac fan during equalizing since no direct load is placed on the power transformer.

The four-way bridge, 30 amp breaker, and ammeter 0-18 amps are conventional.

Editors Note - The efficiency of this charger is impressive. Energy consumption of the Nissan has been metered at 335 watthours/mile travelled. The charger for my Mazda RX-7 conversion is a Lester ferroresonant type. The weight of both cars is about the same. Energy consumption for the Mazda is 744 wh/ mile of travel. I know it is inefficient because noticeable heat is generated during charging.

Main Line Charger
Prototype design
- not intended for final production-



FOX VALLEY ELECTRIC AUTO ASSOCIATION

(NISSAN CONVERSION VEHICLE)

Wheaton, Illinois

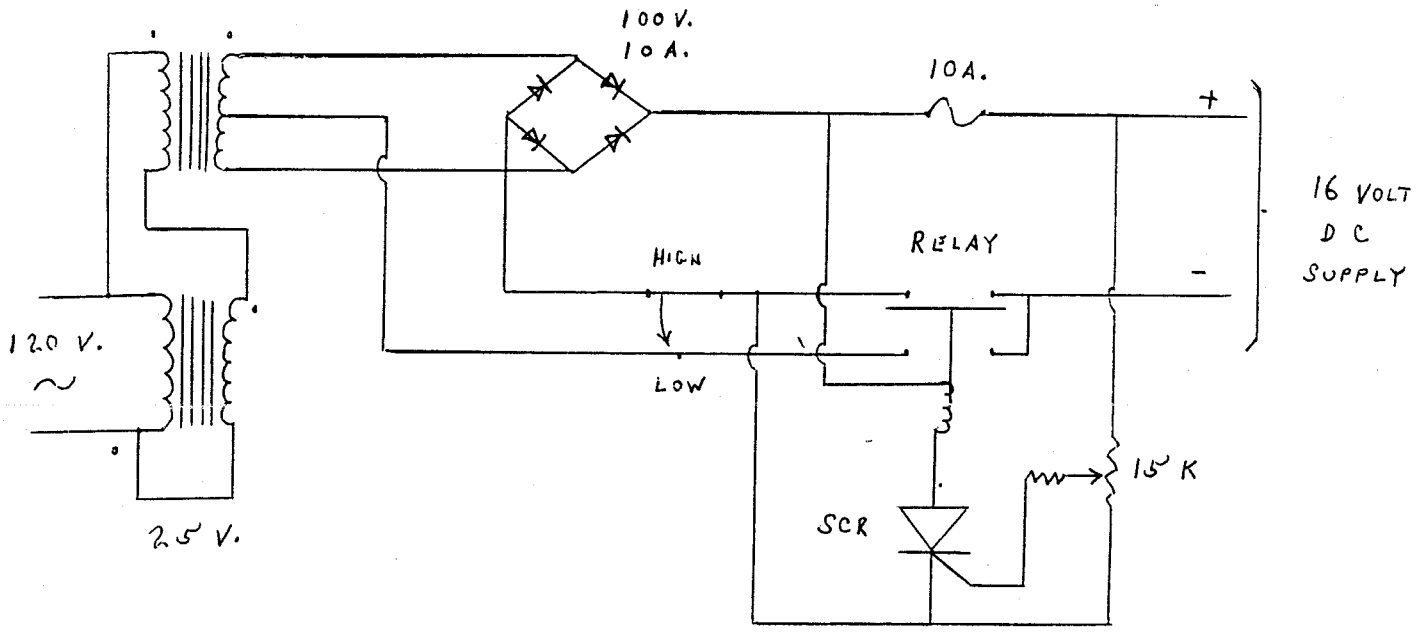
Device II-Auxiliary Battery Charger. Prototype design (Not intended for final production)

Two input power transformers are arranged as autotransformers with magnetic isolation from the ac supply circuit. A reduced voltage is used to impress a conventional full-wave bridge circuit and supply 16 volts to the auxiliary battery during charging.

The secondary of power transformer No. 2 is tapped to allow half-wave bridge operation during trickle charging. In the hi position the full effect of the bridge is transferred to the load. In the low position only two diodes of the bridge are effective back through the center tap of the power transformer.

A manual high-low switch allows choosing between a 4-amp charge rate and a trickle charge of 150 ma. The switch is overridden by a dc control relay energized by an SCR. The SCR is triggered by bias control offered by a 15k ohm potentiometer that is adjusted to fire the SCR just as the battery reaches a full charge of 16.2 volts needed for the counter EMF cells. (See Device III following) As the SCR fires, it pulls the relay winding to ground leaving the battery standing on its own coil.

The full-wave bridge and 10-amp protection circuits are of standard design.

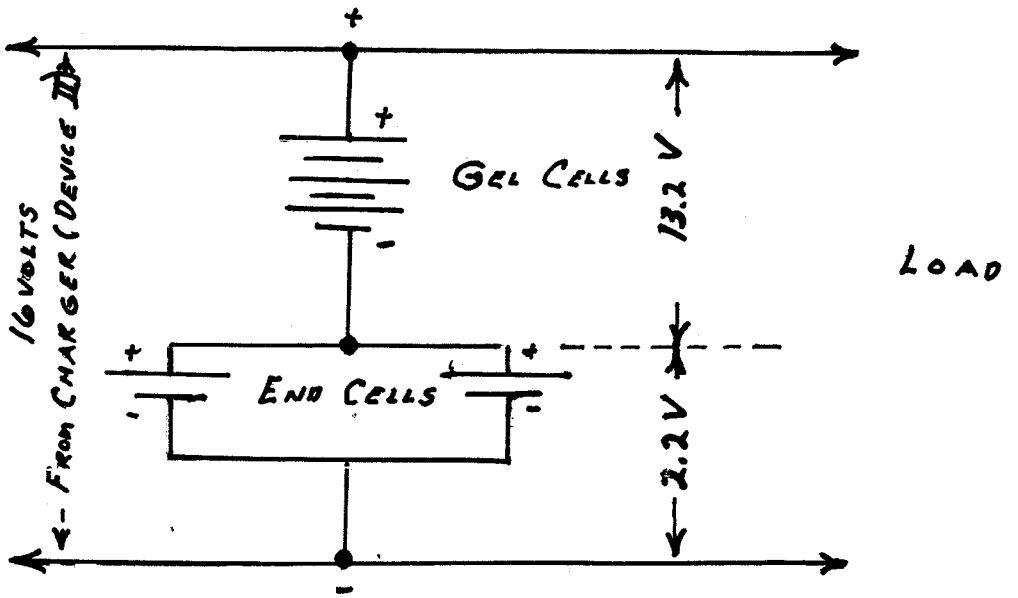


Concept III - Constant voltage supply for auxiliary loads.

A 12 volt sealed gel cell battery is augmented with two 2-volt "Counter EMF Cells" in a series-parallel arrangement. During charging a 16.2 volt supply from Device II will charge the series string. At end of charging the terminal voltage will quickly stabilize at about 14.8 volts due to the low resistance of the parallel-connected end cells that provide "elasticity" of the combination. Counter EMF Cells must have about 120-140 % of the capacity of the auxiliary battery cells.

As auxiliary load continues for about three hours at normal use, the line voltage will taper to a minimum 13.8 volts. The effect of the combination of components approximates a conventional automobile charging system having an engine-driven alternator. It has been demonstrated this simple arrangement can operate all accessories including headlights, control components, wipers, heater motors, and indicator lights.

Credit must be given to the AT&T for the original counter EMF design, published in "Telephony" in 1963. Our innovation adapts the technique to the auxiliay circuits in electric cars. Use of counter EMF cells is much less-costly than the usual dc-dc converter that sells for about $ 450.



Item IV - Determination of an equivalent miles-per gallon for electric vehicles

There is a simplified method for comparing the energy (Watthours) used by an electric vehicle and the more-familar miles-per gallon measure for a gasoline-fueled conventional car. The usual way is to compare the heat content of the two types of "fuel". One kWh of electric energy contains 3413 Btu. One gallon of gasoline contains about 120,000 Btu. The Club's Nissan has an average energy use of 0.334 kWh/mile, or 114 Btu/mile of travel. A conventional car that gets 30 miles per gallon uses (1/30)(120,000 Btu) = 4000 Btu. This comparison however is misleading because it does not include the power plant conversion efficiency and electric distribution in converting a primary fuel to electrical energy and delivery.

The typical power plant uses about 12,000 Btu of heat input to generate one kWh. The electrical transmission and distribution system overall is about 90% efficient. Therefore the primary heat input per mile of travel for the NISSAN would be (0.334)(12000)/.90 = 4413 Btu, slightly higher than the 4000 Btu for a 30 mpg gasoline-fueled car.

An alternative method for calculating energy economy was developed with the assistance of Argonne Lab. It uses market prices for electric and gasoline energy. To see how this works, we will calculate the equivalent mileage for the NISSAN.

An electric car is an additional "appliance" in a household. Energy for battery charging will be billed at the marginal rate established a for residential service. For ComEd, except during the summer peak period, the marginal rate is about 8 cents/kWh. Pump price for gasoline in the Chicago area currently runs from $ 1.21-1.56, depending on motor fuel taxes. we will assume a gallon of gasoline is priced at $ 1.30.

The **economic miles per gallon equivalent** can then be calculated:

Step

1 Trip length = 27 miles

2 Kwh consumed = (27)(0.334) = 9 kWh (Also shown on the kWh meter)

3 Trip cost = (kWh)(Marginal Rate) = (9)($0.08) = $ 0.72

4 Equivalent gasoline required = $\frac{\text{(Trip cost)}}{\text{Gasoline Cost per gallon}} = \frac{\$\ 0.72}{\$\ 1.30} = 0.555$ gallons

5 Equivalent miles per gallon = $\frac{\text{Step 1}}{\text{Step 4}} = \frac{27}{0.555} = 48.6$ miles per gallon

It should be noted that gasoline price includes a substantial cost for various federal, state, and local road taxes and sales taxes. Electricity rates also include a tax component. From the consumer's viewpoint, the comparison should include tax against tax.