Fox Valley Electric Auto Association
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Address Correction Requested

60516-2919 48

NEXT MEETING: Friday, September 20 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. Project Status 2. John Stockberger recognition

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 September wil be $ 4.

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

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SEPTEMBER, 1996 PRESEZ

If the Discussion Topics for September resemble the items scheduled for the August meeting, it's because they are the same. We will have our usual project status update by Project Manager Bob Munroe. John Stockberger's plans changed. The last meting he will probably be attending is in September. We plan at that time to give him recognition as the founder of our Organization.

Electric car conversions have changed over the last 20 years. When John converted his first car the only motors available at a reasonable price were aircraft starter-generators and control systems were built with voltage-switching contactors. Conversions now have a wide choice of commercially-available components that function much better.

KEN

AUGUST, 1996 MEETING MINUTES

The meeting at the College of DuPage was called to order by President Woods at 7:35. Nineteen members attended. We welcomed new Member Andy Redpath who lives in Naperville.

After aproval of the July meeting minutes Treasurer Corel reported $ 1467.67 in the checking and $ 2289.75 in the savings account. There are fourty seven participation shares in the Nissan Project.

Nissan Project Manager Munroe reported that a Curtis 1231C-7701 controller has been purchased. It's voltage range will allow use for both the 120-volt test and the 96-volt final configuration.

There was an extensive discussion of plug braking that is a part of the controller design. In that operational mode, the controller is used as a heat sink to absorb braking energy. It was decided to omit this feature because of possible thermal damage to the controller if this feature is misused.

Member Loescher offered to fabricate a mounting bracket for the circuit breaker. A decision will be made on this at the next working session.

Member Ken Meyers and Dana Mock will reface the existing voltmeter and ammeter instruments for the correct ranges.

There was a discussion about the relative merits of a dc-dc converter vs adding an extra gel cell 12-volt auxiliary battery for the 120-volt test. The consensus was adding a second battery for this activity with a dc-converter built for the final 96 volt system.

There was a discussion about the circuit breaker. It is a 3-pole unit that will allow the positivie leads from each of the three 120-volt battery strings to be wired to one pole. The unit has a 120-volt shunt tripping feature that can be used to provide a dash-mounted "Panic Switch". This seemed to be a good idea. The breaker also has an adjustable overcurrent trip level. The working team will determine if this can be used in place of fuses in each battery string, at least during the test phase. The discussion also included consideration of applicable standard applying to electric cars. A draft version is being written by the SAE. The National Electrical Code Standard that has been adopted refers to off-vehicle electrical supply circuit requirements.

Member Aarvold noted there will be a National Coil Winding event at the Rosemount Conference Center on September 24.

The meeting was adjourned at 9:37

Submitted by Secretary Dave Aarvold

THE NISSAN PROJECT

About six members have been working on the Project since the last Newsletter. The following tasks remain to be completed.

1. Install and wire the key switch interlock relay that energizes the controller logic circuit.
2. Install power cables between controller and motor.
3. Install and connect ammeter, voltmeters, and tempertature meter. Member Mock has finished the circuit design and construction of the required electronics.
4. Install temporary battery charger.
5. Miscelleaneous small items.
6. Energize the power circuit and test with low voltage (12 volts). Static test the drive system.
7. Initiate licensing and insurance procedures.
8. Begin performance testing.

FROM OTHER NEWSLETTERS

This issue of the FVEAA Newsletter will catch up on articles appearing in previous issues of other newsletters that were received after the publication date for our Newsletter, or where space was insufficient to include information.

EEVC (The Eastern Group) in their April, 96 issue reported a search underway for applications using the "motor-in-a-wheel" concept. The article notes that at 65 mph, the typical tire is rotating at 1000 rpm. To keep motor size, cost, and weight at a minimum, most electric motors run at 8-10 times this rpm, requiring a 10-12/1 gear reduction. (Another problem with this design is the "Bounce" forces the motor experiences and the unsprung weight of the assembly that requires special suspension design. - Ed).

Advertised for sale was a 1913 Detroit China Park 2-door EV, and trailer; by Richard R. Smith, 7523 Nature Trail in Columbus GA, 31904, Phone (706) 323-3567.

ELECTRIC GRAND PRIX CORP (In Rochester, NY) in their April-June issue had a page illustrating an installation of an emergency "kill switch" for a Heinemann Model GJ1-B3-DU0250-01C circuit breaker rated 160 volts DC, 400-amps. Our Nissan Project Manager may be interested in this. They also report that an inertia switch is available from Bob Batson, 1 Fletcher Street, Maynard, MA 01754. It can be used to detect a collision from any direction when acceleration is 10-16g (about 20 mph). The switch can be connected to de-energize the main contactor coil.

GLEAN (GLobal Electric Auto News) in the August Executive Report speculated that the ill-fated TROPICA may be revived by a group of RCI investors as the ZEBRA. Don Bright thinks the car, that was developed at a $4-million cost, is viable at a sticker price of $20,000. For a $1000 initial payment to an interest-bearing escrow account, you can reserve one of the first 500 cars. Contact Donald Bright, Marketing & Management, 1376 Mattice Lane, Rohenert Park, CA 94928, Phone (707) 794-8105 for info. His E-mail address is dbright@aol.com.

The issue has an extensive description of the Honda electric 4-passenger vehicle; a car using NiMH batteries, a watercooled 65hp dc brushless motor that delivers 200 ft-lbs of torque and gives the 3600-lb car a 0-60 acceleration in 18.5 seconds. The car was unveiled in June in Washington DC.

There was an interesting photo of Unique Mobility's advanced single-speed transaxle that is offered with either a 32 or 53 kW permanent magnet, brushless DC motor and microprocessor-based controllers.

The Maine Sun Summer 1996 issue featured Member Richard Komp's account of the hands-on photovoltaic workshop he gave at the Midwest Renewable Fair in Amherst, WI. It was a well-attended event.

SUN DAY UPDATE (Based in Takoma Park MD) provided an 8-page list of suggested activities for future Sun Day (The Original Earth Date) local observances.

FROM OTHER NEWSLETTERS - Continued

SEVA (The Sacramento, CA Folks) in their May issue reported on a presentation at their April meeting by two persons who have been working with Nevada Union High School students on an EV conversion of a Chevy S-10 truck. The project required two years and two high school classes to complete. The purpose of the program is to provide student training in future technologies. . The truck is rotated among various county agencies for trial use. The Placer County Board provided $ 13,000 to fund the project.

They also reported that the Florida Alliance For Clean Technologies (FACT) and the Alamo Rent A Car Company and will cooperate in a program to provide 80-90 commuters in South Florida with U S Electricar vehicles. These will be used to commute to a Metro-Dade County Metrorail station for a portion of their daily work-related transportation needs. Cars will be recharged overnight at each participant's home and a specified locations during the day.

VEVA (The Vancouver Organization) in their June Newsletter reported a lot of interest in their first show-and-drive event where 15 VEVA members gave rides in their cars and answered EV questions. The issue also summarized the VEVA Electrathon Canada competition where 16 vehicles were entered. There were a few collisions but no injuries.

WET (Clarence Eller's World Electric Transportation) is back on the FVEAA Exchange list now that he has caught up with the Editor's new address. In a strongly-worded editorial comment, he thinks the recent BLUE SKY award to GM is the outrage of the month. CALSTART presented the recognition to GM for their outstanding contributions to clean air and the advanced transportation industry. He notes that California's New Electric Vehicle Program is working. PSA, Peugeot, Citroen, Renault, Fiat, every major automaker in Japan, Chrysler, Ford, and even GM are all working on electric cars. The issue also contains an account of his participation in the Tour de Sol and Optima battery experiences..

RECENT ARTICLES ABOUT ELECTRIC VEHICLES

Guilt-Free Gas Guzzling. Reason (Magazine) May 96, Page 17. The article argues that automobiles more than pay their own way, according to a study by Kenneth Green of the Reason Foundation. Previous studies from the Department of Transportation, World Resources Institute, and others accuse cars of driving off and leaving the taxpayers with a bill that ranges from $60-700 billion every year. The Reason study places these costs at only $8-billion while car owners pay $22-billion a year in taxes and fees. Green argues the **benefits** from car use, such as freedom of movement, are ignored by other studies. He says, "The fact is, most people own cars and benefit from them. There is no large pool of victims paying money for (owning and operating) cars and receiving no benefit."

RECENT ARTICLES ABOUT ELECTRIC VEHICLES - Continued

Tomorrowland On Wheels. Chicago Sun-Times, (Auto Section) August 5, 96, Page 1. The article is a description of the Mercedes fuel-cell van that was described by the Electric Grand Prix in their June-Sept Newsletter and summarized by the FVEAA in August. (Mercedes must have sent out a press release on the van that formed the basis for many articles about the vehicle -Ed).

A car that runs on gravy. Forbes, 7/15/96, page 60. The subject of this article is a brief history of Amerigon, a Monrovia, California electric car firm, and its founder, Lon Bell. He is called a master at sopping up gravy. The gravy in this instance is the result of government mandates and funding aimed at bring electric cars to California. Bell is a co-founder of CALSTART, a not-for-profit firm that manages $ 80 million for 50 different electric car research projects. He also set up Amerigon with $ 2 million of his own money that so far has taken in around $ 8 million in electric car development grants, most of this from CALSTART. Development of a battery powered car that resembles a dune buggy has cost $ 5 million. In five years, Amerigon has reported a cumulative loss of $ 13 million. President Clinton praised Amerigon in an Alameda speech. Robert Eaton, Chrysler's CEO observed,"Whenever you pass one of those electric cars - and you will pass them - be sure you honk and wave because you helped pay for it".

New Model E - for Efficient. Chicago Tribune 6/27/96, Transportation Section, Page 1. The story is an description of hybrid-electric cars built by several universities. The cars were gathered at Argonne Lab for testing and rating during this year's Future Car Challenge. Automakers provided mid-sized platforms such as the Ford Taurus. Students then converted these cars to electric drive and an onboard engine-generator fueled by propane, compressed natural gas or other non-petroleum fuel.

Combining the Best of Gas and Electric. Chicago Tribune, 7/14/96, Transportation Section, Page 3. The 1996 Tour de Sol provided a preview of hybrid vehicles with 11 vehicles included in this first-time category. Andrew Frank a professor at the University of California - Davis, has "re-engineered" a hybrid version of a Ford Taurus. Below 25 mph, the car runs on batteries, Above this speed, the engine-generator kicks in to deliver an overall 77 miles per gallon. The 3-liter standard engine has been replaced with a 660-cc Honda engine.

Pedicab. Chicago Tribune 6/2/96, Transportation Section, Page 1. Pedicabs, those ubiquitous vehicles found in the Orient have made their appearance on New York streets. They can easily keep up with NYC traffic that averages 7 mph. Pedicabs now have parking spaces at the World Trade Center and South Seaport. The $ 4000 pedicabs do not require medallions that cost $ 200,000 for taxis or $ 80,000 for horse and buggy conveyances. An electric version is planned by Bliss, the entrepreneur who operated pedicabs in Honolulu. before coming to NYC.

Autos are headed for extinction at Grand Canyon National Park. Chicago Sun-Times 8/12/96, Page 21. The article notes that each year 1-million visitors come to this Park and every day 6000 cars chase 2000 available parking spaces. A new plan will provide parking at the Tusayan gateway and provide a shuttle service to canyon sites on electric-powered busses.

RECENT ARTICLES ABOUT ELECTRIC VEHICLES - Concluded

Reinventing the Wheel. Discover (Magazine) 8/96, Page 58. Several FVEAA members have asked about flywheels as an energy storage source for electric cars. This article describes the development efforts of inventor Jack Bitterly, chief scientist at U. S. Flywheel Systems. For twenty-two years he has worked on his vision of cars with motors more powerful that gasoline engines, yet with no emissions or toxic wastes. He has developed a 50- pound composite flywheel, 12 inches in diameter that weighs 80 pounds, including its aluminum container. The wheel spins at 100,000 rpm inside a vacuum chamber. The rim speed of the wheel is 3700 mph. The wheel is suspended in the vacuum chamber by magnetic bearings that never touch the axle. Eddy currents are the only retarding force in the assembly.

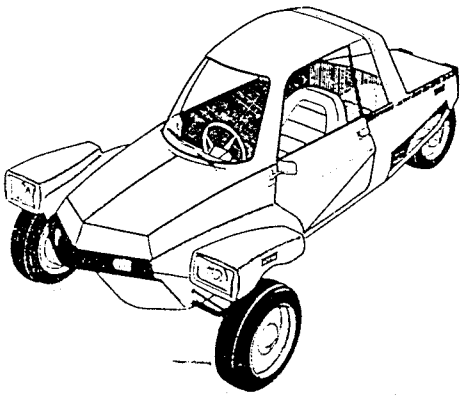
Magnets are mounted on the wheel axle to couple the drive motor energy to the wheel and also to extract the inertial energy. He has designed a compact motor-generator the size of a coffee mug and weighing 3.4 pounds. Motor-generator efficiency is 96%. Each assembly stores 4100 Wh of energy (51 Wh/lb) - over twice the energy density of a standard lead-acid golf car battery. One flywheel assembly would propel a 3000 pound car about 8 miles according to the article.. Each flywheel delivers a steady 25 hp, and is capable of short-time bursts twice that.

A key element in the system is monitoring the wheel and adjusting the magnetic levitation to avoid axle contact during an encounter with a pothole. The monitoring system includes fast sensors and electronics.

To avoid the gyroscopic effect of a single wheel, two wheels can be mounted concentrically on the same axle. This arrangement presents extraordinary manufacturing challenges.

Extensive testing of flywheel failure has been conducted. A composite wheel doesn't produce shrapnel. The kinetic energy dissipates into hot fluff and high speed dust, a sort of mini-volcano that must be contained. With proper containment the risk of injury is much less than an airline passenger sitting for hours next to a screaming jet engine with only a thin aluminum skin, or the risk of a gasoline fire in a conventional car accident.

The inventor estimates that a 12-unit flywheel system would cost about $ 10,000. The assembly has an expected life of at least 10,000 charge-discharge cycles.

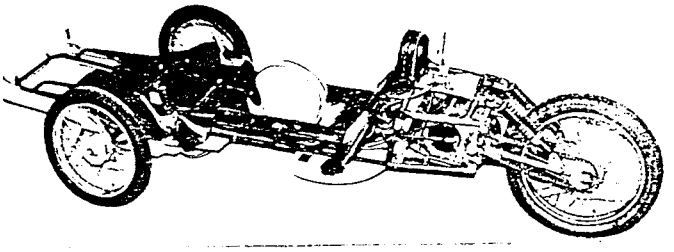


THE FREEWAY ELECTRIC - 1976

CURB WEIGHT - 600 POUNDS

$ 1850

TWO 3-WHEEL VEHICLES



THE CALIFORNIA COMMUTER
EXPERIMENTAL - GASOLINE

CURB WEIGHT 600 LBS

155 MILES PER GALLON

Editor: This is part of a series of excerpts from a paper written by own otuw Eckart Schroeder. The paper is too long to print in it's entirity, but for those of you who would like to read the whole thing we are making copies available at our meetings in the library collection. It will also be available at our internet site in the near future.

BASIC ELECTRICAL TECHNOLOGY OF ELECTRIC VEHICLES

By Eckart Schroeder PART V

AC Synchronous Motors:

If the rotor of an induction motor is provided with permanent magnets, the rotor will start first as an induction motor, using the rods embedded in the rotor iron. When it has reached asynchronous speed, the rotating stator field is pulling the permanent magnetic field of the rotor into synchronism. This gives the name to this type of motor. Therefore, the synchronous motor is more efficient, not having the speed loss between synchronous and asynchronous speeds. Also regenerative braking is more effective since the synchronous motor does not draw its excitation energy from the stator but can provide its own excitation from the permanent magnet field.

For larger ratings the rotor has its own field coil, receiving its excitation energy from an outside DC power source through sliprings and carbon brushes. It is believed that such type is not yet used for EVs

Control and operating characteristics of a synchronous motor are similar to those of an induction motor.

2) Controls

The control equipment is electrically located between the motor of the EV and its power source, in practically all cases a battery

Inherently DC-motors are easier to control with regard to their speed (see equation 6) than AC- motors, as already indicated earlier. However, with the advent of powerful semi-conductors like MOSFETs and gate-turn-off thyristors (GTOs), speed control of AC-motors became more feasible now than one or two decades earlier. If the torque limitations of AC-motors can be overcome by proper design for the purpose of an EV, application of AC machinery may surpass that of DC machinery in the future because of the simpler and less costly design and lower maintenance of the AC machinery.

Controls for DC-Motors

A battery has a constant voltage. Since almost all DC-motors for EV application use a variable voltage in the armature circuit for speed regulation, the controller has to provide this variable voltage at its output terminals. Variable resistors, of course, can do that, but this causes losses which are not acceptable for the energy household of an EV.

The procedure almost universally used nowadays is the so-called pulse width modulation (PWM). In effect the constant DC voltage is "chopped up" into impulses of varying lengths in accordance with the voltage to be desired. Short pulses with long interruptions provide low voltage, long pulses with short interruptions result in high voltage, see Fig. 12. The frequency of these pulses should be relatively high in order to avoid a hum, particularly when the voltage - and the speed of the EV - is low. 15,000 Hz or above should be acceptable. Such high frequency at the current requirements for an EV may need the exclusive application of power MOSFETS (acronym for metallic oxide semi-conductor field effect transistor)

Speed direction reversal can be made by either reversing the field or by reversing the armature current. Field reversal is the simpler method, although, if contactors or power relays are used in the armature circuit, the difficulty of switching a large magnetic field (arcing of the contacts due to a very high EMF when interrupting the field current) can be avoided. This is shown in Fig. 13 where the armature is connected in a so-called H-bridge by contactors. Either contactors 1 and 2 are closed or contactors 3 and 4, providing a current flow in the one or the other direction through the armature. Contactor 5 switches the field. If one wants to avoid contactors, semi-conductors can be utilized as well. The diode across the field is used to short-circuit the field for the switching EMF for longer life of the contacts of contactor 5 and to avoid voltage spikes which

(Continued on page 6)

(Continued from page 5)

can be damaging to the semi-conductors of the PWM controller. The variable resistor is connected to the PWM circuitry and is used to adjust the votage for the armature. The tap of the resistor is mechanically connected to the accelerator pedal. The diagram of Fig. 13 does not at all show every detail of the circuitry but is only indicating what is in principle required for speed control (no circuit breakers, fuses, interlocks or other protective devices are shown).

If regenerative braking has to be provided, the field must be able to be increased and the PWM circuitry must be able to feed back into the battery. If the PWM circuitry cannot feed back into the battery, other means have to be found, possibly bypassing the PWM circuit. A field control is required in order to prevent damage to battery or electronic circuitry by high voltage peaks in case the battery still contains a relatively high charge.

The roles of armature and field can be reversed, i.e. the field is switched by an H-bridge, fed directly from the battery and the armature control is by PWM controller directly without the H- bridge (see Fig. 14). The prevention of voltage spikes when switching the field cannot be done by rectifier diodes. Instead varistors or other non-polarized devices may be employed.

When using a compound wound motor, it is important to "handle" the series type winding in such a way that it is supporting the operation of the motor. For example, when applying regenerative braking, the current of the armature, and thus the current through the series type winding, will reverse. If the polarity of the series type winding is not reversed or the series type winding is not bypassed altogether for regenerative braking, the effective magnetic field may seriously be weakened.

Details of the pulse width modulation circuitry cannot be given here, it would exceed the frame of this article. However, for electronic experimenters, Radio Shack published several "Engineer's Mini Notebooks" which contain basic circuits to put together in order to study pulse generators. These are: "555 Timer IC Circuits", "Op Amp IC Circuits", "Basic Semi-Conductor Circuits", "Science Projects" and "Formulas, Tables and Basic Circuits". Radio Shack carries also the parts necessary for the projects suggested in these books. The principle of pulse generation is relatively simple and based mostly on RC-combinations in conjunction with operational amplifiers, timers or integrated circuits.

Next Month: Controls for AC-Motors and Batteries

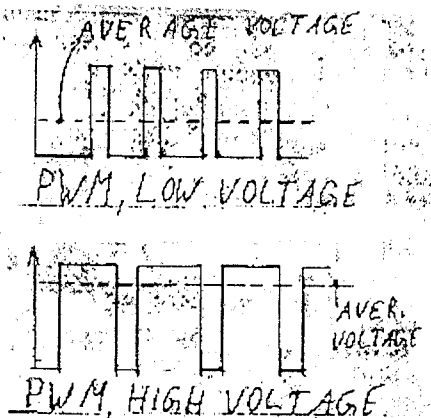


FIG. 12

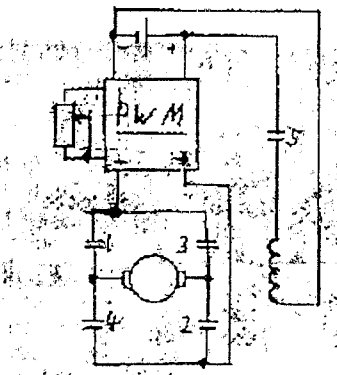


FIG. 13

H-BRIDGE CONNECTION OF ARMATURE

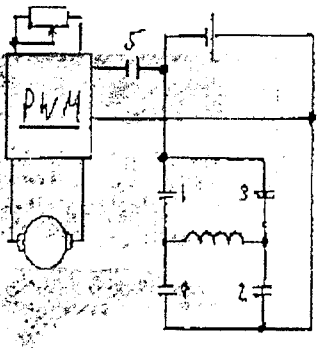


FIG. 14

H-BRIDGE CONNECTION OF FIELD