FVEAA NEWSLETTER
April 1984

MEETING NOTICE

The Fox Valley Electric Auto Association will meet on Friday, April 20, 1984 at 7:30 p.m. in the Mid-America Federal Savings Building located at 250 E. Roosevelt Rd. in Wheaton, Illinois. Andy Chernivsky will give a talk on wind gererators.

HAM FESTS:

Below are listed 3 Ham Fests which will take place before our May meeting.

1. Wednesday, May 2nd - 6:00 p.m. - 10:00 p.m.
   Chicago Amateur Radio Club
   Edgebrook Golfcourse Fieldhouse
   6100 N. Central Ave.
   Chicago, Illinois
2. Saturday, May 5th - 8:00 a.m. - 1:00 p.m.
   Ozaukee Radio Club
   Circle B Recreation Center
   Highway 60
   Cedarburg, Wisconsin
3. Sunday, May 6th
   Kishwaukee Radio Club of DeKalb
   Sandwich Fairgrounds
   Sandwich, Illinois

NAME TAGS

Those who wish to order name tags may see Jack Cahill at the Friday meeting.

NOTICE:

Bob Randerson plans to bring an ALCO battery to the April 20th meeting.

FVEAA
fox valley electric auto association inc.
624 Pershing St. Wheaton, Il.
60187

MINUTES OF REGULAR MEETING
FVEAA
March 16, 1984

The meeting was called to order by President Joe Pollard at 8:00 p.m.

The Treasurer's Report was read by Jack Cahill. Our current balance is $1098.06 based on income of $95.25 and expenses of $60.45 for the past month. It was approved by the membership as read.

Minutes of last month's meeting were published in the last newsletter. They were approved by the membership as published.

Joe Pollard asked everyone to try to come up with a speaker from outside our club for upcoming meetings.

Based on discussions at the last Board Meeting, John Emdee forwarded a proposal that the club purchase one of the small portable copy machines for use at our meetings. They cost approximately $100. There were several objections raised as to its purchase. Within reason, Mid-America Federal Savings will make copies for us during meeting times at no cost. A copy machine at this time did not appear to be of very high priority. No action was taken on this matter.

Bill Shafer commented on seeing a report which showed the KW tubular battery performing as advertised. It seemingly gives extended range and extended life. Cost is still high.

Joe Pollard requested that the Board of Directors look into our summer program.

The meeting was adjourned at 8:40 p.m.

Submitted by
George Zarins
Secretary

FOR SALE by club member, Marion F. Bramel - Electrified Fiat 1974 four-door, G E motor, 72 volt system, 12-6 volt batteries, SRC Control. Asking $900. Address - 502 McHugh Road, Yorkville, IL 60560. Phone (312)553-5344.

FOR SALE by Roger Sutfin - 1966 Renault Dauphine four-door sedan. No motor. Rear trans-axle. Car in good condition. Asking $400. 1800 lbs. with electric motor and batteries. Call 858-4788, or 858-2189 and leave message. (Roger would also like to obtain a narrow, 3-wheel electric scooter. Stomething that could be fixed up would be all right.)

RE AND FEEDING OF GOLF CAR BATTE

Golf car batteries are subjected to much more severe deep cycle duty than the SLI batteries in our internal explosion engined automobiles. Since they a designed and manufactured differently to withstand such duty, the following PRECAUTIONS MUST BE OBSERVED to obtain good range and cycle life:

1. Wet lead-acid batteries self-discharge standing open circuit at a rate varying directly with temperature and previous condition of servitude. Therefore, dont let new batteries stand for longer than 6 weeks without a charge and at least 6 hours of charge (automatic shut off with Lestronic chargers) before first golf course operation.

2. New batteries are not capable of their full capacity until they have been cycled in. Hence, limit use to 18 holes during the first 10 cycles, then progressively thru 27 holes for two cycles up to 36 holes.

3. The ampere-hours of current batteries can deliver without over-discharge varies directly with electrolyte temperature, as does also charge acceptance. Hence, when ambient temperature is 65° F or below, expect less range and limit operation thereto, putting batteries on charge right after use while electrolyte temperature is still elevated. Also, during the first 4 months of new battery life, give them an extra 6 hours of boost charge once a week during the warmest part of the day.

4. Excessive discharge can cause polarity reversal of individual cells, resulting in their complete failure shortly thereafter. The first three numbered points were aimed at preventing excessive discharge early in battery life. As a safeguard against sending out cars that were not fully charged for any one of several potential reasons, first thing in the AM turn on chargers for cars you are going to send out, noting that the ammeter jumps up smartly, tapering into the usual finish charge area in 15 minutes.

5. Battery cycle life varies inversely with depth of discharge. Hence for best battery life, in periods of slow play rotate cars from day to day and dont send any out a second time until all have gone the first eighteen.

6. For good cycle life, specific gravity of the 18 cells fully charged should remain in a ± 10 point spread (total 20 points). Holding that spread requires that new batteries show no more than that spread after the first ten cycles and are held that close by avoidance of excessive discharge, very careful watering of cells and adequate but not excessive charging.

7. After shallow discharge such as 9 or 18 holes, battery on-charge voltage rises rapidly, causing charger output current to taper quickly into the finish charge area. Therefore, except in 90° F or higher ambient, dont cut back setting of manually set timer chargers after such shallow discharges during the first year of new battery life. Lestronic chargers with electronic sensing circuits need no special procedure.

8. Brand new batteries require water addition very in frequently at the outset but dont be deluded by this initial experience. After break-in they will need water every three weeks, increasing to every two weeks and finally once or twice a week as they near the end of their useful lives. Electrolyte levels lower during discharge and rise during charge. Therefore, it is Mandatory that Water Be Added to the cells Only When They Are Fully Charged. Although watering of cells is usually regarded as a very boring "stoop labor" job, actually it is a very important, sensitive chore.

   Correct watering has a very decisive bearing on maintenance of specific gravity balance among all 18 cells. It decreases the probability of individual cell electrolyte dilution by overflow during the gassing mode of charging in hot weather and subsequent watering. Take great pains to fill all cells to the same level which your battery manufacturer advises is correct for his batteries. If you find one or more cells with markedly

higher levels than others before addition of water, they may not be gassing normally in the finish charge mode of charging and possibly defective. Check such cells with a hydrometer for camparison with gravities of normal level cells. Use of purchased distilled water is the safest approach but if it proves too troublesome or expensive, a de-ionizing type of filter which traps any metallic content on a city water line should prove just as effective. Water for batteries should never be handled or stored in metallic containers. Use only glass or plastic.

9. Before expiration of new battery warranty (usually 90 days) check the the specific gravity of every cell in the fully charged state in each car. Any cells outside the 20 points spread should be checked for gassing in the finish-charge mode of charger operation. Most battery manufacturers will replace no-charge within warranty any batteries with one or more defective cells, provided they have not been abused. The most common such abuse is allowing the electrolyte level to fall below the tops of separators. Dilution of cell electrolyte by over-watering and flooding over as well as polarity reversal by over-discharge are the other most common abuses. Failure to catch any irregularities possibly due to defects of original manufacture early in battery life usually results in short service life for the other batteries in the series circuit.

10. MISCELLANEOUS:
   a) Specific gravities are inaccurate for two cycles after water addition.
   b) Treat the hydrometer carefully. A cracked float results in frightsningly low readings. Flush the hydrometer with clean water after each day's use. Every six months disassemble it to wash the float and rub it dry with a clean white paper towel. It is a good idea to keep a spare hydrometer for comparison of questionable readings.
   c) When electrolyte is withdrawn from a cell with a hydrometer, keep its snout in the cell while reading so that all of the fluid is returned to the cell from which it was drawn.
   d) When inserting or removing the charger plug from car receptacle, all pressure or pull must be exerted at right angles to the face of the receptacle. Applying pressure or motion sideways to ease insertion or removal spreads the females inside the receptacle to produce a high resistence connection which distorts the charge characteristics and corrodes the blades of the plug, requiring replacement of both.
   e) Keep all battery terminal connections reasonably tight. Excessive tightening can cause terminal lead cold flow. Any connections that develope a build of whitish corrosion product should be disconnected and cleaned well to provide a good low resistence connection.
   f) Keep tops of batteries clean and dry to prevent leakage paths across them between terminals.

GLOSSARY OF TERMS

Cycle: Any discharge or series of discharges followed by a charge

Cycle Life: Number of cycles of use before batteries must be replaced.

Electrolyte: The fluid mixture of sulphuric acid and water in each cell.

Ampere-hours: Amount of electrical charge transferred. Seventy five amps average flow over 1 hour equals 75 ampere-hours.

CYCLE LIFE OF EV BATTERIES

ASSUMING WELL BALANCED CELLS IN ALL THE BATTERIES CONNECTED IN SERIES AND PROPER BATTERY CARE, CYCLE LIFE CONSISTS OF THE FOLLOWING THREE PHASES:

1. BREAK-IN: THIS IS ONE OF THE TWO MOST DIFFICULT PHASES BECAUSE NEW BATTERY CAPACITY STARTS ABOUT 20% BELOW CAPACITY RATING AND CHARGE ACCEPTANCE IS LOW. THIS COMBINATION IS CONDUCIVE TO EXCESSIVE DISCHARGE EARLY IN BATTERY USEFUL LIFE, WHICH CAN SHORTEN CYCLE LIFE MARKEDLY. BASIC CHANGES IN CRYSTALLINE STRUCTURE OF PLATE ACTIVE MATERIAL OCCUR IN THE FIRST FEW CYCLES. NEED FOR ADDITION OF WATER TO THE CELLS IS RELATIVELY LIGHT DURING THIS PHASE. MOST POSSIBLE DEFECTS OF ORIGINAL BATTERY MANUFACTURE CAN SHOW UP AS IMBALANCE BETWEEN CELLS AND/OR INDIVIDUAL BATTERIES IN THIS PHASE WHICH NORMALLY LASTS 20 TO 70 CYCLES.

2. PLATEAU PHASE: THIS IS THE EASY PHASE IN WHICH CAPACITY IS PER RATING OR BETTER, FINISH-CHARGE VOLTAGE REMAINS IN THE 2.45 - 2.65 VOLTS PER CELL AREA (varying inversely with electrolyte temp) AND ELECTROLYTE TEMP RISE ON-CHARGE REMAINS IN THE 12°-18° RANGE (varying directly with ambient trend and range during charge). HOWEVER, IN BOTH PHASES 1 & 2 SHALLOW DISCHARGE RESULTING FROM LIGHT USE OF THE VEHICLE REQUIRES THAT THE CHARGER RETURN A RELATIVELY HIGH PERCENTAGE OF PRIOR DRAIN DUE TO LOW BATTERY EFFICIENCY IN SHALLOW DISCHARGE CYCLES. NEED FOR ADDITION OF WATER TO THE CELLS INCREASES FROM EVERY 3 WEEKS TO 2 WEEKS DURING THIS PHASE WHICH SHOULD LAST 200 TO 350 CYCLES ASSUMING NO BATTERY DEFECTS AND GOOD BATTERY CARE.

3. TWILIGHT PHASE: THIS IS THE OTHER DIFFICULT PHASE: ONE OF PROGRESSIVE DETERIORATION OF THE BATTERIES IN WHICH INTERNAL SELF-DISCHARGE INCREASES MARKEDLY AND ADDITION OF WATER TO THE CELLS IS NECESSARY ONCE AND ULTIMATELY TWICE A WEEK AS THE BATTERIES APPROACH THE END OF THEIR USEFUL LIVES. THE SYMPTOMS MOST APPARENT TO THE OPERATOR OF THE VEHICLE ARE:
   A. CHARGER AMMETER NEEDLE DOESN'T TAPER DOWN INTO NORMAL LOW FINISH-CHARGE AREA.
   B. HIGH ELECTROLYTE TEMP RISE IN VEHICLE USE AS WELL AS ON-CHARGE.
   C. MARKED REDUCTION OF OPERATING RANGE BETWEEN CHARGES.
   D. NEED FOR MUCH MORE FREQUENT ADDITION OF WATER TO THE CELLS.

   THIS PHASE CAN LAST 50 TO 100 CYCLES IF THE REDUCED OPERATING RANGE STILL FILLS THE NEEDS OF THE VEHICLE OPERATOR AND THE CHARGER AUTOMATIC CHARGE TERMINATION CIRCUIT PROTECTS THE BATTERIES FROM OVERCHARGE AND BATTERY THERMAL RUN-AWAY.

THE CYCLE LIFE NUMBERS LISTED IN EACH PHASE ARE BASED ON MAINTAINING GOOD CELL BALANCE BETWEEN ALL CELLS WITH NO DEFECTS CAUSING CATASTROPHIC FAILURES, PROPER WATERING OF ALL CELLS IN THE FULLY CHARGED CONDITION PLUS AVOIDANCE OF EXCESSIVE DISCHARGE AND OVERCHARGE. OBSERVANCE OF THE FOREGOING QUALIFICATIONS SHOULD FACILITATE HOLDING A SPECIFIC GRAVITY SPREAD OF NOT MORE THAN $\pm$ 10 POINTS (Total 20 points) BETWEEN ALL CELLS FOR AT LEAST 2/3 OF BATTERY CYCLE LIFE. FROM THE CHARACTERISTICS OF THE THREE PHASES IT WILL BE APPRECIATED THAT ADEQUATE BUT NOT EXCESSIVE CHARGING FOR VARIOUS STATES OF DISCHARGE VARIES THROUGHOUT THE THREE PHASES.

THE ANTIMONIAL LEAD-ACID EV BATTERY

A. AN ELECTRO-CHEMICAL ACCUMULATOR, STORING IN CHEMICAL FORM ENERGY WHICH IS RELEASED AS ELECTRICAL ENERGY WHEN AN EXTERNAL LOAD SUCH ELECTRIC MOTOR IS APPLIED.

B. CONVERSION FROM CHEMICAL TO ELECTRICAL ENERGY OCCURS VIA ION FLOW THRU SEPARATORS BETWEEN TWO DISSIMILAR METALS (PbO_2 & Spongy Pb) IN WHICH THE DILUTE H_2SO_4 ELECTROLYTE IS TRANSPORT MEDIUM FOR THE IONS, RESULTING IN ELECTRON FLOW IN THE EXTERNAL LOAD CIRCUIT.

LIKE ALL CHEMICAL REACTIONS, THE ELECTRO-CHEMICAL PROCESS WITHIN THE BATTERY VARIES DIRECTLY WITH ELECTROLYTE TEMPERATURE, AFFECTING BOTH ENERGY CAPACITY AND CHARGE ACCEPTANCE.

D. THIS INTERNAL ELECTRO-CHEMICAL PROCESS CAUSES THE ELECTROLYTE LEVEL TO RECEDE DURING DISCHARGE AND TO RISE DURING CHARGE, PARTICULARLY DURING FINISH CHARGE WHEN WATER IS CONSUMED.

E. AS BATTERIES AGE, THE MAXIMUM VOLTAGE TO WHICH THEY WILL RISE ON-CHARGES DECREASES SLOWLY AT FIRST AND THEN PROGRESSIVELY FASTER AS THEY APPROACH END OF USEFUL LIFE.

F. ANY PART OF PLATE'S ACTIVE MATERIAL WHICH IS ALLOWED TO DRY AND HARDEN BECOMES INACTIVE FOR THE REST OF A BATTERY'S USEFUL LIFE, THEREBY CREATING IMBALANCE BETWEEN CELLS.

G. STANDING OPEN-CIRCUIT, THE BATTERIES ARE SEMI-ACTIVE, SUBJECT TO TWO INTERNAL ACTIONS:

1. INTERNAL SELF-DISCHARGE, THE RATE OF WHICH VARIES DIRECTLY WITH ELECTROLYTE TEMPERATURE AND PREVIOUS CONDITION OF SERVITUDE, BUT THIS IS REVERSIBLE BY PROPER CHARGING BEFORE ELECTROLYTE LEVEL DROPS BELOW THE TOPS OF THE SEPARATORS.

2. ANTIMONIAL MIGRATION FROM POSITIVE TO NEGATIVE PLATES WHICH IS IRREVERSIBLE.

H. CAPACITY OF THE EV BATTERY (In Amp-Hrs or Watt-Hrs) VARIES:

1. INVERSELY WITH RATE OF DISCHARGE: 138 Amps for 1 hour VS 58 amps for 3 Hrs(174 Amp-Hrs).
2. DIRECTLY WITH ELECTROLYTE TEMP: 100% @ 77°F VS 75% @ 36°F.
3. INVERSELY WITH AGE AND PREVIOUS CONDITION OF SERVITUDE.

I. THE UNIT OF EV BATTERY LIFE IS A CYCLE WHICH IS ANY DISCHARGE OR SERIES OF DISCHARGES FOLLOWED BY A CHARGE. CYCLE LIFE VARIES INVERSELY WITH DEPTH OF DISCHARGE. HENCE, THE DEEPER THEY ARE DISCHARGED, THE SHORTER OR LOWER COUNT IS THEIR CYCLE LIFE.

THE EV BATTERY IS DESIGNED FOR RELATIVELY DEEP DISCHARGE BETWEEN CHARGES WHEREAS THE SLI BATTERIES IN OUR AUTOMOBILES ARE DESIGNED FOR SHORT DRAINS AT HIGH CURRENTS FOR STARTING AND LIGHT AUXILIARY LOADS BUT ARE MAINTAINED NORMALLY AT A RELATIVELY HIGH STATE OF CHARGE BY THE ENGINE DRIVEN ALTERNATOR.

K. HENCE EV BATTERIES NEED BETTER MAINTAINENCE AND TIGHTER LIMITS OF OPERATION.

CARE OF EV BATTERIES

1. AVOID EXCESSIVE DISCHARGE: LIMIT DISCHARGE TO 80% OF RATING CORRECTED FOR TEMPERATURE. BREAK-IN NEW BATTERIES PROGRESSIVELY. WHEN BATTERIES ARE DISCHARGED EXCESSIVELY, EXTENDED CHARGING IS NECESSARY TO RESTORE ALL CELLS TO THEIR NORMAL FULLY CHARGED SPECIFIC GRAVITY AREA.

2. WATER THE CELLS CAREFULLY AND CORRECTLY: WATERING THE CELLS IS WIDELY REGARDED AS STOOP LABOR, BUT IT IS ACTUALLY A VERY SENSITIVE CHORE, CRITICAL IN THE MAINTENANCE OF GOOD CELL BALANCE. LEVEL OF ELECTROLYTE WITHIN ANY ONE CYCLE VARIES WITH STATE OF CHARGE, ELECTROLYTE TEMPERATURE, AND AMOUNT OF GAS TRAPPED IN THE PLATE-SEPARATOR ASSEMBLY. ELECTROLYTE LEVELS RECEDE DURING DISCHARGE AND RISE DURING CHARGE. HENCE, IF CELLS ARE WATERED AT OTHER THAN FULLY CHARGED STATE, IT IS IMPRACTICAL TO TREAT EACH CELL PROPERLY SO THAT IN THE FINISH-CHARGE GASSING MODE AT HIGH TEMPERATURE EVERY CELL LEVEL WILL BE CORRECT WITHOUT GASSING OUT FLUID THRU VENT HOLES IN THE CELL CAPS. WHEN LEVELS ARE SO HIGH AS TO CAUSE GASSING OUT FLUID, THAT FLUID CONTAINS SULFURIC ACID WHICH IS LOST TO THAT CELL. THE NEXT TIME WATER IS ADDED, THAT CELL IS DILUTED (lower sp. gr.) WITH RESPECT TO CELLS THAT HAVE NOT GASSED OVER BECAUSE IT HAS MORE WATER AND LESS SULFURIC ACID. SUCH GASSING OVER IS USUALLY THE RESULT OF WATERING CELLS UNEVENLY. SUCH DILUTION PROCESS CAN AND USUALLY DOES BECOME PROGRESSIVE TO THE POINT WHERE THE DILUTED CELLS BECOME THE RANGE LIMITING CELLS, PROGRESSING TO POLARITY REVERSAL AND COMPLETE FAILURE SHORTLY THEREAFTER. WHEN ELECTROLYTE LEVELS ARE FOUND BELOW TOPS OF SEPARATORS IN THE DISCHARGED STATE, ADD JUST ENOUGH WATER TO COVER THE SEPARATOR TOPS, ADDING WATER TO PROPER LEVEL AFTER CHARGE IS COMPLETED. EYEBALL ALL CELL LEVELS BEFORE ADDING WATER. MARKEDLY HIGH LEVEL IN SOME CELLS WITH RESPECT TO OTHERS MAY BE DUE TO NON-GASSING IN THE FINISH CHARGE MODE AND POSSIBLY DEFECTIVE. CHECK ANY SUCH HIGH CELLS WITH A HYDROMETER FOR COMPARISON OF SPECIFIC GRAVITY WITH OTHER CELLS. BATTERIES WITH HIGH LEVELS AND VERY LOW SP GRS WHICH DONT GAS TOWARD THE END OF CHARGE SHOULD BE REPLACED BUT DONT MIX NEW BATTERIES WITH OLD ONES IN A SINGLE SERIES STRING. KEEP TOPS OF ALL BATTERIES CLEAN AND DRY. ALL BATTERY TERMINAL CONNECTIONS SHOULD BE KEPT TIGHT BUT GUARD AGAINST EXCESSIVE TIGHTENING WHICH CAN CAUSE TERMINAL LEAD COLD FLOW, RESULTING IN EARLY SUBSEQUENT LOOSENING. BATTERY WATER SHOULD BE HANDLED AND STORED ONLY IN GLASS OR PLASTIC CONTAINERS, NEVER METAL.

3. USE OF HYDROMETER: PROTECT HYDROMETER FLOAT FROM BREAKAGE AND RINSE OUT WITH CLEAN WATER AFTER EACH DAY'S USE. WHEN ELECTROLYTE IS WITHDRAWN FROM A CELL WITH A HYDROMETER, KEEP ITS SNOUT IN THE CELL WHILE READING SO THAT ALL THE FLUID IS RETURNED TO THE CELL FROM WHICH IT WAS DRAWN. FAILURE TO DO SO RESULTS IN PROGRESSIVE DILUTION DURING SUBSEQUENT WATERING AND CELL IMBALANCE AS DETAILED ABOVE. IMMEDIATELY AFTER WATERING CELLS, HYDROMETER READINGS WILL BE INACCURATE FOR THE NEXT TWO CYCLES.

THERMAL PROBLEMS: AS ILLUSTRATED IN PLATES 4 & 5, CHARGE ACCEPTANCE SUFFERS MORE MARKEDLY WITH ELECTROLYTE TEMPERATURE DROPS BELOW THE 77°F REFERENCE LEVEL THAN DOES THE BATTERY DISCHARGE CAPACITY. HENCE , VEHICLE OPERATION DURING DAYTIME IN RISING AMBIENT TEMPERATURES FOR THE DISCHARGE MODE AND CHARGE OUTDOORS AT NIGHT IN FALLING AMBIENT PLACE THE BATTERIES AT A GREAT DISADVANTAGE. TO PARTIALLY OFFSET THIS DISADVANTAGE, PUT BATTERIES ON CHARGE AS SOON AS POSSIBLE AFTER END OF VEHICLE OPERATION WHILE ELECTROLYTE TEMP IS STILL ELEVATED FROM OPERATIONAL DISCHARGE. WHEN NIGHT AMBIENTS FALL BELOW 60°F, CHARGE VEHICLE INDOORS.

Flat-tire alert

Nothing's more embarrassing than motoring nonchalantly along a comfortable stretch of highway only to discover you have one or more flat tires. Other drivers on the road honk and wave at you, but they're not just being friendly, nosiree. First thing you know, you've stopped at a roadside rest for a stretch of the old legs and an absolute stranger walks up to you and says "Hey buddy, you've got a flat tire!" Well! Is your face red!

But you don't have to put up with that awkward social situation. You can prepare yourself in advance with this simple flat-tire alert that not only tells you that you have a flat, it is so advanced that it even tells you which tire has let you down.

This circuit, while simple, represents a more complicated design problem than you may appreciate. Originally, we tried placing a simple visual system (camera and one light) inside each tire, but results were not promising. We even tried placing the light across from the camera hoping the change in air pressure would change the image, but it was no-go. In addition, the tires became very difficult to balance and we experienced some problem with the camera cables twisting.

Instead, we opted for an external plunger assembly located adjacent to each tire. Under normal driving conditions (Fig. 3), the plunger handily clears the road surface even when fully extended. But in the event the bottom of the tire becomes flat (Fig. 4), the bearing-mounted end wheel rides along the ground while compressing the plunger assembly.

The plunger mechanism itself (Fig. 5) consists of a rod that rides up and down against a compression spring in a slotted sleeve. An actuator tab protrudes through the slot in the sleeve and contacts the actuator leaf of a microswitch, which provides the electrical signal to the circuit (Fig. 6).

A plunger is located adjacent to each tire. LED's 2-5 correspond to each tire. In addition, LED1 is connected as a current-summing WIRED-OR indicator; it not only glows any time any tire is flat, the more flat tires, the brighter that LED glows.

Calibration of the circuit is simple. After installing the plungers, release air from the tires until they represent the tire shown in Fig. 4 (if your tire goes flat on the top or side instead of the bottom, write for advice). Adjust the switch and tab position until the corresponding LED lights. As you proceed through all four tires, you should observe LED1 glowing progressively brighter. When all four plungers have been calibrated, restore the tires to their appearance as in Fig. 3.

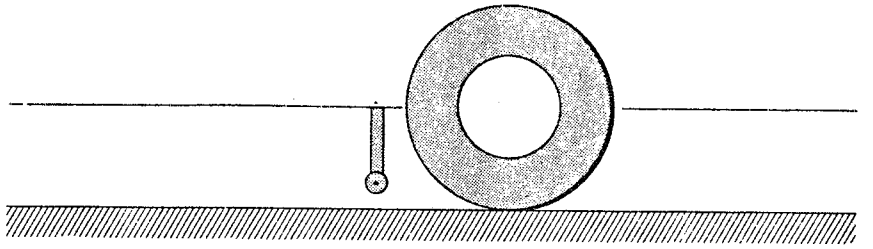


FIG. 3—FLAT TIRE ALERT is shown under normal driving conditions. Note that it clears the road surface even when fully extended.

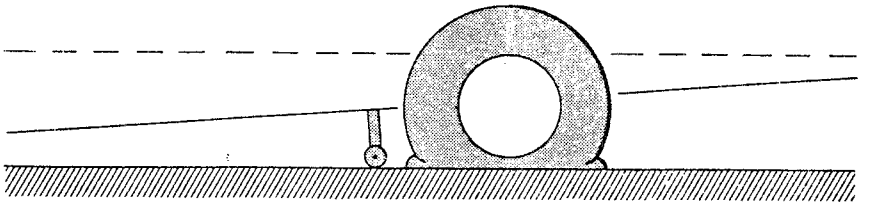


FIG. 4—BEARING-MOUNTED end wheel rides along the ground and compresses the plunger in the event of a flat.

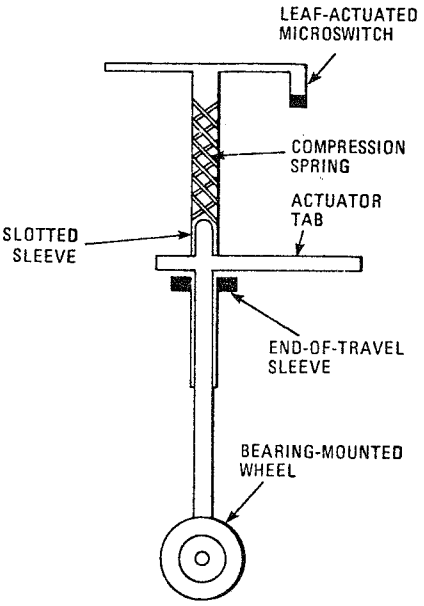


FIG. 5—PLUNGER MECHANISM consists of a rod that rides up and down against a spring in a slotted sleeve.

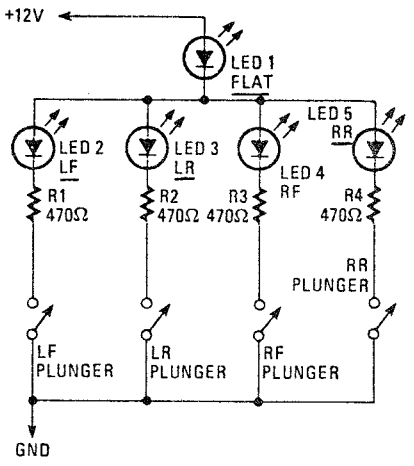


FIG. 6—WHICH TIRE is flat is indicated by LED2-LED5. Additionally, the more flat tires, the brighter LED1 glows.

Collision detector

The same plunger mechanism (Fig. 5) acts as the crucial switch element in a collision detector.

You know the problem. You need to go downtown and the only available parking is parallel parking. Well, everybody knows the only practical approach to parallel parking is the touch system. But let your brakes get just a little bit soft or your acceleration just a little bit peppy and before you know it, your car is an instrument of sculpture, providing design refinements that Detroit never anticipated.

Or you're changing lanes on the freeway, only some idiot isn't going fast enough ahead of you. You know nobody can hear horns at freeway speeds, so you give him a little nudge to get his attention.

Or you park the car on a hill in neutral and forget to set the parking brake.

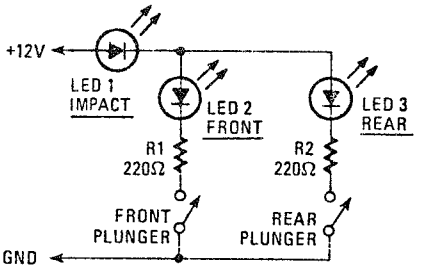


FIG. 7—COLLISION DETECTOR indicates when an impact has taken place and tell you which end has been hit.

Could happen to anyone. Next thing you know, your car's missing from its parking space and off on a little trip of its own.

Any of these situations could lead to a serious collision, but how can you tell when it happens? Well, our little collision detector not only alerts you to the collision, it even tells you if you've been hit from the front or the rear. And if you're simultaneously hit from both front and rear, the "impact" LED glows twice as brightly. The circuit is shown in Fig. 7.

The plungers mount to the front and rear bumpers; on recent models with impact-absorbing bumpers, they can mount between the inside of the bumper and the body—or on standard bumpers, they can mount externally, between the bumper and the colliding person or object.

Wiper-blade maintenance check

Safety officials insist that one of the worst hazards to good vision—especially in inclement climatic conditions typified by substantial precipitation—is a set of poorly-performing wiper blades. In addition to not clearing weather off the window effectively, bad blades can streak the windows miserably, further impairing a driver's view of the road, and his ability to drive safely.

This useful circuit (Fig. 8) helps you keep your wiper blades up to snuff by prompting periodic checks under actual conditions of inclemency.

An array of conductive fingers, SW1, separated by narrow non-conductive paths is used as the sensor. Copper foil cut in a manner similar to the schematic symbol and glued to the outside of the car's windshield (outside the wiper sweep area) can do the job handily. The remainder of the circuit is a simple PNP transistor switch, which turns on the CHECK WIPERS LED any time the SW1 array detects water or snow on the windshield.

This device helps assure that wipers are checked during rain and snow falls for proper operation; similar maintenance checks performed without precipitation present could precipitate inaccurate conclusions and unneeded maintenance costs.

Open-hood alert

There is one driving hazard that has never received adequate coverage in any publication! This shocking omission has at least once been alleged to be the result of concentrated suppressive efforts of pressure groups within the automotive body repair industry—the one industry that most stands to profit from any increased incidence of collision damage incidents. (This same industry has been alleged to be the force behind lobbying efforts aimed at encouraging so-called "go straight on red" legislation.)

The hazard that we are not only *daring* to report here, but *actually daring to try to prevent*, is the danger of driving with the car's hood open. This rolling death threat not only greatly diminishes a driver's ability to see ahead, it also provides an opportunity for death by electrocution in the event of extremely saggy overhead wires.

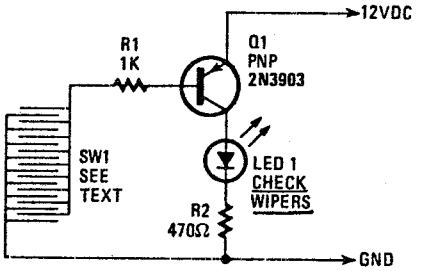


FIG. 8—AN ARRAY of conductive fingers (SW1) separated by non-conductive strips is used as a sensor.

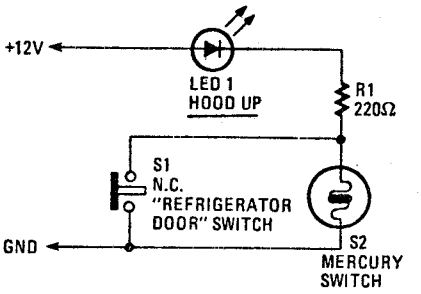


FIG. 9—OPEN-HOOD ALERT uses a refrigerator-door-style, normally closed, momentary switch.

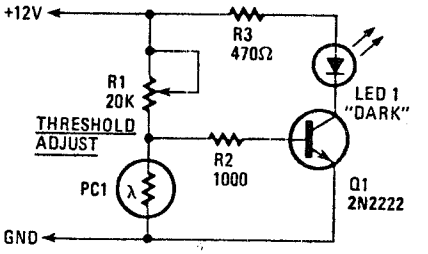


FIG. 10—THIS CIRCUIT monitors ambient light conditions and alerts the driver of insufficient light.

And there's the potential for damage to garage doors—plus the potential for damage to your engine while it's denied the protective covering of its hood.

We went through a great deal of trouble in going through several designs for an effective open-hood alert. Photoelectric techniques were tried, then rejected since the angle of a hood-mounted reflector couldn't be precisely predicted at every highway speed and road condition. Small radar transmitters alongside (but shielded from) radar detectors proved effective (an open hood bounced the signal back and triggered the radar detector), but there are licensing difficulties.

We finally arrived at the fail-safe circuit shown in the schematic (Fig. 9). Switch S1 is a refrigerator-door-style normally closed (open when held in) momentary switch, which is mounted in the engine compartment in such a way that unless the hood is closed securely, the switch is. Switch S2 is a mercury type mounted on the hood itself in such a way that it's off when the hood is down, but when the hood is up it signals "tilt."

If the hood should swing open while you're driving, the switches will close, lighting the HOOD UP LED.

Due to the severe consequences of this potentially dangerous occurrence, we strongly recommend that you check this LED often while driving.

Ambient illumination-insufficiency alert

You've been driving since dawn, about 17 hours straight. Nightfall just kind of snuck up on you—you're a little tired, anyway—and before you know it you're driving in the dark with no headlights. Or you've pulled off the bright, sunlit street and into a dark parking garage or a tunnel—and in the confusion, you forget to check your headlights.

Either way, your visibility is greatly impaired. But this handy little circuit (Fig. 10) monitors the ambient-light level and alerts you to conditions of ambient-illumination insufficiency by lighting a DARK LED (not to be confused with the D.E.D., or Dark Emitting Diode, introduced by National Semi several Aprils ago).

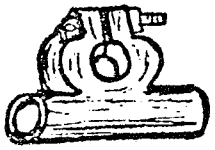
Light-sensitive resistor (or photocell) PC1 is placed where it can sample the ambient illumination. Potentiometer R1 adjusts the light level that triggers the dark response. Resistor R2 limits current to the base of Q1, and R3 limits current through its collector and the LED.

Here's hoping this and the other circuits presented here help make your motoring safer and more comfortable.

If you have any comments on these *Six Unique Projects for Your Car*, or can suggest some of your own, please write us at **Radio-Electronics**, Dept. Apr-1, 200 Park Avenue South, New York, NY 10003. **R-E**

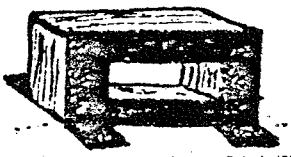
"FOR SALE" "FOR SALE" "FOR SALE" "FOR SALE" "FOR SALE" "FOR SALE"

SOLID BRASS BATTERY CONNECTORS
solder on type fits # OO & OOO
can be used on either pos. or neg. terms.



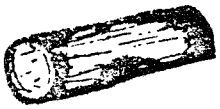
75 ¢ each

STEEL LAMINATED CHOKE CORE
can be wound with 10 turns of # 00 cable. (approx. 12 ft.)



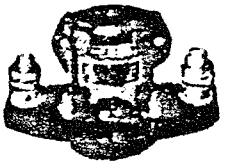
$5.00 EACH

BLACK HEAT SHRINK TUBING
use to finish end of battery cables.
shrinks from 3/4" to less than 1/2"
using a gas flame or heat gun.



50 ¢ per foot

200 AMP. RELAY



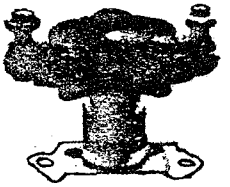
24-28 Volts D.C. U.S.A.F.

$15.00 EACH
ONLY A FEW LEFT

-ALSO SOME HEAVY BATT. CABLE + FREE TUBING

NEW ITEM
LIMITED SUPPLY

400 AMP. RELAY $40.00 EACH



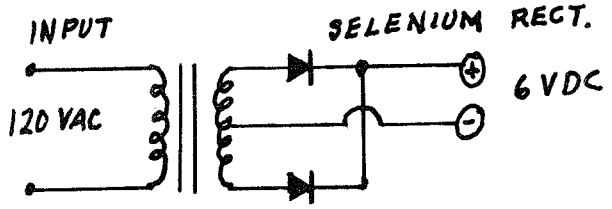
12 VOLT COIL
SINGLE POLE SINGLE THROW
Overall Dimension
5¼"L., 2½"W.
Shipping Weight

ITEMS AVAILABLE AT CLUB MEETINGS

FREE BIG FUSES

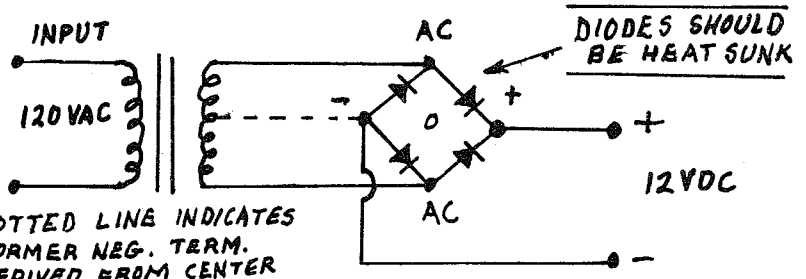
GM goes magnetic. Scientists at the **General Motors Technical Center,** Warren, MI, have discovered a new class of high-performance magnet called Magnequench The new alloy of iron, boron, and neodymium can cut the size of electric motors, because the material can create a magnet over seven times stronger than a conventional ferrite magnet of the same size. GM's first use will be in a cranking motor reduced 40 to 50 percent in weight and 45 percent in size. Future applications in automotive and other products will help save energy.

DON'T THROW AWAY THAT OLD 6 VOLT BATTERY CHARGER



(SUB. BY DON DRAKE)

CHANGE TO FULLWAVE RECT.



DOTTED LINE INDICATES FORMER NEG. TERM. DERIVED FROM CENTER TAP. DO NOT USE FOR 12V CHARGER.