December 1987

MEETING NOTICE

The next meeting will be Dec. 18th, at *CRAGIN FEDERAL SAVINGS & LOAN* 333 W. Wesley St. Wheaton, Ill. -Time - 7:30 P.M. *sharp*. Guests are welcome and need not be members to attend the meeting.

THE PRES SAYS

At the last two meetings, we have attempted to cover a lot of material which caused us to adjourn late. This will be corrected at the December meeting when we will consider only two topics:

1. How many persons will wish to purchase a printed circuit board and components to construct Ken Meyer's charger which we have discussed at the last two meetings. It appears that we will need an order for about 25. The cost for the board and components will be discussed.

2. We will continue our discussion of the voltage upgrade for the present controller and consider if the *Club Car* should be used for this test. Should we incorporate either dynamic or regenerative braking into the revision in view of the marginal hydraulic brake performance?

For those who cannot attend the December meeting, Holiday greetings.

Bill

F. V. E. A. A.

FOX VALLEY ELECTRIC AUTO ASSOCIATION
624 Pershing St. Wheaton, Il 60187

FIRST CLASS

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Phone # ______________________

☐ Just interested in electric vehicles
☐ I have an electric vehicle (describe)____________________
☐ I wish to build an electric vehicle

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AN ACCESSIBLE SOLAR VEHICLE

by Drew Browning & William Becker
Illustrations by Patrick O'Connell

Since the early '70's, we have shared an interest in electric vehicles - Professor Becker through his research and design of various renewable energy transport systems, and Professor Browning through his research, design, and use of sophisticated electric wheelchairs. We now sense that the whole field of electric-powered transportation is about to expreience a dramatic and positive "punctuated evolution" with the onset of rapid developments in carbon-fiber/epoxy composit materials, micro-processor-based control systems, high efficiency electric motors and batteries, near-room-temperature superconductors, and, of course, low-cost and durable PV systems. The sun has quietly risen on the age of the solar electric vehicle (SEV).

As faculty in Industrial Design at a major urban university - the University of Illinois at Chicago - we are well aware of the need for an efficient intermediate-range urban vehicle. Most intra-urban vehicles rarely exceed speeds of 45 mph (even on downtown expressways), constantaly cycle through stop/start conditions, and spend up to 40% of their operating time idling their engines. This urban operating environment is probably the least compatible context in which to deploy the gasoline-fueled internal combustion engine - but, of course, this is the existing "solution." Research has long shown that the battery-powered electric vehicle works best under the above urban driving conditions.

Electric, particularly 'solar' electric, vehicles provide a varied array of benefits to their users and to the general urban environment in which they might operate. Current data on mass-manufactured electric automobiles reveals that selling prices for EV's- even solar EV's - is now comparable to internal combustion vehicles, in all module/design catagories; especially since the addition of costly pollution devices and electronic fuel-efficiency systems. EV's and SEV's require approximately 30% fewer parts than equivalent internal combustion vehicles - and most of those extra internal combustion parts are of the "moving" variety most prone to wear and breakdown.

The electric-powered vehicle has a low-cost and easy-maintenance profile unequalled by any internally powered transport system. Past problems with costly "battery bank burnouts" discovered with use-tests of "night charged" commuter electric cars, can now be permanently resolved with the addition of onboard PV modules which trickle-charge batteries whenever the vehicle encounters sunlight. The addition of newly-available, high-efficiency electric motors and batteries reduce past battery charging/replacement costs to the absolute minimum - bringing the 5-year operating and maintenance costs for an SEV to roughly one-tenth that of a comparable internal combustion carrier.

The list of benefits broadens and deepens as we recognize the design flexibility available to electric vehicles where 'wiring' replaces such 'rigidities' as drive shafts, cooling/exhaust systems, and explosive gas tanks and lines. Passenger compartments, storage areas, vehicle footprint and aerodynamics; even the number of wheels and their geometry can all now be easily reconfigured for different functional and design requirements, with much greater flexibility of design choices without the old complexities and limitations imposed by the internal combustion engine.

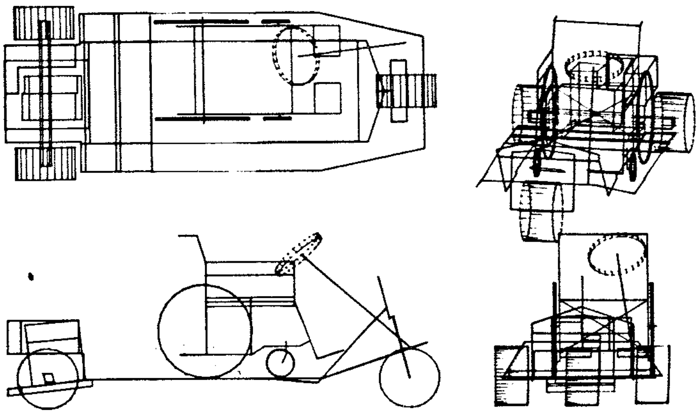
Economic and environmental advantages expand our list of benefits when we note the SEV's 1) lack of dependence on petroleum - currently unproblematic, but chronically unstable in price and availability longterm, 2) low or no pollution profile permitting full indoor/outdoor use, 3) complete lack of noise pollution with no intermittent "muffler" failures, and 4) easy availability of multiple "charging" options and locations (possibly not required at all for SEV's) for pennies per 100 miles of distance covered. On this last point, we can also mention opportunities for reducing costs through charging batteries during "off peak" utility hours, or through "battery exchanges", and the option to use free sources of electric energy via sun and wind. Also, SEV's in low-use patterns such as second or third cars, can be parked in sunny areas to provide, not only power to themselves, but to other sources in the field or at home and garage as well.

But now to describe our "accessible" solar electric vehicle. Through the purchase, by Professor Browning, of two used Cushman utility vehicles, we found ourselves equipped with two "well worn" 36-volt, three-wheeled transporters which could be modified into one sound solar electric vehicle allowing a wheelchair-seated driver access and control. The plan was, and continues to be, to hold most of the parts from the second vehicle as back-up to the first. The goal/problem statement of the project with some initial discussion became: to design and build a vehicle effective in intermediate range urban driving situations; one that is accessible to persons in wheelchairs, easy to park, easy to maintain, energy efficient, and non-polluting.

With the assistance of student researchers, Patrick O'Connell and Alan Stanek, we set forth to strip down the Cushman electric vehicles to their essential frame/controls/motor assemblies. This process completed, we inspected and catalogued all parts, measured the vehicle "footprint" and frame dimensions, and began inputing data into a computer-aided-design program, developed by Professor Browning and operated by Pat O'Connell.

As we modelled the existing vehicle on the computer, we began to get the "feel" for the existing design. A three-wheeled (one fore, two aft), 36-volt, rear motor/drive system supported by a square-tube frame with coil spring suspension fore and aft. The computer soon began to give us the image of a vehicle divided into a forward steering/control section around the steering column/wheel; and a rear power/drive section composed of a battery bank and a rotary switch/motor/transmission assembly between the rear wheels. It immediately became obvious that wheelchair access and support would be designed between these two operating sections (see CAD drawings - Illustration #1). Working with a standard wheelchair, chalk marks on the shop floor gave us patterns of entrance and egress which might work with the reconfigured mid-section of the vehicle. Various space simulations were set-up on the computer until it became clear that two different access approaches seemed superior to others.

The first approach required a fold-down/out ramp concept with a "stretched" frame under the midsection of the vehicle. Using the reconfigured computer model of the vehicle, Pat O'Connell developed a rendering of our accessible SEV (see Illustration #2). Note the long roof section for an estimated 360 watts (minimum) of PV with which to interface our 36 volt system. Side/roof hung sliding doors allow easy opening without interference for a wheelchair user to then deploy a fold-down ramp - which contacts curb or ground with no more than a 12 degree angle. A telescoping "side board" ramp extension is proposed to meet problems which could occur in matching ramp length to varying ground conditions. The front steering/control section of the vehicle employs a vehicle-centered steering column/wheel with column-mounted hand-controls for acceleration and braking, around which is "wrapped" a full-view plastic windshield with single, overhead, truck-type wiper. Standard height bumpers and running lights are placed front and rear; and rignt and left side-view mirrors are mounted appropriately for a "centered" driver. The rear power/drive section of the vehicle



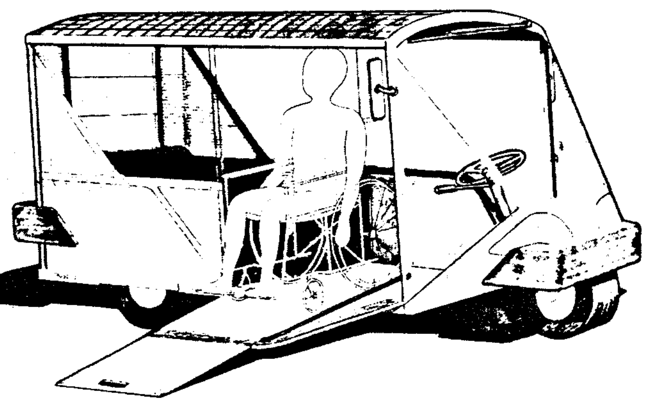


Illustration I (top) CAD drawing showing wheelchair positioning
Illustration II (bottom) rendition of of vehicle showing fold-down ramp

places batteries in a rear "outboard" support structure which allows for easy "on-ground" inspection, charging, and maintenance from the rear exterior of the vehicle just above the bumper. The switches, motor, and transmission of the vehicle are accessible from the interior if the wheelchair-user is facing aft. The entire power/drive assembly is covered with a horizontal 'lid' which, when closed, will allow for carrying a sizable stationwagon-sized payload.

A second approach, now alwo being considered, involves a "lowered floor" structure for the entire mid-section of the vehicle. This concept would employ a radical overhead "bridge" framing structure linking front and rear vehicle sections - but, could permit even easier access to the vehicle without the need for ramps. Upon approaching the vehicle, the wheelchaired user would slide back the same door, as described earlier, but now simply roll up onto a lowered floor which had previously been dropped to ground level for egress. Once on this lowered floor supported by the overhead frame linking the front/rear vehicle sections, the user would activate an overhead electric cable-connected "lift" and elevate into driving position, six inches above ground level. The sliding door would be closed and off we'd go.

We now are in the exciting process of "mocking up" these two approaches, full-size, using cardboard, foam struts, and plywood, while continuing to run alternative details and cost estimates on the computer.

We look forward to writing a test/evaluation article of this SEV for an upcoming issue of PV INTERNATIONAL, and we hope that this article will elicit suggestions and support from the readership of the magazine.

Drew Browning and William Becker are professors in the Industrial Design department, and Patrick O'Connell is a student researcher, all at the University of Illinois at Chicago.

New tax formula private car sales

People who are thinking of buying used cars from private sellers should check out the new sales tax formula going into effect in January to see if they might save money by delaying their deals.

Instead of the current 5% sales tax on private sales of used cars, there will be a 2-category tax that is based partially on the age of the car. Because the new formula is a graduated flat rate, it will mean lower taxes than the current rate in some cases, while in others the existing tax rate is more advantageous.

The new formula has 2 categories, one for luxury used cars selling for $15,000 or more and the other for used cars selling for less than $15,000. The current 5% sales tax (plus local tax) will still be in effect for used car purchases from dealers.

Under the new formula, there are 4 price brackets for luxury cars, with a flat tax for each bracket. The range is from $750 up to $1,500. Cars at the bottom of each bracket will be taxed about the same as they would be this year, but those at the high end of a bracket will be taxed less. For example, the current tax on a $15,000 car is $750, and it will be the same next year. But the current tax on a $19,000 car is $950, and it will be $750 next year, a savings of $200.

Taxes for used cars selling at less than $15,000 are more complicated, because they are graduated from $390 down to $25, according to vehicles' age. Any car selling for $8,000 to $15,000 will be taxed less under the new formula than it would be this year. However, the tax on some lower-priced cars may actually be higher under the new formula. For example, a year-old $6,000 used car would be taxed $300 this year, but next year the tax will be $390.

Vehicle sales between close family members will not be subject to these rates, and will be taxed just $15. For private sales of motorcycles and mopeds, the rate will be $25, regardless of the price or model year.

The tax will continue to be collected at the time of the official transfer of title of a vehicle.

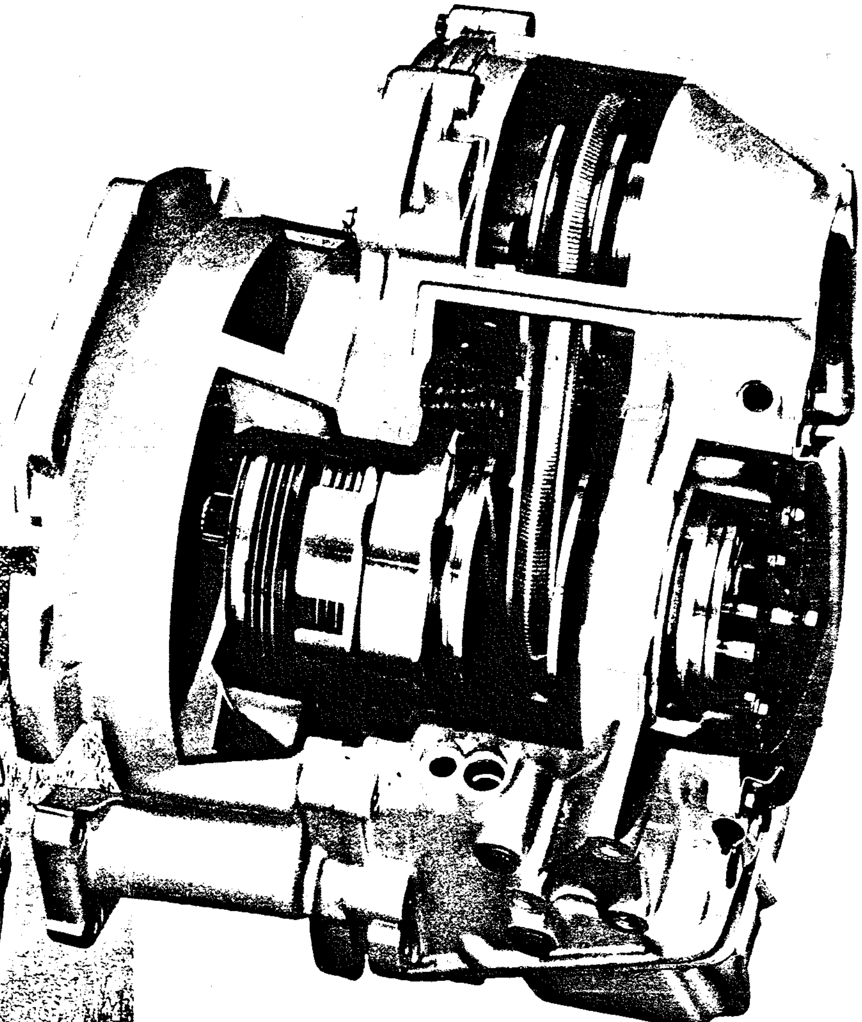
For cars selling for less than $15,000:

number of years after model year of vehicle	tax
1 or less	$390
2	$290
3	$215
4	$165
5	$115
6	$90
7	$80
8	$65
9	$50
10	$40
over 10	$25

For luxury cars, those selling for $15,000 or more:

$15,000 - $19,999	$750
$20,000 - $24,999	$1,000
$25,000 - $29,999	$1,250
$30,000 and over	$1,500

Driving report: Fiat Uno with CVT



Fiat Uno Selecta speeds quietly along, powered by a 1.1-liter engine driving through a Ford-designed CVT. A CVT's steel belt is hydraulically clamped between the variable-size engine input (bottom) and transmission output pulleys (top). The linked metal belt transmits its torque in compression, not in tension like a rubber V-belt.

By DAVID SCOTT

The close-coupled, roller-coaster hills of Dartmoor in England's West Country are an excellent proving ground for a continuously variable transmission. With the standard manual gearbox in this little Fiat Uno Selecta, I would have been busy clutch pedaling and shift-lever sawing to keep up my rolling momentum on the corrugated terrain. And a conventional automatic would have been notching up and down through the gears, while a churning torque converter wasted fuel. But the 1.1-liter engine in this Fiat was twisting power through a CVT; so driving was quiet and relaxed as the transmission glided smoothly and quietly through its broad ratio span.

Described many times in the pages of POPULAR SCIENCE (most recently in the September 1987 issue), the belt-and-pulley CVT is just starting to make its mark on the production-car scene, following lengthy teething problems. Ford of Europe, Inc., will begin production of CVTs for itself, Fiat S.p.A., and other customers this year at its Bordeaux, France, plant. And Subaru of America, Inc., is already using a variation on the CVT theme for its home-market Justy.

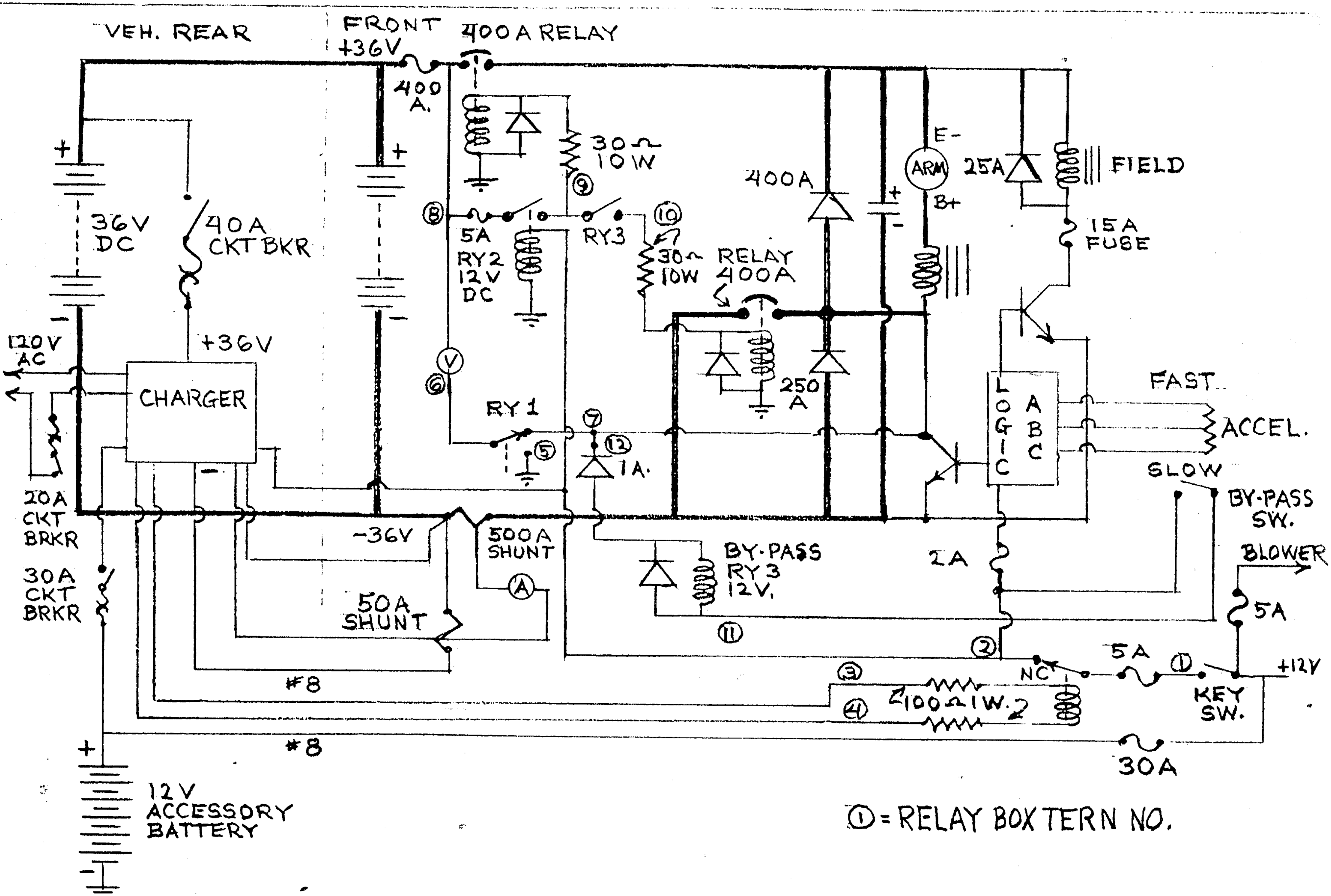
The main advantage of the CVT is its stepless "gear" change, which enables the engine to run within its most efficient, and hence economic, rev band. Look at it as an analog rather than a digital machine, with none of the jerks of normal cog-swapping transmissions. Its ratio spread is equal to that in a six-speed gearbox, with an extra overdrive top gear for a long-striding 27.5 mph per 1,000 rpm. And because it's linked mechanically to the engine, there's no economy loss like that experienced with the fluid coupling in most automatics. On one long 80-mph highway run, the Uno returned a sterling 35.8 mpg. And in London traffic it averaged 31 mpg.

There's no trick to driving a CVT car. It has the usual P-R-N-D-L selector. Starting off in the D position, you release the brake and touch the throttle. As the engine speed rises above idle, the gently slipping hydraulic clutch fully engages the pulley system, and the car moves smoothly off.

As you squeeze the throttle and the car picks up speed, the engine note glissandos down the scale; but the shift hiccup you expect never comes. Instead, you realize that smooth, gradual changes in pulley diameter are lengthening the ratios. The entire throttle-pedal travel is one long automatic-transmission-like kickdown. The harder you push, the faster you go, since you're revving up the engine while sliding down the ratio range.

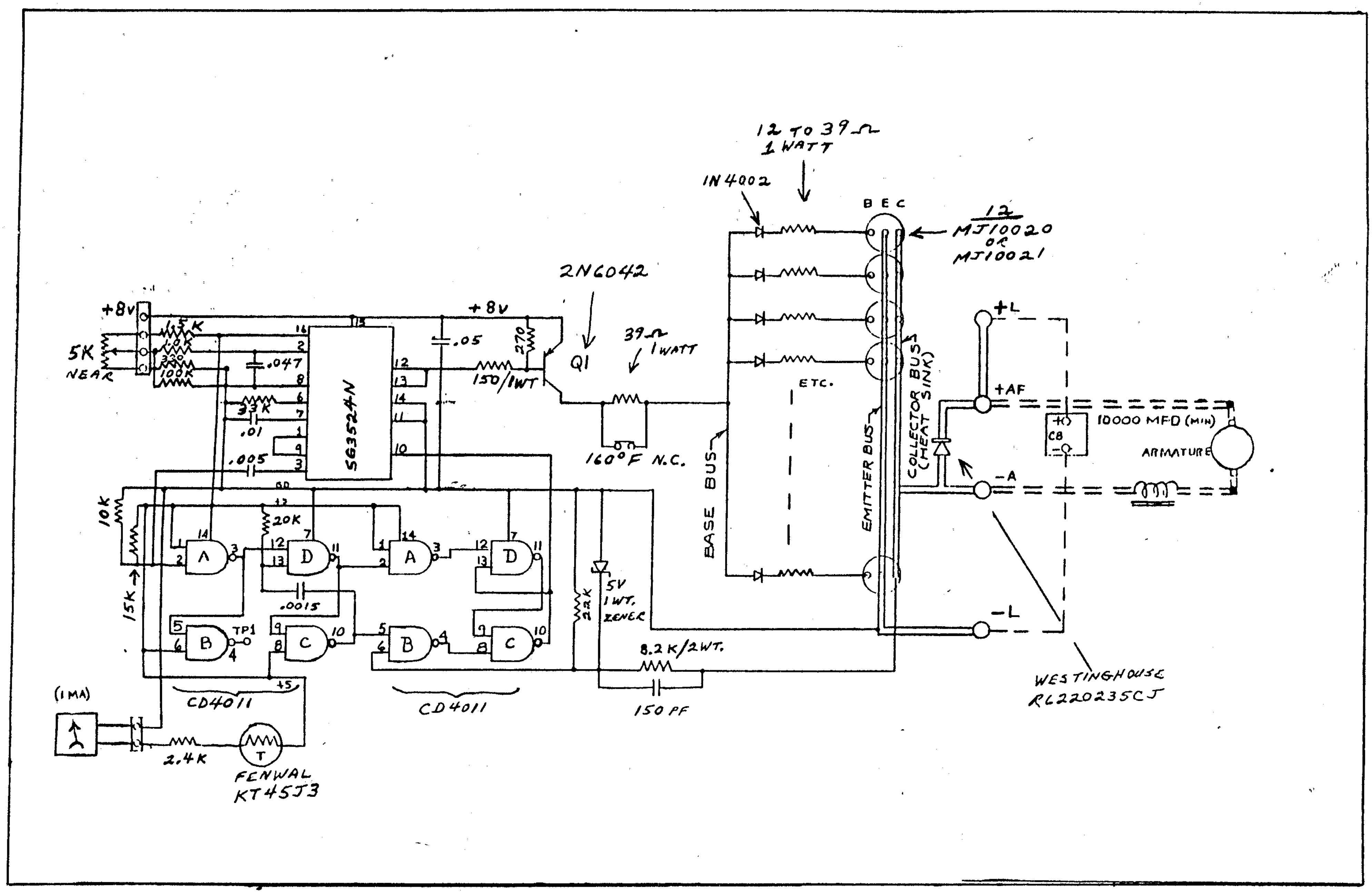
For faster action, you can flip the selector lever to the L position. This gets you quicker downshifting and zippier throttle response for passing or engine braking on steep grades. And mad though it seems, nothing happens if you accidentally snag reverse when moving forward. That's because the reverse position is deactivated by an inhibitor valve until the car stops.

With its tiny 1.1-liter 58-horsepower engine, the Uno Selecta is no fireball, but I got a respectable 0-to-60-mph time of 15 seconds, and a maximum speed of 92 mph. That's not bad for a dream transmission that until a few years ago was considered too problem-prone to be practical. ■



① = RELAY BOX TERN NO.

ELECTRIC VEHICLE SYTEM - 36VOLT.



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EMITTER BUS
COLLECTOR BUS
(HEAT SINK)
+L
+AF
CB
10000 MFD (MIN)
ARMATURE
-A
-L
WESTINGHOUSE
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