TWO ELECTRIC CARS: Ready for the Road?

CONSUMER REPORTS

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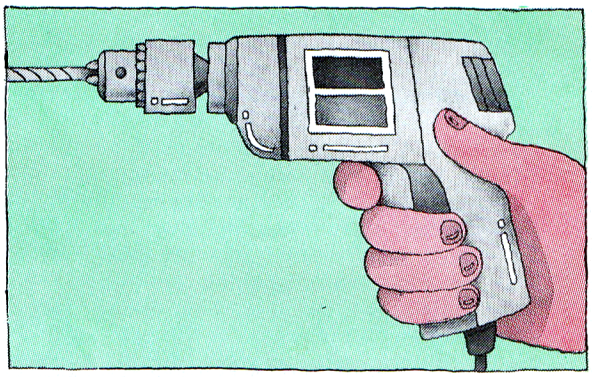
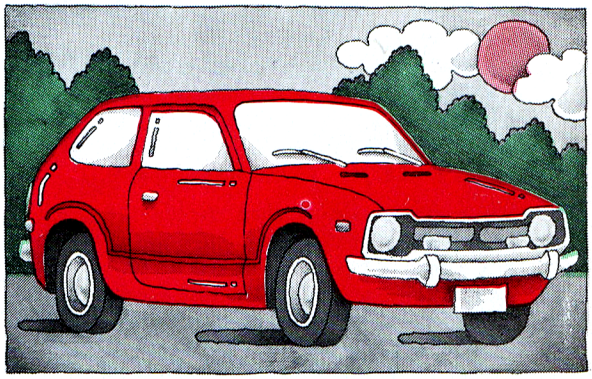
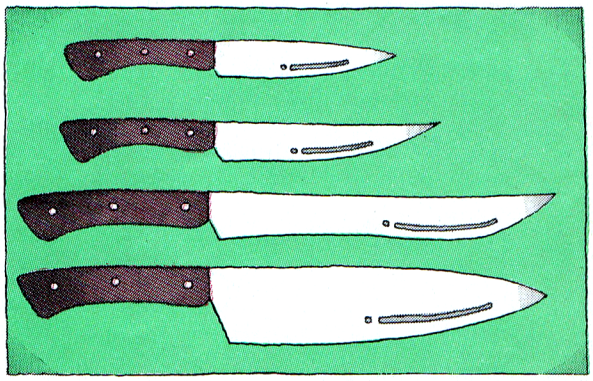
ELECTRIC DRILLS
We found a good one for $13.



HONDA CIVIC CVCC
The real gas-mileage champ.



KITCHEN KNIVES
Is carbon steel really best?

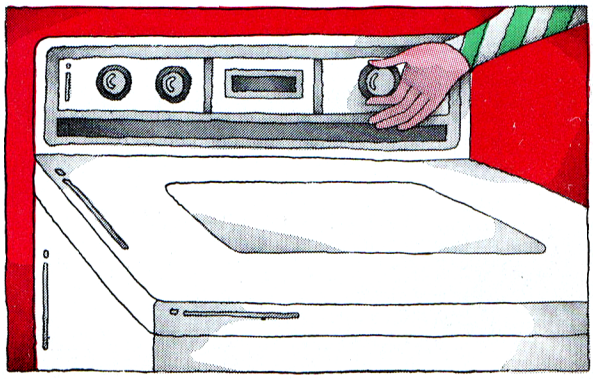


WASHING MACHINES
Tests of no-gimmick top-loaders.

BLANKETS

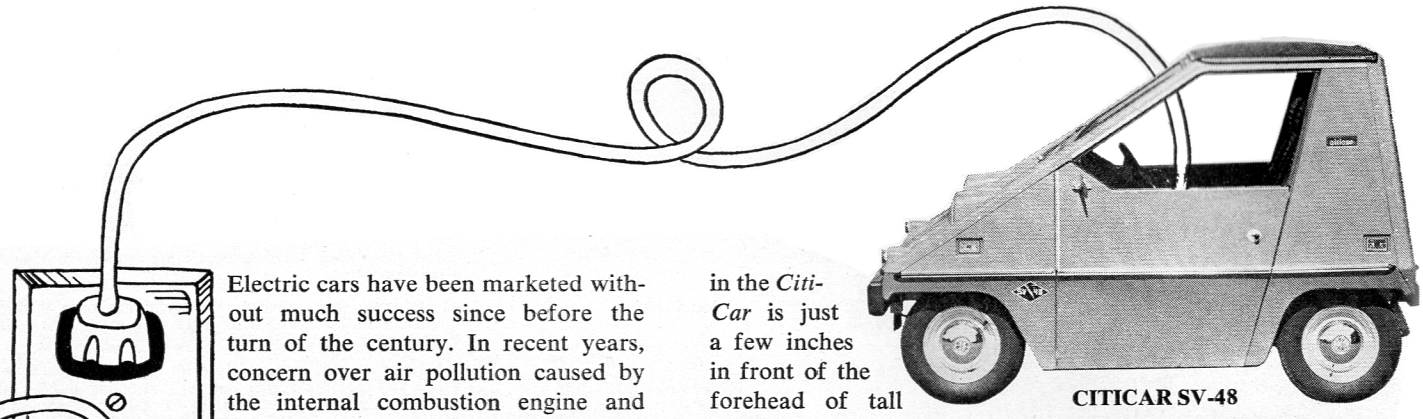
HEARING PROTECTORS

ANTIFREEZE TESTERS



Part 2 of a Special Report
CHIROPRACTORS: HEALERS OR QUACKS?

Two Electric Cars



Electric cars have been marketed without much success since before the turn of the century. In recent years, concern over air pollution caused by the internal combustion engine and the rising cost of gasoline have revived interest in electric cars. CU therefore decided to test the only two electric cars being sold in any volume in this country: the *CitiCar SV-48* and the *Elcar 2000*. We found major safety and operating problems.

The *CitiCar,* made by Sebring-Vanguard, Inc., of Sebring, Fla., cost $2946 delivered to our Auto Test Center in Connecticut. The *Elcar,* an Italian import distributed in the U.S. by Elcar Corp., Elkart, Ind., cost $3475 delivered.

Conventional passenger cars must conform to certain Federal safety standards. But to spur the development of low-emission vehicles, the Government has granted temporary exemptions from some of those standards to manufacturers of electric cars—with unfortunate results.

Conventional cars must provide life-saving protection to occupants in a 30-mph barrier crash, a 30-mph rollover, and a 20-mph side impact from another car. We believe any such crash would imperil the lives of persons inside these tiny, fragile, plastic-bodied vehicles. A rollover or a severe crash holds the further threat of sulfuric acid pouring from ruptured batteries. (The batteries are under the padded-plywood seat cushion in the *CitiCar* and under the plywood floor in the *Elcar*—both within the passenger compartments.)

There are other obvious hazards no longer tolerated in conventional automobiles. Adjusting the safety belts is discouragingly complicated. Yet the windshield frame in the *CitiCar* is just a few inches in front of the forehead of tall occupants, making the use of shoulder belts especially important. The *Elcar's* safety belts are not much better.

CITICAR SV-48

The *CitiCar* has no steering-wheel lock, and the doors cannot be locked. The hinges and latches looked so flimsy that we tied the doors shut before performing any emergency-handling tests. (The *Elcar's* door hardware also looked flimsy, but at least the doors and steering column had locks.)

In both cars, very wide front and rear roof pillars interfere with the driver's view, as do single wipers in the center of the windshields. The spare tires are free to roll around behind the seats and could cause injury in an accident.

The *CitiCar* has a welded-aluminum "roll cage" intended to keep the plastic body from collapsing during a collision; we doubt that it provides as much protection as a well-designed steel body. But steel is heavy, of course, and would make the car even slower than it already is.

The *Elcar* has yet another mark against it: Its suspension is too flimsy to cope with even the low level of performance of which the vehicle is capable. During hard braking tests from 30 mph, the front suspension collapsed, putting an emphatic end to our testing of the *Elcar.*

The manufacturer of the *CitiCar* specifically warns owners that the vehicle should be used only on roads where the speed limit does not exceed 50 mph. The *Elcar* is promoted simply as "perfect on-street transportation for in-town use." But we believe it would be foolhardy to drive either car on any public road. Neither provides anything close to adequate crash protection; and neither handles or accelerates well enough to give us confidence that they're capable of getting out of a tight spot.

CU hopes experiments with electric cars continue. A practical, safe, economical electric car might be just right as a second car limited to short commutes and shopping trips. But neither the *CitiCar* nor the *Elcar* is practical, safe, or economical. We rate both of them Not Acceptable.

On the two pages that follow we report on our tests of these two cars in more detail. However, the results are presented primarily to satisfy the understandable curiosity about electric cars, not as the basis for a rational purchase.

ELCAR 2000

The *CitiCar* is a two-seater, 95 inches long and 55 inches wide. Ours weighs 1303 pounds, including a propane heater ($90) for the occupants and a spare tire and wheel ($36). The *Elcar* also is a two-seater, but it is only 84 inches long and 53 inches wide. Ours weighs 1145 pounds.

The *CitiCar's* 3.5-horsepower motor is powered by eight six-volt batteries similar to those used in golf carts. The accelerator pedal actuates a three-way speed control. Step down one notch and a resistor allows a smooth take-off by limiting the amount of voltage to the motor. Depressing the accelerator pedal further feeds 24 volts to the motor. Stepping down on the accelerator pedal all the way supplies 48 volts to the motor for maximum speed. A built-in charger (photo, below left) plugs into a household outlet to recharge the batteries.

The *Elcar* has a smaller motor rated at 2.7 hp and powered by eight 12-volt batteries. Its electrical controls are more complicated than the *CitiCar's.* A rotary actuator on a column (much like those in old-time trolley cars—see photo, below right) provides three positions: 24 volts, 36 volts, and 48 volts. There's also an accelerator pedal that provides two speeds in each selector position, for a total of six forward speeds. For maximum cruising speed, one flicks a "booster power" toggle switch when in the third selector position. A charger is included in the price of the *Elcar,* but it is not mounted on board. We mounted ours in the rear compartment.

IS ELECTRICITY A CHEAP FUEL?

To test the batteries' endurance, we ran each car repeatedly around a substantially level one-mile course, permitting the car to rest for one minute after each mile and for 15 minutes every half hour. That cycle was designed to simulate an urban drive with several shopping stops.

With the temperature at about 80°F., the *CitiCar* was able to run 33.6 miles on that cycle and then required 14 kilowatt hours (kwh) to recharge fully. In the New York City area, where a kwh costs about nine cents, the energy cost per mile would be 3.7 cents; in some areas, it might be as low as 1.2 cents. By comparison, if the *Honda Civic CVCC* (see page 625) delivered its city mileage of 21 mpg in that same cycle, fuel cost per mile would be about three cents, assuming gasoline at 60 cents a gallon.

The *CitiCar* does not need the oil changes and tune-ups that the *Honda* and other gasoline-burning cars require. However, the *CitiCar* will require a new set of batteries after 400 to 600 recharges, or about 11,000 to 16,000 miles. The batteries would cost about $320, plus labor.

In the same urban shopping cycle, the *Elcar* was able to run 33.2 miles and required 12.8 kwh to recharge the batteries. That figures out to 3.5 cents per mile where electricity costs nine cents per kwh. The *Elcar* would also need new batteries every 11,000 to 16,000 miles. Cost: $250 to $300, plus labor.

Thus, where electricity is relatively expensive, neither electric car would be cheaper to run than the most economical of standard subcompacts.

A BATTERY OF WOES

How well (or, more precisely, how poorly) these cars perform depends a great deal on the outside temperature. For example, during the summer, our *CitiCar*'s useful range without rest periods was about 20 miles; but when the temperature fell to 40°F., the batteries needed to be recharged after less than 10 miles. A full charge usually took more than eight hours.

Other factors affect range. Running at top speed (32.5 mph for the *CitiCar,* 30 mph for the *Elcar*) drains batteries relatively quickly. So does driving in hilly country. Because the headlights of both the *CitiCar* and the *Elcar* dimmed to virtual uselessness by the time half the charge had been consumed, you couldn't (or shouldn't) drive these cars more than about 15 miles after dark.

Acceleration was slow. The *CitiCar* required 17.7 seconds to reach 30 mph. The *Elcar* couldn't quite get up to 30 mph on our test track; it took an excruciating 27.5 seconds to reach 29.5 mph, dangerously slow acceleration even for city streets. Hill-climbing ability of both cars was poor.

The handling of these vehicles hardly inspired driver confidence. During sharp steering maneuvers, the *CitiCar* at first plowed straight ahead; then it would suddenly swing its rear end rapidly to and fro. Bumps caused the car to hop sideways, off course; that characteristic was aggravated by the *CitiCar's* violent ride motions, which caused the driver to turn the steering wheel unintentionally.

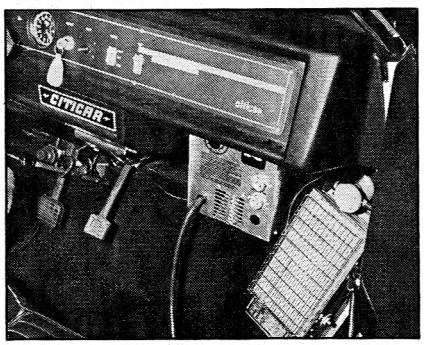
The breakdown of the *Elcar's* front suspension prevented us from performing formal handling tests on that vehicle. But the *Elcar* felt tippy and directionally unstable during normal driving. As in the *CitiCar,* the steering was very quick and unpredictable.

Our braking tests went no better. The *CitiCar's* nonpower brakes (discs in front, drums in rear) required high pedal effort —about 120 pounds to lock the wheels. From 30 mph, the *CitiCar* stopped in 51 feet with no wheels locked and in 43 feet with all wheels locked and the tires sliding. Directional stability was not good; the car swerved and pulled, generally coming to a stop at about a 45-degree angle from the direction of travel.

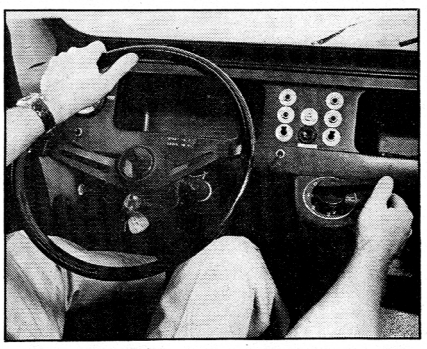
The *Elcar,* with its nonpower all-drum brakes, weaved and leaned sharply when braking from 30 mph. During one hard stop, it almost rolled over. When we tried to stop shorter than about 70 feet, the rear axle hopped. Our shortest stop, 47 feet, involved a sharp veer to the left.

INCONVENIENCE, DISCOMFORT

One would imagine that small electric cars would be most useful for short shopping trips in urban and suburban areas. But



Built-in charger and an optional propane heater take up foot space in the *CitiCar.*



***Elcar's* speed is controlled by rotary actuator (in the hand of the driver above).**

even here, the *CitiCar* and the *Elcar* fell down. Neither vehicle has a rear opening, so one must fold the seatback forward and load shopping bags through the narrow door openings. In the *CitiCar,* a horizontal bar that supports the seatback obstructs

access to the cargo area. And in the *Elcar,* the seatback doesn't stay folded without a prop. Neither car can hold more than a few small packages.

The seats in both cars were too firm and gave inadequate support. In the *Elcar,* the seat cushions can be adjusted both forward and backward. When tall drivers adjusted the *Elcar's* seat all the way back, they found the leg room adequate—but then the steering wheel was too far away. The small brake pedal was too far to the right. Protruding wheel housings limited foot room for the driver and passenger. Entry and exit were difficult.

The seat in the *CitiCar* allows no adjustment. You either fit comfortably or you don't (most CU drivers didn't). Leg room was very tight. The optional propane heater encroached on the passenger's foot room, the steering wheel was too far to the right, and the brake and accelerator pedals were awkwardly high and close. Entry and exit were difficult. The inside mirror not only threatened one's head during entry, but it was distractingly close to the driver's eye.

The *Elcar's* door windows slide horizontally rather than rolling down. They gave adequate protection from the elements. The *CitiCar,* however, has only drafty, flimsy side curtains like those of many early British sports cars.

One might expect an electric car to be quiet. The *CitiCar* and the *Elcar* are quiet only when stopped. At 30 mph on a coarse road, our sound measurements showed the *CitiCar* to be the noisiest vehicle we have tested this year—about as noisy as the *Honda Civic CVCC* was at 60 mph.

The failure of the *Elcar's* front suspension prevented us from recording that vehicle's noise levels, but the *Elcar* seemed to us at least as noisy inside as the *CitiCar.*

The *CitiCar* felt as if it had no springs at all. The car rode uncomfortably on every type of road surface. The *Elcar's* independent suspension gave a somewhat less painful ride. Even so, the car bobbed busily on all but the smoothest roads.

MISCELLANEOUS COMPLAINTS

The *Elcar* has no fresh-air ventilation system. Even with the windows open, the car was hot and stuffy in the summer. The *Elcar* also lacks a heater or defroster, perhaps a concession to the fact that cold weather makes the car's range impractically short anyway. In its petition for exemption from Federal safety standards, the manufacturer of the *Elcar* claimed that the sliding windows would alleviate fogging—but that proved true only when the car was moving.

What fresh air entered the *CitiCar* came in mainly past the ill-fitting side curtains. In cold weather, the constant draft was unpleasant. A switch labeled "defroster" is a dummy. According to the owner's manual, it's "not functional on most models." The optional propane heater was hard to light and modulate. And it quickly fogged all the windows (one of the products of the heater's combustion is water vapor).

In our opinion, most of the many serious breakdowns that afflicted our *Elcar* were design flaws. Our *Elcar* sat in the shop awaiting parts or undergoing repair for a total of 74 days—more than half the time we owned it—until its virtual demise. The main power fuses for the high speed ranges blew repeatedly for no apparent reason during the 370 miles we drove the car. We had to order replacement fuses from the distributor. Each time a fuse blew, we limped home in low speed range and waited for a new fuse to arrive. Recently, the distributor shipped us a circuit breaker to replace the fuse box—a much-needed improvement scheduled for future production.

At just over 100 miles, a short circuit produced a brilliant flash of light from the headlights, and the wiper went berserk, wiping at a frantic pace. According to the distributor, such short circuits occur occasionally, because of inadequate accessory wiring design. We received a wiring kit to correct the defect.

Loose connections at the main power fuse box resulted in a loud clicking noise from the turn-signal flasher when we tried to charge the batteries. That flasher, incidentally, was another weak component; it had to be replaced twice.

At 210 miles, the differential gears disintegrated during normal driving and the car ground to a halt. The replacement gears lasted another 160 miles before crumbling during our braking tests.

The horn failed when grease from the steering column fouled the switch contacts. A moderate tug on the parking-brake handle caused the parking-brake assembly to break in two. The wiper arm, retained only by a set screw, slipped on its drive shaft. The final blow was the suspension failure mentioned earlier.

Our *CitiCar* never left us completely stranded during the time we owned it, although it gave us some anxious moments, as the diary on the facing page indicates. The *CitiCar* suffered from fewer defects than the *Elcar,* and most of those were caused by sloppy manufacture rather than by design flaws. However, four defects were serious. After about 125 miles, the warning light for motor overheating went on even though the motor was only normally warm. At 370 miles, a loose wiring connection caused the voltmeter to flicker and the horn to fail. Most serious, the steering wheel retaining nut was very loose, and all the spring fasteners in the front and rear suspension were loose; had those items gone unnoticed, they could have caused an accident.

THE FUTURE OF ELECTRIC CARS

These two electric cars are clearly unsuitable for any normal transportation function. But the main safety and design problems are solvable, either in these cars or in future competitors.

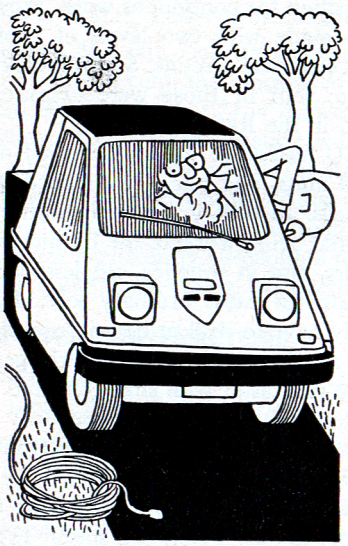
Whether there is any future for the concept of electric cars probably depends on how well they compete in fuel economy and cleanliness with vehicles powered by internal combustion engines. At this point, electric cars are no cheaper to run than such economical subcompacts as the *Honda Civic CVCC* and the *Volkswagen Rabbit*—at least not where electricity is costly. And, of course, those two subcompacts and others like them are not limited to trips of under 30 miles at speeds of less than 30 mph.

The cleanliness of electric cars is another open question. Electric cars themselves produce no air-fouling emissions. But most of the generating plants that produce the electricity needed to recharge the cars' batteries do produce emissions. Advocates of the electric car maintain that generating plants are more efficient than the internal-combustion engine, and that generating plants can disperse emissions high into the atmosphere, rather than concentrating them in city streets. Others, however, point out that wide use of electric cars might require double or triple the present electrical generating capacity of the country. At this writing, Congress is considering initiating a program, under the authority of the Energy Research and Development Administration, to explore further the feasibility of electric vehicles. Such exploration is obviously required.

Notes from an Auto Tester's Diary

CU's auto testers customarily familiarize themselves with vehicles by driving them to and from work and on errands before and during the formal testing program. Here is how it went with one of CU's testers during a day of driving the CitiCar:

8:00 A.M.: Went out to car, unplugged battery charger, and coiled up the extension cord. Wiped dew off glass with handkerchief. Got in, buckled up with some difficulty. Glass fogged again from my breath. Wiped glass again. Switched on power and stepped gingerly on accelerator. Powertrain screams. Fluttering along at top speed, about 30 mph, with unsteady siren emanating from somewhere below the seat. More window wiping to keep pace with breathing. Fairly smooth road tosses the little plastic box so violently that steering a steady course is difficult.



The scream from the powertrain drops in pitch, and the speedometer needle plummets. Momentary panic--then realize the car is negotiating a slight grade, one I hardly ever noticed in other cars. Car climbs slowly but steadily. Incredulous glances from other motorists. Otherwise, the remainder of the trip to work is uneventful.

5:00 P.M.: Returning from work. Confidence builds. Ignore catcalls. Pleased about all the gasoline I'm saving.

8:05 P.M.: After dinner, daughter asks for a ride to friend's house, three miles away. So far, car has gone just 10 miles to and from work. Should be no problem; manufacturer claims at least 25 miles on full charge. On return trip, decide to detour to cigar store in next town, another five miles, for a total of 21 miles. On the way, car lacks zip. But battery indicator shows plenty of charge left.

8:20 P.M.: Getting dark. Coasting down hill to cigar store, turn on headlights. Buy a magazine, start for home.

8:25 P.M.: With the lights of town behind me, notice only faint orange glow on pavement from headlights. Can hardly see road ahead. Let up on throttle, lights brighten appreciably. Feeling uneasy. Switch off headlights and drive along on parking lights.

8:30 P.M.: Instrument-panel light now dull orange. Car really slowing down. Pull to right as far as possible to let line of cars behind pass.

8:35 P.M.: The car with the red blinker doesn't pass. Police. Park and explain to officer that stopping 10 minutes or so would allow batteries to recover. Officer mumbles to himself, drives off. All power off, waiting.

8:47 P.M.: Apply power. Car leaps forward as if fully rejuvenated. Proceed without headlights, just to be sure.

8:50 P.M.: Spurt of energy lasts only about one mile. Back at the side of the road. Watch mirror

for approaching cars; when one comes along, on with emergency flasher for just a few blinks.

9:05 P.M.: Start out again. Progress obviously labored. Creep to a halt after another quarter-mile, at the foot of a small rise.

9:20 P.M. Patience near end. Only quarter-mile more to go. Two more rest stops needed.

9:45 P.M.: Finally roll down driveway. Driver and batteries both drained.