April Hobby Scene

By Marcia Swampfelder

STEREO SPEAKER POSITIONS

***Q.** Should car stereo speakers be pointed to the rear for more thrust, or up for more traction?*

A. That depends on your particular driving conditions. On long trips, the 20-to-30% improvement in gas mileage you get with speakers pointing to the rear is certainly worthwhile. On the other hand, if you drive on snow or ice, the extra traction of speakers pointing upward gives you added control. But be sure to watch the volume when you do this. Recent tests show that extra loud rock music can delaminate radial tires.

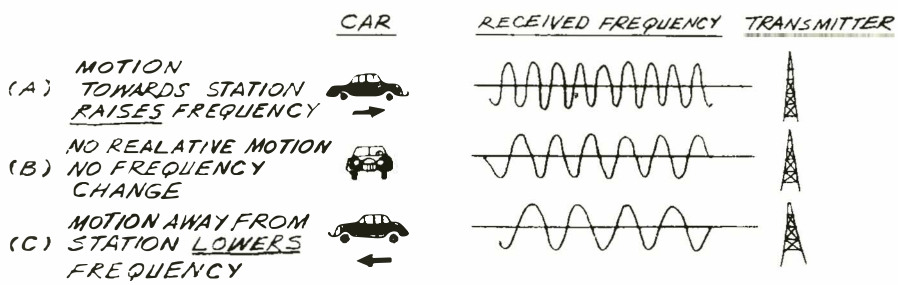
THE DOPPLER EFFECT

***Q.** As I drive around town, I have to keep fine-tuning my AM car radio. Why is this, and how can it be fixed?*

A. Your problem is caused by the Doppler effect. As shown in the diagram, as you drive toward a radio station, you intercept the r-f cycles progressively earlier in each cycle, and the apparent frequency goes up. As you sit still or drive at right angles to the station, you get the normal frequency. As you drive away from the station, you see each cycle later in time, and the frequency goes down. This is why constant retuning may be needed.

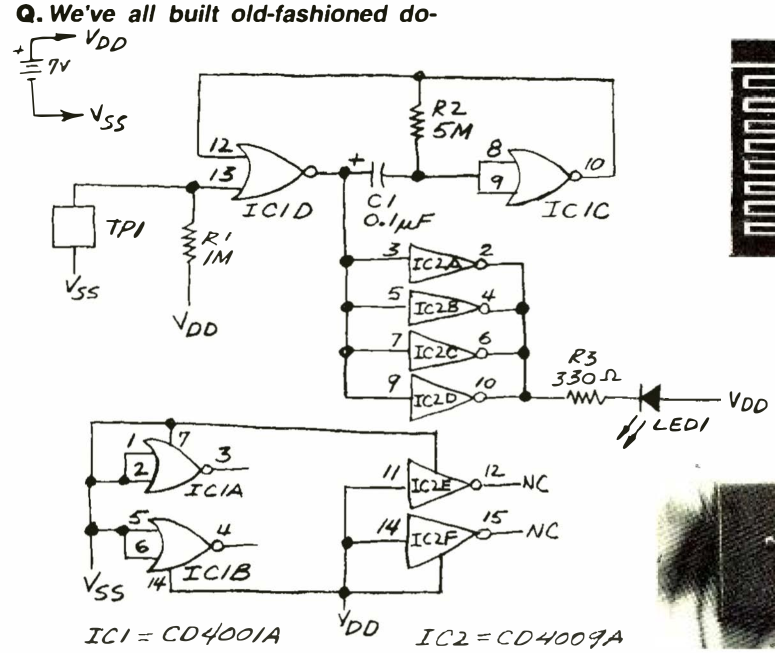
To get around this problem, you can go to a rather expensive phase-locked-loop tracking circuit; but it's far simpler to arrange your driving so that you are a constant distance (for example, in a circular path) from your favorite station.

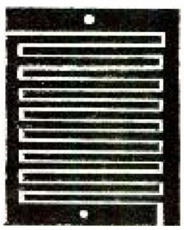
By the way, this is the real reason those loop thruways were built around many cities, and also explains why traffic on them is heaviest during the most popular programs.

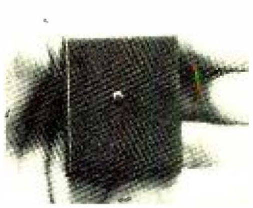


STATE-OF-THE-ART DO-NOTHING BOX

***Q.** We've all built old-fashioned do-nothing boxes using neon lamps and 90-volt batteries. How about an updated design using low voltages, IC's, and a LED?*







A. A schematic and foil pattern for an advanced technology, 100%-IC design do-nothing box is shown here, courtesy of Joel Grodstein, Highland Park, N.J. A 0.7-Hz multivibrator is composed of *IC1*, *R2*, and *C1*. When nothing touches *TP1*, an etched pc touch plate, voltage applied to *IC1D* through *R1* keeps the oscillator turned off. When the plate is touched, skin resistance provides the other half of a voltage divider, and the oscillator free-runs. Its output drives *IC2*, which sinks current from *LED1* and *R3*. Quiescent current demand is 0.04 μA, so the battery will last a long time. Do-nothing boxes should be very compact. The prototype uses a Pomona 3720-2 enclosure measuring a scant 1.75" × 1.44" × 0.69" (4.45 × 3.66 × 1.75 cm). An Eveready E175 7-volt mercury cell and a subminiature tantalum capacitor (Sprague SD35-104 or similar) should be used. The circuit can be assembled on a 1-3/16" × 25/32" (3.02 × 1.98 cm) circuit board using pc, point-to-point, or Wire-Wrap techniques. Touch plate *TP1* is a 1-19/32" × 1-9/32" (4.05 × 3.25 cm) etched pc board which should be mounted in place of the panel supplied with the box. This forms the bottom of the box. The LED (a standard subminiature red—to match the box—diode) mounts on the top of the box after a small hole has been drilled for it. When you pick up the box, your fingers will invariably touch *TP1* and activate the do-nothing circuit, causing the LED to blink.

NEW SOLAR CELLS

Q. *What is the* in situ *solar cell process?*

A. That's the big breakthrough in solar cell design that drops the cost of solar power to $90 per kilowatt. Actually, the *in situ* (Latin for "in place") technique is stunningly simple. Instead of refining the silicon and then building cells, you build the cells first and then refine the silicon.

The process generates a cell from ordinary beach sand (silicon dioxide). After cell fabrication, the sand is chemically treated. The reaction drives off the oxygen, leaving an almost pure polycrystalline silicon. Most conveniently, any remaining impurities rearrange themselves to form uniformly doped series connected pn junctions through a process called Barfoot Layering. For each centimeter of cell thickness, you typically get several hundred series pn junctions or about 120 volts dc under normal sunlight. The thickness of the panel determines the voltage and the area the current. Typical current densities are four amperes per square meter of panel!

You can easily build a 100-watt cell. Simply take an ordinary metal cookie sheet, cover it uniformly with a 1-centimeter thick layer of beach sand, cover that with a piece of screening for the front collector, add a protective glass cover, and clamp everything together with large rubber bands, bungee cords, or something similar.

To do your final chemical refinement, carefully remove the glass cover and spray the sand with two liters of 3,7 Dimethylpentadecon-2-ol Propionate (available from larger organic chemical supply houses). An ordinary window cleaner bottle makes a handy spray source. Reaction time is four hours. Since the reaction is photoisentropic, it should be done under magenta safelight, such as that from a Portal Industries JJ-668 source.

The front terminal is positive and the greatest output will be obtained when the panel is pointed due south at an elevation of your latitude plus ten degrees. A group of panels can, of course, be wired in parallel for independent, on-site power.

INTERFACING COMPUTERS

Q. *What is a MacDonald computer interface?*

A. Dr. Jerome F. MacDonald is the senior member of a design team that has long been working in the Dairy Science Division of the U.S. Department of Agriculture. They have come up with a communications input/output (I/O) and interchange code for computers, terminals, and real-world inputs. The coding is simple, effective, and easy to use. It's spreading rapidly to other government agencies and now is becoming an industry-wide standard. In fact, the code already has an Electronic Industries Evaluationary (EIE) status. Thus, the old MacDonald farm interface is now an EIE I/O.

DE-HEXING CIRCUITS

Q. *After seeing a not-so-recent horror movie, my kid brother claims he is possessed by demons. Is there any electronic cure I can try?*

A. Your brother's cure is simple. Virtually any hex inverter will work. Try the 7404 (TTL), the MC789 (RTL), or the 4049 (CMOS).