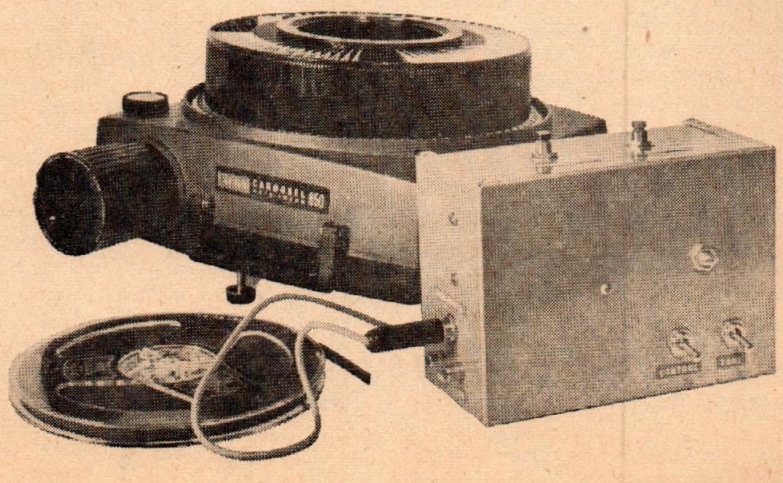
Build it, Program it, Forget it! Our SUPERMATIC T/S SYNCRONIZER gives with the greatest slide shows you ever saw!

By RON MICHAELS

No doubt about it . . . there's an art to making home slide shows interesting! Of course, a little science can also help, which explains why we've designed this unique two-way slide synchronizer circuit. Like any other synchronizer, it links your tape recorder with your slide projector, automatically advancing the slides in step with a taped narration. But unlike any other unit, it will also reverse the slides. The only requirement is that your projector be equipped with a two-way (forwards and backwards) hand-held remote control unit.

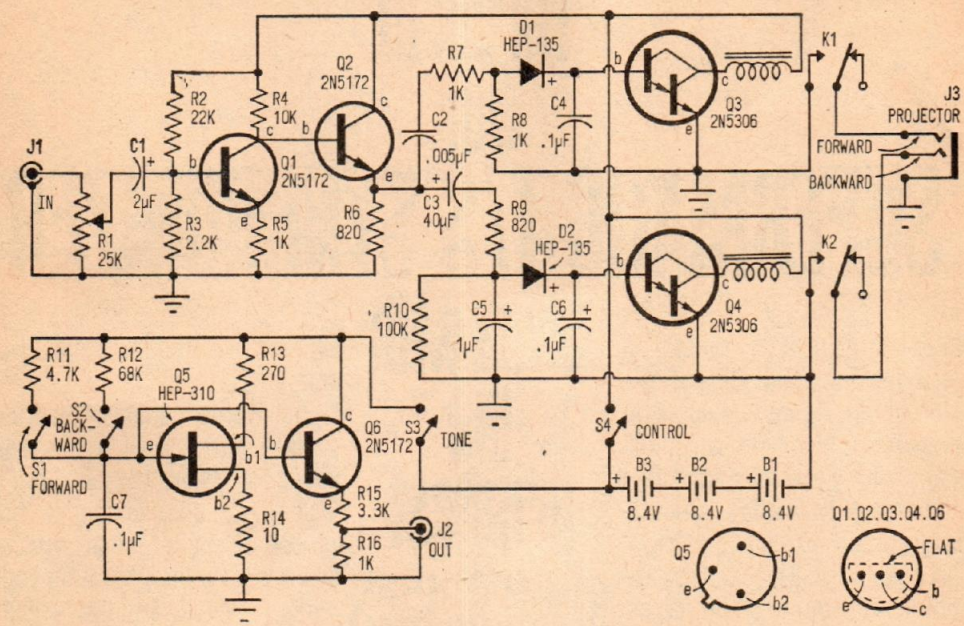
Backwards slide selection sounds nutty until you think about it. When you do, you'll have no trouble imagining the various visual special effects you can achieve by cycling your projector backwards as well as forwards.

The synchronizer circuit will work with any stereo tape recorder. One channel contains the taped narration; the other channel contains the electronic control signals that auto-



SUPER[illegible]TIC T/S SYNCHRONIZER

Circuit of Supermatic T/S Synchronizer. Though Synchronizer will work with any stereo tape recorder, it's ideally suited for those with preamp outputs.



matically cycle the projector via the synchronizer circuit.

How It Works. The circuit consists of two independent tone-operated relay circuits. One (built around transistor Q3) responds to a tone of 1000 Hz (this cycles the projector one slide forward); the other (built around transistor Q4) responds to a tone of 100 Hz (this cycles the projector one slide backwards). Each of these circuits is made up of a frequency-selective filter network and a relay driver/amplifier transistor (actually a dual transistor mounted inside a single case).

Both circuits are driven by a two-transistor tone amplifier stage formed by transistors Q1 and Q2.

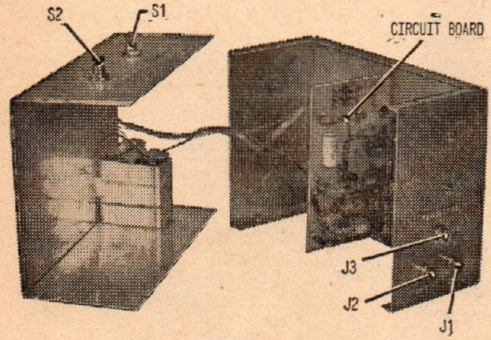
In operation, the circuit monitors the output of the "control" channel—it can be either left or right—of the recorder. When it "hears" either a high- or a low-frequency tone, the appropriate relay closes and activates the changer mechanism in the projector.

Where do the tones come from? You place them on the control channel at the same time you record the narration on the other channel. To do so, you simply activate the two-frequency tone generator built into the circuit. This generator consists of unijunction transistor Q5 (which is wired in a relaxation oscillator circuit) and output transistor Q6. By pushing either one of the two pushbutton switches (S1 or S2), you generate either the high- or low-frequency tone. The generator has its own power switch (S3), since it is not used when the control circuit is working, and vice versa.

The circuit will work best with a tape recorder that has a preamplifier output jack. This way, the preamp output signal of the control channel can be fed directly to the synchronizer circuit. Though the circuit will work with the input connected (via a shielded lead) across the speaker terminals of a tape recorder's power amplifier, the volume control usually must be turned up rather high in such cases. Further, the control signals themselves will be audible. Therefore, if possible, it's best to disconnect

PARTS LIST FOR SUPERMATIC T/S SYNCHRONIZER

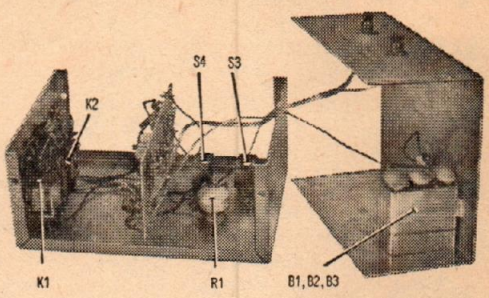
B1, B2, B3—8.4-V mercury battery (Mallory TR146X, Burgess H-146 or equiv.)
C1—2-uF, 15-VDC electrolytic capacitor
C2—.005-uF, 15-VDC disc capacitor
C3—40-uF, 15-VDC electrolytic capacitor
C4, C6, C7—.1-uF, 100-VDC paper capacitor
C5—1-uF, 15-VDC electrolytic capacitor
D1, D2—Silicon diode (Motorola HEP-135 or equiv.)
J1, J2—Phono jack
J3—Two-circuit audio jack
K1, K2—Spdt general-purpose relay; 2500-ohm coil, 7 mA pull-in current (Ohmite GPRX-82T or equiv.)
Q1, Q2, Q6—Silicon transistor (GE 2N5172)
Q3, Q4—Darlington transistor (GE 2N5306)
Q5—Unijunction transistor (Motorola HEP-310)
R1—25,000-ohm, linear-taper potentiometer
R2—22,000-ohm, ½-watt resistor
R3—2200-ohm, ½-watt resistor
R4—10,000-ohm, ½-watt resistor
R5, R7, R8, R16—1000-ohm, ½-watt resistor
R6, R9—820-ohm, ½-watt resistor
R10—100,000-ohm, ½-watt resistor
R11—4700-ohm, ½-watt resistor
R12—68,000-ohm, ½-watt resistor
R13—270-ohm, ½-watt resistor
R14—10-ohm, ½-watt resistor
R15—3300-ohm, ½-watt resistor
S1, S2—Spst pushbutton switch
S3, S4—Spst toggle switch
Misc.—3 x 5 x 7-in. aluminum chassis box, perf board, push-in terminals, battery connectors, two-circuit plug for J3, angle bracket, wire, solder, hardware, etc.



Entire unit is housed in 3 x 5 x 7-in. aluminum chassis box, with majority of components mounted on single perf board. Pushbutton switches S1 and S2 in tone generator are mounted on top of case.

the speaker and temporarily replace it with a dummy load resistor having approximately the same value as the speaker's nominal impedance (generally 4 ohms). Do *not* use this resistor if the circuit is connected to the preamp output.

Building It. The entire circuit can be housed in a 3 x 5 x 7-in. aluminum chassis box with room to spare. Note the parts placement as shown in our photos. All components (except the panel-mounted controls, relays, and jacks) are wired on a piece of perforated phenolic chassis board, using push-in terminals as soldering points.



Three 8.4-V mercury batteries are taped together, then glued to bottom of case. Relays are positioned at one end of case; perf board in center; switches S3, S4, and potentiometer R1 at front.

Work carefully, and be sure to observe polarity when you mount the diodes and the electrolytic capacitors. And solder quickly, with a miniature-tipped iron when you mount the semiconductor components—these are easily damaged by excessive heat.

We chose a battery supply rather than AC-operation for two reasons:

1) The relatively low current drain makes battery power economical. A set of batteries should last through well over a year of slide shows.

2) The use of batteries simplifies hum pick-up problems and eliminates complex grounding requirements.

Note that you must use the 8.4-V mercury batteries called for in the Parts List.

If you wish, you can mount the batteries in individual holders. Considering their long service life, though, it's just as effective to tape the three batteries together into a single battery pack and cement it in place with a dab of contact cement. Use snap-on connectors to wire the batteries to the circuit. At replacement time, simply break loose the cement bead and install a new set.

The relay contact wiring shown in the diagram will control Kodak *Carousel* projectors as well as others using a three-wire control system. Essentially, the mechanism cycles forwards or backwards when either the forward or backward (i.e., reverse) control wire is connected—for a brief time—to a common control wire.

Easiest way to connect the device to your projector is to buy an extra hand-held control unit and cut off the hand-switch assem-

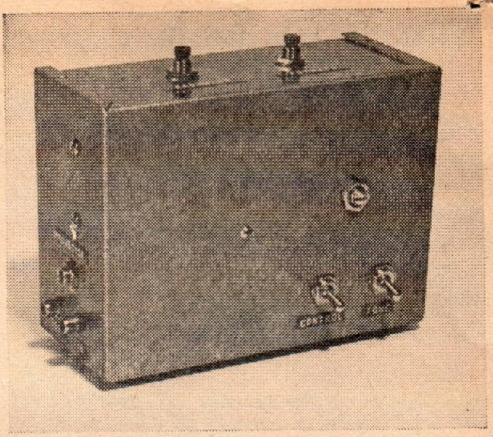
SUPER-MATIC T/S SYNCHRONIZER

bly. Use an ohmmeter or continuity checker to determine which wire in the cable controls forward motion, which controls backwards motion, and which is the common. Do this by connecting the ohmmeter across different pairs of wires leading into the switch unit as you press the buttons.

Next, connect the cut end of the cable to a three-conductor (two-circuit) audio plug so the appropriate cables are routed to the appropriate relay contact terminals as indicated on the diagram.

Using It. To record the control signals, connect the device's output jack to either your recorder's mike or line input, for the channel you've chosen as control channel. Set the recorder's input gain control for this channel high enough so that the tones just overload the recorder (the distortion lamp comes on, or the vu meter reads in the yellow-red region, when you press either S3 or S4). Note: be sure to use shielded cable between recorder and synchronizer.

As you record the narration on the other channel, press either S1 or S2 to place a forward or reverse command on the tape, as desired. Hold the switches down for slightly longer than the time you would hold down the buttons on the hand-held control unit if you were working the projector yourself.



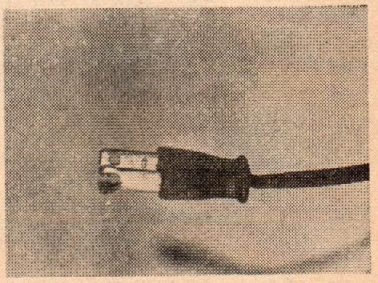
Completed Synchronizer, ready for connection to tape recorder and slide projector. Control immediately above two switches on front is R1; note that author used screwdriver-adjust model.

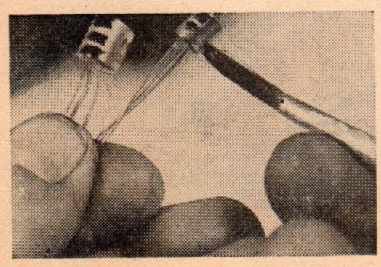
To control the projector, connect the synchronizer's jack to the control channel's output (as described above), and plug the projector's control cable into the three-conductor panel-mounted jack, J3.

Incidentally, input control R1 is provided for use with tape machines that don't have output level controls. If your machine has one, simply set R1 for maximum resistance (minimum attenuation) and bring up the output level until the circuit activates the projector reliably. If the machine doesn't have an output control, set R1 to minimum resistance and back off its setting until the synchronizer works properly. □

PLUG WITH FORKED TONGUE

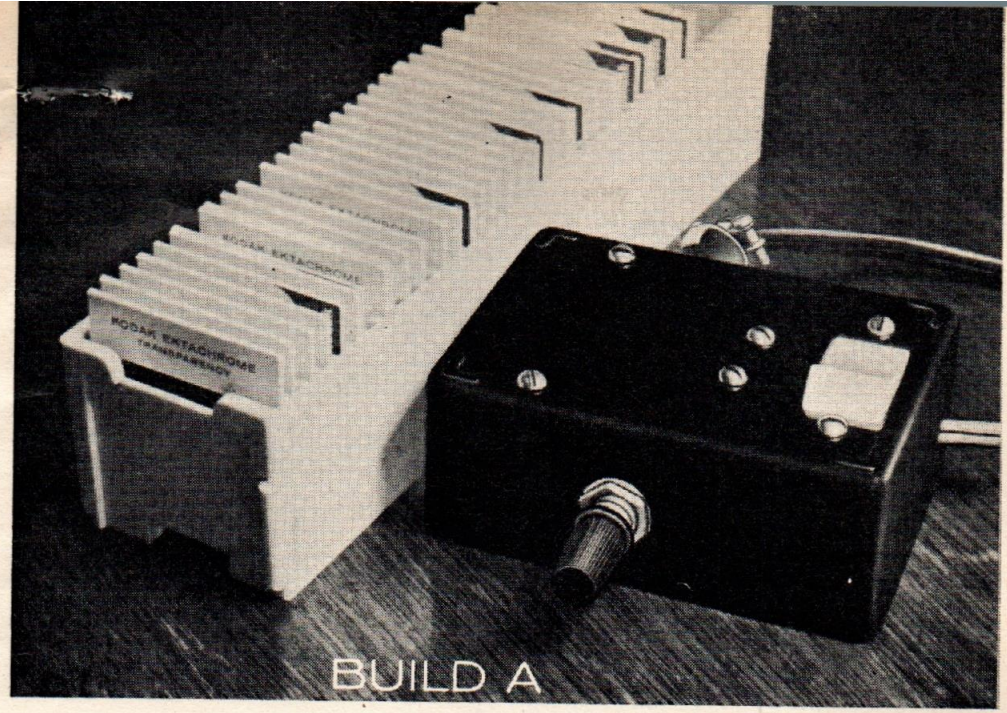
● Polarize your hi-fi and test gear to be sure they're properly grounded. The ground slot on an AC outlet is wider than the other, so make the ground prong on the line cord plug wider, too! Just snip the ground prong with a heavy-duty cutter as shown—the prong will spread. But, be sure you have the ground prong before you snip! —*L. Grant*





COLOR CODE YOUR TRANSISTORS

● A few drops of dope will let you identify transistors as you do resistors—the color code is the same. Use hobby-type dope or quick-dry enamel on the transistor case. A red dot on top means "2N". The next 3 or 4 colors give the numbers that follow the 2N prefix, like 2N1177. —*J. Lamb*



"Relaxatrol" to Automate Your Slide Projector

VARIABLE TIMER CONVERTS PUSH-BUTTON MACHINES TO FULLY AUTOMATIC OPERATION

By GARY W. TOWNER

LOOK, NO HANDS—here's a low-cost way to fully automate a push-button semi-automatic slide projector. Build a "Relaxatrol," set the speed of operation, and join the audience. It is an ideal accessory for continuous repeat-performance applications.

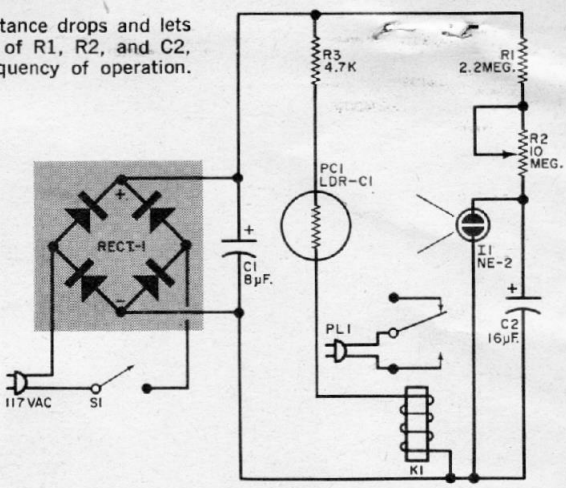
Actually, the Relaxatrol can be used to automatically control at preselected intervals almost any device which is operated manually with switches—without modifying the equipment. The only requirement is that the control be hooked across the switch on the equipment. The control can be overtaken or "dropped out" of the equipment at any time without any additional connections or disconnections.

How It Works. A simple relaxation oscillator consisting of *R1*, *R2*, *C2*, and *I1* (Fig. 1) periodically energizes *K1* to trigger the projector. Capacitor *C2* takes on a charge through *R1* and *R2*, until the voltage across it is sufficient to fire *I1* (usually on the order of 60 to 70 volts).

When the lamp fires, it discharges *C2* until the voltage drops sufficiently to black out the lamp. The frequency of lamp ignition depends upon the values of *C2*, *R1* and *R2*, as well as the voltage across the entire circuit. Variable resistor *R2* makes it possible for you to adjust the frequency according to your needs.

Neon lamp *I1* is close-coupled to a

Fig. 1. When PC1 "sees" the light from I1, its resistance drops and lets enough current flow to energize K1. Time constant of R1, R2, and C2, as well as the applied voltage, determines the frequency of operation.



light-dependent resistor (*PC1*). When the lamp lights, *PC1*'s resistance drops and allows enough current to flow through *K1* to energize it. In the absence of light, the combined resistance of *R3* and *PC1* is enough to keep the relay in its *off* position. The relay simply does what the slide-change push button on the projector would normally do, if the relay contacts are wired in parallel with the push button.

A bridge rectifier can be made up of four individual diodes, but you may find it more convenient to use the commercially available module described in the Parts List. Capacitor *C1* serves as a power supply filter.

PARTS LIST

C1—8-μF, 150-volt electrolytic capacitor
C2—16-μF, 150-volt electrolytic capacitor
I1—NE-2 neon lamp
K1—10,000-ohm, 4.5-mA relay (Allied Radio 75 U 774, type LB-5 or similar)
PC1—LDR-C1 light-dependent resistor (Allied Radio 7 U 565, or similar)
PL1—2-terminal plug (small size; use with matching socket)
R1—2.2-megohm, ½-watt resistor, ± 10%
R2—10-megohm linear potentiometer
R3—4700-ohm, ½-watt resistor, ± 10%
RECT-1—Rectifier bridge (International Rectifier 10DB3A, or similar)
S1—S.p.s.t., 6-ampere switch
Misc.—Black alligator clip insulator, 2⅞" x 4" x 1 9/16" plastic case, 2-terminal strips (4), line cord, hookup wire, knob, etc.

Construction. Layout is not critical and it may be possible to assemble all the parts inside your projector. If you do, be sure to keep the parts away from the hot lamp. However, in most instances, it is better to build a separate unit.

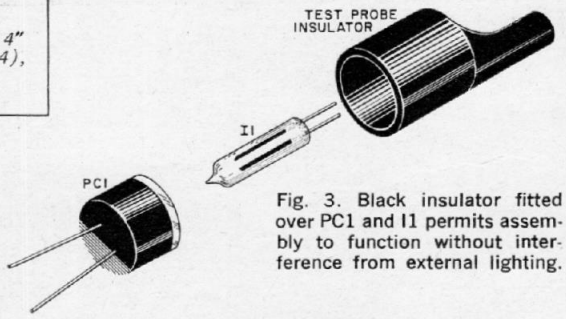


Fig. 3. Black insulator fitted over PC1 and I1 permits assembly to function without interference from external lighting.

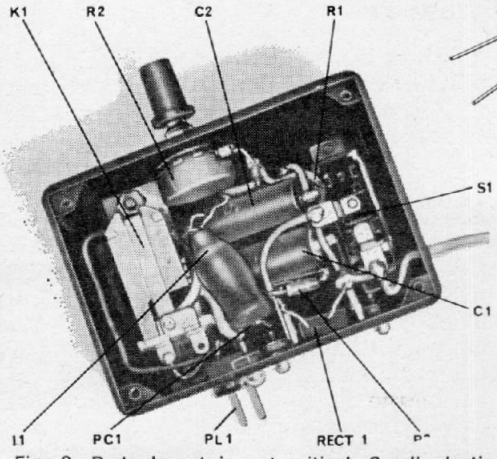


Fig. 2. Parts layout is not critical. Small plastic box helps insulate relay and other components from a.c. line. A line cord can be substituted for PL1.

The small plastic meter box shown in Fig. 2 is inexpensive, easy to work with, and looks good. A test probe insulator, the kind usually placed over an alligator clip, couples the light from the neon lamp to *PC1* and shields the assembly from "outside" light. (See Fig. 3.) You may cut away some of the insulator at each end if it is too long. Assemble the unit as shown in the drawing, and do your best to obtain a light-tight assem-

(*Continued on page* 93)

LOGIC DEMON

(*Continued from page 45*)

button. In the OR function, the bulb lights when either push button is depressed, while in the AND function, both push buttons must be pressed at the same time for the light to come on. With the switch in an NAND position, both push buttons must be simultaneously pressed to put out the light.

The Logic Demon can be used in a classroom or at a Science Fair to demonstrate the practical application of computer (symbolic) logic. Granted that a number of individual switches could be used to perform the same function as the single IC package, it can be seen that the use of integrated circuits greatly simplifies the project. The Logic Demon also demonstrates some practical applications of the use of integrated circuits in computer technology. -30-

"RELAXATROL"

(*Continued from page 56*)

bly. Slip a piece of spaghetti over each of the leads to insulate them and prevent short circuits.

Exercise care and work slowly when drilling holes in the plastic case. Use a file to shape the opening for the switch. A bottom cover for the case can be made from a thin piece of plastic or stiff cardboard, if you don't already have one. Two precautions should be taken: observe polarity of the diodes or proper connections of the rectifier module; and don't compromise the insulation—the rectifiers and *S1* are connected directly to the a.c. line.

Operation. When the unit is completed, check the wiring for any errors, then secure the bottom cover. Plug the a.c. line cord into a wall outlet and switch on the unit. After a slight delay, the relay should pull in and out at a regular interval. Rotate *R2* to change the interval. Range should be from very fast (approximately 15 seconds) to very slow (approximately 2 minutes). If desired,

the time intervals can be marked on a dialplate placed under the control knob.

Connect the push-button leads from the projector to *PL1* through a mating socket. Use a small caliber plug and socket for this purpose to prevent confusion with the a.c. line cord. Set up your projector as usual, and allow the Relaxatrol to go to work. If you want to view a particular slide for a longer period of time, simply turn the unit off until you are ready to start again. If you want to quickly dispose of a slide without upsetting the timing sequence, hit the push button just once.

You can shift the range of speeds by using a smaller or larger resistor in place of *R1* or by changing value of *C2*. —30—

THE "SCROUNGE"

(*Continued from page* 46)

You could hang this antenna from a tree, or—if you want to get fancy—substitute aluminum or copper tubing, but maintain the same dimensions. If you support the lower part of the antenna with insulated standoffs, you'll have a first-class permanent installation.

If you hang the antenna from a tree or other high structure, you can reverse the connections to the coaxial cable to provide for some degree of lightning protection. With the leads reversed, the highest point of the antenna will be connected to the coaxial cable's shield, which is usually grounded at or near the equipment. Antenna action is not materially affected by this reversal because the quarter-wave section acts like a transformer.

As with any antenna work, there is no substitute for actual on-the-job tuning, adjusting, and other optimizing activities. The figures shown are close enough for most applications, and include some consideration for end effect. If you want to experiment using a cut-and-try technique, you can first try shortening the quarter-wave section about ½" at a time before modifying the half-wave section. Telescoping sections such as are found on a pair of TV "rabbit ears" could help you pin down the exact dimensions. —30—