Build a Sliding Bar "Antique" Radio

The Sliding-Bar Crystal Radio is nothing new to real old timers, who started building those radio sets after World War I. Despite their antiquity, a sliding-bar assembly helps to separate and tune in the broadcast band well. The receiver contains two coils that can be adjusted by moving pointers (brushes) back and forth along an exposed portion of their surfaces. By tuning the radio in that fashion, even strong local stations can be separated.

Take a trip into the past with our sliding-bar radio, and bring some solid state with you for an up-to-date twist!

BY HOMER L. DAVIDSON

Sliding-Bar Construction. The sliding-bar assembly is made from square tubes found at most popular hobby stores. The small square brass tubes sell for about 99-cents each. You will need two different stocks (sizes): 3/16-inch square and 1/4-inch square. The 3/16 square tubes fit snuggly into 1/4,-inch square tubes. A long section of 3/16-inch stock (called the main bar) is placed above the coils and between the wooden supports for the tuning coil (see photos). The two pointers (cut from the 1/4-inch stock) slide upon it to tune the coils.

When you are cutting a piece, it is best to have it secured in a vise rather than just holding it. Be careful not to squeeze the piece out of shape when using a vise. Start by cutting a 7-1/2-inch section of 3/16-inch stock for use as the main bar (see Fig. 1). Drill holes in the ends for mounting screws used later. Cut two pieces 1-1/2-inches long from the 1/4-inch stock. Those pieces (sliders) will actually ride back and forth on the main bar. They will carry the pointers, which actually make contact with the coils.

To make the pointers you must cut two 3/4-inch pieces from the larger stock to form sleeves, and two 3/4-inch

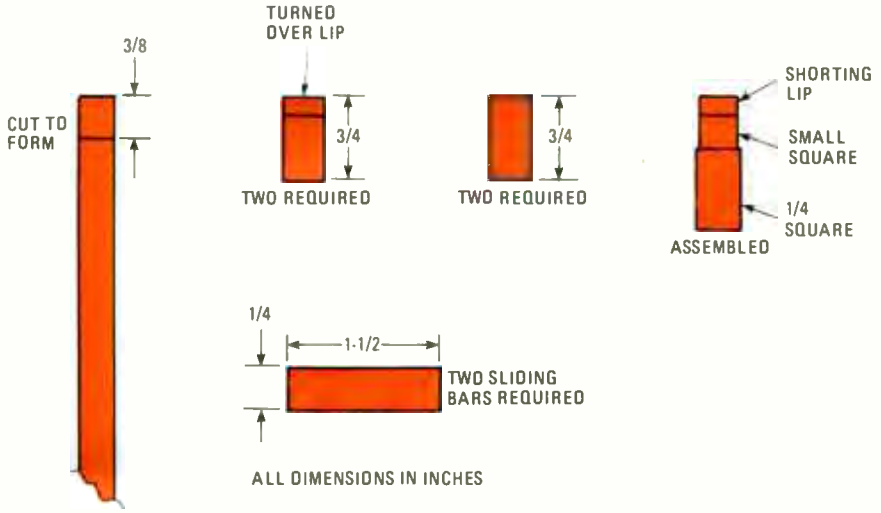


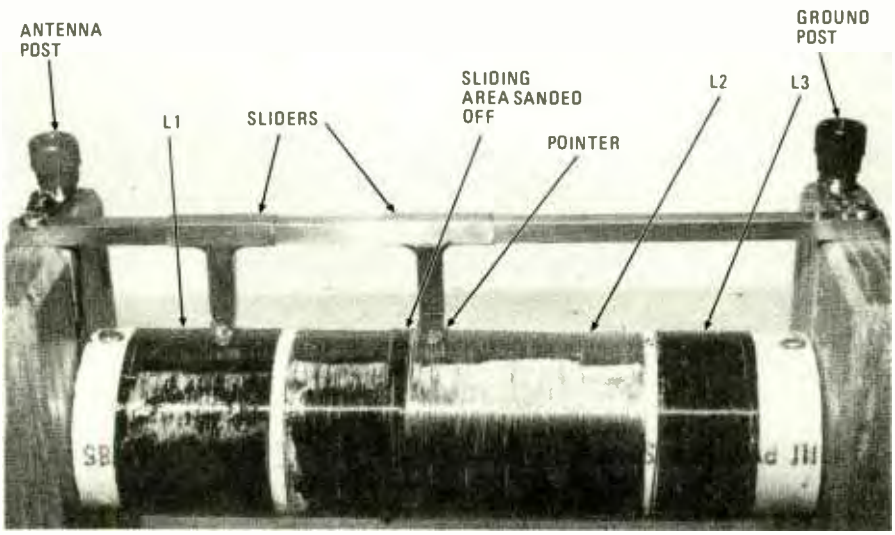
Fig. 1. The sliding bar is made up of the larger ¼ inch stock so the slider bars will ride or float outside the larger piece. A brush is formed on the end of the pointer.

pieces of the smaller stock to make into brushes. Use a hacksaw to cut out a lip about ⅜-inch tall in the two brush sections. The lips are to be used as contact points so they must be gently folded back toward the tubes to form smooth curved surfaces. Be sure the lips completely cover the openings so they can hold the springs in place.

Sand the curved tips of the brushes for good contact against the coils. Good contact must be made between the outside of the main bar and the inside of the sliding bars, and between the inside of the sleeves and the outside of the brushes. So sand or use steel wool to shine up and remove any coating on the brass tubes so the tubes will have no resistance between them. Square up all the ends of the pieces cut and remove any burrs.

The brass tubes solder up nicely with a 150-watt soldering gun. Tin the middle of a slider on one side. Mount the square edge of a sleeve against it there and apply solder on each side. That makes a strong bond between the two pieces. If the two pieces are not perfectly perpendicular, re-melt the solder and try it again.

The brushes must be able to slide in and out of the sleeves freely, so clean them further if necessary. Locate a couple of small springs and place them inside the sleeves. Place the brushes inside the sleeves and make sure the springs push the brushes out. If the springs are not long enough, just carefully pull them apart to the desired length. You may wish to perform that procedure again after the main bar and coil are in position on the frame to adjust the force they will apply.



A close-up of the entire sliding-bar tuning-coil assembly showing how the coils are placed and the pointers in position ready for action.

Coil Winding. The prototype's coils were wound on a 7-½-inch long × 1-½-inch inside-diameter, PVC pipe. The outside of the pipe is almost 2 inches across. Any non-magnetic coil form with approximately the same outer diameter and length will do. The main coil, L2, is wound with 145 turns of No. 22 or 24 enameled wire, while L1 and L3 have 65 and 45 turns, respectively, of No. 24 or 26 enameled wire. Remember while you're making them, that the coils must be tightly wound so that when the pointer moves over the turns, they will not spread apart.

Drill two small 1/16-inch holes ½-inch from one end of the pipe (see Fig. 2), and about ¼-inch apart from each other. Follow that procedure when drilling the rest of the holes in the tube using Fig. 2 as a guide.

Now you can start winding L1. Beginning with a pair of holes close to one end, thread some of the wire for L1 through one hole, back out the other, and loop it back through the first hole leaving about 6 inches of wire inside the pipe. All coil ends are to be prepared that way with some portion of the wire left inside the tube until they are to be wired. Now wind 65 turns without gaps between the strands (close wound). Slip a piece of cellophane or masking tape over the coil winding to keep it from unwinding as you terminate the coil, in the same way it began, at the next set of holes.

Now begin the main coil, L2, at the holes ¼-inch from the end of L1, and wind 145 turns of No. 22 or 24 enameled wire, but leave a 10-inch piece inside. If your fingers get cramped or tired while winding the large coil, place a piece of tape over the winding to hold it in place so you can flex your fingers.

Wind the last coil, L3, with 45 turns, using the remaining holes to terminate its ends, leaving about 8 inches on each end for hookup.

Coil Preparation. On the side of the pipe, opposite the coil holes, place two strips of cellophane or masking tape on each side of a ½-inch wide area. You will remove the enamel insulation from the wire in that area. Do not use a knife or razor blade; instead slowly rub a piece of sandpaper on the exposed area between the strips of tape, working back and forth in the direction of the windings. The insulation comes off really easy that way.

The coil windings may be held in

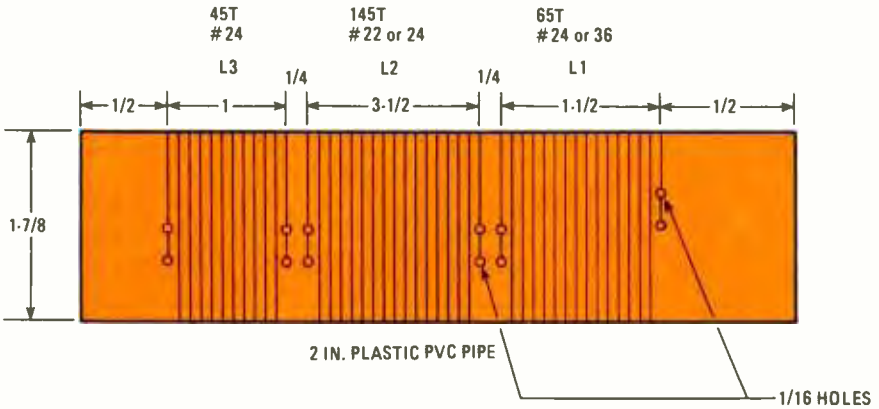


Fig. 2. Here's a drawing of the three coils placed on the pipe and the dimensions of the PVC pipe itself. Mark and drill the holes before winding the coils.

place with coil dope or plastic-model cement. Even a light coat of rubber silicone will do. Place a light layer on each side of the scraped area to keep the wire from shifting. Likewise, place the adhesive on the first and last turns of each coil to help keep them from unwinding.

Drill a ⅛-inch hole at each end of the tubing adjacent to the sanded area. Screws through those holes will hold the coil form to the wooden end supports. Make a small hole close to each mounting hole to be used to pass some hookup wires through.

Connect one terminal from each coil together and solder them to a piece of hookup wire. That wire will be used to connect the coils to ground, so you may tuck the three leads back into the tube. Allow the wire to stick out of the small hole on the side of the coil where L3 is located. Connect the other terminals of L2 and L3 together and solder them to a piece of hookup wire, which will be used to connect them to the tuning capacitor. Thread the wire through one of the prepared holes at either end. Take the remaining lead from L1 and solder it to some hookup wire also. Since the wire will be running to the antenna, it should run out the small hole on the side of the tube opposite the ground wire. Mark the wires for easy identification when the coil-assembly ends will be covered.

Wood Work. The main board measures 5-½ × 12 inches (see Fig. 3). The prototype has a discarded piece of walnut purchased from a souvenir store as a base. Scrap wood pieces may be found at hobby stores if you haven't any yourself, and, of course, any type of wood will do. Drill two ⅛-inch holes into it to accommodate screws to attach the left and right support pieces to the board. The holes must be a little over 7 inches apart; the actual distance will depend on the thickness of the side supports you make.

The dimensions of the two prototype supports are 3 × 7 inches and were cut from a piece of oak. Pieces of walnut and oak are very hard to work with, but when finished appear nice and solid. Glue and nail two round circles of soft wood to each support 1-⅛ inches from the top to hold the coils in position. Be sure that the pieces you use are small enough to fit inside the tube. Drill two holes in each board at a slant to be used to attach the center panel (see photo). Be mindful of the clearance needed for the coils when determining the angle and elevation of the board you desire.

Cut the center (slanted) piece 7-½-inches long × 3-inches wide. Drill two ⅜-inch holes in the slanted panel for mounting the volume control and variable capacitor. Drill a ¼-inch hole in the board to mount the earphone jack.

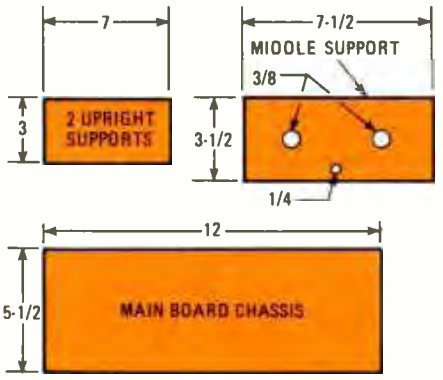


Fig. 3. These are the dimensions of both wooden supports, the panel, and the chassis. They are to be predrilled according to the text.

Sand down the boards and bevel all edges if a bench sander is handy. Make sure all pencil and pen marks are sanded away. Spray a couple of clear coats of lacquer or gloss spray over the wood (or stain if you wish) before putting the pieces together. Now sand down the finish with steel wool.

Once finished, attach one support to the base with screws through the holes made previously, put the tube in position up against the support, and secure the other support to the base with a screw. Place screws through the holes at the ends of the PVC tubing to secure it to the side supports with the sanded surface facing away from the base.

Mount binding posts to the top of the side supports and run the ground and antenna wires to their respective posts and connect them.

Now mount the center panel. After all the wooden pieces have been assembled, cover the exposed surface of the coils with tape, and carefully spray on two more coats of finish. When dry, remove the tape.

This is a close up of how the oak supports are tied to the panel.

The Amplifier Board. The circuit itself is really just a crystal radio with amplified output (see Fig. 4). The antenna is tuned by L1. The tank circuit consists of L2 and L3 both in parallel with the tuning capacitor, C1. Any variable capacitor around 365-pF will do for C1. You may even use one section of a dual miniature capacitor. Some of those capacitors can still be found at certain electronic-parts stores. The tank-circuit output is demodulated (rectified) by diode D1. Capacitor, C2 provides an AC path to ground for the incoming audio, which is picked off of the VOLUME control, R1, for the amplifier, U1. The output of the amplifier is then

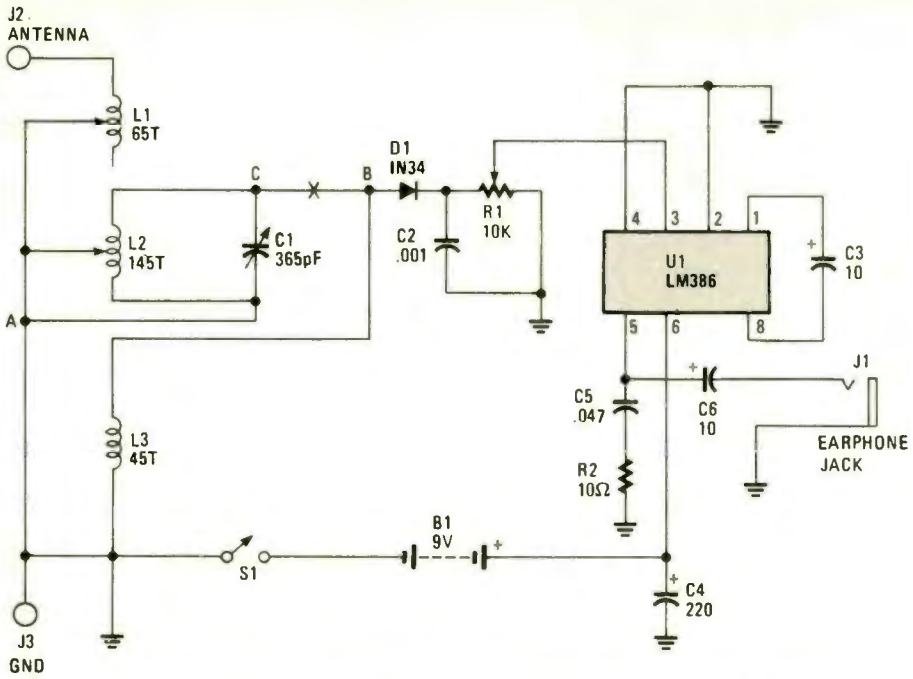


Fig. 4. In this schematic diagram of the Sliding-Bar Receiver, the section marked A is actually the sliding-bar tuning-coil assembly itself. The section marked C is the hookup wire from the coil assembly, and section B is the diode.

AC coupled to the earphone jack for listening.

To start circuit-board construction, cut off a ½ × 2-½-inch piece of perfboard from a larger piece. Mount the IC socket in the center of the board. Place C4 close to socket pin 6 and solder its positive lead to that pin. Wire C3 across pins 1 and 8.

Solder a piece of bare hookup wire on pin 2, loop it around pin 3 and solder it to pin 4. It will be used as the ground wire for the board, so make the loop large enough for several other components to be connected to it. Solder the minus side of C4 to the ground wire, and solder C5 and the positive side of C6 to pin 5. Connect R2 between C5 and the ground wire.

Solder a 6-inch piece of hookup wire to pin 3 to be used to connect the resistor-wiper connection. Bring another 5-inch piece of wire from the minus side of C6 to be used to connect it to the earphone jack. Connect a 6-inch hookup wire to pin 6 for connection to B+. Run three wires from the ground wire to connect it to the VOLUME control, switch S1, and the tuning capacitor.

Final Assembly. Slide the pointers onto the main bar and push the springs and brushes into their sleeves. Tape them in place for now. Place the sliding-bar assembly over the coil and rest its ends on the side supports. Position the main bar so that the brushes are directly over the sanded area of the coils, and secure it to the supports with screws through the holes made in the bar. Remove the tape. Each slider should be placed over either L1 or L2. A drop of solder should be placed on the square bar near the ends of L1 and L2 so that the pointers can not slide off the coil's useful area. Connect a wire between the ground terminal and the brass sliding bar.

Connect capacitor C2 across the two far terminals of R1. Connect the wiper terminal to the hookup wire from pin 3 on the perfboard. Solder one of the ground wires coming off the circuit board to one of the outside terminals of R1.

Connect the black lead of the battery clip to S1 (the switch on R1), and the other terminal of S1 to one of the ground-hookup wires from the circuit board. Run a wire from that same terminal to the ground binding post.

Connect the remaining terminal from the coil (the one attached to L3 and L2) to the stator of C1. Connect the other side of C1 to the grounded terminal on R1. Mount R1 and C1 in the panel and connect D1 between the stator of C1 and the ungrounded side of R1.

Connect the wire from C6 to the earphone jack, and the remaining terminal from the jack to the grounded side of C1. Install the jack and attach the perfboard to the underside of the panel. Your unit is ready for testing.

Testing. Connect an antenna wire to the antenna terminal, and a cold-water ground to the ground post. Plug in the earphones, and turn the switch on. You should hear some sound in the earphones. Rotate the tuning capacitor to tune in local broadcast stations. Stations at the lower end of the dial will tune in with the slider towards the grounded end of L2. Slide the antenna tuner, L1, to separate close stations. By using the two sliders and the tuning capacitor, most stations can be separated.

If nothing is received, check the small amplifier circuit. If a VOM or DMM is handy, check the circuit voltages, in particular those at pins 5 and 6 of U1. If there's little voltage at pin 6 instead of the near 9-volts and the battery and switch check out okay, then test for excessive current by inserting the milliampere meter between one battery terminal and the clip. Suspect a leaky IC or improper connections if the current is above 20 milliamps.

If pin 6 is fine, but pin 5 has no output, measure the diode for possible leakage with a low-resistance measurement and reversed test leads. If that fails to turn up anything, recheck the circuit for poor wiring connections.

Once everything is working, you are ready to have some old-fashioned fun, with a modern twist. Happy listening. ■

PARTS LIST FOR THE SLIDING-BAR RECEIVER

CAPACITORS

C1—365-pF, variable
C2—.001-μF, 50-WVDC, ceramic-disc
C3, C6—10-μF, 35-WVDC, electrolytic
C4—220-μF, 35-WVDC, electrolytic
C5—.047-μF, 50-WVDC, ceramic-disc

ADDITIONAL PARTS AND MATERIALS

D1—1N34 crystal diode
J1—Earphone jack
J2, J3—Binding posts
R1—10,000-ohm potentiometer with SPST switch
R2—10-ohm, ¼-watt resistor
S1—SPST switch (part of R1)
U1—LM386 audio-amplifier integrated circuit

2" OD × 7-½" PVC-plastic pipe; 8- to 38-ohm earphone or equivalent headphone; 9-volt battery; 9-volt battery clip; number 22 or 24 wire, and number 26 enameled wires for coils; oak-, walnut-, or pine-wood pieces for chassis and supports; hookup wire; IC socket; solder, wood screws, etc.