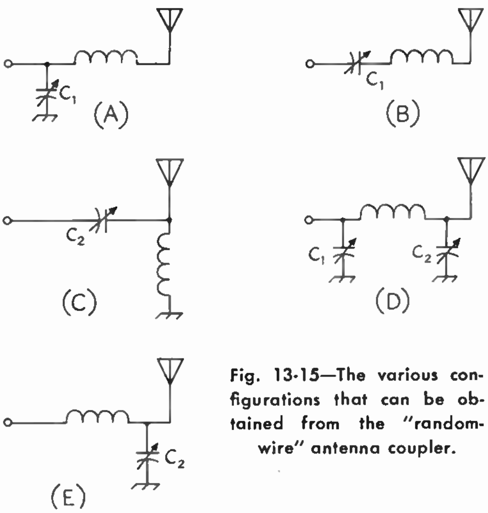

Fig. 13-15—The various configurations that can be obtained from the "random-wire" antenna coupler.

is obtained (maintaining a constant transmitter input). When the correct settings have been found for each frequency band, and these settings have been noted for future reference, it is an easy matter to hop from band to band. With certain settings and configurations it will be possible to dissipate a large part of the transmitter output in the tuner itself, and for this reason an output indicator is highly desirable, at least for the initial tune-up. Either an r.f. ammeter in the output lead or an r.f. voltmeter from it to chassis will be satisfactory. Under some conditions a neon bulb will serve as an r.f. voltmeter.

If TVI is a problem, the low-pass filter should be installed in the line between coupler and transmitter.

Fig. 13-16—An example of how the antenna coupler can be built. In this case the components are installed in a 10 × 17 × 3-inch aluminum chassis that serves as the support for the transmitter. An r.f. ammeter (right) is used as an output indicator. (W4UWA/DL4, *QST*, November, 1958).

A WIDE-RANGE COUPLER FOR BALANCED TRANSMISSION LINES

Matching networks or "Transmatches" for unbalanced (coaxial) lines are normally satisfied by the circuits shown in Fig. 13-13. The limitations of coaxial line with high standing-wave ratios automatically put a limit on the power ratings of the components in the network.

It is different with open-wire (balanced) line. They can operate with much higher standing-wave ratios than coaxial lines can, for the same loss or without failure. As a result, couplers designed for use with open-wire lines may be called upon to withstand higher voltages and currents at any given power level than would a coupler used with coaxial line. For this reason, couplers designed to be used with open-wire lines often seem to require components out of proportion to the power being handled. However, the antenna system with the open-wire line and the "large" coupler may be an efficient system on three or four amateur bands, while the "convenient" system may be a compromise with efficiency on two or three bands.

A wire antenna, fed at the center with open-wire line, is the most efficient multiband antenna devised to date. A transmission-line coupler of the type to be described is required, because the transmission line is "tuned" (it always has a high s.w.r.). The coupler permits the antenna system to present a proper load to the transmitter, with maximum overall efficiency. Regardless of the s.w.r. on the open-wire line, the coupler transforms the load to a non-reactive 50 ohms. A built-in "Monimatch" s.w.r. indicator shows when the correct tuning has been obtained.

Since low-impedance loads require series tuning, and high-impedance loads require parallel tuning, provision is included for both types of circuits. Tapped coils tend to be lossy at the higher frequencies and suitable switches are expensive, so the coupler uses plug-in coils for efficiency and clip leads for simplicity.

The choice of series or parallel tuning is obtained by using a split-stator capacitor (C_3 in Fig. 13-18) and an inductor, L_2, that may or may not be split in the center. When the inductor is not opened, the transmission line is connected across the entire coil, to provide parallel tuning. Series tuning is obtained by opening the coil and connecting the transmission line to the break. The several combinations are shown in Fig. 13-18.

A good idea of the construction can be obtained from Figs. 13-17 and 13-19. All construction is straightforward and conventional, with the possible exception of the Monimatch. The jack bar for the inductors (Millen 41305) is mounted above a hole through which the coaxial line (inner conductor) from P_1 passes, as well as the return back to the stator of C_1 and, on the 80-meter unit, the jumper to the stator of C_2. C_1 is supported by a small aluminum bracket, to bring its shaft to the same height as that of C_3. A Millen 39106 shaft coupling is

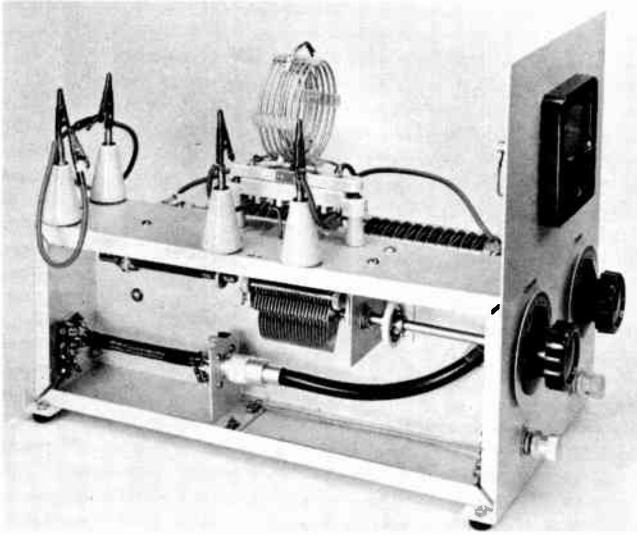

Fig. 13-17—Wide-range transmission-line coupler has provision for high- or low-C series or parallel tuning. A built-in Monimatch simplifies the tuning and insures offering the proper load to the transmitter.

The Monimatch section is at the lower left. Coaxial line running from it loops around and outer conductor is grounded at C_1 rotor. On front panel, left-hand dial tunes C_1 and right-hand dial turns split-stator C_3.

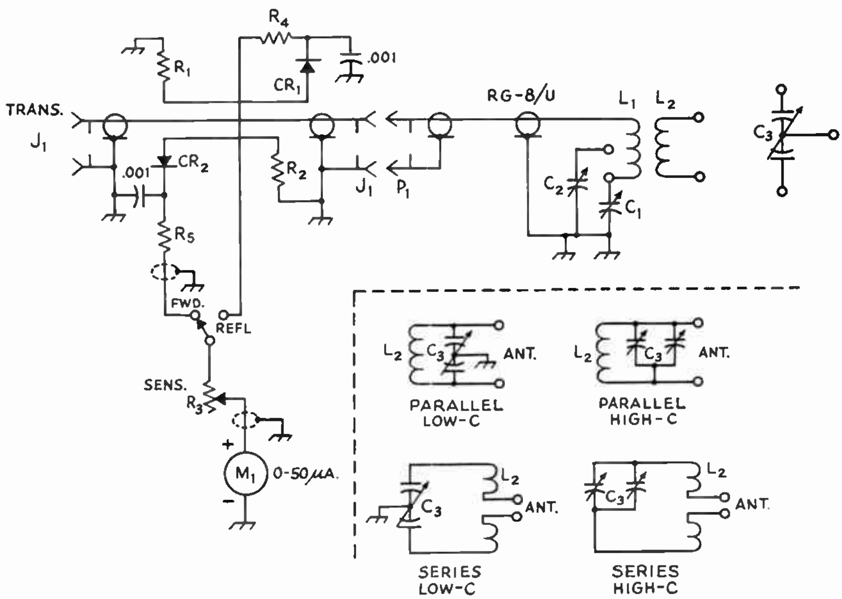

Fig. 13-18—Circuit diagram of the wide-range coupler. Capacitor C_3 connects to L_2 in several ways through use of clip leads. Similarly, the transmission line may be connected either to the outside of the inductor L_2 (parallel tuning) or to the inside (series tuning).

C_1—325-pf. variable (Hammarlund (MC-325)

C_2—Same as C_1; used on 80 meters only. Jumper on L_2 plug bar connects C_2 in circuit.

C_3—Dual 100-pf. transmitting variable (Johnson 154-510)

CR_1, CR_2—1N34A or similar diode

J_1, J_2—Coaxial chassis receptacle, SO-239

L_1, L_2—See coil table.

M_1—0-50 microammeter (Lafayette 99G5042)

P_1—Coaxial plug, PL-259

R_1, R_2—68-ohm ½-watt composition. See text.

R_3—30,000-ohm ½-watt potentiometer, linear taper.

S_1—Single-pole 5-position (two used) rotary switch (Mallory 3215J)

R_4, R_5—1000 ohm, ½ watt. For use below 50 watts, substitute 1 mh. r.f. choke. (Miller 70F103AI)

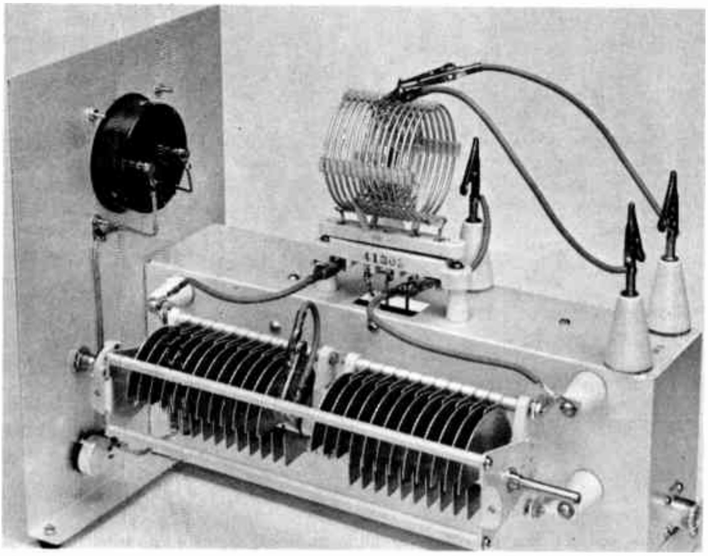

Fig. 13-19—The coupler is built on a 13 X 5 X 3-inch aluminum chassis. The front panel is 8 X 10½ inches. Split-stator C_3 is supported on 1-inch ceramic cone insulators, and the four alligator clips that take the transmission line are mounted on 1½-inch cone insulators. Note clip lead connected to split-stator capacitor rotor connection: this can be connected to lug on chassis or to one side of L_2.

used to C_1; a Hammarlund FC-46-S is used at C_3. Alligator clips used to take the transmission line are forced on to decapitated brass screws and soldered in place. The pair of clips at the rear of the chassis are used with series tuning; those on the side with parallel. This preserves the symmetry, provided the transmission line is brought down vertically to the coupler.

The Monimatch is made from a 6-inch length of RG-8/U. The vinyl outer covering is removed and the outside braid slipped off. One inch of polyethylene insulation is removed at each end, revealing 1-inch lengths of inner conductor and leaving 4 inches of polyethylene. Two 4½-inch lengths of No. 14 wire are taped to opposite sides of the polyethylene. Tin the ends of the wires before fastening them in place with the tape. Slip the outer braid back over the assembly and tape it tightly in place. The 1-inch excess outer conductor at each end is unbraided and twisted together to form *four* leads at each end. These leads are to be connected to soldering lugs under each corner of J_1 and J_2, while the inner conductor is soldered to the inner connection of J_1 and J_2.

If a 50-ohm dummy load is available, it can be used to test the Monimatch. Starting with the value of 68 ohms at R_1 and R_2, check the reflected indication when the transmitter is connected to J_1 and the dummy load is connected to J_2. Then try resistors a few ohms either side of this value, until a good null is obtained. Reverse the connections to J_1 and J_2 and check the value of R_2 in the same manner. It is not absolutely essential that a perfect null be obtained; it is more a matter of pride, since it won't make much difference to the transmitter if it is offered 48 or 52 ohms instead of the magic 50.

It is possible to make an educated guess on what kind of load (high- or low-impedance) the line presents in the shack, based on the electrical length of the line. However, it is more likely that a little "cut and try" is in order. The coil table shows some values and the ranges of impedances they will handle. It is suggested that initial experiments be carried on at low power (50 to 100 watts). Try parallel tuning first. If a match cannot be obtained with any settings of C_1 and C_3 (C_2 in circuit if on 80 meters), leave the coil connected for parallel tuning but tap the transmission line in towards the center of the coil. If this is the condition that will permit a "reflected" reading of zero, series tuning is indicated and the coil should be opened at the center and the series connection used on that band. The wire is clipped at the center of the coil and bent out and upwards; the two clip leads from the rear of the chassis are used to make the connection. The temporary tests on individual turns can be made with clips that have been flattened at the tips.

When constructing the coils, the leads from L_1 must be "snaked" between the turns of L_2. To insulate the leads, use a couple of the ceramic bushings furnished with Centralab index heads for ceramic switch sections (Centralab PA-301).

Antenna Coupler Coil Table

Band	*Range—ohms*		*L1*		*L2*	
	Parallel	*Series*	*Turns*	*Material*	*Turns*	*Material*
3.5 Mc.	800-4000	80-700	12	A	39	B
7	600-5000	25-600	6	A	13	C
14	600-5000	25-700	3	A	7	C
21	500-5000	50-500	3	A	5	C
21	1500-5000	20-100	4	A	5	C

Material A: No. 16, 2 inch diam., 10 t.p.i. (B&W 3907-1)
B: No. 14, 2½ inch diam., 8 t.p.i. (B&W 3906-1)
C: No. 12, 2½ inch diam., 6 t.p.i. (B&W 3905-1)