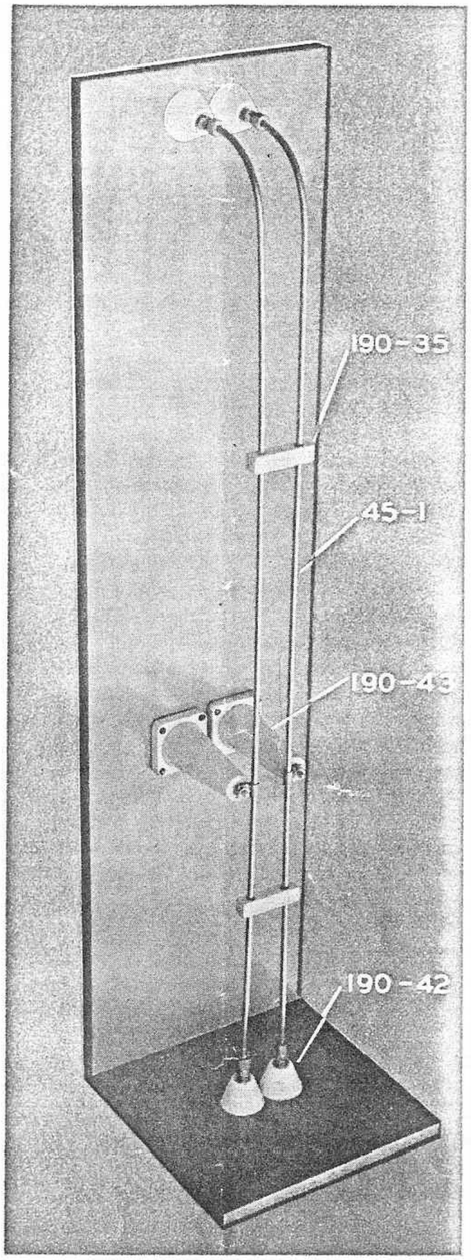
Multiband Antenna for High Frequencies (Continued)

pedance between 75 and 1200 ohms by the simple expedient of using a specially constructed transmission line. Several different models of such an antenna system are possible and Table I shows representative combinations designed for use on amateur bands. In each of the arrangements shown in Table I the length of the multiband transmission line is so chosen that the reactance at the transmitter end is negligible and the line can be coupled to the output tank circuit of the transmitter by a simple pickup coil. An impedance matching network need not be used provided the number of turns in the pickup coil is continuously adjustable.

In cases when it is not convenient to use a transmission line as long as is shown in Table I it is, of course, entirely practicable to reduce the length of the line to a convenient value and build out the equivalent electrical length by inserting an impedance matching network between the transmitter and the line. When such a network is used the line can be made any length, and then the only important dimension is the antenna itself. The only precaution which must be observed is that the transmission line should not be ⅛, ⅜, ⅝, etc. wave length long at any of the operating frequencies. If the line happens to be cut to a length equivalent to an odd number of ⅛ wave lengths, trouble may be encountered due to the network transmitting not only the fundamental frequency but also harmonic frequencies. This difficulty can be overcome by proper adjustment of the impedance matching network, but a discussion of this subject will be reserved for a later article. In general it is better to avoid these specific lengths.

Table I can be used directly for designing multiband antennas for amateur use. It will be noticed that the antenna lengths shown are an even number of one-quarter wave lengths long at the lowest and highest frequencies. In the case of antennas for 14,000 kc. and 4,000 kc. operation the frequencies are not harmonically related, but the lengths are chosen for the highest frequency, and they are also approximately right for the lower frequency where small variations in length do not represent very large percentages of a wave length.



The constructional model illustrated above was built to show the manner of assembly. Items and their type numbers are as follows: Spacers (190-35); Stand-off Insulators (190-43); Feed-through Insulators (190-42); Seamless Copper Tubing (45-1).

In designing similar systems for other groups of frequencies, the antenna length should be (k-.05) 492,000/f feet where f is the frequency in kilocycles and k is the number of half-wave lengths. Thus, for two or more frequencies integral values of k should be chosen to give approximately the same length and the exact length should be that for the highest frequency.

For example, consider model A antenna. At 14,300 kc. and k=4 or a two wave length antenna the length is 136 feet. This length is also correct for f=7,050 and k=2 or f=3440 and k=1. The frequency range of the amateur bands may be tolerated by this length even though the transmission line be terminated in an antenna impedance not a pure resistance.

The feeder length should be determined by the relation 234,000 m/f feet where f is the frequency in kilocycles and m is the number of quarter-wave lengths. That is, the 66 ft. feeder of model A antenna is one wave length at 14,200 kc., a half-wave length at 7,100 kc., and one-quarter wave length at 3,550 kc.

A slight variation from the above procedure is indicated in Model G. In this antenna the length of 103 feet is 1½ wave lengths at 14,100 kc. and approximately ¾ and ⅜ wave lengths on the 40 and 80 meter bands. The feeder length of 82.5 feet is 1¼ wave lengths at 14,200 kc. and approximately ⅝ and 5/16 wave lengths at the 40 and 80 meter bands. That is, on 40 and 80 meters the transmission line is terminated in an impedance largely reactive but is of such length that the impedance at the input to the transmission line is approximately a pure resistance. The loss in the transmission line is slightly larger under this condition, but this antenna may be used successfully where space is a factor.

Many amateurs are using so-called Zeppelin antennas rather than antennas fed at the center because their transmitters happen to be located nearer the end than the center of the antenna and the transmission line is shorter if it is connected to the end of the doublet. The Zeppelin antenna is an inherently unbalanced system (Zeppelin feeders balanced for equal currents are not balanced for equal phase and vice-versa) and a considerable portion of the energy is una-