# RECEIVING ANTENNAS

## A presentation to NJARC 13 Jan 95

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# BACKGROUND

**The introduction of all-wave broadcast receivers in the 1930's percipitated the development of effective broad-band receiving antennas applicable to the home environment.**

**These designs have been largely forgotten, but can still provide excellent performance for the radio aficionado, and with modern materials can be fairly easily reproduced.**

# AGENDA

**Antenna basics**

**The Fundamental Problems**

**The Classic Solutions**

**The late 20th Century**

# Antenna Basics

**The Antenna System Mission: Capture a clean signal and deliver it to the receiver.**

**The Hertz**

**The Marconi**

**Non-resonant "compromise" antennas.**

# The Hertizian Antenna

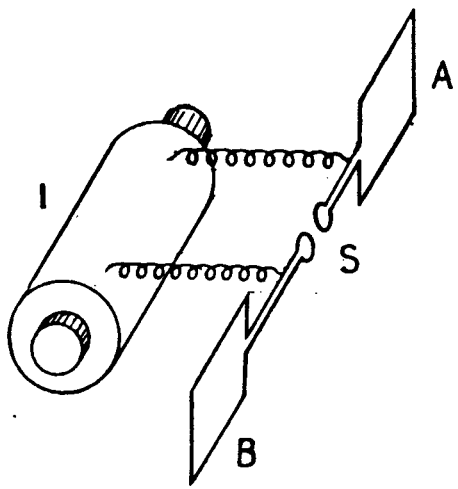



FIG. 9.—A Hertzian oscillator (AB) charged by an induction coil I.

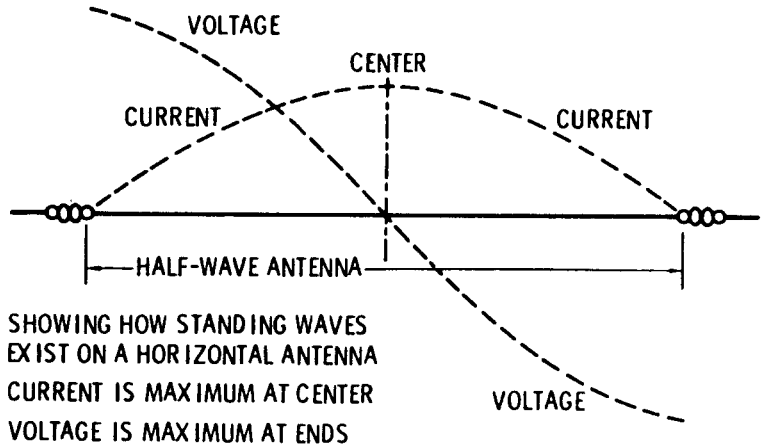



**Figure 7. The Resonant Antenna**

The greatest amount of current flows in the antenna when it is resonant. The shortest conductor that is self-resonant at a given frequency is one that is about a half-wavelength long. The reflection pattern on the antenna creates a standing wave of both voltage and current. The half-wave, center-fed antenna is often called a "doublet."

# The Marconi Antenna

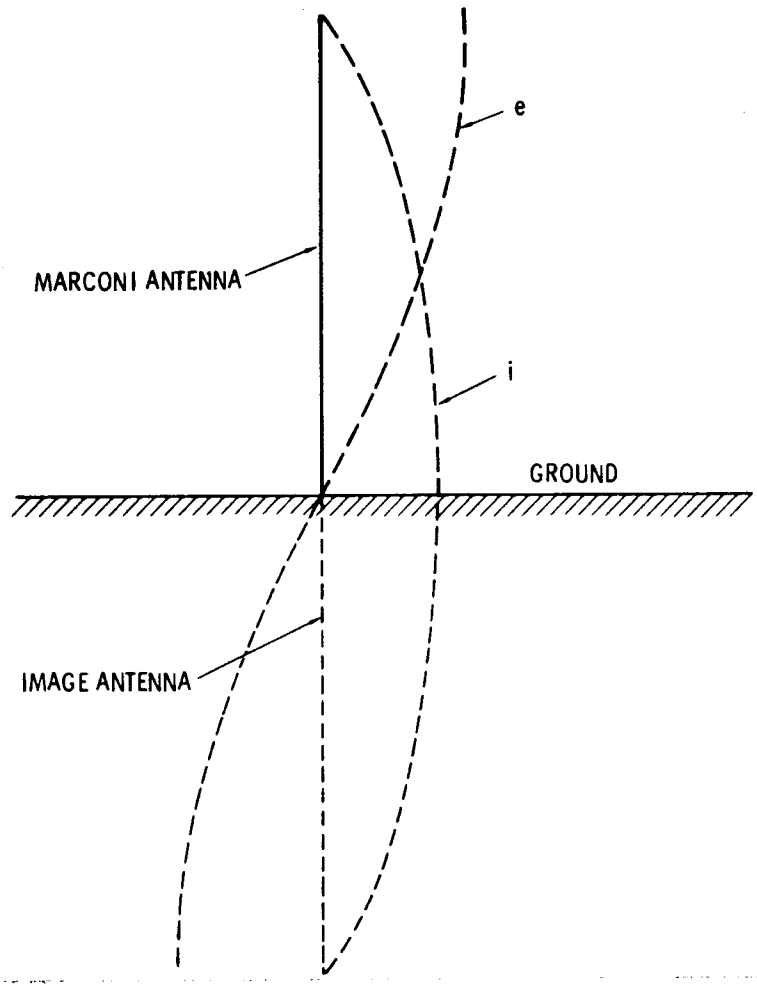



**Figure 18. Marconi Antenna and Ground Image**

The missing half of the dipole antenna is supplied by the ground image for the case of the Marconi antenna. Antenna feedpoint impedance is one-half that of dipole, or about 36.5 ohms.

# Problems

**A half wavelengeth at 1500 KHz is over 300 feet.**

**A quarter wavelength at 600 KHz is over 375 feet.**

# The Saving Grace

**Because background noise is high, and receivers are fairly sensitive; a receiving antenna does not need to be highly efficient.**

**Signal to noise ratio is far more important than absolute signal level.**

**A modest size skywire can give excellent results.**

# The Old Standby: The Inverted-L

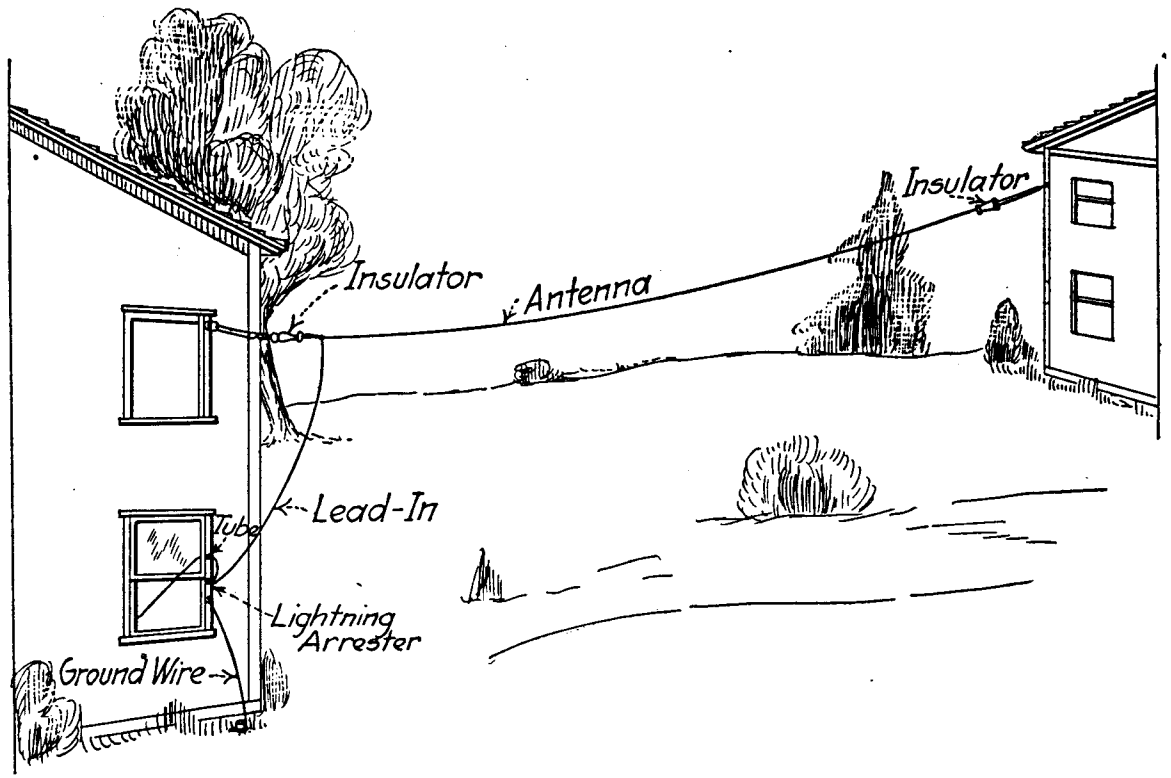



FIG. 9.—Typical outside antenna.

# THE INTERFERENCE ZONE

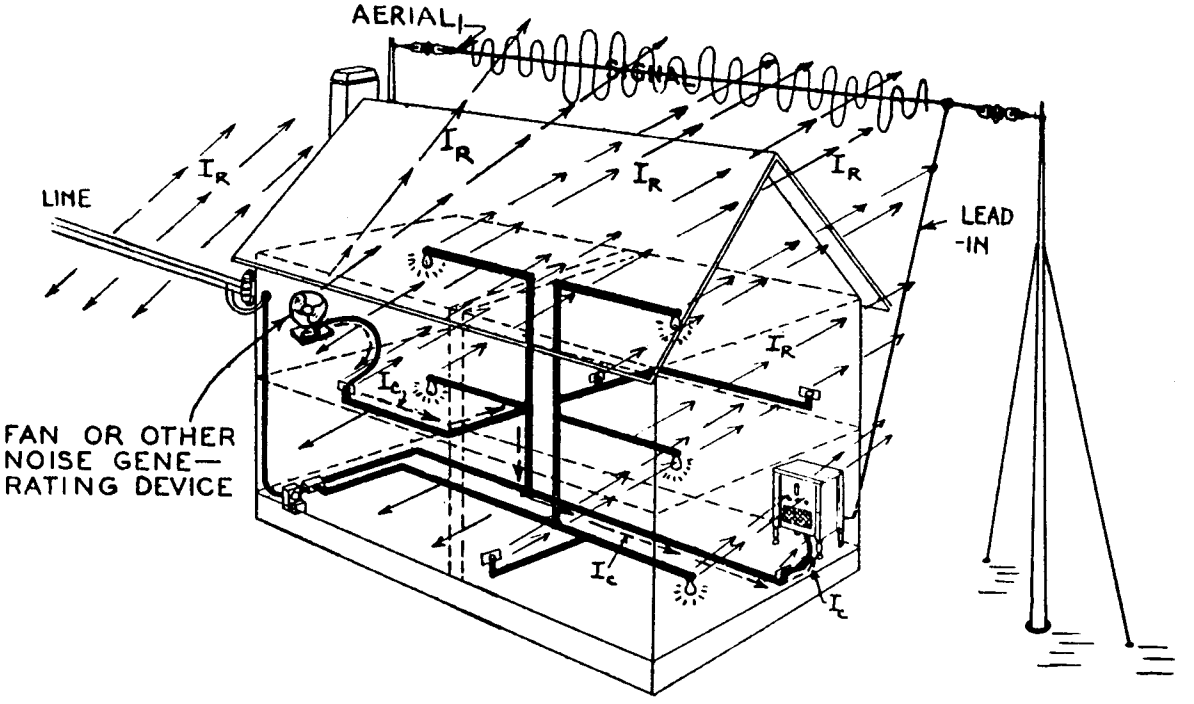



FIG. 30-4.—How an electrical device located in one part of a building can produce electrical interference part of which ($I_c$) is conducted directly through the electric light wiring to radio receivers operating from the same lighting line; the other part ($I_R$) may be radiated either directly from the device or from the electric light circuit wiring in the building to the aerial, lead-in and ground wires of the receiver, inducing interference voltages in them. These are heard in the radio receiver as disturbing noises of a certain character depending upon the nature of the interfering device (see Art. 30-16).

# INDOOR ANTENNA

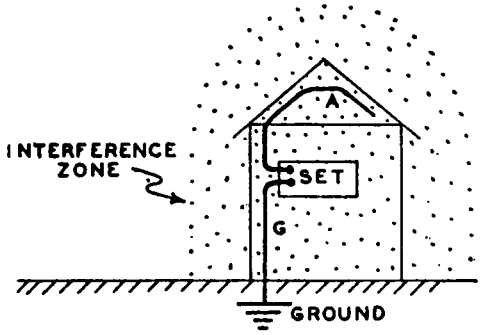



FIG. 30-24.—A typical example of an indoor aerial installed in a location full of interference. Both the indoor aerial, the lead-in and the ground wires run right through the strong interference zone and all of them pick up the disturbances. Noisy reception is bound to result.

# OUTDOOR ANTENNAS

## Improving the signal to noise ratio

FIG. 30-25.—A typical example of an outdoor aerial installation in which part of the aerial and the entire lead-in and ground leads are in the strong interference zone localized about the building. Since only a small proportion of the antenna system lies in a noise-free zone the signal-to-noise ratio will be low and noisy reception will result.

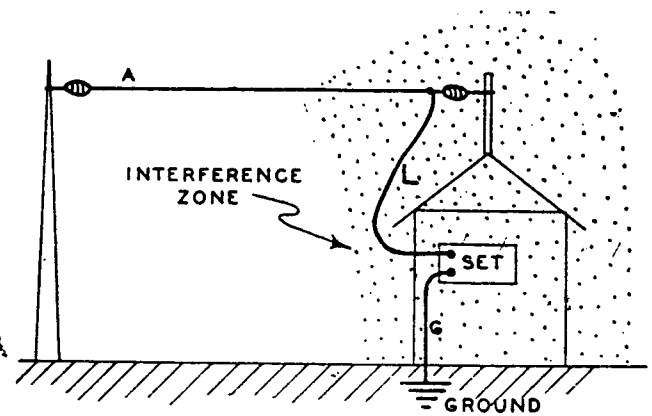
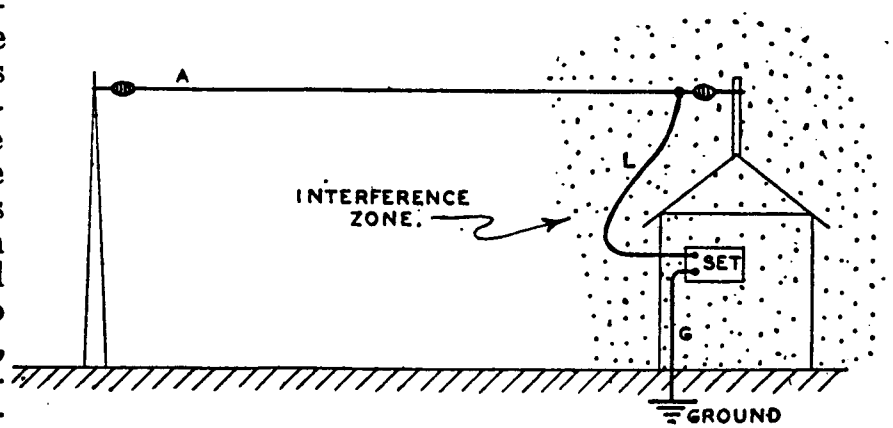



FIG. 30-26. — Lengthening the aerial wire as shown here, often improves the signal - to - noise ratio, for it adds more wire which picks up signal impulses but no noise impulses, since it lies outside of the interference zone.



# RANDOM WIRE

## With shielded lead in

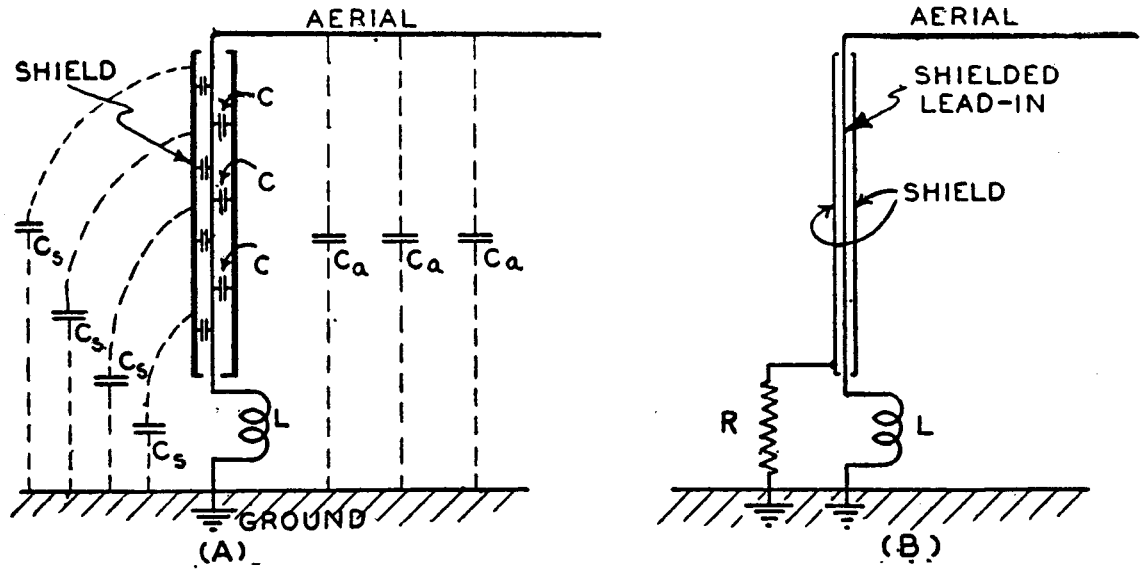
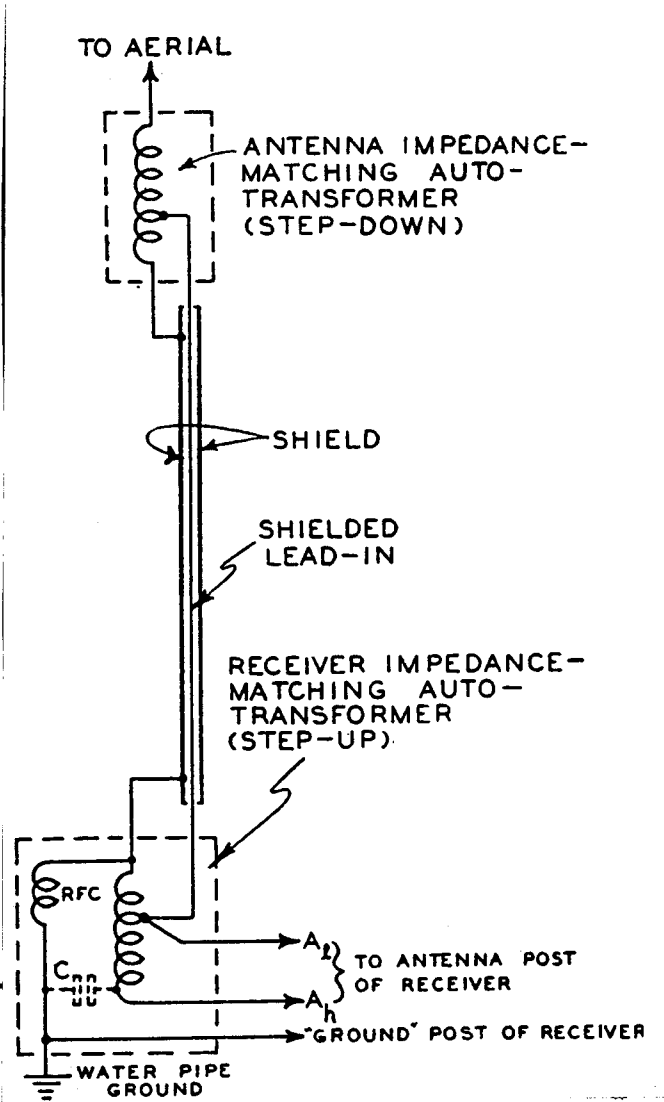



FIG. 30-28.—(*A*) The various capacities which exist between the aerial, ground, lead-in and shield in a shielded lead-in antenna system.

(*B*) How the lower end of the shield may be connected to ground through a resistance (or choke) to reduce local oscillations of noise current in the shield circuit.

# RANDOM WIRE

## With shielded lead in and matching transformer



# THE DOUBLET

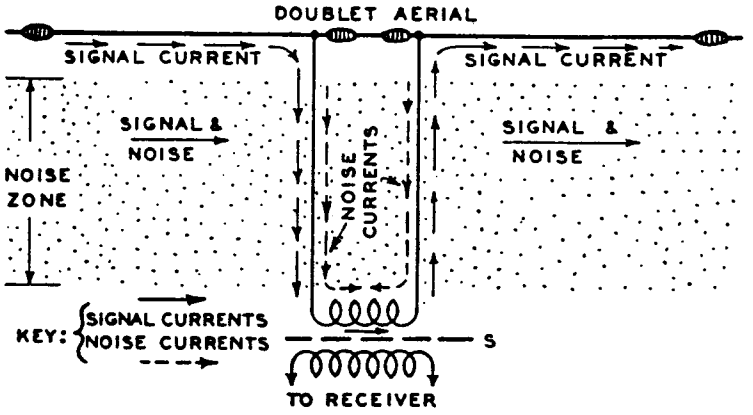



FIG. 30-46. — How the noise voltages induced in a parallel-feeder lead-in are cancelled out in the primary impedance-matching transformer. The signal voltages induced in the two halves of the doublet are additive.

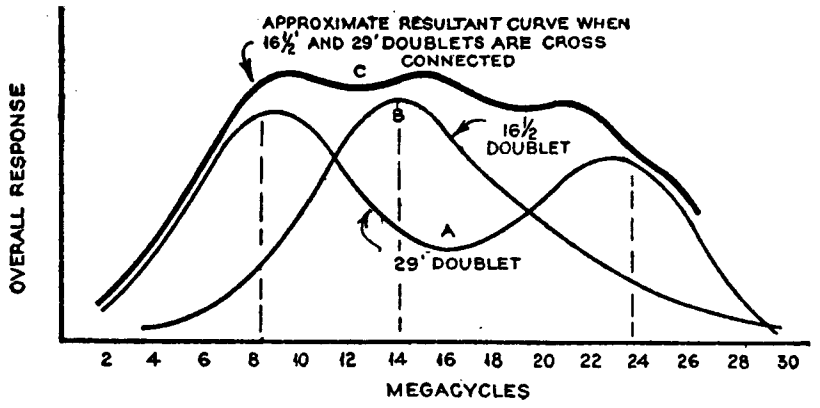
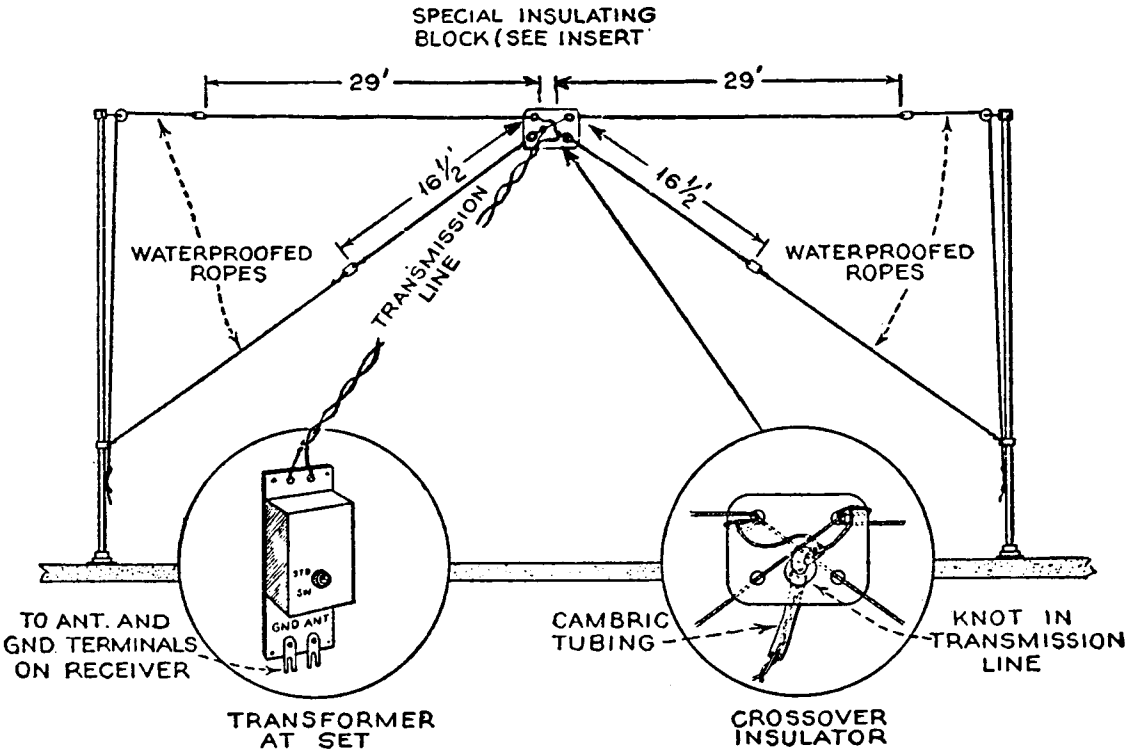



FIG. 30-51. — Individual response curves (*A* and *B*) of each doublet, and the overall response, *C*, of both doublets together in the double-doublet system of Fig. 30-52. The lengths of the doublets as marked here are the lengths for each section—½ the overall length.

# THE DOUBLE DOUBLET




*Courtesy RCA Mfg. Co.*

FIG. 30-52.—How a double-doublet receiving antenna system may be erected. The response characteristics of a double-doublet of the dimensions shown here are presented in Fig. 30-51. The special crossover arrangement shown here in the circle at the lower right is important. The antenna impedance-matching transformer (see Fig. 30-53) is not shown here.

# THE DOUBLE DOUBLET / TEE

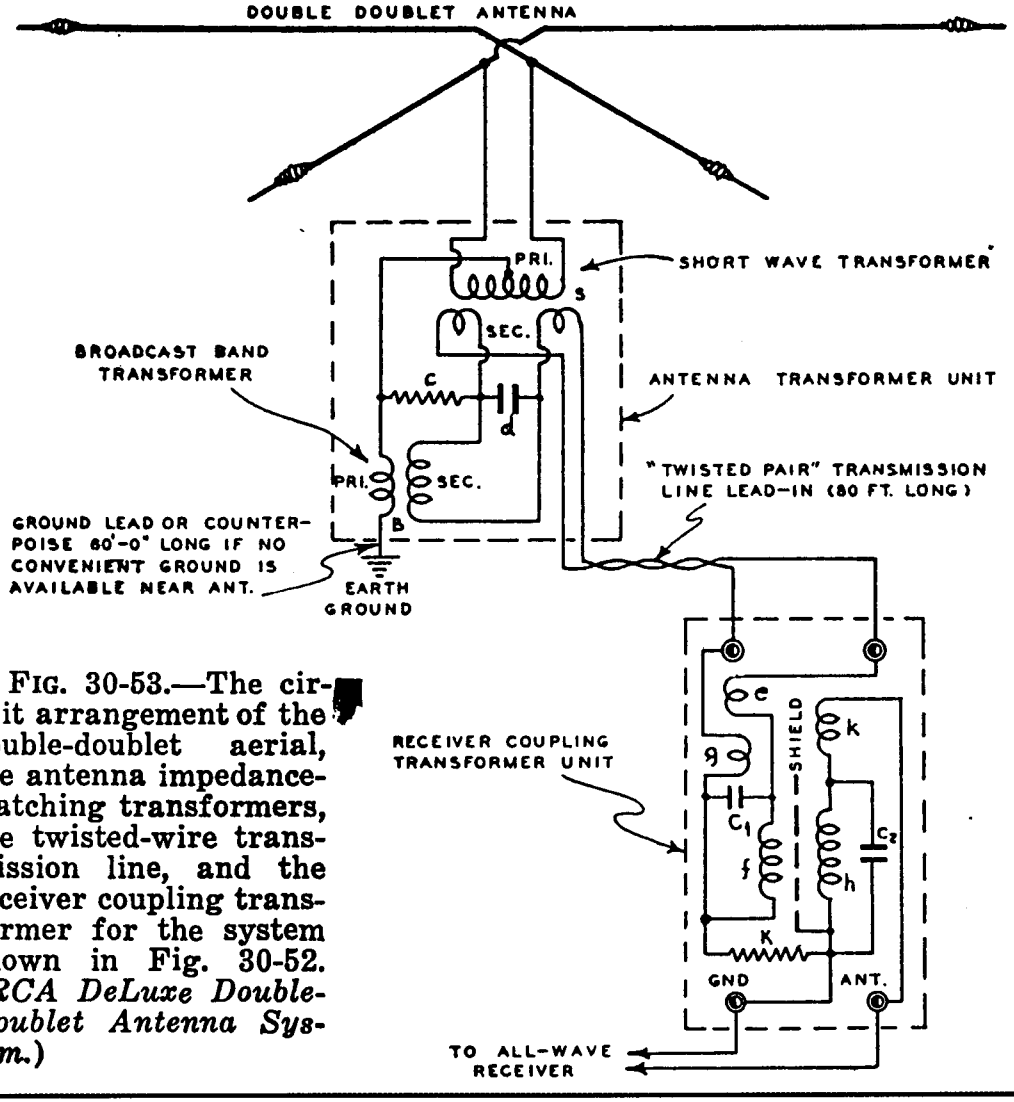



FIG. 30-53.—The circuit arrangement of the double-doublet aerial, the antenna impedance-matching transformers, the twisted-wire transmission line, and the receiver coupling transformer for the system shown in Fig. 30-52. (*RCA DeLuxe Double-Doublet Antenna System.*)

# DOUBLET / TEE OPERATION

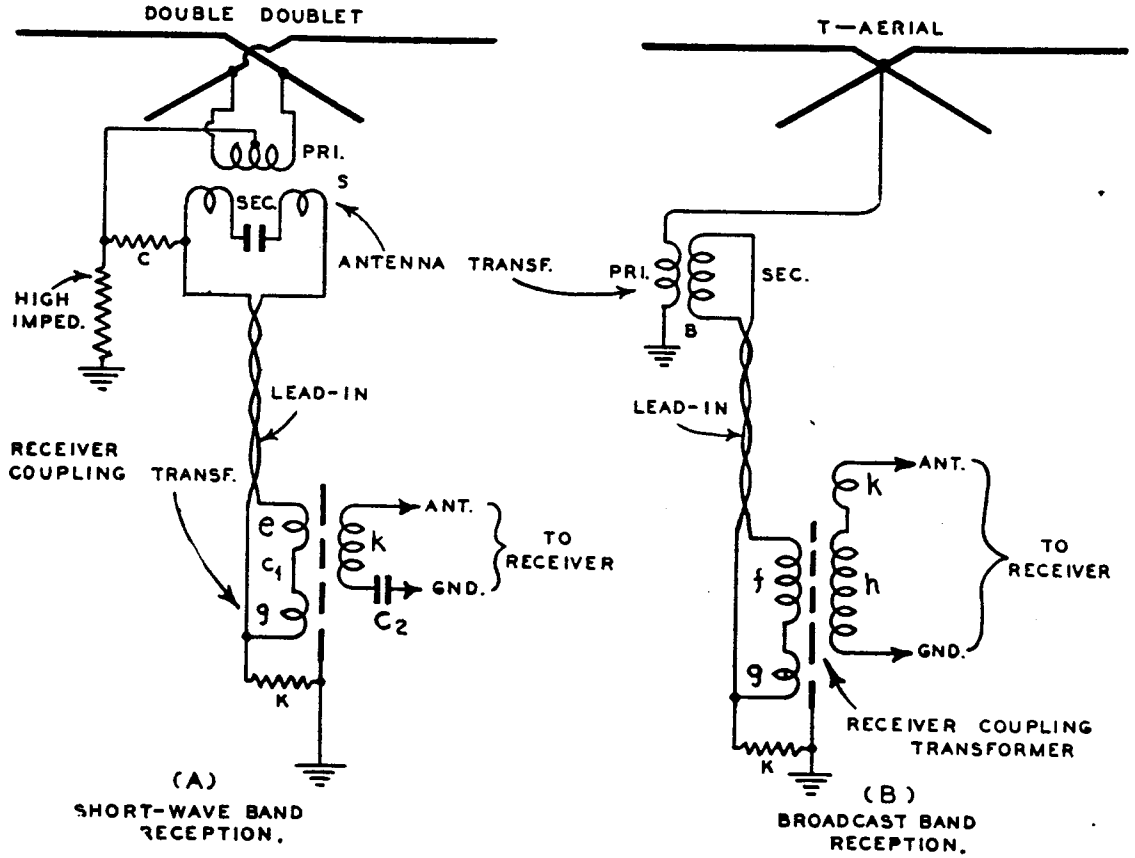
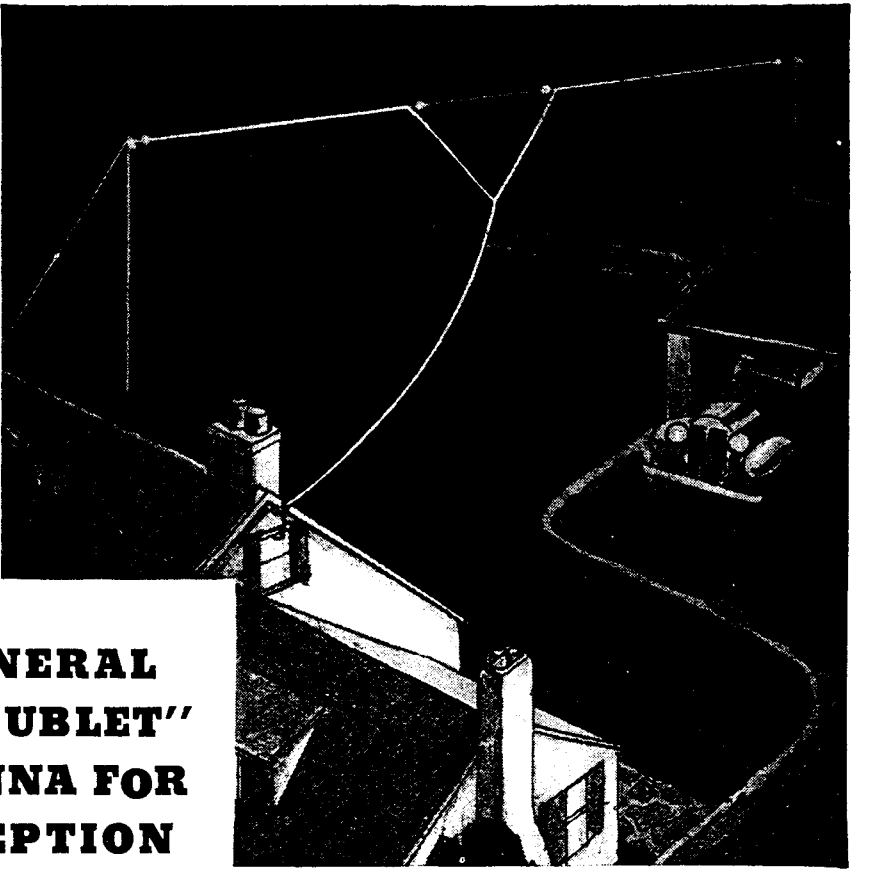



FIG. 30-54.—(A) The essential circuit arrangement which exists when short-wave signals are being received by the double-doublet antenna circuit of Fig. 30-53.

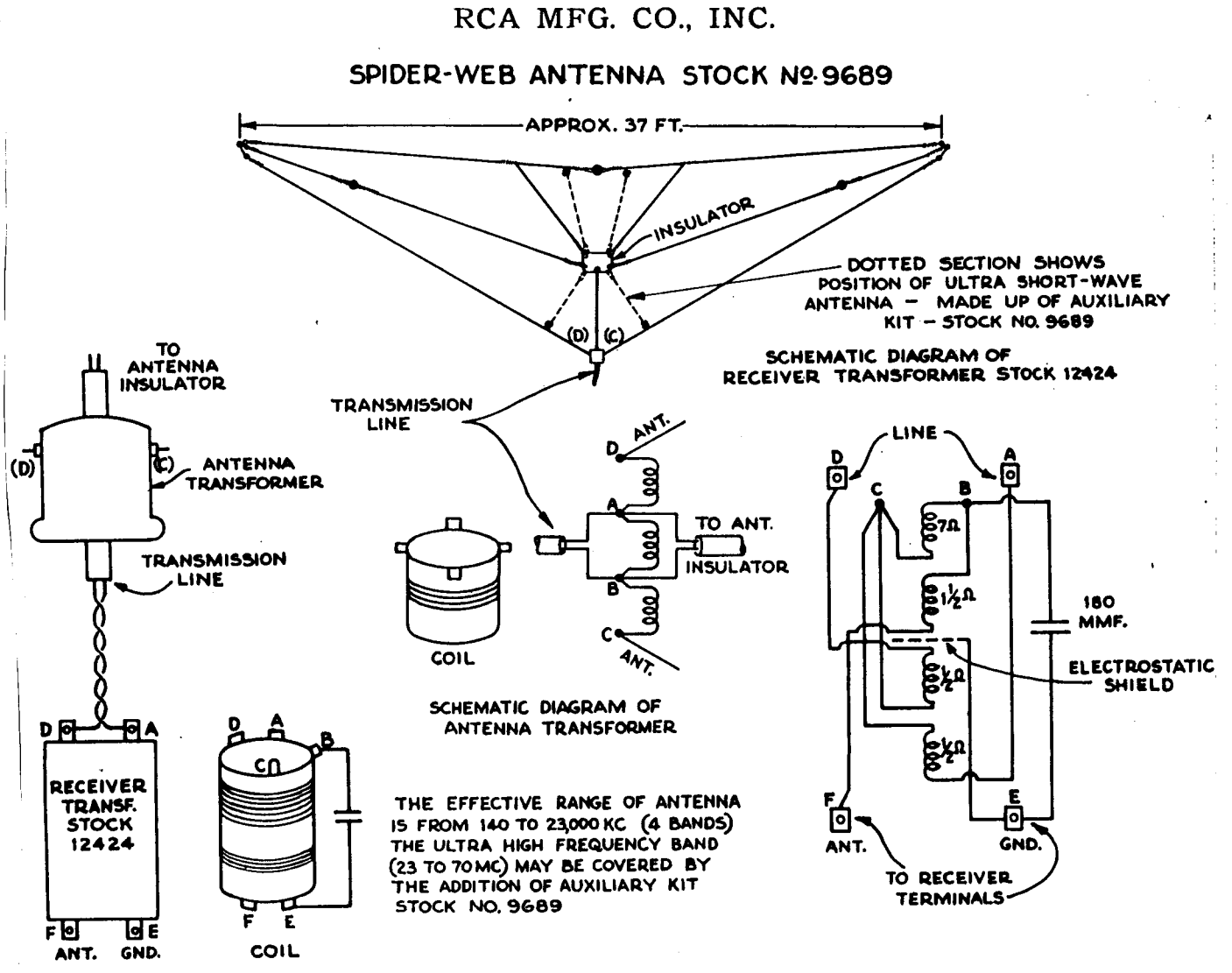
(*B*) The arrangement which exists when standard-broadcast band signals are being received. Notice that the circuit automatically connects the two parts of the double-doublet together at the center to form a T-type antenna for more effective pickup over the standard-broadcast range.

# GENERAL ELECTRIC V-DOUBLET



**INSTALL A GENERAL ELECTRIC "V-DOUBLET" ALL-WAVE ANTENNA FOR SUPERIOR RECEPTION**

# RCA SPIDERWEB



# MODERN COMPONENTS

- **Ferrite-core broad-band transformers**
  - **Easy to fabricate**
  - **100:1 frequency range**
  - **Impedance matching, baluns, etc.**
- **75-ohm TV cable and accessories**
- **300 and 450-ohm twin lead**

# SIGNAL DISTRIBUTION

**Need MF/HF versions of VHF components.**

**2-Way and 4-way splitters**

**Distribution ampilfiers**

**These are easy to build with ferrite transformers**

# THE NEXT TIME

**1930's aerials in the 1990's**