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GEORGE M. ROSE, K2AH, AND HIS HISTORY-MAKING, 146-MC TRANSISTOR TRANSMITTER (See page 3 for story.)

Construction of Inductors for TVI Filters

By
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Many of the published articles on the construction of low-pass filters include complete instructions for winding the inductors required for the filter sections. If the author's work is duplicated, and if the directions for winding the coils are followed implicitly, no difficulty will be encountered in building and adjusting the filter. However, the average amateur may experience considerable difficulty if he chooses to modify the original design to suit his particular needs; he may be handicapped by lack of references on the construction of coils which will fulfill given requirements of inductance and Q.

**Tube Dept., Radio Corp. of America, Harrison, N. J.*

This article supplies easy-to-follow instructions for winding inductors to given inductance specifications, and describes methods for checking inductance with an accuracy adequate to meet the requirements for practical TVI filters.

Construction

A single-turn flat loop as shown in *Fig. 1* is satisfactory for an inductance of 0.03 to 0.1 μh. For inductances greater than 0.1 μh, the inductor may be wound as a conventional coil having several turns, as shown in *Fig. 2*, in order to conserve space and to maintain a reasonable Q.

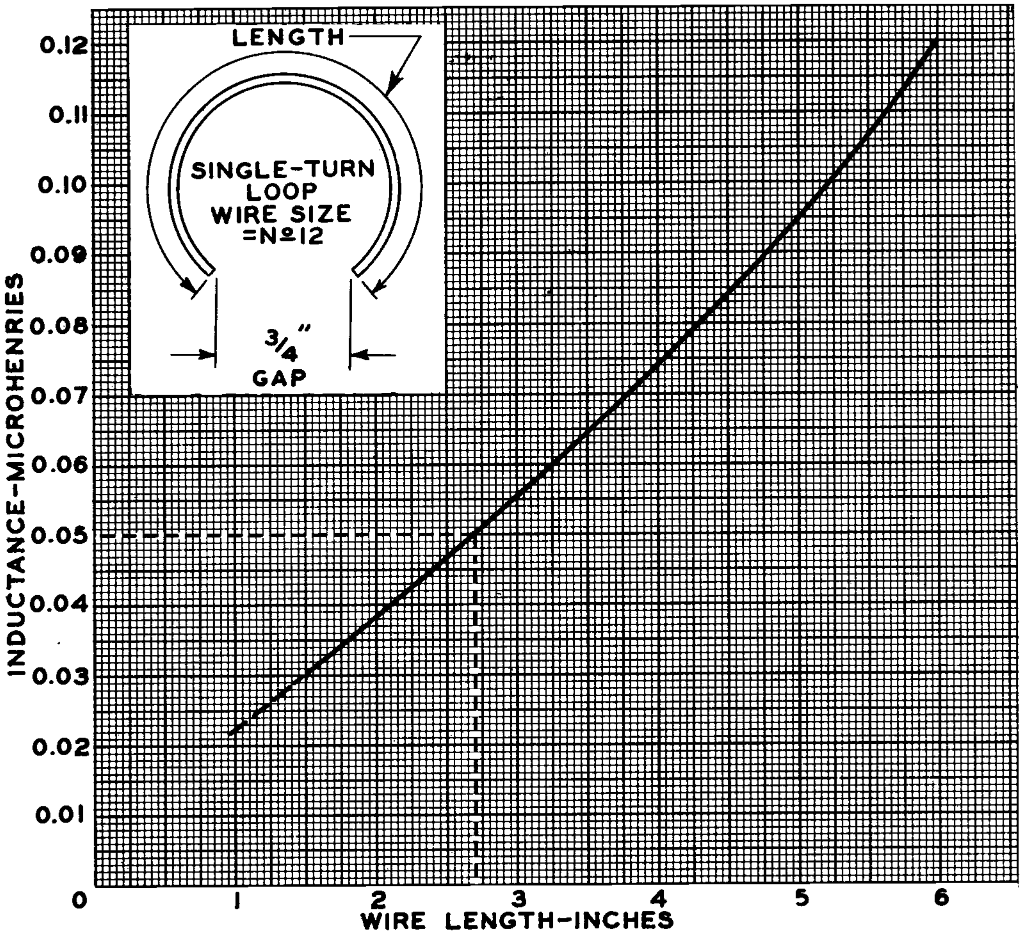


Fig. 1. Curve for determining the dimensions of a single-turn, flat loop (for inductance values of 0.03 to 0.1 μh).

COVER PHOTO

History in the making! George M. Rose (K2AH), Manager of the RCA Tube Department's Advanced Development Group, is shown keying a 146-Mc transistor transmitter. We believe this to be the first use of a transistor in two-way radio communication.

This preview of "things to come" was made possible by the use of a developmental-type transistor now being studied in the RCA Tube Department's laboratories. With this small experimental battery-operated crystal oscillator, K2AH of Mountain Lakes, N. J. contacted W2KNI, Mountainside, N. J. (16 mi. away), W2DPB, E. Orange, N. J. (16 mi. away), and W2UK, New Brunswick, N. J. (25 mi. away)!

According to George, power input to this tiny rig was 30 milliwatts (10 v at 3 ma). This transmitter, employing a point-contact transistor and a 16-Mc crystal operating on its 9th overtone, is powered by a 22½-volt, hearing-aid battery. The transmitting antenna at K2AH is a 12-element beam and the receiving antennas at W2KNI, W2DPB, and W2UK contain 10, 6, and 40 elements respectively.

RCA transistors are still in the developmental stages but when they become commercially available, you will be so informed by an announcement in HAM TIPS.

Example 1. The dimensions of a 0.05-μh inductor can be found from *Fig. 1*. The dashed lines indicate how the wire length (2.7 inches) can be read from the curve opposite the inductance of 0.05 μh. This length of No. 12 wire, when formed into a single-turn flat loop having a ¾-inch gap between the ends of the wire as shown in *Fig. 1*, will have an inductance of 0.05 μh.

Example 2. If a 0.25-μh inductor is required, the number of turns can be determined from *Fig. 2* as shown by the dashed lines. If 3.4 turns of No. 12 wire are wound with a pitch of eight turns per inch and the diameter of

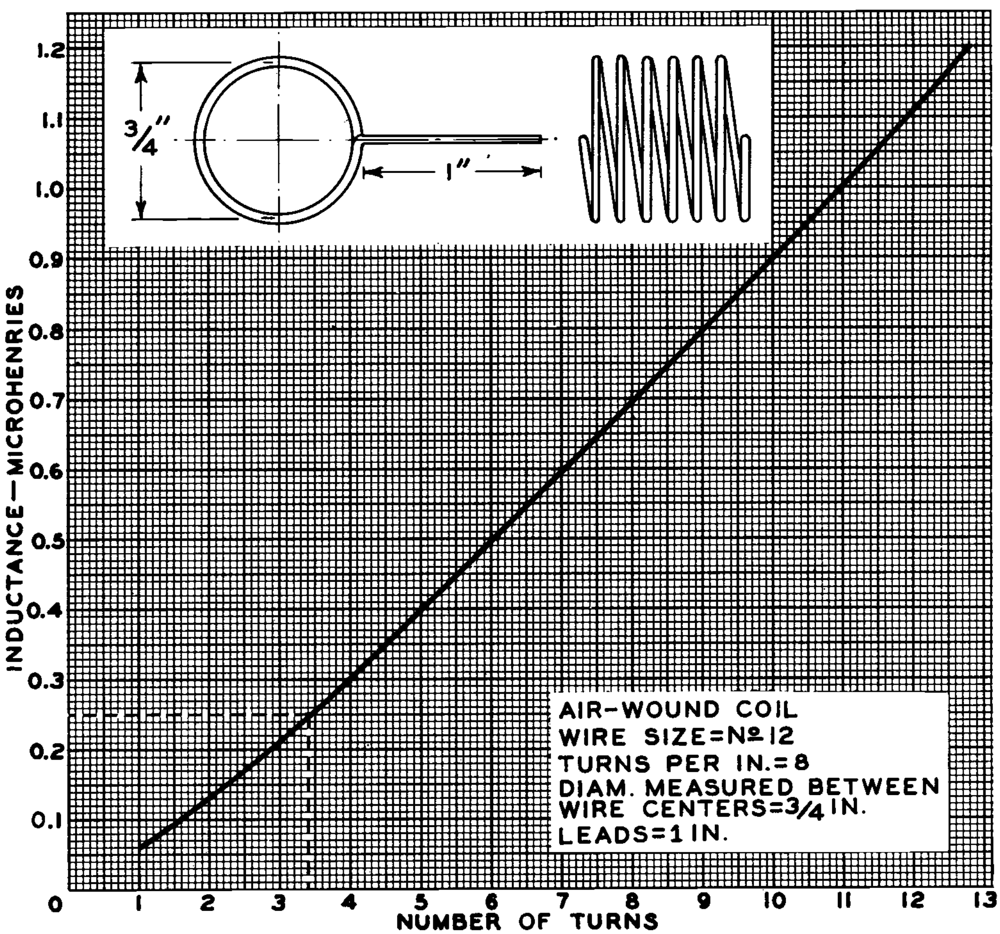


Fig. 2. Curve for determining the number of turns for inductance values greater than 0.1 μh.

the coil is 3/4 inch (measured from the center of the wire as shown in *Fig. 2*), the coil will have an inductance of approximately 0.25 μh (including the inductance of the one-inch leads).

Coils wound in accordance with *Figures 1* and *2* are sufficiently accurate for most TVI applications; they may be soldered into a low-pass filter without further adjustment.

If desired, the coil may be wound to other dimensions. The nomograph shown in *Fig. 4* facilitates the selection of suitable values of inductance and capacitance for a circuit resonant at a given frequency. For example, the inductance necessary for resonance at 67.25 Mc with a 20-$\mu\mu$f capacitor can be determined by placing a straight-edge on the nomograph so that it connects the 67.25-Mc point on the frequency scale and the 20-$\mu\mu$f point on the capacitance scale. The intersection of the straight-edge with the inductance scale determines the required inductance value. The inductance, capacitance, and frequency ranges covered in this nomograph are applicable to most low-pass, TVI filter designs.

Measurements

The inductance of the coil may be measured with a Q-meter, or it may be checked in a resonant circuit with a grid-dip meter as shown in *Fig. 3*.

To facilitate measurement of inductance in a resonant circuit with a grid-dip meter, a calibrated variable capacitor should be included in the resonant circuit. Since such a capacitor cannot be found in the average ham shack, a reasonably accurate capacitance standard can be made from a set of six silver-mica capacitors—one each of 5, 10, 20, 40, 70, and 100 $\mu\mu$f (five per cent tolerance). Combinations of these six capacitors will provide a capacitance range of 5 to 150 $\mu\mu$f in 5 $\mu\mu$f steps. Errors can be kept to a minimum by clipping the capacitor leads short and by soldering short connections to the coil being tested. Lumping of capacitance-tolerance error can be minimized by using a single capacitor whenever feasible rather than a combination of capacitors; the use of a single capacitor is practical when the frequency of the signal source can be varied.

The XYL's TV receiver can be used to calibrate the grid-dip oscillator. One or two wide, black, vertical bars will be visible on the kinescope when the grid-dip oscillator frequency is approximately the same as the picture-carrier frequency. When the oscillator frequency approaches the sound-carrier frequency, a T-6 c.w. signal will emanate from the speaker. The distance between the TV antenna transmission line and the grid-dip meter may be five feet or more during this calibration. TV sound– and picture-carrier frequencies for several channels are indicated on the nomograph, *Fig. 4*, for convenient reference when a TV receiver is used for calibrating the grid-dip oscillator.

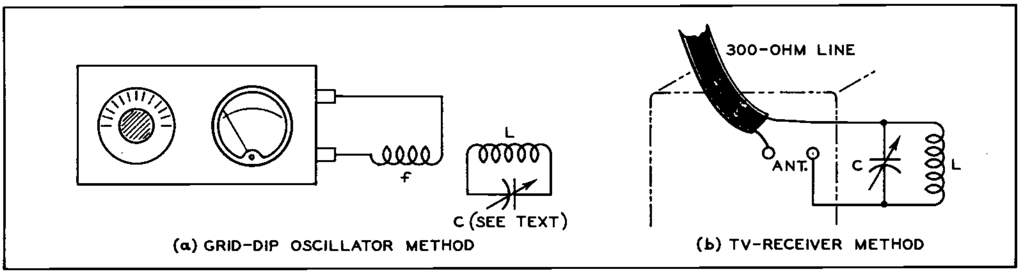
The TV receiver can also be used, alone, as a resonance indicator when a grid-dip meter is not available.* When this method is employed, the parallel resonant circuit containing a known capacitance and an unknown inductance is connected between one side of the 300-ohm transmission line and the TV receiver antenna terminal as shown in *Fig. 3b*. When the inductor and the capacitor are resonant at a picture-carrier frequency, the picture brightness is reduced. When the inductor and capacitor are resonant at a sound-carrier frequency, the volume is reduced.

Two examples are given below to illustrate this method of adjusting coils to specific inductance values. In each case, the coil is connected in parallel with a capacitor (determined from the nomograph for a given TV sound- or picture-carrier frequency) and connected in one side of the transmission line as described above.

Example 1. Using Channel-2 carrier frequencies, adjust a TVI inductor for an inductance of 0.2 μh. (a) From the nomograph, select the value of capacitance necessary for reson-

* *"The Practical Side of Building TVI Filters," by J. H. Owens, "Radio-Electronics," May,* 1952.

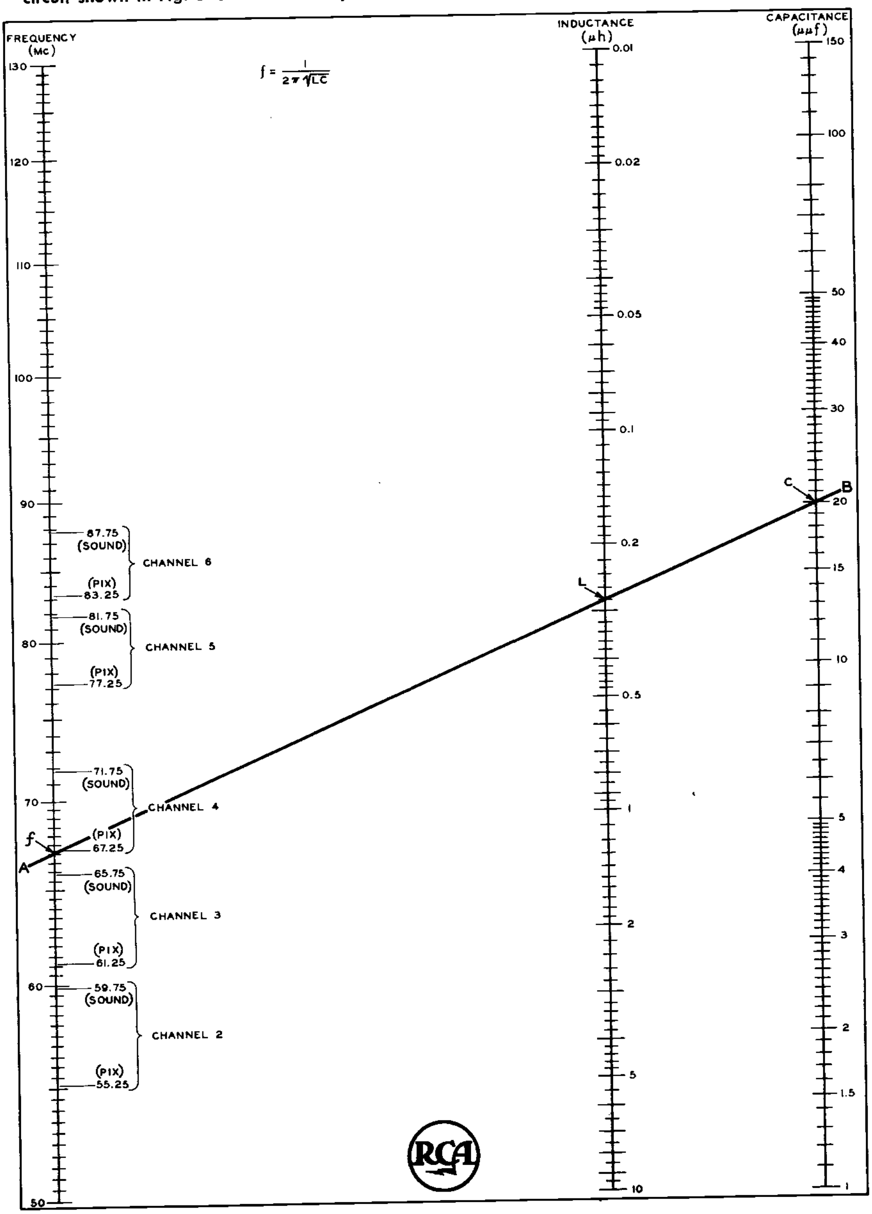
Fig. 3. Two methods of checking inductance by the resonant-circuit method. Capacitor C is a silver-mica type of known capacitance, and L is the unknown inductance.



ance with a 0.2-μh coil at 55.25 or 59.75 megacycles: (C = 41 $\mu\mu$f for the picture-carrier frequency, and 36 $\mu\mu$f for the sound-carrier frequency). (b) Compare these values of capacitance with standard values of silver-mica capacitors and select the closest available capacitor—40 $\mu\mu$f in this case. Connect the coil across the 40-$\mu\mu$f capacitor and prune the coil and vary the spacing between the turns until the Channel-2 picture brightness decreases to a minimum. The inductance of the coil will then be close enough to 0.2 μh for TVI filter applications.

Example 2. Same as *Example 1* except Channel-3 carrier frequency is used as the resonant frequency. (a) From the nomograph, select the value of capacitance necessary for resonance with a 0.2-μh coil at 61.25 or 65.75 megacycles: (C = 35 $\mu\mu$f at the picture-carrier frequency, and 30 $\mu\mu$f at the sound-carrier frequency). (b) Use a capacitance of 30 $\mu\mu$f (20- and 10-$\mu\mu$f capacitors in parallel). Prune the coil and vary the spacing between the turns until the Channel-3 sound drops to a minimum.

Fig. 4. Nomograph for determining any one of the three parameters, inductance, capacitance, or resonant frequency of a parallel resonant circuit when the other two are known. For a given frequency, f, and the desired inductance, L, the value of capacitance for the parallel circuit shown in Fig. 3 is determined by the intersection, C, of line AB and the capacitance scale.



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Editor

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