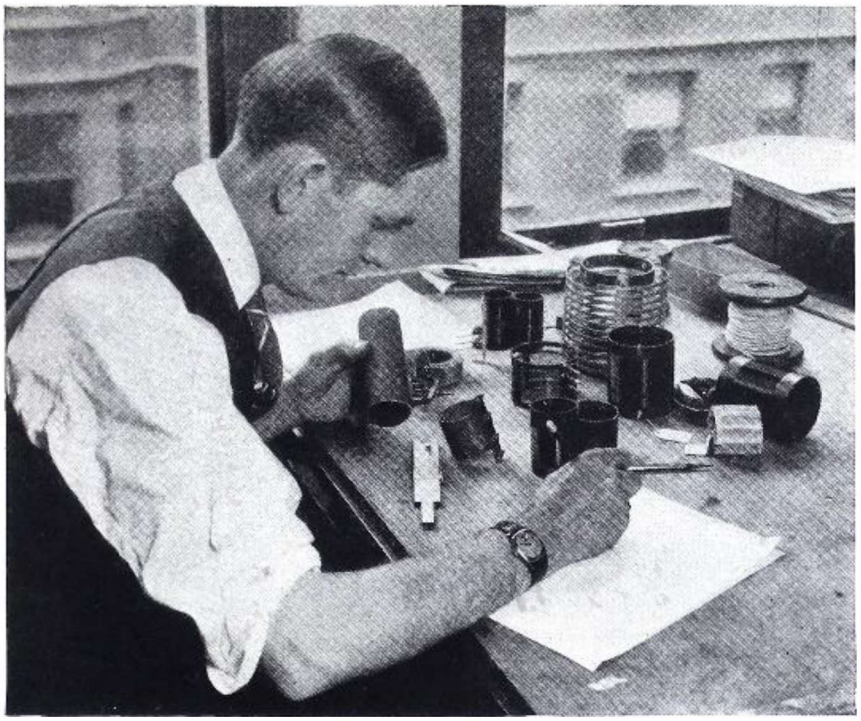

PLANNING THE COIL

With a little skill, and the proper knowledge of coil construction outlined in this article, coils can be made at home that will satisfy all the needs of broadcast reception. Then, with the proper technique, the designing of special coils may be undertaken.

For the Amateur Designer of COILS

By EMIL REISMAN

IN spite of the fact that coil manufacturers have brought the making of coils to a high state of perfection, there are many set builders, both professional and amateur, who still prefer to wind their own coils.

A well designed coil must have a low DC resistance; it must have a very low self capacity; it must have a minimum of dielectric in its field; it must have a minimum of metal in its field; its insulation resistance must be high; and the relation between its length and diameter must be of the proper ratio.

The DC resistance of a coil is determined by the size of wire used in its construction. A wire too heavy leads to excessive eddy current losses. Therefore some of the smaller sizes of wire are to be preferred to the large sizes, even though their ohmic resistance is larger. In general, wire ranging from No. 18 to No. 26 is suitable for inductance coils.

The self capacity of a coil is a very important factor because coil capacity is a highly absorbing condenser. The dielectric is the wire insulation and the material of the coil form. The self capacity of a coil adds greatly to its high-frequency resistance. A coil wound in the form of a solonoid with its turns slightly spaced has been found to have the lowest self capacity.

Any metal in the field of the coil introduces eddy current losses. Consequently, coils should not be mounted near or against metallic objects.

A high insulation resistance between the turns of the coil is essential or else much energy will be dissipated. The insulation of the wire and the form upon which the wire is wound should be of the best.

It has been found by the Bureau of Standards that in order to obtain the lowest possible high-frequency resistance and maximum inductance in a solonoid type of inductance coil, the coil should have such shape that the ratio

$$\frac{\text{diameter}}{\text{length}} = 2.46 \text{ approximately.}$$

The following is a formula whereby the inductance of a solonoid may be determined from its physical dimensions. Of course, when a certain inductance is wanted, the dimensions of the coil may be calculated from the formula by transposing the quantities.

$$L = \frac{.0395\ a^2n^2}{b} K$$

where L = inductance in microhenries.
a = radius of the coil measured from the axis to the center of any wire.
b = length of coil.
n = number of turns.

The values of *a* and *b* are measured in centimeters. Inches may be converted to centimeters by multiplying by the constant 2.54. The value of *K* is a certain number which depends upon the ratio of the coil diameter to the coil length. The values of K have been calculated by H. Nagoaka and are given in the accompanying table.

Diameter / Length	*K*	*Diameter / Length*	*K*
.00	1.000	.95	.700
.05	.979	1.00	.688
.10	.959	1.10	.667
.15	.939	1.20	.648
.20	.920	1.40	.611
.25	.902	1.60	.580
.30	.884	1.80	.551
.35	.867	2.00	.526
.40	.850	2.50	.472
.45	.834	3.00	.429
.50	.818	3.50	.394
.55	.803	4.00	.365
.60	.789	4.50	.341
.65	.775	5.00	.320
.70	.761	6.00	.285
.75	.748	7.00	.258
.80	.735	8.00	.237
.85	.723	9.00	.219
.90	.711	10.00	.203

The natural wavelength of any coil and condenser in parallel may be determined by means of the following formula.

$$\lambda = 1884 \sqrt{L\ C}$$

where λ = wavelength in meters.
L = inductance in microhenries.
C = capacity in microfarads.

This formula may be used to determine the wavelength range of a coil and variable condenser if the minimum and maximum capacity of the condenser is known. If the inductance of the coil is not known, it may be calculated from the formula previously given.

Good coils, like good valves, are necessary for the satisfactory operation of any set. A set of poor coils in a receiving set may be the cause of broad tuning, interference, and poor volume.

Properly designed coils make for sensitivity, selectivity and quality.