The ratio of winding length to diameter is

$$\frac{2.25}{3} = 0.75$$

and from Fig. 4 the value of K corresponding to this ration is 5.9. We know n, the number of turns, 74, and d, the diameter of the wire in millimetres 0.565; the diameter of the coil, we have to reduce to millimetres—1-inch = 25.4 millimetres

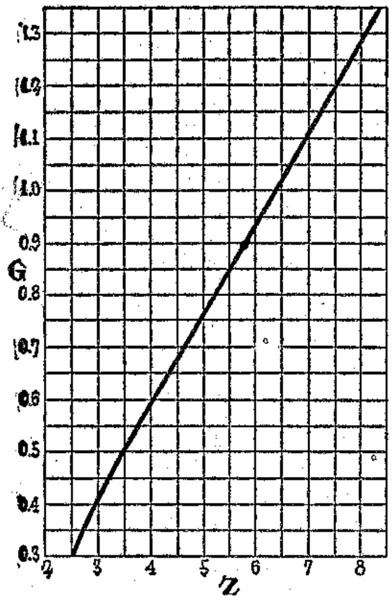

Fig. 3.—Values of "G" corresponding to "Z."

approximately, so D is 76.2; 2D will be 152.4.

We are now in a position to simplify the term in the minor bracket. The

$$\frac{Knd}{2D} \text{ becomes } \frac{5.9 \times 74 \times .565}{152.5}$$

or 1.62. This figure has now to be squared, giving a result of 2.62.

Substitution may now be effected throughout the entire equation

$$R_{HF} = R\left(1 + F + G\left(\frac{Knd}{2D}\right)^2\right)$$

$$= 1.24\ (1 + 1.43 + .948 \times 2.62)$$
$$= 1.24\ (1 + 1.43 + 2.48)$$
$$= 1.24 \times 4.91$$
$$= 6.09$$

Thus we have found the high-frequency resistance of this coil at a frequency of 1000 kilocycles per second (300 metres), to be 6.09 ohms, a very different figure from the direct current resistance of 1.24 ohms. Even this figure of 6.09 ohms will be increased slightly in practice by certain losses (e.g., dielectric losses and eddy current losses in screening), which will inevitably be introduced when the coil is located in a receiver. However, the distribution of these additional losses need not be dealt with here.

It will be seen that in order to determine the optimum wire diameter for any particular coil, it is necessary to work out the high-frequency resistances for a number of different wire diameters, plotting a curve like that labelled "r.f.-resistance" in Fig. 1, and reading off the diameter corresponding to the lowest point in the curve. When it is realised that this has in fact been done, albeit with the aid of certain mathematical short cuts, for three different inductances corresponding to those for which the required numbers of turns were given in the last paper, for three different coil diameters in respect of each inductance, and for quite a number of winding lengths in respect of each coil diameter, and that the whole of these results are summarised in the little charts of Fig. 5, most experimenters will be heartily grateful that it fell to the lot of "Cathode" and not to their lot to prepare this data.

Referring to these charts, it will be seen that they correspond to those previously published giving the number of turns. Three inductances are again provided for to accommodate variable condensers of differing maximum capacity. In this connection the writer wishes to make a word of explanation. It was originally intended to publish four sets of charts for coils of 200 m.h., 280 m.h., 320 m.h., and 340 m.h., the last two being intended respectively for variable condensers of .0003 mfd. and .00025 mfd. maximum capacity. Measurements subsequently showed that the minimum capacity of a .0003 condenser was so little different from that of a .00025 condenser that the inductance of 340 m.h. was suitable for both; naturally the charts covering coils of 320 m.h. were cut out. Unfortunately, the text was not amended everywhere, with the result that one or two phrases appeared which may have rather puzzled readers in the absence of this explanation.

It must be clearly understood that the optimum wire diameter referred to in this paper is the diameter of the copper section only and that the increase in diameter occasioned by the

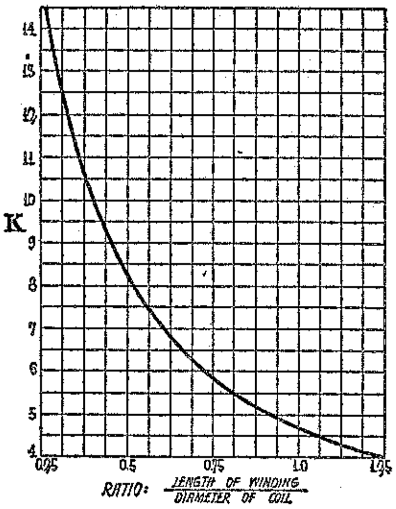

Fig. 4.—Values of "K" for Various Coil Ratios.

insulating covering of the wire must not be taken into consideration. As a matter of fact, the wire covering may frequently be usefully employed in distributing the wire over the allotted winding length. Some slight loss of efficiency will result from using this method of spacing, a better method being to use a grooved former.

It will be noted that the charts of Fig. 5, giving the optimum wire diameter, have the B. and S. gauges corresponding to different diameters noted alongside, so that the best gauge to employ can be read off directly. In New Zealand, however, most of the wire is rated by the Standard Wire Gauge, or S.W.G., which is slightly different from the B. and S. gauge. A variation from the optimum diameter of a single gauge, or even two, is not likely to affect the coil efficiency very