DESIGN CHARTS FOR CONSTRUCTORS

No. 11 SINGLE-LAYER INDUCTANCE WINDING DATA 0.3μH TO 60μH

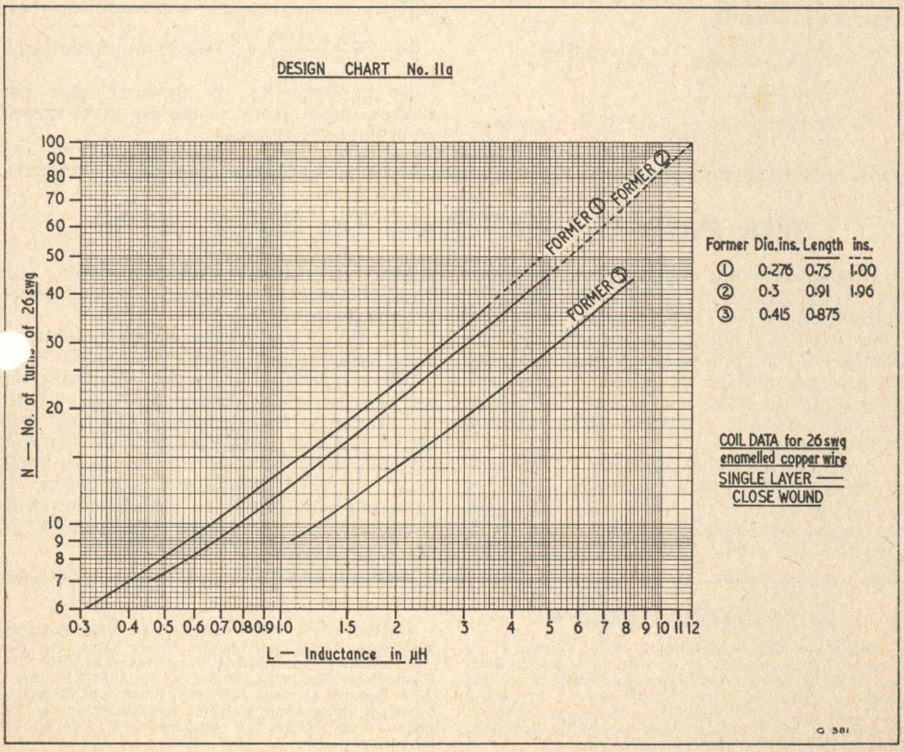
by **HUGH GUY**

REGULAR READERS WILL NEED NO FURTHER explanation than that given in last month's issue of *The Radio Constructor* to enable them to use the two further charts in this issue of the series of four, comprising the single layer inductance data.

These charts relate the number of turns of either 26 or 36 s.w.g. enamelled copper wire each gauge covered on a separate chart, wound on any of a given series of formers, with the value of inductance thereby obtained.

The formers that may be used are in three groups, each group being determined by its diameter. Thus formers under the heading Former 1 have a diameter of 0.276in, whilst those under the headings of Former 2 and 3 have respective diameters of 0.300in and 0.415in. Formers of these diameters are among the most widely used in radio engineering these days. They are all of the iron-cored type, and a representative range is illustrated in Fig. 1. This range is manufactured by Aladdin Radio Industries of Greenford.

Since there are two different lengths of former available in both types 1 and 2, it has been necessary to indicate the distinction on the charts. Obviously the longer formers will



valve will appear as merely a generator of the output voltage. Now in an earlier article it was said that all generators and batteries have some internal resistance, so that even if they were shorted the current that would flow would be equal to the generator voltage divided by this internal resistance. The valve may be represented then by a generator and some internal resistance. Fig. 7a can be redrawn, therefore, as in 7b. Note that the internal resistance is the R_a of the valve, and that the load the generator is feeding is the anode load of the valve. Fig. 7b is called the valve "equivalent circuit." It has no practical use on the bench, but it is a very convenient way of simply representing the valve for analytical purposes. The generator voltage is $\mu\Delta V_g$. This is derived from the fact that $\mu = \frac{\Delta V_a}{\Delta V_g}$, $\therefore \mu\Delta V_g = \Delta V_a$. The valve (and generator) output voltage is ΔV_a, or from above, $\mu\Delta V_g$.

Now the total resistance in the circuit is $R_a + R_L$, so the current is:

$$I_a = \frac{\mu\Delta V_g}{R_a + R_L} \quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

The true output voltage is that which is developed across R_L.

$$\Delta V_o = I_a R_L; \quad \therefore I_a = \frac{\Delta V_o}{R_L}$$

If we substitute $\frac{\Delta V_o}{R_L}$ for I_a in the above expression (1), we get:

$$\frac{\Delta V_o}{R_L} = \frac{\mu\Delta V_g}{R_a + R_L} \quad\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Now the gain of the stage is $\frac{\Delta V_o}{\Delta V_g}$, the output voltage divided by the input voltage.

Rearranging (2):

$$\frac{\Delta V_o}{\Delta V_g} = \frac{\mu R_L}{R_a + R_L} = \text{Gain N}\ldots\ldots(3)$$

So if we look up R_a and μ in the valve book, we can choose R_L to give the gain we require.

Now if R_L were made, say, 100kΩ, and R_a were only 10kΩ, the denominator of (3) would be hardly changed by ignoring R_a altogether.

Then N becomes: $\frac{\mu R_L}{R_L} = \mu$

So the gain of a valve can be equal to μ if R_L is sufficiently high, and this value is the maximum a valve can have.

As an example, if $\mu = 30$, $R_a = 6k\Omega$ and $R_L = 10k\Omega$, then the gain will be:

$$N = \frac{30 \times 10}{10 + 6} = 19 \text{ times approximately.}$$

If R_L is increased to 100kΩ, the gain becomes:

$$N = \frac{30 \times 100}{10 + 100} = 27 \text{ times approximately.}$$

So the higher R_L, the higher the gain, but the maximum gain possible can never exceed μ, in this case 30 times.

New Audio Output Valve — The G.E.C. KT88

A new audio output valve, the KT88, with an anode dissipation of 35 watts has been introduced by The General Electric Co. Ltd. This valve is a higher-power version of the familiar KT66, although it is smaller in size. It does not replace the KT66, but is complementary to it for output powers in excess of those readily available from existing KT66 circuits.

An example of the usefulness of this new valve for public address equipment is that, at a supply voltage of 500V, with auto-bias operation, the available power output is 50W or twice that obtainable from a pair of types KT66. At a supply voltage of 560V, with fixed bias operation, output power of 100W is available.

The KT88 has a larger cathode, allowing for a higher mutual conductance, and a more modern type of construction permitting the use of higher anode voltages and dissipations. It is designed for use mainly in a push-pull circuit and will operate satisfactorily as either a triode or a pentode. In the ultra-linear (UL) circuit, satisfactory operation is obtained with the screen grids connected to tapping points including from 20% to 40% of the total turns of each half-primary.

Catalogues Received

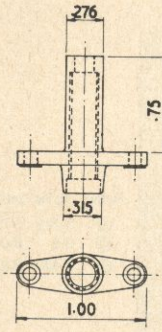
DUKE & CO., 621 Romford Road, Manor Park, London, E12.—A nicely duplicated three-colour illustrated list of ten foolscap pages, containing many real bargains. Who, for example, could resist a three-band coil pack, pair of 465 kc/s i.f.t.'s, two-gang condenser and printed dial for the nominal sum of 3/9, post 1/9? The catalogue is sent free to readers.

DIRECT T.V. REPLACEMENTS, 134-136 Lewisham Way, New Cross, London, SE14.—This catalogue commences by introducing "The most complete T.V. Component Replacement Service in Great Britain." After reading through the items listed, not forgetting technical information, we think few would dispute this claim. Available for 1/-. Post free on mentioning this magazine.

Nº 11

TYPICAL COIL FORMERS SUITABLE FOR USE WITH DESIGN CHARTS

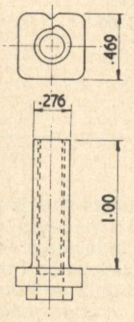
FORMER ①



TEE BASE

Chart Code — Former ①

Aladdin Types-5961, 5959

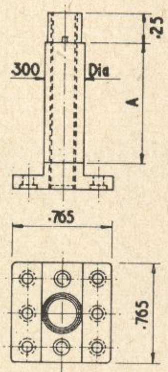


CAM BASE

Chart Code — Former ①

Aladdin Types-5947, 5948

FORMER ②



MOULDED BAKELITE

Chart Code — Former ②

Aladdin Type —— 5938

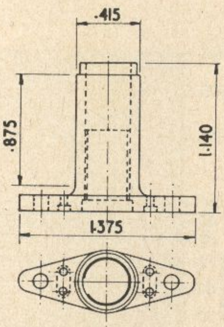
A 0.910ins.

Chart Code — Former ②

Aladdin Type —— 5937

A 1.96ins.

FORMER ③



MOULDED BAKELITE

Chart Code — Former ③

Aladdin Types — 5892, 5925

SCREW DUST CORES FOR FORMERS

Dia. m/m	Pitch m/m	Length ins.	Aladdin Type	Associated Former Type
6	0.75	0.500	5921	5947, 5959
6	1.0	0.315	5972	5937
6	1.0	0.375	5942	5938
6	1.0	0.500	5839	5961
6	1.0	0.625	5884	5948
8	0.75	0.675	5920	5925
8	1.25	0.500	5918	5892
8	1.25	0.675	5804	

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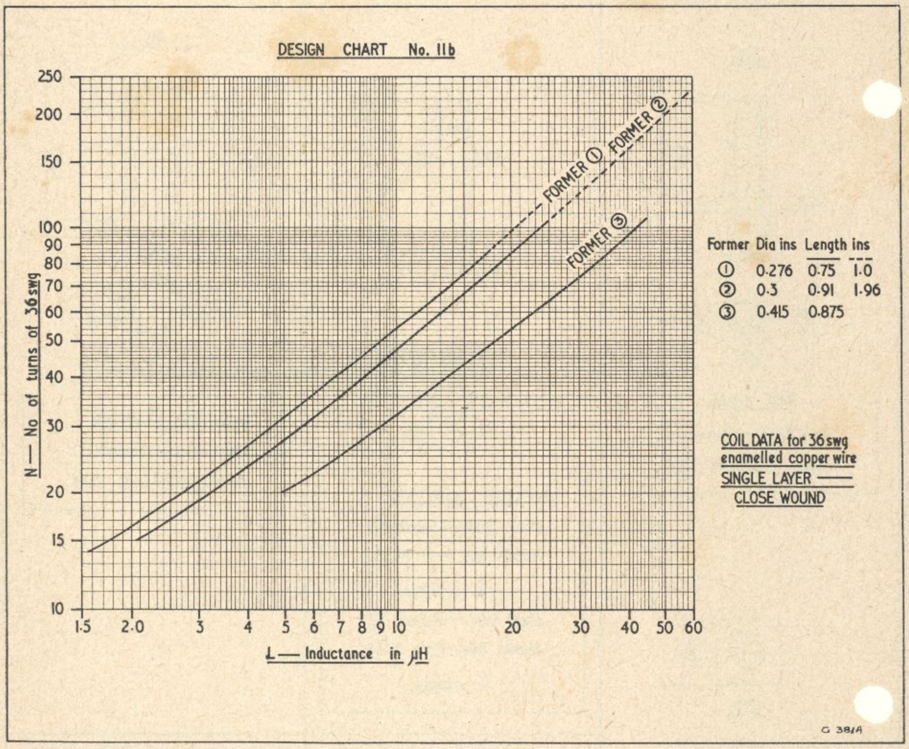
accommodate most turns of wire, and therefore the difference in lengths has been indicated by a continuation of the heavy data lines in dotted form.

For example, the maximum number of close wound turns of 26 s.w.g. wire that can be wound on the shorter type of Former 2 (i.e. the former of length 0.91in) is seen from Chart 11a to be 45, (since this is the finish of the heavy data line for Former 2. Up to 100 turns may be wound on the longer Former 2, however.

is Former 3, in the first instance. Then the charts show that 36 s.w.g. must be used, since the data line for Former 3 on the chart for 26 s.w.g. does not extend to 10μH inductance. On chart 11b $32\frac{1}{2}$ turns are seen to be required.

If the longer of the types of Former 2 were being used, then we have a choice of wire gauge; using 26 s.w.g. wire we would need 84 turns, whilst using the alternative gauge only 47 turns would be required. In the latter case we see that a short former could be used here.



Using the Charts

The use of the charts is quite straightforward. To wind a coil of some specific value of inductance it is merely necessary to select a former from the range for which the charts are applicable, and read off the appropriate number of turns for this inductance using the data line corresponding to the chosen former. Certain inductance values overlap on the two charts, providing an alternative wire gauge in these instances.

Example

As an example, consider the process of designing a coil for an inductance of 10μH.

We will assume that the former to be used

Iron Dust Cores

All the coil data quoted here is for formers with the iron dust core removed. When the core is screwed in the inductance will increase, in some cases by as much as 2 : 1 on its design figure. This effect should be borne in mind when designing coils, a good policy being to wind coils to say two-thirds of their required value, using the iron core as a means of variable control on the final value of the inductance. The actual amount by which the core increases the inductance depends not only on the core material, but also on the penetration of the core within the coil. ~~If the length of the core is greater than that of the coil,~~