Design of R.F. Transformer

By CATHODE

(Continued from last week.)

WHERE a neutralised circuit of the type shown in Fig. 4 is used, concentric mounting is ideal. This circuit, however, suffers from the disadvantage that a part only of the voltage developed across C is applied to the grid of the succeeding valve. When a neutralised circuit of the type shown in Fig. 5, or an unbalanced circuit such as is usually used with a screen-grid valve, is adopted, it is advisable to move the primary down to the low-potential end of the secondary to reduce the effect of the capacity between the two windings. This will reduce the coupling factor a little, but with the comparatively short windings usually used for this type of work the reduction should not be greater than 10 or 15 per cent.

It must be noted here that while T may be taken as an approximation to the optimum turns ratio of the transformer, it really refers to the ratio between the square roots of the primary and secondary inductances. As the inductance of a coil depends on its shape as well as on the number of turns on it, it is as well to increase the turns ratio about a quarter above the ratio indicated by T. This will compensate for the shorter winding usually used for the primary.

When the optimum transformer ratio is employed, the amplification obtainable from a transformer-valve combination may be calculated from the formula:—

$$\frac{U}{2}\sqrt{\frac{L}{prC}} \qquad (8)$$

Notably in the case of the screen-grid valve, and also in cases where an exceedingly high degree of selectivity is required, it will not always be practicable or convenient to use the optimum primary. In the case of the screen-grid valve in particular, difficulty is often encountered with double-hump resonance curves when the primary is made large enough to match the valve.

In such cases the transformer ratio is really determined by considerations of selectivity rather than by those of maximum efficiency. It should not be forgotten, however, that a secondary of extreme efficiency and a very close coupling between primary and secondary are of assistance in promoting selectivity, since the same load in the plate circuit of the valve may be obtained with a much higher transformer ratio than where the secondary coil and the coupling are below standard. Selectivity is, of course, promoted by a high ratio of transformer.

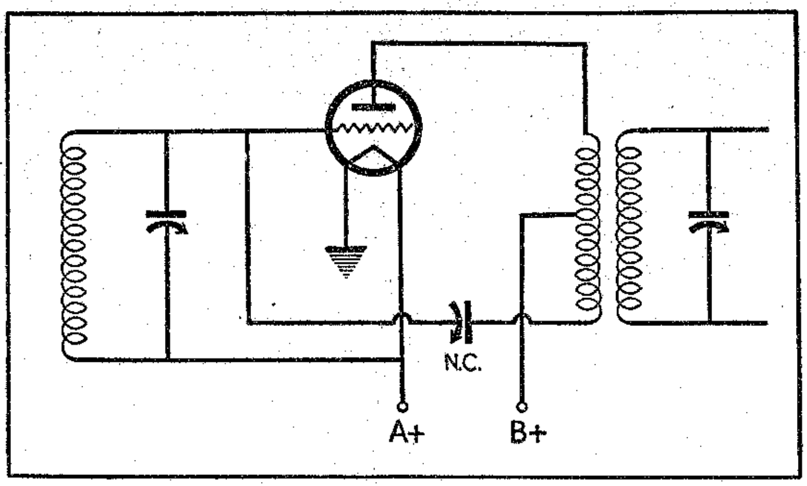

Fig. 4.

Hints on Efficient Design.

IT is not proposed to enter into a lengthy discussion on modes of construction. Those readers who are seeking the highest efficiency for their high-frequency coupling transformers may, however, derive some benefit from the following suggestions:

(1) In order to maintain "k" at the highest possible figure and thereby gain enhanced selectivity while still loading the valve properly, the primary should be wound directly over or under some portion of the secondary and should not be wound spaced from the secondary on the same former.

(2) With the same object in view, the primary should be spaced over a considerable part of the winding length of the secondary. If the constructor is anxious to use the once popular slot-wound primary, the length of the secondary winding should be reduced to the point where the falling off in the efficiency of the coil becomes serious.

(3) The secondary winding should have the lowest possible high-frequency resistance consistent with the dimensions to which it must be limited. This object will be achieved by using a coil of suitable shape and wound with wire of the optimum diameter.

(4) A point which is not brought out in the simple theory given here is that the capacity between primary and secondary windings, as well as the self-capacity of the primary, should be reduced to the lowest possible limits. Advantage should be taken of the low dielectric constant of air to reduce this capacity. Thus the primary may be wound over eight hard rubber spacing strips (perhaps 3-16in. wide by 1-8in. thick) spaced at equidistant intervals around the secondary and held in position with rubber bands until the winding is completed; the ends of the windings may be soldered to tags held by bolts passed up from the underside of one or two of the spacing strips, the heads of the screws being heavily countersunk so as not to come in contact with the secondary.

Alternatively, the primary may be wound on a former of a smaller diameter than the secondary former, care being taken that there is a clear air space on all sides between the primary winding and the interior of the secondary former. Where a slot-wound primary is used the primary should not quite fill the slot.

The turns of the primary should be spaced (except where slot-wound) in order to reduce self-capacity, and since primary resistance is immaterial, should be wound with the finest gauge of wire which the constructor is willing to manipulate. No. 42 is not too small, and No. 36 should be regarded as the maximum permissible, except where extreme mechanical strength is necessary.

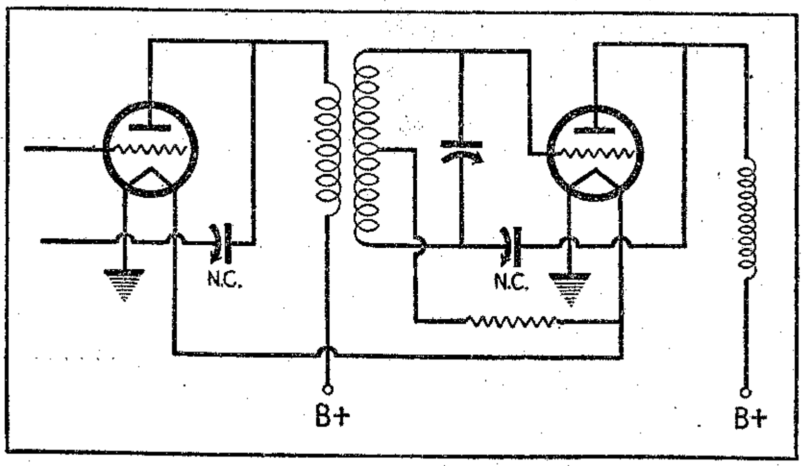

Fig. 5.

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