

The Screen-grid Valve as R.F. Amplifier

Varied Experiences of Constructors



HAT great interest has been shown in the screen-grid valve as an R.F. amplifier has been evidenced by the very large number of correspondents who, during the last few weeks have written in on this score. As stated previously, we have held these over until now, they are published collectively with some additional notes.

The fate of the screen-grid valve still hangs in the balance. It was at first greeted with great enthusiasm, but now there is a reactive tendency and it is being considered more critically than formerly. The great difficulty with this valve is its flat tuning, and when devices are introduced to sharpen this, losses occur which render it little better than the average valve. It appears that a screen grid set would be most suitable for use in the country distant from a local station. Even then, tuning would be flat, and there would be great difficulty in separating stations whose wavelengths approximate one another.

A short time ago "Pentode" discussed the application of the screen grid, recommending transformer coupling.

This has generally proved successful, as the correspondents indicate.

The screen-grid valve has been reviewed by one of New Zealand's radio authorities, Mr. E. R. McCarthy, who states: The science of radio frequency amplification has of late seen retrogression rather than progress. Nothing of any real value has been introduced since the Haseltine neutrodyne system several years back, and even that, in so far as the principle of neutralisation by external capacitative reactance is concerned, was only a variant of the earlier Rice system.

A surprising number of manufacturers have returned to the oldest method of stabilising known—potentiometer grid control.

That there is still a call for sets which will bring in distant stations was distinctly evidenced by the sudden rush when the screen-grid valve was announced, and it is decidedly unfortunate that this was heralded by so much misleading publicity, which led builders to expect much that has proven impossible.

Many of the leading publications carried editorial matter describing the great amplification obtainable from a valve which would not oscillate, and even the largest valve manufacturers and best engineers in the country allowed statements to appear such as "A voltage amplification of 200 per stage is obtainable, but at broadcast programmes the resonant impedance is lower, reducing the amplification by 25 per cent. of this value."

Prior to commencing any actual work, certain limits were laid down as essential if the results were to be of any value in designing a receiver which could be constructed by the home builder. First, standard apparatus, obtainable by anyone, must be employed. Second, if possible, the need for any complicated balancing by means of expensive accurate apparatus after construction, must be avoided. Thirdly, the use of shielding undesirable as introducing superfluous expenses and trouble. Last, no involved or critical adjustments of any kind were allowable, as such a receiver must be infallibly sure to give good results, if the connections are properly made, in the hands of the most inexperienced operator.

Types of Coils.

A TEST was given of coils of sixteen types, as many of each type being tried as were deemed necessary to determine their worth. Inasmuch as the reproduction of all these curves here would lead to confusion, due to their numbers, and would serve no particularly useful purpose, we will show the results obtained in these most useful types, which had a bearing on the final result, but as a matter of information, it may perhaps be advisable to outline roughly the types involved and the major reasons for their abandonment.

All coils were of the general type, having 77 turns of wire in the secondary circuit, and spaced to conform to an approach to the ideal shape factor, and supported by skeleton bakelite frame, so that the insulation losses are kept at a minimum figure.

The actually tested coils as the introduction of a primary coil or the use of a portion of a secondary coil for coupling, have a decided effect on both the inductance of the secondary.

1. A tuned impedance, directly from plate to grid to ground.
2. An auto transformer, in which a portion of the secondary is used as primary, and low potential end being common.
3. A transformer in which the primary and secondary are coupled by a by-pass condenser at the low potential ends, the direction of the winding be-

ing continuous from plate to grid, and the coils being tuned from plate to grid as in the original "R. B. Lab." circuit and other Betts circuit adaptations.

4. A primary wound to take up a length of one and a-half inches inside the secondary.

5. A primary wound to take up one-half inch placed inside, and in the centre of the secondary.

6. A primary wound to take up one-half inch, placed inside, and opposite the loss potential end of the secondary.

7. A primary wound with a length of one-eighth inch, placed in both positions above described.

8. A primary wound in a 1.32 inch slot, coupled adjustable to the secondary.

9. A primary wound on the same diameter as, and at an adjustable distance from, the secondary.

10. A tuned primary with adjustable coupling of the secondary.

Types four and six are very commonly used, and hence we have selected them for detailed presentation in connection with two types.

Type four is generally advocated for use with the shield grid valve when the tuned impedance arrangement is not employed. After the number of turns increase to a certain point, no further increase in amplification is obtained.

Type six is the type most commonly used at the present time, and the results indicate that if conventional circuits are to be employed, it is considerably superior to any of the others tried.

The results indicate at least as good result as with the widespread primary in amplification, with a considerably improved selectivity factor.

Type two is extremely interesting. In this type of coil a varying portion of the secondary acts as primary, with the primary and secondary currents in this portion of the coil in quadrature. The inductive coupling is much greater in this type of coil for the same number of turns, hence a comparatively high primary impedance is built up with a relatively small number of turns with consequent greater overall amplification.

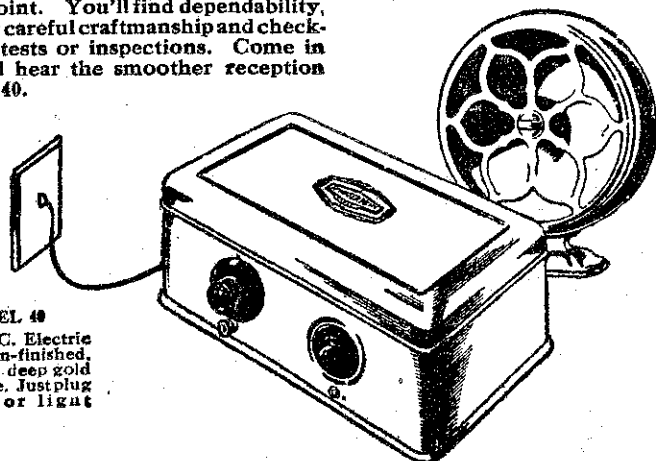
Shifting the Phase Angle.

A REVIEW of various past methods of stabilisation indicated that the best results were probably obtained by shifting the phase angle of the current in various stages by the method somewhat similar to that used in the circuit described in the "Listeners' Guide."

In a circuit containing two stages of radio-frequency amplification it will rarely be found necessary to employ more than one such resistance, as sufficient adjustment of the tune relation can be obtained to avoid oscillation, while still maintaining the satisfactory value of overall amplification. Maximum results, regardless of the type

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