

The Operation of the Pentode



LAST week the conclusion of Mr. Dawson's interesting article was rather badly mixed up, and "we have found it necessary to repeat the article in order that its full significance may not be lost by the mishap.

The pentode has yet another considerable advantage over normal power valves in that to produce the same volume as a three electrode power valve the pentode requires only a fraction of the a.c. grid voltage that would be required for the triode.

If the pentode is fully loaded it gives a larger output of better quality with smaller input signal voltage, and of course a smaller negative grid biasing voltage is required.

Eliminating One Audio Stage.

AS a result of the pentode advantages discussed above, it is possible and practicable to eliminate the normal first stage of a.f. amplification with its valve and coupling transformer.

In addition to the reduction of expense thus involved there is a definite gain in quality, as even the finest components are not 100 per cent. efficient, and every additional stage of a.f. amplification must add something to the overall distortion.

The amplification possible with the pentode is of special appeal to the home set builder on account of the savings shown above. The set may also be smaller and more compact, and requires less power for operation.

As less preceding amplification is required, this gain can often be used to advantage to increase the selectivity of the set by making the radio-frequency stage couplings looser without reducing the signal strength too much.

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Valve

A Remarkably Sensitive Output Valve

By W. M. Dawson,

A.M.I.R.E., M.I.W.T.

By virtue of the good high note amplification, the selectivity of the set may be much greater, than with a triode power valve, without seriously impairing the quality of the reproduction.

Pentode Can be Used in Every Set.

THE only external distinguishing feature of the pentode is an extra connection for the screen grid.

The pentode can thus be readily adapted to existing sets by simply making an extra connection from the power pack (or B battery).

Many enthusiasts are now using the pentode with excellent results. In some cases, however, users have been unable to achieve success, and whenever these cases have been investigated the writer has invariably found that the operating conditions have been quite unsuited to the valve, considering the associated equipment, and

it would seem that the pentode is still a very much misunderstood valve with the average radio enthusiast.

No valve can work to best advantage under adverse conditions, and the pentode is as docile and easy to handle

Plate Impedance.

THE matter of pentode plate impedance is a common stumbling-block with experimenters, who frequently have visions of attempting to "match" the valve impedance to the speaker by using a high ratio step-down transformer. It has been shown above that an essential fundamental of the pentode circuit is the very considerable valve impedance compared with that of the speaker. What is unknown to most people, however, is that recent research reveals a very definite optimum load impedance for a given pentode valve, and this optimum value does not hold good for other types.

The correct load impedances for the following well-known types are:—

C243	4500 ohms
D243 and E443	8000 "
B443	6250 "
C443	9000 "
R443 N & F443	10000 "
C643	9500 "

With a triode valve, a considerable amount of mismatching of the load impedance is possible before audible distortion takes place, though the undistorted output of the valve is reduced.

In the case of the pentode, the correct load impedance is more important, and when deviated from, produces that shrill reproduction, with high note emphasis that many people wrongly consider to be a definite characteristic of pentode reproduction.

The pentode can and will give quality at least equal to the triode—reproduction with well-defined bass frequencies and excellent balance.

The Moving-Coil Speaker.

LET us consider first the case of the moving-coil type of loudspeaker, where the impedance of the voice coil is supposed to remain constant at all frequencies in the musical range. In practice we must qualify this by saying comparatively constant, because the impedance does, of course, rise at higher frequencies.

Through a constant impedance load we must pass a uniform current, if we are to obtain uniform power expenditure, and as this "constant current" principle is the main feature of the pentode, it follows that the pentode power-valve, plus moving-coil speaker, very closely approaches the ideal in respect to absence of frequency discrimination.

We qualified, and said, "very closely approaches the ideal," not because of any shortcomings of the pentode, but because even the moving-coil speaker is not perfect in that its mechanical and electrical resonances introduce distortion of their own, and a fidelity curve of the acoustic output plotted against wattage input will soon disillusion any who fancy that the modern speaker closely approaches perfection.

Fortunately, the human ear is very tolerant of imperfections in reproduction—particularly in the matter of relative sound intensities.

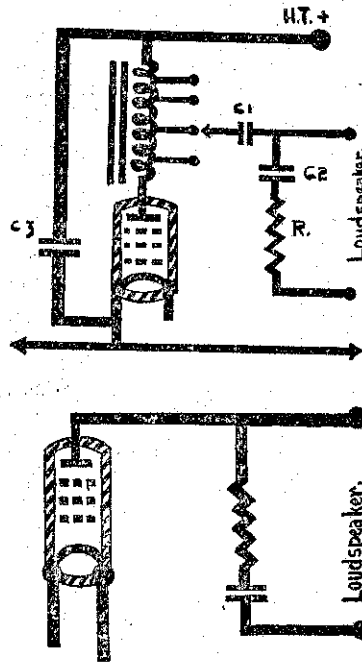


Fig. 1.—Output filter circuit for magnetic speaker. C1, 4 mfd.; C3 4 mfd.; C2, .01 mfd.; R, 5000-10,000 ohms.

Fig. 2.—The elements of the filter circuit mentioned in the article. In this simplified circuit the plate current flows round the speaker windings. Condenser approx. .01 mfd. Resistance approx. 5000-10,000 ohms.

as a triode once its little peculiarities are understood.

No apology is therefore required for going to practical considerations in some detail. This, in conjunction with the release of new data, will, it is hoped, enable readers to use this remarkable valve intelligently and effectively.