The Application of the Screen-grid

Essential Precautions the Constructor must Observe

By "PENTODE"

IT has come to the notice of the writer that several constructors have tried out a screen-grid valve in their sets without any further alteration of the wiring or coils beyond moving the grid or plate lead and applying the potential to the screen grid. This is all right when done out of pure curiosity to see what will happen, but to expect all the results that the screen-grid valve is capable of giving is bound to end in disappointment. There are many who have heard of all the wonderful results obtainable from the four electrode valve, but who possess commercially-made sets and do not care to interfere unless they know what they are doing. The object of this article is to give, if possible, that little help where the writer considers it to be most needed. No doubt it will also help to some extent those who are about to design and build a receiver incorporating this valve, and one or two circuits are given to be used with the screen-grid valve.

Without going too deeply into the theory, it is well known that the impedance in the anode circuit must balance that of the valve. Maximum amplification is only obtained in a radio frequency stage when these two impendances are equal. If a valve having a low impedance is inserted in a valve socket of a receiver in which the impedance in the plate or anode lead is high, then the full amplification of the valve is not obtainable. It would need a long article to explain just why this is so, but it can be taken for granted by the reader.

The Evolution of the Valve.

BEFORE dealing with the screened grid valve, let us go over one or two points dealing with the progress of wireless. In America, when broadcasting first began, it was considered advisable to standardise as far as possible, all component parts.

First of all the valve was standardised and the 201A type produced. It was aimed to have one valve suitable for every part of the receiver. Now, to be suitable for audio frequency work the impedance had to be comparatively low. Using this valve in the radio frequency stages, designers had to use a coil of low impedance in its anode, and so the number of turns averaged between five and ten. Fortunately the number of turns for a broadcast coil is usually about 60, and so a voltage step up was possible in the radio frequency transformer, and partly compensated for the low amplification of the valve itself.

At the same time in England valve manufacturers were designing valves with amplification factors of 25 and 30. To do this the impedance of the valve was raised. A larger R.F. coil which possessed no step up effect was used in the anode of these valves, and all the amplification had to be produced by the valve. The tuned anode method of coupling was evolved.

Now compare these two methods. As far as actual amplification was concerned, both gave about the same, but of the two the American method gave far greater selectivity. All commercial machines adopted transformer coupling in their R.F. stages and were designed for the 201A valve. The substitution of a higher impedance valve resulted in a serious loss of amplification. Fully 95 per cent. of the receivers in New Zealand are of American design, and it will be now clear why it is impossible to use a screened grid valve without fairly extensive alterations. These valves have an impedance of 150,000 ohms, and it is not likely that it will give anything like full efficiency when substituted for a valve of 6,000 ohms impedance. To get the best out of these valves the anode coil has to be tuned and wound so as to reduce all losses to a minimum.

Now look at it from another angle. In a circuit using the three electrode valve the inter-electrode capacities have been balanced and neutralised out. All undesirable capacities in wiring, etc., have been cancelled by the neutralising condenser, but the screened grid valve employs no such devices, nor does it need any, and efficient wiring and screening are needed to exclude all tendencies for the valve to oscillate.

The Browning-Drake.

IN general practice a single stage of screened grid is comparatively easy to build and operate. The use of two stages, however, calls for great care in design, and anyone contemplating substituting two four-electrode valves for two ordinary triodes is strongly advised to either redesign the whole receiver or not to attempt the work. Sooner build a screened grid "H.F. Booster" as described in this article, as it adds another stage without the addition of further tuning dials.

To owners of Browning-Drakes and other receivers using but a single stage of R.F. the following will make interesting and instructive reading matter, especially if they are thinking of trying out one of these new valves.

Glance at Fig. 2 and it will be seen to be the circuit diagram of the radio frequency and detector stages of the well-known Browning Drake. Neutralisation is effected by taking a tapping from one of the turns of the secondary of the regeneroformer. The aerial connection being indicated as an arrow indicates that this can either be a tapping direct to the grid coil or a small primary adopted. Reaction on the detector valve is obtained by a small adjustable tickler coil. The primary coil inside the regeneroformer is wound with the correct number of turns to suit the valve preceeding. It is this circuit that we desire to alter in the easiest way, so that a screened grid valve can be used in the R.F. stage.

Changing Over.

THE first essential is to note the performance of the present receiver and before thinking of changing over make quite certain that the following points are quite in order.

First and foremost, does any interaction take place between the aerial and regeneroformer coils? "Heaven knows!" will be the answer in most cases, but it can be soon ascertained by the following process.

If the set will not nentralise at all it is one of two causes. Either the neutralising condenser is of the wrong value of capacity or there is an interaction taking place between the two tuning coils. If the receiver is unstable, particularly on the lower wavelengths, it is usually due to an unsuitable neutralising capacity, either too much or too little. Turn the radio frequency valve down and adjust the neutralising condensers until weakest signal strength is noted. If, on turning on the valve, the receiver is unstable on the higher wavelengths, then the trouble can usually be traced to interaction between the two main tuning coils. If this is the case, it must be definitely corrected before going any further. Although, by careful arrangement, the coils can be placed so as to prevent interaction, the writer advises screen-

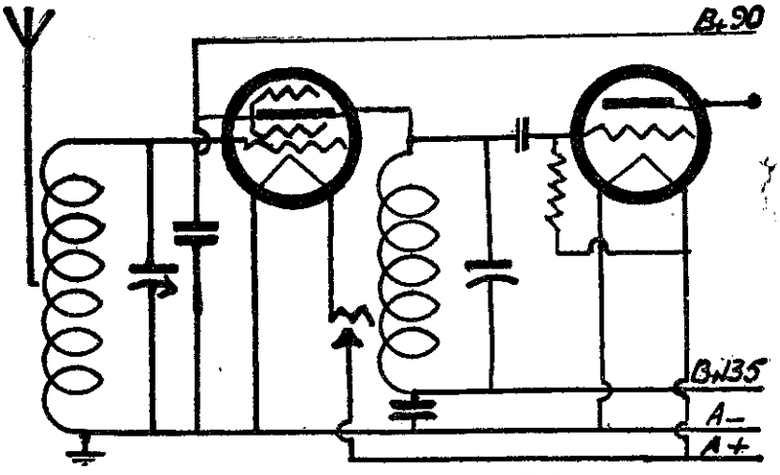

Diagram 1.—The Tuned Anode R.F. Stages.

The Shielded Five Neutrodyne

Screening Boxes—Sheet metal supplied or boxes made up to specifications.

	s.	d.
3 Ebonite Formers, 3½in. x 2in. with strip 1in. x 12in. Empire Cloth	3	6
½lb. 24G. D.C.C. Wire	2	6
½lb. 30G. D.C.C. Wire	2	3
3 Cardwell .0005 Condensers, each	12	6
Or Ormond .0005 Condensers, each	12	0
1 Fixed Condenser .0025, each	2	0
1 Fixed Condenser, .001, each 1/-, 2/-		
2 Fixed Condensers, .5 mfd., each	3	3
5 Parkin U X Sockets	2	3
1 Magnus Rheostat, 6, 10 or 20 ohms, each	3	0
2 Airzone Neutralising Condensers, each	5	0
1 Airzone R.F. Choke	5	0
2 Emmco Midget Transformers, each	13	9
Or 2 Thordarson Transformers, each	25	0
12 Terminals N.P., 3d. each, engraved, each	0	6
1 Panel 21 x 7, Ebonite, 10/9; Formica	18	8
1 Jack S.C. F.C.	3	6
½ lb. connecting wire, 3-length sleeving	3	2

THOS. BALLINGER & CO., LTD.

58-62 VICTORIA STREET :: WELLINGTON.

"WHERE THE QUALITY GOODS ARE SOLD."