Practical Hints on Neutralising

Considerations when Building

By "Pentode"

IN a previous issue of "Radio Record" the writer gave a short article on the various methods employed for reducing the feed-back produced by interaction between grid and anode coils in a receiver. This article will describe, in, it is hoped, understandable language, the effect and remedy of feed-back due to the close proximity of the valve electrodes.

If a receiver was designed and built, taking great precautions to shield and isolate the grid and plate coils, it would still be very unstable and would oscillate furiously whenever the tuning systems were in resonance.

Oscillation cannot occur without a feed-back, whether inductive or of a capacity, and excluding possible causes through the various battery leads common to both coils, we only have the small capacity existing between the grid and plate inside the valve. It is this small capacity forming a coupling between the grid and plate coil through which the feed-back takes place. This has been realised for years and has given food for thought to many radio engineers.

Controlling Oscillation.

PERHAPS the easiest way to understand the present methods employed to overcome this difficulty is to recapitulate the various courses practised during the past few years.

Assuming that the reader has already read the article in last week's issue, it will be remembered that a valve will start to oscillate if the field of the grid and plate coils interact. This is known as an inductive coupling. Methods were given for overcoming this interaction by placing the coils at certain angles and also by screening. Also a method was given for suppressing oscillations by the addition of damping resistances.

Yet another method which should have been enumerated in the previous article is the circuits employed in potentiometer control. Just why this controls the valve will interest many readers, and the reason really lies in the fact that when the grid of a valve is given a positive potential the resistance of the grid-filament coil is greatly increased. By resistance the high-frequency resistance is meant.

Consider for a moment, the resistance between the filament and grid electrodes inside the valve. When the grid is negative the resistance is infinite; when positive, the resistance decreases dependent upon the potential applied to the grid. By referring to the circuit of any high-frequency amplifying valve it is at once apparent that any resistance, or should we say, partial conductor, between the grid and filament electrodes is directly across the two ends of the grid coil. Thus, with a positive potential on the grid a damping resistance is introduced across the grid coil. This resistance is susceptible to variations of grid bias, accomplished by connecting a high resistance, usually 200 or 400 ohms, directly across the filament leads and arranging a sliding arm to run along this resistance. To this arm is connected the grid return.

In practice the grid is made more positive until a balance is reached. The damping introduced exactly balancing the energy fed back by either interaction between anode and grid coils, or the small interelectrode capacity of the valve itself. It can always be remembered that reaction or feed-back is merely a lowering of the resistance of the grid coil. If, therefore, resistance is added to more than compensate any feed-back present, the circuit will be quite stable. But to introduce any form of damping lowers the efficiency of the circuit, and the greatest possible amplification per stage is not obtained.

The Neutrodyne Principle.

LATE in 1925 the neutrodyne principle was introduced, and is still the most popular method of stabilising a high-frequency amplifying valve. It must be stressed here that the neutrodyne principle merely overcomes the feed-back due to the small capacity existing between the grid and plate electrodes and connections thereto, and does not remedy any inductive coupling that may exist between grid and anode coils. To obtain a perfectly stable receiver by this means, the two coils will have to be completely isolated by any of the methods enumerated.

The neutrodyne principle depends for its action on the application of an equal capacity to that of the valve electrodes and connections only in the opposite direction. The current flowing through the added capacity is out of phase with that flowing through the valve. This is known as neutralising or balancing the valve.

This was first accomplished in the well-known tuned anode circuit by taking the B positive lead from a tapping in the middle of the anode coil, and connecting a very small condenser across the free end of the coil and grid of the preceding valve. This circuit held the ground for many months, but suffered from several drawbacks. It was extremely unselective, and hand capacity was very marked when manipulating the anode coil and user.

These disadvantages were overcome by using a high-frequency transformer in which the primary impedance could be matched with that of the valve used and the tuning condenser of the secondary coil was at earthed potential. It is this arrangement, split primary high-frequency transformer that has been universally used throughout the world and is as popular to-day as ever.

The Elstree Six.

IN November, 1926, the Elstree Six was described and became a very notorious receiver in England at that time. This receiver, which later took third prize in the Radio World's Fair at New York, has three stages of neutralised high-frequency amplification, only in this case it is the grid coil which is tapped and connected via a small capacity to the plate of the valve itself.

Evolving from this arrangement, numerous circuits were published in English journals using the split secondary method of neutralising. This method, found in perhaps fifty per cent. of receivers of an English design, is undoubtedly the easiest way to effect neutralisation, but it suffers from one drawback: It is not quite as sensitive as the circuit employing the split primary. The voltage applied to the grid is in effect halved, due to the filament connection being in the middle of the grid coil.

The Screen Grid Valve.

IN the development of the high-frequency amplifying valve, the most

Future Constructional Articles.

Next Week "Pentode" will describe

"The 'Pentode' Three."

An Excellent Receiver which should fill the Requirements of a Large Number of Constructors.

Another Future Article of Considerable Interest

"The Screen Grid Six."

A Set for Distance Quality and Volume.