ANOTHER correspondent, "R.T.C." (Dunedin), asks the following questions:

1. What guage of tinned or enamelled wire should I use in both the antenna coil in the transformer?

A.: Within a size or two, guage does not matter. Usually 22 is considered as satisfactory as any. For the transformer try about 85 turns on a 2½-inch former. Space the wire so that the primary and the secondary, although close-wound, do not touch one another. If wound too tightly, oscillation will be difficult to control.

2. What diameter of former should be used for the tickler coil?

A.: If a 2½-inch secondary former is used, a 2-inch will be necessary. Wind on about 25 to 30 turns D.S.C. 30-guage wire.

3. Should a .0001 m.f.d. condenser be connected in series between the antenna and the aerial coil?—Yes. It will sharpen tuning.

4. What should be the value of fixed condenser between "B" plus 135 and "A"—.5 m.f.d.?

5. What voltage should be applied to the plate of the .201A as detector?

A.: From 22½ to 45 volts.

For Sale or Exchange.

See page 32 for column of casual advertisements.

Finer Details of Radio

Three Electrode Valves as Detectors

By "PENTODE"

FOLLOWING our discussion on the theory of the modern valve when used as an amplifier, let us consider for a while just how and why a valve will detect signals when called upon to do so. The valve is the same as all the others in the receiver, but why does the first, if that be a R.F. valve, not detect? How is it that the mere fact of the inclusion of a grid leak and condenser specifies which valve is destined to convert the inconceivably high frequency impulses into audible low frequency electrical vibrations. To thoroughly understand the various principles involved needs a certain amount of imagination, not because there is any doubt as to the accepted explanation, but rather from the numerous factors working together upon which the final result of rectification takes place. A little concentrated thought will be needed, and the writer will endeavour, in this short article, to make it as clear as possible.

The word "detection" means the rectification of the high frequency alternating currents as they are received from the aerial or amplified by the radio frequency valves in a receiver. Several methods have been used, but the three of most importance are those using a crystal detector, a grid leak and condenser in conjunction with a valve, and the one known as the "anode bend" detector. As it is only with the valve that we are concerned, the last two methods only will be discussed.

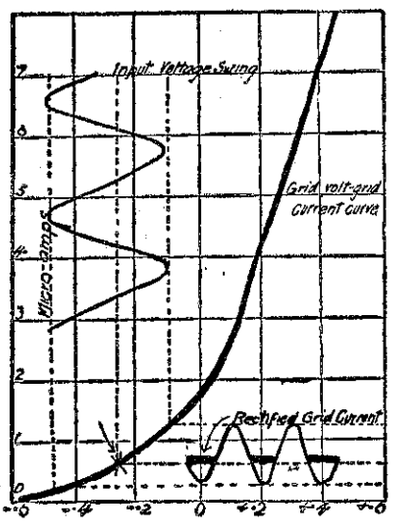

Diagram 10—Grid voltages along base, anode current vertically. Leaky grid detector.

The Leaky Grid.

THE most common and universally used system is the leaky grid condenser, and as this is the more difficult to fully understand it is dealt with first.

Last week a simple graph was explained, showing the relation between the grid voltage and anode current. Reference to the accompanying diagram shows the relation between grid current and grid voltage, irrespective of anode voltage, which is constant at 22 volts. Whereas the anode current amounted to several milliamps, the grid current as shown here amounts to one or two microamps. A milliamp is a one-thousandth of an ampre, a microamp is a one-thousandth of a milliamp. The vertical lines indicating grid voltages show the grid potential relative to the filament. These are expressed as fractions of a volt, the reason being explained later.

It will be noted that even when the grid is made slightly negative a small amount of grid current flows, and it is not until over ½ volt negative bias has been applied to the grid, that grid current is completely prevented from flowing.

This is accounted for by the fact that the velocity of the electrons, as they rush toward the grid, is so great that it needs a small retarding potential to completely prevent them from settling in the grid and liberating their small charge of electricity. It is upon this small bend in the bottom of the grid-current, grid voltage curve that the action of detection depends. The curve is based upon measurements taken using a 201A type valve with 22 volts B supply and a 6 megohm grid leak. The valve of the condenser is not critical.

In the average receiver the grid return, in the case of a detector (the grid leak) is connected to the filament positive terminal and it would be assumed that the grid would be at a positive potential, the valve being half the filament supply voltage. This is incorrect.

The operating point of the valve is that which is finally evolved after one or two governing factors have been satisfied. Let us at first assume the grid to be 3 volts positive with respect to the filament. The graph does not accommodate this supposition, but it would be seen that a large grid current would flow. This, however, has to flow through the grid-leak. Whenever a current flows through a resistance, a voltage drop occurs across the said resistance. The grid-leak is merely a simple high resistance and the voltage drop across this would be comparatively great. In actual practice, the drop is such that the average detector valve operates with the grid at a fraction of a volt from the zero, usually, as shown, slightly on the negative side. So that although the grid return is connected to the positive filament terminal, the grid does not follow suit, but settles down to an operating point which depends upon the valve of the grid leak and the current flowing through this resistance, causing a voltage drop across the same. This point has to be remembered.

Having arrived at the working point we are ready to apply a high-frequency wave to the grid to understand the various steps towards rectification. The series of waves on the left-hand top corner show the applied R.F. wave. The marked operating point shown, is correct only when no signals are being applied to the grid.

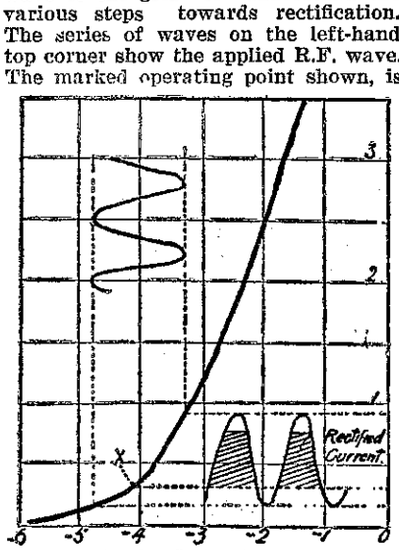

Diagram 2—Anode bend detector. Grid voltages and anode current as diagram.

Directly a wave is impressed upon the grid, the operating point moves in sympathy. When at rest, this point is at 3 volts negative, but when the incoming wave is applied, this point moves from .1 to .5 volts up and down the curve.