Regeneration—in Theory and in Practice

Various Methods of Control

RECENTLY quite a few correspondents have written in regarding reaction and its control. Some time ago an article by "Megohm" appeared explaining this, and the following are the salient points of that article:—

INSIDE a valve when in action we have the filament heated by the A battery, which causes a stream of electrons to be shot off or "emitted" from the filament. These electrons, being negative, are attracted to the plate, which is always positive on ac-

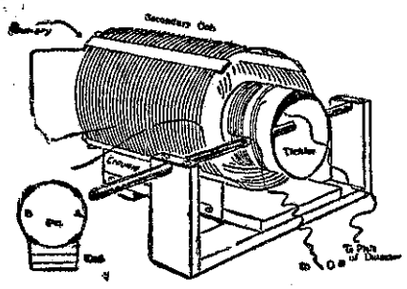

Diagram 1. Tickler Control

count of the B battery current which flows from plate to filament and back to the B battery. The voltage impulses of signals that come to the grid have a great effect upon the conductivity of the space between the filament and grid with regard to the flow of electrons, so that as the grid becomes more or less negative, the flow of the electrons decreases or increases.

In this way the small impulses on the grid are able to produce larger changes in the plate circuit, and thus amplification is obtained.

From this it is seen that there is more energy flowing in the plate circuit than in the grid circuit, so that if we can feed back a little of the plate circuit energy in such a way as to increase that which is already in the grid circuit, this increase will be amplified and appear as a still greater increase in currents flowing in the plate circuit.

Damping Effects.

THERE is always a certain amount of "damping" in a wireless circuit, which tends to make signals die down. We can prolong the dying-down process by supplying energy to compensate for that which is lost, so in an oscillatory circuit we can feed in energy and wipe out the effects of damping.

If we use reaction to feed energy back into the grid circuit of a valve we can so adjust matters that the oscillations produced by passing waves are prolonged and die away gradually, or we can feed back a larger amount, so that once oscillations are started, they are maintained indefinitely. This latter condition is called "self-oscillation," and occurs when the energy fed back balances that lost in overcoming resistance, and so on.

This process is equivalent to reducing the damping of the circuit, and it is most beneficial in increasing the sharpness of tuning of the circuit, since the lower the losses by damping, the sharper the tuning, and this holds good up to the point at which self-oscillation commences, when the damping is said to be reduced to zero.

Regeneration, then, is the action by which part of the energy from the plate circuit of a valve is fed back into the grid circuit.

Methods of Control.

IT is plain that the amount of feedback must be under the control of the operator. For strong incoming signals little or no feedback may be required, while for very weak signals the maximum allowable feedback must be used. There is always a capacity feedback through the plate to grid capacity of the valve and the amount of regeneration through this valve capacity varies according to the construction of the valve.

The added means of feedback must be controlled so that this combined with the energy passing through the valve will equal the desired valve.

Regeneration is usually applied only to the detector valve.

1. Tickler Coil Control.

DIAGRAM 1 shows reaction controlled by a tickler coil, connected in the plate circuit and coupled to the tuned coil of the grid circuit. The construction of the tickler coil is shown in diagram 2.

The tuned winding, which is the secondary of a radio frequency transformer, and the primary winding of this transformer, are wound on a stationary former in the usual way. The tickled coil former and extends through which rotates within the stationary former. A shaft is attached to the tickler coil form and extends through

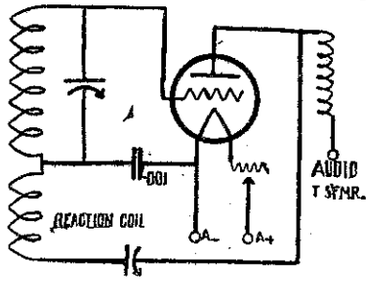

Diagram 2. Condenser Control

to a control knob. If the tickler coil is small, consisting of ten turns or less it must be placed close to the secondary coil. If the tickler is large, containing fifteen to thirty turns, it may be placed farther away from the stationary coil.

As the tickler is turned to increase its coupling to the stationary coil, the effective inductance of the tuned stationary coil is increased. Therefore, the tuning point at which the circuit becomes resonant or tuned to a certain frequency will change with the changes of tickler adjustment. In other words, reaction controlled by a tickler requires that the receiver be retuned after adjustment of the tickler.

This is a rather serious disadvantage, since a receiver cannot be logged unless a note is made of the tickler setting.

2. Resistance Control.

There is another method of using the tickler coil—that of placing a variable resistance of 50,000 ohms in the

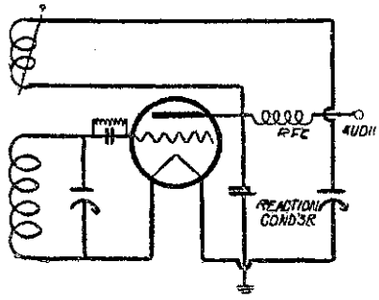

Diagram 3. Combination Method.

regenerator circuit. This may be done in series or in shunt with the tickler and the audio circuit. The method has very restricted application.

3. Condenser Control.

Diagram 3 shows a method of controlling reaction by a condenser as a bypass for the radio frequency energy in the plate circuit. Here the tickler winding forms part of the tuned coil winding. The tickler winding should have a number of turns equal to about one-fourth the number of turns in the tuned portion of the coil.

4. The Combination of Moveable Tickler and Condenser.

Far the best method is the combination of the moving tickler and the condenser method as in diagram IV.

The plate of the valve is connected to the tickler and to the audio transformer through a choke. The other end of the tickler is connected to the stalor plates of a condenser, while the moving plates go to one of the filament leads. That is, the control condenser is in series with the tickler.

Preliminary Adjustment.

WHEN making the preliminary adjustments for this system the condenser should be turned to maximum capacity (plates full in). Connections to the tickler should be reversed and tried both ways. The connections are left in the way that produces maximum regeneration or oscillation. With the condenser still at maximum capacity the tickler is coupled closer and closer to the fixed coil, that is, the knob is turned towards full on until oscillation takes place. Oscillation may then be prevented and regeneration controlled by variable condenser. The less the condenser capacity the less will be the regeneration and the greater the condenser capacity, the more regeneration will be obtained.

If it is impossible to obtain sufficient regeneration at the low frequencies or higher wavelengths it will be necessary to increase the coupling or the number of turns on the tickler coil.

When it is found that the set bursts into oscillation when the tickler is very little in the field of the tuned coil, that is, that the number on the dial is yet low, it indicates that there are too many turns on the coil. If there is a difficulty to get the set to oscillate the number should be increased.

Make adjustments when there are the least number listening in say the afternoon.