Causes and Cure of Oscillation

A Concise Account of the Why and Wherefore of the Squeals that Kill Raaio Reception

EVERYONE who has had any experience with a radio receiver, either home-made or factory-built, will have some definite idea as to what is meant by oscillation. The constructor will be far more interested in this term and what it means than is the owner of the commercial receiver. These latter sets are now built so carefully that uncontrollable oscillation is a thing of the past. There are, however, a large number of receivers, especially those of the older type, that give trouble because of this cause. In dealing with this common trouble, we must take into account not only the home-built set, but this class of factory-built receivers.

Owners of the older sets will find that there is a decided tendency to howling and squealing when tuning in to stations on the lower wave-lengths. Those who own a home-built or other regeneration using set, will know that when the regeneration coil or condenser is advanced beyond a certain point, loud whistles and screams emanate from the loudspeaker. This is oscillation, or feed-back. It is caused through a certain amount of energy from the plate of a valve being fed back into the grid circuit and again amplified by the valve.

When this is controlled in the proper manner, the signal strength can be increased greatly. The power added to the input side overcomes more and more the resistance of the grid circuit. It is possible to feed more than enough of the output power back into the input grid side to more than overcome the resistance of the grid circuit, and when this happens the set squeals, and not only mars the reception of the listener but also that of his neighbours. A little regeneration will not spoil the tone, but excess causes distortion.

How Oscillation is Affected.

THE tendency to oscillate increases as the frequency increases or as the wavelength decreases, other things remaining the same. A receiver may deliver very weak signals on the lower frequencies, but can be very sensitive at the higher. This is very frequently seen in the commercial receiver, which is built to oscillate just above the highest frequency to be received, and as this is approached the set becomes more and more sensitive.

Oscillation may take place in the radio-frequency amplifier, the detector, and the audio-frequency amplifier. In a receiver embodying each of these stages the greatest tendency to oscillate is in the second radio-frequency valve and those R.F. valves following it. The next greatest tendency towards oscillation is found in the detector circuit, and, last of all, in the audio.

As a rule, the tendency towards oscillation is increased by low resistance, that is, by good design in the grid circuits. It is also increased by using large tuning coils with small condensers. We might summarise the factors controlling oscillation as follows:—

Tendency towards oscillation is increased by—

- Higher frequencies or lower wavelengths.
- Additional radio stages.
- Low resistance, good design.
- Large tuning coils and small condensers.
- Regeneration coil too large.
- Loose coupling between coils.
- Value of grid leak too high.
- Loose coupling in the aerial circuit.
- Normal filament voltage.
- High plate voltage, using a common "B" battery or power unit.

The tendency towards free oscillation is decreased by the converse of these.

Oscillation Control.

OSCILLATION may be controlled by four principal methods.

1. Eliminate the ways in which coupling may take place from coil to coil. This may be either inductive or capacitive. We shall return to this point.

2. Using a second feed-back which is opposite in phase to the first feed-back, and so cancels it out. This is the bridge method.

3. Reducing the power either in the grid circuit or in the plate circuit.

4. Introduce losses, such as resistances. This latter does not only mean resistances formed by length of resistance wire, but high-frequency resistance or any loss that acts as an effective resistance.

Unwanted feed-back is best tackled by first determining where in the receiver it is taking place, and then determine the method from this.

Resistance feed-backs where energy is fed from one circuit to another through intervening resistances such as those in the voltage divider of a power pack, a common battery, or grid bias for two or more audio valves taken from a tapped resistance may be overcome by using by-pass condensers in the plate and grid circuits, thus shortening the effective high-frequency path. Plate by-pass condensers are inserted between Bx or filament negative, or across the "B" battery. Sometimes, a choke has to be inserted in the R.F. plate leads on the power pack side of the junction of the by-pass condenser, which may vary in capacity from .006 up to .01 mfds. for the radio valve. The capacity for the audio and detector valves should be 1 mfd. A separate by-pass condenser must be used on each stage or valve of the receiver. The grid condenser is placed in the circuit between the grid return and the filament positive. Avoid common grid returns to a rheostat, separating them by grid condensers as indicated.

Inductive Feed-back. — Although there might be no connection between one circuit and another, yet radio frequency current will feed back through the ether, and when two radio frequency coils are close to one another and have their cores parallel, the maximum amount of feed-back will take place. In order to overcome this, a very large amount of damping must be introduced or the amount of feed-back lessened by mechanical means. This is best done by arranging the coils so that the field from one core does not touch the field of the other in such a way as to cause howling. The coils should be at right angles, or at an angle of 35 degrees. This latter is used in the neutrodyne. The coils are frequently placed far apart—this aspect has been dealt with by "Cathode."

Another way in which the inductive feed-back takes place in poorly-designed receivers is through closed loops in the wiring. A closed loop is formed whenever the wire on the positive side of the circuit is run a little distance from the wire for the negative side.

This applies to all filament, plate grid circuits, both in and outside the receiver itself. It is very easy to eliminate this type of feed back by bunching or cabling the battery wires. Plate and grid wires, however, must be kept short, as nearly as possible at right angles to one another, well above the baseboard and clear of the filament wiring. A much prettier job can be made by right-angling all the leads, but it is better to sacrifice looks for efficiency and take grid and plate currents by the shortest possible paths. It is better to make the battery leads long and cable them than to make them short and have them running by themselves. Remember the rule in respect of filament wiring is the exact opposite to that for plate and grid wiring.

A method of preventing feed-back of the inductive type which is now becoming very popular is to shield the R.F. coils; in fact, some of the latest models of receivers shield everything.

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