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Additional Notes on Self-Excited Oscillators

Dynamic Instability

This is caused by changes in frequency caused by changes in plate voltage, or dynamic Instability. If we plot a curve of oscillator frequency change against changes of plate voltage it will be found that as the voltage is increased from zero there will be a continuous frequency change until the final voltage is reached. The extent of this change is a measure of the dymamic instability of the oscillator. With a poorly designed transmitter operating on 7 Mhz and 500 volts on the plate the frequency change can be 20 KHz or more. Naturally it will be worse if the plate voltage is 1000 volts or more. With a poorly filtered plate supply, the note from such a transmitter is going to be r.a.c. hash because the frequency will be flitting back and forth at the plate supply ripple frequency.

The remedy for dynamic instability is to have an adequetly filtered and regulated power supply and the use of a high "C" tank (s). 500 pf should be used on 80 meters and 250 pf for 40 and 20 meters.

Other Considerations

Attention should be given to exitation and the value of the grid leak. They have more to do with the final note of the oscillator than most realize. If the tube is to ~~be~~ work at reasonable efficiency it must have high bias which in turn calls for a high-resistance grid leak and plenty of exication. The dynamic stability is improved under these conditions. The setting that gives the least plate current when the oscillator is not delivering power to a load is not the correct one. The exication must be adjusted with a load on the oscillator. Otherwise the excitation will be insufficient and the stability will suffer. In general, the no-load plate current should be at least half the loaded plate current although this depends on the frequency.The excitation is increased in the Hartley circuit by moving the filament tap nearer the plate end; in the T.P.T.G by increasing the capacity of the grid tuning capacitor. This rules out the TNT circuit. The T.P.T.G. has additional interlocking effects too so the Hartley circuit clearly is the best choice for a power oscillator. The exitation adjustment is critical and must be made in small steps always listening to the osdillator on a monitor.
If the circuit is High-C, a ~~xxxxx~~ key chirp is an almost certain indication of insufficient exitation with the exceptions noted later. Use the highest value of grid leak that will the tube to operate stably with normal input. Usually between 10 and 20,000 ohms for a single tube. The higher the resistance the higher the exitation required so every time the leak is changed so must the excitation.

Efficiency

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High-C tanks ~~brin~~ with it large circulating currents, hense the coils and connecting leads should be heavy conductors and every effort be made for low resistance connections. TNT users take note.

It is necessary at this point to make a distinction between tube efficiency and circuit efficiency. If the tube is running normal plate current under load and is correctly biased and excited, its efficiency will be as high as in any other circuit regardless of the L-C ratio. The circuit efficience will be somewhat lower in the High-C circuit however, because of the greater losses caused by the higher tank current. The distinction is important because it is necessary for the tube itself to operate at high efficiency if it is to stay cool in opegation. And it is highly desirable for the heat dissapation in the tube to be well within the ratings because heat makes the elements in the tube expand which in turn causes the interelectrode capacities to change. Since the interlectrode capacities are unavoidably a part of the circuit, there results the second cause of instability - a slow frequency change or drift. The greater the condenser capacity in the tuned circuit, the less will changes in tube capacity affect the frequency. Therefore the ~~things~~ same things which give good dynamic stability will also minimize frequency drift - High-C, a high resistance grid leak, and correct excitation. In addition the tube must never be overloaded . The plate should never show signs of cilor even when the tube is allowed to oscillate for hours at a time.

Frequency drift can also be caused by heating of the tank coil and condenser, another reason why the resistance in the tuned circuit must be low. Drift from this cause will be less when power is being taken from the circuit because the tank current decreases with increasing load.

Mechanical Instability

Cleaning up dynamic instability and drift ~~xxx~~ are not in themselves a guarantee of a good note. It is when these things have been done that the smaller - but nevertheless just as serious - causes of instability becomes apparant. Mechanical vibration of coils, tubes, condenser plates, etc must be avoided. Self-excited oscillators must be isolated from operator's movements, the set must be installed either on a separate table or mounted on rubber or suspended with vibration-proof cord. Protect the set from vibration.

Never build the oscillator and power supply as one unit.

Antennas and Feeders

An antenna suspended in the clear can swing quite a lot before it will affect the oscillator frequency. However the feeders are another

Matter. Zepp feeders especially are likely to be bad offenders because the wirese are relatively close together and hense have fairly large capacity to each other, so that if they swing back and forthé the oscillator frequency may change considerably. For this reason the feeder wires should be spaced at least 10 or 12-inches and xkxx should be liberally supplied with light-weight spacers. With light weight spacers the whole feeder system tends to swing as a unit in a wind, but heavy spacers cause the wires to wip back and forth. The antenna and feeders should be pulled up tight of course.

Always couple the antenna to the "cold" end of the tank where the rf voltage is low and little energy will be transferred through capacity coupling. This will minimize harmonics from being transferred to the antenna.

Other Things

Even after these causes of instability have been given the right kind of attention, it is still possible to have a modulated and chirpy signal if the r.f. is not kept where it belongs and not in the power supply. The leads to the supply should be well filtered. The supply should be remote located from the oscillator to minimize direct pickup. Sometimes shielding the leads is desirable.

Under certain conditions, the note will be D.C. with no sign of rf getting into the poser supply/// without the antenna connected. However when the antenna is connected, rf appears in the supply. This is the result of pick-up from the coupling system. If the antenna circuit is paralleled tuned with high rf voltages appearing at the transmitter end. Additional feeder length can be added to make the system series tuned (low impedance at the transmitter end) or the tuner can be remote from the rig and coax fed to the rig.

Always use the loosest coupling that will allow the tube to draw its rated current with tha antenna tuned to resonance. Take as much power out of the oscillator as you can while always monitoring the note!

Some experimenters have noticed a resonance condition caused by the capacitors in the filament circuit resulting in an untamed "beast" These oscillations have been found around 8 MHz. Changing values and using a resistor for a filament center tap instead of the filament transformer center tap eliminated these resonance effects.

Others while trying to make low frequency power oscillators (less than 2 MHz) experienced considerable problems until the circuit was changed to a "faithful" Hartley.

The filament resonance condition mentioned above has also been cured by installing a .05 capacitor across the filament pins at the socket.