

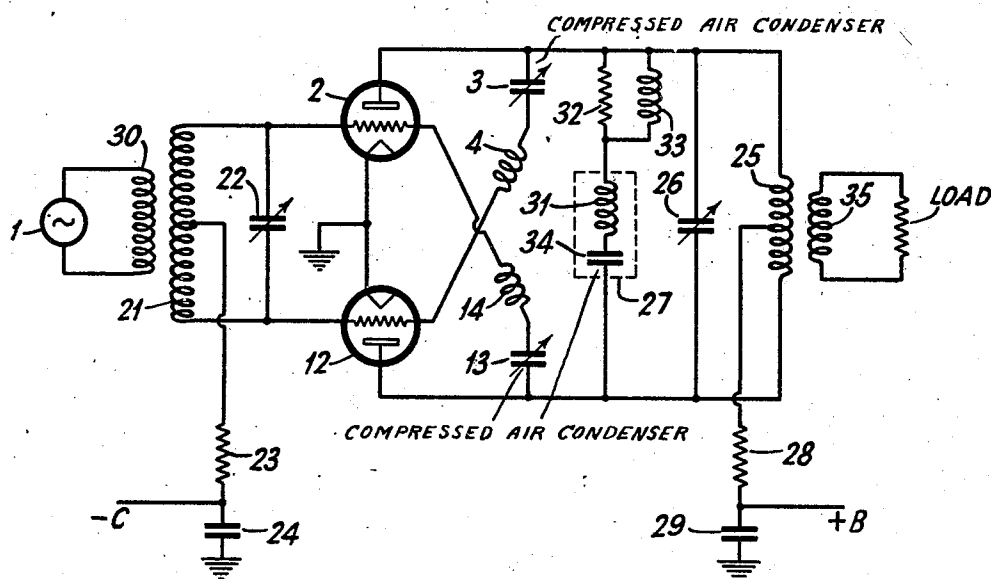
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PARASITIC OSCILLATION SUPPRESSION WITH COMPRESSED
AIR CONDENSERS IN THERMIONIC CIRCUITS

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PARASITIC OSCILLATION SUPPRESSION
WITH COMPRESSED AIR CONDENSERS IN
THERMIONIC CIRCUITSJames L. Finch, Patchogue, N. Y., assignor to
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This invention relates to thermionic circuits in connection with which compressed air tuning condensers are employed, and relates particularly to high frequency power amplifier circuits of a radio transmitter using compressed air condensers.

An object of this invention is to discourage or entirely suppress any parasitic oscillations by connecting in series with the compressed air condensers a resistance shunted by an inductance.

Another object of this invention is to improve radio transmitting high frequency amplifier circuits generally. Compressed air condensers of the usual construction have a certain amount of inherent inductance in series with the capacity element, which inherent inductance is generally greater than that of the ordinary plate condenser, with the open air as a dielectric. This inherent inductance combines with other capacities of the circuit to produce a resonant circuit at a much higher frequency than that for which the circuit is designed. The presence of such a resonant circuit very often leads to parasitic oscillations at the frequency of these circuits. In the prior art, these compressed air condensers have been usually connected directly into the circuit in which the capacity which they provide is required. This has made these circuits subject to parasitic oscillation as mentioned above.

The single figure of the drawing shows a typical power amplifier of push-pull variety in connection with which compressed air tuning condensers are used.

In the drawing, 1 represents a source of oscillating power used for exciting the power amplifier circuit. Itmes 2 and 12 are the thermionic triodes used in this amplifier, each having the usual anode, grid and cathode. The grids of these tubes are tuned with an inductance 21 and variable tuning condenser 22, as indicated. The grids are connected to a source of negative potential -C through the mid-tap of 21 and through an impedance 23. The bias source is by-passed by a condenser 24. The plates of tubes 2 and 12 are tuned with a plate inductance 25 which in turn is shunted with tuning condensers 26 and 34. A source of plate power +B is connected to the plates through the mid-tap of 25 and through an impedance 28. This source of plate power is usually by-passed to ground by a condenser 29. The usual circuit method of neutralization against parasitic oscillations due to regeneration through the plate to the grid capacity of the tubes 2 and 12 is provided by

means of neutralizing condensers 3 and 13 of the compressed air type. The connection between these neutralizing condensers and the grids contain a small amount of inherent circuit inductance 4 and 14 caused by the condenser construction and circuit leads which is usually of relatively small impedance at the operating frequency generated at source 1 and impressed on the grids by inductive coupling between its output inductance 30 and the grid inductance 21.

Plate tuning condenser 26 is assumed to be of the open air type consisting of heavy plates connected directly to the plates of tubes 2 and 12 and comprising negligible inductance in these connections. This is the case in connection with many of the well known commercial transmitter circuits in which the tubes are water cooled. Condenser 34 indicated as being within a casing 27 shown by the dotted line is also of the variable compressed air type and is used in this case because it has very high capacity per unit of space occupied. Due to the construction of such compressed air condensers they have a small amount of inherent inductance associated with one of the terminals which is represented by numeral 31. In the prior art, this condenser is generally connected directly to the plate of tube 2, omitting the elements 32 and 33 of this invention.

I have found that the inherent inductance in combination with the casing capacity of the condenser element 34 of the compressed air condenser casing, and in combination with tuning condenser 26, and any stray capacity of the circuits, produces a resonant circuit at a frequency very much higher than the normal frequency. In this case, inductance 25 simply serves as a choke through which anode potential is fed to the plates. At this parasitic frequency, the inductance 4 and 14 in series with the compressed air neutralizing condensers also becomes important, the reactance 4 and 14 becoming of the same order as the reactance of 3 and 13. Thus, at this frequency the circuit is no longer neutralized and sufficient regeneration is introduced to cause oscillations.

By the circuit method of my invention, I connect a resistor 32 and an inductor 33 in the circuit of the compressed air condenser 34, as shown on the drawing. At the normal operating frequency, the resistance of 32 is much higher than the reactance of 33, and the reactance of either 32 or 33 is very low compared with the reactance of 34. Thus, they have very little effect on the tuning of the circuit and absorb very little power from the circuit. At the para-

sitic frequency, however, the reactance of 33 becomes very much higher and becomes of the same order of magnitude as the resistance of 32. At this frequency, therefore, 32 absorbs power from the circuit and discourages or suppresses the parasitic oscillations.

Modifications of my invention can consist of the substitution of elements 32 and 33 of any other elements which have the characteristic of low loss and low reactance at the operating frequency and high loss at the parasitic frequency.

Further modifications will consist of the use of compressed air condensers between the plates of tubes 2 and 12 and ground or between the plates of tubes 2 and 12, and the high voltage end of by-pass condenser 29.

Still further modifications will consist of any other type of thermionic circuits and tubes other than the triodes shown in which compressed air condensers are employed and in which this method of discouraging parasitic oscillations is employed. Therefore, this invention should not be limited to the precise circuit arrangement shown.

What is claimed is:

1. In a high frequency wave energy system a circuit including an electron discharge device coupled in said circuit, an anode circuit, said anode circuit having an inductance and a capacity in parallel tuned to resonance at the frequency of said wave energy, said capacity being of the compressed air dielectric type having high capacity per unit of space occupied and having inherent inductive reactance which with other circuit capacities produces a resonant circuit at frequencies other than the frequency of said wave energy, and a resistance and second inductance in parallel therewith in said parallel resonant circuit, the value of said resistance being higher than the value of the reactance of said second inductance, the reactance of said resistance and of said second inductance being less than the reactance of said first named capacity.

2. In a wave amplifying system, a pair of electron discharge systems having input electrodes and output electrodes connected in neutralized wave repeating circuits including means for tuning at least one of said circuits to an operating frequency, said last means including inductance

and a compressed air dielectric condenser having high capacity per unit of space occupied, said condenser also having inherent inductance which with other circuit elements provide parallel paths wherein voltages of frequencies other than said operating frequencies are set up to destroy the neutralization of said circuits, and means for reducing the effect of said voltages including a resistance and an inductance in parallel connected in series with said condenser, the value of said resistance being high as compared to the reactance of said last inductance at said operating frequency, the reactance of said resistance and of said last inductance being low as compared to the reactance of said condenser.

3. In a high frequency push-pull amplifier circuit, comprising a pair of electron discharge devices, each having anode, grid and cathode circuits, a source of input voltage supply connected to the grid circuit of said electron discharge devices, means for tuning the grid circuit to the frequency of the input voltage, three compressed air dielectric condensers, each one having inherent inductance and capacities in series with the condenser capacitive elements which may reduce parasitic oscillations, means for neutralizing each one of said grid circuits of the electron discharge devices including one of said compressed air dielectric condensers, means for tuning the anode circuit of said electron discharge devices including an inductance, a variable air dielectric condenser and the third one of said compressed air dielectric condensers, which is included in a shunt circuit across the anode circuit, said shunt circuit also including means to eliminate said parasitic oscillations which are caused by the inherent inductance and capacities of said compressed air dielectric condensers, said means including an inductance and a resistance connected in parallel and in series with said third compressed air dielectric condenser, the resistance being of a value higher than the reactance of said inductance at the frequency to which said grid circuit is tuned, the reactance of the resistance and the inductance being low as compared to the reactance of said compressed air dielectric condensers.

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