

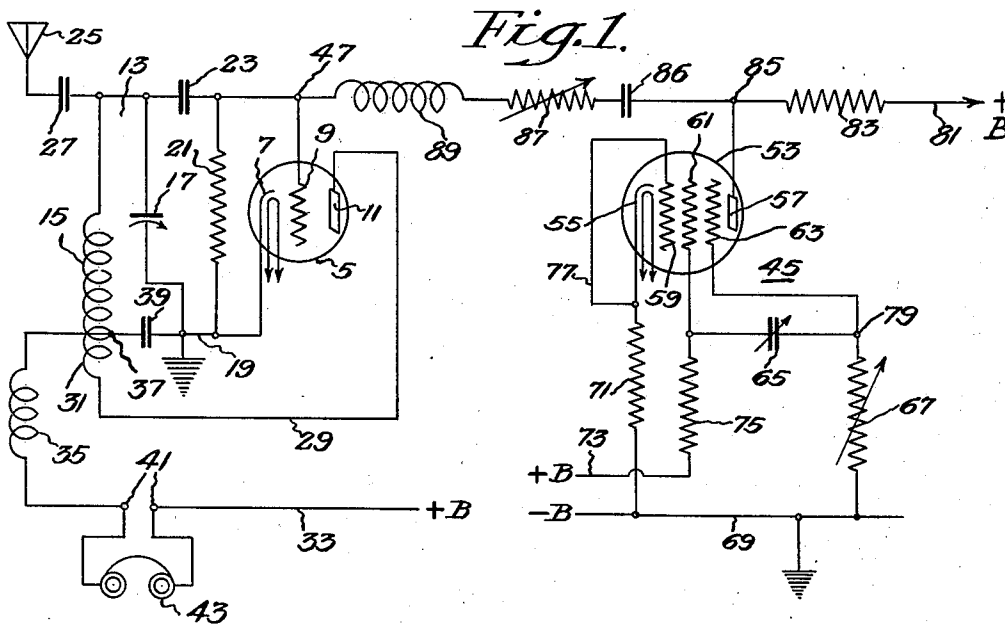
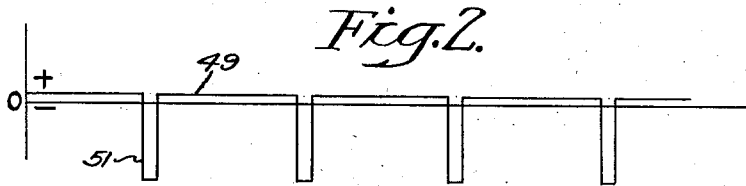
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QUENCHING OSCILLATOR FOR SUPERREGENERATIVE RECEIVERS

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QUENCHING OSCILLATOR FOR SUPER-REGENERATIVE RECEIVERS

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10 Claims. (Cl. 250—20)

The present invention relates to a quenching oscillator for super-regenerative receivers and has for its primary object to provide means for quenching the radio frequency oscillations of a super-regenerative receiver at a very rapid rate without losing receiver sensitivity.

The sensitivity of a super-regenerative receiver is a function of the ability of the local oscillator to vary its amplitude in accordance with the modulation of an incoming signal. If the positive portion of the quenching cycle is too short the radio frequency oscillator will not have time to build up oscillations of sufficient amplitude, and if too long the oscillations will reach a steady state and will not be able to reproduce the signal modulation. It is, therefore, a further object of the present invention to provide a quenching oscillator for a super-regenerative receiver which will provide optimum duration for the positive portion of the quenching cycle for best sensitivity. This has been found to depend upon the rate at which the radio frequency oscillator can build up oscillations and upon the decrement of the radio frequency oscillator circuit.

As the frequency of the usual sine-wave quenching oscillator is increased much beyond audibility, the duration of the positive half-cycle is not sufficient to permit the radio frequency oscillations to build up sufficiently for full sensitivity. Accordingly, it is a further object of the present invention to provide a quenching oscillator system which provides preferably a wave form having a long positive portion and a relatively short negative portion, thereby permitting quenching at rapid rates above the rate normally considered practicable.

The invention will, however, be better understood from the following description when considered in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the drawing, Figure 1 is a schematic circuit diagram of a super-regenerative receiver embodying the invention, and

Fig. 2 is a curve representing the wave form at present preferred and as provided by the system of Fig. 1 for quenching the radio frequency oscillations.

According to Fig. 1, a super-regenerative receiver comprising an oscillating detector 5 of the electric discharge type comprising a cathode 7, a control grid 9 and an anode 11 is connected with the tuned signal circuit indicated at 13. The latter comprises the inductance 15 and shunt

variable tuning capacitor 17 connected between the cathode 7 by a ground lead 19, and the control grid 9 through a grid leak and condenser means 21—23. The antenna for applying received signals to the circuit 13 is indicated at 25 and is coupled to the high potential side of the circuit through a coupling capacitor 27 of relatively low capacity.

Feed back control for the anode 11 is provided through an anode circuit 29 connected with a feed back winding 31 forming a continuation of the winding 15 and anode potential is applied thereto from a supply lead 33 and a choke coil 35 to a tap point 37 between the windings 15 and 31. The ground lead 19 is isolated from the anode circuit through a block capacitor 39.

Signal output terminals 41 are provided in the supply lead 33 to which may be connected any suitable output device such as a pair of headphones 43. The super-regenerative circuit described represents any suitable super-regenerative receiver to which a quenching frequency is to be applied. In the present example the quenching frequency is supplied from an oscillator 45 through connection with the grid 9 as indicated at 47.

The oscillator ordinarily provided in connection with such circuits is usually satisfactory when the signal frequency is high, for example, about 60 megacycles and the quenching frequency is low, for example, about 15,000 cycles. Under such conditions a quenching oscillator of the sine-wave type embodying inductance and capacity tuning means will provide a relatively high degree of sensitivity. In the present system, however, a lower signal frequency is contemplated and the quenching frequency is increased to accommodate higher modulation frequency prevalent at the present time. Under this condition the positive portion of a normal sine wave cycle soon becomes too short for the radio frequency oscillations to reach optimum value and loss of sensitivity results. Therefore, a quenching wave form having a relatively long positive portion and a relatively short negative portion is desired. Stated in other words negative impulses of high amplitude and short duration occurring at relatively high frequency with respect to the highest signal modulation frequency are necessary. Under this condition, the positive half-waves are relatively long and of minimum amplitude, forming intervals between the impulses.

A wave form which is at present preferred is that shown in Fig. 2 at 49 having a square wave form and negative impulses or half-waves 51 of a

relatively short duration and high amplitude thereby providing a relatively, low amplitude, long positive half-waves between impulses.

Any impulse generator which will produce a negative impulse or half-wave of short duration with respect to the positive half-wave may be used but it has been found that an oscillator of the type known as a relaxation oscillator is preferable as its frequency is determined by the series combination of a resistor and a capacitor rather than an inductor and a capacitor. For example, a multivibrator type of resistance-capacity oscillator may be used. The frequency of impulses may be increased up to a limit determined by the tube capacity.

Such an oscillator is shown in 45 in connection with the super-regenerative receiver circuit and comprises a suitable electric discharge amplifier device 53 having a cathode 55, an anode 57, a control grid 59, a screen grid 61 and a suppressor grid 63. The oscillator circuit comprises a variable capacitor 65 and a variable resistor 67 connected in series between the screen grid 61 as an oscillator grid and the cathode 55, the cathode connection including a grounded lead 69 and a bias resistor 71 in series with the oscillator circuit elements 65 and 67. Positive potential is applied to the oscillator or screen grid 61 from a positive supply lead 73 through a coupling resistor 75. The control grid is connected to cathode through a lead 77. The suppressor grid 63 as an oscillator anode is connected to the junction between the capacitor 65 and resistor 67 as indicated at 79. A positive operating potential is applied from a supply lead 81 through a coupling resistor 83 to the anode 57 and connection is made at 85 through a coupling capacitor 86, a variable resistor 87 and a radio frequency choke coil 89 with the terminal 47 for applying the quenching oscillations to the super-regenerative circuit. The capacitor 86 serves to isolate the anode potential from the grid of the detector and the resistor is variable to control the amplitude of the oscillations applied to the detector. Radio frequency current is prevented from leaving the detector by the choke coil 89.

The impulse frequency of the relaxation oscillator or impulse generator 45 is largely determined by the time constant of the circuit 65, 67 and the duration of the negative impulse is determined by the value of the capacitor. Therefore, for any quenching frequency, the quenching cycle can be proportioned to best suit the oscillating detector. The negative impulses appear at the anode, which is not included in the oscillator circuit per se, and are applied to the detector at an electrode which serves to suppress the oscillations, such as the grid, in the present example.

Maximum quenching frequencies up to 100,000 times per second, and with maximum sensitivity, may be obtained with a pentode type of tube shown. It is not feasible to reduce the negative impulse indicated at 51 of Fig. 2 sufficiently to maintain sensitivity because of the internal tube capacitance which may remain when the capacity of the device 65 is reduced to zero. Complete quenching may, however, be obtained as high as 200,000 turns per second but with lowered sensitivity.

This system is therefore of benefit when the quenching frequency or quenching impulses must be relatively rapid and when the signal frequency is relatively low whereby long positive portions

are obtained with relatively short high amplitude negative impulses as shown in Fig. 2. The system has the further advantage that the circuit elements are relatively few in number and comprise only variable resistors and capacitors and a degree of control limited only by the tube capacitance.

I claim as my invention:—

1. In a super-regenerative receiver, an oscillating detector, means for applying thereto a quenching signal comprising a series of high frequency impulses, and means for limiting said impulses to negative half-waves of relatively high amplitude and of short duration with respect to the positive half-wave intervals therebetween.

2. In a super-regenerative receiver, the combination with an oscillating detector, of an oscillator, means for applying a quenching signal from the oscillator to the detector, means for operating said oscillator to provide a quenching signal having a relatively high frequency with respect to the signal modulation frequency, and means for controlling said oscillator to limit said quenching signal to negative half-wave impulses of relatively high amplitude and of relatively short duration with respect to positive half-wave intervals between impulses.

3. In a super-regenerative receiving system, a square wave form quenching oscillator, means for limiting the output of said oscillator to high frequency negative half-wave impulses of relatively short duration with respect to the positive half-wave intervals between impulses, and means for controlling the duration and frequency of said impulses.

4. In a super-regenerative receiving system, the combination with an oscillating detector, of an oscillator comprising an electric discharge device including oscillator electrodes and an output anode, a substantially non-inductive frequency determining circuit coupling said oscillator electrodes and including resistance and capacity elements only, one of said elements being variable, means for deriving from the anode a quenching signal comprising a series of high frequency negative half-wave impulses of relatively short duration with respect to positive half-wave intervals therebetween and means for variably applying said impulses to said detector.

5. The combination with a super-regenerative oscillating detector for receiving modulated high frequency signals, of means for applying thereto a substantially square wave form quenching signal comprising successive negative half-wave impulses of relatively high amplitude and of relatively short duration with respect to the time between impulses occupied by the positive half-waves and at a rate higher than the highest signal modulation frequency.

6. The combination with a super-regenerative oscillating detector for receiving modulated high frequency signals, of means for applying thereto a quenching oscillatory signal comprising successive negative electrical half-wave impulses of relatively high amplitude and of relatively short duration with respect to the time between impulses occupied by the positive half-waves and at a rate higher than the highest signal modulation frequency, said last named means comprising an oscillation generator including an electric discharge tube having an anode, a cathode, and oscillator electrodes therebetween independent of the anode, an oscillator circuit coupling said oscillator electrodes and the cathode and including non-inductive tuning elements, means

for operating said oscillator whereby said negative impulses appear on the anode and means for coupling said anode to said detector.

7. In a super-regenerative receiving system, an
5 oscillation generator providing a quenching signal
oscillation generator, said generator including an
oscillator tube and a relaxation oscillator circuit having capacity and resistance connected between two of the electrodes thereof and with
10 the capacity of such low value as to approach
the value of the internal capacity of the tube
between said electrodes thereby to produce at
the anode a quenching signal comprising negative
half-wave impulses of minimum time duration
15 and positive half-wave extended intervals
of minimum amplitude in each cycle.

8. In a super-regenerative receiving system, an
oscillation generator providing a quenching signal
oscillation generator, said generator including
20 an oscillator tube and an oscillator circuit
having capacity and resistance connected between two of the electrodes thereof and with
the capacity of such low value as to approach
the value of the internal capacity of the tube
25 between said electrodes thereby to produce at
the anode a square wave form quenching signal

comprising negative half-wave impulses of minimum time duration with respect to the positive half-waves of said signal, an oscillating detector comprising an electric discharge device having
5 an electrode for suppressing oscillations, means
for coupling said electrode with the anode of the
oscillation generator and means for varying said
coupling.

9. In a super-regenerative receiving system,
the combination as defined in claim 4, further
10 characterized by the fact that one of the oscillator electrodes is more negative than the cathode of said device whereby said device is operative to produce strong oscillations.

10. In a super-regenerative receiver, an oscillating detector for received modulated carrier
15 waves, means for applying to the detector a quenching voltage wave comprising a series of half-wave voltage impulses at a frequency higher than the modulation frequency, and means for
20 limiting the form of the voltage wave to negative impulses of relatively high amplitude and of short duration with respect to the positive half-wave intervals therebetween.

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