

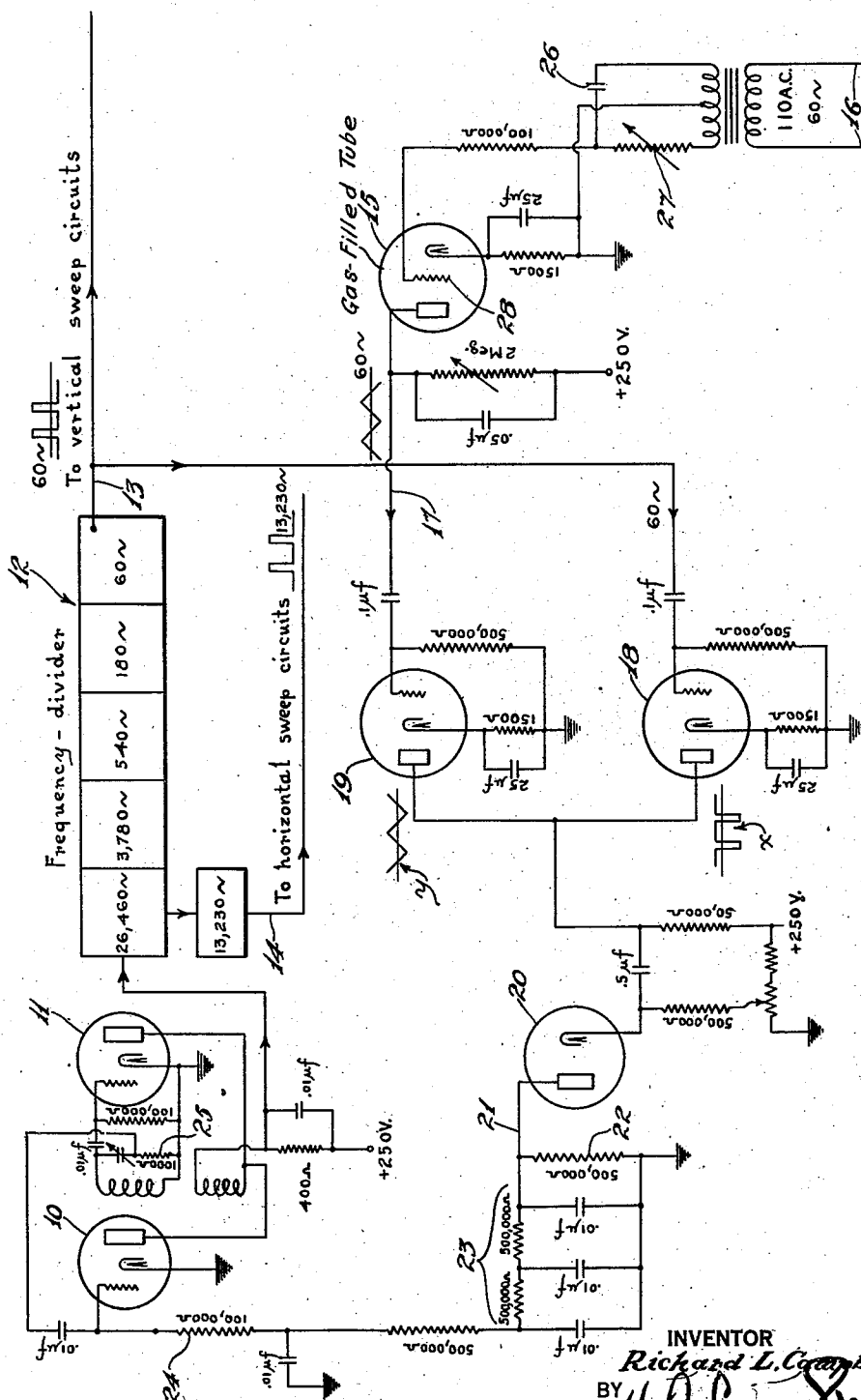
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SYNCHRONIZING GENERATOR

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SYNCHRONIZING GENERATOR

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My invention relates to improvements in synchronizing generators of the type more particularly adapted for controlling the horizontal and vertical deflecting circuits in television communicating systems using cathode-ray tubes.

One of the objects of my invention is to provide an improved generator of the character referred to in which the relation of the two frequencies is maintained more accurately and in a simpler way than has been the case heretofore.

Other objects and advantages will hereinafter appear.

The drawing is a simplified, diagrammatic showing of a synchronizing generator constructed and operating in accordance with my invention.

In the drawing, the reference numeral 10 designates a frequency-control tube for a master oscillator 11 which is adjusted to generate an electrical wave at 26,460 cycles. A frequency-reducing or frequency-divider circuit 12 which is supplied from the master oscillator as represented, and which may be of any suitable, conventional construction, operates to derive in the output line 13 electrical synchronizing pulses at 60 cycles for the vertical sweep circuits, and electrical synchronizing pulses at 13,230 cycles in the output line 14, for the horizontal sweep circuits.

A "Thyratron" 15, controlled with a 60-cycle alternating-current line 16, generates a 60-cycle saw-tooth wave in the output line 17. The tube 15 is gas-filled.

The 60-cycle pulse output from the line 13 is applied to the grid of an amplifier tube 18, and the 60-cycle saw-tooth wave in the output line 17 from the "Thyratron" 15 is applied to the grid of an amplifier tube 19. The tubes 18 and 19, which supply a detector tube 20, constitute a "mixer" circuit in which the 60-cycle pulse and the 60-cycle saw-tooth wave are added. There is thus developed, in the output line 21 from the detector, a direct-current potential which varies in accordance with the relative phase conditions of the two waves. This varying direct-current potential is applied, as shown, to the grid of the frequency-control tube 10.

In operation, a variation in the detector voltage operates to change the grid voltage of the control tube 10 and shift the master oscillator frequency in one direction or the other, depending upon which way the detector voltage varied. If the frequency of the line 16 decreases, the voltage applied to the control tube 10 becomes less negative, which accordingly reduces the frequency of the master oscillator, and consequently the frequency of the synchronizing pulses in the

output line 13. If the master oscillator circuit tends to change in frequency, it is automatically corrected in the same manner.

The plate of the diode 20 is grounded through a suitable load resistor 22, and in this way a negative voltage is maintained with respect to ground. The negative voltage varies in accordance with the position of the wave x superimposed upon the wave y .

Through a suitable filter 23, which removes components of the waves x and y in the output from the diode 20, such output is applied to the low end of the grid resistor 24 associated with the frequency-control tube 10. Across the resistor 24 is fed a quadrature component of the oscillator voltage, obtained by inserting a resistor 25 in series with the tank condenser, as shown. The quadrature voltage from the tank circuit is amplified in the tube 10 and fed back to the plate of the oscillator 11. In operation, the control-tube grid voltage is 90 degrees leading the oscillator grid voltage, and in the plate it is reversed 180 degrees, so that it then has the same electric effect as would a variable negative inductance shunting the tank inductance. An occurring variation in this voltage will, accordingly, vary the oscillator tank tuning, and correspondingly vary the frequency. When the detector output changes, therefore, the frequency of the master oscillator 11 is changed in the proper direction to correct the frequency difference which caused the detector output voltage to shift in the first instance.

By means of the condenser 26 and the variable resistance 27, the phase of the voltage applied to the "Thyratron" grid 28 may be controlled with respect to the phase of line 16.

Some of the salient features and advantages of my improved synchronizing generator may be summarized as follows:

The tube 11 and associated parts constitute a resonantly-tuned oscillator, which generates a sine wave.

Use of a gaseous triode, such as the tube 15, provides constant output voltage regardless of voltage fluctuations in line 16. This provides a more stable frequency-control action. In other words, the saw-tooth voltage output from tube 15 is of constant amplitude, whereas the wave in supply line 16 is not.

It is sometimes desirable to use a source of standard frequency on the grid of tube 15 which is not sinusoidal. The saw-tooth voltage output of tube 15 is independent of input wave form, and therefore this device will operate on standardiz-

ing voltages of more than one character, without changes in the general arrangement of the circuits of tubes 15, 18, 19 and 20. In some of the synchronizing generators used heretofore, for example, as in the system disclosed in Patent No. 2,132,654 issued October 11, 1938 to Smith, a sine-wave source must be used. My generator works satisfactorily on any kind of a source regardless of wave form, and use of a saw-tooth wave is one of the simplest ways of obtaining the desired results.

The control action in my improved generator can be made to take place over a linear slope of the saw-tooth wave, instead of over a small portion of a sine curve in a particular part of the cycle, such as in the synchronizing generators used heretofore, for example, as in the system disclosed in the Smith patent referred to.

As an alternative, in my improved generator extremely sharp range of control can be obtained by operation of control over the "fly-back" portion of the saw-tooth wave. This is desirable in some cases where precise phase conditions must be maintained with the power supply system.

The advantages obtained by my improved synchronizing generator are not dependent upon the fact that the tubes 18 and 19 are amplifiers, nor is amplification necessary.

The frequency-control tube 10 requires relatively less power to control the master frequency because no appreciable current is taken by the grid of tube 10, whereas in the system disclosed in the Smith patent referred to, control voltage is fed to a 2000 ohm resistor. For this reason, in my improved generator, a more sensitive frequency-control action results. The frequency-control tube 10 in my generator is a potentially-operated device for the master oscillator 11, whereas Smith's 2000 ohm resistor associated with the oscillator T1 T2 is a current-operated device.

In synchronizing generators such as is disclosed in the Smith patent referred to, a multivibrator type of master oscillator is used, whereas in my improved generator the master oscillator is resonantly-tuned, and gives a sine wave. In these prior art systems, therefore, the desirable control arrangement and action embodied in my improved synchronizing generator cannot be used.

The various values of resistance and capacity are given by way of example only, and may be changed to suit particular requirements.

It will be appreciated that modifications of the disclosed embodiment of my invention are possible without departing from the spirit of my invention or the scope of the claims.

I claim as my invention:

1. In a synchronizing generator, a resonantly-tuned master oscillator for generating an electrical wave at a relatively high frequency, a frequency-reduction circuit supplied from said oscillator and operating to derive from said electrical wave electrical pulses occurring at a relatively low frequency, an alternating-current supply at said low frequency, an electronic device to which said alternating-current supply is applied and operating to convert the electrical wave of said supply to an electrical wave of a substantially different shape and of substantially constant amplitude, means supplied with said pulses and with said second-named electrical wave and operating to develop a resultant direct-current potential which varies in accordance with occurring variations in the relative phase conditions of said pulses and said second-named electrical wave, a frequency-control tube coupled to said master

oscillator and operable to vary the frequency of the latter in either direction, and a connection for applying said direct-current potential to the grid-circuit of said frequency-control tube.

2. In a synchronizing generator, a resonantly-tuned master oscillator for generating an electrical wave at a relatively high frequency, a frequency-reduction circuit supplied from said oscillator and operating to derive from said electrical wave electrical pulses occurring at a relatively low frequency, an alternating-current supply at said low frequency, a saw-tooth wave generator controlled from said supply, amplifier tubes supplied respectively with said pulses and with the saw-tooth wave and having a common output circuit, a rectifier tube the input circuit of which is supplied from said common output circuit and operating to develop a resultant direct-current potential which varies in accordance with occurring variations in the relative phase conditions of said pulses and said saw-tooth wave, a frequency-control tube coupled to said master oscillator and operating to vary the frequency of the latter in either direction, and a connection for applying said direct-current potential to said frequency-control tube to govern operating action of the same.

3. In a synchronizing generator, means for developing electrical pulses at a relatively high frequency and at a relatively low frequency respectively, a source of supply of an electrical wave substantially at said low frequency, an electronic device to which said wave is applied and operating to convert the same to an electrical wave of a substantially different shape than the shape of said first-named wave and of substantially constant amplitude, means responsive both to the pulses at said relatively low frequency and to said second-named electrical wave at said low frequency and operating to derive therefrom a resultant control effect, and connecting means for applying said control effect to said first-named means to vary the frequency of operation thereof in accordance with occurring variations in said control effect.

4. In a synchronizing generator, means for developing electrical pulses at a relatively high frequency and to a relatively low frequency respectively, a source of supply of an electrical wave substantially at said low frequency, an electronic device to which said wave is applied and operating to convert the same to a substantially saw-tooth electrical wave of substantially constant amplitude, means responsive both to the pulses at said relatively low frequency and to said substantially saw-tooth electrical wave at said low frequency and operating to derive therefrom a resultant control effect, and connecting means for applying said control effect to said first-named means to vary the frequency of operation thereof in accordance with occurring variations in said control effect.

5. In a synchronizing generator, means for developing electrical pulses at a relatively high frequency and a relatively low frequency respectively, a source of supply of an electrical wave substantially at said low frequency, an electronic device to which said wave is applied and operating to convert the same to a substantially saw-tooth electrical wave of substantially constant amplitude, an amplifier tube to the input circuit of which the pulses at said relatively low frequency are applied, an amplifier tube to the input circuit of which the substantially saw-tooth electrical wave is applied, said tubes having a com-

mon output circuit, a rectifier tube supplied from said common output circuit and operating to derive therefrom a resultant control effect, and connecting means for applying said control effect to said first-named means to vary the frequency of operation thereof in accordance with occurring variations in said control effect.

6. In a synchronizing generator, means for developing electrical pulses at a relatively high frequency and at a relatively low frequency respectively, said means including a resonantly-tuned master oscillator and a frequency-control device coupled to said oscillator, a source of supply of an electrical wave substantially at said low frequency, an electronic device to which said wave

is applied and operating to convert the same to a substantially saw-tooth electrical wave, an amplifier tube to the input circuit of which the pulses at said relatively low frequency are applied, an amplifier tube to the input circuit of which the substantially saw-tooth electrical wave is applied, said tubes having a common output circuit, a rectifier tube supplied from said common output circuit and operating to derive therefrom a resultant control effect, and connecting means for applying said control effect to said frequency-control device to vary the frequency of operation of said oscillator in accordance with occurring variations in said control effect.

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