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OSCILLATION GENERATOR

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Fig. 1

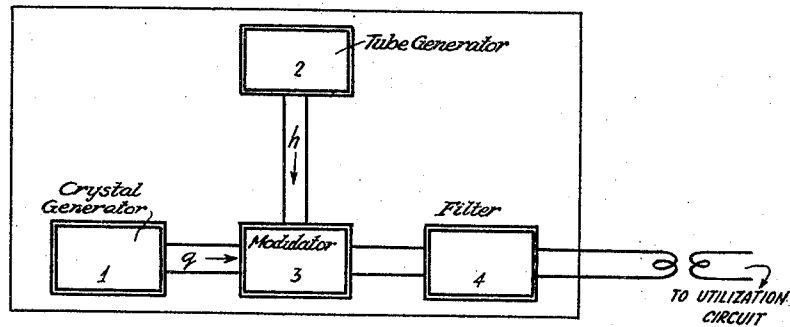


Fig. 2

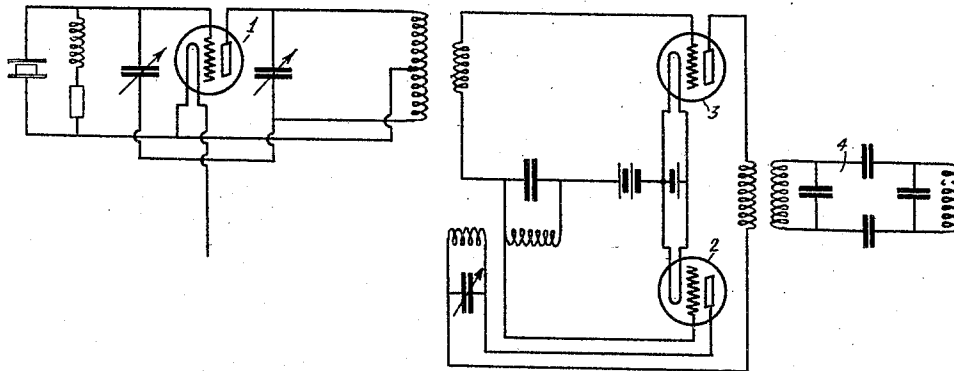
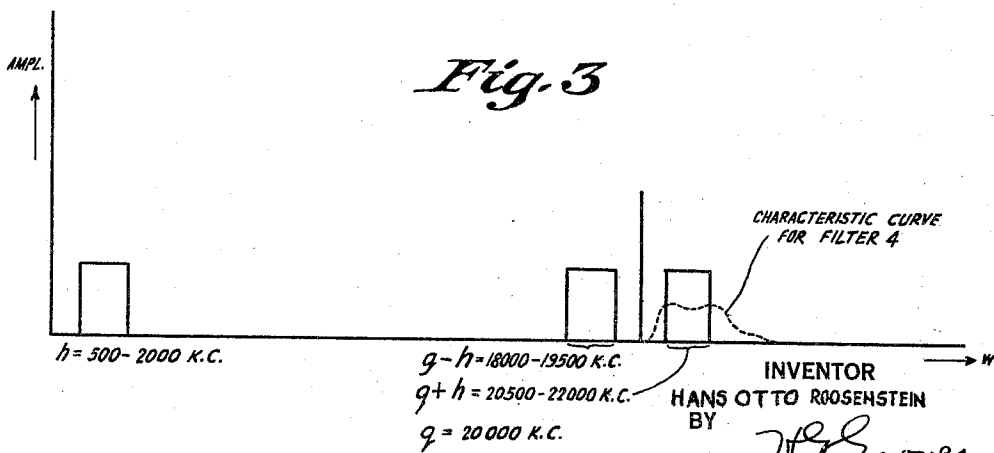


Fig. 3



UNITED STATES PATENT OFFICE

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OSCILLATION GENERATOR

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For the production of short waves, as is well known from the prior art, crystal-controlled thermionic-tube generators are employed, and these offer the practical advantage that they insure an almost absolutely constant wave-length. Now in practical work, the problem to vary the carrier frequency of a transmitter within certain narrow limits, arises quite frequently; and, a crystal-controlled transmitter does not lend itself readily to such variation.

The present invention is concerned with a transmitter arrangement which furnishes a useful frequency, which latter, while being extremely stable, is also adapted to be varied quite readily. According to this invention, the transmitter outfit consists of the combination of a mechanically controlled and preferably crystal controlled thermionic generator and a generator which is not subject to crystal control, that is, most suitably a self-excited thermionic transmitter or in other words, an electrically controlled generator. The auxiliary generator which produces a substantially lower frequency than the crystal-controlled thermionic transmitter, is employed for the modulation of the wave of the crystal controlled transmitter; and, from among the ensuing oscillations, one side band is separated by a filter circuit or equivalent means, and used in the useful or load circuit. By changing the frequency of the auxiliary generator, this working or useful frequency can be easily varied within definite limits. For instance, if the frequency of the crystal controlled transmitter is q and the modulating frequency of the auxiliary generator h , there result these two frequencies: $q+h$ and $q-h$ one of which is utilized.

In the accompanying drawing, Fig. 1 diagrammatically illustrates the invention; Fig. 2 is wiring diagram therefor; and, Fig. 3 is a graph explanatory thereof.

A fundamental circuit scheme is shown in Fig. 1 wherein a modulator 3 is influenced by two wave generators, the crystal controlled generator 1 and the vacuum tube regeneratively connected generator 2 and where the desired wave is separated by means of a filter circuit 4.

It is obvious that the working or useful frequency is extremely stable inasmuch as in the presence of fluctuations of the frequency of the auxiliary generator (the wave length of the crystal controlled transmitter being admissibly considered absolutely constant) the percentage variations of the useful frequency are essentially lower than when the useful frequency were generated without a stable crystal generator. For instance, if the stable frequency $q=20000$ kilocycles, and the modulation frequency variable inside the range 500-2000 kilocycles, then the useful or working frequency is capable of variation inside a range between 18000-19500 and 20500-22000 kilocycles, as explained graphically in Fig. 3 where the abscissæ stand for the frequency ω and the ordinates for the amplitudes.

One specific embodiment of the basic idea of the invention is shown in Fig. 2 by way of example where the tube arrangement or assembly 1 denotes the crystal controlled transmitter, the tube 2 the auxiliary generator, tube 3 the modulator tube, and 4 is the filter circuit. The arrangement according to the invention may be employed in transmitter apparatus and in receiving apparatus since, as is well known, in many receiver apparatus the production of an auxiliary wave, for instance, for heterodyning is necessary and since also this heterodyne wave must be variable.

The invention is also useful for fading elimination. By wobbling the frequency of generator 2, the carrier output is wobbled and may be used to good advantage for fading elimination.

Then again, by properly choosing the frequency of generator 2, each of the sidebands produced may be used to separately transmit the same or preferably different signals without interference. Separation of the side bands for use as carriers may be accomplished by the use of filters.

I claim:

1. Apparatus for the generation of substantially constant frequency oscillations comprising a mechanically controlled oscillator having a high degree of frequency sta-

bility, an independent non-mechanically controlled oscillator arranged to generate frequencies which are relatively low compared to the frequencies generated by said mechanically controlled oscillator, means for
5 adjusting the frequency of said independent non-mechanically controlled oscillator, and a modulator having input and output circuits for inter-modulating waves from
10 said oscillators, said input circuit being coupled to both said oscillators, and a selector circuit coupled to the output of said modulator for choosing a desired wave from the output of said modulator.

15 2. In a system comprising a high frequency piezo-crystal oscillator and a relatively low adjustable frequency oscillator, the method of producing a wave whose frequency is variable over a range which is small
20 compared to the frequency of said crystal and yet having substantially the same degree of frequency stability as the frequency of the wave produced by said crystal oscillator, which consists in intermodulating waves
25 from said high frequency crystal controlled oscillator with waves from said relatively low adjustable frequency oscillator, thereby producing waves of side band frequencies, and selecting a wave of a desired side band.

30 3. In a system comprising a substantially constant vacuum tube oscillator whose frequency is controlled by a mechanical resonant device, and an independent adjustable frequency oscillator whose frequency is low
35 relative to the frequency generated by said vacuum tube oscillator, the method of obtaining a wave whose frequency is variable over a range which is small compared to the frequency of said vacuum tube oscillator and
40 yet having substantially the same degree of frequency stability as the frequency of the wave produced by said vacuum tube oscillator, which comprises intermodulating waves from said high frequency vacuum tube oscillator with waves from said relatively low
45 adjustable independent oscillator, thereby producing waves of side band frequency and selecting a wave from a desired side band.

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