Nov. 8, 1932. J. M. MILLER 1,886,571

RADIO RECEIVING SYSTEM

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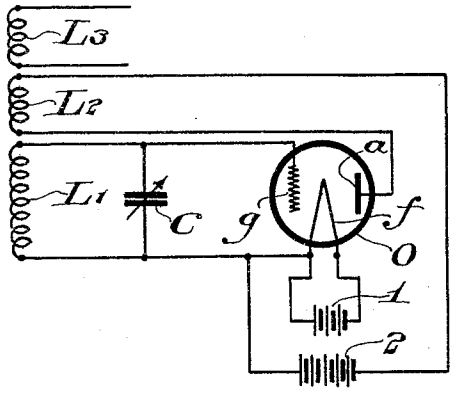


Fig. 1.

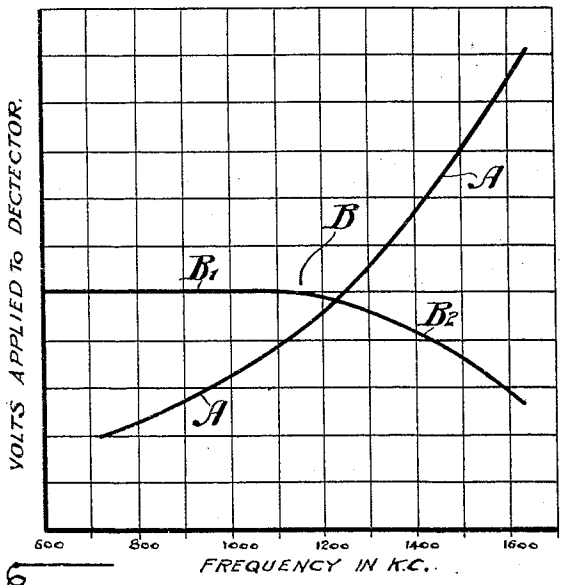


Fig. 2.

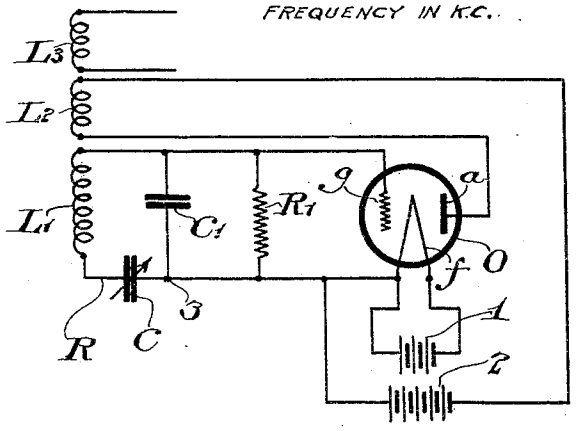


Fig. 3.

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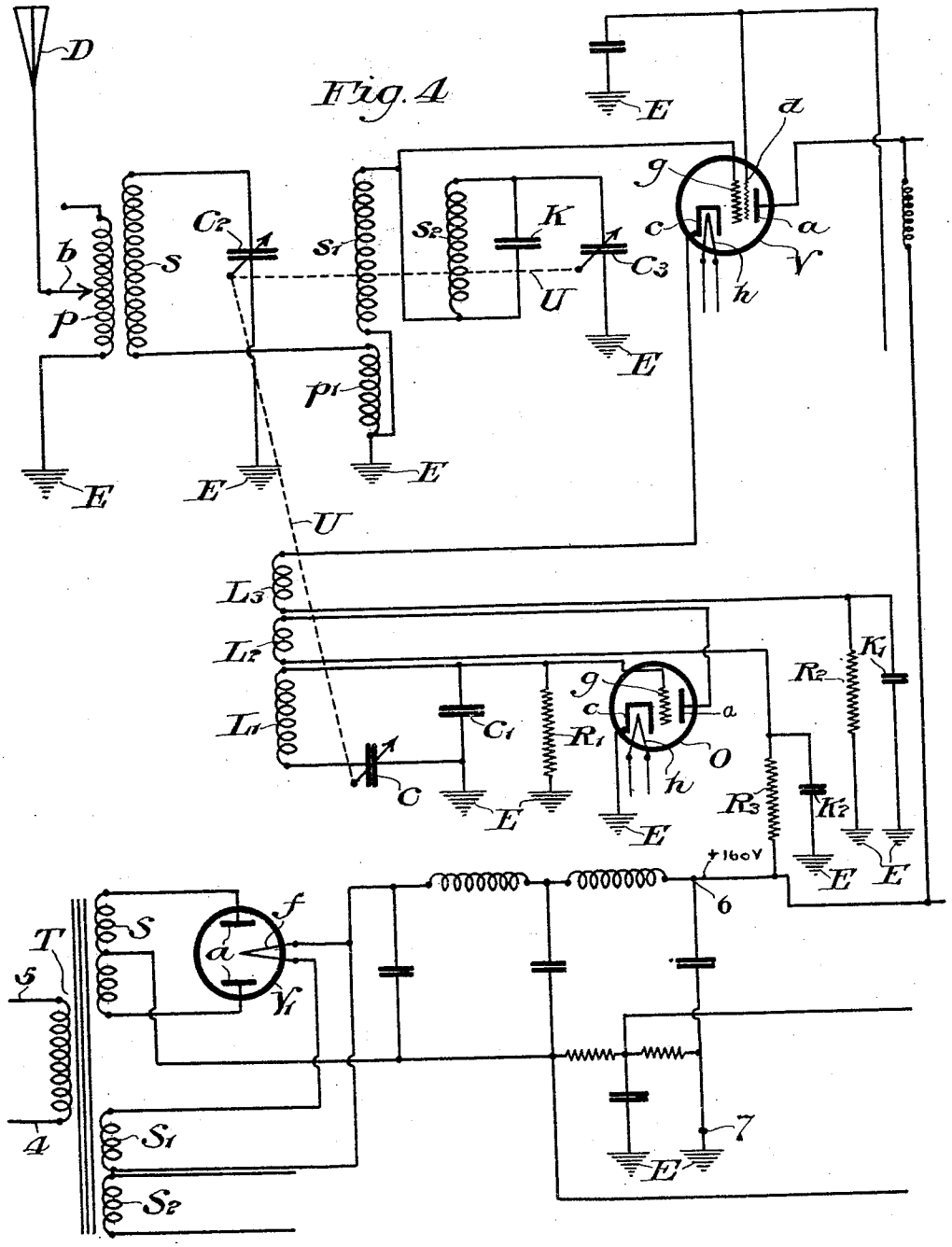
By

Nov. 8, 1932. J. M. MILLER 1,886,571

RADIO RECEIVING SYSTEM

Filed July 23, 1930 2 Sheets-Sheet 2

Fig. 4



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Patented Nov. 8, 1932 1,886,571

UNITED STATES PATENT OFFICE

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RADIO RECEIVING SYSTEM

Application filed July 23, 1930. Serial No. 470,016.

My invention relates to radio receiving systems or sets in which beats are produced by interaction of locally produced oscillations with the oscillations representing the received signals; and more particularly to superheterodyne receiving systems or sets, for reception of broadcast speech and music.

In accordance with my invention, the local oscillator of the receiver, comprising a vacuum tube having regeneratively magnetically coupled output and input circuits, is given such characteristics that the voltage impressed upon or in advance of the input circuit of a detector is substantially constant or varies within suitably narrow limits throughout a substantial range of frequencies of the oscillations locally generated.

In accordance with my invention, there is imparted to the local oscillator system of the receiving apparatus such characteristics that throughout the range of frequencies of the locally produced oscillations the oscillator system continues near the threshold of non-oscillation, yielding oscillations which are feeble or of suitably low amplitude, reducing undesirable radiation or re-radiation, and whose effect, as represented by the voltage impressed upon or in advance of the input circuit of the detector, is of substantially constant magnitude or varies within narrow limits throughout the aforesaid range of frequencies.

In accordance with my invention, the oscillator system is such that the amplitude of the oscillations produced, or the magnitude of the voltage impressed upon or in advance of the input circuit of the detector, is dependent substantially solely upon the radio or high frequency resistance of the tunable loop circuit of the input system of the oscillator, and the input resistance or impedance remains, throughout the range of frequencies of the oscillations generated, of such magnitude, or varies within such narrow limits, that the voltage impressed upon or in advance of the input circuit of the detector is substantially constant throughout a substantial range of frequencies of the locally generated oscillations, or even decreases with increase of frequency of those oscillations due to effective increase of said resistance. This is in contra-distinction from the ordinary local oscillator heretofore commonly used in heterodyne receivers, of which it is characteristic that the voltage impressed upon the detector rapidly increases with increase of frequency of the locally generated oscillations.

In accordance with my invention, there is bridged across the control grid and cathode of the oscillator tube a condenser, preferably of fixed capacity, which is in series in a loop with an inductance and a condenser, the latter variable as to its capacity for varying the frequency of the locally produced oscillations. The system has such characteristics that the frequency of the locally generated oscillations is closely dependent solely upon the capacity of the variable condenser, which makes practical a uni-control receiver or set in which the adjustable element of oscillator variable condenser is mechanically coupled for operation in unison with the adjustable element or elements of one or more variable condensers utilized in tuning a circuit or cascaded circuits, in advance of the detector, to the frequency of the signal representing oscillations.

More particularly, the aforesaid fixed condenser, in series with the variable condenser and inductance, has the important function of rendering the oscillator frequency substantially independent of variations in tube characteristics and their effects, which vary materially, even though the tubes be of the same manufacture or type; substantially independent of variations in line or plate voltage or in filament current; and, in general, substantially independent of those effects which have material influence upon the oscillator frequency and the beat frequency when the input electrodes are connected to the

terminals of the commonly used loop comprising an inductance shunted by a variable condenser. As a result of utilizing a fixed condenser in the aforesaid relation, the simultaneous adjustment of the condensers of the signal selecting system and the oscillator circuit of the receiver effects selection of the desired signal and generation of oscillations of the proper frequency to produce a beat frequency corresponding to the frequency for which the intermediate amplifier of the receiver is tuned.

Further in accordance with my invention, there is disposed in the input circuit of the oscillator tube a resistance so positioned and of such magnitude as to render more constant throughout the range of frequencies of the locally generated oscillations the input resistance or impedance of the oscillator tube; and more particularly, such resistance serves also to prevent intermittent cessation of generation of oscillations, particularly adjacent the low frequency end of the frequency range.

My invention resides in a system of the character hereinafter described and claimed.

For an understanding of my invention, and for an illustration of some of the various embodiments thereof, reference is to be had to accompanying drawings, in which:

Fig. 1 is a diagrammatic illustration of the commonly used local oscillator system.

Fig. 2 comprises curves or graphs illustrating the characteristics of a system generally illustrated by Fig. 1 and of my improved system.

Fig. 3 is a diagrammatic view of a local oscillator system having characteristics utilizable in accordance with my invention in radio reception of the character herein described.

Fig. 4 is a diagrammatic view of a portion of a superheterodyne radio receiving system, in accordance with my invention.

Referring to Fig. 1, O is a thermionic vacuum tube having control grid *g*, anode or plate *a*, and cathode *f*, which, in this instance, is a filament maintained at suitable temperature by current from the source 1. In the grid or input circuit is an inductance L1, shunted by the variable condenser C, forming a tunable loop whose terminals are connected to the grid and cathode. In the anode or plate circuit is an inductance L2, coupled to L1, with the usual source 2 of plate circuit current supply. This system comprises magnetically coupled input and output systems, causing regeneration to the point of production of oscillations whose frequency is to substantial extent, but not substantially entirely, dependent upon the capacity of variable condenser C, though the frequency is dependent upon other factors, including variations in voltage of the source 2, and in characteristics of the tube O and their effects. Coupled to the inductance L1 is an inductance or coil L3 across whose terminals appears a voltage which may be impressed upon the input circuit of the detector of a heterodyne or superheterodyne system. That voltage, across the terminals of the coil L3, increases rapidly as the condenser C is adjusted to smaller and smaller capacities to produce oscillations of higher and higher frequencies.

The curve A, Fig. 2, in a general way represents the voltage-frequency characteristic of such an oscillator. The voltage impressed upon the detector in such case rises very rapidly with increase in frequency, and this is undesirable, particularly in superheterodyne reception.

For the purposes of my invention, I utilize an oscillator system of the character illustrated in Fig. 3, which is a modification of Fig. 1 in that there is bridged across the grid and cathode a condenser C1, preferably of fixed capacity. The input terminals of the tube O are no longer bridged across the terminals of the condenser C, but are connected respectively to one terminal of the tunable loop, as before, and to a point 3 between the condenser C1 and the variable condenser C, which in effect is in series with C1 across the terminals of the inductance L1. A system of this character has improved characteristics, as compared with Fig. 1, for utilization in heterodyne or superheterodyne reception, as will presently appear. In addition there is preferably utilized a resistance R1 shunted across grid and cathode with beneficial effects later described.

A system, such as illustrated in Fig. 3, is utilized, in accordance with my invention, in radio receiving sets in which a beat frequency is produced, and particularly in superheterodyne sets for receiving broadcast signals including music and speech. The oscillator is required to produce oscillations of frequencies varying from say 680 to 1630 kilocycles, to produce a constant beat or intermediate frequency of, say, 130 kilocycles, for the present broadcast frequencies ranging from 550 to 1500 kilocycles. While my invention is not limited to these particular frequencies, either of the broadcast range or of the local oscillator, they serve as an illustration of an application of my invention.

Referring to Fig. 2, the voltage across the terminals of the coil L3 varies with frequency generally in accord with the characteristic curve B, having the portions B1 and B2. The part B1 shows that the voltage applied to the detector is substantially constant throughout a considerable portion of the frequency range of the oscillator. Portion B2 shows that the system has a characteristic opposite to that indicated by the curve A, illustrative of Fig. 1, in that the voltage impressed upon the detector actually decreases with further increase of frequency, or through the high frequency portion of the range. The character-

istic B is decidedly advantageous as compared with the characteristic, such as curve A, particularly in broadcast reception by the superhetrodyne method where it is desirable that the voltage impressed upon the first detector of a superhetrodyne system shall be constant or vary within suitably small limits, which is the case represented by the characteristic B. With commonly used oscillators, such as indicated by Fig. 1, the voltage impressed upon the detector may increase in some instances as much as twenty times between the lowest and highest frequencies of the entire range. Characteristic A represents a more moderate change of voltage of the order of five times. Characteristic B shows a variation of about 2, and it would be much less except for the effects which cause the downwardly curving portion B2, which is entirely due to the oscillator system or circuit itself, but generally is caused by other influences or effects due to practical considerations in the production of superheterodyne receiving sets.

Figure 4 represents a portion of a superheterodyne receiving system, in accordance with my invention, in which there is applied a local oscillator system of the character shown in Fig. 3.

In Fig. 4, D represents an antenna or other suitable absorption structure. In this case between the antenna D and earth E or ground, or equivalent counter capacity, or the metal chassis of a receiving set, is included the primary *p* to different taps on which connects the antenna switch *b* to suit the receiving system to antennas of different characteristics or lengths. Coupled to the primary *p* is the secondary *s*, in circuit with which is the primary *p*1. In shunt to *s* and *p*1 is the tuning condenser C2 for tuning the circuit to the frequency of the signal oscillation. Coupled to the primary *p*1 is the secondary *s*1, in series with which is an inductance *s*2, both shunted or bridged by the condenser C3 variable to tune this cascaded circuit to the frequency of the signal oscillations. In shunt to the inductance *s*2 is a condenser K.

V is the first detector, of a superheterodyne system, having a control grid *g*, cathode *c*, maintained at suitable temperature by the electric heater *h*, and the plate or anode *a*, and shield or screen grid *d*. The control grid is connected to a point between the inductances *s*1 and *s*2, while the cathode is connected through the coil or secondary L3 and grid biasing resistance R2, shunted by condenser K1, to ground E, or other terminal of the loop tuned by the condenser C3.

To the output circuit of the detector V is coupled the input circuit of an intermediate frequency amplifier tube, with which may be cascaded one or more similar intermediate frequency amplifier tubes, the plate circuit of the last of which is coupled to the input of the second detector tube. The coupling of the output of each intermediate frequency amplifier to the input of the next tube is tuned to a narrow band of frequencies, within which lies the intermediate frequency, yielding high selectively, as disclosed in my copending application Serial No. 465,603, filed July 3, 1930. The output circuit of the second detector is operatively related to a signal translating instrument, commonly a loud speaker, either directly or generally through one or more stages of audio frequency amplification. The intermediate frequency amplifiers, second detector, etc., are not illustrated, since that arrangement is per se well known.

The local oscillator O in this instance is provided with a cathode *c*, heated by the electric heater *h*. It will be understood, however, that the oscillator tube may have as its cathode a filament *f* as in Fig. 3. The parts of the oscillator are generally the same with the action and characteristics of a system such as illustrated by Fig. 3. The plate circuit is coupled by coil L2 to the coil L1 of the input circuit, under conditions producing oscillations. The coil L3 in the detector input circuit is coupled with the inductance L1, to impress upon the detector V a voltage of radio frequency differing to fixed extent from the signal frequencies to which the condensers C2 and C3 tune their respective circuits. As indicated by the broken line U, the rotors or adjustable elements of the three condensers C1, C2 and C3 are mechanically coupled in unison, so that as the cascaded circuits are tuned to the signal frequency, the condenser C is varied as to its capacity in such amount as to cause the frequency of the oscillations produced by generator O always to differ to fixed extent from the signal frequency, thereby yielding a constant beat or intermediate frequency.

In the example illustrated, for the power for heating the cathodes and supplying current to the plate circuits of the various tubes of the set, there is provided a transformer T whose primary is connected across the commercial alternating current lighting or power lines 4 and 5. The secondary S has its terminals connected to the anodes *a* of the rectifier tube V1 whose filament or cathode *f* receives its current from the secondary S1. The rectified current is passed through a filter system comprising a suitable arrangement of inductances and capacities, yielding at the terminals 6 and 7 a rectified filtered current delivered to the plate circuits of the tubes O, V, and of the other tubes of the system. Between the positive terminal 6 and the earth E, or terminal 7, may exist a difference of potential of 160 v., which may be the maximum utilized on the plate circuit of any of the tubes in the system. In the plate circuit of the oscillator O, in series with the coil L2, is a resistance R3 shunted by con-

denser K2, of suitable magnitude, say 10,000 ohms, which keeps the plate current of the tube O from rising to high magnitude, or regulates the plate current. The resistance R3 is of such magnitude that the effective voltage impressed upon the plate circuit of the tube O is of the order, of, say 100 volts, the tube O being of the type now commonly known as UY227 or C327.

The secondary S2 of the transformer T supplies current for the heaters *h*, of the several tubes, for maintaining their cathodes at suitable temperature. In lieu of cathodes *c*, filaments such as *f*, Fig. 3, may be utilized, in which case they receive their current from the secondary S2, or a secondary similar or in addition thereto.

A local oscillator having the desirable characteristics for the purposes herein described and claimed, may comprise, with tube of the type aforesaid, coils L1, L2 and L3, having inductances respectively, of 190, 13 and 3.5 microhenries. The mutual inductance between the coils L1 and L2 is of the order of 32 microhenries, while the mutual inductance between coils L1 and L3 may be of the order of 6 microhenries. For producing oscillations of frequencies within the range of, say 680 to 1630 kilocycles, the capacity of the variable condenser C will vary between 50 and 400 micro-microfarads, the condenser C1 having a capacity of 1200 micro-microfarads, and the resistor R1 having a resistance of about 50,000 ohms.

The capacity of the condenser C1, very high in comparison with the grid-cathode capacity of the tube O, is considerably in excess of the maximum capacity of the variable condenser C.

When the loop circuit L1, C, C1 is adjusted by variation of condenser C for any frequency within the frequency range of the locally generated oscillations, of the total potential difference, the portion across the condenser C1 will be roughly inversely proportional to the ratio of the capacity of condenser C1 to the then capacity of the condenser C. The difference of potential across the terminals of condenser C1, which is the potential effective across the grid and cathode of the tube O, is a maximum for the lowest frequency of the range, and decreases to a minimum for the highest frequency. The voltage impressed upon the input electrodes of the oscillator O, therefore, varies with the frequency, and in such sense that the voltage impressed upon the input electrodes of the tube O decreases relatively with increase of frequency of the generated oscillations.

In a system of the character illustrated by Fig. 1 this relation does not obtain, for the voltage impressed upon the input electrodes of the oscillator tube is always equal to that across the terminals of the tunable loop, i. e., across the terminals of the variable condenser C, a relation upon which very largely depends the fact that the voltage impressed upon the detector by an oscillator, such as shown in Fig. 1, rapidly increases with the frequency of the locally generated oscillations.

With an oscillator system of the character of Fig. 3, oscillations are generated when

$$\frac{MGm}{RC1}$$

is equal to or greater than unity, where M is the mutual inductance between the grid and plate coils L1 and L2, Gm is the mutual conductance of the tube O, C1 is the capacity of the condenser C1, and R is the high or radio frequency resistance effectively in series in the resonant loop L1, C, C1.

The ratio of

$$\frac{M}{R}$$

is so chosen that, at the highest frequency of the range, the system will produce oscillations. At the highest frequency the magnitude of R is a maximum, decreasing with decreasing frequency. The ratio of

$$\frac{M}{R}$$

is, in a practical case such as illustrated in Fig. 4, so chosen that oscillations will be produced at the highest frequency notwithstanding usual or reasonable variations in voltage of the supply line 4, 5.

The magnitude of the oscillatory current, or the amplitude of the oscillations produced, decreases with increasing frequency, offsetting the effect of the inductive coupling L1, L3 which produces a voltage across the terminals of the secondary L3 which increases with the frequency of the oscillations, even if their amplitude remain constant. In consequence, as illustrated by the substantially straight portion B1, of the characteristic B, Fig. 2, the decrease of amplitude of the oscillations with increasing frequency offsets the opposite characteristic of the inductive coupling to the detector.

The resistance factor R, above referred to, increases with increasing frequency, and in the high frequency portion of the range the rate of increase in resistance with increase of frequency is so high that the amplitude of the oscillations produced decreases at such high rate that notwithstanding the aforesaid characteristic of the inductive coupling to the detector, the voltage impressed upon the detector may, as indicated by the portion B2 of the characteristic curve B, materially decrease with increasing frequency. The condition, represented by the portion B2 of the characteristic, is ascribed to the cumulative effects with increasing fre-

quency of departure from 90 degrees difference in phase between the currents in the grid and plate coils L1 and L2, of approach to resonance at the higher frequencies of the circuit of coil L3, of the increase of resistance of the conductor of the coil L1, of the dielectric and other losses of the condensers and other elements of the circuit, and of resistance representing losses occasioned by metal masses adjacent the oscillatory system or kindred causes.

In an oscillator system of this character, with a chosen mutual inductance between grid and plate coils, only the resistance varies with frequency, and for production of oscillations of highest frequency the relations are such that their amplitude is small, and throughout the range to the lowest frequency, the amplitude increases though in general small, with a high magnitude of input impedance. With such relatively feeble oscillations there arises the advantage that the radiation or re-radiation from the receiving system is small, with a minimum of disturbing effect upon neighboring circuits or receiving systems.

In general, the oscillator throughout the frequency range operates relatively closely to the threshold of non-oscillation.

It is a further characteristic that the variation of frequency of the oscillations generated is dependent to unusualy high degree solely upon the magnitude of the capacity of the variable condenser C, assuming other circuit constants fixed. The frequency is not materially affected by the characteristics of the oscillator tube O, as they may vary between different specimens of the same type. The frequency is not substantially affected by variations in the grid-cathode capacity of the tube, nor is the frequency substantially affected by changes in voltage of the supply source, as circuit 4, 5, which ordinarily cause considerable changes in frequency by resultant variations in plate voltage and cathode temperature.

The resistance R1, in shunt to the condenser C1, serves as a leakage path from the grid of the oscillator tube. It preferably has relatively low magnitude as of the order of 50,000 ohms, making the input impedance of the system more uniform throughout the frequency range. In addition, it prevents intermittent interruption in the generation of oscillations, particularly at the low frequency end of the range.

Where the variation of frequency of the oscillations generated is not dependent substantially solely upon the variation of the capacity of the condenser C, Fig. 1 for example, the coupling of the rotor or adjustable element of that condenser in a uni-control with the adjustable elements of the tuning condensers such as C2 and C3, Fig. 4, causes variation in the beat or intermediate frequency of the receiving system, which in the case of a tuned intermediate frequency amplifier is undesirable.

By utilizing in a heterodyne or superheterodyne system, however, in accordance with my invention, a local oscillator system of the character described, in which the variation of frequency of the generated oscillations is dependent practically solely upon the capacity of the variable condenser C, there obtains a substantially fixed difference between the frequencies of the signal and locally generated oscillations with substantially fixed beat or intermediate frequency throughout the range of frequencies of the received signals to which the receiving system is tunable. In particular, in such uni-control, the frequency of the local oscillator is substantially independent of variations in characteristics of the vacuum tube employed, and independent of changes in voltage of the supply source.

It is of great practical importance, in a superheterodyne system, as herein described, that the local oscillator system have the characteristics hereinbefore described, and in particular that the variation of frequency of the locally generated oscillations shall be dependent substantially entirely upon or strictly related to the capacity of the variable condenser C. It is particularly desirable that the oscillator have this characteristic when utilized in a superheterodyne system provided with highly selective systems, one in advance of the first detector and tunable to the desired signal frequencies, and the other following the first detector and highly selective of the beat frequency. For this purpose it is of importance and highly desirable, particularly in a uni-control system, such as described, that the frequency of the oscillator always differs to substantially strictly the same extent throughout the range of desired signal frequencies, to yield a substantially strictly constant beat frequency to co-act with and have full advantage of the highly selective intermediate frequency amplifier system.

I claim:

1. In a heterodyne receiving system, a detector, means for impressing thereon signal-representing oscillations, a local oscillator comprising a vacuum tube having an output system coupled to its input system, inductance and a plurality of condensers, one of fixed capacity, all in series with each other in a loop in said input system, connections from the terminals of said condenser of fixed capacity to the input electrodes of said tube, means for varying the capacity of another of said condensers to vary the frequency of the locally generated oscillations, and means for impressing upon said detector a voltage produced by the locally generated oscillations and varying within narrow limits through-

out the frequency range of the locally produced oscillations.

2. In a heterodyne receiving system, a detector, means for impressing thereon signal-representing oscillations, a local oscillator comprising a vacuum tube having an output system coupled to its input system, inductance and a plurality of condensers, one of fixed capacity, all in series with each other in a loop in said input system, connections from the terminals of said condenser of fixed capacity to the input electrodes of said tube, means for varying the capacity of another of said condensers to vary the frequency of the locally generated oscillations, means for impressing upon said detector a voltage produced by the locally generated oscillations and varying within narrow limits throughout the frequency range of the locally produced oscillations, and a resistance connected in parallel with said condenser of fixed capacity and in series with said inductance and said variable condenser in series.

3. In a heterodyne receiving system, a detector, means for impressing thereon signal-representing oscillations, a local oscillator comprising a vacuum tube having an output system coupled to its input system, inductance and a plurality of condensers, one of fixed capacity, all in series with each other in a loop in said input system, connections from the terminals of said condenser of fixed capacity to the input electrodes of said tube, means for varying the capacity of another of said condensers for varying the frequency of the generated oscillations, the characteristic of the oscillator being such that the oscillations produced are throughout the frequency range of the generated oscillations of low amplitude decreasing with increase of frequency, and an inductive coupling through which the locally produced oscillations impress upon said detector a voltage which varies within narrow limits throughout the frequency range of the locally generated oscillations.

4. In a heterodyne receiving system, a detector, means for impressing thereon signal-representing oscillations, a local oscillator comprising a vacuum tube having in its input system a loop comprising an inductance and a plurality of condensers, all in series, one of said condensers variable to vary the frequency of the locally generated oscillations, another of said condensers having a capacity large with respect to that of said variable condenser, connections from the terminals of said last named condenser to the input electrodes of said tube, an inductance in the output system of said tube coupled to said inductance, and means for impressing upon the detector a voltage produced by the locally generated oscillations.

5. In a heterodyne receiving system, a vacuum tube detector, means for impressing thereon signal-representing oscillations, a local oscillator comprising a vacuum tube having an output system coupled to its input system, a loop in said input system comprising an inductance and a plurality of condensers, all in series with each other, connections from the terminals of one of said condensers to the input electrodes of said oscillator tube, a commercial power system supplying cathode-heating and plate currents for said detector and oscillator tubes, an inductive coupling between said inductance and the input of said detector tube, and means for varying the capacity of another of said condensers for varying the frequency of the locally generated oscillations, said one of said condensers having a capacity large with respect to the capacity of said variable condenser, said oscillator system having such characteristic that the amplitude of the locally generated oscillations decreases with increase in their frequency and the voltage impressed upon said detector tube remains substantially constant throughout the frequency range of the locally generated oscillations and substantially free of variation due to variations of voltage of said power system.

6. In a superheterodyne receiving system, a first detector, an intermediate or beat frequency amplifier, and a second detector, a selector system for tuning to signal-representing oscillations varying in frequency throughout a range, said selector system comprising at least one variable tuning condenser, a local oscillator comprising a vacuum tube, a loop in the input system thereof comprising inductance and a plurality of condensers all in series, one of said condensers having a capacity, large with respect to the variable capacity of another of said condensers, connections from the terminals of said one of said condensers to the input electrodes of said tube, the local oscillator system having such characteristic that the frequency of the oscillations generated is varied substantially solely by the capacity of said variable condenser, an inductive coupling through which the locally generated oscillations impress a voltage upon said first detector, means for mechanically coupling the adjustable elements of said tuning condenser and of said variable condenser of the oscillator system, the characteristic of the oscillator system being such that the voltage impressed upon said first detector varies within narrow limits throughout the range of frequency of the locally generated oscillations and that throughout the frequency range of signal-representing oscillations the locally generated oscillations have a frequency causing said intermediate frequency to be constant.

7. In a superheterodyne receiving system, a first detector, a selector system in advance of said detector tunable to signal-representing oscillations, said selector system comprising

at least one variable tuning condenser, a second detector, a highly selective intermediate frequency amplifier between said detectors, a local oscillator comprising a vacuum tube, a loop in the input circuit thereof comprising inductance and a plurality of condensers, all in series, one of said condensers having a capacity large with respect to the variable capacity of another of said condensers, connections from the terminals of said one of said condensers to the input electrodes of said tubes, a coupling through which the locally generated oscillations impress a voltage upon the first detector, and means for mechanically coupling the adjustable elements of said tuning condenser and said variable oscillator condenser for movement in unison to effect selection of signals in advance of the first detector and impression of the signals at beat frequency upon the second condenser, the characteristic of the oscillator system being such that, as the frequency of the generated oscillations is determined substantially solely by the capacity of the variable condenser of the oscillator system, the beat frequency is constant and within the range of the selective intermediate frequency amplifier.

8. In a superheterodyne receiving system, a first detector, a selector system in advance of said detector tunable to signal-representing oscillations, said selector system comprising at least one variable tuning condenser, a second detector, a highly selective intermediate frequency amplifier between said detectors, a local oscillator comprising a vacuum tube and a variable condenser for varying the frequency of the generated oscillations, means mechanically coupling the adjustable elements of the condensers of said selector system and local oscillator for movement in unison, and means for insuring that the beat frequency is within the narrow range of said selective system comprising a loop in the input circuit of said oscillator including an inductance in series with said second variable condenser and a condenser of relatively large capacity connected to input electrodes of said oscillator tube.

9. In a heterodyne receiving system comprising a detector tube and an oscillator tube for generating local oscillations and having in association with a pair of its electrodes a resonance loop of inductance and variable capacity, the method of ensuring that the voltage impressed upon the detector tube by the locally generated oscillations is substantially independent of adjustments of said variable capacity, which comprises impressing upon said pair of electrodes of the oscillator tube a potential difference whose magnitude is dependent upon the potential difference across a fixed capacity in series with said variable capacity within said resonance loop, and impressing the locally generated oscillations through an inductive coupling upon the detector.

10. In a superheterodyne receiving system comprising a first detector, a tuned intermediate frequency amplifier system, a preselector system, in advance of the first detector, including at least one adjustable tuning device, and an oscillator tube having in association with a pair of its electrodes a resonance loop of inductance and a condenser variable in unison with said tuning device of the preselector system, the method of insuring, notwithstanding variations in oscillator tube characteristics or changes in voltage of the source supplying current to the oscillator tube, that simultaneous adjustment of said tuning device and said condenser shall effect selection of desired signals and local generation of oscillations to produce beats of the frequency to which said intermediate frequency amplifier system is tuned, which comprises impressing upon said pair of electrodes of the oscillator tube a difference of potential dependent upon the difference of potential across a fixed capacity in series within said loop with said variable condenser.

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