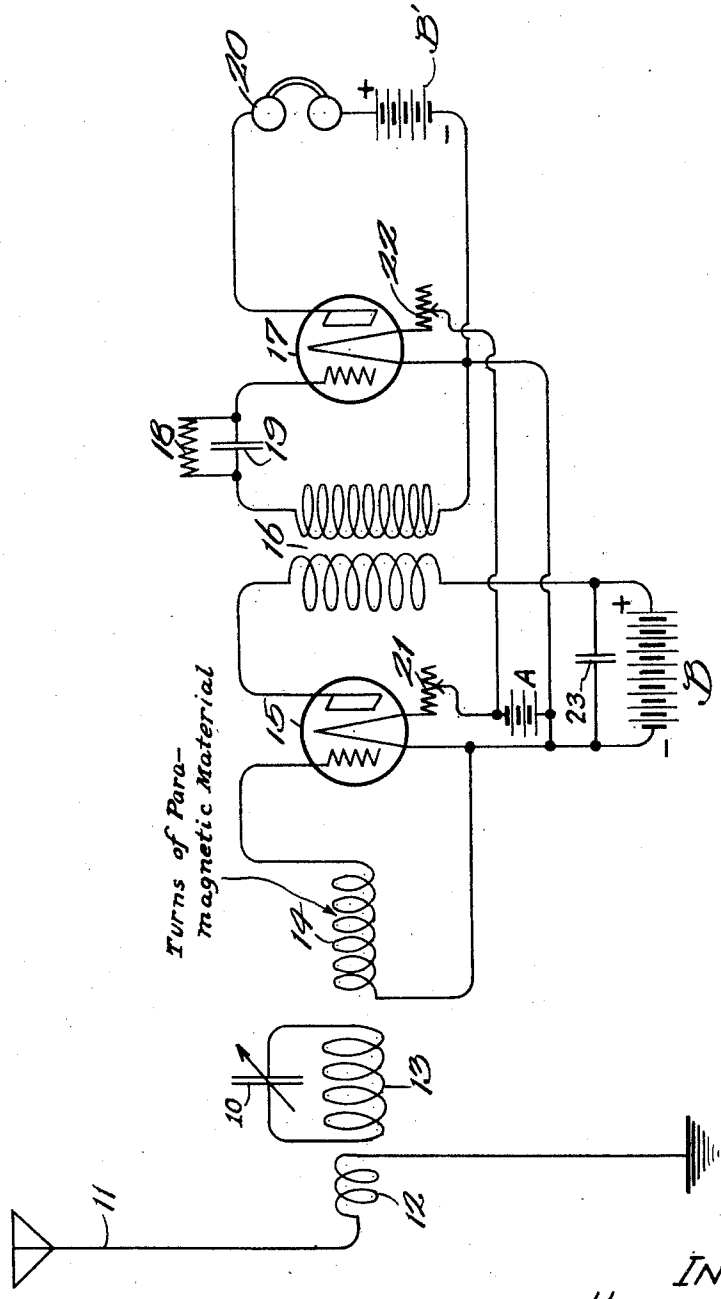
Dec. 31, 1929. H. B. BABSON ET AL 1,741,493

HIGH FREQUENCY COMMUNICATING SYSTEM

Filed Aug. 25, 1926



INVENTORS
HENRY B. BABSON
GEORGE WARICK ANKERSEN
BY Cheever & Cox
ATTYS

Patented Dec. 31, 1929

1,741,493

UNITED STATES PATENT OFFICE

HENRY B. BABSON AND GEORGE WARICK ANKERSEN, OF CHICAGO, ILLINOIS

HIGH-FREQUENCY COMMUNICATING SYSTEM

Application filed August 25, 1926. Serial No. 131,408.

This invention relates to high frequency communicating systems, and its particular object is to provide means for accomplishing the selective and uniform reception of a band of frequencies of a sufficient breadth for satisfactory radio reception with a sharp attenuation as between such frequencies and frequencies lying on either side of this band. This is of especial utility in the reception of the speech frequencies broadcasted by the radio frequency transmitting systems in that it is desirable to distinguish sharply between stations operating on closely adjacent carrier frequencies and still to receive with substantially equal energy amplitudes all frequencies within the breadth of the acoustic spectrum or frequency range with which the carrier wave of each station is modulated. The object of the invention, therefore, in its application to radio receiving systems is to provide a method and means for receiving a substantially flat-topped and sharp-sided band of frequencies, the position of which band in the frequency scale may be adjusted to coincide with the position in the frequency scale of the particular station that is being received.

When selectivity as between stations is accomplished through the medium of a tuning circuit of a high degree of selectivity, the peak of the selective resonant curve may be so sharp as to cut off or unequally attenuate the modulating frequencies representing the higher tones or overtones. We have discovered that by associating with such a sharply resonant tuning circuit a winding, which may be the secondary winding of a transformer of which the resonant circuit winding constitutes one of the windings, and giving this associated winding the desired characteristics by making its turns or convolutions of magnetic or para-magnetic material, the magnetic characteristics of the material of the winding react upon the associated resonant tuning circuit in a way which gives it the desired characteristics, and in a way which seems to be essentially different from the effect produced where the material of the associated winding is of a non-magnetic or dia-magnetic material.

In order to illustrate one embodiment of the invention, reference is made to the accompanying drawing which shows the application of the invention to a radio receiving circuit. In the circuit illustrated in the drawing the antenna 11 is connected with ground by way of the antenna coil 12. Associated with the antenna coil 12 is a resonant tuning circuit including the tuning coil 13 and the variable condenser 10. The grid coil 14 is in inductive association with the tuning coil 13, and has one end connected with the grid of the thermionic amplifier 15 while the other end of the grid coil is connected with one terminal of the amplifier filament. The plate circuit of the thermionic amplifying tube 15 extends from the positive terminal of the B battery through the primary winding of a high frequency transformer 16 to the plate of the tube. The secondary winding of the transformer 16 has one terminal connected with the grid of the thermionic director 17 by way of the usual gridleak 18 and grid condenser 19, while the other terminal is connected with the filament of the detector. The plate circuit of the detector includes the battery designated B′ and the telephonic receiving apparatus 20, which is indicated as an ordinary telephone head set. The current for heating the filaments of the amplifier tube 15 and detector tube 17 is supplied by the A battery, in the usual way, the amount of current flowing through the filaments being regulated by the filament rheostats 21 and 22 respectively. A bypass condenser 23 is connected across the terminals of the B battery. In accordance with the usual practice the voltage applied to the plate circuit of the amplifier tube is greater than the voltage applied to the plate circuit of the detector tube.

Generally the circuit as thus far described corresponds, in the matter of the energy transferring connection between the antenna and the tube 15, with the circuit disclosed in our copending application Serial No. 80,904, filed January 13, 1926. As disclosed in this earlier filed application, the energy is transferred from the antenna or other collector of high frequency energy through the medium of a series of inductively related coils in

which the relation is such that the tuning function of the combination is segregated in a tuning circuit interposed between the antenna coil and the grid coil, the object being to provide an arrangement for permitting sharper tuning and a higher degree of selectivity by relegating the tuning function to a circuit set free to the greatest extent possible from the broadening effect of energy losses in the grid circuit. Such an arrangement is employed in the illustrated embodiment of the present invention wherein the transfer of energy is not directly from the antenna coil 12 to the grid coil 14, but is effected intermediately through the interposed resonant variable tuning circuit containing the tuning coil 13 and the variable condenser 10.

With a tuning circuit of this sort, it is possible to make the tuning so sharp, that is, to make, the resonant tuning curve so narrow at its peak, that there is unequal attenuation of the frequencies in the outlying parts of the band representing the audio frequency modulation of the carrier wave. It has been found that if the grid coil 14 is made up of wire of magnetic material, and preferably of iron wire, there is a very noticeable improvement in the quality of reception. In one practical embodiment of the invention, which has given excellent results in operation, the antenna coil is made up of ten turns of No. 22 copper wire 2¾″ in diameter, the tuning coil consists of 48 turns of No. 22 copper wire about 3″ in diameter, and the grid coil consists of 30 turns of iron wire, .003 inches in diamter, the grid coil being of a diameter of about 2 inches. In this specific arrangement that is being described as an illustration, the antenna coil is placed inside one end of the tuning coil, and the grid coil is placed inside the other end of the tuning coil, the convolutions of the antenna coil lying close to the convolutions at one end of the tuning coil, and the convolutions of the grid coil being separated to the extent of the difference in the diameters given from the convolutions at the other end of the tuning coil, there being a space intervening between the adjacent ends of the antenna coil and grid coil.

The exact reason for the improvement in reception noted as a result of the use of a grid coil consisting of a small gauge iron wire is not at the present time known with certainty, and a theoretical explanation will therefore not be attempted. But it may be definitely stated as a result of the trials that have already been made that the use of small gauge iron wire or magnetic wire in the grid coil has the effect of markedly improving the action of the circuit with respect to faithful reception of the transmitted audio frequency modulations, presumably by broadening the peak of resonant tuning curve, while at the same time permitting the circuit to remain sharply selective.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. In a high frequency communicating system, including a resonant tuning circuit and a receiving circuit, a transformer for coupling the tuning and receiving circuits, one of the windings of which transformer is of high magnetic permeability.

2. In a high frequency receiver including a resonant tuning circuit and a receiving circuit, a transformer coupling said circuits, one of the windings of which transformer comprises magnetic material to increase the permeability of the magnetic circuit of the transformer whereby to equalize the attenuation of the vibrations transmitted through the transformer to the receiving circuit.

3. In a high frequency communicating system including a resonant tuning circuit and a receiving circuit, a transformer coupling the circuits, said transformer having one of its coils formed of turns of fine iron wire.

4. In a high frequency receiving system, a transformer for transferring energy to the grid circuit of a thermionic tube, the grid circuit winding of said transformer consisting of a plurality of turns of fine wire of a para-magnetic material.

5. A coreless coil, adapted for use in a high frequency system, to couple a tuning circuit to a receiving circuit, said coil, having turns of iron wire so arranged as to number of turns, diameter and pitch as to be limited in its effective response to a comparatively narrow band of frequencies relative to the total available band of radio frequencies.

6. A coreless coil, adapted for use in a high frequency system, to couple a tuning circuit to a receiving circuit, said coil having turns of iron wire.

7. A core-less coil, adapted for use in a high frequency system, to couple a tuning circuit to a receiving circuit, said coil having turns of iron wire whereby the self-inductance of said coil decreases with an increase in frequency.

8. A high frequency system having a pair of coils, one of said coils being included in a low loss resonant circuit, the other coil being included in a non-resonant circuit and formed of iron wire whereby to flatten the peak of the resonance curve of said first coil.

9. In a high frequency receiving system, a transformer for coupling a tuning circuit to an energy receiving circuit, said transformer having a winding comprising fine iron wire included in the energy receiving circuit whereby to transmit audio frequency modulations of radio frequency vibrations to said energy receiving circuit without distortion.

10. In a radio frequency receiving system, a transformer having a winding included in

a resonant tuning circuit and a second winding included in an energy receiving circuit, said second winding comprising fine iron wire whereby to transmit undistorted audio frequency modulations of radio frequency vibrations from the tuning circuit to the energy receiving circuit.

11. In a radio frequency communicating system including an energy receiving circuit and a resonant tuning circuit for receiving radio frequency vibrations and transmitting said vibrations to the energy receiving circuit, a coil formed of fine iron wire arranged in said energy receiving circuit and inductively coupled with a coil arranged in the tuning circuit whereby the energy receiving circuit may receive radio frequency vibrations having audio frequency modulations in which said modulations are substantially undistorted.

In witness whereof, we have hereunto subscribed our names.

HENRY B. BABSON.
GEORGE WARICK ANKERSEN.