

April 21, 1931.

E. W. BALLENTINE

1,801,479

DISTORTION IN RADIO RECEIVING CIRCUITS

Filed March 12, 1928

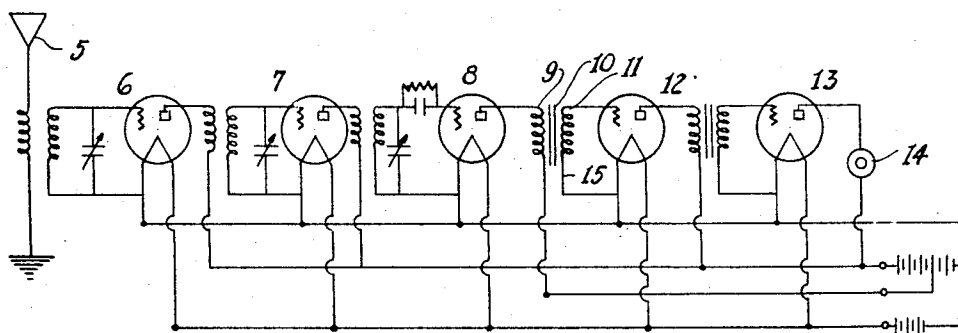


Fig. 1

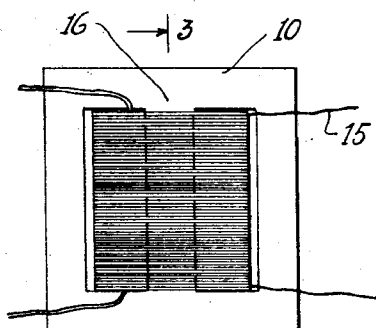


Fig. 2

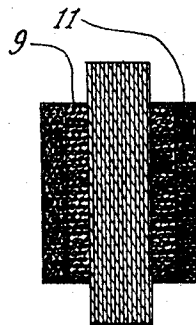


Fig. 3

INVENTOR:
E. W. Ballentine
By *E. J. Andrews*
ATTY.

UNITED STATES PATENT OFFICE

EARLE W. BALLENTINE, OF CHICAGO, ILLINOIS, ASSIGNOR TO GILBY WIRE COMPANY,
OF NEWARK, NEW JERSEY, A CORPORATION OF NEW JERSEY

DISTORTION IN RADIO RECEIVING CIRCUITS

Application filed March 12, 1928. Serial No. 260,895.

This invention relates to distortions in radio receiving circuits and it has for its object providing means for eliminating the objectionable distortions, or the unequal amplification of the frequencies of the audio input circuits. The particular object is to modify the secondary circuits of the audio transformers of the receiving system so as to eliminate, or reduce to a negligible quantity, any abnormal distortions in the circuits which are ordinarily transmitted to the loud speaker. These abnormal effects tend to distort the reproduced sounds of certain pitches, particularly those pitches which correspond to the resonance frequencies of certain portions of the secondary circuits.

Of the accompanying drawings, Fig. 1 is a diagrammatic illustration of a typical radio receiving system which embodies the features of my invention; Fig. 2 is an elevation of a transformer which embodies the features of my invention, with the casing of the transformer removed; and Fig. 3 is a sectional view of the transformer along the line 3—3 of Fig. 2.

Although I have illustrated a certain typical radio receiving system and also a typical audio transformer to be used therewith, yet, it is to be understood that my invention is applicable to any ordinary type of audio receiving systems which transmute the vibrations received into sound vibrations; and it is also applicable to any ordinary type of audio transformer.

When electrical vibrations are broadcast and are received by a radio receiving set, as is understood, electrical vibrations are set up in the various radio circuits and in the detector system, and these vibrations are transformed by the detector of the set into pulsations which correspond in frequency to the pitch of the sounds, the effects of which have been broadcast. These pulsations are then, by means of audio transformers, changed into alternating vibrations which, in turn, are caused to af-

fect the diaphragm or other elements of the head-phone, or the loud-speaker, and the electrical vibrations are thus transmuted into sound vibrations which pass through the air to the ear.

Referring to the drawings, the effect of the broadcast vibrations are received by the antenna 5 and they are transmitted by the radio systems 6 and 7 to the detector system 8. This system 8 imparts pulsations to the primary 9 of the audio transformer 10 and these pulsations produce alternating vibrations in the secondary coil 11 of the transformer. These vibrations, in turn, are amplified by the audio amplifying systems 12 and 13 and the result is transmitted to a loud speaker 14 which transmutes the electrical vibrations into sound vibrations.

The audio transformer 10 comprises a primary coil 9 and a secondary coil 11, both surrounding the same core 16 of the transformer. As the number of turns in the coil 11 is materially greater than the number in the coil 9, the transformer produces an increased electromotive force in the secondary coil circuit 15, and an increased amplification of the electrical vibrations.

It has been found that in such a system, the secondary coil of the transformer often has a tendency to distort more or less the vibrations which it is desired to transmit from one audio amplifying system to another, or from the last audio amplifying system to the loud speaker or other reproducer, and that this distortion occurs particularly in certain higher audible frequencies. By distortion I refer to the unequal amplifications of the various frequencies which the transformer transmits. I have discovered that, by introducing into the turns of the secondary coil of the transformer sufficient extra distributed resistance, this distortion is materially reduced or substantially eliminated. My invention, therefore, consists in introducing such distributed resistance in the turns of the coil itself; and

this I prefer to do by using, instead of the ordinary wire, such as copper wire, for the coil, a special resistance wire which has a resistivity much greater than that of ordinary copper wire.

I have also found that there is a certain critical resistance relative to copper for the turns of wire necessary to eliminate the distortion, above which the effect will be substantially eliminated, and below which there is not much effect on the distortion; and that this critical resistance depends upon the number of turns in the entire coil and also on the size of the wire.

I have found that the distortion of the higher frequencies will be substantially eliminated with a transformer having a primary coil of about 5,000 turns of No. 40 enameled copper wire and a secondary coil of about 15,000 turns of No. 40 enameled wire consisting of an alloy of about 65 parts of copper and 35 parts of zinc and having a specific resistivity of about four times that of copper. The resistance of the secondary in these conditions is somewhat above the critical resistance.

By reducing the size of the wire in the secondary coil, or otherwise changing the properties of the coil a resistivity of the secondary wire of about three times that of copper will also eliminate substantially the distortion of the higher frequencies, as the critical resistance will be exceeded. But if, in either of these cases, the resistivity of the secondary coil wire is reduced materially it will fall below the critical resistance required for the particular conditions and the undesirable effects will not be eliminated.

While I do not wish to be limited to the particular kind of wire that is to be used; or to the number of turns or the size of the wire; yet, I prefer for the secondary coil No. 40 wire composed of an alloy of copper and zinc of about the proportions mentioned above. I find that by substituting such wire for the ordinary copper wire of the secondary coil of the transformer of the audio amplifying system, if the resistance is not below the critical resistance of the coil and wire, the objectionable distortion is substantially eliminated.

It is to be understood, however, that this substitution may be made in one or both of the audio amplifying systems illustrated. Also, that the particular system illustrated is merely typical; and that the same substitution could be made in any audio amplifying system. It is also to be understood that the invention is applicable to audio amplifying systems in general, without reference to the method of receiving, by the transformer, the electrical effects or the method of transmitting the corresponding electrical impulses, or vibrations, or oscillations, or the method

of transmuting such oscillations into other forms of energy.

I claim as my invention:

A transformer comprising a primary coil of about 5000 turns of No. 40 enameled copper wire and a secondary coil of about 15000 turns of No. 40 resistance wire having a specific resistivity of about four times that of copper, the said resistance wire being composed of an alloy of substantially sixty-five parts of copper and thirty-five parts of zinc.

In testimony whereof, I hereunto set my hand.

EARLE W. BALLENTINE.