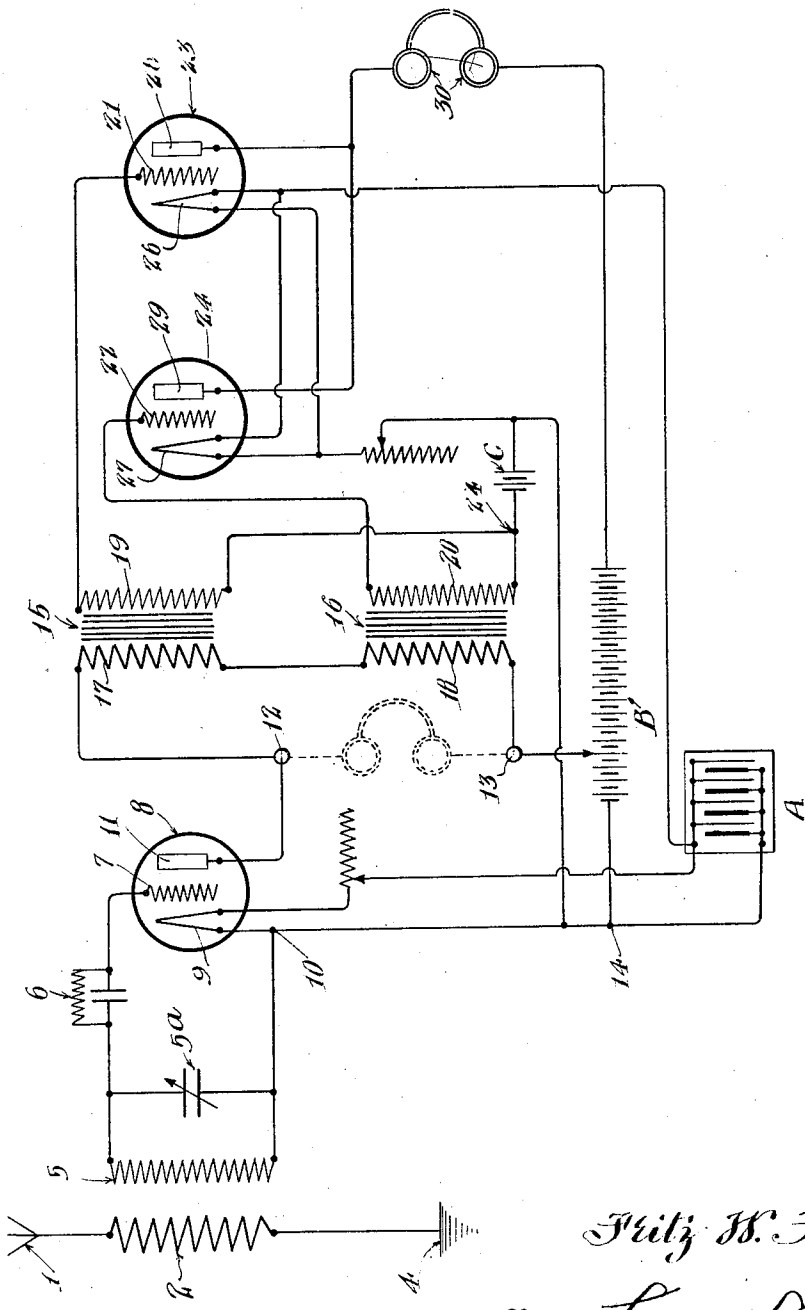
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APPARATUS FOR PRODUCING SOUND

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APPARATUS FOR PRODUCING SOUND.

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This invention relates to improvements in the arrangement and connection of electrical apparatus for the production of sound and more particularly refers to an amplifying apparatus for use in connection with a detector circuit in a radio or wireless receiving apparatus, although it is intended to cover the improved apparatus in whatever connection it is employed.

In a wireless or radial receiver for the production of sound, such as speech or music, it is necessary to simultaneously handle an extremely wide range of frequencies such as from twenty-five cycles per second to six thousand cycles per second. Thus the background which is necessary in orchestral or band music mainly employs low frequencies such as below four hundred cycles per second, whereas the major volume of speech either male or female will range between two hundred and fifty cycles per second and three hundred cycles per second, and certain musical instruments and constant sounds employ frequencies around or above five thousand cycles per second. In the customary transformer coupled amplifiers, these different frequencies are not equally amplified with the result that certain of the frequencies dominate the others and tend to repress the amplification of certain frequencies with the result that the produced sound is greatly distorted and the orchestral and band music appears tinny while the speech is given unnatural twang.

This distortion of sound in the general type of transformer coupled amplifiers is due to a number of causes, such as first, overloading of the transformers employed in the amplifiers with the result that the cores of the transformers become magnetized to or approaching the saturation point, causing distortion in the current delivered to the secondary of the transformer, and second, the vacuum or audion tubes employed in the amplifier are overloaded in such customary transformer coupled amplifiers with the result that the more readily amplified frequencies are emphasized and the less readily amplified frequencies are repressed so that the current delivered from the vacuum or audion tubes into the plate circuit of the transformers is greatly distorted.

An object of this invention is to provide a means for reducing the load upon the amplifying tubes so that the tubes may properly amplify all the desired range of frequencies.

Another object of this invention is to provide means for reducing the load upon the amplifying transformers so that the cores of the transformers will not be magnetized to the saturation point and may induce in the secondary of the transformer the desired range of frequencies without an accompanying distortion of the same.

Other objects of the present invention are to provide means or arrangement of apparatus for producing distortion free amplification which apparatus will be simple in construction and operation.

According to the present invention overloading of the vacuum or audion tubes is eliminated by first, dividing the current to be handled in the amplifier to a plurality of grid electrodes, in place of impressing the entire current upon a single grid and second, by providing a plurality of separate parallel paths for the current leading to such grid electrodes.

The present invention provides a means for taking the load off the transformers by utilizing in each stage of amplification a plurality of separate amplifying transformers having their primaries connected in series with the preceding detector with parallel connections so that the entire secondary current does not pass through any single transformer.

I also provide such means or arrangement of apparatus that the potential variations of the separate grids of the amplifiers are maintained similar, that is, the charges upon the grids are of like potential at any given instant and by this means I am enabled to provide a single or unit plate circuit for receiving the amplified current which circuit may be thus directly connected with either phones or loud speakers without employing any auxiliary circuits or connections to couple the various currents received from the different plate electrodes.

This invention will be readily understood from the following description of the accompanying drawings in which I have diagrammatically indicated one form of apparatus in which the several improvements of this invention are embodied.

In the drawing, for clearness, I have illustrated the circuit of the present invention connected together with one form of a detecting circuit. It is to be understood, however, that the form of detecting circuit does not form an essential part of the present invention, as the invention may be employed with various different detecting circuits.

In the drawings

1 represents the ordinary grounded aerial connected through a tuning coil 2, which in the diagram is indicated as a loose coupler with the aerial connected through the primary core of the coupler and grounded as indicated at 4. The secondary 5 is connected as usual in a grid circuit through a grid leak 6 to the grid 7 of the detector vacuum or audion tube 8. The coil 2 may have the variable condenser 5^a shunted across the secondary 5. The grid circuit is completed through the filament 9 of the detector, which is heated by "A" battery, by connecting the secondary 5 to the negative terminal of the "A" battery as indicated at 10.

11 indicates the plate of the detector tube which is connected to a point 12. 13 indicates a second point connected to a "B" battery at the positive side, the negative side of the battery being connected to the negative terminal of the "A" battery as indicated at 14.

When the detector is employed without an amplifier, phones may be connected across points 12 and 13, as indicated by dotted lines, whereupon the plate circuit is complete from the plate 11 of the tube through the phones and "B" battery and filament 9 of the tube.

When employing the apparatus, embodying this invention as an amplifier for such a detector unit, a plurality of transformers are connected in series in the plate circuit of the detector. In this case two transformers 15 and 16 are shown, although it is understood that any number of transformers may be employed if desired, and particularly if the amplified unit is to be employed as the second or third amplifier in a cascade system of amplification, it may be desirable to employ more than two transformers. The transformers 15 and 16 have their primaries 17 and 18 connected in series between the taps 12 and 13 and are preferably positioned apart so that there is no inductive connection between the same. The secondaries 19 and 20 of the transformers are connected to separate grids 21 and 22 respectively, preferably located in the separate vacuum or audion amplifying tubes 23 and 24. The other terminals of the secondaries 19 and 20 may be connected together as indicated at 24 and lead through a "C" battery of from 3 to 8 volts and hence connected to the negative lead of the circuit employed for heating the filaments 26 and 27 of the separate tubes of the amplifier. These filaments 26 and 27 may be heated from the "A" battery employed for the detector tube 8 as indicated.

The circuit is arranged so that the grids 21 and 22 will maintain like potential variations of the amplified current. This is accomplished by the arrangement of the circuit shown in which the terminals of the secondary windings 19 and 20, adjacent those terminals of the primary windings 17 and 18 which terminals are most directly coupled with the plate 11, are the terminals of the secondary, which are connected to the grids 21 and 22.

By this arrangement the plate electrodes 28 and 29, respectively, of the tubes 23 and 24 may be directly connected together and lead through the phones or loud speaker 30 without the necessity of employing additional rectifying circuits for joining the separate plates. The plate circuit of the amplifier is completed by being connected to the positive of the "B" battery, hence leading to the filaments 26 and 27 by the positive lead to such filaments.

While I have shown the plate circuit of the amplifying unit connected through phones or speaker 30, it is understood that in place of the speaker 30 the plate circuit may include transformers or other means for connecting succeeding stages of amplification in cascade or other arrangement if desired. If the succeeding stages of amplification are to employ the principles of this invention, it is preferable that the succeeding higher stages of amplification should employ a progressively larger number of transformers and amplifying tubes.

The various constants of the circuit are not set forth in specific detail, as any of the well made forms of the transformers, tubes or other parts illustrated may be employed, the construction of which is well understood in the art.

By employing the amplifier of the present invention, the various range of frequencies will be much more uniformly amplified than in the general transformer coupled amplifiers and this is accomplished as shown by a simple form of apparatus.

While the embodiment herein described is well suited for the purpose of this invention, it is not intended to limit the invention to the particular embodiment shown as various modifications may be made in the details without departing from the spirit of the invention.

This invention is of the scope set forth in the accompanying claim.

I claim:

In a wireless receiving circuit, the combination with a detecting circuit, of an audio frequency amplifying circuit comprising audio frequency transformers having their primaries disposed in series in an output por-

tion of said detector circuit and having their secondaries connected to the grids of separate audions, said transformers being inadequate to separately handle the current without distortion, the plates of said audions being directly connected together so that the plates operate at the same potential and provide a unit output circuit for said audio frequency amplifying circuit, whereby the load on each transformer is reduced to prevent distortion from saturation of the cores thereof.

Signed at Los Angeles, Cal., this 23d day of January, 1924.

FRITZ W. FALCK.