Feb. 2, 1937. E. S. LANSING 2,069,316

TRANSMISSION OF SOUND CURRENTS

Filed Oct. 16, 1931

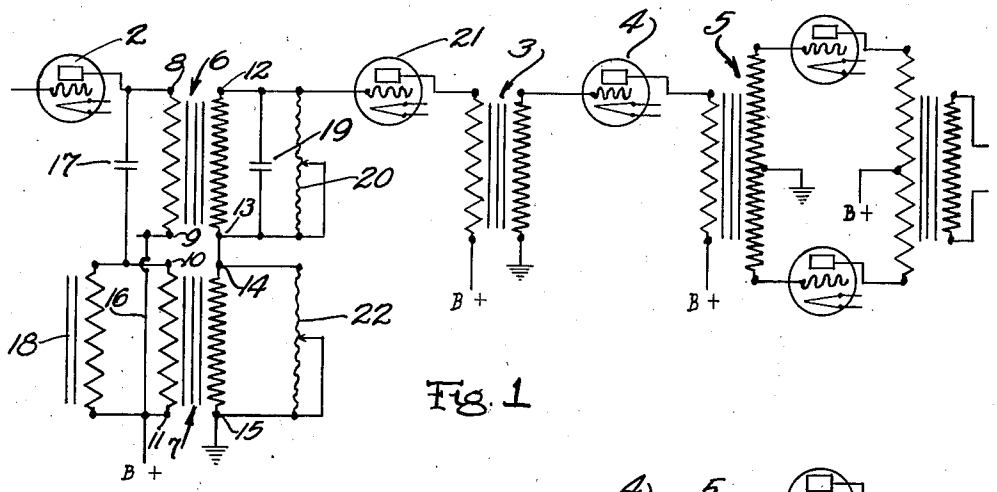


Fig. 1

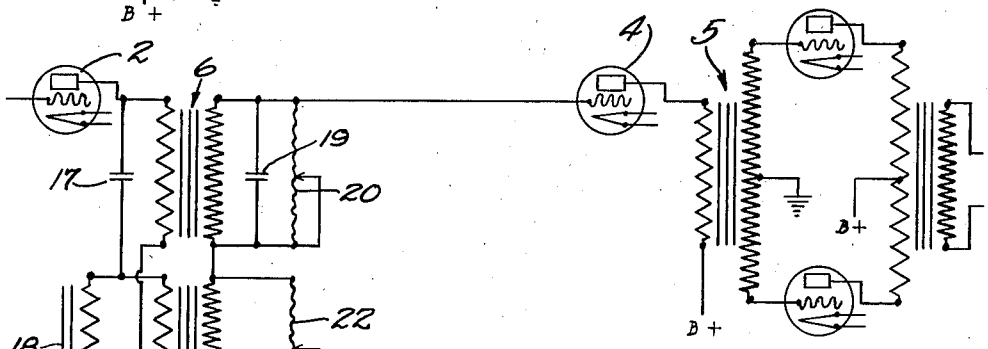


Fig. 2

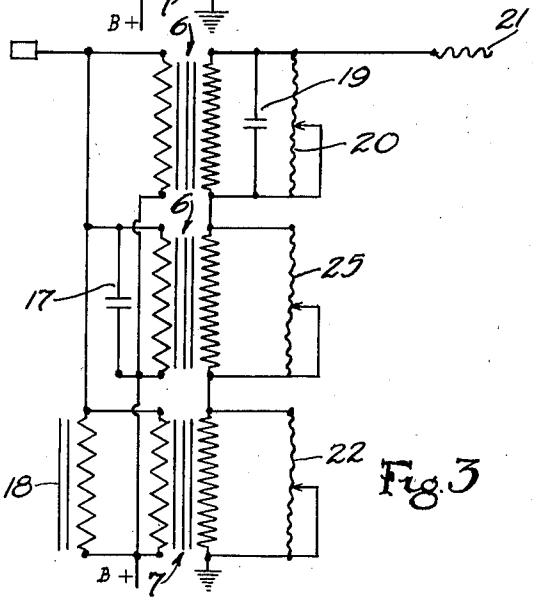


Fig. 3

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Patented Feb. 2, 1937

2,069,316

UNITED STATES PATENT OFFICE

2,069,316

TRANSMISSION OF SOUND CURRENTS

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Application October 16, 1931, Serial No. 569,249

12 Claims. (Cl. 179—1)

This invention relates to the transmission of sound currents, and has to do particularly with the dividing and amplifying of sound currents in recording and reproducing devices of various types. The present invention is a continuation in part of my application Serial No. 477,060, filed August 22, 1930.

The present invention is an improvement over that disclosed in my prior application in that it eliminates one or both tubes in what I call the mixer unit. I still prefer to use a plurality of transformers, preferably of varying ratios, and also prefer to parallel the by-pass condenser around the low frequency transformer and conduct the B current around the high frequency transformer as set forth in the above mentioned application, but instead of using two separate channels for feeding two separate tubes, I now directly connect the secondaries of each transformer whereby the sound waves divided at the front end of the mixer are brought together at the back end and fed through a single channel to the tube or to the first audio stage of the receiver. Another feature of this improved hook-up is the combination between said direct secondary connection and a condenser which eliminates any high frequencies that may pass through the low frequency transformer and at the same time act as a path of least resistance for the high frequencies from the high frequency transformer.

Other novel features of the invention reside in the much simplified unit and hook-up and the providing of a transformer coupled circuit to produce a relatively great amplification, a more pronounced division and a better quality than has heretofore been possible. A variable impedance makes possible the balancing of the complete circuit to synchronize with any acoustical conditions that may be present.

In the drawing:

Fig. 1 is a diagrammatic wiring diagram of the preferred manner of connecting my dividing and amplifying unit together with its one tube in between a standard detector or pick up and a standard amplifier, and also indicating the preferred manner of connecting the variable impedance around the transmitters.

Fig. 2 represents a diagrammatic wiring diagram similar to Fig. 1, but illustrating a modified arrangement in that the first audio tube takes the place of the tube in the mixer and the mixer transformers taking the place of the first audio coupling transformers.

Fig. 3 is a diagrammatic lay-out similar to Fig. 2 but illustrating a system which gives a much more complete control in that it separates the frequency range into three component parts.

My mixer unit may be utilized in connection with substantially any type of amplifier but its most general use will be found in connection with the amplifier of the standard radio receiving unit. In Fig. 1, I have shown an amplifier unit consisting of a detector tube 2, a first audio transformer 3, first audio tube 4, and the last audio stage which may be generally designated 5.

In general, I prefer to insert my mixer unit in between the detector tube 2 and the first audio transformer 3 but it will be understood that a portion or all of the mixing unit may be embodied in the amplifier circuit at different points as long as it is not inserted between the last audio stage and the speaker.

The mixer itself preferably consists of two transformers, or the equivalent of two transformers, which may be generally designated 6 and 7. The primary terminals of the transformer 6 which may be called the low frequency transformer or low section may be designated 8 and 9 and the primary terminals of the high frequency transformer or high section 7 may be designated 10 and 11. The secondary terminals of the transformer 6 are indicated as at 12 and 13 and the secondary terminals of the transformer 7 as at 14 and 15.

Relatively good results may be obtained with this mixer by using transformers 6 and 7 of the same ratio but I find I obtain a more definite division of high and low frequencies by providing a transformer 6 having a ratio of substantially 3½ to 1 and a transformer 7 with a ratio of substantially 3½ to ½. The frequency input into the transformers 6 and 7 is by means of any standard pick up device or detector tube and, as shown in Fig. 1, is from the plate of the detector tube 2. The other primary terminals 9 and 11 are directly connected by means of the wire 16 to the B supply. The primaries of transformers 6 and 7 are connected in parallel with each other through a .1 mfd. condenser 17. The high frequency sound currents from the detector tube will readily pass through the condenser 17 and the majority of the low frequency sound waves will be blocked so they pass through the primary of the transformer 6.

As the primaries are connected in parallel there is no sound connection between the terminals 9 and 10 and the B current can be fed only through the primary of the transformer 6 and then to the detector or similar unit as the case may be.

In the present arrangement the base and treble sound frequencies are divided approximately at 600 cycles with the result that practically all the sound waves having a frequency which places them below the center of the musical scale will be transmitted to the primary of the transformer 6. As the terminals 9 and 11 are completely separated, no strays will be transmitted from the primary of the transformer 6 to the primary of the transformer 7, with the result that the division of the low frequency tones is complete.

The high frequency notes will pass through a condenser 17, as the path of least resistance, and what few low frequencies should pass through this condenser 17 will be absorbed by a choke coil 18 connected in parallel to the terminals 10 and 11. By the use of a parallel connected condenser 17, a choke coil 18, and the by-passing of the B supply around the primary of the transformer 7 only the high frequencies may be passed through the primary of the transformer 7.

An important feature of this invention is the fact that I directly connect the terminals 13 and 14 of the respective secondaries of the transformers. A .01 mfd. condenser 19 is connected to the terminals 12 and 13 so that it shunts the transformer 6; the value of .01 mfd. having a certain predetermined ratio relative to the impedance of the transformer. With this condenser 19 connected as shown in Fig. 1, it eliminates any high frequencies that might pass through transformer 6 but it will be understood that the condenser 19 has a real combination with the high frequency transformer 7 in that it acts as a path of least resistance for the high frequencies from such transformer.

A potentiometer or variable resistance 20 is connected across the terminals 12 and 13 of the secondary of the transformer 6. This potentiometer 20 plays a very important part in my hook-up because it provides a variable impedance to the tube 21 which forms what might be termed an integral part of my mixer unit. Thus I have the high and low secondaries of the transformers 6 and 7 connected in series and a variable resistance 20 which controls the input impedance to the tube 21 or the following tube, as will be later explained. While the condenser 19 acts as a block for any high frequency strays in the transformer 6 it acts as a path of least resistance for the high frequencies in the transformer 7.

A potentiometer 22, which, of course, is provided with a control knob similar to and adjacent the control knob of the potentiometer 20, is utilized to control the impedance input from the transformer 7 into the tube 21. It will be understood by those skilled in the art that both the potentiometers 20 and 22 may be placed ahead of the transformers 6 and 7 if desired. The important thing here is that the primaries of the transformers are connected together in parallel to a condenser and the secondaries are connected together in series with a condenser around the secondary of only the low frequency transformer.

It will thus be seen that I am able to eliminate all coupling resistances and whatever sounds are allowed to go through in the proportions controlled by the potentiometers go through a single unit and are amplified through a single tube. By eliminating the condensers and resistance coupling, as shown in my above mentioned application, I also obtain more gain.

In the modification illustrated in Fig. 2, I have eliminated the use of the tube 21 in which case the transformers 6 and 7 will take the place of the first audio transformer 3 and, of course, the first audio tube 4 taking the place of the mixer tube 21. It will thus be seen that with the preferred embodiment as shown in Fig. 1, more gain and a more definite division of frequencies is obtained by using the tube 21, but on the other hand good results by the circuit shown in Fig. 2 and in addition the first audio transformer is eliminated.

In the modification shown in Fig. 3 I have shown a mixer system which gives a much more complete control in that it separates the frequency range into three component parts thus providing a path through the center of the musical scale. In this modification I preferably use two transformers identical with the transformer 6 shown in Fig. 1 and a transformer 7 identical with the transformer 7 shown in Fig. 1, the only difference being that I provide an additional potentiometer 25 for the second transformer 6 and connect the condenser 17 around the primary terminals of the second transformer 6; the capacity of the condensers 17 and 19 remaining the same as in Fig. 1.

What I claim is:

1. In a transformer coupled sound frequency dividing and transmitting system of the class described having one or more audio stages, a low frequency transformer unit and a high frequency transformer unit, a choke coil connected in parallel only with the primary of the high frequency transformer unit, a condenser connected in series parallel with the primaries of said units and said choke said high and low frequency transformer units being connected into the receiving circuit at a point ahead of the last audio stage, the secondaries of said transformer units being connected together in series, a variable resistance connecting the secondary terminals of the low frequency transformer unit acting to vary the input impedance to the following tube, and a condenser of predetermined capacity relative to the impedance of the low frequency transformer unit for blocking any high frequencies that might pass through the low frequency transformer unit.

2. In a transformer coupled sound frequency dividing and transmitting system of the class described having one or more audio stages, the combination of a low frequency transformer unit and a high frequency transformer unit, said transformer units being connected into the receiving circuit at a point ahead of the last audio stage, the secondaries of said transformer units being connected in series, variable resistances connected across each transformer and acting to individually vary the input impedance of the high and low frequency transformer units to the following tube to respectively control the range of high and low frequencies desired, a condenser for blocking any high frequencies that might pass through the secondary of the low frequency transformer unit, a B supply and means for connecting the same directly and solely to the primary of the low frequency transformer.

3. In a transformer coupled sound frequency dividing and transmitting system of the class described having one or more audio stages, the combination of a low frequency transformer unit and a high frequency transformer unit, said transformer units being connected into the receiving circuit at a point ahead of the last audio stage, a choke connected in parallel with the

primary of the high frequency transformer unit, a condenser connected in series parallel with the primaries of said units and said choke the secondaries of the transformer units being connected in series, variable resistances acting to individually vary the input impedance of the transformer units to the following tube, and a condenser for blocking any high frequencies that might pass through the secondary of the low frequency transformer unit, said divided and regulated frequencies being fed direct through a single channel from the secondaries of the transformer units to the next audio stage.

4. In a sound frequency dividing and transmitting system of the class described having one or more audio stages, the combination of high and low frequency transformers, the primaries of said transformers being connected together in parallel through a condenser, and the secondaries being connected together in series, a condenser shunted across the secondary of the low frequency transformer, and separately controlled variable resistances connected across each transformer.

5. In a sound frequency dividing and transmitting system of the class described having one or more audio stages, a low frequency transformer section and a high frequency transformer section, said transformer sections being connected into the receiving circuit at a point ahead of the last audio stage, the primaries of said transformer sections being connected together in parallel through a condenser, and the secondaries of said same sections being connected in series, variable resistances connected across the secondaries of each transformer acting to individually vary the input impedance of the transformers to the following tube respectively according to range of high and low frequencies desired, and a choke connected in parallel with the primary of the high frequency transformer for rejecting any stray low frequencies.

6. In a transformer coupled sound frequency dividing and transmitting system of the class described having one or more audio stages, a low frequency transformer and a high frequency transformer, said transformers being connected into the receiving circuit at a point ahead of the last audio stage, the primaries of said transformers being connected together in parallel through a condenser, the secondaries of said same transformers being connected in series, individual variable resistances connected across each transformer and acting to vary the input impedance to the following tube to respectively control the range of high and low frequencies desired, and a condenser for blocking any high frequencies that might pass through the low frequency transformer.

7. In a transformer coupled sound frequency dividing and transmitting system of the class described having one or more audio stages, a low frequency transformer and a high frequency transformer, said transformers being connected into the receiving circuit at a point ahead of the last audio stage, the primaries of said transformers being connected together in parallel through a condenser, the secondaries of said same transformers being connected in series, individual variable resistances connecting the secondary terminals of the low and high frequency transformers acting to vary the input impedance to the following tube, a condenser of predetermined capacity relative to the impedance of the low frequency transformer for blocking any high frequencies that might pass through the low frequency transformer, a B supply and means for connecting the same directly and solely to the primary of the low frequency transformer.

8. In a transformer coupled sound frequency dividing and transmitting system of the class described having one or more audio stages, a low frequency transformer and a high frequency transformer, said transformers being connected into the receiving circuit at a point ahead of the last audio stage, the primaries of said transformers being connected together in parallel through a condenser, the secondaries of said same transformers being connected in series, individual variable resistances connected across each transformer and acting to individually vary the input impedance of the transformers to the following tube to respectively control the range of high and low frequencies desired, a condenser for blocking any high frequencies that might pass through the low frequency transformer, a B supply and means for connecting the same directly and solely to the primary of the low frequency transformer.

9. In a transformer coupled sound frequency dividing and transmitting system of the class described having one or more audio stages, a low frequency transformer and a high frequency transformer, said transformers being connected into the receiving circuit at a point ahead of the last audio stage, the primaries of said transformers being connected together in parallel through a condenser, the secondaries of said same transformers being connected in series, individual variable resistances connected across each transformer and acting to vary the imput impedance to the following tube to respectively control the range of high and low frequencies desired, and a condenser for blocking any high frequencies that might pass through the low frequency transformer, said divided and regulated frequencies being fed direct through a single channel from the transformers to the next audio stage.

10. In a transformer coupled sound frequency dividing and transmitting system of the class described having one or more audio stages, a low frequency transformer and a high frequency transformer, said transformers being connected into the receiving circuit at a point ahead of the last audio stage, the primaries of said transformers being connected together in parallel through a condenser, the secondaries of said same transformers being connected in series, individual variable resistances connected across each transformer and acting to vary the input impedance to the following tube to respectively control the range of high and low frequencies desired, and a condenser for blocking any high frequencies that might pass through the low frequency transformer, said divided and regulated frequencies being fed direct through a single channel from the transformers through an amplifier to the next audio stage.

11. In a transformer coupled sound frequency dividing and transmitting system of the class described having one or more audio stages, a low frequency transformer and a high frequency transformer, said transformers being connected into the receiving circuit at a point ahead of the last audio stage, the primaries of said transformers being connected together in parallel through a condenser, the secondaries of said same transformers being connected in series, individual variable resistances connecting the secondary terminals of the low and high frequency transformers acting to vary the input

impedance to the following tube to respectively control the range of high and low frequencies desired, and a condenser of predetermined capacity relative to the impedance of the low frequency transformer for blocking any high freqeuncies that might pass through the low frequency transformer, said divided and regulated frequencies being fed direct through a single channel from the transformers to the next audio stage.

12. In a transformer coupled sound frequency dividing and transmitting system of the class described having one or more audio stages, a low frequency transformer and a high frequency transformer, said transformers being connected into the receiving circuit at a point ahead of the last audio stage, the primaries of said transformers being connected together in parallel through a condenser, the secondaries of said same transformers being connected in series, variable resistances connected across each transformer and acting to individually vary the input impedance of the transformers to the following tube to respectively control the range of high and low frequencies desired, and a condenser for blocking any high frequencies that might pass through the low frequency transformer, said divided and regulated frequencies being fed direct through a single channel from the transformers to the next audio stage.

EDWARD S. LANSING.