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METHOD AND APPARATUS FOR COORDINATING RADIO AND PHONOGRAPH REPRODUCTION

Original Filed May 21, 1924

Fig. 1.

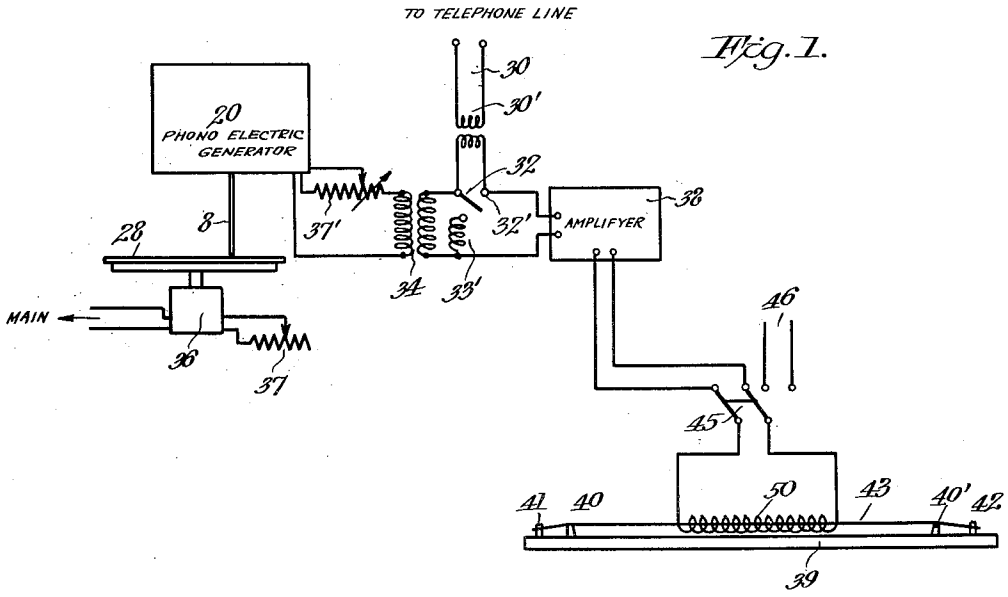
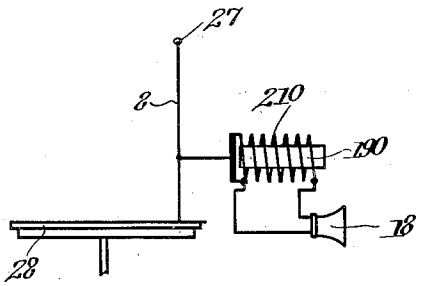


Fig. 2.



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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR COORDINATING RADIO AND PHONOGRAPH REPRODUCTION.

Original application filed May 21, 1924, Serial No. 714,899. Divided and this application filed January 25, 1926. Serial No. 83,499.

My invention relates to improving the efficiency of radio and wire telephone and phonograph reproduction, and more especially to co-ordinating these methods of reproduction, (and similar means, as reproduction from different radio stations), and still more especially to convenience in said co-operation and to the production of new effects and results thereby.

The object of my invention is to accomplish said increase in efficiency and said co-ordination, and said convenience in co-ordination and operation, and said new effects and results.

The accompanying drawings show, partly diagrammatically, means adapted for the carrying out of my invention.

Figure 1 shows the arrangement of apparatus and circuits and

Figure 2 a type of electric generator adapted for use with my electro-phonograph.

This application is a division of U. S. application Serial No. 714,899, filed May 21, 1924.

In Fig. 1 is shown a novel system in which a radio or wire telephone and a phonograph act individually or in conjunction, and without any necessary mechanical connection between the phonograph record and the device emitting the sound, i. e. the reproducer; here shown as a piano, 39. Here 20 is the phono-electric generator, whereby the minute electric impulses are produced in the circuit 37′, 34, by the relative motion of the record 28, either optically as shown in U. S applications Serial No. 685,699, filed March 23rd, 1912 and 42,856, filed July 29th, 1915, and Serial No. 635,362, phonograph-kinetoscope, filed July 26th, 1911, and Serial No. 423,186, filed Nov. 10th, 1920, (but which optical methods and apparatus are not claimed herein); or as shown, and more fully and in detail in Fig. 2, mechanically by the action of the phonograph needle 8; or in any other suitable manner.

The disc 28 is driven by the electric motor 36, whose speed is regulated as desired by the adjustable resistance 37, or other suitable means. 37′ is an adjustable impedance for regulating the strength of the electric impulses in the circuit, and hence the strength of the reproduction in the piano-speaker 39.

30 is the circuit of the wireless or wire telephone line; 36 is an amplifier operating the piano speaker 39, described below. 34 and 30′ are transformers for putting the phono-electric generator and the telephone circuits in operative relation to the amplifier.

32 is a switch. When it is thrown to the right, on to the contact 32′, the wireless telephone is cut out, and only the phonograph record is heard. When it is thrown to the left, to contact with 33′, the phonograph is cut out and at the same time, by reason of the insertion in the circuit thereby of the compensating coil 33′, or other suitable means, the tuning of the wireless circuit is maintained unchanged. When the switch is in the intermediate position, as shown, both wireless and phonograph act conjointly and a soloist on the wireless may be accompanied by a full orchestra on the phonograph, or vice versa, speed being regulated by 37 and relative intensity by 37′. 45 is a switch whose function is described below.

Fig. 2 shows a suitable form of phono-electric generator more in detail. Here a light coil 210 is fastened to the phonograph needle, as shown, and being moved back and forth in the field of the magnet 190 by the motion of 8, pivoted at 27 and actuated by the revolving phonograph disc 28, generates currents which are carried to the reproducer 18, as shown.

By this invention a number of entirely new and very useful results are obtained, e. g.

It enables one to accompany a broadcast solo by McCormack, "That Old Refrain" for example, by a phonograph record of Kriesler's (the composer's) rendition on the violin of the same composition, and to modulate the strength of the accompaniment at every instant, and instantaneously, to suit the momentarily varying strength of the broadcast of the soloist; the tempo being similarly varied to coincide with that of the broadcast; or to supplement the rendition by Damrosch and his orchestra of "Evening Star" from Tannhauser over the radio by Caruso's voice from a phonograph record; or to hear Caruso and McCormack sing together the same famous song, a possibility of great value in the study of singing.

Since the same loud speaker is used, e. g. applicant's piano loud speaker, and actuated in the same way, i. e. by the same loud speaker mechanism, and all scratching and

static and other abrupt disturbing impulses are eliminated accurate and satisfactory comparison and accompaniment is rendered possible, which is of course not possible where the loud speakers are of different types, or operated by different types of mechanism, e. g. one by a mechanically acting lever and the other by an electromagnetic mechanism, or there are disturbing impulses.

The listener may himself accompany the radio or phonograph, by playing on the piano, and the effect is much more natural and agreeable, as both sounds come from the same location in the room. The desired changes in modulation may be made instantly and by one seated at a distance, in place of one standing beside the phonograph loud speaker; and without danger of injuring the record, by merely shifting the element 37'.

Another advantage is in shifting phonograph records at a distance from the loud speaker without the necessity of employing special mechanism. One may be seated in a chair on the opposite side of the room from the piano loud speaker, and listening to the radio. A broadcast may come in which might be accompanied by a phonograph record. If the phonograph motor and disc table is at the elbow, all that is necessary to place the desired disc on the rotating table, and adjust the speed and then the modulation by moving 37, 37'. And the modulation may be made such that the phonograph record is reproduced many times louder than any standard type of phonograph could do, or adjusted more delicately and softly, or loudly and softly on the same record, to accompany the radio, without moving from the seat. And if the micro-photo-phonographic records are used, described and claimed in Serial No. 423,186, filed Nov. 10th, 1920, the storage and handling and cost of the records is much reduced.

The type in which an independently playable musical instrument with strings such as a piano is used, enables the listener to accompany either the radio or the phonograph or both combined, himself. This is of great value to students on these instruments. A student can compare his own touch on the piano with that of the greatest living masters of the art; or of those long dead. By the use of an area source, such as the piano, the necessity of having the phonograph disc driving apparatus and the radio apparatus in the same part of the room is obviated. The wireless apparatus is often best located in one part of the room, near a window, while the phonograph discs may be more conveniently located near a fire place or electric reading lamp. Or one member of the household who may prefer to sit in one place, may prefer the radio and another, who may prefer to sit in another, may prefer the phonograph. With the area source, both will hear both reproductions equally well, no matter where they may sit.

By the use of the piano as loud speaker, absolutely correct reproduction is obtained and static and scratching is cut out.

By this system the power required for driving the phonograph discs is much reduced and the whole outfit may be driven from dry cells; a matter of importance where no electric power circuits are available.

It is preferred that the thrust of the moving part of the electromagnetic or other mechanism which operates the loud speaker against the diaphragm or its equivalent should be opposed, not by a spring or other device having a natural period, but as shown in Fig. 5 of the parent application, by inertia, and that the only substantial restoring forces should be those inherent in the diaphragm or its equivalent. This has been found to give, for reasons not here disclosed, much better results; but same is not herein claimed; being claimed in a companion application, also a division of 714,899.

When the switch 45 is thrown, and the piano is played upon, the loud spaker mechanism acts as a generator and the music played is transmitted through the circuit 46 to any place desired, for example to another room in the house.

By the term "electro-phonograph" is meant a phonograph in which the recorded sounds are first transformed into electric impulses before being reproduced; and includes the elements necessary for generating the electric impulses from the phonograph records.

Applicant, in his investigations on cutting out scratching, static, and abrupt disturbing impulses generally, by the use of a plurality of resonant elements, discovered that even a violin, with only four strings, though not cutting out static to any useful extent, when used as a loud speaker for electric-phonographs, cut out a part of the scratching from the phonograph discs. Applicant the discovered (amongst other ways) that by adding additional resonant elements, for example, reeds attached to the violin bridge, substantially all the scratching could be cut out. He further found that if the number of reeds was made sufficiently numerous, such a violin loud speaker would even cut out substantially all of the static when used for receiving radio broadcasting.

Applicant then discovered that a piano could be used for receiving radio broadcasting, and that it had a sufficient number of resonant elements attached to its sound board, i. e. the piano strings, to act extremely efficiently as a static eliminator, in addition to other properties, i. e. that of giving absolutely faithful reproduction of all sounds, from the lowest to the highest, and of giving

equal intensity of sound in all parts of the room. As an illustration of the efficiency of the piano as a static eliminator, during the past three summers, applicant, who has one in his house, and the members of his household and guests, have never heard static or known that there was any static, except on such occasions as they listened in on other types of apparatus, to ascertain the atmospheric conditions. Reports of other tests, e. g. by the U. S. Navy, will be found in the "Boston American" for August 28, 1924, with photographs of the apparatus and description of the mechanism attached to the back of a piano, and other details.

The piano loud speaker 39 of Figure 1 may have its sound board set in vibration by the electric telephonic impulses in any suitable way, since the essential feature of its efficiency as a loud speaker lies in the conjunction of the sound board with the plurality of resonant elements, i. e. piano wires. In most cases, e. g. as in the "Boston American" reference of August 28, 1924, any good speaker mechanism is simply wired into the back of the piano, and its vibrating element fastened to the back of the sound board.

Better results are, however, obtained by the arrangement shown in Figure 1, in which a nickel or iron wire 43 is fastened at each end to adjustable tuning pins 41, 42, stretched over bridges 40, 40′, and the received telephonic currents flowing through the coil 50 vary the magnetization of the wire 43, and change its length by the well known magnetostriction effect, thereby bending the sound board in and out, and causing the whole sound board to act as a unitary large diaphragm. By employing a number of such wires 43, and suitably arranging them, as shown in another co-pending application, the piano sound board and wires are made so that they have no detrimental selective resonance. The advantage of using the adjustable tuning pins 41, 42, is that by proper stretching of the nickel wire, the magnetostriction effect is greatly improved, and made uniform.

By the expression "operable selectively" by the phonograph or wireless, is meant operable by either one or the other, as desired. By the term "operable jointly" is meant operable by both of them together and simultaneously.

What I claim is:—

1. In combination, an electro-phonograph, a wireless receiving set, and a loud speaker comprising a piano operable by the direct electro-magnetic action of the electro-phonograph and the wireless receiving set, selectively, whereby comparision may be made between phonograph and wireless reproductions without disturbance from scratching, static, and other abrupt disturbing impulses, the diminution of sound intensity with distance from said loud speaker is greatly reduced, and the operation of said loud speaker, phonograph and wireless set is made substantially independent of their positions relative to one another.

2. In combination, an electro-phonograph, a wireless receiving set, and a loud speaker comprising a piano operable by the direct electro-magnetic action of the electro-phonograph and the wireless receiving set, selectively or jointly, whereby comparison may be made, either simultaneously or consecutively, between phonograph and wireless reproductions without disturbance from scratching, static, and other abrupt disturbing impulses, the diminution of sound intensity with distance from said loud speaker is greatly reduced, and the operation of said loud speaker, phonograph and wireless set is made substantially independent of their positions relative to one another.

3. In combination, an electro-phonograph, a wireless receiving set, and a loud speaker comprising an independently playable piano operable by the direct electro-magnetic action of the electro-phonograph and the wireless receiving set, selectively, whereby comparison may be made between phonograph and wireless reproductions without disturbance from scratching, static and other abrupt disturbing impulses, the diminution of sound intensity with distance from said loud speaker is greatly reduced, the operation of said loud speaker, phonograph and wireless set is made substantially independent of their positions relative to one another, and reproduction may be accompanied on the piano by independent playing thereof.

4. In combination, an electro-phonograph, a wireless receiving set, and a loud speaker comprising an independently playable piano operable by the direct electro-magnetic action of the electro-phonograph and the wireless receiving set, selectively or jointly, whereby comparison may be made, either simultaneously or consecutively, between phonograph and wireless reproductions without disturbance from scratching, static and other abrupt disturbing impulses, the diminution of sound intensity with distance from said loud speaker is greatly reduced, the operation of said loud speaker, phonograph and wireless set is made substantially independent of their positions relative to one another, and reproduction may be accompanied on the piano by independent playing thereof.

5. In combination, an electro-phonograph, and a piano operable as a loud speaker for said electro-phonograph, whereby scratching and other abrupt disturbing impulses are eliminated from the reproduction of the record and the diminution of sound intensity with distance from said loud speaker is greatly reduced.

6. In combination, an electro-phonograph, and an independently playable piano operable as a loud speaker from said electro-phonograph, whereby scratching and other abrupt disturbing impulses are eliminated from the reproduction of the record, the diminution of sound intensity with distance from said loud speaker is greatly reduced, and reproduction may be accompanied on the piano by independent playing thereof.

7. In combination, an electro-phonograph, and a piano operable as a loud speaker for said electro-phonograph by the direct electro-magnetic action of the phonograph on the piano sound board, whereby scratching and other abrupt disturbing impulses are eliminated from the reproduction of the record and the diminution of sound intensity with distance from said loud speaker is greatly reduced.

8. In combination, an electro-phonograph, and a piano operable as a loud speaker for said electro-phonograph by the direct electro-magnetic action of the phonograph on the piano sound board through means in operative contact with the latter, whereby scratching and other abrupt disturbing impulses are eliminated from the reproduction of the record and the diminution of sound intensity with distance from said loud speaker is greatly reduced.

9. In combination, an electro-phonograph, a wireless receiving set, and a loud speaker comprising a piano operable by the electro-phonograph and the wireless receiving set, selectively, whereby comparison may be made between phonograph and wireless reproductions without disturbance from scratching, static, and other abrupt disturbing impulses, the diminution of sound intensity with distance from said loud speaker is greatly reduced, and the operation of said loud speaker, phonograph and wireless set is made substantially independent of their positions relative to one another.

10. In combination, an electro-phonograph, a wireless receiving set, and a loud speaker comprising a piano operable by the electro-phonograph and the wireless receiving set, selectively or jointly, whereby comparison may be made, either simultaneously or consecutively, between phonograph and wireless reproductions without disturbance from scratching, static, and other abrupt disturbing impulses, the diminution of sound intensity with distance from said loud speaker is greatly reduced, and the operation of said loud speaker, phonograph and wireless set is made substantially independent of their positions relative to one another.

11. In combination, an electro-phonograph, a wireless receiving set, and a loud speaker comprising an independently playable piano operable by the electro-phonograph and the wireless receiving set, selectively, whereby comparison may be made between phonograph and wireless reproductions without disturbance from scratching, static and other abrupt disturbing inpulses, the diminution of sound intensity with distance from said loud speaker is greatly reduced, the operation of said loud speaker, phonograph and wireless set is made substantially independent of their positions relative to one another, and reproduction may be accompanied on the piano by independent playing thereof.

12. In combination, an electro-phonograph, a wireless receiving set, and a loud speaker comprising an independently playable piano operable by the electro-phonograph and the wireless receiving set, selectively or jointly, whereby comparison may be made, either simultaneously or consecutively, between phonograph and wireless reproductions without disturbance from scratching, static and other abrupt disturbing impulses, the diminution of sound intensity with distance from said loud speaker is greatly reduced, the operation of said loud speaker, phonograph and wireless set is made substantially independent of their positions relative to one another, and reproduction may be accompanied on the piano by independent playing thereof.

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