Feb. 7, 1928. 1,658,479

J. DEPEW

LOUD SPEAKER

Filed Feb. 12, 1926

Fig. 1

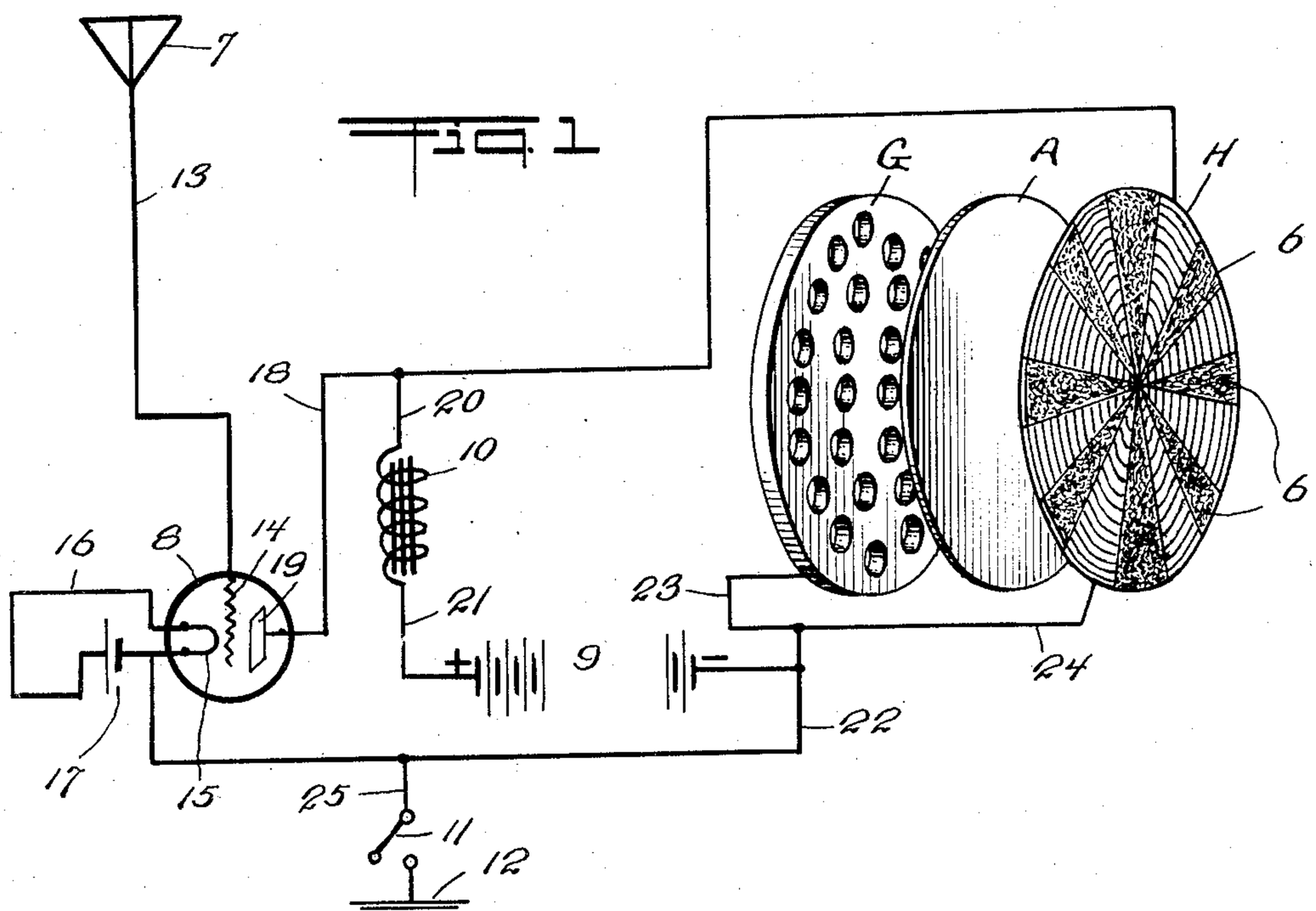
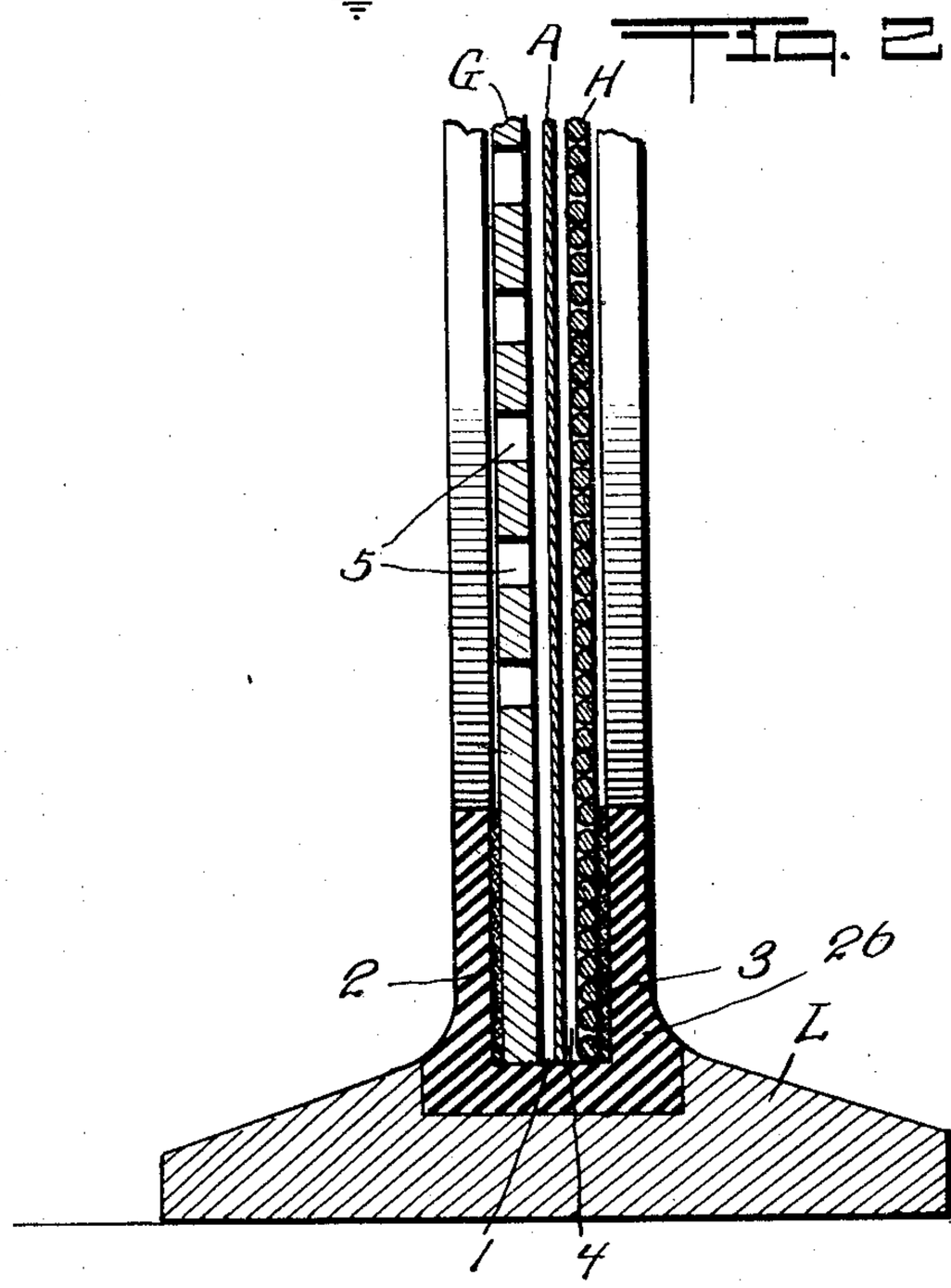


Fig. 2



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UNITED STATES PATENT OFFICE.

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LOUD SPEAKER.

Application filed February 12, 1926. Serial No. 87,976.

This invention relates to loud speakers of the general type suitable for use with radio broadcasting receivers, electrically operated sound amplifiers, and receivers of various types used in wire and wireless telephony, and in fact in practically all relations where loud sounds are to be produced initially, or where ordinary sounds are to be amplified, by means of small initial variations in the electromotive forces or amperage of electric currents.

In my co-pending application, filed herewith, Serial No. 87,974 I have shown a loud speaker of this same general type in which a diaphragm of insulating material is arranged to vibrate between two relatively stationary condenser plates, while in my pending application Serial No. 87,975, also filed herewith, I have shown a loud speaker in which a diaphragm of insulating material is arranged to vibrate between two relatively stationary pancake windings.

In the present application I disclose a loud speaker which is in a sense a composite of said two mentioned loud speakers, that is in which a diaphragm of insulating material is arranged to vibrate acoustically between a condenser plate on one side and a pancake winding on the opposite side, an object of the present improvement being to provide a loud speaker in which the diaphragm will be made to vibrate in an efficient manner for reproducing sounds.

I also seek in this application to combine the advantages of a metallic plate and a pancake winding, for actuating a diaphragm of insulating material.

Other objects and aims of the invention, more or less specific than those referred to above, will be in part obvious and in part pointed out in the course of the following description of the elements, combinations, arrangements of parts and applications of principles, constituting the invention, and the scope of protection contemplated will be indicated in the appended claims.

In the accompanying drawings which are to be taken as a part of this specification, and in which I have shown merely a preferred form of embodiment of the invention:—

Figure 1 is a view, partly a perspective and partly a diagram, showing one form of my improved loud speaker and suitable electric circuits for use therewith.

Figure 2 is a fragmentary sectional view illustrating the manner in which the diaphragm and its actuating elements are mounted.

Referring to the drawings for describing in detail the structure therein illustrated the reference character L indicates a suitable supporting pedestal or base designed to support the plate G, the pancake winding H and the movable diaphragm A. The plate, winding, and diaphragm may be held rigidly in position in any suitable or approved manner but for the purpose of illustration are shown here to be received within a groove 1 provided in the base L. A suitable cement or like material as 2 is provided for fixing the plate G rigidly in position at one side of the groove while a similar cement as 3 is provided for retaining the winding H fixed rigidly within the groove at the opposite side of the groove so that a space as 4 is left between the opposing surfaces of the plate and the winding.

The diaphragm A may be of any suitable di-electric, such for instance as a sheet of cellophane, preferably embossed. It is very thin and is received loosely into the space 4 so that it is capable of vibrating bodily back and forth between the winding and the plate.

The plate G is of metal and is provided with perforations 5 therethrough serving as acoustical apertures.

The winding H is made up of an insulated wire wound spirally to a suitable size pancake form. The successive convolutions of the coil are slightly spaced apart, and the whole is secured and braced by means of sectors as 6 of shellac or other appropriate binding and insulating material applied practically as a cement and then allowed to dry and harden. The spaces between the wires and intermediate the sectors 6 constitute openings or apertures for the same purpose as the apertures 5 of the plate G, namely to permit ready displacement of air under the impulse of the moving diaphragm, thus enabling free vibratory movement of the diaphragm and unobstructed egress of sound waves.

As an illustration of one way in which this loud speaker may be connected for operation the drawing herewith illustrates an aerial as 7, an audion tube as 8, a B battery as 9, an impedance as 10, a grounding switch as 11, and a ground as 12. An aerial wire 13 extends from the aerial 7 to the grid 14 of the

audion tube, and the audion filament as 15 is connected in a circuit 16 with an A battery 17.

A wire 18 extends from the audion plate 19 to one side of the pancake winding H. The impedance coil 10 is tapped onto this wire by means of a wire 20. The opposite end of the coil 10 is connected with the B battery by means of a wire 21. A wire 22 extends from the opposite side of the B battery into connection with the filament circuit 16. From this wire 22 a branch wire 23 connects with the plate G, and a second branch wire 24 connects with the pancake winding H opposite to the wire 18. The switch 11 is connected with the wire 22 by wire 25.

The portion as 26 of the base L which engages the plate G, winding H, and diaphragm A, is of insulating material and thus it will be noted that the plate G and the winding H are insulated from each other and are bridged across the B battery, also that the impedance 10 is so located as to produce a differential effect in energizing different portions of the winding H.

With the current from the B battery steadily in action and the audion tube 8 idle, no effect is produced upon the diaphragm A, but when the audion tube is energized, in the manner well known in this art, the flow of current from the B battery through the audion tube is varied, and the condenser plate G and pancake winding H are energized in opposite senses, each to varying degrees. The result is that the diaphragm A, or portions thereof, is displaced and caused to vibrate also to different degrees and thus throw off sound waves.

By virtue of the impedance 10, the condenser plate G and the pancake winding H, considered as condenser plates, though charged equally and oppositely, are charged at slightly different moments of time, so that for each individual change in the battery potential and under the audion action, the two condenser plates act upon the diaphragm A, not simultaneously but in succession. The result is that the diaphragm, being a dielectric and consequently neutral, is first attracted by the pancake winding H and then attracted by the condenser plate E, or is first repelled by the pancake winding H and is then repelled by the condenser plate E.

In other words, the action of the diaphragm is based upon the well-known action of an impedance in biasing the action of condenser plates, as regards their time relation.

I point out, in addition, that in my device the diaphragm, though made of considerable area, is easily affected throughout practically its entire area, and that this fact makes for greatly improved efficiency.

While I show my invention as used in connection with an aerial and thus as under control of electromagnetic waves, it will be understood that I may substitute any known equivalent for the aerial, and thus may control my device by means of a telephone line or by any other agency capable of energizing an audion or equivalent instrument in the conventional manner. Thus the particular circuit shown and described is not essential.

While I have shown and described a particular means for holding the plates and the diaphragm in their respective operative positions nevertheless any other appropriate means may obviously be employed to this end.

It will also be understood that I claim for my loud speaker all of the uses to which a loud speaker can be applied, and that as many changes could be made in this construction without departing from the scope of the invention as defined in the following claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative only and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A device of the character described, comprising a condenser plate, a pancake winding disposed adjacent to said condenser plate, a diaphragm located between said pancake winding and said condenser plate, a source of electricity connected with said pancake winding and said condenser plate, and means connected with said source of electricity for varying the electromotive force with which said pancake winding and said condenser plate are charged by said source of electricity.

2. A device of the character described comprising a condenser plate, a pancake winding disposed in close proximity to said condenser plate and insulated therefrom, a diaphragm of insulating material located between said condenser plate and said pancake winding and movable relatively thereto for the purpose of producing sound waves, a source of electricity bridged across said condenser plate and said pancake winding so as to charge the same in opposite senses, and means connected with said source of electricity and with said condenser plate and pancake winding for the purpose of impressing upon said condenser plate and said pancake winding variations in the electromotive force whereby they are charged from said source of electricity.

3. A device of the character described, comprising a condenser plate, a pancake winding disposed adjacent the same, a diaphragm made of dielectric material and located between said condenser plate and

said pancake winding, said diaphragm being loose and light in order to be easily actuated for the purpose of producing sound waves, a source of electricity bridged across said condenser plate and said pancake winding in order to energize the same in opposite senses, an impedance connected with said source of electricity and with said pancake winding, and means connected with said source of electricity and co-acting therewith for varying the electromotive force impressed by said source of electricity upon said condenser plate and said pancake winding.

4. In a device of the class described, the combination of a condenser plate, a pancake winding disposed adjacent said condenser plate, a diaphragm made of dielectric material and located loosely between said condenser plate and said pancake winding, said diaphragm being free to move slightly in order to produce sound waves, a circuit containing a B battery and an impedance and bridged across said condenser plate and said pancake winding, and means connected with said circuit and including an audion bulb and an A battery for varying the electromotive force of said B battery upon said plate and winding.

5. In a device of the class described, the combination of a condenser plate, a pancake winding, a diaphragm of insulating material sandwiched in between said condenser plate and said pancake winding, said diaphragm being free to move slightly in response to attractions and repulsions of said condenser plate and said pancake winding, a source of electricity bridged across said condenser plate and said pancake winding so as to charge said condenser plate and said pancake winding in opposite senses, an impedance connected with said source of electricity and with said pancake winding, and means connected with said source of electricity and including an audion tube for the purpose of varying the electromotive force impressed by said source of electricity upon said condenser plate and said pancake winding.

6. In a device of the class described, a condenser plate, a pancake winding, an acoustical diaphragm sandwiched between said plate and winding, and means to variably excite said plate and winding and thereby cause acoustical vibration of said diaphragm.

7. In a device of the class described, a condenser plate, a pancake winding, means to hold said plate and said winding rigidly in position spaced slightly apart in substantially parallel relation to each other, an acoustical diaphragm sandwiched between said plate and winding, and means to variably excite said plate and winding and thereby cause acoustical vibration of said diaphragm.

8. In a device of the class described, a condenser plate, a pancake winding, an acoustical diaphragm of insulating material sandwiched between said plate and winding, and means to variably excite said plate and winding and thereby cause acoustical vibration of said diaphragm.

9. In a device of the class described, a condenser plate, a pancake winding, said plate and winding being of substantially equal diameters, means to hold said plate and winding rigidly in position spaced slightly apart in substantially parallel relation to each other, an acoustical diaphragm of insulating material also of substantially the same diameter as said plate and winding and being sandwiched between said plate and winding, and means to variably excite said plate and winding and thereby cause acoustical vibration of said diaphragm.

In testimony whereof I affix my signature.

JOHN DEPEW.