Oct. 31, 1933. H. R. VAN DEVENTER 1,932,461

LOUD SPEAKER

Filed June 7, 1932 2 Sheets-Sheet 1

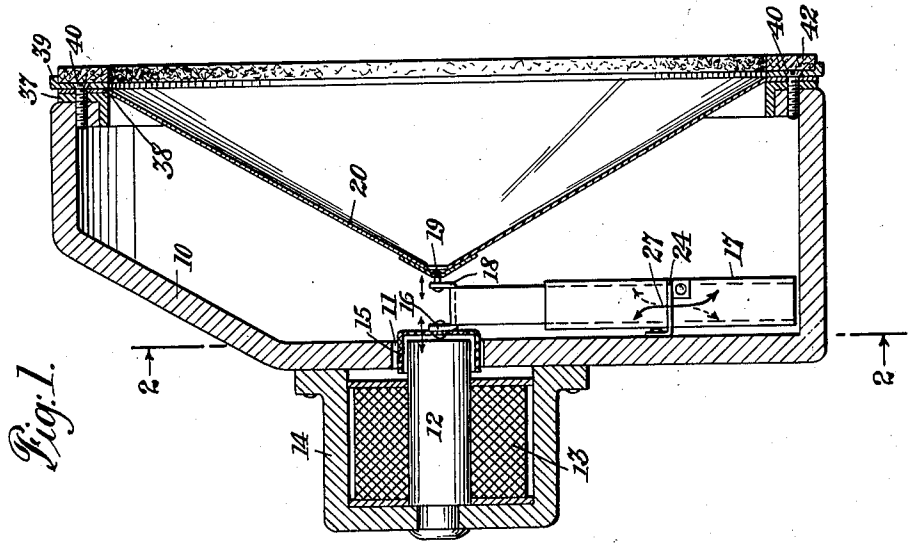


Fig. 1.

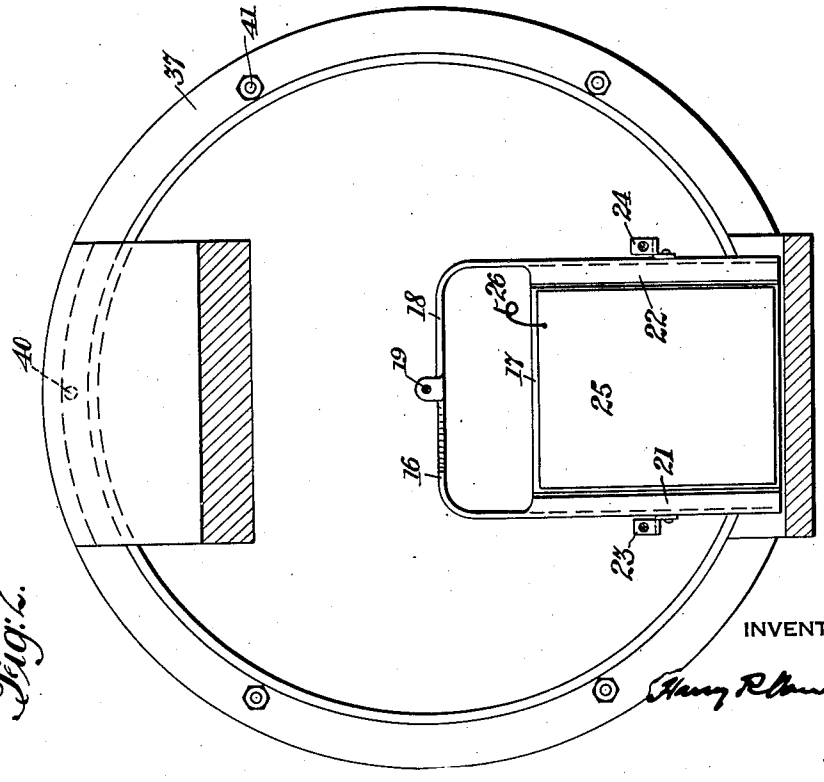


Fig. 2.

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Filed June 7, 1932 2 Sheets-Sheet 2

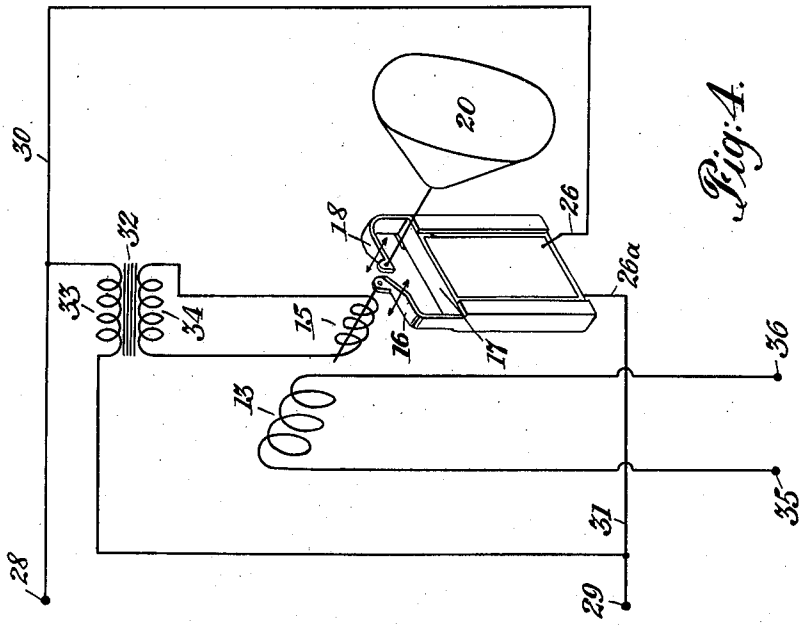


Fig. 4.

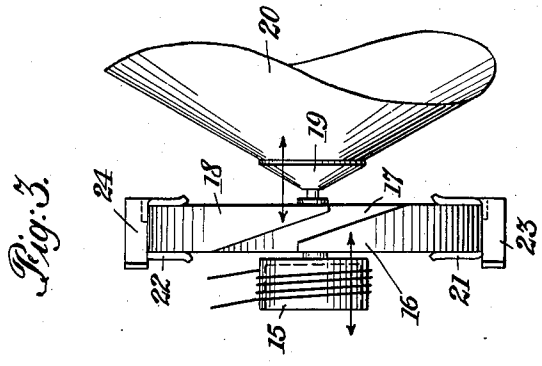


Fig. 3.

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1,932,461

LOUD SPEAKER

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Application June 7, 1932. Serial No. 615,836

7 Claims. (Cl. 179—109)

This invention relates to improvements in loud speakers and has for an object the provision in a loud speaker of a driving element favorable for the reproduction of tones in one portion of the audible range, a second driving element favorable for the reproduction of tones in a different portion of the audible range, and a diaphragm so arranged that one of the driving elements comprises the link between the other element and the diaphragm.

Another object is to provide two driving elements one of which is adapted not only to impart its motion to a diaphragm, but is also adapted to transmit motion from the other element to the diaphragm.

A further object of the invention is to provide a loud speaker in which vibrations of the lower register in one element are superimposed upon an element vibrating in the intermediate and lower registers, and in which a diaphragm attached to one of the vibrating elements receives the vibrations of both elements.

Other objects and advantages of the invention will be apparent to those skilled in the art from the description of one embodiment thereof herein.

It is well known in the art that some types of loud speakers, for example the dynamic types, faithfully reproduce tones of middle and lower register of the audible range, while other types of speakers, for example the piezo-electric crystal types, faithfully reproduce tones of the middle and high register.

The present invention contemplates the use of two types of reproducers, which together faithfully reproduce all of the tones of the audible range, combined in a novel manner wherein one of the reproducers forms the connecting link between the other reproducer and a suitable diaphragm, and not only transmits impulses from the other reproducer to the diaphragm but also reproduces and imparts impulses thereto.

In a preferred embodiment of the invention as illustrated in the drawings:

Figure 1 is a sectional elevation showing the relation of the two reproducers to the diaphragm;

Figure 2 is a section as viewed along the line 2—2 of Figure 1;

Figure 3 is an end view of a crystal element showing the method of connecting the diaphragm and the voice coil thereto; and

Figure 4 is a diagram showing the method of connecting the device to the output of an amplifier.

A frame 10 is provided and acts as a main support for the other elements. A circular opening 11 in the frame 10 has the core 12 concentric therewith, with a space between the core 12 and the inner surface of the opening 11. The core 12 has an electro-magnetic winding 13 thereon and is held in concentric relation to the opening 11 by a yoke 14 which is secured to the frame 10 in any suitable manner, the core 12 being securely fastened to the yoke 14.

When the winding 13 is energized, magnetic lines of force build up in the core 12 and the core 12, the yoke 14 and a portion of the frame 10 form a path for the magnetic flux; thereby an intense magnetic field in the annular space between the surface of the opening 11 and the core 12 is produced.

A movable coil 15 is positioned in this annular space and is adapted to receive currents from a suitable source, for example the modulated output of an amplifier, and to move in time relation to these currents due to the presence of this movable coil in the intense field between the opening 11 and the core 12.

In the present speakers of this character, called in the trade "electro-dynamic" speakers, it is customary to mount the movable coil directly on the apex of a cone shaped diaphragm.

In the improved loud speaker described herein the movable coil 15 is secured to the movable arm 16 of a crystal reproducer 17. A second arm 18 of the reproducer 17 is secured to the apex 19 of a diaphragm or cone 20. The crystal reproducer is secured to the frame 10 by means of brackets 23 and 24 which are in turn secured to clamp members 21 and 22 respectively. These clamp members support the crystal on opposite sides thereof and the arm 16 before mentioned is extended from the clamp 21 and the arm 18 is an extension of the clamp 22.

The crystal has electrodes one of which is shown at 25 in Figures 2 and 4 with a lead wire 26 connected thereto and when these electrodes are connected to a suitable amplifier the crystal 17 flexes as indicated by the arrows 27, the solid arrow showing one movement and the dotted arrow showing the opposite movement. If the dynamic portion of the speaker were not connected the motion of the crystal 17 would be imparted to the cone 20 via the arm 18.

An annular ring 37 of L cross section is supported by the frame 10, and the outer edge 38 of the cone 20 is clamped between the ring 37 and an outer clamp ring 39, the clamping being effected by means of screws 40 and bolts 41. The screws 40 also serve for securing the cone assembly to the frame 10.

A felt ring 42 is provided for membering up against a suitable baffle board (not shown).

Both reproducers are connected as shown in Figure 4 in which 28 and 29 represent terminals of any suitable source of modulated impulses, for example an amplifier, and the primary 33 of the transformer 32 is connected in parallel with the terminals 28 and 29 via the wires 30 and 31 respectively. The secondary 34 of the transformer 32 is connected to the moving coil 15.

The magnet winding 13 is connected via the terminals 35 and 36 to a suitable source of direct current.

One of the crystal electrodes is connected via the wires 26 and 30 to the terminal 28 and the other crystal electrode is connected via the wires 26*a* and 31 to the terminal 29.

With the device connected up as shown in Figure 4 to the amplifier of a radio set which is receiving a broadcast, the tones of the middle and lower ranges of frequency are more faithfully reproduced by the electro-dynamic portion of the speaker and these tones are carried to the cone 20 via the arm 16, the crystal element 17 and the arm 18. At the same time tones of the higher ranges are more favorably reproduced by the crystal element and they are imparted via the arm 18 to the cone 20, resulting in faithful reproduction of all tones of the audible range.

Many changes may be made in this device by those skilled in the art without departing from the invention herein described and illustrated, and as defined in the following claims.

What is claimed is:

1. In a loud speaker, an electro-dynamic reproducer having a moving element, a crystal reproducer, a diaphragm, an arm connected to said crystal adapted to support said moving element, and a second arm secured to said crystal and adapted to move said diaphragm.

2. In a device of the character described, a frame, an electro-magnet secured to said frame, a movable coil adjacent to said magnet, a crystal element carried by said frame, a diaphragm supported on said frame, an arm secured to said crystal and to said movable coil, and a second arm secured to said crystal and to said diaphragm.

3. In a device of the character described, a frame, an electro-magnet secured to said frame, a movable coil adjacent to said magnet, a crystal element carried by said frame, a cone supported on said frame having its apex adjacent to said crystal, an arm secured to said crystal and to said movable coil, and a second arm secured to said crystal and to the apex of said cone.

4. In a device of the character described, a frame having a circular opening therein, a yoke secured to said frame, a core carried by said yoke extending into said opening and positioned substantially concentric therewith forming therebetween an annular air gap, an electro-magnetic winding on said core for producing a magnetic field, a crystal reproducing element mounted on said frame, a diaphragm also supported by the frame, an arm secured to said crystal and adapted to support a movable coil in said air gap, and a second arm secured to said crystal and adapted to move said diaphragm.

5. In a loud speaker, an electro-dynamic reproducing element having a supporting frame, a diaphragm supported by said frame, a piezo-electric crystal having clamping members on opposite sides thereof, a bracket secured to each of said clamping members and adapted to support said crystal on said frame, an arm extending from one of said clamps to a movable member of said dynamic reproducing element, and an arm extending from the other of said clamps operatively connected to said diaphragm.

6. In a loud speaker, an electro-dynamic reproducing element having a supporting frame, a cone supported by said frame and having an apex extending from said element, a crystal reproducing element having clamping members on opposite sides thereof, a bracket secured to each of said clamping members and adapted to support said crystal on said frame, an arm extending from one of said clamps to a movable member of said dynamic reproducing element, and an arm extending from the other of said clamps secured to the apex of said cone.

7. In a device of the character described, an electro-magnetic field, a source of direct current therefor, a transformer, a movable coil connected to the secondary of said transformer, a crystal reproducer having electrodes, a source of modulated currents connected to a primary winding of said transformer and to said electrodes, a diaphragm, an arm connecting said crystal to said movable coil, and a second arm connecting said crystal to said diaphragm.

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