Dec. 20, 1927. 1,653,128

L. A. SMITH

LOUD SPEAKER

Filed April 15, 1927 2 Sheets-Sheet 1

Fig. 1.

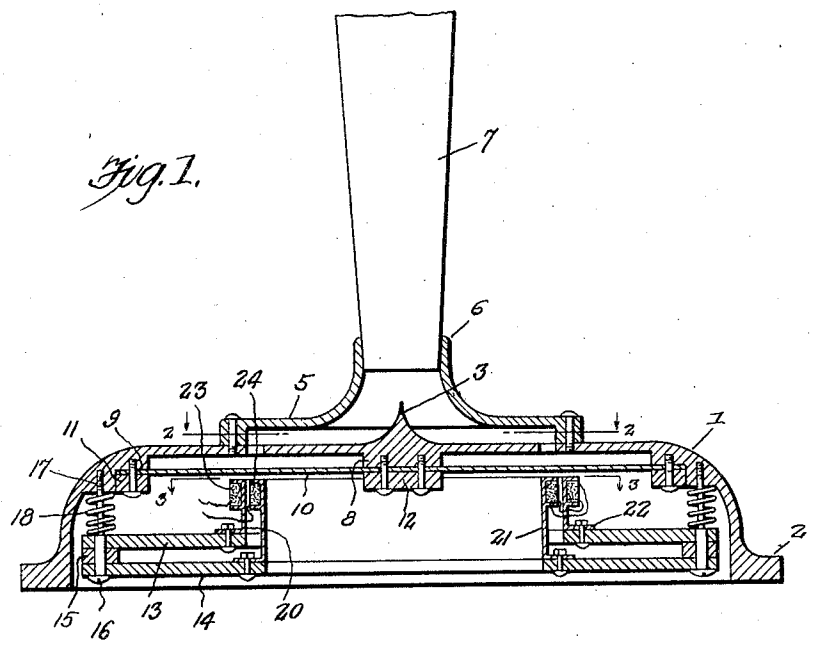


Fig. 2.

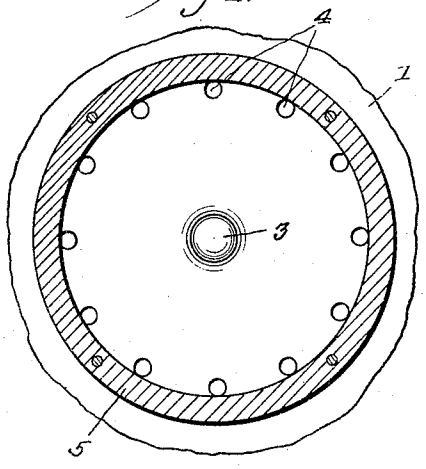
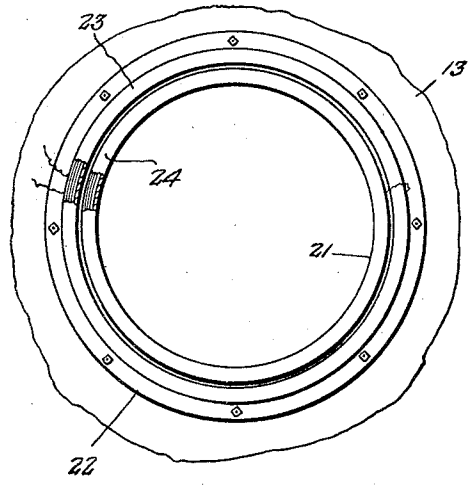


Fig. 3.



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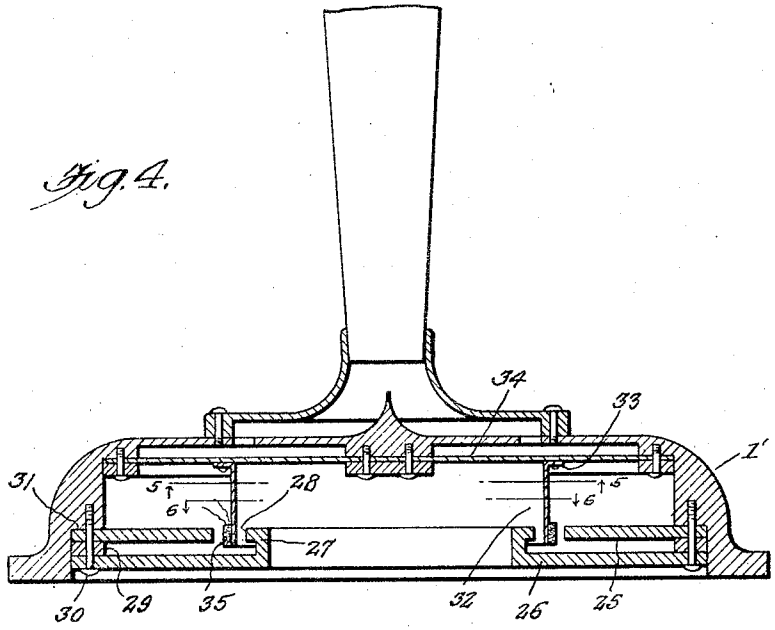
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Filed April 15, 1927 2 Sheets-Sheet 2

Fig. 4.



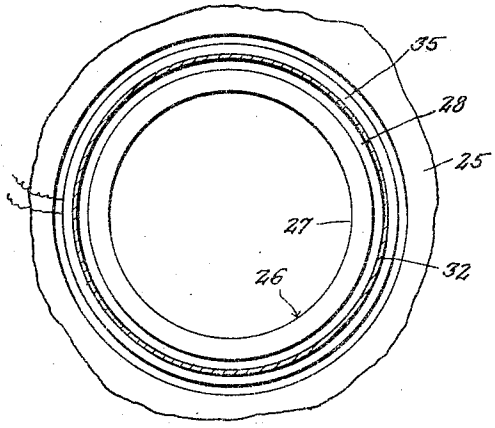


Fig. 6.

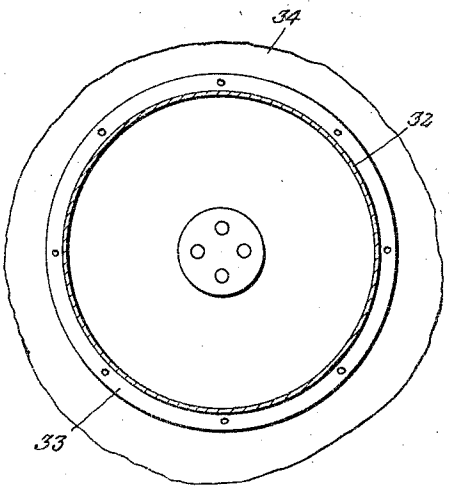


Fig. 5.

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UNITED STATES PATENT OFFICE.

LAWRENCE ALVIN SMITH, OF NEW ORLEANS, LOUISIANA.

LOUD SPEAKER.

Application filed April 15, 1927. Serial No. 184,092.

This invention relates to improvements in loud speaker units, such as used for reproducing radio signals or other sounds transmitted electrically.

An object of the invention resides in providing a loud speaker unit having a diaphragm anchored at a plurality of spaced intervals in concentric circumferential relation and an annular electro-magnetic operating means for vibrating an annular portion of the diaghragm in reproducing sound.

A further object of the invention resides in providing a loud speaker unit having a base member which rigidly mounts a flexible reproducer diaphragm secured to said base member in the central portion and at the edge portion to provide an annular or ring-shaped vibratory section operable by improved electro-magnetic means operated in accordance with sound waves carried by electrical impulses impressed thereon.

A further object of the invention resides in providing a loud speaker unit in which all of the parts are conveniently secured to a base member and in which suitable pole pieces are adapted to support a suitable energized coil and concentrate the magnetic field of a pair of permanent magnets of spring-shaped form mounted in spaced relation by a suitable spacing means, and secured by the same mounting elements to the base member in order that the maximum efficiency of operation of the reproducer may be obtained.

The invention comprehends numerous other objects residing in the specific details of construction and arrangement of the parts for simplifying the structure of the loud speaker unit, in addition to providing ready access to the several elements thereof by which suitable adjustments or replacements may be made, all of which are more particularly pointed out in the following detailed description and claims directed to a preferred form of the invention, it being understood however that various changes in the size, shape and relation of the parts may be made without departing from the spirit and scope of the invention as herein set forth.

In the drawings forming part of this application:

Figure 1 is a vertical transverse sectional view through the loud speaker unit and the base member forming a housing for the elements of the unit, showing the improved construction of this invention.

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1.

Fig. 4 is a view similar to Fig. 1, showing a slightly modified form of construction.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4.

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 4.

A base member is indicated at 1 which is of dome-shaped construction, being open at the bottom, and provided with the annular flange 2 on the bottom edge for engaging a suitable supporting surface on which the loud speaker is to be mounted. The central portion of the base member 1 is of substantially flat annular form and is provided in the center with an upwardly extending sound reflecting projection 3 in spaced concentric relation to which are arranged a plurality of openings 4.

A sound conducting cap member 5 is mounted on the upper face of the base member 1 as shown in Fig. 1, and provided with the central upwardly extending neck portion 6 which receives and mounts the amplifying horn 7 of ony suitable and desired type. The curvatures between the neck portion 6 and of the cap member, is such that it provides a constantly enlarging curved passage for sound waves, in order that they will be reflected in travel along the upper surface of the base member at right angles outwardly into the amplifying horn 7. The opening 4 provides conduit for conducting the sound from below the central portion of the cap base member into the space between the cap member 5, and the upper face of the base member.

The central portion of the base member immediately below the projection 3, is formed with an annular boss 8 projecting downwardly and terminating in the same horizontal plane as the annular shoulder 9 on the inside of the base member, concentrically arranged with the boss 8. The sound reproducing diaphragm 10 is mounted on the shoulder 9 and the end of the boss 8, and suitably retained thereon by the ring member 11 and the disk 12, having suitable screws or the like extending therethrough at intervals and threaded or otherwise secured in the base member.

This provides a support for the periphery in the center of the diaphragm 10 so that the sound reproducing portion of the diaphragm is of ring-shaped form. The operating unit for reproducing sound by vibrating the diaphragm 10 includes the ring-shaped permanent magnets 13 and 14 respectively, which are of uniform exterior diameter while the ring 13 is provided with a larger opening in the central portion in the ring 14 as shown clearly in Fig. 1.

These ring members 13 and 14 forming the permanent magnet, are of plate-like formation, and spaced by a suitable spacing ring 15 engaged between the outer edge portions of the plate. Suitable screw members 16 mounted the permanent magnets 13 and 14 and the spacing rings 15 in rigid assembled relation and have threaded projections 17 threadedly mounted in sockets in the base member 1 as shown in Fig. 1, while coiled springs 18 are positioned over the projections 17, and normally tend to retain the permanent magnet assembly having the plates 13 and 14 in positions of adjustment of the screws 16 and to take up any lost motion which may occur between the threads on the extensions 17 and the sockets in the base member 1.

A pair of cylindrical pole pieces of unequal length are indicated at 21 and 20 respectively, which have at one end radially extending flanges adapted to engage the permanent magnets 13 and 14 in order that the pole pieces may be secured thereto as illustrated in Fig. 1. The pole piece 20 is of larger size than the pole piece 21 and mounted in concentric relation therewith. The size of each of the pole pieces 20 and 21 correspond to the size of the respective central openings in the permanent magnets 13 and 14, while the length of each pole piece is such that the upper ends as shown in Fig. 1, terminate in the same plane and in close adjacent relation to the under side of the diaphragm 10.

In this way the magnetism from the permanent magnet is transmitted by the pole pieces 20 and 21, directly to the diaphragm 10, an angular or ring-shaped portion of which is included in the magnetic circuit between the poles, which are in substantially closed adjacent relation in order that the magnetism from each pole will have a full action on the annular or ring-shaped portion of the diaphragm 10 in effecting its operation, thereby obtaining the full strength of the magnetic source of the permanent magnet on the diaphragm.

Coil windings 23 and 24 are mounted on the upper end portions of the pole pieces 20 and 21 respectively, and are preferably connected in series in a suitable electric circuit held to energize suitable electric circuits energized with currents varying in accordance with predetermined sound waves or impulses. The variation in the current in the coils 23 and 24 will therefor affect the effective strength of the magnetic field on the diaphragm 10 and will vibrate the diaphragm to reproduce sound waves in synchronism with variations of the magnetic force of the field acting on said diaphragm. This action will take place throughout a ring-shaped area so that the reproduced sound will be directed through the opening 4 and outwardly through the amplifying horns 7.

As the magnetic field is concentrated at the terminals of the pole pieces 20 and 21, and between the pole pieces and the diaphragm 10, it will be readily appreciated, that by varying the strength of the magnetic field at both pole pieces, a more efficient control of the loud speaker is obtained for reproducing sound waves of varying intensity in order to obtain a more accurate reproduction of music or other sound broadcasted by radio in the manner well known in the art.

A construction embodying the same features above set forth in the construction and assembly of the parts as well as efficiency in operation, is obtained in the construction shown in Figs. 4 to 6 employing the electrodynamic principle of reproduction. In this construction, the permanent magnets are indicated at 25 and 26 respectively in which the magnet 25 is a plate of ring-shaped form and of substantially duplicate construction with the permanent magnet 13. The permanent magnet 26 is a ring-shaped plate having a lateral extension 27 at the end portion of which is an outwardly projecting radial flange 28.

A spacing ring 29 is used between the outer edges of the permanent magnets 25 and 26 respectively, and suitable securing means 30 in the form of threaded bulbs serve to rigidly mount the permanent magnet structure in the base 1'. The base is preferably constructed with a shoulder portion at 31 to receive the permanent magnet structure in place of using the bolts 16 with the coiled springs 18 as no adjustment of the permanent magnet is required.

A cylindrical supporting member 32 similar to pole piece 21 has the flange 33 on one end thereof secured to the diaphragm 34 in annular relation to the central, in the manner as shown clearly in Figs. 4 and 5, while at the lower end, this member 32 carries the coil windings 35 positioned between the inner edge portion of pole piece 25 and the outer edge of annular flange 28 on the pole piece 26.

This coil 35 is electrically connected in the circuit carrying electrical impulses varied in accordance with predetermined sound waves in a well known manner so that the electromagnetic field set up by the coils 35 and cur-

rent flowing therethrough will cooperate with the field between the permanent magnets 25 and 26 to produce the vibration of the diaphragm and thereby reproduce the sound waves impressed on the coil 35, by electrical impulses.

It will be understood that in the construction shown in Figs. 1 and 2, the parts are of substantially duplicate construction in every respect with the exception of the pole piece 26, and that either form of the device can be constructed with the use of the substantially same part in a re-arranged relation, thereby providing a loud speaker construction, which may employ the electro-dynamic principle of reproducing the sound as shown in Fig. 4 or the application of bolt holes of the permanent magnets direct to the diaphragm in a circumferential portion thereof for obtaining the full effect of the variation of the magnetic field in the operation of the diaphragm to reproduce sound.

Having thus described my invention, what I claim as new is:—

1. A loud speaker unit, comprising a base member having a central upwardly curved sound reflecting projection, said base member having a plurality of openings formed therein in circumferential relation concentric to said projection, a cap member detachably mounted on the top of said base member over said opening and projection, and spaced therefrom to form a sound passage, said cap member having an upwardly extending neck adapted to receive an amplifying horn, a diaphragm mounted in the base member below the central portion, and means for operating the diaphragm to produce sound waves for transmission through said opening, the sound passage between the cap member and upper portion of the base for reflecting outwardly through the neck in said cap member into the amplifying horn.

2. A loud speaker unit, comprising a base member having a plurality of circumferentially arranged openings in the central top portion thereof, a cap member mounted on the top of said central portion of the base member and spaced from said openings to provide a sound passage on top of the base member, the central portion of said cap member having an upwardly extending neck for directing sound outwardly therethrough, the under side of the top portion of said base member having a depending boss in concentric relation with respect to said opening, and an annular concentric shoulder lying in the same horizontal plane as the end of said bore, a circular diaphragm mounted on the under side of said base and engaged with said shoulder and said bore, means securing the diaphragm to the shoulder and boss independently to provide a ring-shaped portion of the diaphragm freely suspended for vibration laterally to the plane thereof, and electro-magnetic means operable on the ring-shaped portion of said diaphragm for vibrating the same in a predetermined manner to reproduce sound waves for projection through the openings in said base, the sound passage between the base and the cap member and outwardly through the neck of said cap member.

3. A loud speaker unit, comprising a base member having the upper central portion formed with a plurality of circumferentially arranged openings, a boss and an annular shoulder formed on one side of said base member in concentric relation with each other and said opening, an annular diaphragm mounted on said boss and shoulder, means securing said diaphragm to said boss and shoulder, the central portion of the diaphragm being freely vibratable for reproducing sound waves, a pair of ring-shaped plates forming permanent magnets in having central openings of unequal size, a spacing ring positioned between the outer edge portions of said permanent magnet, means for securing said magnets and the spacing ring in assembled relation, the inner annular edges of said plates forming the opposite poles of the permanent magnet assembly, and means for impressing the field of permanent magnet substantially at the poles thereof, for controlling the operation of said diaphragm in a circumferential portion concentrically arranged between the boss and annular shoulder, and a coil winding electrically energizable to produce a magnetic field for cooperation with the field of said permanent magnet, said coil winding being mounted in circumferential relation with the inner edges of said poles and lying substantially in the annular magnetic field thereof.

In testimony whereof I affix my signature.

LAWRENCE ALVIN SMITH.