

Dec. 3, 1940.

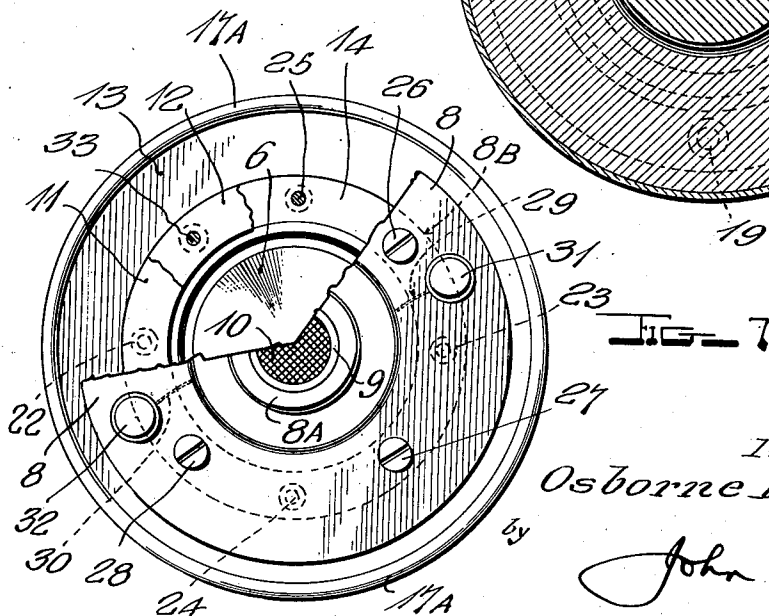
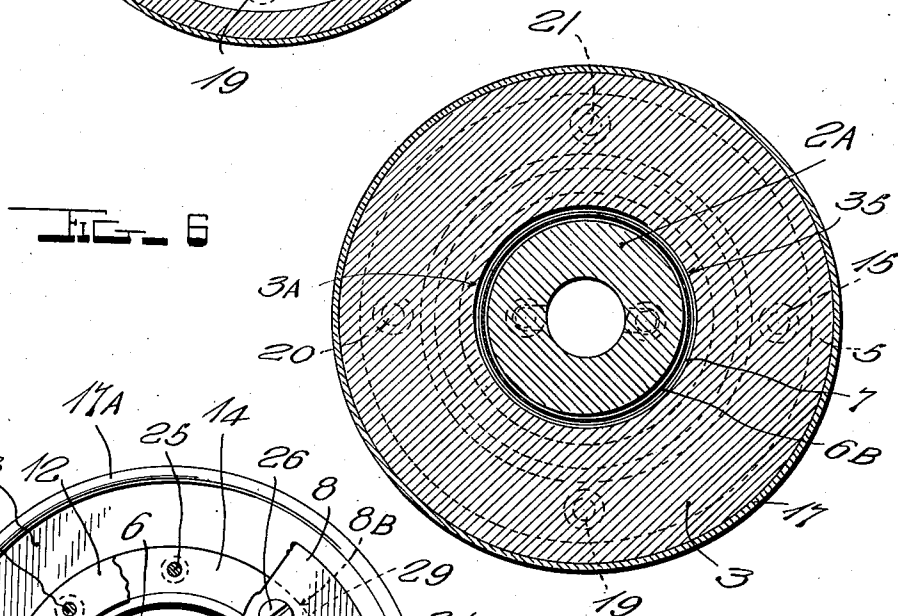
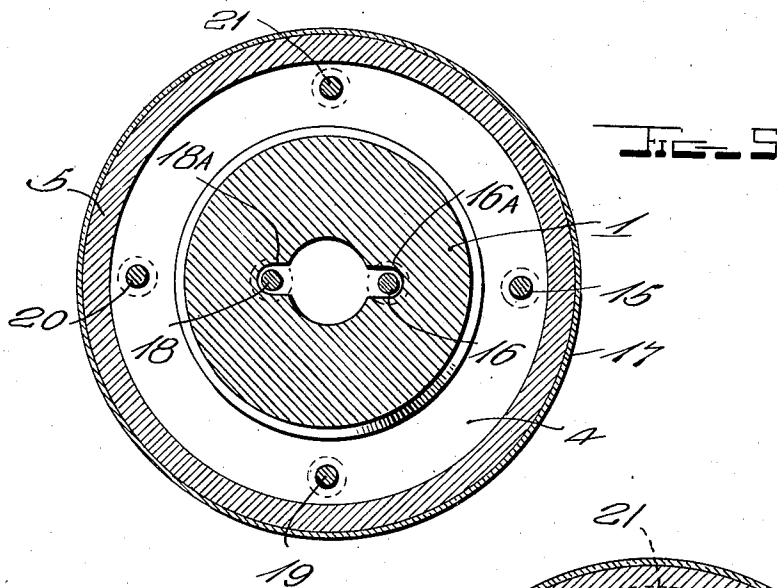
O. I. PRICE

2,223,496

SOUND REPRODUCER

Original Filed Nov. 12, 1937

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,223,496

SOUND REPRODUCER

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Original application November 12, 1937, Serial
No. 174,241, now Patent No. 2,180,482, dated
November 21, 1939. Divided and this applica-
tion August 16, 1939, Serial No. 290,485

2 Claims. (Cl. 179—115.5)

My invention relates broadly to electrical sound reproducers and more particularly to an improved construction of electrical sound reproducer.

This application is a division of my application Serial No. 174,241, filed November 12, 1937, for Sound reproducer and method of manufacturing the same, now Patent 2,180,482, granted Nov. 21, 1939.

One of the objects of my invention is to provide a construction of electrical sound reproducer of the magnetic type having a permanent magnetic field of extremely high flux density.

Another object of my invention is to provide a construction of permanent magnet type of electrical sound reproducer wherein a permanent magnetic field of extremely high flux density is maintained continuously across an annular magnetic gap in which a winding carried by a sound reproducing diaphragm is traversed by varying currents and wherein the high flux density is confined to the magnetic path of the sound reproducer per se and substantially shielded against external leakage.

A further object of my invention is to provide a construction of electrical sound reproducer embodying a permanent magnet of toroidal shape terminating in an annular head and coacting with a surrounding magnetic plate providing an annular gap in which a winding carried by a sound reproducing diaphragm and traversed by varying currents is arranged to operate.

A still further object of my invention is to provide a construction of sound reproducer whose characteristics remain substantially constant independently of wide variations in conditions of temperature and humidity while reproducing sound over a wide frequency response characteristic.

Other and further objects of my invention reside in the improved construction of electrical sound reproducer as set forth more fully in the specification hereinafter following by reference to the accompanying drawings in which:

Figure 1 is a vertical sectional view through an electrical sound reproducer constructed in accordance with my invention; Fig. 2 is a fragmentary plan view of the permanent magnet employed in the electrical sound reproducer of my invention; Fig. 3 is a side elevation partially broken away and shown in cross section of the permanent magnet employed in the electrical sound reproducer of my invention; Fig. 4 is a fragmentary view of a modified form of permanent magnet which may be employed in the sound reproducer of my invention, the view being partially broken

away and shown in cross section; Fig. 5 is a transverse sectional view through the electrical sound reproducer taken on line 5—5 of Fig. 1; Fig. 6 is a transverse sectional view through the electrical sound reproducer taken on line 6—6 of Fig. 1; and Fig. 7 is a top plan view of the electrical sound reproducer with parts broken away and illustrated in cross section.

My invention is directed to an electrical sound reproducer capable of functioning under conditions encountered in marine and aircraft operation where the electrical sound reproducer is subjected to wide changes in temperature, barometric pressure and humidity conditions. I have successfully operated the electrical sound reproducer of my invention on shipboard and in aircraft. I have devised a magnetic structure of electrical sound reproducer of my invention with a view of obtaining a permanent magnetic field of extremely high flux density. I provide a toroidal shaped permanent magnet formed from an alloy of aluminum, nickel and cobalt. The toroidal shaped permanent magnet is magnetized under conditions of high charging current and provides a flux density in the sound reproducer in a range of 10,800 gaussess or higher. I dispose the toroidal shaped permanent magnet in a path of soft steel which includes an annular gap within which the winding, supported by the sound reproducing diaphragm and carrying current variations is disposed. I surround the magnetic system with a shield which is so complete that there is substantially negligible magnetic leakage from the magnetic structure. Moreover, the shield is so constructed that the magnetic parts and the diaphragm are substantially protected against dampness, salt water, acid fumes, high pressures and vacuums, whereby the magnetic system and diaphragm operate independently of wide variations in conditions of temperature, barometric pressure and humidity.

Referring to the drawings in detail, reference character 1 indicates the toroidal shaped permanent magnet employed in the electrical sound reproducer of my invention. The permanent magnet employed is formed from an alloy of aluminum, nickel and cobalt and when magnetized under control of a high charging current, a permanent magnetic field of the order of 10,800 gaussess is established. The permanent magnet 1 tapers from a relatively large diameter adjacent its base to a smaller diameter adjacent the top thereof. In Fig. 3 I have shown the permanent magnet with a straight wall, tapered so that the toroidal shaped permanent magnet is substantially frusto-

conical. In Fig. 4 I have shown the permanent magnet having a gradual taper 1A from a position adjacent the base to a position adjacent the top of the magnet. The permanent magnet 1 has a central bore extending longitudinally there-
 5 through with diametrically opposite longitudinally extending grooves 16A and 18A for accommodating non-magnetic securing bolts 16 and 18 which pass through the soft steel base 4 and
 10 enter the soft steel cap plate 2. The soft steel cap plate 2 has a shaped annular head 2A and an angularly inclined wall 2B connected with head 2A through a curved interconnecting wall portion 2C. The head 2A of the annular cap 2 is aligned
 15 with the annular face 3A of soft steel plate 3. The soft steel plate 3 is secured in position with respect to the soft steel base 4 with the cylindrical soft steel case 5 serving as a spacer member between soft steel base 4 and soft steel plate 3
 20 by means of the non-magnetic securing bolts 15, 19, 20 and 21. The cylindrical soft steel case 5 serves as the neutral portion of the magnetic system and provides a path for the magnetic lines which emanate from the permanent mag-
 25 net 1 and thread through soft steel annular cap 2, head 2A, annular gap 35, annular face 3A and soft steel plate 3, the soft steel case 5 and through the soft steel base 4, returning to the permanent magnet.

30 The sound reproducing diaphragm is indicated generally at 6 having a central sound reproducing portion 6A and winding supporting portion 6B where the winding supporting portion 6B extends through the annular gap 35 for support-
 35 ing winding 7 between soft steel annular head 2 and soft steel annular face 3A. The diaphragm is suspended by the annular flexible and resilient metallic rim 14 which is secured between flexible gaskets 11 and 12 by screw members 22, 23, 24
 40 and 25 shown more clearly in Fig. 7. The screw members 22, 23, 24 and 25 pass into the annular plate 8 which forms part of the support for the sound reproducing horn adapted to be connected to the screw threaded cylindrical neck
 45 8A. The plate 8 has an annular recess 8B therein which enables the plate 8 to completely cover the gaskets 11 and 12 and form a tight seal against the entry of moisture, salt water, acid fumes or gases. Plate 8 seats directly against
 50 the top 13 of the case. The top 13 may be of aluminum, zinc, brass or other non-magnetic material, and is provided with a central recess indicated at 13A which aligns with the recess 8B in plate 8 allowing a snug fit for gasket 12 when the
 55 assembly is inserted in position, thus further presenting an obstructive path against the entry of moisture, salt water, acid fumes, or gases. Top plate 13 also provides a connection means over which the top edge 17A of the non-magnetic
 60 protective case 17 is rolled. The case 17 is formed from aluminum or other suitable non-magnetic material and entirely encases the magnetic parts of the sound reproducing system. When rolled over at the top edge 17A, a tight joint is provided with respect to top plate 13. The support-
 65 ing plate 8 which carries the diaphragm assembly and supports the sound reproducing horn may also be constructed from aluminum or bronze or other non-magnetic materials so that a complete
 70 non-magnetic housing is provided around the magnetic system. Not only does this non-magnetic housing aid in confining the magnetic lines of force within the magnetic system, but the casing prevents the undesirable influence which external fields may have upon the magnetic system

which tend to realign the molecular structure of the permanent magnet from outside sources. The plate 8 which carries the diaphragm assembly is wholly removable as a unit from soft steel plate 3 so that the diaphragm may be assembled com-
 5 pletely within the top plate 8 before insertion with respect to magnetic gap 35. The top plate 3 is provided with recesses 3B aligned with the heads or screws 22, 23, 24 and 25 allowing the assembly to be compactly effected.

10 While I have referred to plate 8 as being formed from aluminum, I have found that in certain instances that it is desirable to form the plate 8 from soft steel for the purpose of providing a magnetic leakage path for avoiding
 15 stray fields where a bronze or aluminum plate would allow the passage of such leakage fields. I provide a cylindrical collar 9 within the screw threaded terminus 8A and a protective screen 10 within the cylindrical terminus for the protection
 20 of the sound reproducing diaphragm 6.

The plate 8 carries binding posts 31 and 32 in insulated position thereon as shown more particularly in Fig. 7. Binding posts 31 and 32 are
 25 connected through leads 29 and 30 to opposite ends of winding 7 carried by the coil supporting portion 6B of the sound reproducing diaphragm. The plate 8 is removably secured in position as a complete assembly in itself readily separable
 30 from the permanent magnet system by means of screws 26, 27, 28, and 33 which pass through plate 8 and enter the soft steel plate 3 through non-magnetic plate 13 as indicated more particularly in Fig. 7. When plate 8 is formed from
 35 soft steel for the purpose of providing a magnetic leakage path, the screws 26, 27, 28 and 33 further serve as a connection to the soft steel plate 3 through which magnetic lines of force thread.

40 As heretofore observed the complete sound reproducing diaphragm assembly is supported by plate 8 which when secured in position on the casing insures that the coil 7 may be centered in the gap 35 between annular head 2A and annular magnetic face 3A. The winding 7 is connected
 45 in the variable current circuit and when energized by variable currents coacts with the intense magnetic field established across gap 35 for imparting vibrations to the sound reproducing diaphragm 6 which is free to vibrate through
 50 flexible suspension 14 for the reproducing of sound.

The loud speaker of my invention operates to reproduce sound uniformly over a wide frequency range with a high degree of fidelity. The fact
 55 that all parts of the structure are protected against variations in temperature, barometric pressure, and humidity, insures permanency in operation of the structure whether in aircraft, on shipboard or under other severe conditions.
 60 The fact that the parts of the sound reproducer are constructed from materials not subject to change under conditions of wide variations in temperature, barometric pressure, and humidity further insures the permanency in operation of
 65 the sound reproducer.

While I have described my invention in one of its preferred embodiments I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a sound transducer of the electrodynamic

type employing a permanent magnet field structure, in combination, magnetic means for providing an annular gap having a high flux density, an annular plate member of non-magnetic material disposed on said magnetic means concentric with said annular gap, a substantially seamless cup-shaped casing of non-magnetic material for said magnetic means, the peripheral edge of said casing being engaged with the outer surface of said annular plate member for substantially enclosing said magnetic means with the exception of the annular gap portion thereof, a head member having a sound chamber and a passage thereto, a diaphragm having a winding thereon adapted to be disposed in said annular gap, means for supporting said diaphragm in said head member in cooperative relation to said sound chamber, and means for mounting said head member in connection with said annular plate member with said winding centered in said annular gap, said head member being cooperative with said annular plate member and said casing for substantially wholly enclosing said magnetic means and said diaphragm.

2. In a sound transducer of the electrodynamic type employing a permanent magnet field structure, in combination, magnetic means for providing an annular gap having a high flux density, an annular plate member of non-magnetic material disposed on said magnetic means concentric with said annular gap, a substantially seamless cup-shaped casing of non-magnetic material for said magnetic means, the peripheral edge of said casing being engaged with the outer surface of said annular plate member for substantially enclosing said magnetic means with the exception of the annular gap portion thereof, a head member having a sound chamber and a passage thereto, means for mounting said head member in connection with said annular plate member for substantially wholly enclosing said magnetic means, a diaphragm having a winding thereof adapted to be disposed in said annular gap, and means including said head member for mounting said diaphragm in cooperative relation to said sound chamber with said winding centered in said annular gap.

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