

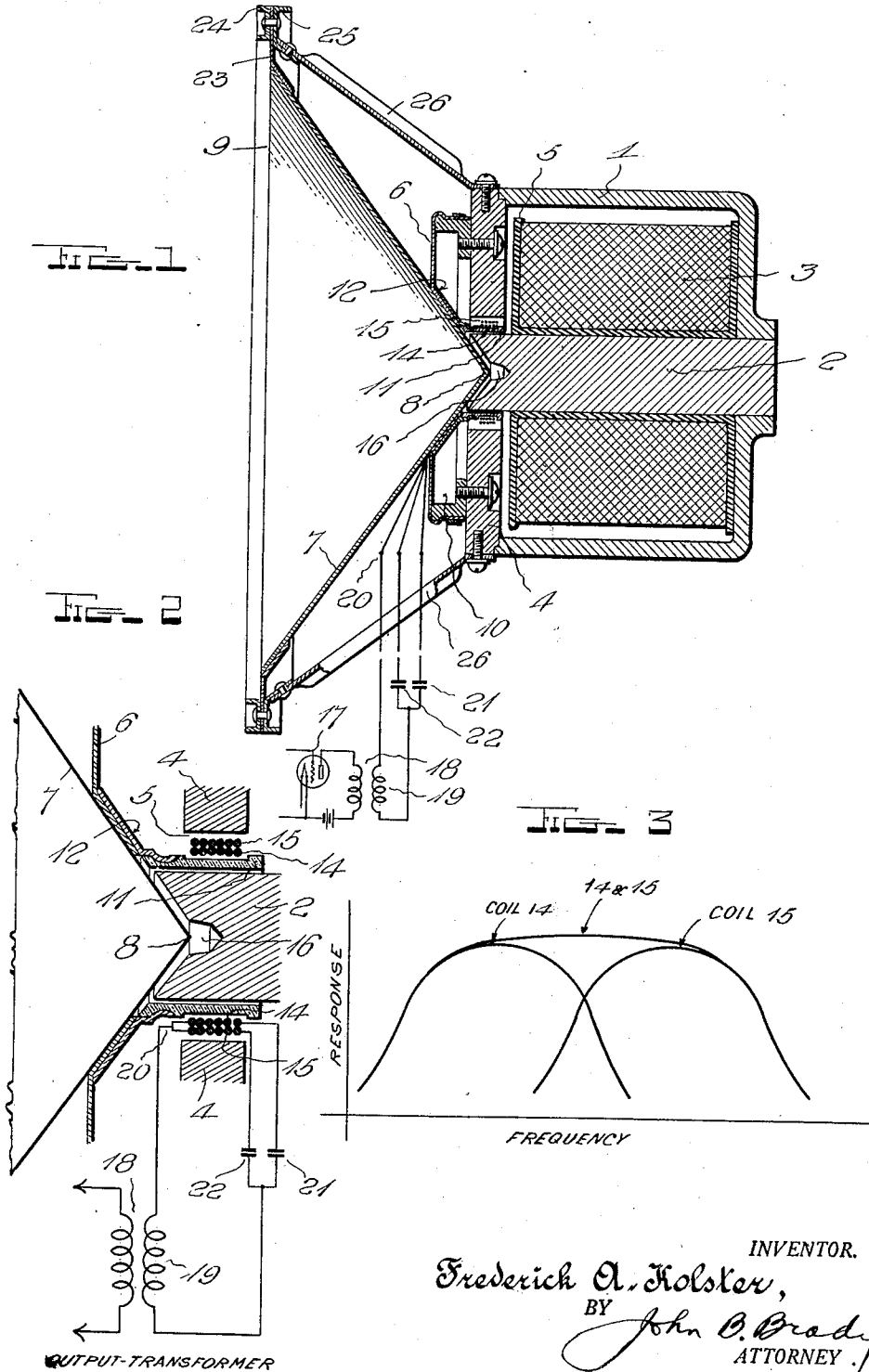
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F. A. KOLSTER

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ELECTROMAGNETIC SOUND REPRODUCER SYSTEM

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INVENTOR.

Frederick A. Kolster,

BY

John C. Brady
ATTORNEY.

UNITED STATES PATENT OFFICE

FREDERICK A. KOLSTER, OF PALO ALTO, CALIFORNIA, ASSIGNOR TO FEDERAL TELEGRAPH COMPANY, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF CALIFORNIA

ELECTROMAGNETIC SOUND REPRODUCER SYSTEM

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My invention relates broadly to sound reproducers and more particularly to a sound reproducer of the electrodynamic type.

One of the objects of my invention is to provide a construction of electrodynamic sound reproducer having means for efficiently reproducing sound over a broad frequency range.

Another object of my invention is to provide a construction of electrodynamic sound reproducer having means for securing uniform response to tone frequencies over a wide range of frequencies for securing fidelity in sound reproduction.

Still another object of my invention is to provide a construction of electrodynamic loud speaker which includes a plurality of voice coils connected in separate circuits responsive to different ranges of tone frequencies for securing uniform response over a wide range of frequencies.

A further object of my invention is to provide an electrodynamic sound reproducer having a multiplicity of voice coils disposed in the permanent field of the electrodynamic system where the voice coils are individually connected in different audiofrequency circuits responsive to different ranges of frequencies for securing a uniform reproduction of sound over a broad frequency range by the conjoint effect of the voice coils.

A still further object of my invention is to provide a circuit arrangement for an electrodynamic type of loud speaker having means for efficiently operating from the relatively heavy current existent in the output system of a power amplifier.

My invention will be more clearly understood from the specification hereinafter following by reference to the following specification and the accompanying drawing wherein:

Figure 1 is a cross-sectional view taken through the electrodynamic sound reproducer of my invention; Fig. 2 is an enlarged

cross-sectional view of the electrodynamic operating mechanism in the sound reproducer of my invention illustrating the multiple windings connected in the separate branch circuits in the output system of the power amplifier; and Fig. 3 is a chart illustrating the principle of my invention.

In the development of the electrodynamic type of sound reproducer of the class shown in Letters Patent 1,637,119 to Frederick A. Kolster and Sigurd A. Sollie, I have found that the efficiency of the sound reproducer may be substantially increased by the provision of a multiple winding on the movable element of the electrodynamic sound reproducer. By providing independent paths from the output system through each of the windings on the movable element I am able to secure uniform response over a relatively wide range of frequencies for improving the reproduction of sound.

My invention finds particular application in electric phonograph systems and in radio receiving apparatus where a power amplifier is employed to supply variable currents through the windings carried by the movable element of the electrodynamic system. I have found that by dividing the path of the current through the moving coil into a plurality of branches and constructing the several branches for efficient response over definite frequency ranges the frequency responses of the different branches may be so adjusted as to overlap one adjacent the other, and thereby render the reproduction of sound uniform over a wide frequency range. I provide means for independently tuning the different branches to the selected range of frequencies in order to secure the cooperative effect of the several windings in the movable element of the electrodynamic system.

Referring to the drawing in more detail, reference character 1 designates a casing which houses the electrodynamic operating mechanism which includes the central pole

member 2 on which is disposed the electromagnetic winding 3. A plate member 4 is secured to the front of the casing 1 and is provided with a central annular aperture 5 through which the pole member 2 projects. The conical shaped sound reproducing diaphragm is supported by means of a flexible annular web member 6 which is secured to the surface of the conical shaped sound reproducing diaphragm 7 in a position intermediate the apex 8 and peripheral edge 9. The peripheral edge 9 is connected to a flexible web 23 which is supported in an annular frame structure composed of channel shaped members 24—25 riveted one to the other. The channel shaped members are supported in predetermined relation to the electrodynamic system by means of arms 26. The web 6 is suitably secured to the ring structure 10 which is carried by the plate 4. A tubular member 11 of insulating material is connected by means of metallic member 12 with the conical shaped sound reproducing diaphragm 7. The tubular member 11 carries a multiplicity of independent windings. For the purpose of illustrating the principle of my invention I have shown two such windings disposed one upon the other, the winding in one layer being designated as voice coil 14, and the winding in the other layer being designated as voice coil 15. The windings all operate within a common magnetic field provided by the electromagnetic winding 3 and the lines of force which pass through the annular gap formed in aperture 5 between front plate 4 and pole member 2. The pole member 2 is cut away at the front thereof, as indicated at 16, to receive the apex 8 of the conical shaped sound reproducing diaphragm 7 in a position free for vibratory motion.

Independent paths are provided through the voice coils from the output system of the power amplifier. In Figure 1 I have designated electron tube 17 as constituting the last stage of power amplification in an electric phonograph system or in a radio receiving apparatus. The output circuit of the power amplifier system includes an output transformer designated at 18 having a secondary winding 19 which connects to the common point 20 of the ends of the voice coils 14 and 15. The opposite ends of the voice coils 14 and 15 connect through different branch circuits with the opposite side of the secondary winding 19. I have illustrated condenser 21 in series with voice coil 14 and condenser 22 in series with voice coil 15. These condensers have that capacity necessary to tune the branches to particular ranges of audio frequencies according to the characteristic curves illustrated in Fig. 3. The frequency response curve of voice coil 14 drops off at a point where the frequency response curve of voice coil 15 rises by virtue of the differently

tuned branch circuits, giving as a result the combined effect of voice coils 14 and 15 or a response curve which is substantially uniform over a wide range of frequencies. While I have illustrated two voice coils in two separate branch circuits, it will be understood that a multiplicity of voice coils may be provided for securing efficient reproduction over a broad frequency range.

While I have described my invention in a certain preferred embodiment, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are 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 reproducer of the electrodynamic type a sound reproducing diaphragm, an electromagnetic field system having a magnetic gap therein, a coil support carried by said diaphragm and projecting into said gap and a plurality of independent windings each in series with a condenser and carried by said coil support and operative by the conjoint influence of currents in said plurality of windings for imparting vibrations to said sound reproducing diaphragm.

2. A sound reproducer of the electrodynamic type comprising a field magnet system including an annular magnetic gap, a sound reproducing diaphragm, independent circuits each having a condenser in series therewith responsive to different ranges of audio frequencies, said circuits having elements thereof attached to said sound reproducing diaphragm and extending into said annular magnetic gap for actuation by current paths for impressing sound vibrations upon said diaphragm.

3. In a loud speaker, a field magnet frame having pole pieces arranged to form an annular air gap, a speech coil movable axially in said air gap, said coil consisting of a plurality of windings each having a condenser in series therewith adapted to respond most efficiently to different bands of frequencies, and a diaphragm operated by said coil.

4. In a loud speaker, the combination of a field magnet having an annular air gap, and a cone diaphragm carrying a speech coil adapted to vibrate axially in said air gap, said coil consisting of at least two windings each having a condenser in series therewith and so connected in circuit as to respond most efficiently to the higher and lower tonal register, respectively.

5. A sound reproducer of the electrodynamic type, comprising a sound reproducing diaphragm, a multiplicity of separate windings supported by said diaphragm, an electromagnetic field common to all of said windings, said windings each having independent series connections to separately tuned branch

circuits adjusted to respond to different frequency ranges.

6. In an electromagnetic translating device, a plurality of windings each in series
5 with an independent tuned circuit movable in a magnetic field and adapted to respond most efficiently to different bands of frequencies, and vibratory means actuated by said windings.

10 In testimony whereof I affix my signature.
FREDERICK A. KOLSTER.

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