

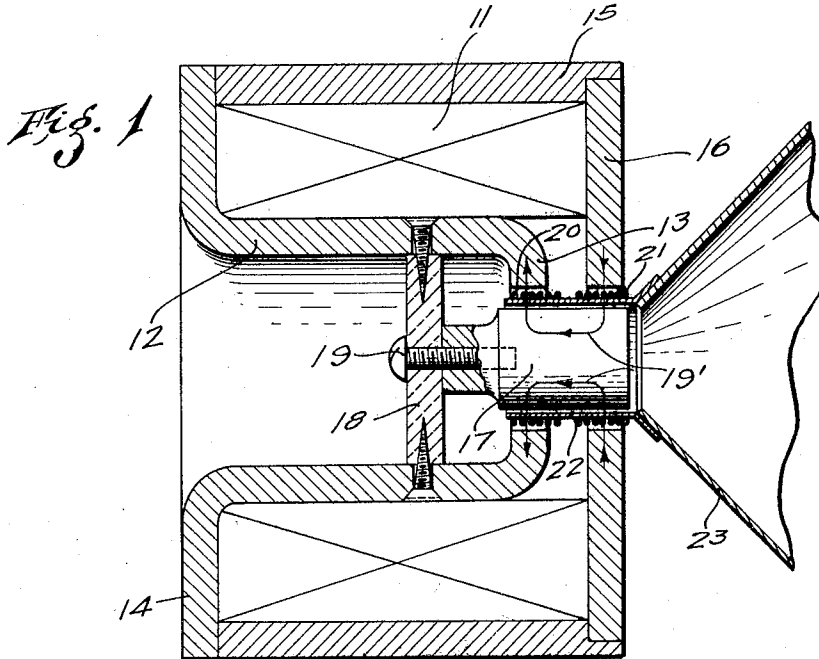
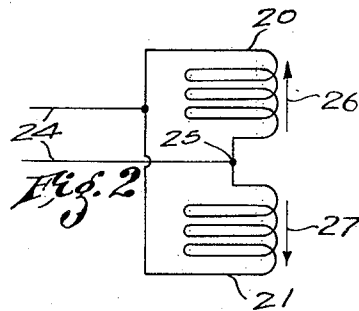
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H. J. FANGER

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DYNAMIC LOUD SPEAKER UNIT

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INVENTOR
Herman J. Fanger

By *John Flann*

ATTORNEY

UNITED STATES PATENT OFFICE

HERMAN J. FANGER, OF OAKLAND, CALIFORNIA

DYNAMIC LOUD SPEAKER UNIT

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This invention relates to devices for transforming signal carrying electrical impulses into sound waves; and more particularly to a device employing the dynamic principle whereby a movable conductor is actuated in accordance with the signals to be reproduced.

Such units employ a magnetic field, usually produced by the aid of a field coil supplied with direct current. The magnetic circuit includes a small gap in which a coil or other conductor is movable, in such manner that the movement cuts the magnetic lines of force. When such a conductor is supplied with current carrying the impulses, this current reacts with the transverse field to move the coil, and this movement can be used to actuate an air actuator, such as a diaphragm or a cone.

The field coil, in order to secure good efficiency, must be supplied with a considerable energizing current, sometimes of the order of an ampere. In prior devices, the heat losses in the coil serves to heat the coil and the surrounding parts of the structure; and it is obvious that this heating must be taken care of by proper circulation so that it may not affect the unit deleteriously.

It is one of the objects of my invention to prevent this undesirable temperature rise, and more particularly by providing a large radiating surface for the structure. I accomplish this result by so arranging the magnetic circuit that it has, in addition to an external radiating surface, a supplemental interior radiating surface. Accordingly, it is another object of my invention to provide a structure for the magnetic circuit that accomplishes these useful results.

In dynamic speakers of the prior art, the magnetic field set up by the moving conductor has a reaction on the core of the field coil, causing eddy currents therein; this reaction may produce and often does produce, distortion in the reproduction. It is another object of my invention to neutralize this effect. More particularly, I utilize a special form of coil that has no appreciable magnetic effect on the core. For example, I can use a pair of moving coil sections, supplied with

current in such a way that the combined magnetic effect is substantially zero.

In a single coil device, it is evident that movement of the coil in response to signaling impulses may serve partly to remove the coil from the influence of the field, and the response for a large coil movement is materially lessened. In my two coil arrangement, this effect is nicely overcome, for as one coil moves out of the field, the other can move into the field. Furthermore, the effect of the coils on the air actuator is cumulative, to produce a push-pull result.

It is often desirable to provide a speaker that embodies a horn as well as a cone, so that all tones of the signals can be faithfully reproduced. It is another object of my invention to provide a single unit in which the horn and cone are both actuated thereby, and particularly by using the cone as the mouth for the diaphragm.

My invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of an embodiment of my invention. For this purpose I have shown a form in the drawing accompanying and forming part of the present specification. I shall now proceed to describe this form in detail, which illustrates the general principles of my invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of my invention is best defined by the appended claims.

Referring to the drawing:

Figure 1 is a sectional view, mainly diagrammatic, of a loud speaker unit embodying my invention; and

Fig. 2 is a diagram showing the manner in which the two sections of the movable coil used in my device are energized.

In Fig. 1, I show a field coil 11 in diagrammatic fashion only. It is shown as disposed on a tubular magnetic member 12. This member has an internal flange 13, forming a large central aperture at one end. It can be further provided with an external flange 14 at the opposite end, against which one end of coil 11 can rest. The exterior of coil 11 is covered by a tubular magnetic casing 15 fas-

tened to flange 14. At its other end, this casing is provided with an annular pole piece 16 forming an aperture of substantially the same size as flange 13, but overlying it.

5 A short core piece 17 is held centrally of both flange 13 and pole piece 16, as by the aid of a non-magnetic bridging member 18. This bridge 18 can be fastened in tube 12, and a screw 19 passing through it can serve to
10 hold the piece 17 firmly in centered or central relation to the members 13 and 16.

It is apparent that if, say, the pole piece 16 forms a north pole, the inner edge of flange 13 must form a south pole. The core 17 at that
15 portion opposite the inner edge of pole piece 16 has a south pole induced thereby; and that portion opposite flange 13 has a north pole induced thereby. The course of the lines of force through the core 17 is shown by arrows
20 19. Thus it is seen that two narrow air gaps are formed; in one, the lines radiate outwardly from a north pole (opposite flange 13); and in the other, the lines converge inwardly to a south pole (opposite piece 16).

25 Before proceeding with a description of the moving parts of the mechanism, attention is directed to the fact that a large interior cooling surface is presented by the interior of tube 12. Consequently the heat energy lost
30 in coil 11 can be easily dissipated without danger of excessive temperature rise.

Cooperating with the two narrow annular air gaps, are a pair of coils 20, 21, supported on a thin tube 22 attached to a cone 23. This
35 cone can be fastened in any appropriate manner at its edges, whereby the whole movable structure is constrained for axial movement. Then as these coils are axially moved, the cone 23 is actuated to set up corresponding sound
40 waves. In order that these coils have a cumulative effect on the cone, they must of course carry currents that circulate in opposite directions because the lines of force in the two air gaps extend in different directions. Thus for coil 20, influenced by the gap
45 formed by flange 13, currents must be supplied that circulate, say, in a clockwise direction; while for coil 21, influenced by the gap formed by annular member 16, currents must
50 be supplied that circulate in a counterclockwise direction. The coils can be supplied from a circuit 24 (Fig. 2) that carries the signaling impulses by having one terminal of the circuit connecting to a common point 25
55 for both coils; and the other terminal connects to the outer terminals of both coils, thus providing a parallel connection for the coils; and if the coils are wound in the same direction on tube 22, the currents will then
60 circulate in opposite directions. The magnetic effects of coils 20, 21 are indicated by arrows 26, 27, and since both coils are of equivalent number of turns, these two effects cancel each other. There is thus no magnetic
65 reaction, due to these coils on the core.

Preferably, I arrange coils 20 and 21 so as to be not quite centrally disposed in the gaps when these coils are unexcited; coil 20, say, has its medial line passing to the right of the medial line of flange 13; and the coil 21 has
70 its medial line passing to the left of the medial line of annular member 16. In this way, when these coils are supplied with current, and if say, they are urged toward the right, then coil 20 tends to move away from its gap,
75 while coil 21 tends to move into it. The effect is that even for very large low frequency currents, the coils 20, 21 faithfully follow all the modulations without distortion, because the movement of one coil in or out of its field
80 is compensated for by the movement of the other coil in an opposite sense.

I claim:

1. In a dynamic signal reproducer, a hollow magnetic member, a field coil disposed
85 over the member, an annular pole piece axially spaced from the end of said member, a core centrally supported with respect to both the tubular member and the annular pole piece to form therewith a pair of an-
90 nular air gaps, a tubular movable support disposed in said gaps, and a pair of coils mounted on the support, one in each gap.

2. The combination as set forth in claim 1, in which the coils are so arranged that the simultaneous axial movements thereof serve to move one further into its field, and to move the other further out of its field.

3. In a dynamic signal reproducer, a hollow magnetic member, a field coil disposed
100 on said member, a casing for the coil, extending beyond the hollow member, an annular pole piece fastened to the casing and axially spaced close to the end of the hollow member, a core centrally supported in said member
105 and extending axially thereof to form a pair of annular air gaps, respectively opposite the end of the hollow member, and with the inner edge of the annular pole piece, a tubular support extending across both gaps, and a
110 pair of coils mounted on the support, and respectively in the gaps.

4. The combination as set forth in claim 3, in which the magnetic lines of force in the two gaps extend in opposite directions, and in which both coils on the tubular support are connected to a source of signaling impulses in such manner that the forces acting on the coils simultaneously are cumulative.

In testimony whereof I have hereunto set
120 my hand.

HERMAN J. FANGER.