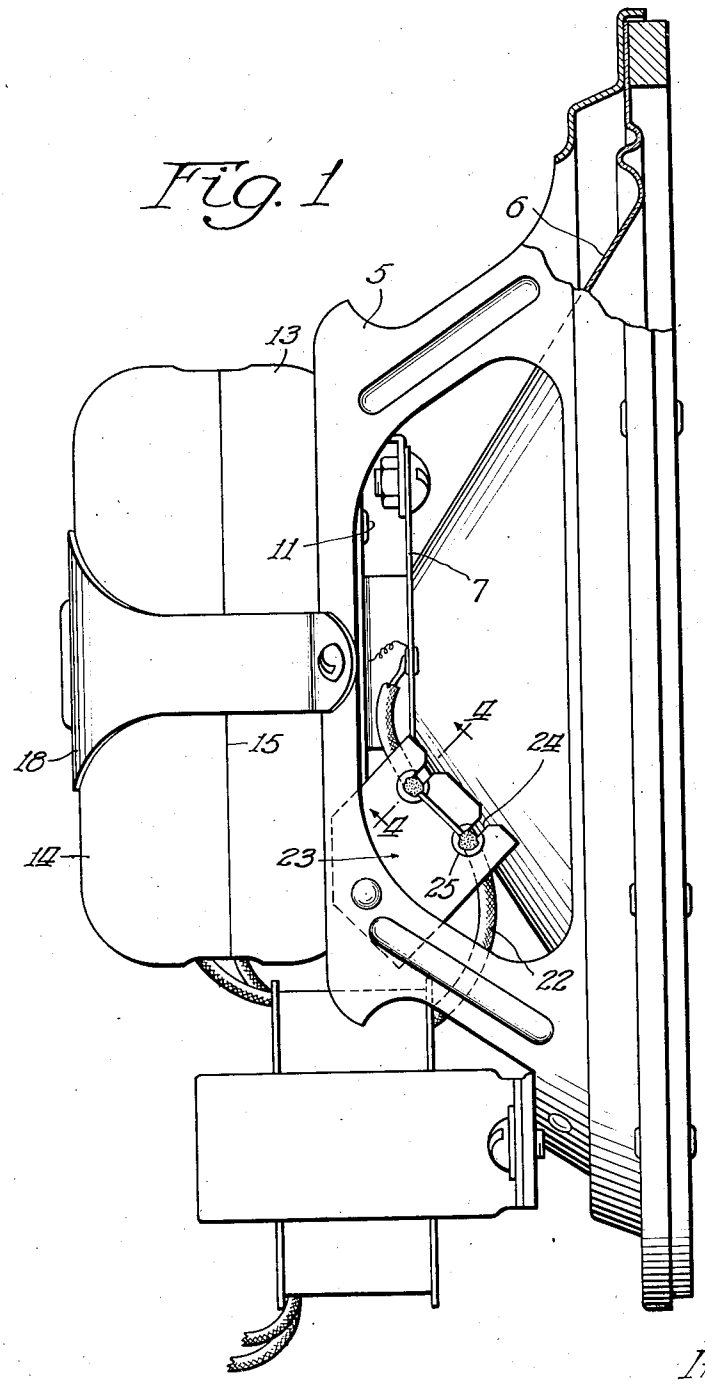
March 19, 1935. W. A. ELLMORE 1,995,025

DYNAMIC SPEAKER UNIT

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Fig. 1



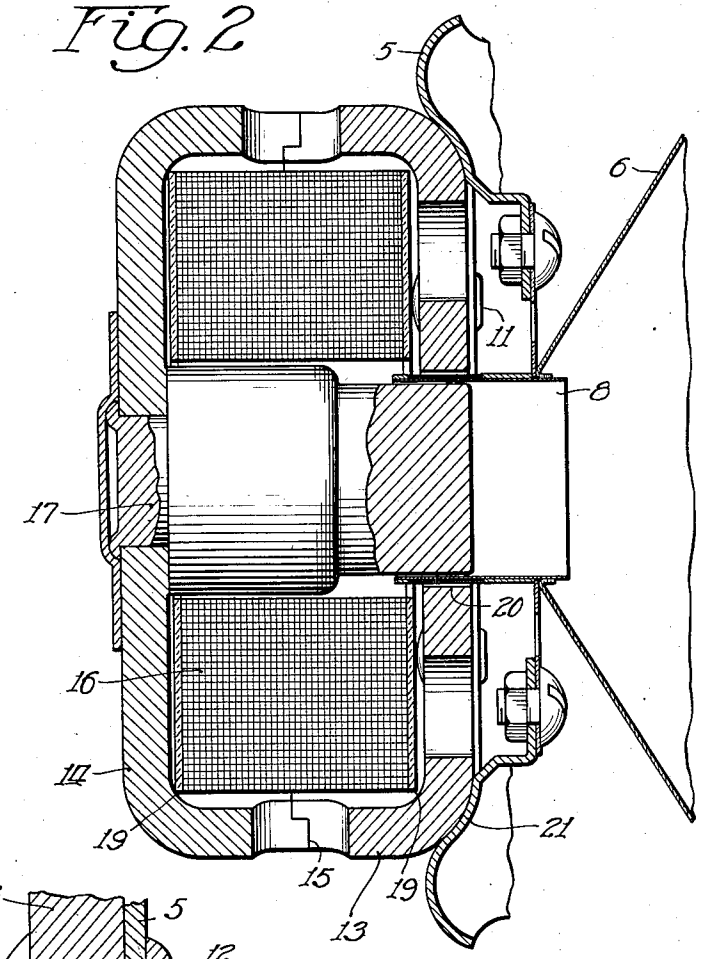
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Fig. 2



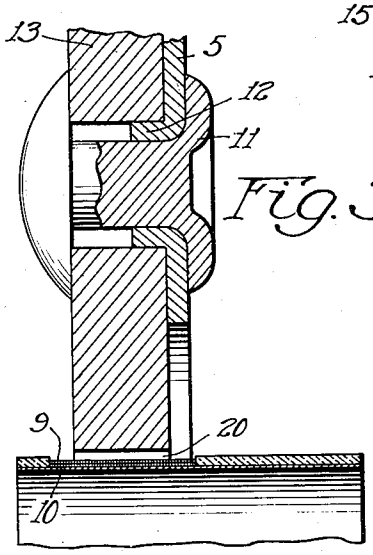
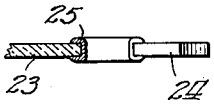


Fig. 3

Fig. 4



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1,995,025

UNITED STATES PATENT OFFICE

1,995,025

DYNAMIC SPEAKER UNIT

William A. Ellmore, Wilmette, Ill., assignor to Utah Radio Products Company, Chicago, Ill., a corporation of Illinois

Application July 22, 1931, Serial No. 552,319

2 Claims. (Cl. 179—115.5)

My invention relates to devices for transforming electrical vibrations into sound vibrations, and more particularly to that general type of device commonly known as a dynamic speaker.

The principal object of my invention is to obtain a coordination of all the parts of the speaker unit which will give a higher efficiency from both the magnetic circuit of the unit and the voice coil reaction than has heretofore been possible.

My invention contemplates also the provision of a novel pot or housing construction in the magnetic circuit whereby to obtain a greater magnetic flux to increase the efficiency of the device.

My invention contemplates also the provision of a novel voice coil arrangement with respect to the pot construction whereby to obtain a smaller gap in the magnetic circuit of the field coil and also to obtain a more accurate voice coil response to current over a wide range of frequency.

Other objects and advantages of this invention lie in certain features of the frame construction and its connection with the field coil pot and in the simplification of the wiring connections. These and other minor objects will appear more readily as the description proceeds in connection with the accompanying drawings, wherein the preferred form of the invention is shown.

In the drawings,—

Fig. 1 is a side view, partly in section, of a speaker embodying my invention.

Fig. 2 is a transverse section through the speaker unit, showing the relation of the various parts thereof.

Fig. 3 is an enlarged detail illustrating the manner of mounting the pot to the frame and also the relative positioning of the voice coil and the pot.

Fig. 4 is an enlarged detail section on the line 4—4 of Fig. 1.

Referring now in detail to the drawings, the main frame of the speaker is indicated at 5, and to this frame all of the other elements which go to make up the unit are secured. The cone is indicated at 6, the numeral 7 indicates the spider to which the cone and voice coil are secured, and the voice coil frame or cylinder is indicated by the numeral 8. This voice coil carries two layers of wire, as indicated at 9 and 10 in Fig. 3, the purpose of which will be brought out more clearly hereinafter. The frame, it is noted, is secured by means of the rivets 11 to the front cup-shaped section 13 of the pot. Extruded portion 12 locates the frame on the pot. A complementary cup-shaped section 14 of the pot abuts the section 13 with a joint such as indicated at 15 in Fig. 2. The pot houses a field coil 16 and has fixed thereto the field core 17. The strap 18 serves to clamp the back of the pot against the frame.

The field core extends into the pot section 13 at the opening 20, and the voice coil 8 fits between section 13 and the field core. The clearances here are relatively small, and the spacing must be accurate. It is of vital importance therefore to properly center the core 17 with respect to the opening 20.

The construction by which this centering and spacing is obtained is as follows: The core is fixed to pot section 14, and then the shoulder at 15 on section 14 is cut, and the surface on the core 17 which is to fit in opening 20 is machined about a common center. Preferably, these operations are carried on simultaneously. The shoulder on 14 and the surface on the core are, therefore, concentric. In a like manner, opening 20 is reamed, and the shoulder on section 13 at 15 is cut about a common center in one operation.

Now when the annular shoulders on 13 and 14, which are cut to a fairly tight fit, are telescoped, it is clear that the core must be properly centered with respect to opening 20. This makes it easy to assemble the parts with no fear of their being improperly positioned.

Having the general construction in mind, the particular pot structure which is so effective in obtaining a high efficiency in the magnetic circuit will now be described more in detail. The magnetic circuit about the field coil 16 will follow generally the core 17 through the interior of the field coil and then will extend around the field coil on the exterior, curving at the corners 19 thereof. In order to take advantage of the natural tendency of the lines of force to follow the shortest path, the pot has been constructed so as to be rounded at the corners 19 while following a substantially straight path along the side wall. The natural tendency of the lines of force along the side wall is, of course, to follow substantially a straight path. For this reason the joint has been placed substantially midway of the side wall, thus allowing a straightened circuit for the flux and giving a much greater efficiency of magnetic circuit. The greatest reluctance to the lines of force occurs at the joint due to this being a break in the metal. The joint, however, since it is located midway between the side walls, does not permit any tendency of the lines of force to cut across the ends of the field coil and thus cut down the efficiency.

Referring now to the voice coil structure and its cooperation with the pot, the voice coil is as usual, mounted upon the paper cylinder 8 and consists of the layers 9 and 10 wound from one end down to the other end and back. Heretofore, so far as I am aware, the usual system has been to use a four layer winding, all of one wire, wound over each other without insulation. It has also been proposed to use a single layer of wire where the wire has been flattened and wound on edge. I find that the two layer system has many advantages over either of the above systems. In the first place, the two layer winding down and back gives the greatest efficiency for the amount of wire, that is, it makes a winding of less thickness than the other types, and therefore the clearance at 20 between the pot and the core 17 may be made very small, and is so made in the present application. This reduces the reluctance of the magnetic path from the core to the pot. Another advantage of this type of voice coil lies in the fact that we obtain a lower self-inductance in the voice coil, which results in a lower ratio of high frequency impedance to low frequency impedance. Owing to the fact that we can use such a small amount of wire, this coil has a low reactance, allowing a high current flow, which gives the same result substantially in power that could be obtained with more layers of voice coil. Another advantage of a voice coil of this type lies in the fact that it can be made of extremely small mass so as to respond better to high frequencies. The response to high frequencies is determined to a great extent by the mass of the moving parts. This increase in response to high frequencies has a very good effect in connection with the ordinary radio set, since it reduces the tendency of high frequency sounds to drop off because the set itself does not respond so well to high frequencies, particularly if the selectivity of the set is good.

Another feature of importance in the voice coil arrangement lies in the making of this coil somewhat longer than the thickness of the pot section 13. This extension is made sufficient to cover the range of movement of voice coil so as to take advantage of the fringing flux. Preferably the length of the coil is at least as great as the thickness between opposite faces of the pot section 13 at the aperture therein plus half the range of movement of the voice coil. This also makes the displacement of the voice coil more nearly proportional to the current within the limits of the motion for which the speaker is designed.

The particular type of mounting between the frame and the field coil pot is of distinct advantage in a device of this character. Vibrations, of course, must be prevented in the structure, and the device must be capable of quick assembly without danger of error in positioning the parts. For this reason, the portions of the frame which carry the field pot are rounded, as indicated at 21, to give a good seat for the pot, and then the extrusions 12 form an ideal centering or securing means to insure a tight vibration-proof construction.

One other feature of importance consists in the manner of bringing the lead-in wires, such as indicated at 22 in Fig. 1, to the voice coil. The wiring strip is shown at 23 as mounted on the frame permanently, and in order to simplify the attachment of the lead-in wires to this strip, I preferably slot the strip as indicated at 24 and use a filler or eyelet piece 25 which is inserted through a hole in the strip before the slotting is done and slotted when the slot is made in the strip, so that the wire can be slid in through this slot and positioned at the base of the slot very quickly. The only necessary thing, then, to make the wiring connection solid is to solder the connections to the eyelets.

From the above description, it is believed that the construction and advantages of this device will be clear to those skilled in the art. It is also believed to be obvious that various minor modifications may be made without departing from the scope of the invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a dynamic speaker, a frame member, a field core and winding, and a voice coil fitting over one end of said core and supported by said frame for movement endwise relative to said core, a container for said field core and winding, said container being secured to the other end of said field core, and connecting means between said container and frame for preventing vibrations comprising spaced openings in said container, projections on said frame entering said openings, and securing means extending through said openings and projections and rigidly clamping said container and frame together.

2. In a dynamic speaker, a frame member, a field core and winding, a container for said field core and winding, and connecting means between said container and frame for preventing vibrations comprising spaced openings in said container, projections on said frame entering said openings and securing means rigidly clamping said container and frame together, said frame having a recessed portion in which the container fits.

WILLIAM A. ELLMORE.