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UNITARY FIELD STRUCTURE FOR MAGNETIC LOUDSPEAKER

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FIG. 1

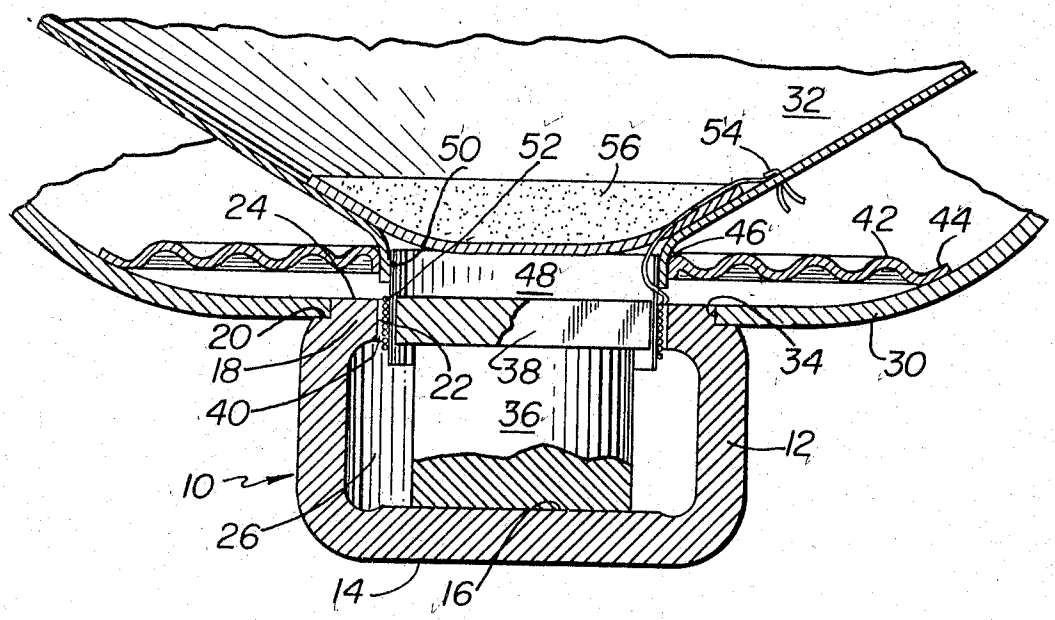
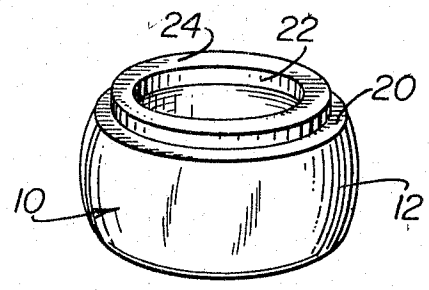


FIG. 2



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UNITARY FIELD STRUCTURE FOR MAGNETIC LOUDSPEAKER

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Original application Mar. 30, 1961, Ser. No. 99,414, now Patent No. 3,191,421, dated June 29, 1965. Divided and this application June 10, 1965, Ser. No. 474,197

2 Claims. (Cl. 335—231)

ABSTRACT OF THE DISCLOSURE

A speaker pot for the magnetic circuit of a loudspeaker that is of one-piece homogeneous construction and is provided with a unitary inwardly extending annular flange, the inner periphery of which cooperates with a permanent magnet placed within the speaker pot to form the air gap in the said magnetic circuit.

This application is a division of application Ser. No. 99,414, filed Mar. 30, 1961, now Patent No. 3,191,421. The invention relates generally to loudspeakers, and more particularly is concerned with a unitary speaker pot for use in the field structure of the magnet circuit utilized with said loud speaker.

The so-called magnetic speaker of today is formed basically of a paper cone or diaphragm to which there is secured a voice coil. The output of a source of audio frequency energy is connected to cause the passage of alternating current through the voice coil, the amplitude of which varies with the intelligence carried by the said output. A magnetic field of very high flux density is established, and the voice coil is arranged so that the turns of wire are transverse of the principal lines of force of the magnetic field. In accordance with well known principles, the flow of current through the voice coil will tend to move the individual wires and hence, will move the entire voice coil, vibrating the same in accordance with the audio frequency. Since the cone or diaphragm is secured to the voice coil, the cone is also vibrated, thereby driving a column of air forwardly and rearwardly of the voice coil. This produces the sound waves which are heard from the usual speaker.

This invention is concerned primarily with the field structure of the magnetic circuit which establishes the high magnetic field within which the voice coil is adapted to oscillate. Such field structures in the past have been made of substantially U-shaped members. A typical structure consisted of a strip of low carbon steel bent in the form of a U and having a bridging bar or front plate secured across the free ends of the U. The speaker basket is secured to the bridging bar. In the center of the bridging bar there was a circular opening within which was disposed a steel disc. The diameter of the disc is slightly less than the inner diameter of the opening, and the disc was mounted to a powerful permanent magnet of lesser diameter than the disc, the permanent magnet extending from the disc down to the inner surface of the bottom of the U to which it is usually cemented. The flux path, as will be understood, extends generally along the axial length of the permanent magnet which is somewhat like the core of a transformer, dividing through the pole piece, passing thence across the gap established between the pole piece and the bridging bar, through the arms of the U-shaped field structure and back to the bottom of the magnet. A short section of a cylindrical paper tube is mounted for reciprocal movement in the gap and carries the voice coil usually as a layer or two of fine wire wrapped thereon and held in place by shellac or cement. To the upper end of this cylindrical section, often called the former, is secured a varnished buckram

spider or diaphragm and the inner portion of the speaker cone. The spider in turn is cemented to the basket of the speaker which, of course, is in the form of a metal frame, and the outer ends of the speaker cone are suspended at the outer ends of the basket. The spider provides the resilient suspension for the apex of the cone.

This structure has been used for many years, especially in low cost speakers of relatively small size. There have been many disadvantages of such speakers. In the first place, the U-shaped field member uses the flux available from the magnet in a very inefficient manner. Since the sides of the U opposite its two legs are open, very substantial fringing of flux from the magnet was created. This caused interference in the apparatus with which the speaker was associated. Another disadvantage was that only a faction of the voice coil was located in flux fields of strong and uniform density, thereby adversely affecting fidelity as well as rendering the vibration driving of the cone inefficient.

Another important disadvantage of the previous speaker pots, as the field structures were called, was that they were expensive to manufacture and there was difficulty in maintaining the proper dimensional relationships as required for efficient and proper operation.

Most of the above described disadvantages have been eliminated by the appearance recently of a field structure which completely encloses the permanent field magnet. This field structure consists of a cylindrical jar-like container in which the permanent magnet is co-axially mounted, and the pole piece substantially closes the top opening of the container but for the gap formed between itself and the upper rim of the container. The difficulty in making such a field structure was that because the upper rim of the container or pot was required to have a flange of substantially lesser inside diameter than the body of the container, an undercut was necessary. This meant that the field structure container had to be manufactured on a screw machine. Besides being wasteful of material in a structure of this kind, the screw machine operation is very expensive as well, but the advantages to be achieved over previous structures of this kind nevertheless made the machined device popular and successful.

The primary object of this invention is to provide a loudspeaker field structure of a configuration whereby the structure may be made from sheet steel as a stamping or drawing with accompanying saving of material, labor and expense.

Many other objects and advantages of the invention will become apparent as a description of the novel article proceeds hereinafter, in connection with which a preferred embodiment of the invention is illustrated in the accompanying drawings.

In the said drawings:

FIG. 1 is a sectional view taken through a portion of a loudspeaker in which the magnetic circuit of the said speaker includes a field structure constructed in accordance with the invention.

FIG. 2 is a perspective view of the completed pot.

The structure of the invention is characterized by the fact that the same is formed of an integral sheet of steel as a stamping or drawing.

Looking first at FIGS. 1 and 2, the reference character **10** is used to designate generally the completed field structure itself, and as will be seen, the same comprises a generally cylindrical body portion **12** and an integral circular bottom wall **14** having an interior flat bottom surface **16**. At its upper end, the pot **10** (as it will often be called hereinafter) is provided with a radially inwardly extending flange **18** having an annular exterior shoulder **20**, an annular interior cylindrical surface **22**, and an axially facing end surface **24** of circular configuration. Because of the flange **18**, it will be appreciated that there is a sub-

stantial portion of the said flange which overhangs the interior cylindrical chamber **26** provided in the said pot.

The critical dimensions and relationships of the structure described are, substantially accurate parallelism between the inner bottom surface **16** of the pot and the upper surface **24** and accurate co-axial relationship between the cylindrical interior of the flange **18** at **22** and the shoulder **20**.

Before proceeding with a description of the advantageous manner in which the pot **10** may be manufactured, attention is invited to FIG. 1 which shows how the pot is used in the construction of a loudspeaker.

The reference character **30** is the so-called speaker basket which is formed of sheet metal in the form of a framework or cage to protect the paper cone **32** and support the outer periphery thereof. The basket **30** is provided with a co-axial opening **34** that is of such dimension as to engage upon shoulder **20**. The basket **30** is secured in place upon the pot **12** in any suitable manner, and it is desirable that the pot and basket be rigidly connected. A cylindrical permanent magnet **36** is co-axially cemented to the surface **16**, and it has a disc-like pole piece **38** mounted to the top thereof. The diameter of the pole piece **38** is somewhat less than the inner diameter of the cylindrical surface **22**, thereby to provide a narrow gap or annular space between the pole piece **38** and the flange **18**. This gap or annular space **40** is very narrow, the narrower the better, and it will be obvious that from the axis of the pole piece **38** and radiating outwardly therefrom, there will be established a high flux density path for the magnetic flux created by the permanent magnet **36**. In FIG. 1, the size of the gap is exaggerated for purposes of clarity.

A varnished resilient buckram or linen suspension spider **42** of annular configuration and provided with molded concentric grooves is cemented to the interior of the basket at **44**. The inner end or apex of the cone **32** is cemented to the diaphragm **42** at **46**, and a short cylindrical tube **48** of relatively thin paper or cardboard is secured to the cone **32** at **50** and extends through the gap **40** co-axially of the pole piece **38**. This short tubular section **48** serves as the former for several turns of wire **52** which comprise the voice coil, the wire being arranged on the former **48** so that the field created by the wire as current passes therethrough will cut the lines of force extending across the gap **40** between the pole piece and the flange **18**. The wires from the coil are shown at **54** extending up through the interior of the cone and out through the walls thereof to the source of audio frequency current. **56** is a felt disc which protects the mechanism just described from dust. Obviously the suspension spider **42** serves as resilient means to oppose movement of the former **48** and the cone **32**.

The reasons for maintaining certain of the dimensions of the pot **10** will now be obvious. It will also be obvious that the entire cylindrical wall portion **12** comprises a low reluctance path for magnetic flux from the permanent

magnet **36** and that the chamber **26** is required in order to prevent leakage across the intervening space.

Reference is made to my co-pending application, Ser. No. 99,414, filed Mar. 30, 1961, now Patent No. 3,191,421, for a description, in detail, of a preferred method of manufacturing pot **10**.

The completed pot **10** is illustrated in FIG. 2.

There are several important things which should be kept in mind with respect to the field structure described. This structure is formed from sheet material hence the scrap is a minimum. There are no machining operations other than that described in connection with the drilling of the opening in the pot to form the inner surfaces **22**. No annealing is needed throughout the entire process, since none of the steps thereof are of such radical nature as to require this.

Obviously, throughout this description the words "upper" and "bottom" have been used to designate the opened and closed ends respectively of the pot **10** regardless of how the pot itself is arranged.

It will be appreciated that variations in the structure may be made without departing from the spirit or scope of the invention as defined in the appended claims.

What it is desired to secure by Letters Patent in the United States is:

1. An integral, one-piece speaker pot for use with the field structure in the magnetic circuit of a loudspeaker, said speaker pot comprising a one-piece homogeneous cup-like structure of substantially uniform wall thickness having a closed bottom and a cylindrical side wall, an inwardly extending annular flange-like formation on the upper end of said cup-like structure which is a unitary part thereof, said inwardly extending portion having an opening therein which defines a cylindrical surface, the diameter of which is substantially less than inner diameter of the cylindrical side wall, said cylindrical surface being adapted, upon the mounting of a magnet in said cup-like structure, to cooperate therewith to define an annular air gap for the said magnetic circuit, and a seat in the interior of said cup-like structure for supporting said magnet.

2. A structure as claimed in claim **1** in which a loudspeaker basket seating shoulder is provided on the exterior of said flange co-axial with said cup member.

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