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OSCILLATING COIL FOR ELECTRODYNAMIC LOUDSPEAKERS

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Fig. 2

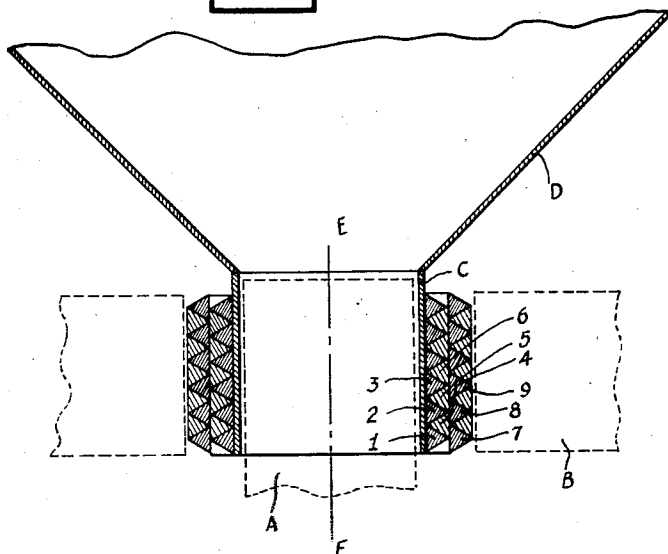


Fig. 1

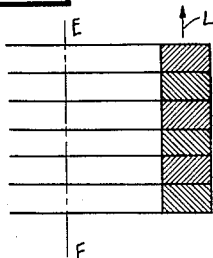


Fig. 3

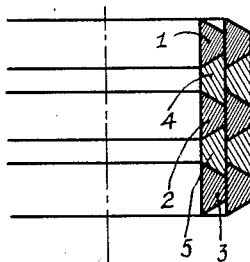
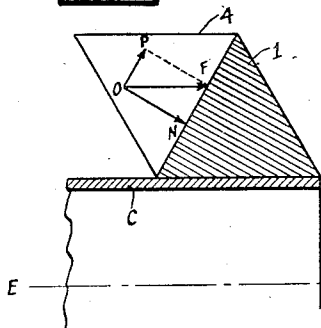


Fig. 4



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OSCILLATING COIL FOR ELECTRODYNAMIC
LOUDSPEAKERS

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6 Claims. (Cl. 175—340)

The object of this invention is an oscillating coil for electrodynamic loudspeakers which compared with the forms of construction known in the earlier art distinguishes itself by special solid-
5 lidity. As a result of such increased strength the coil form or supporting body of the coil can be made weaker, and as a result the requisite width of air-gap may be diminished. This in turn means the advantageous feature of greater sensitivity or responsiveness and higher efficiency.

A further object of the invention is to provide a voice coil device in which the coil form may be made very thin, thus permitting an air gap between the inner and outer pole pieces narrower
15 than usual to be provided. In certain cases the voice coil form on which the coil is wound may be omitted entirely due to the arrangement and construction of the coil itself.

Another object is to considerably increase the efficiency and sensitivity of the usual type of electro-dynamic sound reproducer by a novel method of shaping and winding the voice coil. As usually wound with wire of circular cross-section, a large percentage of the coil volume is taken up by the waste space between the successive turns. According to my invention this space is filled with
25 conducting material in the shape of additional turns of wire, so that I find it possible to substantially fill (except for the small clearance required between the relatively moving parts) the air gap with useful coil turns.

A still further object is to arrange certain turns of the outer layer of a voice coil so that an outer turn puts radial pressure on or contacts two adjacent inner turns thereby serving to restrain them from moving with respect to each other. Other objects of the invention will appear as the description thereof proceeds. For an understanding of the invention itself reference is made
40 to the accompanying drawing in which,

Fig. 1 shows a coil form wound with wire of rectangular section;

Fig. 2 shows a coil form wound with wire of triangular section; and,

Fig. 3 shows one half of a coil wound with wire of trapezoidal section; and,

Fig. 4 is an enlarged section of two adjacent end turns of the coil of Fig. 2.

Known in the prior art are coils for which circular wire is used. However, this means a low utilization factor of the winding space due to the large volume taken up by interstices which remain between the constituent spires or turns. This disadvantage can be obviated by the use of
55 wire of rectangular cross-section.

If in the case of such a winding the insulation were supposed to be absent then the constituent wires could be supposed to be placed directly adjacent to one another without any spaces or interstices being incidentally formed as shown in
60 Fig. 1. In this embodiment planes laid through the conductor strips are positioned at right angles to the coil axis. Now, such coils involve the drawback that the forces coming to act upon the conductors tend to tear the joints asunder, as indicated in the drawing by the arrow. Now, the purpose of this invention is to overcome this in-
65 convenience.

According to this invention it is possible to increase the strength of the coil, this being accomplished by the aid of a profiled wire having a cross-sectional form other than circular, the wire cross-section being preferably so chosen and the wire itself being so wound that the constituent layers and turns will interengage. In such an arrangement the joints between turns will not be acted upon by the full force; indeed, owing to the slope only the corresponding force components. Another merit is that also the joints between the constituent turns and layers will no longer extend throughout the whole coil surface, but at the most some portion thereof. In other words, the chances of a break in the insulating layer produced at any given place extending through and affecting the whole coil resulting possibly in the entire coil being broken in two are thus di-
80 minished.

The two embodiments illustrated in Figs. 2 and 3 have proved of particularly great advantage. In the embodiment shown in Fig. 2 wire of triangular cross-section is employed, the winding being so built that the triangular profile with one of its sides comes to be placed against and bear upon the cylindrical surface of the supporter body, while the apices located opposite those sides extend outwardly. In the next layer the triangles are positioned inversed, that is to say, the apices thereof thus coming to be placed between the spaces left in the first layer. The same arrangement is repeated if additional lay-
90 ers are provided.

The coil form C having axis E—F may be made of thin insulating material such as cardboard, paper or fabric and is carried by the inner end of a large diaphragm D between the inner pole piece A and outer pole piece B of an electromagnet (not shown). The diaphragm D and elec-
105 tromagnet per se may be of the usual construction. The form C may be of cylindrical shape. Numerals 1, 2 and 3 denote successive turns of
110

the inner layer; 4, 5 and 6 successive turns of the succeeding layer of winding; and 7, 8 and 9 successive turns of the next succeeding layer. It will be understood that the wire conductor is coated with a thin covering of insulating varnish or enamel as known to those skilled in the wire making art. In winding the outer layer the wire is preferably held taut or under tension, in which case turn 7 exerts an inward pressure against turns 1 and 4 and contacts with both said turns, thereby assisting in preventing turn 1 from moving endwise with respect to 4. If such motion occurred turn 1 may become loose and hit against 4 resulting in a clicking, objectionable noise.

Referring to Fig. 4 let OF represent the force exerted by turn 4 against turn 1. This force may be due to the inertia of turn 4 near the end of the path of motion of the voice coil or it may represent the force induced in turn 4 by the passage of an impulse of current therethrough. This force OF may be resolved into two components, ON and OP. It will be seen that due to the inclined faces of the respective coils, component ON will force turn 1 against the coil form, increasing the friction between them and thereby preventing turn 1 from moving endwise on the form and separating from turn 4. In other words by shaping my wire to have inclined faces, I am enabled to use certain forces arising during the action of my device, which would otherwise be detrimental, to assist in securing its proper functioning.

In the embodiment shown in Fig. 3, wire of trapezoidal cross-section is used, in other words the cross section is a trapezium having its inner and outer faces parallel to each other and in the claims the term trapezoid or trapezoidal is used in this sense. The mode of winding is substantially the same except that the wires placed in one and the same layer do not touch, but are separated from one another by the wires of the next layer. For instance, the procedure is such that first the wires 1, 2, and 3 belonging to the first layer are wound first, and thereupon the wires 4 and 5 of the second layer are wound in the spaces, it being, of course, immaterial in what sequence the winding process proceeds so far as the invention is concerned. Instead of first accommodating the first layer and in connection therewith the second layer, it is also feasible to lay both layers simultaneously by running the turns 1 and 4 and similarly turns 2 and 5 etc., adjacently upon the support or coil form. Due to the inclined faces of adjacent, contacting turns it is to be understood that the diagram of forces shown in Fig. 4 applies equally as well to the form of coil shown in Fig. 3 as it does to that shown in Fig. 2.

Owing to the stabler disposition of the structure insured by a more favorable arrangement of the joints it is further possible to secure internal cohesion and solidity merely by the aid of insulation used on the wires. As a result the provision of a distinct support or bobbin is dispensable in some cases. Since the small insulation layers to replace the same and making it dispensable cannot be regarded as a supporting body in the strict sense of the term, the basic idea of the present invention allows of the manufacture of unsupported coils which because of their little width and their high space utilization factor may be considered as the optimum form of construction of loudspeaker coils.

Having described my invention, what I claim is:—

1. A voice coil comprising a winding of wire having a substantially triangular cross-section, and the flat bases of adjacent turns forming a substantially cylindrical surface.

2. A voice coil winding having two adjacent turns and an outer turn having a single substantially flat inner surface in contact with each of said adjacent turns.

3. In a device of the class described, a substantially cylindrical form, a winding thereon mounted to move in a magnetic field and comprised of two adjacent turns, the cross-section of said winding being triangular and having a bounding edge inclined at an acute angle to the axis of said cylindrical form, whereby the force exerted by one turn on an adjacent turn produces a radially exerted component thereon.

4. A voice coil comprising a form, a winding of wire on said form the successive turns of said winding being spaced apart on said form by an amount substantially equal to the width of said wire and other turns of said wire wound in the spaces provided between said first wound turns, said wire being of non-circular cross section.

5. A voice coil comprising a form, a coil of wire wound on said form the cross section of said wire being non-circular, two adjacent turns of said winding having their outer edges in the same plane and an outer turn wound in contact with each of said named turns and having its inner surface substantially flat, thereby exerting a pressure on said two inner turns to retain them in position.

6. A wire, the cross sectional shape of which is preformed into the shape of a trapezoid, said wire being bent around a cylinder to form a coil, successive turns of said wire being spaced apart and other turns of the same cross-sectional shape interposed between said first named turns.

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