Oct. 11, 1938. J. P. QUAM 2,132,833

ELECTRICAL COIL

Filed Jan. 13, 1936

Fig. 1.

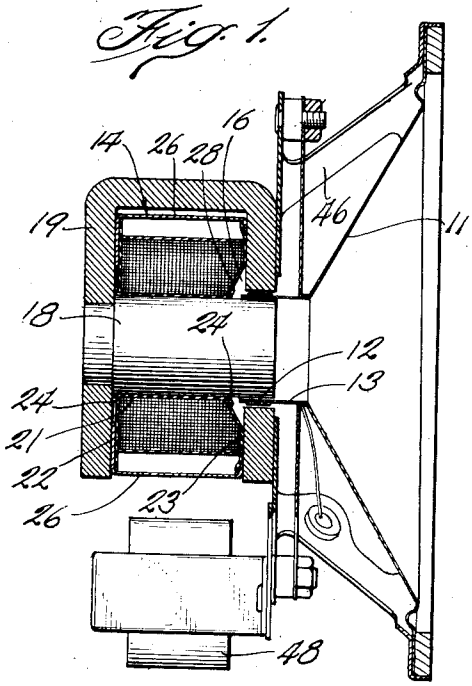


Fig. 3.

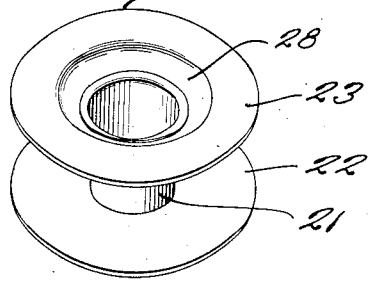


Fig. 4.

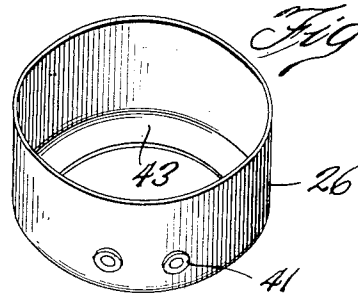


Fig. 2.

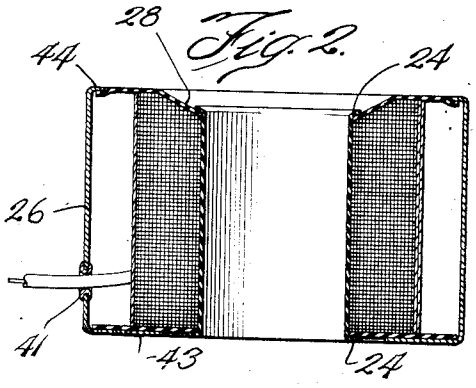


Fig. 5.

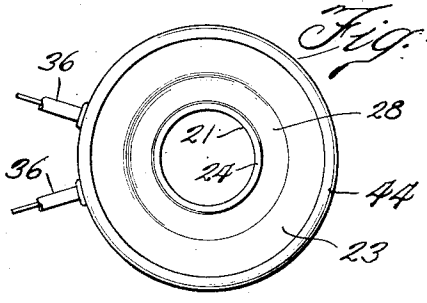
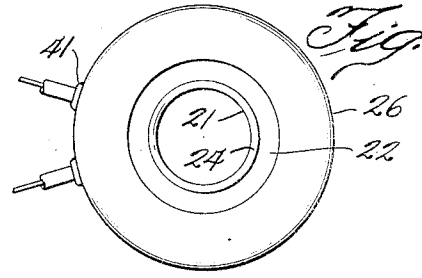


Fig. 6.



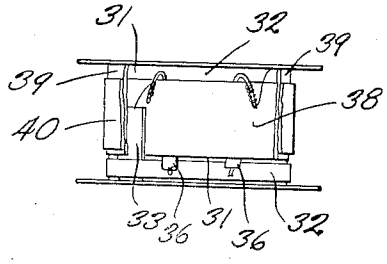


Fig. 7.

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UNITED STATES PATENT OFFICE

2,132,833

ELECTRICAL COIL

James P. Quam, Chicago, Ill., assignor to Quam-Nichols Company, Chicago, Ill., a corporation of Missouri

Application January 13, 1936, Serial No. 58,823

3 Claims. (Cl. 179—115.5)

This invention relates to loud speakers and in general is a continuation in part of my copending applications Serial Nos. 670,865 and 723,034, and in some of its aspects relates more broadly to the formation of an encased coil of wire such as may be used for the field coil of a dynamic loud speaker.

On most types of electrical coils where a quantity of relatively fine wire is wound on a spool, it is necessary not only to secure the wire in a manner to keep it tightly wound, but to cover the outer layers so as to protect the same against cutting, scratching or a like injury. Where such a coil is mounted in a manner so that it is exposed to dirt, moisture and the like in a house, as a wound coil in a radio receiver, it is important to the life and satisfactory operation of the receiver that such coil be protected against these harmful elements. Heretofore attempts have been made to overcome these difficulties by winding by hand a cloth or composition tape-like covering around the wire of the coil and then gluing or taping this covering in position. This, however, has not been satisfactory. The covering often becomes torn, or becomes loosened and may be moved around on the wire, and many times the glue or the like on the covering deteriorates and the latter is pulled entirely from the wire. The wire is then without adequate protection, or no protection at all. Moisture and dirt collect on the coil, sometimes causing corrosion. In addition, with this type of covering, the coil often presents a very untidy appearance, even when originally completed, and this of course becomes worse if the covering is damaged in any manner, or as it becomes dirty.

Another problem that has confronted the industry is that of providing at low cost a properly shaped spool on which to wind the field coil of a dynamic speaker. This problem has been complicated by the necessity of providing an annular depression in one side of the spool to make room for the operation of the voice coil, it being desirable that this voice coil, which is located around the core of the field coil at one end thereof, be able to extend within the outlines of the field coil. Heretofore extra pieces, often of metal, have been used to provide this depression, thus making the spool relatively expensive.

It is an object of my invention to provide an improved electrical coil, particularly adapted for use as a field coil in a radio loud speaker.

It is also an object of the present invention to provide a coil such as might be used, for example, on dynamic loud speakers, which is so constructed that it may be manufactured more economically than such coils heretofore.

It is a further object of the invention to provide such coils in which the coiled wire is more fully protected that in any comparable constructions heretofore used.

Other objects and advantages of my invention will be apparent from the following description, taken with the drawing, in which:

Fig. 1 is a sectional view of the form of dynamic speaker chosen for illustration of this invention.

Fig. 2 is an enlarged sectional view of the coil unit alone.

Fig. 3 is a perspective view of the spool on which the wire is wound.

Fig. 4 is a perspective view of the sleeve into which the spool is inserted.

Fig. 5 is a front side view of the finished coil assembly.

Fig. 6 is a rear view of the structure shown in Fig. 5.

Fig. 7 is a view of the coil with the sleeve removed, and with parts broken away to show the manner of connecting the leads.

Although only one form of the invention has been chosen for illustration, this invention may take numerous forms and particularly may be used with numerous types of loud speakers, and in fact the coil may be modified for use in other electrical equipment.

In practicing my invention, I provide a spool formed by cutting a suitable length of a paper tube, applying paper side rings to it, and securing them thereon by spinning the edge of the tube outwardly. The wire is then wound on said spool, and suitably insulated leads are then connected to said coil and secured on said spool. Then the spool is inserted in a metal can or sleeve having an inwardly-extending flange on one side, and the other side of the sleeve is spun inwardly over said spool to retain the same in place. One of the side rings of the spool is preferably shaped to provide a space for the operation of the voice coil on a dynamic loud speaker. The paper used is preferably a waterproof paper free from acid and having high insulating characteristics. The entire coil assembly, when completed, is preferably dipped in an insulating and waterproofing paint.

The details of construction of the loud speaker need not for the most part be fully described. It should be observed, however, that the diaphragm 11 is actuated by a voice coil 12 wound around a thin paper tube 13 which is secured to

the diaphragm. The coil assembly indicated as a whole by the reference numeral 14, is shaped to provide an annular recess 16 into which the voice coil 12 and its carrying tube 13 may reciprocate. The voice coil operates in a voice coil gap formed between the core 18 of the field unit and the yoke 19 which, in the illustrated form, is U-shaped and consequently open along three sides. On these open sides the coil is not protected against injury except by such special means as may be provided.

The coil is formed of suitable wire, preferably enameled, wound on a spool which comprises a major feature of this invention. This spool includes a paper tube or sleeve 21 which fits closely about the core 18, and side rings 22 and 23 also formed of paper and secured on the tube 21 by flanges 24, as seen best in Figs. 1 and 2. A can or sleeve 26 surrounds the spool and coil thereon and is preferably made of metal to protect the coil along its periphery where it is not protected by the yoke 19.

The voice coil 12 and its carrying tube 13 are illustrated in Fig. 1 at their position of rest. During operation of the speaker these elements oscillate back and forth along the core 18, and hence it is necessary that the coil assembly 14 should not obstruct this vibratory movement. To this end the side ring 23 is shaped, as shown best in Figs. 1 and 2, with an annular depression 28 adjacent the opening therethrough. To avoid the necessity for exactitude which would be expensive commercially, this depression is slightly larger than would be absolutely necessary.

It is very desirable that the paper used for the tube 21 and the side rings 22 be acid-free so as not to damage the insulation on the wire of the coil. It is of course also desirable that this paper have high insulating qualities. Furthermore, the tube 21 must be of a quality of paper which permits the formation of the retaining flanges 24, and the side ring 23 must be of a quality which permits the formation therein of the depression 28 and which, when so formed, by stamping or the like will retain its shape during the winding of the coil and subsequent handling thereof. Any paper or papers which meet these requirements may be used, and it is preferable that such paper be waterproof to protect the coil from moisture so far as possible. A paper known as neutral grade has been found very satisfactory.

In the formation of the coil assembly a tube 21 of the proper length is cut from a longer tube. The two side rings 22 and 23 are then applied over the tube 21 and its flanges 24 formed. These flanges may be formed by spinning or stamping, and, if desired, one of them may be formed before the side rings are applied to the tube. The side ring 23 should of course be shaped to form the depression 28 before it was applied to the tube 21. This shaping may be accomplished by means of a press, the die members of which are preferably heated.

When the spool has thus been formed, the desired number of turns of the enameled wire are wound on it, and the lead-in wires 30 are attached to the opposite ends of the coil. These leads may be applied in any suitable manner. One convenient way is to first wind a layer or two of insulating acid-free paper 31 around the coil, one end of the wire of the coil extending out through the overlapping ends of the paper, and the other end, protected between the layers of a folded cloth insulator 33, extending up between the side of the paper and a side ring. The paper 31 and insulator 33 may be secured in place by two narrow strips 32 of scotch tape or other adhesive. The leads 36 may be soldered to the free ends of the coil, and may be secured in place by a strip of scotch tape 38, or other adhesive member. The attached ends of the leads are covered with an insulating cloth 39 secured by scotch tape 40 or other adhesive.

The free end of the leads may be threaded through holes provided in the sleeve 26, and the coil may then be inserted into said sleeve. The holes through the sleeve 26 for the lead-in wires may be provided with eyelets 41, or the steel in which the holes are formed may be rolled over to form smooth surfaces so as not to cut the insulation on the wire.

The steel can or sleeve 26 is pre-formed, as by stamping, with an inwardly-extending flange 43 at one side thereof. When the coil assembly is inserted into the sleeve, it is pressed against this flange 43 and then the other edge of the sleeve 26 is spun over to form the flange 44 and retain the assembled coil in place.

When the coil assembly has thus been completed, the leads 36 may be gripped and the complete assembly may be dipped in any suitable waterproofing paint, such as ordinary lacquer, thus sealing the joints between the various parts of the housing or the coil, and increasing the waterproof characteristics of the paper itself.

It should be mentioned that before the coil assembly 14 or core 18 are applied to the speaker, the yoke 19 is welded to the support frame 46, which is centered with respect to the voice coil opening. Then the coil assembly is put in place and the core 18 is inserted through the voice opening and through the coil assembly, and while being centered in the voice coil opening, is forcefully driven into the opening in the farther leg of the yoke 19. The cone 11 with its voice coil 12 carried on the tube 13, may then be applied to the support frame 46, as illustrated in Fig. 1. If desired, a transformer 48 may be mounted on the frame 46, and the speaker is then completed.

It will be observed that the speaker spool comprises only three paper parts, and that they are very easily assembled, and hence the cost of this spool is extremely small. Furthermore, the sleeve 26, which may be added when desired at very little additional cost, thoroughly protects the coil from damage due to improper handling. Furthermore, the coil assembly may be dipped in a water-proofing paint, with the result that it not only has an attractive neat appearance, but is substantially moisture-proof, thus minimizing the danger of corrosion occurring on the coil to ruin or impair its operation.

Although but one embodiment of my invention has been herein shown and described, it will be understood that I am not limited thereby, but limit my invention only by the scope of the appended claims.

I claim:

1. A dynamic loud speaker including in combination a pole piece open at the sides and comprising a pair of spaced apart legs and a core extending between the legs, and a completely preassembled field coil for assembly into said pole piece as a rigid unit and fitting relatively snugly between such legs comprising an insulating core surrounding the pole piece core, with an insulating washer on each end of the coil core to form therewith a spool for a coil winding,

and a one-piece thin metal housing for the coil with continuous side-walls at the open sides of the pole piece, and an integral flange at each end positioned over the outer portions of the insulating washers and pressed thereon to provide a rigid assembly for the complete coil.

2. A dynamic loud speaker including in combination, an open-sided magnet having a pair of parallel legs and a core extending between the legs and centered in an aperture in one leg to form a voice coil aperture, a voice coil movable in said aperture, and an energizing coil assembly for said magnet comprising a preassembled rigid unit for insertion into or withdrawal from said magnet in such complete preassembled form, said unit having an insulating spool surrounding said core for carrying a wire winding and having an insulating washer at each end, with the washer at the voice coil end of the spool having an annular recess therein below the voice coil aperture to itself act as a form for the wire winding to provide a configuration for the energizing coil such as to enlarge the path for movement of the voice coil, and a one-piece thin metal housing for the coil with continuous side-walls at the open sides of the magnet, and integral flanges at each end extending over portions of the end washers and pressed thereon to provide a rigid coil unit assembly.

3. A dynamic loud speaker including in combination, an open-sided magnet having a pair of parallel legs and a core extending between the legs and centered in an aperture in one leg to form a voice coil aperture, a voice coil movable in said aperture, and an energizing coil unit for said magnet preassembled as a rigid complete unit for insertion into or withdrawal from said magnet in such preassembled form, comprising a coil spool of insulating material having a core surrounding the magnet core and a one-piece washer at each end and a housing for said coil to protect the coil against damage at the open sides of the magnet comprising a drawn one-piece substantially cup-shaped metal can having continuous side-walls and integral retaining flanges at each end, with the flange at the voice coil end being relatively narrow so as not to extend into and interfere with the voice coil movement, with the other flange relatively wide, and both flanges being pressed onto the insulating washers to provide a rigid coil unit.

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