METHOD OF ASSEMBLY OF A LOUD SPEAKER

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METHOD OF ASSEMBLY OF A LOUD SPEAKER

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Claim. (Cl. 29—155.59)

This invention relates to an improved and simplified method for assembling and mounting a permanent magnet field structure on the diaphragm housing of a loud speaker. This application is a division of my pending application for Letters Patent of the United States, Serial No. 613,187 filed October 1, 1956.

Loud speaker assemblies usually include a diaphragm supporting structure in the form of a housing and a magnetic field structure for energizing the diaphragm voice coil. In a permanent magnet type loud speaker, the field structure may include a yoke, a magnet mounted thereon, a pole tip, a front plate and some arrangement for protecting the air gap from the accumulation of foreign particles. An inherent problem in the assembly of permanent magnet type loud speakers is the excessive labor and cost involved in the multiple handling of the component parts. There are also additional supplemental operations required to adjust the magnet and to insure that the diaphragm voice coil is properly centered in the air gap formed by the field structure.

It is a principal object of this invention to provide a simplified and improved method for assembling and mounting a permanent magnet field structure on the diaphragm housing of a loud speaker without the need for cement, soldering or threaded fasteners of any kind.

A further object of this invention relates to the provision of an improved method of assembling and mounting a permanent magnet field structure on the diaphragm housing of a loud speaker which automatically and permanently centers the pole tip in the air gap during such assembly and mounting.

Briefly, the foregoing objectives are attained in accordance with this invention by providing a U-shaped yoke with projecting guides that are adapted to pass through properly located apertures in a front plate which are in turn aligned with similarly located apertures on a diaphragm supporting housing. The diaphragm housing and front plate include central bores for receiving the voice coil which are adapted to be axially aligned by virtue of the alignment of the foregoing apertures on the projecting guides. The front plate has projecting pins spaced circumferentially about the central bore on its rear face which are adapted to engage similarly located apertures on a mating flange of a magnet centering member. The centering member is made of non-magnetic resiliently flexible material and is cup-shaped with a depressed central portion that is adapted to overlie the central bore in the front plate when mounted thereon. The front plate and centering member are first assembled as a sub-assembly by staking them together and at the same time piercing a bore through the depressed portion of the centering member which will be concentric with the bore in the front plate so that a core tip projecting through the centering member bore will be concentric with the front plate bore. This is accomplished by piloting the piercing operation through the bore in the front plate. A permanent magnet is supported within the yoke with its projected axis extending through the concentric bores and a pole tip is mounted on the projecting extremities of the magnet and secured in centered position within the concentric bores by means of the non-magnetic centering member. The yoke, magnet, pole tip and the centering member and front plate sub-assembly are then assembled on the diaphragm housing with the yoke guides extending through the apertures in the front plate and diaphragm housing. Pressure is then applied to deform the projecting extremities of the guides and thereby fasten the component parts together. The depth of the depressed portion of the centering member is such that the pressure will collapse the depressed portion slightly and the resiliency of the centering member will hold the pole tip in centered relation within the front plate bore.

In the drawings:

Fig. 1 is a side elevation of a loud speaker having the field structure partially cut away to illustrate the interior;

Fig. 2 is an exploded perspective view of the sub-assembly of a front plate and core tip dust cup at an intermediate stage of assembly;

Fig. 3 is an exploded perspective view of the field structure in relation to the diaphragm housing; and

Fig. 4 is an enlarged sectional view of the centering portion of the assembly.

Referring now more particularly to Figs. 1 and 2 of the drawings, there is shown a preferred form of the loud speaker assembly of this invention having a permanent magnetic field structure which includes a yoke, indicated generally at 10, which is formed from a metal blank bent in the form of an open U-frame having a back plate 11 and sides 12 and 13. The field structure also includes a magnet 15, and a pole tip 16 and a sub-assembly which includes a front plate 18 and a centering member 19 which is fastened thereto by projecting nubs 32.

The sides 12 and 13 of the yoke 10 are provided with outwardly projecting tangs 21 and 22 at their extremities so devised as to project through spaced apertures 23 and 24 respectively in the front plate 18 and subsequently through similarly located apertures 26 and 27 in the rear of the diaphragm housing 20. The apertures in the front plate and diaphragm housing are located so that when they are aligned with each other along the tangs 21 and 22, the housing 20 will be aligned axially with a central bore 28 in the front plate 18. The magnet 15 is supported on the back plate 11 of the yoke and in turn is extended axially by the pole tip 16 which extends through axially aligned bores 29, 28 and 17 in the centering member 19, the front plate 18 and diaphragm housing 20 in such manner as to define a concentric air gap surrounding the pole tip, which is adapted to receive in centered relation a voice coil 30 carried by the throat of the diaphragm.

Referring now more particularly to Fig. 2 of the drawings, the front plate 18 and centering member 19 are shown disassembled in the exploded view to expose the projecting nubs 32 on the rear face of the front plate, which are spaced from each other circumferentially about the central bore 28. The centering member 19 is composed of a resiliently flexible and non-magnetic cup-shaped member having a planar flanged portion 33 with apertures 34 through the respective corners for receiving the nub-like projections 32 on the rear face of the front plate. The central portion 35 of the centering member is depressed to form a dust cup which is adapted when assembled to surround the pole tip 16. In the preferred form shown, the centering member is staked to the front plate 18 and the depressed dust cup...
portion 35 is pierced by a suitable die which is piloted through the bore 28 in the front plate 18 to make the bore 29 concentric with the bore 28. In assembly the bore 29, which is of substantially the same or slightly greater diameter than that of the pole tip 16, automatically guides the pole tip into centered relationship, is maintained fixed without fear of distortion from bumps that normally occur in the rough handling incident to the packing and shipment of loud speakers from the place of production to the set manufacturer and ultimate user, as will be hereinafter more fully described.

The form and structure of the limited number of parts of the loud speaker field structure is such as to simplify the assembly and reduce the amount of handling necessary in producing the loud speaker. The method of assembly contemplated that the yoke is first placed open end up with its back plate resting on the stationary head of a press. The magnet 15 is then located in a slight recess 36 which is provided on the inner face of the back plate 11 to insure that the magnet will not slide out of the yoke. The pole tip 16, which is provided with a flange 37 on one extremity, is inserted into the bore of the centering member 19, and the pole tip and sub-assembly of the front plate 18 and centering member 19 are then placed as a unit upon the yoke 10 with the tangs 21 and 22 projecting through apertures 23 and 24 in the front plate 18. This operates to position the magnet 15 and pole tip 16 in centered alignment and at the same time brings the flanged end 37 of the pole tip into abutting engagement against the adjacent end of the magnet.

Thereafter, the diaphragm housing 20 is placed over the front plate 18 with the apertures 26 and 27 in registration with the apertures 23 and 24, at which time the tangs 21 and 22 project through the apertures. While the assembly is so held on the stationary head of the press, the movable head of the press is brought down so as to swage the tangs 21 and 22 against the front face of the diaphragm housing 20. The depth of the central depressed portion 35 of the centering member 19 is such that the press initially collapses the portion 35 slightly against the flange 37 and causes the wall of the portion 35 to deform inwardly to insulate a tightly centered assembly of the component parts. The position of the portion 35 before and after the application of pressure by the press is illustrated in Fig. 4 of the drawings, wherein the broken line represents the position before deformation and the full line represents the position after deformation. Further pressure from the press following the collapsing of the central portion 35 swages the tangs 21 and 22 against the front face of the diaphragm housing to permanently secure the component parts together in centered relation.

It will be readily apparent that the automatic and permanent centering which results from the construction and method of assembly hereinbefore described eliminates the necessity for the use of centering gauges and also reduces the number of parts and major handling operations as well as those additional supplemental operations ordinarily required to center the core tip and voice coil within the air gap.

I have shown and described what I consider to be the preferred embodiment of my invention, and it will be obvious to those skilled in the art that other changes and modifications may be made both in the construction and in the method of assembly of the loud speaker without departing from the scope of my invention as defined by the appended claims:

In a loud speaker assembly having a diaphragm housing with a central voice coil opening and with apertures on either side thereof and having a magnetic field structure including a U-shaped yoke having side plates each with a projection extending therefrom and having a back plate joining said side plates, said back plate having a centered depressed portion adapted to receive a magnet, and a magnet and a flanged pole tip therefor, a front plate for the yoke having a central bore adapted to surround the pole tip and form a voice coil air gap and having apertures on either side thereof for receiving the side plate projections therethrough, and a non-magnetic resiliently flexible pole tip centering member having a depressed portion adapted to have formed therein a central bore of substantially the same diameter as the pole tip, the method of assembly consisting of, fixing the centering member over the bore in the front plate by deforming coating portions of the plate and centering members, then piercing to form a central bore through the depressed portion of the centering member in concentric relation to the front plate bore, placing and resiliently retaining the pole tip in the centering member bore thus formed with its flanged extremity disposed external thereto, placing the yoke back plate on a horizontal surface, placing the magnet on the back plate of the yoke in the centered depressed portion thereof with its axis parallel to and between the side plates, then mounting the front plate, the centering member and the pole tip as a sub-assembly on the yoke side plates by passing the side plate projections through the front plate apertures, then mounting the diaphragm housing on the front plate with the yoke side plate projections passing through the housing apertures, then axially pressing the housing against the front plate and yoke side plates to compress the depressed portion of the centering member against the pole tip flange and magnet, and thereafter deforming the side plate projections to secure the loud speaker assembly together with the pole tip accurately centered within the air gap.

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