Nov. 10, 1931. C. J. FITCH 1,830,755

SPEAKER UNIT

Filed May 12, 1928 2 Sheets-Sheet 1

Fig. 1.

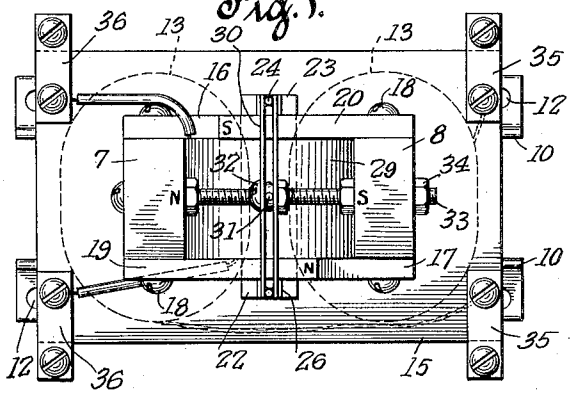


Fig. 4.

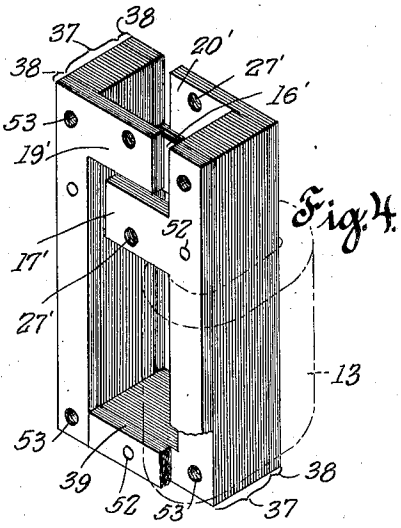


Fig. 2.

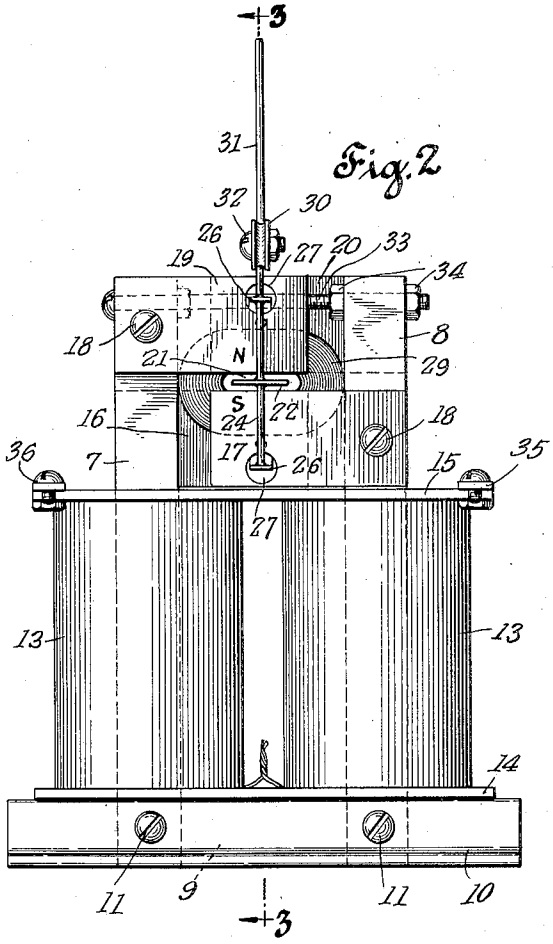
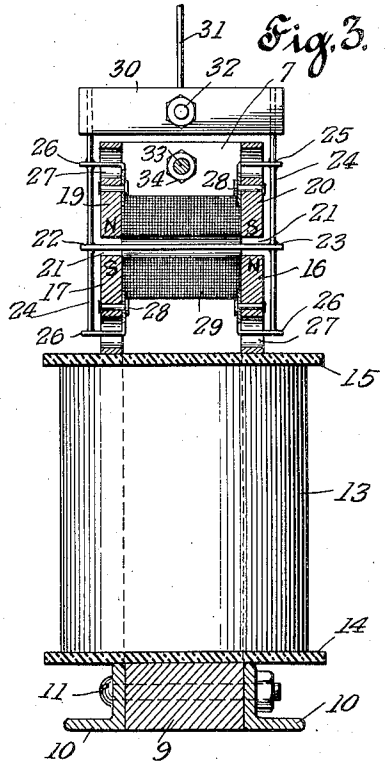


Fig. 3.



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Fig. 5.

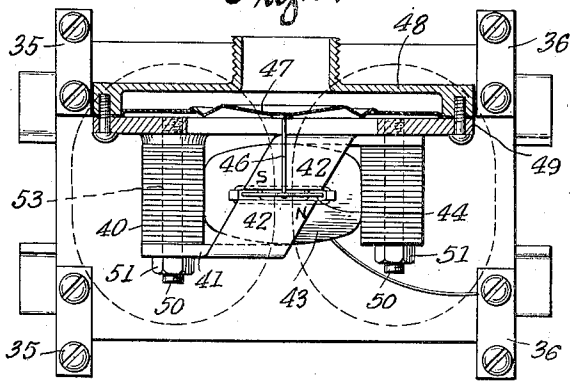
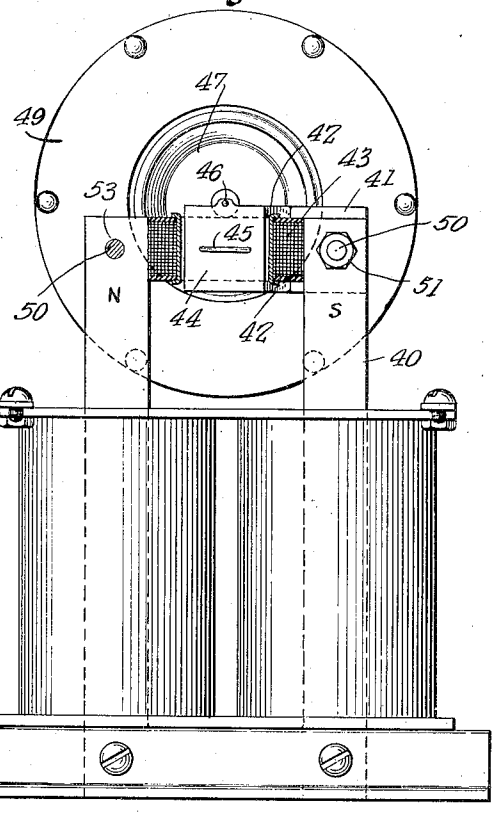


Fig. 6.



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1,830,755

UNITED STATES PATENT OFFICE

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SPEAKER UNIT

Application filed May 12, 1928. Serial No. 277,233.

This invention relates particularly to speaker units of the electromagnetic as distinguished from the permanent magnet type of construction.

Special objects of the present invention are to provide an electro-magnet structure for telephone or speaker units, which will be particularly simple and inexpensive and readily assembled, which can be made of readily obtainable materials, such as sheet and bar stock material, which will reproduce truly without blare or distortion, which will have a powerful action, and at the same time will be capable of operating at reduced volume, and which will not blast under one set of extreme conditions, or on the other hand, lose its fidelity of reproduction under the opposite set of extreme conditions.

The novel features of construction, combinations and relations of parts which make possible the attainment of the foregoing and other desirable objects will appear as the specification proceeds.

The drawings accompanying and forming part of the specification illustrate certain commercial embodiments of the invention, but as these are primarily for purposes of disclosure, it should be understood the structure may be varied without departure from the true spirit and broad scope of the invention.

Fig. 1 is a top plan view of the unit as constructed for the operation of a cone type of speaker; Fig. 2 is a side view of the unit; Fig. 3 is a central vertical sectional view as on the plane of line 3—3 of Fig. 2; Fig. 4 is a detailed perspective view of a laminated magnet core and pole construction; Fig. 5 is a plan and part sectional view of a form of the unit adapted for operation of a diaphragm and horn type of speaker; Fig. 6 is a side and partial sectional view of the latter form of unit.

In the form of the invention first shown, Figs. 1, 2 and 3, the sides of the magnet are made up of solid bars 7, 8 of magnetic material, rectangular in cross-section and joined by a correspondingly shaped block 9, said side bars and back piece being clamped in this general U form by angle bars 10 held by bolts 11 which also pass through the ends of the side bars. These clamp bars 10 may be of magnetic material, so as to aid in forming the magnetic bridge across the ends of the side bars and they are preferably placed with the flanges of the same downwardly so as to serve as a supporting and mounting base of the unit, said flanges being indicated as perforated at 12 in Fig. 1 for passage of suitable mounting screws.

Energizing coils 13 are shown as slipped down over the side bars of the magnet core onto an insulating base piece 14 and over these coils there is shown an insulating plate 15, which in the illustration is held in place on the side bars by magnetic pole pieces 16, 17 secured to opposite edges of the side bars 7 and 8 by screws 18 immediately over said insulating plate. Above these lower pole pieces there are provided the upper pole pieces 19, 20, projecting from opposite faces of the side bars 7 and 8.

The pole pieces described may all be made of flat bar stock secured by the screws 18 in flat engagement with the opposite edge surfaces of the side bars and arranged in overlapping relation, with the upper set of pole pieces spaced to the lower set to leave two fairly wide and relatively long magnetic gaps 21 in which is located a flat armature piece 22.

The mounting of the armature is effected in the illustration by having it project at the sides beyond the pole pieces as shown in Fig. 1 and by having these projecting end portions secured, as by soldering at 23 to support rods 24, which are soldered or otherwise secured at 25 to springs 26 projecting through openings 27 in the pole pieces and having angled inner ends secured to said pole pieces by rivets 28. This construction, it will be seen, provides a resilient mounting normally centering the armature in the gaps, but permitting the armature to move bodily up or down according as to how it is energized by the surrounding coil 29. This coil is indicated as positioned and held in place between the four pole pieces by the base portions of the mounting springs and rivet heads at the inside faces of the pole pieces.

The armature mounting rods 24 are shown as extended upward above the upper pole pieces and as being soldered or otherwise suitably attached to the strips 30, between which the cone or other actuating rod 31 is clamped by screw 32.

The upper ends of the side bars are shown as rigidly braced the proper distance apart by a nonmagnetic through screw 33 and nuts 34. This brace preserves the proper spacing of the pole pieces.

Terminals for the magnetizing coils are shown mounted on the insulating base plate 15 at 35 and at the opposite end of the same insulating base there are shown terminals 36 for the speaker coil 29.

Instead of the solid bar material first shown, the magnet may be made up in laminated form as shown in Fig. 4. In this construction, the central portion of the magnet core is made up of substantially U-shaped stampings 37 and the polar projections 16', 17', 19' and 20' by separate groups of laminations 38 secured to the outer faces of the U laminations, and having straight legs so that they may be entered in the magnetizing coils.

In making up this laminated form of the invention, the magnetizing coils may be slipped down over the sides of the centrally located group of U-shaped stampings and then the outside pole-carrying groups of stampings may be inserted in the coils at the sides of the central group, the gaps at the lower ends of the outside groups being then closed by filler pieces 39.

In the form of the invention illustrated in Figs. 5 and 6, the laminations 40 of the magnet core are all of the U-form shown at 37 in Fig. 4, and the pole pieces are in the form of strips 41 of magnetic material having flanges 42 folded inward at the upper and lower edges of the same, said flanges holding in place between them the speaker coil 43 surrounding the armature 44, which in this instance, is mounted to rock intermediate its ends on a spring hinge wire 45 and is connected at its upper end with a driving pin 46 engaged with the diaphragm 47. The diaphragm is shown clamped at its edges between the throat plate 48 to which the horn is attached and a back flange 49. This back flange is shown as carrying screw studs 50 passing through the upper ends of the laminations and through the pole pieces, so that when the nuts 51 are applied thereto they will serve to secure the pole pieces in place, clamp the laminations together and to secure the diaphragm mounting in place on the unit.

The construction provides a sturdy, compact, powerful unit reproducing the lower as truly as the upper tones, the latter in particular resulting from the high saturation of the magnetic gaps. The device can be manufactured from readily obtainable stock materials at reasonable cost and without requiring special skill in either the making or assembling of the parts. Because of the powerful magnetic flux, the gaps may be made wide enough to positively insure against any chattering of the armature.

The sides of the magnet yoke and the pole pieces provide an enclosure for the actuating winding as clearly shown in Figs. 1, 2, 3, 5 and 6. The mounting of the armature by means of the pole pieces insures the maintenance of the proper relation between these parts and the bridge construction provides a central balanced drive for the cone, diaphragm or other form of speaker element. The wide flat armature operating in two magnetic gaps gives the desired powerful operation, and as these gaps are maintained close to magnetic saturation by the powerful field windings, the action is sensitive and accurate, so that with a reduction in power, the reproduction is as true as when the unit is operated at full load. The structure is such that it may be readily assembled. The clamp at the bottom and the insulating plates above and below the windings keep the sides of the yoke in true parallelism and the bracing screw 33 between the pole tips further insures the maintenance of the parts in proper relation. In the laminated form of yoke construction illustrated in Fig. 4, the central group of U-shaped sheets 37, the side groups of straight length pieces with polar projections and the connecting base pieces 39 may be separately fastened together as by riveting as indicated at 52 and then bolts or similar fastenings be subsequently passed through alined openings 53 in the entire assembled structure.

What is claimed is:

1. An electro-magnetic speaker unit, comprising a substantially U-shaped magnet core, energizing windings on the legs of said magnet core, said legs projecting beyond said windings, polar extensions on the projecting portions of the legs arranged in position to provide a pair of magnetic gaps, an armature supported in said magnetic gaps and an actuating winding for said armature supported between the projecting portions of the legs and the polar extensions thereof, an insulating base plate engaged on the legs of the magnet core over the energizing windings thereon, the polar extensions overstanding said insulating base plate to secure the same in position.

2. An electro-magnetic speaker unit, comprising a substantially U-shaped magnet core, energizing windings on the legs of said magnet core, said legs projecting beyond said windings, polar extensions on the projecting portions of the legs arranged in position to provide a pair of magnetic gaps, an armature supported in said magnetic gaps and an actuating winding for said armature supported between the projecting portions of the

legs and the polar extensions thereof, an insulating base plate engaged on the legs of the magnet core over the energizing windings thereon, the polar extensions overstanding said insulating base plate to secure the same in position, terminals for the energizing windings of the magnet on said insulating base at one side and terminals for the actuating winding of the armature on the opposite side of the base.

3. An electro-magnetic speaker unit, comprising a substantially U-shaped magnet core, energizing windings on the legs of said magnet core, said legs projecting beyond said windings, polar extensions on the projecting portions of the legs arranged in position to provide a pair of magnetic gaps, an armature supported in said magnetic gaps, an actuating winding for said armature supported between the projecting portions of the legs and the polar extensions thereof, said mounting means for the armature comprising springs carried by the polar extensions and having a supporting connection with the armature, said supporting connections comprising rods at opposite sides of the polar extensions, a bridge connecting said rods above the polar extensions and a drive rod for a speaker cone connected to said bridge.

4. An electro-magnetic speaker unit, comprising a substantially U-shaped magnet core, energizing windings on the legs of said magnet core, said legs projecting beyond said windings, polar extensions on the projecting portions of the legs arranged in position to provide a pair of magnetic gaps, an armature supported in said magnetic gaps, an actuating winding for said armature supported between the projecting portions of the legs and the polar extensions thereof and clamp bars of angle cross-section forming a yoke connecting the legs at the base thereof and forming a base structure for mounting the unit.

5. An electro-magnetic speaker unit comprising magnetic side and base portions, a clamp securing said side and base portions together in magnetically coupled U-shape, an insulating base plate engaged over the side portions above the clamp and base portion, energizing windings engaged over the side portions above said insulating base, an insulating base plate engaged over the side portions above the windings, polar extensions applied to opposite sides of said side portions above said last mentioned insulating base plate, an armature cooperatively related to said polar extensions, an actuating winding for said armature between the side portions above the second insulating base plate and a driving pin connected with the armature.

6. An electro-magnetic speaker unit comprising magnetic side and base portions, a clamp securing said side and base portions together in magnetically coupled U-shape, an insulating base plate engaged over the side portions above the clamp and base portions, energizing windings engaged over the side portions above said insulating base, an insulating base plate engaged over the side portions above the windings, polar extensions applied to opposite sides of said portions above said last mentioned insulating base plate, an armature cooperatively related to said polar extensions, an actuating winding for said armature between the side portions above the second insulating base plate, a driving pin connected with the armature and means carried by the polar extensions for resiliently supporting the armature in proper cooperative relation to said polar extensions.

7. An electro-magnetic speaker unit, comprising separately formed magnetic side and base portions, a clamp yoke securing said portions together in U-magnet form, magnetizing windings on said side portions, polar extensions applied to opposite faces of said side portions above the windings thereon and positioned to form a pair of relatively long, narrow magnetic gaps, a wide flat armature positioned in said gaps, means for resiliently supporting said armature thus positioned, a drive pin connected with said armature and an actuating winding surrounding the armature between said polar extensions.

8. An electro-magnetic speaker unit, comprising a laminated core made up of substantially U-shaped plates located at the central portion of the core structure and straight length plates located at opposite sides of said U-shaped plates and provided with angularly extending polar projections, magnetizing windings surrounding the straight portions of said side plates and the leg portions of the centrally located U-shaped plates, an armature cooperatively related to the polar projections and an actuating winding for said armature.

9. An electro-magnetic speaker unit, comprising a laminated core made up of substantially U-shaped plates located at the central portion of the core structure and straight length plates located at opposite sides of said U-shaped plates and provided with angularly extending polar projections, magnetizing windings surrounding the straight portions of said side plates and the leg portions of the centrally located U-shaped plates, an armature cooperatively related to the polar projections and an actuating winding for said armature, said actuating winding being disposed between the legs of said U-shaped laminations inside the polar projections of the side laminations.

10. An electro-magnetic speaker unit, comprising a laminated core made up of substantially U-shaped plates located at the central

portion of the core structure and straight length plates located at opposite sides of said U-shaped plates and provided with angularly extending polar projections, magnetizing windings surrounding the s raight portions of said side plates and the leg portions of the centrally located U-shaped plates, an armature cooperatively related to the polar projections, an actuating winding for said armature, said actuating winding being disposed between the legs of said U-shaped laminations inside the polar projections of the side laminations and means for clamping all sections of the laminated structure together.

11. An electro-magnetic speaker unit, comprising a laminated core made up of substantially U-shaped plates located at the central portion of the core structure and straight length plates located at opposite sides of said U-shaped plates and provided with angularly extending polar projections, magnetizing windings surrounding the straight portions of said side plates and the leg portions of the centrally located U-shaped plates, an armature cooperatively related to the polar projections, an actuating winding for said armature, there being two polar projections for each leg of the magnet on opposite sides of each magnet leg, one at the end of the leg and the other positioned back from the end of the leg and arranged reversely on the two legs to stand in overlapping spaced relation at opposite sides of the magnet structure, thus forming two magnetic gaps and the armature extending through both gaps.

12. An electro-magnetic speaker unit, comprising a U-shaped magnet yoke of substantially rectangular cross-section, magnetizing windings on the legs of said yoke, pole pieces applied to opposite faces of said legs above the windings thereon, there being two pole pieces on each leg, on opposite sides of the same and positioned at one end and the other spaced back from the end of the leg, said pole pieces on the two legs being arranged in reverse relation and standing in spaced overlapped relation at opposite sides of the magnet structure to form magnetic gaps at opposite sides of the magnet, an armature supported in said magnetic gaps, a drive pin connected with said armature, the said ends of said armature being linked by a bridge above the pole pieces and the drive pin being connected with said bridge.

13. An electro-magnetic speaker unit, comprising a magnetic yoke, magnetizing windings on the sides of said yoke, pole pieces applied to opposite faces of said side pieces and standing in staggered relation to provide magnetic gaps at opposite sides of the magnet structure, an armature extending through said gaps, means for resiliently supporting said armature positioned in the gaps, a bridge connecting opposite ends of the armature above the pole pieces, a drive pin connected with said bridge and actuating winding surrounding the armature below said bridge.

14. An electro-magnetic speaker unit, comprising a laminated core of thin flat substantially U-shaped plates forming a bi-polar magnet yoke, substantially L shaped laminations having straight legs and angularly projecting polar extensions, said L shaped laminations being applied to the outside faces of the U-shaped laminations, means securing said plates together in assembled yoke forming relation, polarizing windings on the arms of said magnet yoke, cooperating pole pieces carried by the arms of the yoke, an armature supported between said pole pieces, an actuating winding supported between the pole pieces and the arms of the magnet yoke in position surrounding the armature and a drive pin connected with said armature.

In testimony whereof I affix my signature.

CLYDE J. FITCH.