

May 6, 1941.

A. E. WOODRUFF ET AL

2,241,105

SOUND TRANSLATING DEVICE

Filed May 24, 1938

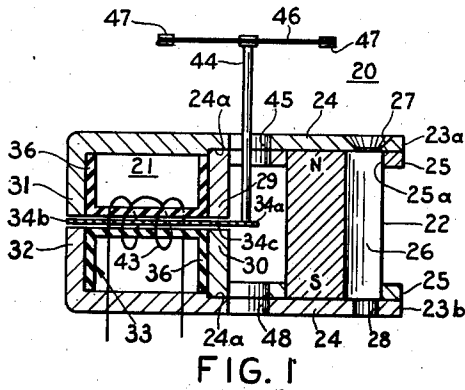


FIG. 1

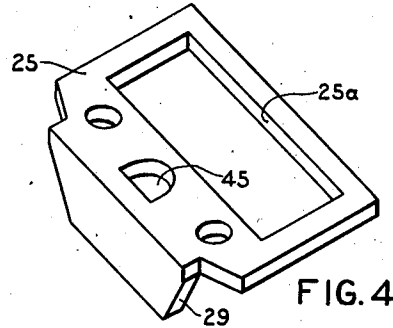


FIG. 4

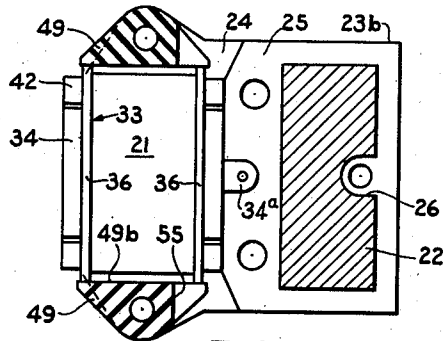


FIG. 2

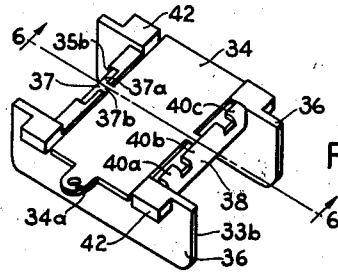


FIG. 5

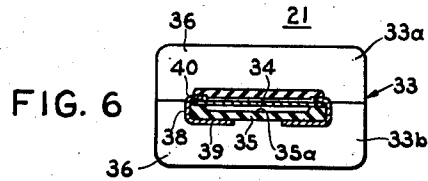


FIG. 6

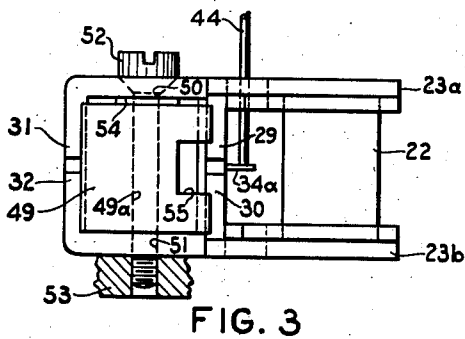


FIG. 3

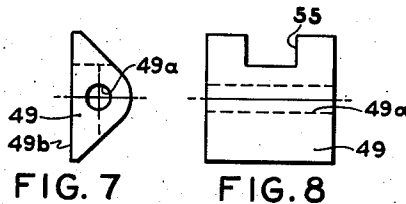


FIG. 7

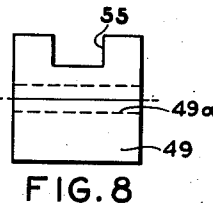


FIG. 8

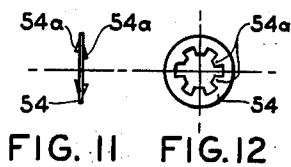


FIG. 11



FIG. 12

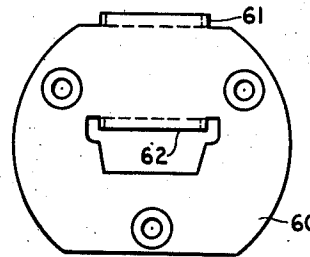


FIG. 9

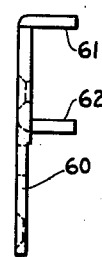


FIG. 10

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2,241,105

SOUND TRANSLATING DEVICE

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Application May 24, 1938, Serial No. 209,802

11 Claims. (Cl. 179—119)

The present invention relates to sound translating devices and more particularly to a sound translating device of the magnetic or sound powered type.

In a sound translating device of this type a magnetic field structure is provided which conventionally comprises a bar magnet having field members formed of magnetic material arranged on the opposite ends thereof. Also, the field members are provided with outwardly extending body portions, each carrying two pole pieces spaced from each other and constituting two sets, the pole pieces of each of the sets being directed toward each other, and the pole faces of each set being arranged in spaced-apart relation in order to receive therebetween the opposite ends of a pivotally mounted armature formed of magnetic material. One end of the pivotally mounted armature is connected to a diaphragm and a winding or voice coil carried by a winding spool is electromagnetically coupled to the armature. In the case of a transmitter of this type, the vibrations of the diaphragm produced by the sound to be transmitted causes the ends of the armature to vibrate between the pole faces of the sets of pole pieces, thereby to generate a corresponding signal voltage. In the case of a receiver of this type, the signal current passing through the voice coil causes the ends of the armature to vibrate between the pole faces of the sets of pole pieces, thereby to reproduce at the diaphragm a corresponding sound. In prior sound translating devices of this type it has been possible to produce only two or three bars of pressure in the receiver with an input pressure of twenty bars in the transmitter, thereby restricting the use of this type of equipment to substations spaced apart only short distances. Furthermore, prior sound translating devices of this type embody field structures which are productive of strong stray magnetic fields.

Accordingly, it is an object of the present invention to provide an improved sound translating device of the type described which is of extremely simple and rugged construction, which is compact and economical to manufacture, and which is efficient in operation.

Another object of the invention is to provide an improved sound translating device of the type described, having embodied therein a field structure which is so constructed and arranged that the production of stray magnetic fields is minimized.

Another object of the invention is to provide in a sound translating device of the type de-

scribed comprising a field structure and a winding spool, an improved arrangement for securing the field structure in assembled relation and for retaining the winding spool in place.

A further object of the invention is to provide in a sound translating device of the type described comprising a field structure and securing and spacing elements for retaining the field structure in assembled relation, an improved arrangement for compensating for the difference in the thermal coefficients of expansion of the securing and the spacing elements.

In general, the objects as set forth above are attained in accordance with the present invention by providing in a sound translating device of the character noted, a field structure comprising a bar magnet, and field members formed of magnetic material arranged on the opposite ends of the bar magnet, the field members having recesses therein receiving and surrounding the extreme outer ends of the bar magnet, thereby to minimize flux leakage between the ends of the bar magnet. Also the field members have outwardly extending body portions, each carrying two pole pieces spaced from each other and constituting two sets, the pole pieces of each of the sets being directed toward each other and the pole faces of each set being arranged in spaced-apart relation in order to receive therebetween the opposite ends of a pivotally mounted armature formed of magnetic material. In accordance with another feature of the invention, the field members of the field structure arranged on the opposite ends of the bar magnet are formed of flat magnetic stock having outwardly extending body portions, each provided with two pole pieces spaced from each other and constituting two sets, the two pole pieces provided on each member being formed integrally from the stock of the member, the pole pieces of each of the sets being directed toward each other, and the pole faces of each set being arranged in spaced-apart relation in order to receive therebetween the opposite ends of a pivotally mounted armature formed of magnetic material.

In accordance with another feature of the invention a winding spool is provided with an armature formed of magnetic material pivotally mounted thereon, whereby the winding spool and armature constitute an assembly which is retained in place by securing and spacing elements arranged between the body portions of the field members of the field structure. In accordance with a further feature of the invention there is provided means including a resilient washer

interposed between one of the field members of the field structure and each of the spacing elements for compensating for the difference in the thermal coefficients of expansion of the securing and the spacing elements, whereby the adjustments of the elements of the sound translating device are not injuriously affected by ambient temperature variations.

In accordance with a further feature of the invention the bar magnet has a maximum energy greater than 1.2×10^6 ergs per c. c. and a coercive force greater than 400 Oersteds; the pole pieces have an A. C. permeability of the order of 600 to 800; and the armature has an A. C. permeability of the order of 500 to 1500.

The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawing, in which Figure 1 is a sectional view of a sound translating device in the form of a telephone transmitter of the magnetic or sound powered type embodying the present invention; Fig. 2 is a plan view, partly in section, of the sound translating device of Fig. 1; Fig. 3 is a side elevational view of the sound translating device; Fig. 4 is a perspective view of an element of the field structure embodied in the sound translating device; Fig. 5 is a perspective view of a portion of a winding spool and armature assembly embodied in the sound translating device; Fig. 6 is a sectional view of the complete assembly taken along the line 6—6 of Fig. 5; Fig. 7 is a plan view of a spacing element embodied in the sound translating device; Fig. 8 is a side elevational view of the spacing element of Fig. 7; Fig. 9 is a plan view of one of the field members of a modified form of the field structure of the sound translating device of Fig. 1; Fig. 10 is a side elevational view of the field member of Fig. 9; Fig. 11 is a side elevational view of a resilient washer forming a part of an arrangement for securing the field members of the field structure in spaced-apart relation and for retaining the winding spool and armature assembly in place; and Fig. 12 is a plan view of the resilient washer of Fig. 11.

Referring now more particularly to Figs. 1 to 4, inclusive, of the drawing there is illustrated a sound translating device in the form of a telephone transmitter of the magnetic or sound powered type embodying the features of the present invention and comprising a field structure 20 and a winding spool and armature assembly 21. The field structure 20 includes a permanent bar magnet 22 having a maximum energy greater than 1.2×10^6 ergs per c. c. and a coercive force greater than 400 Oersteds, and two similar field members 23^a and 23^b formed of magnetic material having an A. C. permeability of the order of 600 to 800 and arranged on the opposite ends of the bar magnet, the field members 23^a and 23^b being arranged on the north and south poles, respectively, of the bar magnet 22. Preferably the bar magnet 22 is formed of an alloy comprising 5 to 40% nickel, 7 to 20% aluminum, 0.5 to 30% cobalt and the remainder iron, such, for example, as the alloy known as "Alnico"; while the field members 23^a and 23^b are formed of an alloy comprising approximately 45% nickel and 55% iron, such, for example, as the alloy

known as "Allegheny Electric Metal." The members 23^a and 23^b are of similar construction, each including outside and inside elements 24 and 25, respectively, formed of flat stock and secured together in facing engagement. The inside element 25 is seated in a recess 24^a provided in the inner surface of the outside element 24, the elements 24 and 25 being secured together by rivets or the like extending therethrough. The inside element 25 is provided with an aperture 25^a therethrough which is arranged in alignment with a solid portion of the outside element 24 secured thereto, thereby providing a recess in the field member comprising the outside and inside elements 24 and 25. The recess in the members 23^a and 23^b receive and surround the opposite and extreme outer ends of the bar magnet 22, thereby to minimize flux leakage between the portions of the bar magnet 22 adjacent the extreme outer ends thereof and the consequent production of stray magnetic fields.

Also, the bar magnet 22 is provided with a longitudinally extending recess 26 therein which is arranged in alignment with openings 27 and 28 formed in the members 23^a and 23^b, respectively, and adapted to receive a stud or the like for securing the field members 23^a and 23^b to the bar magnet 22. Also, each of the elements 24 and 25 is provided with an extended body portion having a pole piece formed integrally therewith, the inside elements of the field members 23^a and 23^b being provided with pole pieces 29 and 30, respectively, and the outside elements of the field members 23^a and 23^b being provided with pole pieces 31 and 32, respectively. The pole pieces 29, 30 and 31, 32 constitute sets spaced from each other, the adjacent pole pieces of each set being directed toward each other and the pole faces thereof being arranged in spaced-apart relation in order to receive therebetween the opposite ends of a pivotally mounted armature formed of magnetic material.

Preferably, the winding spool and armature assembly 21 is of the construction of that disclosed and claimed in the copending application of Albert E. Woodruff, Serial No. 209,803, filed May 24, 1938, and as shown in Figs. 5 and 6, comprises a winding spool 33 formed of insulating material such as "Bakelite" and an armature 34 formed of flat magnetic stock. Preferably the armature 34 is formed of steel containing approximately 4% silicon and has an A. C. permeability of the order of 500 to 1500.

The winding spool 33 is split longitudinally and comprises complementary upper and lower sections 33^a and 33^b, respectively, of similar construction. Each of the sections includes a body 35 carrying two spaced apart winding retaining heads 36. The wall of the body 35 of the lower section 33^b is provided with a longitudinally extending recess 35^a therein, which is disposed adjacent the joint between the upper and lower sections 33^a and 33^b, respectively. The wall of the body of the upper section 33^a is substantially flat adjacent the joint between the upper and lower section 33^a and 33^b, respectively. The armature 34 is provided with a longitudinally extending operating lug 34^a and two transversely extending spaced apart lugs 37 intermediate the ends thereof. Each of the lugs 37 projects from one side of the armature 34 and is provided with a head 37^a connected by a length 37^b to the armature 34, the length 37^b being of reduced cross-sectional area. The armature 34 is arranged in the recess 35^a provided in the wall of the body 35 of the

lower section 33^b, the armature 34 being retained in position by spaced apart and aligned recesses 35^b provided in the body 35 of the lower section 33^b and receiving the heads 37^a on the lugs 37. The lugs 37 are retained in the recesses 35^b provided in the body 35 of the lower section 33^b by two mounting clips 38. Each of the clips 38 is of substantially U-shape, comprising two flanges 39 and 40, the flange 40 being provided with three spaced apart fingers 40^a, 40^b and 40^c. Each of the clips 38 embraces one side of the body 35 of the lower section 33^b, the clip 38 being retained in place by the clamping action between the two outside fingers 40^a and 40^c and the flange 39 upon the body 35. The intermediate finger 40^b on the clip 38 engages the head 37^a on one of the lugs 37, thereby rigidly securing the lug to the body 35 of the lower section 33^b. The clips 38 mount the armature 34 on the body 35 of the lower section 33^b for vibratory movements about an axis extending between the lugs 37 transversely of the winding spool 33.

In constructing the assembly 21 the armature 34 is brought into position with respect to the recess 35^a provided in the body 35 of the pre-formed lower section 33^b of the winding spool 33 and lowered into place, the heads 37^a on the lugs 37 being received in the recesses 35^b formed in the body 35. The clips 38 are then placed upon the sides of the body 35 and the outside fingers 40^a and 40^c and the flange 39 are bent into engagement with the body 35 in order securely to fasten the clips 38 thereto. The armature 34 is then aligned and the intermediate fingers 40^b are then bent into engagement with the heads 37^a on the lugs 37, in order securely to retain the armature 34 in position. The pre-formed upper section 33^a is then brought into superimposed relation with the lower section 33^b to complete the assembly 21, the upper and lower sections 33^a and 33^b, respectively, being retained together by the field structure of the telephone transmitter in any suitable manner.

The walls of the bodies 35 of the upper and lower sections 33^a and 33^b are spaced a short distance from the armature 34 and the ends of the armature 34 project through the winding spool 33, these ends of the armature being protected against injury by projections 42 provided on the ends of the sections 33^a and 33^b. Thus, the composite body of the winding spool 33 is hollow; and is provided with a wall surrounding a narrow opening extending longitudinally there-through, the armature 34 being arranged within the opening in the body. The armature 34 is supported by the lugs 37 for vibratory movements out of contact with the wall of the body and about an axis extending between the lugs 37 transversely of the winding spool 33. When the armature 34 is moved from its normal position, the lugs 37 are subjected to torsional strains, these strains being localized in the lengths of cross-sectional area 37^b of the lugs 37. This torsional mounting of the armature 34 is very advantageous as it causes the armature 34 to be deflected an amount precisely corresponding to the force exerted on the operating lug 34^a, the deflection of the armature 34 being directly proportioned to the force exerted upon the operating lug 34^a over a wide range.

A winding 43 is arranged about the body between the winding retaining heads 36 of the winding spool 33 and one end 34^b of the armature 34 is disposed between the oppositely disposed pole faces of the set of adjacent pole pieces

31 and 32, while the other end 34^c of the armature 34 is disposed between the oppositely disposed pole faces of the set of adjacent pole pieces 29 and 30. The operating lug 34^a on the armature 34 is provided with an opening therein in which one end of a rod 44 is secured, the rod 44 extending through an opening 45, formed in the field member 23^a. The other end of the rod 44 is secured to a sound wave responsive diaphragm 46 supported about its periphery by suitable clamping means 47. Also, an opening 48 is provided in the field member 23^b in case it is desirable to extend the rod 44 through the member 23^b to the diaphragm 46. This arrangement provides for extending the rod 44 through either one of the field members 23^a or 23^b, thereby rendering reversible the position of the diaphragm 46 with respect to the field structure 20.

Normally, the armature 34 occupies a position wherein the opposite ends thereof are disposed intermediate the adjacent pole faces of the two sets of pole pieces and is adapted to be vibrated by the rod 44 when the diaphragm 46 is vibrated by sound waves impinging thereon. Thus, the movement of the armature 34 is controlled in accordance with the vibratory movements of the diaphragm 46, the vibratory movements of the diaphragm 46 corresponding to the vibrations of the air produced by the sound to be transmitted. As the armature 34 is moved in a clockwise direction about its pivot, the magnetic field of the field structure 20 traverses a path extending from the north pole of the bar magnet 22 by way of the field member 23^a, the pole piece 31, the armature 34, the pole piece 30 and the field member 23^b to the south pole of the bar magnet 22. On the other hand, when the armature is moved in a counter-clockwise direction about its pivot, the magnetic field of the field structure 20 traverses a path extending from the north pole of the bar magnet 22 by way of the field member 23^a, the pole piece 29, the armature 34, the pole piece 32 and the field member 23^b to the south pole of the bar magnet 22. Thus, during the vibratory movements of the armature 34 the magnetic field of the field structure 20 traverses the armature 34 in opposite directions, causing a corresponding electromotive force to be generated in the winding 43 electromagnetically coupled thereto. The electromotive force generated in the winding 43 is transmitted to a distant point where it is utilized in a suitable receiver or other translating device to reproduce the sound transmitted, in a well-known manner.

The pole faces of the two sets of pole pieces are secured together in spaced-apart relation by an arrangement including two spacing elements 49, shown in Figs. 7 and 8, formed of non-magnetic material, and arranged between the body portions of the field members 23^a and 23^b. Preferably, each of the spacing elements 49 is formed of "Bakelite" and is provided with an opening 49^a extending longitudinally there-through and arranged in alignment with two openings 50 and 51 formed in the field members 23^a and 23^b, respectively. Each of the spacing elements 49 is secured in place by a stud or securing element 52 formed of non-magnetic material extending through the aligned openings 50, 49^a and 51, and threaded into an opening provided in a supporting plate 53. Preferably, each of the studs 52 is formed of brass and is surrounded by a resilient washer 54 disposed between the field member 23^a and the spacing element 49, the washer 54 being provided with a plurality of

oppositely extending teeth 54^a engaging the field member 23^a and the spacing element 49. This arrangement compensates for the difference in the thermal coefficients of expansion of the studs 52 and the spacing elements 49, and retains the field members 23^a and 23^b securely together in spaced-apart relation in spite of variations in the ambient temperature. Also, each of the spacing elements 49 is provided with a flat surface 49^b abutting the winding retaining heads 36 of the winding spool 33, the spacing elements being disposed adjacent the opposite sides of the winding spool and armature assembly 21 thereby to retain the assembly in place. A recess 55 is provided in each of the spacing elements 49 in order to accommodate the conductors extending electrical connections to the winding 43.

In assembling the sound translating device the extreme outer ends of the bar magnet 22 are inserted in the recesses provided in the field members 23^a and 23^b by the apertures 25^a formed in the inside elements 25 thereof. The bar magnet 22 and the field members 23^a and 23^b are then securely fastened together by a stud or the like extending through the recess 26 formed in the bar magnet 22 and the aligned openings 27 and 28 formed in the field members 23^a and 23^b, respectively. The previously assembled winding spool and armature assembly 21 is then slid into place between the two sets of pole pieces and connections are extended to the terminals of the winding 43. The spacing elements 49 are then arranged between the body portions of the field members 23^a and 23^b and secured in place by the studs 52. Finally, the rod 44 is inserted through the opening 45 formed in the field member 23^a and the opposite ends thereof are connected to the operating lug 34^a formed on the armature 34 and the diaphragm 46.

In a modified form of the field structure two field members 60 of similar construction are secured in face engagement with the opposite ends of the bar magnet 22. Each of the field members, as best shown in Figs. 9 and 10, is formed of flat magnetic stock and provided with an extended body portion having two pole pieces 61 and 62 spaced from each other, the pole pieces 61 and 62 being formed integrally with the stock of the field member 60. The two pole pieces on each of the field members cooperate with each other to provide two sets, the pole pieces of each set being directed toward each other and the pole faces of each set of pole pieces being arranged in spaced-apart relation. The field members 60 are assembled upon the opposite ends of the bar magnet 22, and the winding spool and armature assembly 21 is arranged between the two sets of pole pieces in an obvious manner. The construction and operation of this form of the field structure is otherwise the same as the form of field structure illustrated in the sound translating device of Fig. 1.

From the foregoing description it is apparent that a compact and rugged sound translating device is provided. Moreover, sound translating devices of this construction have high operating efficiencies, it being possible to produce between thirty and forty bars of pressure in the receiver with an input pressure of twenty bars in the transmitter, thereby rendering it possible to utilize this type of equipment in substations spaced apart considerable distances. The efficiency of the sound translating device is appreciably increased in spite of the fact that the size of the field structure is considerably reduced by

utilizing the combination of a permanent magnet having high maximum energy characteristic, pole pieces having a high A. C. permeability and a vibratory armature having a high A. C. permeability. Also the efficiency of the device is maintained at its maximum value by forming the permanent magnet of a material having high coercivity. While the features of the present invention have been illustrated as being embodied in a telephone transmitter, it is apparent that they may be readily embodied in a telephone receiver or other sound translating device.

While there have been described what are at present considered to be the preferred embodiments of the invention, it will be understood that various modifications may be made therein and it is contemplated to cover in the appended claims all such modifications as fall within the true spirit and scope of the present invention.

What is claimed is:

1. A sound translating device comprising, in combination, a bar magnet, field members formed of magnetic material arranged on the opposite ends of said bar magnet, said field members having longitudinally extending body portions carrying two pole pieces spaced from each other and constituting two sets, the pole pieces of each of said sets being directed toward each other and the pole faces of each set being arranged in spaced-apart relation in order to receive therebetween the opposite ends of an armature mounted for pivotal movement about a laterally extending axis, a winding spool arranged between said two sets of pole pieces, two laterally spaced-apart spacing elements formed of non-magnetic material arranged between the body portions of said field members, said spacing elements being disposed exteriorly of said winding spool and adjacent the opposite sides thereof, and means including a securing element and said spacing elements for securing said field members together in spaced-apart relation and for preventing movement of said winding spool between said two sets of pole pieces in a lateral direction.

2. A sound translating device comprising, in combination, a bar magnet, field members formed of magnetic material arranged on the opposite ends of said bar magnet, said field members having longitudinally extending body portions carrying two pole pieces spaced from each other and constituting two sets, the pole pieces of each of said sets being directed toward each other and the pole faces of each set being arranged in spaced-apart relation in order to receive therebetween the opposite ends of an armature mounted for pivotal movement about a laterally extending axis, a winding spool arranged between said two sets of pole pieces, two laterally spaced-apart spacing elements formed of non-magnetic material extending between the body portions of said field members, said spacing elements being disposed exteriorly of said winding spool and adjacent the opposite sides thereof, and means including two securing elements extending between the body portions of said field members and said spacing elements for retaining said field members together in spaced-apart relation and for preventing movement of said winding spool between said two sets of pole pieces in a lateral direction in place, and means including resilient washers interposed between one of said field members and said spacing elements for compensating for the difference in the thermal coefficients of expansion of said securing elements and said spacing elements.

3. A sound translating device comprising, in combination, a bar magnet, field members formed of magnetic material arranged on the opposite ends of said bar magnet, said field members having longitudinally extending body portions carrying two pole pieces spaced from each other and constituting two sets, the pole pieces of each of said sets being directed toward each other and the pole faces of each set being arranged in spaced-apart relation, a winding spool arranged between said two sets of pole pieces, said winding spool having an armature mounted thereon for pivotal movement about a laterally extending axis, the opposite ends of said armature being arranged between the pole faces of the pole pieces of said two sets, two laterally spaced-apart spacing elements formed of non-magnetic material extending between the body portions of said field members, said spacing elements being disposed exteriorly of said winding spool and in abutting relation with the sides thereof, and means including a securing element and said spacing elements for securing said field members together in spaced-apart relation and for preventing movement of said winding spool between said two sets of pole pieces in a lateral direction.

4. A sound translating device comprising, in combination, a bar magnet, field members formed of magnetic material arranged on the opposite ends of said bar magnet, said field members having recesses therein receiving and surrounding the extreme outer ends of said bar magnet, thereby to minimize flux leakage between the ends of said bar magnet, said field members having outwardly extending body portions carrying two pole pieces spaced from each other and constituting two sets, the pole pieces of each of said sets being directed toward each other and the pole faces of each set being arranged in spaced-apart relation in order to receive therebetween the opposite ends of a pivotally mounted armature, a winding spool arranged between said two sets of pole pieces, two spacing elements formed of non-magnetic material arranged between the body portions of said field members and disposed adjacent the opposite sides of said winding spool, and means including a securing element and said spacing elements for securing said field members together in spaced-apart relation and for retaining said winding spool in place.

5. A sound translating device comprising, in combination, a bar magnet, similar field members formed of magnetic material arranged on the opposite ends of said bar magnet, each of said field members including inside and outside elements formed of flat stock and secured together in facing engagement, each of said inside elements having an aperture therethrough in alignment with a solid portion of the outside element secured thereto, thereby providing a recess in each of said field members, the recesses in said field members receiving and surrounding the extreme outer ends of said bar magnet, thereby to minimize flux leakage between the ends of said bar magnet, a pole piece formed integral with each of said inside and outside elements, the pole pieces formed integral with corresponding elements being directed toward each other and constituting a set, said sets of pole pieces being spaced from each other and the pole faces of each set being arranged in spaced-apart relation, a winding spool arranged between said two sets of pole pieces, said winding spool having an armature pivotally mounted thereon, the opposite ends of said armature being arranged between the pole faces of the pole pieces

of said two sets, two spacing elements formed of non-magnetic material arranged between the body portions of said field members and disposed adjacent the opposite sides of said winding spool, and means including a securing element and said spacing elements for securing said field members together in spaced-apart relation and for retaining said winding spool in place.

6. A field structure for a sound translating device comprising, in combination, a bar magnet, field members formed of magnetic material arranged on the opposite ends of said bar magnet, at least one of said field members including inside and outside elements formed of flat stock and secured together in facing engagement, said inside element having an aperture therethrough in alignment with a solid portion of said outside element, thereby providing a recess in said one field member, the recess in said one field member receiving and surrounding one extreme outer end of said bar magnet, thereby to minimize flux leakage from the one end of said bar magnet, and a pole piece carried by each of said field members, said pole pieces being directed toward each other and constituting a set, the pole faces of said set of pole pieces being arranged in spaced-apart relation in order to receive therebetween a movable armature.

7. A field structure for a sound translating device comprising, in combination, a bar magnet, similar field members formed of magnetic material arranged on the opposite ends of said bar magnet, each of said field members including inside and outside elements formed of flat stock and secured together in facing engagement, each of said inside elements having an aperture therethrough in alignment with a solid portion of the outside element secured thereto, thereby providing a recess in each of said field members, the recesses in said field members receiving and surrounding the extreme outer ends of said bar magnet, thereby to minimize flux leakage between the ends of said bar magnet, and a pole piece carried by each of said field members, said pole pieces being directed toward each other and constituting a set, the pole faces of said set of pole pieces being arranged in spaced-apart relation in order to receive therebetween a movable armature.

8. A field structure for a sound translating device comprising, in combination, a bar magnet, similar field members formed of magnetic material arranged on the opposite ends of said bar magnet, each of said field members including inside and outside elements formed of flat stock and secured together in facing engagement, each of said inside elements having an aperture therethrough in alignment with a solid portion of the outside element secured thereto, thereby providing a recess in each of said field members, the recesses in said field members receiving and surrounding the extreme outer ends of said bar magnet, thereby to minimize flux leakage between the ends of said bar magnet, and a pole piece formed integral with each of said inside and outside elements, the pole pieces formed integral with corresponding elements being directed toward each other and constituting a set, said sets of pole pieces being spaced from each other and the pole faces of each set being arranged in spaced-apart relation in order to receive therebetween the opposite ends of a pivotally mounted armature.

9. A sound translating device comprising, in combination, a bar magnet, similar field members formed of flat magnetic stock arranged on the opposite ends of said bar magnet, said field mem-

bers having outwardly extending body portions provided with two pole pieces spaced from each other and constituting two sets, the two pole pieces provided on each field member being formed integral therewith from the stock of said field member, the pole pieces of each of said sets being directed toward each other and the pole faces of each set being arranged in spaced-apart relation in order to receive therebetween the opposite ends of a pivotally mounted armature, a winding spool arranged between said two sets of pole pieces, two spacing elements formed of non-magnetic material arranged between the body portions of said field members and disposed adjacent the opposite sides of said winding spool, and means including a securing element and said spacing elements for securing said field members together in spaced-apart relation and for retaining said winding spool in place.

10. A sound translating device comprising, in combination, a bar magnet, similar field members formed of flat magnetic stock arranged on the opposite ends of said bar magnet, said field members having outwardly extending body portions provided with two pole pieces spaced from each other and constituting two sets, the two pole pieces provided on each field member being formed integral therewith from the stock of said field member, the pole pieces of each of said sets being directed toward each other and the pole

faces of each set being arranged in spaced-apart relation, a winding spool arranged between said two sets of pole pieces, said winding spool having an armature pivotally mounted thereon, the opposite ends of said armature being arranged between the pole faces of the pole pieces of said two sets, two spacing elements formed of non-magnetic material arranged between the body portions of said field members and disposed adjacent the opposite sides of said winding spool, and means including a securing element and said spacing elements for securing said field members together in spaced-apart relation and for retaining said winding spool in place.

11. A sound translating device comprising, in combination, a bar magnet, a pair of field members secured in spaced-apart relationship, each of said field members including inside and outside plates secured together in facing engagement, said inside plates having aligned openings there-through in alignment with solid portions of said outside plates thereby to provide aligned sockets in said field members, the sockets in said field members receiving and grippingly engaging the opposite ends of said bar magnet to support said bar magnet in place, pole pieces associated with said field members, and a movable armature operatively associated with said pole pieces.

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