

April 17, 1934.

C. MESSICK

1,955,248

MAGNETIC MOVEMENT

Filed April 18, 1928

2 Sheets-Sheet 1

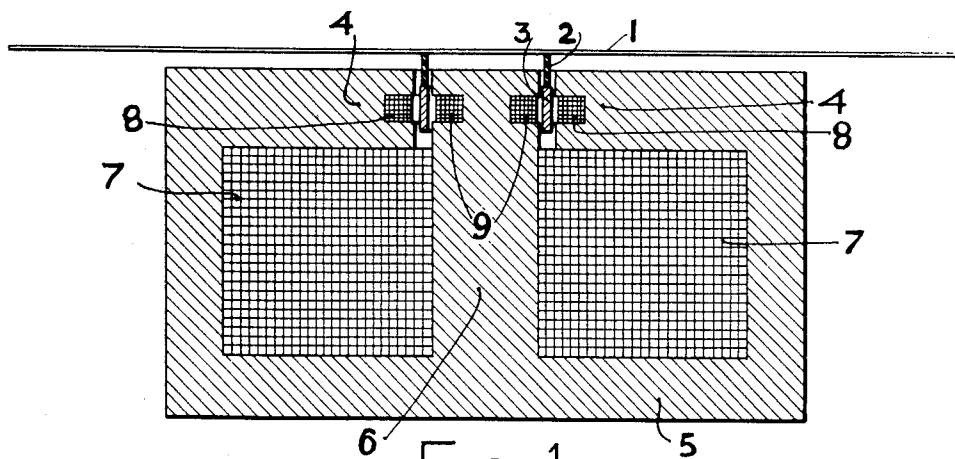


FIG. 1.

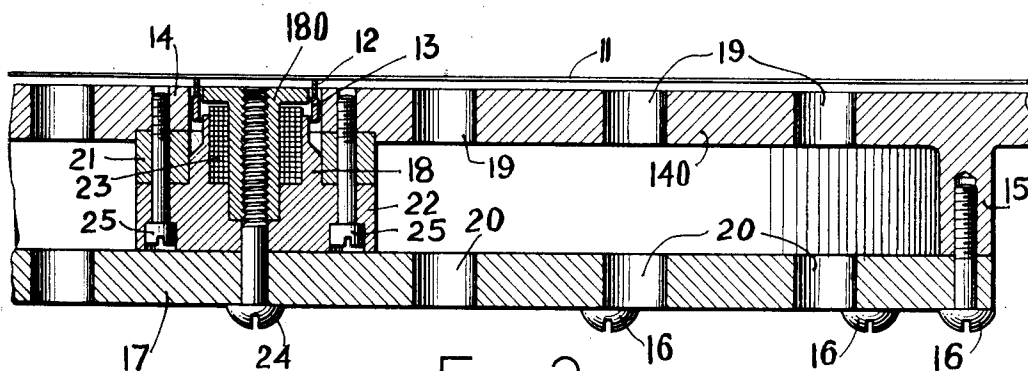


FIG. 2.

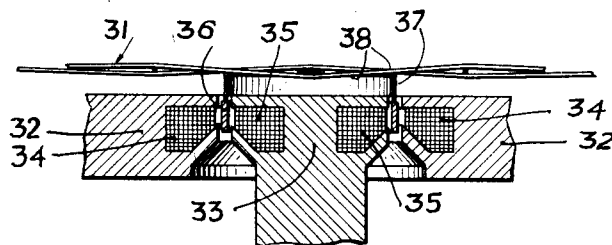


FIG. 3.

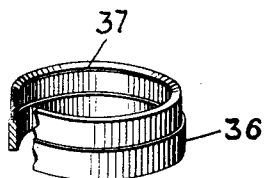


FIG 3 a.

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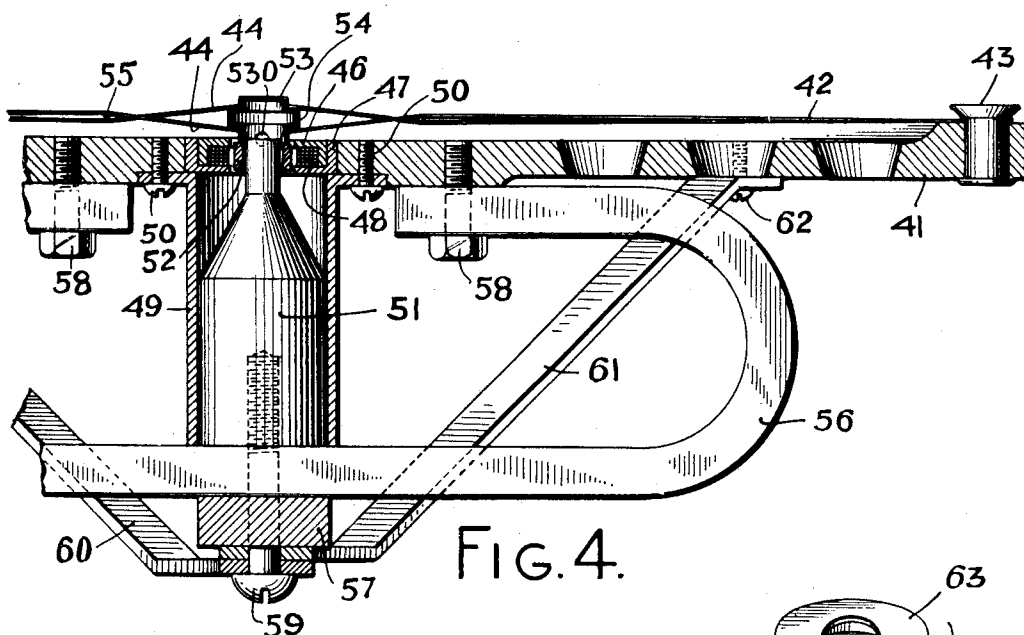


FIG. 4.

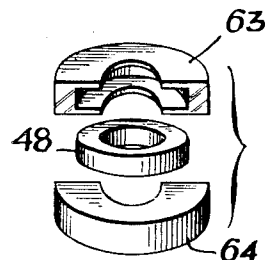


FIG. 5.

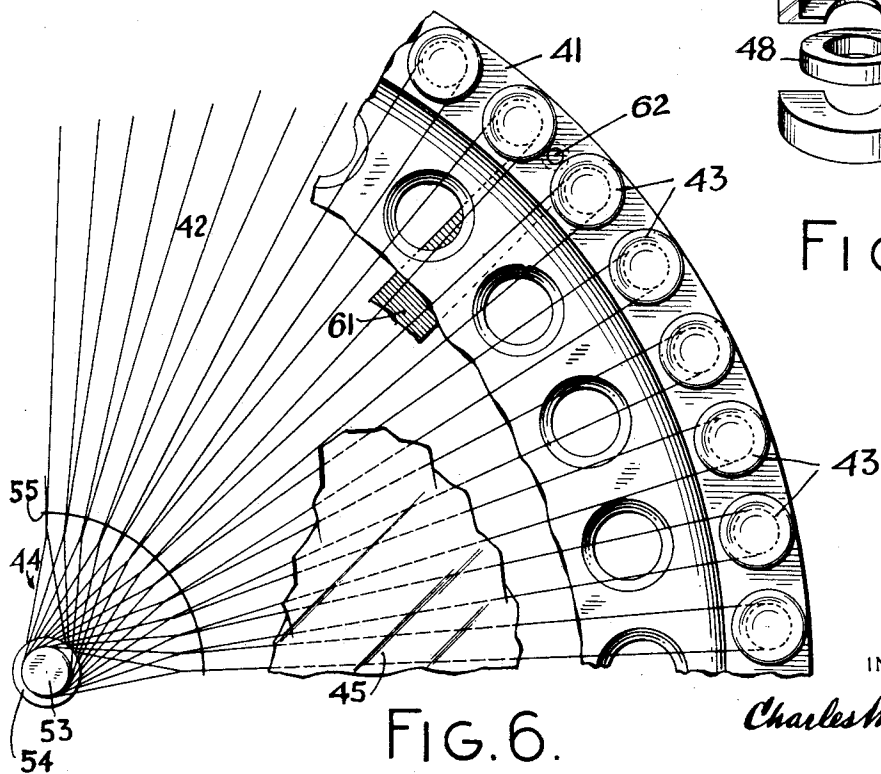


FIG. 6.

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MAGNETIC MOVEMENT

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3 Claims. (Cl. 179—115)

One object of this invention is to provide an improved electromagnetic movement in place of solenoids, direct approach magnets "shearing magnets", moving coils and magnetic movements of various reciprocating types.

Another object is to provide an improved electromagnetic movement for telephone receivers, loud speakers, transmitters, microphones, phonograph pick ups, etc.

Another object is to combine such a movement with a radially tensioned diaphragm of large size and suitable for operation without the aid of a horn.

The invention consists in the improved design of one or more of the parts and combinations of one or more of the parts which will appear from the following detail descriptions of embodiments of the invention, and will be pointed out in the appended claims.

Referring to the accompanying drawings:—

Fig. 1 is a diagrammatic cross section of one of my magnetic movements provided with a field excited by a direct current winding.

Fig. 2 is a diagrammatic cross section of a modified form of my magnetic movement provided with a direct current field excited by means of a disc shaped permanent magnet.

Fig. 3 is a diagrammatic cross section of a modified form of poles for my magnetic movement as applied to a radially tensioned diaphragm. Fig. 3a is a perspective of the armature of Fig. 3.

Fig. 4 is a diagrammatic cross section of a modified form of my magnetic movement combined with a radially tensioned diaphragm.

Fig. 5 is an exploded view of a modified form of one of the poles of my magnetic movement.

Fig. 6 is a plan view of a fragment of the device shown in Fig. 4.

In Fig. 1 the numeral 1 indicates a vibratory diaphragm, designed to reciprocate up and down in a conventional manner, upon which is secured a support ring of nonmagnetic material 2, carrying a ring shaped armature 3, of magnetic material, preferably discontinuous in its circumference. This discontinuity may be effected by radially slotting the armature 3 or making it of magnetic particles embedded in a matrix of for instance hard rubber or a hard resin, or laminations, preferably radial, may be used.

The principal object of such magnetic discontinuity of armature 3, is to prevent radial unbalance of the magnetic pull due to accidental eccentric mounting of armature 3. A direct current field is induced in the annular pole 4, yoke 5,

and central pole 6 through armature 3 by the conventional direct current winding 7. Such magnetic discontinuity of armature 3 will also tend to prevent induced or eddy currents in armature 3. Voice coils 8 and 9 are designed to actuate the armature 3 and drive diaphragm 1 as a telephone receiver diaphragm or when my magnetic movement is used as a transmitter alternating current is induced in voice coils 8 and 9. The voice coils 8 and 9 should preferably be so connected that their action will be cumulative to either increase the flow of magnetic flux in the pole pieces above them and simultaneously to decrease the flow of magnetic flux in the pole pieces below them, or the reverse. The armature 3 will thus be pulled up or down according to the momentary direction of flow of the voice coil current.

It should be noted that the armature 3, support ring 2 and diaphragm 1 should be made as light as possible consistent with the performance of their respective functions, preferably much lighter than it is practical to clearly show same in Fig. 1. A similar remark applies to the moving parts in all the other figures of the drawings.

It should be also noted that the armature 3 overlaps the adjacent pole-pieces less than half, when the armature is in its indicated normal position.

The modification shown in Fig. 2 is provided with a diaphragm 11, having a copper ring-shaped support 12, carrying an armature 13. An annular pole 14 forms the central part of an iron frame casting 140 which is also provided with a ring-shaped projection 15, upon which is secured by screws 16 a radially magnetized, permanent disk magnet 17.

At the centre of magnet 17 is secured one-half of a pole 18, the other half thereof consisting of the iron mushroom 18. Both casting 140 and magnet 17 are perforated with holes, respectively, bearing the numerals 19 and 20, which holes are designed to prevent compression of air between diaphragm 11 and casting 140 when diaphragm 11 vibrates.

A heavy copper ring 21 is positioned between the lower enlarged portion 22 of half pole 18 and pole 14. Both copper ring 21 and copper ring 12 are designed to reduce leakage of alternating current flux from a voice coil 23, when my magnetic movement is operated as a motor or into voice coil 23 when operated as a generator, as the case may be.

In the construction of Fig. 2 only one voice coil, namely 23, is used and it is secured in place

by being mounted upon mushroom 180 which is held in position with respect to the magnet 17 and half pole 18 by screw 24. Member 22 and copper ring 21 are secured to pole 14 by screws 25—25.

It will be noted that the shape of the voice coils 8, 9 and 23 differ, but each is embedded in the adjacent pole. This is to increase the efficiency of my magnetic movement. Such increase of efficiency may in some cases be further augmented by making the poles and the armature of special magnetic alloys of high magnetic permeability. The exact shape of the armature and the poles to fit a particular set of conditions may be largely predetermined by the use of conventional electrical formulas.

The modification shown in Fig. 3 indicates a radially tensioned diaphragm 31, and specially shaped poles consisting of an annular pole 32 and a central pole 33, these poles being provided with voice coils 34 and 35 respectively. The diaphragm 31 may be of, for instance, the same general type as that shown in Fig. 6 hereof. The special shape of poles 32 and 33 is designed to permit the use without excessive magnetic leakage, of a specially light weight armature 36, in which all of the magnetic material is used to advantage. The armature 36 is soldered to a brass ring 37, which is soldered to filaments 38, of diaphragm 31, where the filaments 38 lie in a common horizontal plane, thus facilitating the soldering.

In Figs. 4 and 6 a perforated iron frame casting 41 is shown supporting a radially tensioned diaphragm 42, which is tensioned thereon at the rivets 43 of casting 41. The radial tension members consist of the filaments 44, upon which is cemented a surface member 45, shown in Fig. 6. Reference is invited to my U. S. Patents Nos. 1,503,696 and 1,645,110, which show radially tensioned diaphragms and describe the characteristics of such diaphragms.

At the centre of Fig. 4 is shown a double cup 46—47 to contain the voice coil 48. The double cup 46—47 is preferably made of silicon steel or some magnet alloy of high permeability, and is held in casting 41 by being tightly fitted thereinto. A flanged brass tube 49 is fastened by screws 50—50 to casting 41, and contains a centre pole 51 which is silver soldered into tube 49. Pole 51 is surrounded at its upper end by armature 52.

Armature 52 is silver soldered to the lower end of a hollow brass ferrule 53, made of very thin gauge brass. Ferrule 53 is provided with holes 530 to prevent air pressure building up therein during vibration, and a flange 54, acts as a spacer to separate the upper from the lower filaments of diaphragm 42. The filaments 44, which are preferably made of music spring wire are brought into a common plane by the lacing member 55. A larger number of filaments 44, is preferable to that diagrammatically indicated in Fig. 6.

Two C magnets 56—57 provide direct current flux, and each has the same polarity where se-

cured to frame 41 by tap screws 58—58 and the opposite polarity where secured to the centre pole 51 by the tap screw 59. Braces 60 and 61 are also secured to the magnets 56 and 57, and the center pole 51 by screw 59, and the ends of braces 60—61 are secured at their outer ends to casting 41 by screws 62.

Fig. 5 shows a modified form of the double cup 46—47 of Fig. 4. The form shown in Fig. 5 is split radially and the two identical parts thereof are indicated by the numerals 63 and 64.

I do not limit myself to the exact construction above described, and the magnetic elements, particularly the poles and the armature may be designed in accordance with magnetic theory to give such performance characteristics as are required for any form of magnetic movement where the work must be moved in other than an endless orbit.

I claim:—

1. In a driving motor for loud speaker diaphragms, a central pole piece and a surrounding pole piece, each of said pole pieces having two pole faces, an annular coil between the pole faces of each pole piece, means for creating a normal magnetic field between said pole pieces, means for energizing said coil with a control current for disturbing the normal magnetic field, and an annular armature made of magnetic material positioned in the air gap between said pole pieces and adapted to move parallel to said pole faces and having a length not greater than the distance between the centers of said pole faces.

2. A loud speaker motor comprising a field magnet structure having a central pole piece and a second pole piece encircling the central pole piece and forming with it an annular air gap, at least one of said pole pieces having two pole faces, an annular armature made of magnetic material reciprocable in said gap in a path parallel with said pole faces, the armature and said pole faces being so proportioned with respect to each other that when the armature is in its normal position less than half of each of said pole faces is covered by the armature, and a coil associated with one of the parts of the motor to effect reciprocation of the armature when the coil is energized with varying current.

3. A loud speaker motor comprising a field magnet, having a first pole piece and a second pole piece adjacent to the first pole piece and forming with it an air gap, at least one of said pole pieces having two pole faces, an armature made of magnetic material reciprocable in said air gap in a path substantially parallel with said pole faces, elastic suspension means designed to wholly support said armature, said armature and said pole faces being so proportioned with respect to each other that when the armature is in its normal position less than half of the total area of said two pole faces is covered by the armature, and a stationary coil associated with the pole pieces to effect reciprocation of the armature when the coil is energized with varying current.

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