Jan. 7, 1936. C. MESSICK 2,026,994

ARMATURE FOR MAGNETIC MOVEMENTS

Filed May 15, 1929

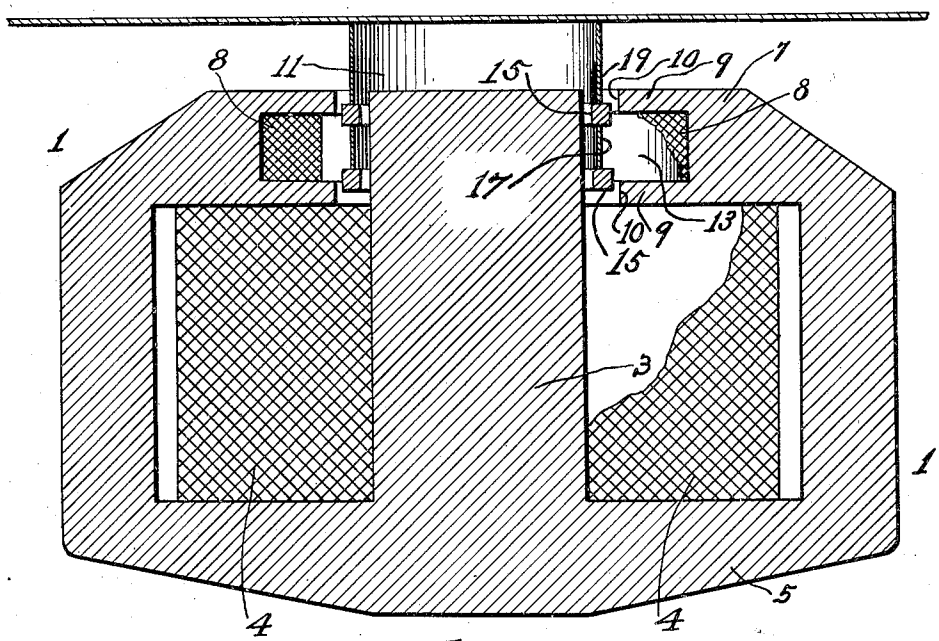


Fig. 1

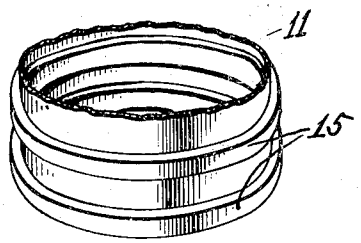


Fig. 2

Inventor
Charles Messick

Patented Jan. 7, 1936 2,026,994

UNITED STATES PATENT OFFICE

2,026,994

ARMATURE FOR MAGNETIC MOVEMENTS

Charles Messick, Brentwood, N. Y.

Application May 15, 1929, Serial No. 363,279

16 Claims. (Cl. 179—119)

This invention pertains to improved "shearing" type armatures for reciprocating electric motors of the same general type as is described in, for instance: British Patent No. 253,159 to Sykes, British Patent No. 238,310 to Voigt, U. S. Patent No. 1,100,188 to Liebowitz, U. S. Patent No. 1,333,298 to Evershed and Kilroy.

One object of the present invention is to increase the efficiency of the magnetic design of such armatures, first by reducing the weight thereof, and second by reducing magnetic leakage lengthwise of the armature. Either of these improvements may be used alone or both may be incorporated in one of my improved armatures.

Another object is to provide armatures of improved proportions.

Referring to the accompanying drawing:—

Fig. 1 is a vertical cross-section of one form of my improved armature and the co-operating pole pieces and adjacent members, and

Fig. 2 is a perspective of the armature of Fig. 1.

The numeral 1 indicates a structure of magnetic material including a centre pole 3, surrounded by a conventional field winding 4, and a pot 5. An end plate 7 is provided on pot 5 and at its central portion is formed into an annular pole divided into two pole pieces 9—9 which bound a space 13 containing a voice coil 8 of conventional type. The poles 9—9 are provided with pole faces 10—10, and an aramture 11, which is designed according to Fig. 1 for vertical reciprocation, is positioned adjacent thereto.

These parts, except armature 11, may be considered as equivalents of and without inventive novelty over my pending application for Magnetic movements, Serial No. 270,872, filed April 18, 1928, now Patent 1,955,248, issued April 17, 1934.

Armature 11 is specially designed and proportioned and is an improvement. It includes in the preferred construction, two, preferably similar, members of magnetic material 15—15 each of which when measured in width, that is in the vertical dimension of its indicated cross-section, approximates the width, as measured vertically in Fig. 1, of an adjacent pole face 10. This dimensional equivalence of a magnetic member 15 and an adjacent pole face 10 is designed to provide an efficient magnetic circuit through member 15 and pole face 10, while avoiding excess weight of the moving parts which include member 15 and to avoid excess leakage from pole face 10, which will occur if it is made unnecessarily wide. Members 15—15 happen to be in the form of rings because they are designed for use with a cylindrical type of magetic movement and are connected together by means of a member 17. The horizontal thickness, according to Fig. 1, of members 15—15 may preferably be of the same order as their vertical dimensions, as this is a desirable compromise of magnetic leakage, weight, etc. The connecting members 17 and 19 are of thin metal, to reduce the weight of the armature as a whole, and are preferably made of non-magnetic material to prevent magnetic leakage losses. The armature 11 may be connected to any diaphragm or to any other device, at its upper end, like, for instance, the diaphragm shown at the top of Fig. 1.

It will be noted that the members 15—15 do not cover more than half of the pole faces 10—10 in the indicated position, which is the neutral position. By designing the magnetic members 15—15 of armature 11 to cover less of the pole faces 10—10, as is the case with the armatures shown in my said co-pending application, the stroke of the armature 11, when under the influence of a conventional voice coil winding, will be lengthened because the lines of force through the particular pole face 10, carrying the larger amount of magnetic flux, will not straighten out so soon.

My improved armature 11 as above described may be substituted for armature 3, 13, etc., of my said co-pending application.

I claim:—

1. In a magnetic movement, an armature of magnetic material consisting of two magnetic members, spaced apart and connected by a means of small weight; a divided pole including two pole faces parallel to which the armature is designed to move, each of which is adjacent to and overlaps one of the members when in neutral position, the width of each of said members being of the same order of magnitude as the width of the adjacent pole face.

2. In a magnetic movement, an armature of magnetic material consisting of two magnetic members, spaced apart and connected by a means of non-magnetic material and small weight; a divided pole including two pole faces parallel to which the armature is designed to move, each of which is adjacent to and overlaps one of the members when in neutral position, the width of each of said members being of the same order of magnitude as the width of the adjacent pole face.

3. In a magnetic movement, an armature of magnetic material consisting of two magnetic members, spaced apart and connected by a means of small weight; a divided pole including two

pole faces parallel to which the armature is designed to move, each of which is adjacent to and overlaps one of the members not more than one-half when in neutral position, the width of each of said members being of the same order of magnitude as the width of the adjacent pole face.

4. In a magnetic movement the combination of a pair of pole pieces of the same polarity, a stationary voice coil to vary the strength of the polarity of one of the pole pieces with respect to the other, a pole face on each of the pole pieces and a reciprocating armature provided with two magnetic portions each having a face adjacent to and of substantially the same area as one of said pole faces, the adjacent faces overlapping when in normal position.

5. In a magnetic movement the combination of a pair of pole pieces of the same polarity, a stationary voice coil to vary the strength of the polarity of one of the pole pieces with respect to the other, a pole face on each of the pole pieces and a reciprocating armature provided with two magnetic portions each being of substantially square cross section, having a face adjacent to and of substantially the same area as one of said pole faces, the adjacent faces overlapping when in normal position.

6. In a magnetic movement the combination of a pair of pole pieces of the same polarity, a stationary voice coil to vary the strength of the polarity of one of the pole pieces with respect to the other, including a local magnetic path through which such variation may be effected, a pole face on each of the pole pieces, pole face means of opposite polarity, spaced therefrom, a reciprocating armature therebetween and provided with two magnetic portions, magnetically separated and each having a face adjacent to one of said pole faces, the adjacent faces overlapping when in normal position, and being designed so that one of the pole faces is substantially covered and the other substantially uncovered when at the end of a full load reciprocation.

7. In a magnetic movement, means to provide a polarizing magnetic flux, a circuit therefor of substantially unchanging reluctance, an armature, a mounting therefor designed to permit it to reciprocate across the flux, said armature including two magnetic members each having a substantially continuous face, spaced apart and connected by substantially non-magnetic means, pole pieces in the path of the flux, each terminating in one substantially continuous pole face adjacent to a member and a stationary voice coil associated with the pole pieces to actuate the armature.

8. In a magnetic movement, means to provide a polarizing magnetic flux, two pole pieces of opposite polarity in the path of the flux and separated by an air gap, at least one of said pole pieces having a continuous but limited magnetic width and a stationary voice coil associated with said pole piece of limited width, a magnetic armature provided with a member having a magnetic lentgh substantially no greater than the width of said pole piece, in the gap and provided with a mounting permitting the member to reciprocate therein in the general direction of its length.

9. In a magnetic movement, the combination of a source of polarizing flux, a circuit therefor of substantially unchanging reluctance, one unwound pole, an air gap, another pole divided into two pole pieces, a voice coil to vary the relative quantity of polarizing flux through the two pole pieces, an armature mounted to reciprocate across the poles in the gap, said armature being provided with two magnetic members, each adjacent a pole piece, and connected together by substantially non-magnetic means.

10. In a magnetic movement, the combination of means to provide polarizing flux, a circuit of substantially unchanging reluctance for such flux, an air gap in said circuit the sides of which are of opposite polarity and at least one of which is divided into at least two pole pieces, a voice coil to vary the quantity of polarizing flux through the pole pieces, relatively, one to another, an armature of magnetic material mounted to reciprocate in the gap and across the pole pieces, of high magnetic reluctance where it extends between pole pieces carrying polarizing flux of the same polarity.

11. A loud speaker motor comprising a cup shaped member and a center pole inside the cup, both of which are of paramagnetic material; two spaced washer like poles of paramagnetic material magnetically connected at their outer edges and fastened to the rim of the cup with the holes in the washers of larger diameter than the end of the center pole and concentric with same, forming air gaps between the washers and the side surfaces of the center pole; a field coil about the center pole at the bottom of the cup and an armature coil around the outer end of the center pole between the spaced washers; two armature rings of paramagnetic material, one in each air gap between the holes in the washers and the sides of the center pole, a non-magnetic armature spider to which said rings are fastened in spaced relation slightly different from that of the spaced washers; an armature guiding means allowing the armature to move in the direction of the axis of the holes in the washers, a sound producing diaphragm and a connection from the armature to the sound producing diaphragm to transmit the movements of the armature to said diaphragm.

12. In a loud speaker motor, two flat parallel spaced annular poles with their outside edges magnetically connected together and their pole surfaces facing inwardly, a round core extending through the spaced annular poles so as to form air gaps between the surface of the core and pole surfaces of the annular poles; an armature coil encircling that portion of core lying between the two annular poles, two armature rings of paramagnetic material, one in each air gap between the annular poles and the core, an essentially non-magnetic armature holder to hold the armature rings in spaced relation slightly different from that of the spaced annular poles, an armature guiding means allowing the armature rings to move in the direction of the axis of the core without rubbing against the annular poles, core or armature coil; a sound producing diaphragm, a connection from the armature rings to the sound producing diaphragm to transmit the movements of the armature rings to said diaphragm, and a field system arranged to magnetize the core with one polarity and the annular poles with the opposite polarity of steady magnetism.

13. In a loud speaker, a field magnetic structure composed of a cup shaped member, a center pole attached to the bottom of said cup and extending outwardly, two spaced annular poles attached to the rim of the cup with their annular holes forming circular air gaps with the sides

of the center pole, an armature magnetic structure composed of two armature rings, one partially in each air gap between the annular poles and the core; a non-magnetic armature holder to hold the armature rings in spaced relation slightly different from that of the spaced annular poles, an armature guiding means to allow the armature rings and holder to move in and out in the direction of the axis of the center pole without touching the pole surfaces, a sound-producing diaphragm, a connection to transmit the motion of the armature rings and holder to the diaphragm, a field coil around the portion of the center pole in the bottom of the cup, which when excited with a unidirectional current of electricity establishes a field flux in both of the air gaps between the annular poles and the sides of the center pole, the center pole being of one polarity of magnetism and the two annular poles being of the opposite polarity, an armature coil around that portion of the center pole lying between the two annular poles, which when excited with one half of an alternating current cycle increases the flux in the air gap between one annular pole and the center pole while decreasing the flux in the air gap between the other annular pole and the center pole, causing the armature ring partially in the air gap where the flux is being increased to be drawn further into this air gap, while letting the armature ring which is partially in the air gap where the flux is being decreased to move further out of this air gap, the movement of both rings being of the same amount and direction and transmitted by means of the armature holder and connection to the sound producing diaphragm, the opposite half of the alternating current cycle causing the strengthening and weakening of the flux in the opposite air gaps and the converse motion of the armature rings and diaphragm.

14. In a magnetic movement, the combination of a source of polarizing flux, a path of magnetic material therefor, a gap in the path and having sides of opposite polarity, a pair of pole pieces of the same polarity at at least one side, a movable armature mounted to reciprocate across said pole pieces, pole piece means at the other side of the gap, a local magnetic path being thus formed through the members at the two sides of the gap and the armature, a stationary voice coil to create alternating flux in said local magnetic path and thus cause the armature to reciprocate, the central portion of the armature, where it extends between said pair of pole pieces, being constructed so as to substantially prevent leakage from one of its ends to the other of its ends of the flux in said local magnetic path.

15. In a magnetic movement, the combination of means to provide polarizing flux, a circuit of substantially unchanging reluctance for such flux, a gap in said circuit the sides of which are of opposite polarity and at least one of which is divided into at least two pole pieces, a voice coil to vary the quantity of polarizing flux through the pole pieces, relatively, one to another, and an armature of magnetic material mounted to reciprocate in the gap and across the pole pieces, said armature being of high magnetic reluctance to alternating flux where it extends between the two pole pieces carrying polarizing flux of the same polarity.

16. In a magnetic movement, the combination of means to provide polarizing flux, a circuit of substantially unchanging reluctance for such flux, a gap in said circuit the sides of which are of opposite polarity and at least one of which is divided into at least two pole pieces, a voice coil to vary the quantity of polarizing flux through the pole pieces, relatively, one to another, an armature of magnetic material mounted to reciprocate in the gap across the pole pieces and to provide a path of low magnetic reluctance for both alternating and direct current flux across the gap and of high magnetic reluctance to alternating flux lengthwise in the armature where it extends between pole pieces carrying polarizing flux of the same polarity.

CHARLES MESSICK.