Jan. 11, 1944. C. E. EICHHORN 2,338,909

ELECTROMAGNETIC OSCILLATING DEVICE WITH FREELY OSCILLATING ARMATURE

Filed Aug. 15, 1939

Fig. 1.

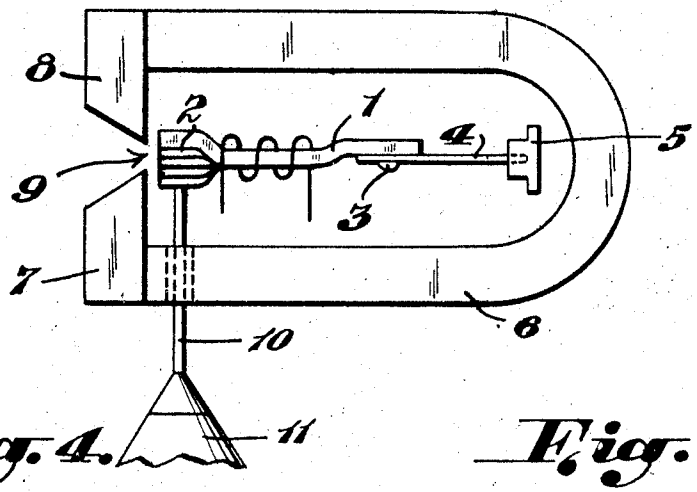


Fig. 4.

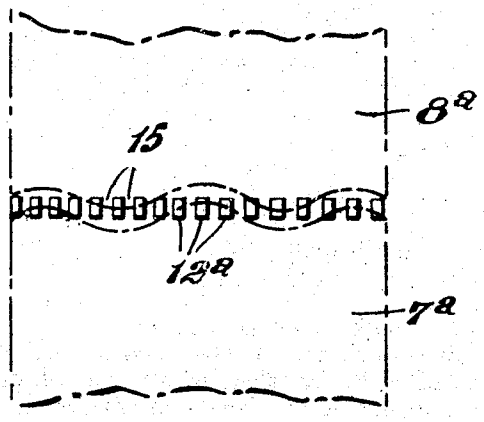


Fig. 2.

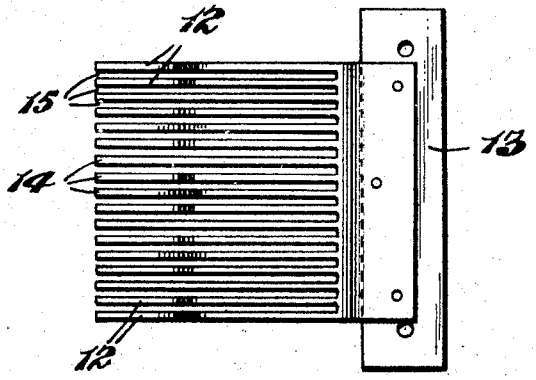
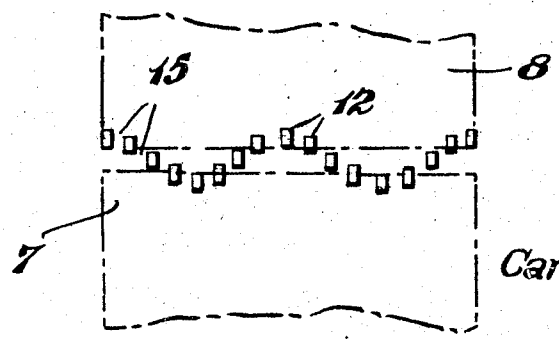


Fig. 3.



Inventor,
Carl E. Eichhorn

By: Glascock Downing & Seebold
Attorneys.

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ELECTROMAGNETIC OSCILLATING DEVICE WITH FREELY OSCILLATING ARMATURE

Carl Ernst Eichhorn, Steinach in Thuringen, Germany; vested in the Alien Property Custodian

Application August 15, 1939, Serial No. 290,306
In Germany June 4, 1936

1 Claim. (Cl. 175—339)

The object of the present invention is to provide an electromagnetic oscillating device for loudspeakers and sound-pick-ups and microphones, fitted with a magnetic pair of poles, the poles of which are directed towards each other and separated by an air space. The device includes a freely oscillating armature that is terminated parallel to a face between the two magnetic poles. The free end of the armature is turned towards the air-space.

The usual electromagnetic oscillating devices for radio loud-speakers of the above mentioned type include an iron armature of a width which slightly overlaps the air space and is therefore sensitive, but possesses a very small amplitude range. If such an armature is to carry out stronger vibrations, it would at once exceed its scope unfavorably and the vibrations would no longer correspond with the electrical oscillations inducing these vibrations.

If the armature materially overlaps the width of the air space a greater amplitude range is provided but the device is not sensitive, since that part of the magnetic flux flowing between the poles of the magnetic circuit which passes through the armature is greater and affects a saturation of that armature zone which is situated opposite the air space, thus preventing the magnetic flow in the freely-oscillating-armature that is induced by the electric vibrations.

With the hitherto used electromagnetic oscillating devices it was therefore difficult, to achieve at the same time strong vibrations combined with a normally wide amplitude range.

Attempts have been made to abolish the foregoing disadvantages of these electromagnetic oscillating devices. It has for instance been attempted to achieve a greater amplitude range by placing the iron armature and the air space in oblique position to each other. If such an oscillating device is used as a loudspeaker, the armature carries out an unfavorable turning-movement. In the German Patent 630,970 the armature crosses the air gap symmetrically but that part of the flux between the poles of the pair of magnetic poles which passes through the armature is great and causes the disadvantages stated.

It is therefore an object of the present invention to provide a magnetic oscillating device wherein the disadvantages of the prior arrangements are avoided.

Another object of the invention is to provide an electromagnetic device having a novel type of armature which is responsive to substantially all changes in the magnetic circuit over a relatively great amplitude range.

Other and further features and objects of the invention will be apparent from a consideration of the accompanying drawing and the following description wherein an exemplary embodiment of the invention is disclosed.

In the drawing:

Fig. 1 is a side view of a magnetic oscillating device provided with a permanent magnet and a free vibrating armature.

Fig. 2 is a plan view of the armature.

Fig. 3 is an end view of the armature wherein the ends of the iron bars are arranged in wave form showing the relationship thereof to a rectangular air gap.

Fig. 4 is an end view of a modified armature wherein the iron bars are arranged in a common plane and the air gap undulated.

In the arrangement shown in Fig. 1, the free end 2 of the armature 1 is adapted to move and the other end is secured by means of screws or rivets 3 to an elastic blade spring 4 which is supported in a bearing block 5. Arranged round this oscillating device is a permanent driving or field magnet 6 provided with two pole-pieces 7 and 8 which leave an air space 9 between them and which are cut off obliquely on the outer side in such manner that the narrowest part of the air space lies immediately adjacent the free end of the armature 1. Near the free end 2 of the armature is secured a wire 10 for the purpose of transmitting the vibrations of the armature to the loudspeaker diaphragm 11.

In Fig. 2 an armature is shown formed of iron bars 12 of any desired thickness lying close to one another in side-by-side relation. Each of these iron bars is aligned at one end and secured to a brass blade spring 13. At their other ends, or at their driving ends 14, the bars are partly bent or stepped to both sides of a common plane, so that the driving faces of the iron bars exhibit a zigzag or wave-shaped outline as shown in Fig. 3. The drive faces of the iron bars, in proportion to the width of a straight running air space, are about the same width as the latter. They themselves are individually narrower than, or no more than slightly wider than, the air gap, but the zig-zag or wave shaped outline of the drive face of the armature forms overlapping zones.

The subdivision of iron armatures to form a comblike structure is known but in the present invention it is utilised for the first time for freely oscillating armatures for loudspeakers, pick-ups and microphones with the difference that the

iron bars 12 are magnetically separated by spaces 15 so that the armature will not short-circuit the magnetic flux that emanates from the pole pieces 7 and 8. The iron bars 12 cannot therefore divert the magnetism of the pole pieces through the armature from one pole piece to the other pole piece, but carry the flux advantageously and effectively through the armature. This function is assisted by the fact that the iron bars are each narrower than the air gap, as shown in Fig. 3, or at most no more than slightly overlap the air gap.

The magnetism of the pole pieces 7 and 8 is carried by magnetic influence to the little armature bars respectively swinging above them and magnetizes them. As the little iron bars are not of the same width as the air space, they cannot carry from one pole piece to the other the magnetism that has been obtained by the magnetic influence of the polepieces. The iron bars are in their vibrations, alternately more or less magnetized by an S or N magnetism of the pole pieces.

In Fig. 4 the air gap is wave-shaped by suitable formations on the ends of the pole pieces 7*a* and 8*a*. The iron bars 12*a* are, however, arranged in a common plane throughout the length of the armature.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

In magnetic vibrating apparatus, a magnet having pole piece elements provided with an air gap therebetween, the pole piece elements having side faces lying in a common plane perpendicular to the median plane of the air gap, an armature element arranged wholly outside said gap on the side of said side face plane opposite to the pole pieces and with its median plane coincident with the extended median plane of the air gap, the armature having one end remote from the pole pieces held in a fixed support and the other end closely adjacent to said side face plane and free to oscillate in a direction substantially parallel thereto, said armature element including a plurality of longitudinally extending iron bars magnetically separated with respect to each other, the air gap portion of the side face plane constituting an air gap zone and the adjacent ends of the armature bars defining an armature zone in a plane parallel to said air gap zone, said zones being similar in area but with one having a rectangular shape and the other an undulating shape, whereby an armature of material thinner than the distance between said pole pieces has portions overlapping each pole piece over a considerable amplitude of vibration but sidewise passage of flux at the free end of the armature is substantially prevented.

CARL ERNST EICHHORN.