C. E. AVERY.

ELECTROMAGNET.

APPLICATION FILED JULY 10, 1917.

1,413,374.

Patented Apr. 18, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

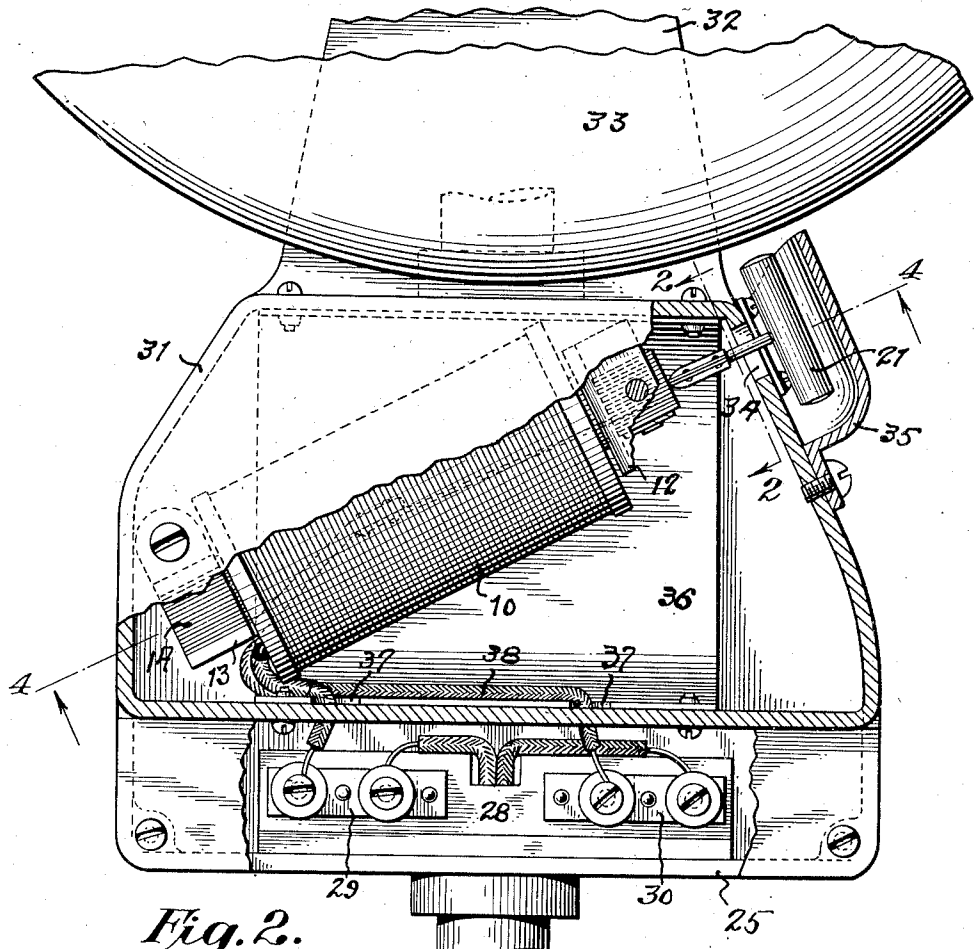
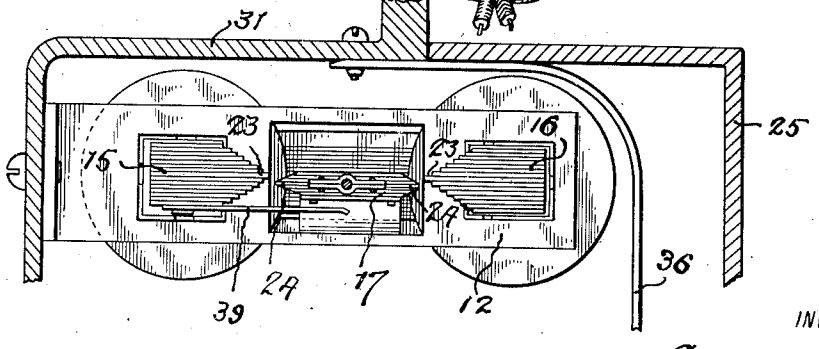


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

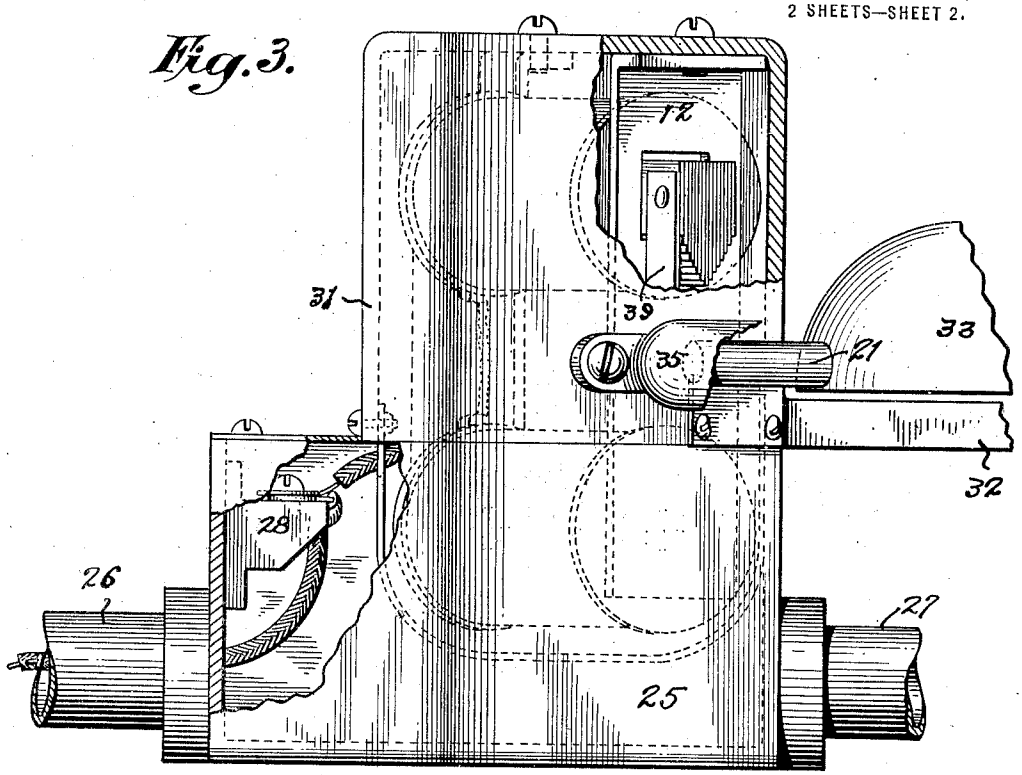
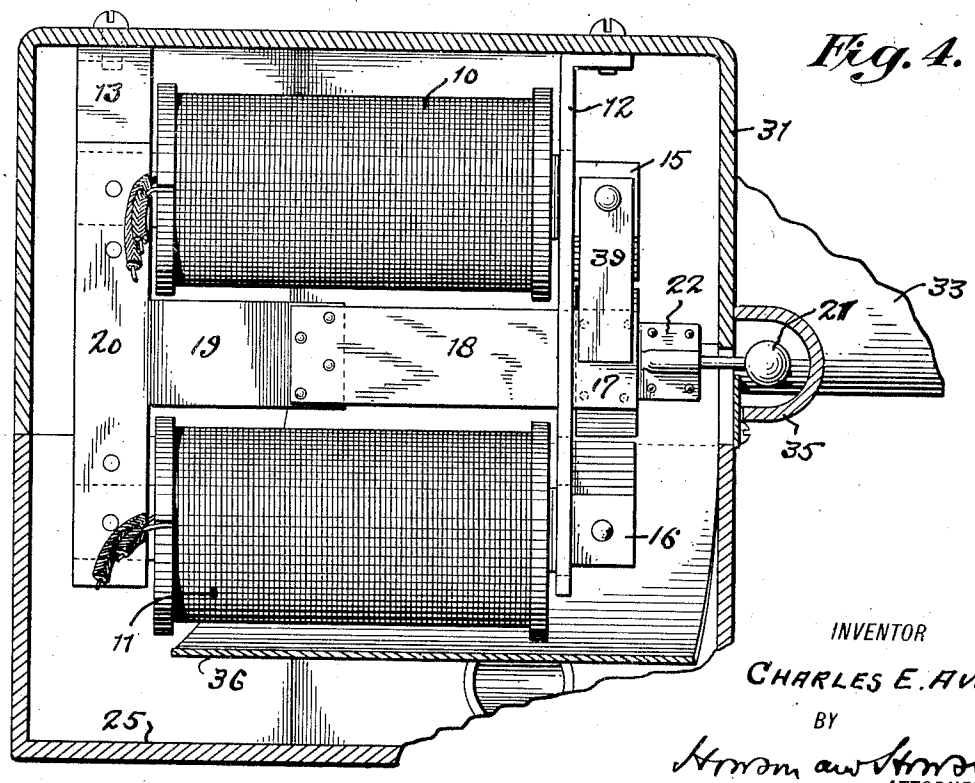


Fig. 4.



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CHARLES E. AVERY, OF TRENTON, NEW JERSEY, ASSIGNOR TO MANHATTAN ELECTRICAL SUPPLY COMPANY, INC., OF JERSEY CITY, NEW JERSEY, A CORPORATION OF MASSACHUSETTS.

ELECTROMAGNET.

1,413,374. Specification of Letters Patent. Patented Apr. 18, 1922.

Application filed July 10, 1917. Serial No. 179,709.

To all whom it may concern:

Be it known that I, CHARLES E. AVERY, a citizen of the United States of America, and residing in Trenton, in the county of Mercer and State of New Jersey, have invented a certain new and useful Improvement in Electromagnets, of which the following is a specification.

My invention relates to electro-magnets and particularly to alternating current magnets, the object of my invention being to construct a magnet with an armature, the vibrations of which have a cycle or frequency materially lower than the cycle of the alternating current, and preferably so harmonized with relation to the frequency of the alternating current that the vibration of the armature corresponds to a factor of the cycle of the alternating current which energizes the magnet.

Referring to the accompanying drawings,

Fig. 1 is a broken front elevation of a gong installation, employing a magnet in which my invention is embodied in one form;

Fig. 2 is a section on the line 2—2, Fig. 1;

Fig. 3 is a broken side elevation of the gong installation;

Fig. 4 is a section on the line 4—4, Fig. 1;

When alternating current is used to energize an electro-magnet, an oscillating field is created which tends to impart to the armature a vibratory movement corresponding precisely to the frequency of the current. When the armature is associated with a gong hammer, this rapid oscillation causes the hammer to vibrate against the gong with a buzzing sound which is undesirable. It has consequently been common practice to use either direct current to energize the magnet, or so to arrange the armature that but a single impact results when the magnet is energized by an alternating current, as for example in the construction shown in my co-pending application, Ser. No. 157,738.

Where a vibratory signal is desired, the result is accomplished with an D. C. magnet by means of a current interrupter of desired frequency. I have now devised an A. C. magnet which produces a substantially identical effect by so arranging the armature that the cycle of its vibrations, instead of corresponding to the cycle of the A. C. for the magnet, is lower than the latter. Preferably the cycles have a predetermined harmonious relation which insures strokes of equal intensity for the hammer gong during the maintenance of the current in the magnet.

Referring to the accompanying drawings in which I have embodied my invention in an electric gong, the coils 10 and 11 are carried by a pair of non-magnetic brackets 12 and 13. A U-shaped core 14, preferably laminated, is so arranged that its branches 15 and 16 extend at their free ends beyond the coils, and are spaced apart by an air gap. The armature 17 works through this air gap at right angles to the plane of the branches 15 and 16 and is never in contact with the magnet poles. The armature is carried by a spring 18 mounted upon a carrier 19 which may be secured in position in any suitable way, as, for instance, by riveting its base 20 to the bridge of the core 14. When the magnet is used to operate a gong hammer, as in the present instance, the hammer 21 may be secured to the armature 17 by a bracket, such as 22. Both the carrier 19 and the spring 18 are preferably of non-magnetic material, such as brass. I so adjust the spring 18 that in its normal position of rest, the armature 17 lies to one side of the area of greatest magnetic attraction between the poles 15 and 16. (See Fig. 2). In order to concentrate the magnetic field and to localize the area of greatest magnetic attraction, the pole pieces 15 and 16 are made V-shaped on their opposed faces with their apices 23 approaching each other as indicated. This is readily accomplished in laminated pole pieces by forming the free ends of the laminae with cross plates of different length, those at the central portion of the poles being greatest in length, and those at the sides being least in length. Similarly, the opposite ends 24 of the armature 17 may be given a corresponding V-shape by building up the armature from laminae of different lengths.

If the magnet be now energized by an alternating current the armature is at once attracted and tends to assume a position in which its apices 24 are aligned with the apices 23 of the core. The movement of the armature toward this position is so rapid, however, that its inertia carries it beyond this mid position. Moreover, the magnetic

efforts are intermittent as a result of the nature of the current employed. It is desirable to so arrange the armature that the field is maintained at the moment the armature enters the area of greatest magnetic effort, but is interrupted as the armature passes through the field so that its inertia carries it beyond the concentrated field area before the succeeding current impulse re-establishes the field. The stroke of the armature is thus checked as little as is possible.

It is also desirable to so space the gong from the magnet that after the hammer strikes the gong, its rebound is substantially simultaneous with a current impulse, so that the armature moves backward not only under the mechanical influence of the rebound and the stress of its spring support 18, but also under the pull of the magnetic field. These forces carry the armature through the concentrated magnetic field area, the field being again momentarily interrupted. By properly regulating the length and strength of the spring 18, and the weight and position of the hammer 21 and armature, the vibrations of the latter and its associated members may be so harmonized with the frequency of the alternating current that the cycle of armature vibrations has a predetermined relation to the cycle of the current pulsations, and is preferably so regulated that the number of strokes of the gong is a factor of the number of pulsations or frequency of the alternating current. Thus if the current has the usual frequency of 60 the cycle or number of strokes may be 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40. It must be understood that this harmonization of the stroke cycles to the current cycles is not essential to the desired operation of the armature, but it is preferred, since by this arrangement a magnetic effort is exerted upon the armature at each end of its vibratory course as well as intermediate said ends. This causes the strokes to be initiated with a well defined motion in each direction, and furthermore insures their equality in duration, and in the strength of the impact upon the gong—a characteristic which is not so pronounced if, for instance, a current impulse occurs just as the hammer is about to strike the gong thus tending to halt it before impact. My experience has established that a vibratory frequency of 20 for the armature gives a most satisfactory action for the gong hammer.

The particular housing of the magnet and its associated parts may be modified in any desired fashion. I have shown a convenient arrangement which is of advantage in making the installation since it permits the wiring for the gongs to be installed during the construction of the building, while the gongs and their associated magnets may be installed later after the building operations have been completed. This preserves the gong and its mechanism from accumulating dirt during the building operations and protects the parts from accidental injury. To this end, I have provided an outlet box 25 to which the signal wire may be led through conduits 26 and 27. Upon one wall of the box 25 is mounted an insulating base 28 carrying a pair of connecting plates 29 and 30, to which the incoming and outgoing wires may be connected at the time of the conduit installation. The brackets 12 and 13, carrying the magnet coils 10 and 11 may be mounted within a casing 31 cast integral with the arm 32 on which the gong 33 is mounted. The stem of the gong hammer 21 vibrates in a slot 34 formed in the casing 31, while a supplemental hood 35 is secured to the main casing to protect the exposed hammer head from injury. An apron 36 depends from the casing 31 and surrounds the magnet 11 which lies below the lower margin of the casing. In assembled position, the apron 36 extends into the outlet box 35 to one side of the insulating block 28. Apertures 37 in the apron permit the connecting wires 38 to be led from the terminal plates 29 and 30 to the magnet coils. A guard 39 mounted upon one of the branches of the magnet core extends into the path of the armature 17 to prevent excessive vibration thereof.

Various modifications in detail of construction will readily occur to those skilled in the art without departing from what I claim as my invention.

I claim:—

1. An alternating current electro-magnet comprising spaced pole pieces, an armature vibrating across the lines of force between said pole pieces, and means constraining said armature, under the influence of the magnetic field, to a frequency of vibration constituting a sub-multiple of the frequency of the alternating current which energizes the magnet.

2. An alternating current electro-magnet comprising pole pieces V-shaped to afford a concentrated magnetic field and an armature vibrating through the concentrated field across the lines of force and back and forth past the point of greatest attraction when the magnet is energized.

3. An alternating current electro-magnet comprising a pair of pole pieces having their opposed faces V-shaped to afford a concentrated magnetic field and an armature vibrating through said field past the apices of said pole pieces.

4. An alternating current electro-magnet comprising pole pieces spaced apart and an armature vibrating through the air gap between the poles across the lines of force, said armature having the ends adjacent the pole pieces V-shaped for the purpose specified.

5. An alternating current electro-magnet comprising a pair of pole pieces having their opposed faces V-shaped to afford a concentrated magnetic field and an armature vibrating through said field past the apices of said pole pieces, said armature having its ends adjacent the pole pieces U-shaped for the purpose described.

6. In an alternating current electro-magnet, an armature, and a spring-actuated support therefor constraining said armature, under the influence of the magnetic field, to a frequency of vibration lower than the frequency of the alternating current energizing the magnet.

7. In an alternating current electro-magnet, an armature, and a resilient support therefor constraining said armature, under the influence of the magnetic field, to a frequency of vibration lower than the frequency of the alternating current energizing the magnet.

8. In an alternating current electro-magnet, spaced pole pieces V-shaped to afford a concentrated magnetic field therebetween, an armature normally lying to one side of the area of greatest concentration of the lines of force, but arranged to vibrate across the lines of force of said magnetic field, and means constraining said armature, under the influence of the magnetic field, to a frequency of vibration lower than the frequency of the alternating current energizing the magnet.

9. In an alternating current electro-magnet, spaced pole pieces, an armature vibrating across the lines of force between said pole pieces, and means constraining said armature, under the influence of said magnetic field, to a frequency of vibration lower than but harmonious with the frequency of the magnet-energizing current.

10. In an alternating current electro-magnet, spaced pole pieces, an armature vibrating across the lines of force between said pole pieces, and means constraining said armature, under the influence of said magnetic field, to a frequency of vibration lower than that of the magnet-energizing current but constituting a factor of its frequency.

11. In an alternating current electro-magnet a pair of laminated poles having their central laminæ longer than the marginal laminæ to afford opposed V-shaped faces securing a concentrated magnetic field.

12. In an alternating current electro-magnet a laminated armature having its central laminæ longer than its outer laminæ to produce V-shaped ends for the purpose described.

13. In an alternating current electro-magnet, a pair of spaced poles having opposed V-shaped faces to afford a concentrated field, and an armature having V-shaped ends vibrating through the air gap between the poles across the lines of force.

In testimony whereof I have signed my name to this specification.

CHARLES E. AVERY.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,413,374, granted April 18, 1922, upon the application of Charles E. Avery, of Trenton, New Jersey, for an improvement in "Electromagnets," an error appears in the printed specification requiring correction as follows: Page 3, line 7, claim 5, for "U-shaped" read *V-shaped;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of May, A. D., 1922.

[SEAL.] KARL FENNING,

Acting Commissioner of Patents.