Oct. 8, 1929. J. W. OVERHOLT 1,731,057

REVOLVING FIELD INDUCTION TOY AND NOVELTY

Filed March 19, 1927

Fig. 1.

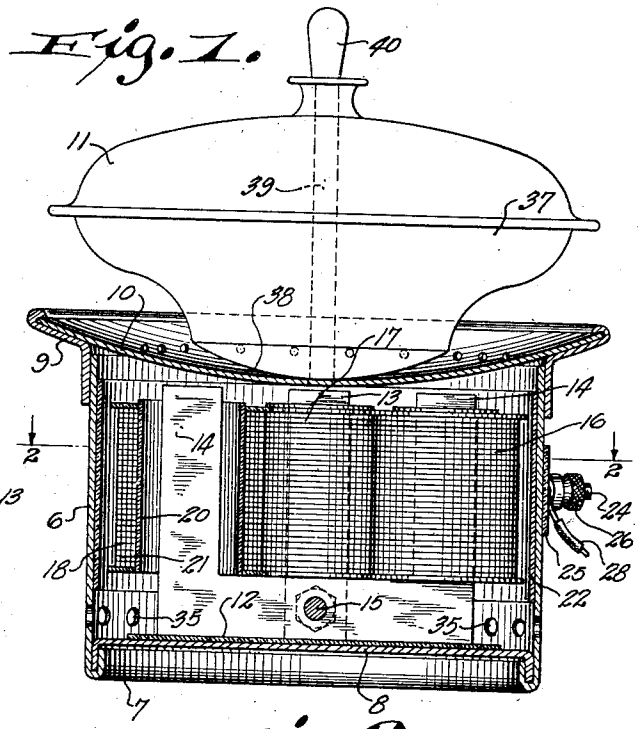


Fig. 3.

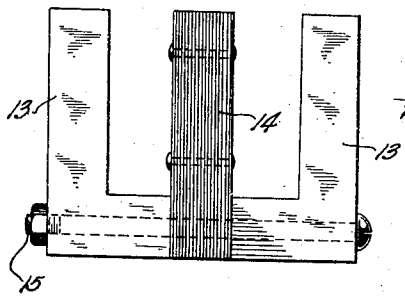


Fig. 2.

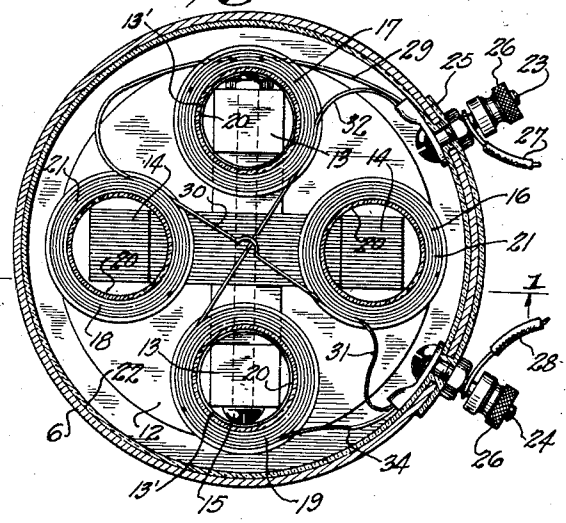
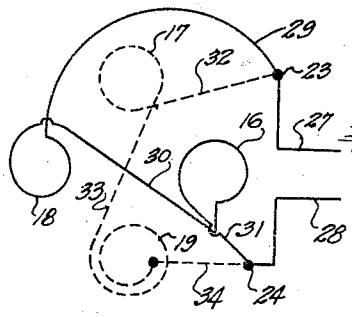


Fig. 4.



INVENTOR.
John W. Overholt,
BY
Morsell, Keeney & Morsell
ATTORNEYS.

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UNITED STATES PATENT OFFICE

JOHN W. OVERHOLT, OF WEST ALLIS, WISCONSIN

REVOLVING-FIELD INDUCTION TOY AND NOVELTY

Application filed March 19, 1927. Serial No. 176,699.

This invention relates to improvements in revolving field induction toys and novelties.

It is the primary object of the present invention to provide a self-contained apparatus which will produce a stray revolving electromagnetic field for the purpose of driving a rotor positioned within the stray field as a toy, novelty, or as an advertising display apparatus.

A further object of the invention is to provide an apparatus of the character described which may be operated by an alternating current single phase power circuit.

A further object of the invention is to provide an apparatus of the class described so arranged as to cause the magnetic flux of the field to stray out in an axial direction from the field cores to set up a magnetic field at a suitable distance away from the cores in order to influence a floating rotor, of any suitable form, positioned in the midst of the field.

A further object of the invention is to provide an apparatus of the class described in which the rotor to be used therewith is susceptible of being formed in many different shapes, designs or characters.

A further object of the invention is to provide a revolving field induction toy and novelty which is of very simple construction, is inexpensive to manufacture, is strong and durable, is easily operated, and is well adapted for the purposes described.

With the above and other objects in view the invention consists of the improved revolving field induction toy and novelty and its parts and combinations as set forth in the claims and all equivalents thereof.

In the accompanying drawing in which the same reference characters indicate the same parts in all of the views:

Fig. 1 is a vertical sectional view of the revolving field induction toy and novelty taken on line 1—1 of Fig. 2 and showing a rotor mounted thereon;

Fig. 2 is a cross-sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is a detail view of the cores used in the apparatus; and

Fig. 4 is a diagrammatic view of the wiring and circuits.

Referring now more particularly to the drawing it will appear that the device comprises a cylindrical hollow housing 6, the lower edges of the sides of which are flanged, as at 7, to receive a bottom member 8. The top of the housing is provided with an annular flanged portion 9 which receives a concaved or dished diaphragm 10, closing the upper end of the housing. Said diaphragm is formed of sheet metal which has non-magnetic qualities and is a poor conductor of electricity and the diaphragm is adapted to support a rotor 11, to be more fully hereinafter explained, and the concavity of the diaphragm serves to at all times correctly position the rotor and keep it in the center of the field.

Disposed within the interior of the housing, supported by the bottom 8 and separated therefrom by a layer of insulation 12, are two pairs of cores 13 and 14 shown in detail in Fig. 3. The cores 14 which are magnetic and are built up of a plurality of connected together thin laminations of soft iron, are formed integral in a U-shaped piece, while the cores 13, which are non-magnetic and formed of molded bakelite or other suitable material, are in two L-shaped pieces secured together and to the cores 14 by a bolt 15, as shown in Fig. 3 and the ends may be tempered with metal strips 13'. As assembled the four cores are spaced at ninety degree intervals and the magnetic and non-magnetic cores are alternated.

Each of the cores 13 and 14 has mounted thereon a coil, the coils being designated 16, 17, 18 and 19 respectively. Each of the coils is composed of a spool 20 formed of a suitable insulating material wound with copper wire, as indicated at 21.

The interior wall of the casing is lined with an annular layer of insulation 22 and projecting through the casing wall are a pair of terminals 23 and 24, conveniently spaced apart and externally insulated from one another by an insulation strip 25. The external portions of the terminals are adapted to have clamped thereto by means of caps 26, circuit wires 27 and 28.

An electrical connection 29 extends from

the inner end portion of the terminal 23 to one of the coils 18 mounted on a magnetic core and is connected with one end portion of the coil winding. The other end portion of the winding of said coil is secured to a connection 30 which extends to and is connected with one end of the winding on coil 16. The other end portion of the winding of coil 16 is connected by a wire 31 with the inner end portion of the other terminal 24. This circuit, shown in full lines in the connection diagram in Fig. 4, forms the highly inductive circuit of the apparatus.

There is also extended from the inner end of the terminal 23 a connection 32 which connects with one end portion of the winding of coil 17 mounted on a non-magnetic core. The other end portion of said winding is connected with one end portion of the winding of coil 19 by a wire 33 and a wire 34 returns from the other end portion of said winding to the terminal 24. This latter circuit, shown in dotted lines in the connection diagram, forms a circuit of lesser inductivity.

It should be observed that the lower portion of the housing is provided with apertures 35 to admit air, while the dished top 10 has an annular row of apertures 36 for air outlets. The two series of openings provide for ample air circulation through the housing to ventilate the coils and cores and thereby dissipate the heat generated in the coil and core losses.

As mentioned, a rotor 11 is adapted to be mounted on the top diaphragm 10 and the rotor is of a self-contained, floating type formed of sheet metal and preferably in the shape of a hollow ball, top or the like. The rotor 11 shown in the drawing is in the form of a hollow sheet metal top, medially horizontally split, as at 37. The lower half of the rotor is formed of copper or other sheet metal that is a good electrical conductor and the bottom portion of the rotor is curved, as at 38, to form a sectional spherical surface, said curvature being important in that it will serve to keep the rotor stabilized at all times. The interior of the rotor is provided with a vertical hollow shaft 39 extending from an upper handle portion 40 to the curved bottom portion 38 to brace the latter portion.

In operation the circuit wires 27 and 28 of the apparatus are preferably connected with an ordinary bell transformer which in turn is attached to a convenient alternating current outlet, as a plug or socket. With the coils thus energized a highly inductive circuit and a less inductive circuit will be set up. An electromagnetic field is set up also and the magnetic flux of the field is caused to stray out in an axial direction from the field cores so as to set up a magnetic field at a suitable distance from the cores and the magnetic field thus developed affects the magnetic rotor mounted on the diaphragm to such an extent that the rotor will be set into rotation and kept rotating as long as the coils are energized. The field is caused to revolve by having the current which produces polarity in the electro-magnets in two parallel circuits with a considerable phase difference between them. The two electric circuits energizing the coils, each connect an equal number of poles in parallel circuits in such a way that with this phase difference between the circuits, a more or less uniform electro-magnetic revolving field is set up which will in turn induce eddy currents in the rotor positioned in the field, the reaction being that the rotor is caused to rotate with the field. The circuit employed to produce this result, as explained, is a single phase circuit from the source of power to the terminals of the field. From this point the circuit is divided in the two parallel circuits. The phase difference between the two circuits is obtained preferably by having an electro-magnetic core in one circuit which will cause it to have a relatively small current with highly inductive reactance, the result being that it will lag behind the phase of the supply or power circuit. The other circuit has a non-magnetic core and the inductance of the coils is only equivalent to approximately the ampere turns of the air core coils, hence it will be almost in phase with the supply circuit. Therefore, in one circuit there is a small current with high inductance, setting up a magnetic field in a dense iron core, and in the other circuit there is a heavy current with comparatively small inductance, producing a similar field, but leading the first circuit in phase angle by the difference in the two reactances.

From the foregoing description it will be seen that the improved revolving field induction toy and novelty is of very simple and novel construction, and is well adapted for the purpose described.

What I claim as my invention is:

1. A revolving field induction device, comprising a support having an upper concave portion, a pair of U-shaped cores below said concave portion and medially crossing each other, one core being highly magnetic and the other core being non-magnetic, a pair of coils mounted on the end portions of each core, a highly inductive electrical circuit including the coils of the magnetic core, an electrical circuit of lesser-inductivity including the coils of the non-magnetic core, said circuits setting up in the direction of the concave portion a pair of magnetic fields separated by a phase difference, and a detached metallic rotor resting on the concave portion and adapted to be rotated thereon by said fields.

2. In an induction device, the combination with a support of poorly conducting material, a U-shaped magnetic core positioned

vertically below said support, a pair of spaced apart coils on said core, a highly inductive electrical circuit including said coils, a U-shaped non-magnetic core positioned vertically below said support and at right angles to said magnetic core, a pair of spaced coils mounted on said non-magnetic core, an electrical circuit of less inductivity than the first circuit including said last mentioned coils, means for connecting both circuits with a source of alternating current, and an object including conducting material resting on the support with a relatively small area of contact.

In testimony whereof, I affix my signature.

JOHN W. OVERHOLT.