

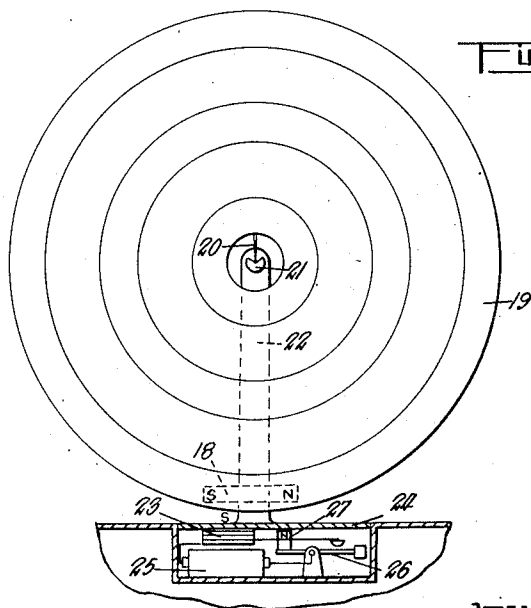
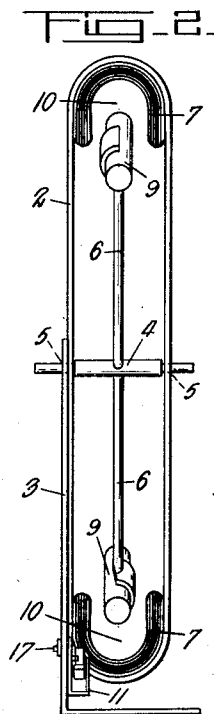
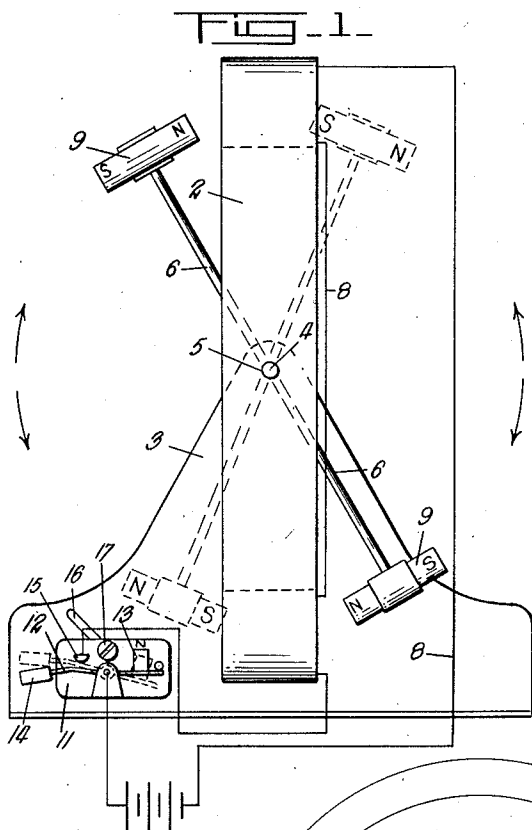
May 6, 1958

J. ANTHONY
ELECTROMOTORS

2,833,943

Filed March 4, 1954

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 4.

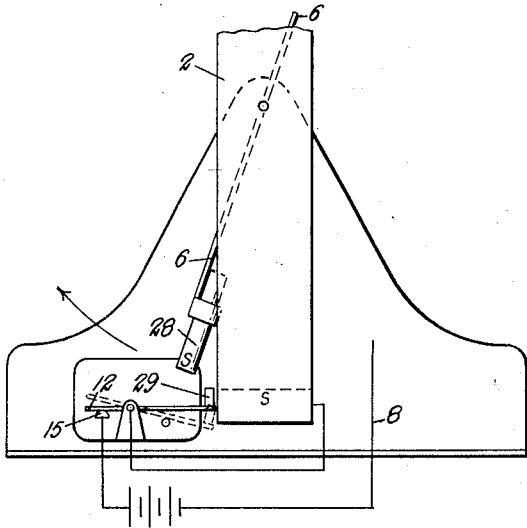


FIG. 5.

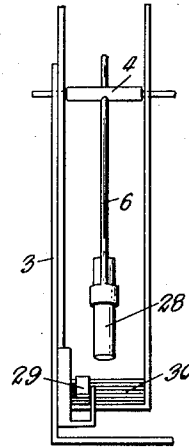


FIG. 6.

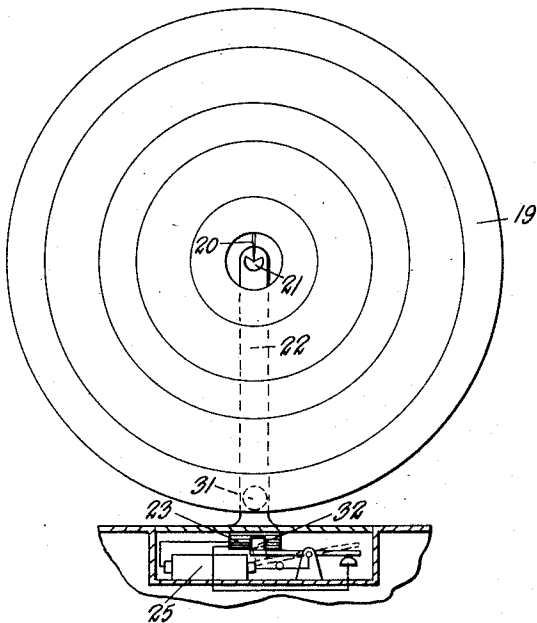
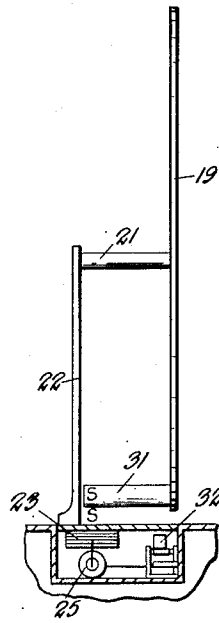


FIG. 7.



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ELECTROMOTORS

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10 Claims. (Cl. 310—32)

This invention relates to improvements in relatively low power electromotors of the type used to animate advertising displays, toys and the like.

It is an object of the invention to provide an electromotor having a rotor and a field coil, wherein the rotor embodies means of magnetic permeability whereby the rotor becomes responsive to the magnetic field generated by the field coil disposed outside the path of the rotor.

It is a further object of the invention to provide an electromotor as set forth wherein the field coil, or sometimes referred to herein as the actuating coil, is disposed outside the physical influence of the rotor or elements of the latter and is disposed with its axis adapted theoretically to substantially intersect the rotary axis of the rotor so that the coil is disposed substantially transverse of the rotary motion of the rotor but free of the latter.

It is another object of the invention to provide an electromotor as set forth embodying magnetically responsive switch means and electrically associated with the field coil for controlling energization of the latter and adapted to be actuated by the influence of a magnetic field adapted to extend between the rotor and the switch means during rotation of the rotor, the said switch means being controllable in period of actuation for governing rotation of said rotor by controlling the spacing between the magnetically responsive switch means and the rotor.

Another object of the invention is to improve the foregoing type of motor by devising an assembly wherein a rotary motion as well as an oscillating motion can be produced; the swingably mounted permanent magnet, which may either oscillate or rotate, having the dual functions of constituting the motor rotor and the permanent magnet means for operating the switch contacts controlling the energization of the stationary coil.

Another object of the invention is to produce a rotary motor which will rotate in either direction and wherein a pair of oppositely disposed permanent magnets constitute the rotor and are arranged to swing through or past several coils; the magnetically actuated switch controlling the energization of the coils being located within the orbit of the rotating magnetic fields of the rotor and operated by the magnets as they rotate, the speed of the rotor being proportional to the length of time the switch remains closed under the influence of each magnet.

A still further object of the invention is to provide a modification of the motor arrangement and wherein the swingable permanent magnet is so mounted that the stationary electromagnetic coil is within the path of the field of one pole of the magnet and the magnetically actuated switch within the path of the field of the other pole of the magnet; the arrangement being preferably such that the coil repels the magnet and the attraction of the magnet closes the switch.

With the foregoing and other objects in view as shall appear, the invention consists of an electromotor constructed and arranged all as hereinafter more particularly

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described, and illustrated in the accompanying drawings, in which:

Figure 1 is a front elevational view of the rotary motor;

Figure 2 is an end view thereof;

Figure 3 is a front elevational view of a motor and display card assembly mounted for oscillation;

Figure 4 is a similar view to Figure 1, and showing the lower portion of a modified rotary motor arrangement wherein one pole of each rotor magnet is only utilized in operating the switch and providing the propulsion;

Figure 5 is an end view thereof;

Figure 6 is a similar view to Figure 3, and showing an oscillatable display card having its bar magnet extending transversely thereof whereby one pole is repellant to the coil and the other pole operates the switch; and

Figure 7 is an end view thereof.

Figures 1 and 2 illustrate a practical and simple arrangement of the rotating motor, wherein a flat sided vertical ring 2 is carried upon an L-shape base member 3 and constitutes the motor frame.

A rotor axis spindle 4 is mounted within centrally located orifices 5 in the sides of the ring, and carries a pair of arms 6 which are rotatable through the ring.

A pair of electro-magnetic coils of wire 7, preferably of U-shape as illustrated, are mounted in the upper and lower ends of the ring and are connected in series within an electrical circuit 8.

A pair of permanent magnets 9 are mounted upon the ends of the arms 6 to pass through the gaps 10 in the U-shaped coils 7 as the arms rotate. The magnets are similar in size and strength and are similarly positioned upon their arms in regard to polarity, as shown in Figure 1.

The circuit 8 is controlled by a switch 11, suitably mounted, as upon the side of the base member 3, and positioned to be within the orbit of the path of the fields of the rotating magnets 9. The switch is designed to be magnetically operated by the magnets 9 as they rotate past the switch, and in the type illustrated, consists of a centrally fulcrumed contact rocker arm 12 which is connected within the circuit 8 and opens and closes the circuit in its swinging movement. One end of the arm carries a permanent magnet 13 and the other end, a counter-weight 14 which normally keeps the switch open, the counter-balancing weight carrying end of the arm contacting the circuit contact 15 in closing the switch. The permanent magnet 13 is preferably positioned upon the arm with its north pole uppermost. The current for the circuit 8 is generally supplied by one or two flashlight dry cells.

To start the motor, the spindle 5 or the arms 6 are given a rotation by hand, for example in a counter-clockwise direction, as seen in Figure 1. As the uppermost magnet 9 swings downwardly towards the position as shown in dotted lines, the trailing north pole end of the magnet 9 repels the switch magnet 13 and thus swings the switch arm 12 into the position shown in dotted lines to close the switch and energize the coils 7. As the magnets 9 enter and pass through the energized coils 7, the coils repel the leading south poles of the magnets and drive the magnet carrying arms 6 in a counter-clockwise direction, the switch opening under the action of the counterweight 14 as the magnets 9 move away from and cease to depress the switch magnet.

It will be apparent that the duration of the closed time of the switch is proportionate to the speed of rotation of the rotor magnets 9 or vice versa, and therefore that the switch acts as a governor in maintaining a constant rotor speed.

As the south poles of the magnets approach the centres of the coils, the switch is closed under the repulsion of

the north pole of the magnet which is adjacent to the switch, whereby the coils are energized to repel the south poles of the magnets and attract the north poles of the magnets. When the north pole of the magnet, which is adjacent to the switch, reaches the point of maximum attraction to the coil, its north pole field of repulsion has lost its influence upon the north pole of the switch magnet, whereby the switch opens and de-energizes the coil.

If the speed of the rotor increases beyond its constant speed, the south poles of the rotor magnets pass the centres of the coil before the repulsion of the rotor magnet adjacent to the switch closes the switch to energize the coil, which results in the rotor magnets receiving a lesser repulsion impulse from the coils. The increased speed of the rotor also shortens the duration of the closed time of the switch and energization of the coils, with the resultant decrease in the speed of the rotor. As the speed of the rotor decreases, its magnet adjacent to the switch closes the switch as its south pole moves into the area of maximum repulsion of the coil, whereby the rotor magnets receive a greater repulsion impulse from the coils, and increase in speed.

The constant speed of the rotor may be increased or decreased by adjusting the position of the switch within the depth of the path of the magnetic fields of the rotating magnets and the spaced relation of the switch to the adjacent coil. In the drawing, Figure 1 shows the side of the base 3 formed with a slot 16, a switch anchoring bolt 17 extending through the slot. By this arrangement, the switch may be adjusted in its relation to the path of rotation of the rotor magnets and the adjacent coil by sliding the bolt along the slot. The closer the switch is to the path, the longer it will remain closed in the passing of the magnets, and the further it is away from the path the shorter will be the time of its closure; its spaced relationship to the adjacent coil governing the energization of both coils in relation to the rotor magnets passing into and away from the magnetic influence of the energized coils.

The motor may be also run in a clockwise direction without any alteration in its arrangement. In the case of the arrangement as illustrated, the rotor magnets 9 partly pass through the coils 7 before the leading north pole end of the lower magnet repels the switch magnet to close the switch. Upon closing of the switch, the coils are energized to drive the magnets 9 and the arms 6 in a clockwise direction.

An oscillating motion of the motor may be produced by weighting the rotor in the vicinity of one of the arms 6 whereby the off-balance weight will prevent rotation and set up an oscillating motion wherein the magnets 9 swing to and fro through the coils 7, the switch operating under the influence of the lower magnet.

Figure 3 shows the same type of motor particularly designed for oscillation, and to give what may be termed a "mystery appeal" to an advertising device. In this arrangement, a permanent magnet 18 is mounted upon the rear face of an oscillatable element, such as the ring-disc 19 having a fulcrum pin 20 resting upon a fulcrum bar 21 carried upon a supporting bracket 22.

An electromagnetic coil 23 is positioned underneath the base 24 of the bracket, as is also a rocker arm switch and dry cell 25; the energization of the coil by the dry cell being controlled by the switch. One end of the switch rocker arm 26 carries a permanent magnet 27 with its north pole uppermost, whereby the north pole of the oscillating permanent magnet 18 repels the switch magnet to swing the arm and close the switch which energizes the coil 23 during a portion of each oscillation; the momentarily energized coil alternately repelling and attracting the permanent magnet to produce its oscillations.

To the observer who does not see the magnet upon the bottom portion of the back of the oscillating element, or the adjacent coil and switch which are hidden from view,

the operation of the device merely balanced upon the fulcrum 20, has an element of mystery.

In the modification illustrated in Figures 4 and 5, the rotor arms 6 carry permanent magnets 28 which extend radially with their south poles outermost. The rocker arm 12 of the switch 11 carries an iron stud 29 instead of the magnet 13. As the south poles of the magnets 28 move past the pair of coils 30 in a clockwise direction, as indicated in Figure 4, the coils are energized to repel the magnets as they pass through the centres of the coil fields. The energization of the coils is accomplished by the fields of attraction of the passing rotor magnets upon the iron stud 29 of the switch which is in close relationship to the lower coil, whereby the fields of attraction of the magnets reach and move the stud 29 to close the switch coincident with the magnets being in position to receive maximum driving repulsion by the energized coils. The other features of the construction are the same as those shown in Figures 1 and 2.

Figures 6 and 7 illustrate a modification of the arrangement shown in Figure 3. In this case, the magnet 18 is replaced by a magnet 31 positioned transversely of the disc 19, the coil and switch being so arranged that the coil 23 is within the path of the field of the south pole of the magnet, and the switch within the path of the field of the north pole of the magnet; the magnet 27 of the switch being replaced by an iron stud 32 which is attracted upwardly by the magnet to close the switch.

As the disc oscillates on the fulcrum pin 20, the north pole field of attraction of the magnet 31 intermittently attracts the stud 32 to close the switch and energize the coil as the magnet swings thereover; the momentary energization of the coil repelling the south pole of the magnet upon each oscillation, whereby the continuing oscillating movement is achieved.

It will be apparent from the foregoing description of a preferred construction of the electromotor of the invention, that essentially the field coil 7 (Figure 2) or 30 (Figure 5) need only be associated with means having magnetic permeability on the rotor.

In the devices shown, the means of magnetic permeability constitute the permanent magnets 9 (Figure 1), 18 (Figure 3), 28 (Figure 4), or 31 (Figure 6).

Moreover, while I have shown a permanent magnet mounted upon an actuating arm of a switch element, it will be understood that the arm need only embody means of magnetic permeability adapted to be actuated by a permanent magnet associated with the rotor. It should therefore be understood that the actuation of the rotor by the field coil does not require the placement of a permanent magnet on the rotor and that the actuation of the switch only requires a permanent magnet mounted either on the rotor or the actuable switch element associated with magnetic responsive means respectively with the switch element or rotor.

It will be observed that the field coil in all cases is disposed substantially in alignment with a radius extending from the axis of the rotor, i. e., the axis of the coil, theoretically extends substantially to point of intersection with the rotary axis of the rotor but transversely of the rotary motion thereof. It is a characteristic of the apparatus of the invention that no mechanical linkage exists between the rotor and the switch element or the rotor and the field coil so that commutation of electrical energy is effected magnetically as it will be apparent that in Figure 1, for example, the commutating switch device is actuated by the influence of the field of the permanent magnets 9. Thus what I term "magnetic commutation" herein, may be controlled by moving the switch device to positions of greater or lesser intensity of the field of the permanent magnet 9 in the example disclosed.

Accordingly, having regard to the concept set forth in the present disclosure, it will be apparent that substantial modification of the specific form of apparatus and inter-

pretation of the principles set forth is within the scope of skilled persons.

What I claim as my invention is:

1. In an electromotor, an element mounted for movement about a fixed point; means providing the said element with at least one bi-polar magnetic field which is adapted to be carried by the element through at least two positions along a constant course, and means for procuring the movement of the element including, propulsion means intermittently energizable to co-operate with one of the poles of said magnetic field, and a switching device which is magnetically actuatable only by the other pole of said magnetic field to effect energization of said propulsion means; said switching device and propulsion means being spaced apart and arranged to be passed by said magnetic field in its said course; one of the two aforesaid positions of the latter consisting of a first position wherein one of the poles of said magnetic fields within range to actuate said switching device to effect the energization of the propulsion means while the other said pole is within range to co-operate with such propulsion means to move the element about its fixed point; the other of the two positions aforesaid being one in which the poles of the said magnetic area are beyond such range.

2. The electromotor set forth in claim 1 wherein the means providing the said magnetic field is a bi-polar bar magnet with its poles facing the course through which it is carried by the said element while the said switching device and propulsion means are in a line which is substantially tangent to the said course.

3. The electromotor set forth in claim 1 wherein the means providing the said magnetic field is a bi-polar bar magnet with its poles facing the course through which it is carried by the said element while the said switching device and propulsion means are in a line which is substantially tangent to the said course; the said first position of the said magnetic field means being substantially intermediate the said switching device and the said propulsion means with one of its poles actuating said switching device and the other co-operating with the said propulsion means.

4. The electromotor set forth in claim 1 wherein, the parts are so constituted, oriented and arranged that one pole of said bi-polar magnetic field will be in position to actuate said switching device only when the other pole thereof is in position to co-operate with said propulsion means.

5. In an electromotor, an element pivotally mounted for oscillation; a permanent magnet carried upon the free end of said element and having its poles positioned transversely of the path of oscillation of the element; a fixed element propulsion coil of wire positioned within the path of the passing magnetic field of one pole of the magnet; and a magnetically actuated circuit contact

switch controlling the energization of the coil and operable only by the passing magnetic field of the other pole of the magnet.

6. In an electromotor, an element mounted for travel about a fixed point; a stationary magnetic device arranged to be passed by said element in its travel, and a movable magnetic device carried cyclically by said element into and out of magnetic range of the stationary magnetic device; one of said magnetic devices providing two spaced unlike magnetic fields; the other of said magnetic devices having means providing an intermittent magnetic field for co-operation with one of the unlike magnetic fields aforesaid to propel the said element; a switch biased to extinguish said intermittent magnetic field, and a magnetic component polarizing the said switch and rendering it magnetically actuatable only by the other of said unlike magnetic fields to initiate said intermittent magnetic field; the foregoing parts being constituted, oriented and arranged to provide that the said switch will be actuated by the appropriate one of the unlike magnetic fields only when the other of them is in position for co-operation with the resultantly initiated intermittent magnetic field to procure propulsion of the said element.

7. The electromotor set forth in claim 6 wherein the said constitution, orientation and arrangement of the parts is such as to provide that both the actuation of the switch and propulsion of the element are achieved by magnetic repulsion.

8. The electromotor set forth in claim 6 wherein said magnetic device providing the two unlike magnetic fields is a bar magnet.

9. The electromotor set forth in claim 6 wherein the said constitution, orientation and arrangement of the parts is such that the propulsion of the said element is achieved by magnetic repulsion between the said intermittent magnetic field and the particular one of the unlike magnetic fields with which it co-operates.

10. The electromotor set forth in claim 6 wherein the said magnetic device providing the two unlike magnetic fields is also the movable magnetic device carried by the element and consists of a bar magnet; the specific field thereof actuating the switch having the same polarity as the magnetic component polarizing the switch; the said intermittent magnetic field having the same polarity as the other of said unlike magnetic fields.

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