April 6, 1948. E. E. GREGORY 2,439,248

ELECTROMOTOR

Filed Oct. 4, 1943 2 Sheets-Sheet 1

Fig. 1.

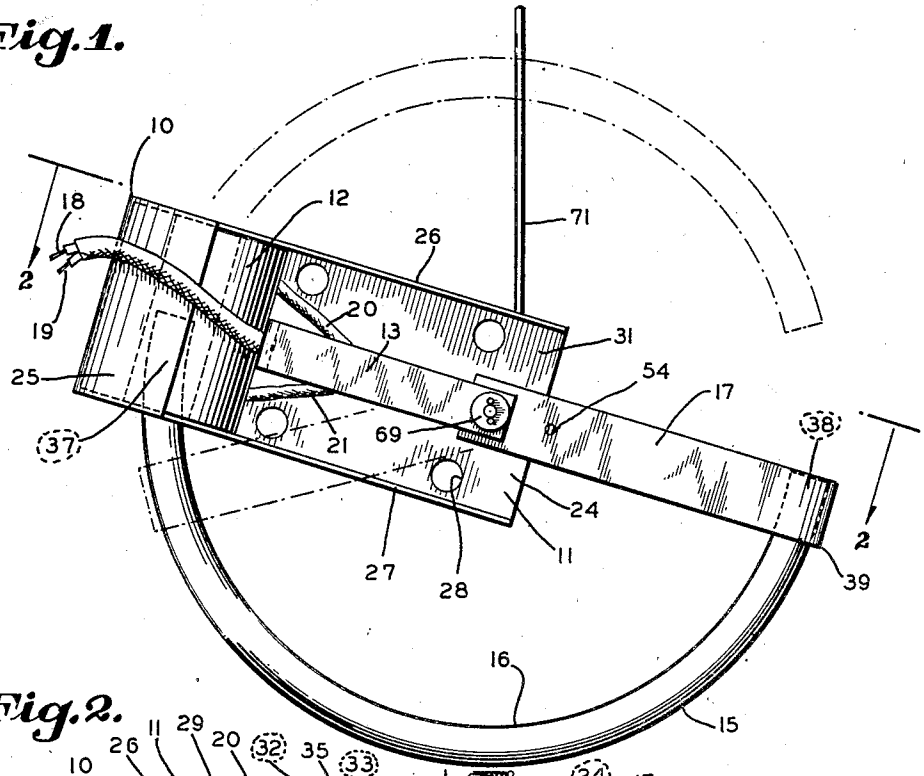


Fig. 2.

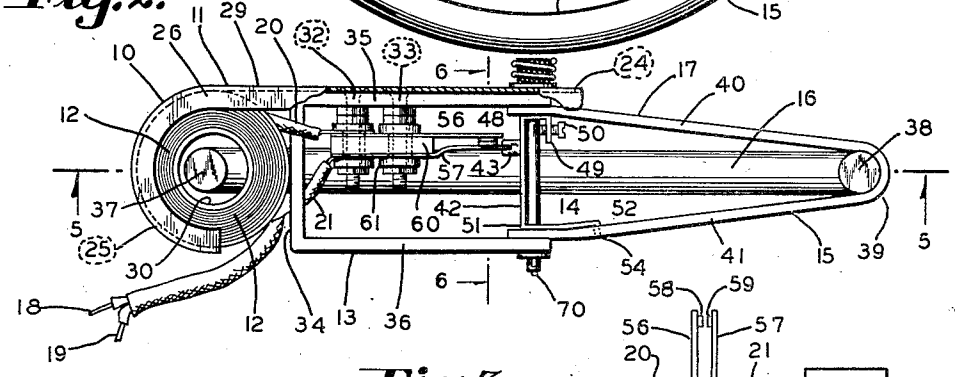


Fig. 3.

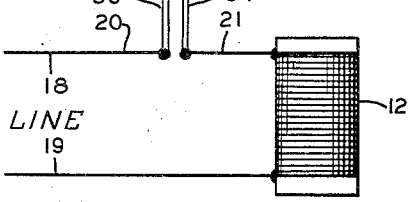
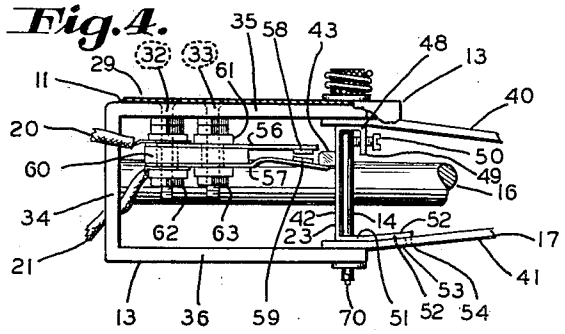


Fig. 4.



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Filed Oct. 4, 1943 2 Sheets-Sheet 2

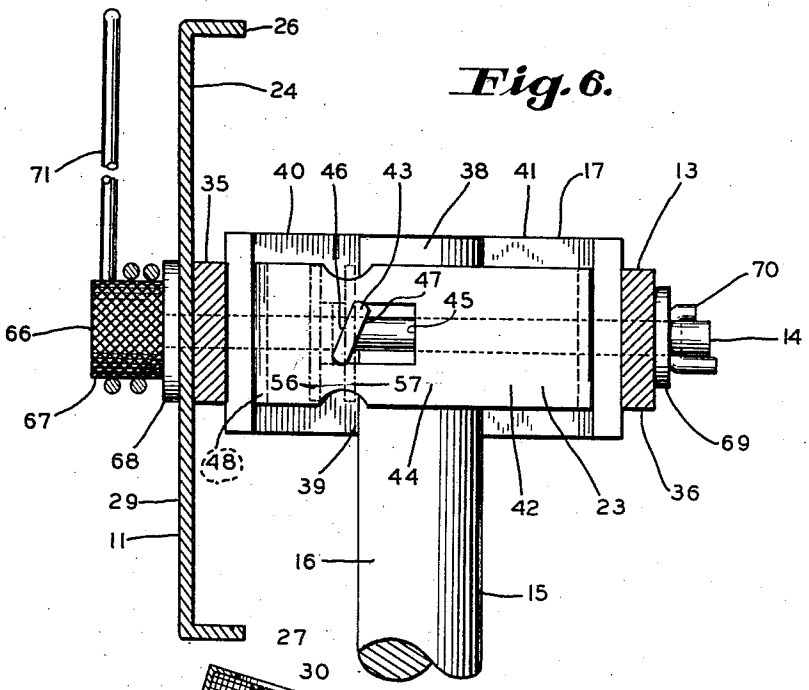


Fig. 6.

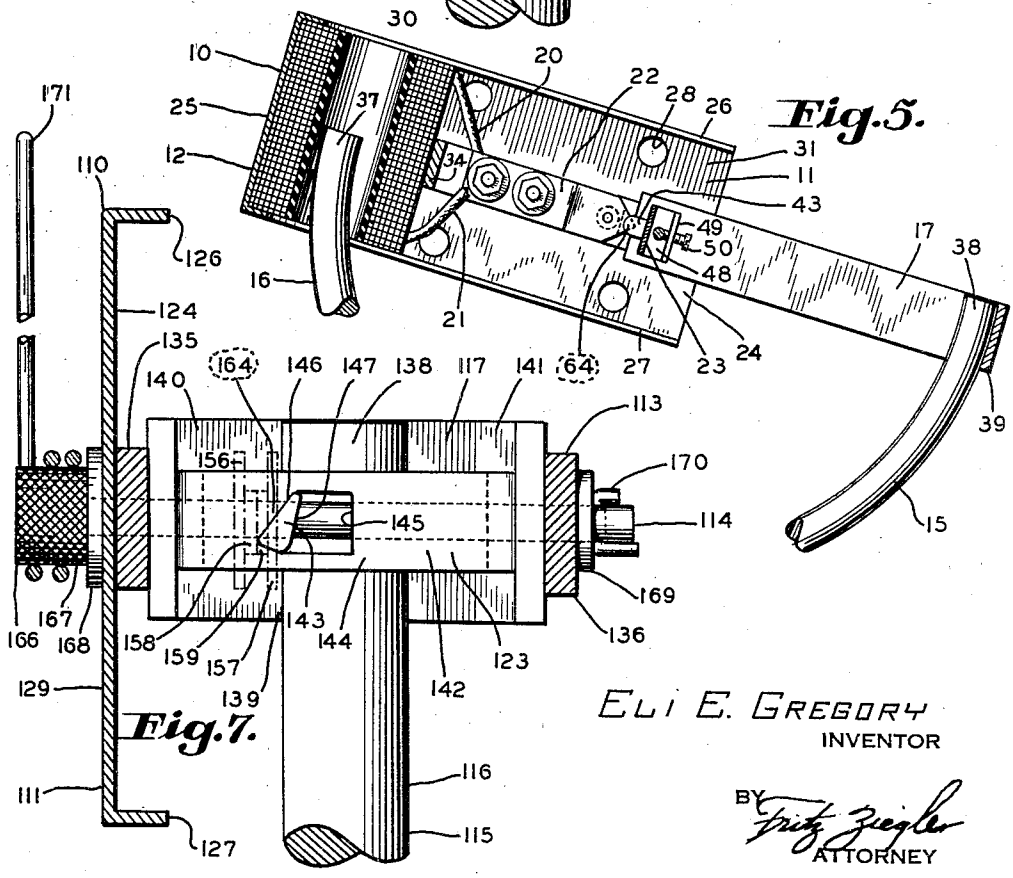


Fig. 5.

Fig. 7.

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ELECTROMOTOR

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Application October 4, 1943, Serial No. 504,846

3 Claims. (Cl. 172—126)

1

This invention relates generally to electric motors and more particularly to electromotors of the class adapted to produce an oscillating motion.

Devices of this type are widely used for producing reciprocal motion of parts of advertising posters or displays for the purpose of attracting attention thereto. Such devices are described in detail in Reissue Patent No. 21,579, reissued September 24, 1940, to which reference will be hereinafter made.

Among the objects of the present invention lies the provision of improved electromotor structure wherein by reason of the novel construction, organization and arrangement of the parts lower cost of production and lower cost of operation are obtained.

Another more specific object herein lies in the provision of novel electrical circuit controlling means in which the solenoid is energized for only a relatively short period of time, and this energization is correlated and synchronized with the oscillation of the oscillator and more particularly the armature thereof.

Another object herein lies in the structure of the class described which is simple in construction, has few parts and in which the parts subject to wear are reduced so that the device may be operated for relatively long periods without attention for oiling, adjusting or other servicing.

Another object herein lies in the provision of an electromotor device especially adapted for actuating animated advertising devices and which is so constructed that it can be dismantled from one advertising device and applied to another by persons who do not have more than ordinary mechanical skill.

Another object herein lies in the provision of electromotor structure for actuating advertising devices and which is capable of being adjusted in position with relation to such devices so that the length of the stroke of the oscillator may be correlated to the desired length of the stroke of the moving part in the advertising device.

A still further object herein lies in the provision of a device of the class described which may where desired be self-starting.

These objects and other incidental ends and advantages will more fully appear in the progress of this disclosure and be pointed out in the appended claims.

In the drawings, in which similar reference characters designate corresponding parts throughout the several views in which:

Figure 1 is a rear elevational view of a preferred

2

embodiment of the invention and as the same would appear applied to the rear surface of an advertising device (not shown).

Figure 2 is a plan view of Figure 1 as might be seen from a plane disposed parallel to and above the plane 2—2 on Figure 1. In this figure the parts are shown with the electrical switch contacts in a closed position thereof.

Figure 3 is a schematic wiring diagram of the electrical circuit.

Figure 4 is a fragmentary plan view taken similarly to Figure 2 but showing electrical switch contacts in an open position thereof.

Figure 5 is a fragmentary vertical sectional view as seen from the plane 5—5 on Figure 2.

Figure 6 is an enlarged fragmentary vertical sectional view as seen from the plane 6—6 on Figure 2.

Figure 7 is a fragmentary vertical sectional view taken similarly to Figure 6 but showing a second embodiment of the invention.

Turning now to the first embodiment of the invention as illustrated in Figures 1 to 6 inclusive, the electromotor is generally indicated by reference character 10 and comprises broadly a base 11, a solenoid 12, a frame 13, an axle 14, an oscillator 15 including an armature 16 and an armature carrier 17, main supply conductors 18 and 19, auxiliary conductors 20 and 21, an electrical switch 22, and an electrical switch control element 23.

The base 11 may take the form of a sheet of planar material having a flat body portion 24 and a semi-cylindrical body portion 25. The upper and lower longitudinal edges of the base 11 are provided with forwardly and inwardly bent flanges 26 and 27. The flanges 26 and 27 serve to strengthen the body portion 24; on the semi-cylindrical body portion 25, said flanges serving to prevent axial or vertical displacement of the solenoid 12. The base 11 may be composed of any suitable material as, for example, brass, aluminum, or steel, and may be provided with a plurality of orifices 28 which may be penetrated by screws (not shown) to secure the forward surface 29 against the rear surface of a poster or other advertising device (not shown).

The solenoid 12 may be of a well known construction having a direct current resistance sufficiently high to enable the device to be in constant use with an E. M. F. of the largest expected value, for example, 110 volts. Since the solenoid 12 has electric current passing through it for only relatively short intervals, there are correspondingly longer intervals during which the

heat produced therein may be dissipated, and this may be taken into account in the design of the solenoidal coil, with resultant economies in cost of materials and labor. The solenoid 12 is provided in the usual manner with an axially disposed centrally hollow cylinder or channel 30, the effective diameter of which is sufficient to permit the arcuate passage therethrough of the armature 16. The solenoid 12 is maintained within the pocket formed by the semi-cylindrical portion 25 and the upper and lower flanges 26 and 27 by the frame 13 in a manner to be pointed out.

The frame 13 is preferably composed of a relatively rigid material such as metal and is secured to the rear surface 31 of the base 11 in any suitable manner as, for example, by the screws 32 and 33. Thus as best seen in Figure 2 the frame 13 is of substantially U-shape having a solenoid retaining portion 34, a base plate engaging portion 35 and a rear axle supporting portion 36. The juxtaposed free ends of the portions 35 and 36 are provided with aligned orifices which act as journals for the axle 14.

The oscillator 15 includes the armature 16 and the armature carrier 17. The armature 16 is of semi-circular shape and is composed of magnetic material such as steel or iron. As seen in Figure 1, the free end 37 of the armature 16 may be disposed within the cylinder 30 of the solenoid 12 when the device is one position of rest. The other end 38 of the armature 16 is secured to the armature carrier 17 at the bight portion 39 thereof in any suitable manner as, for example, by welding. The carrier 17 is of substantially V-shape including the portions 40 and 41. The juxtaposed free ends of the portions 40 and 41 are provided with aligned orifices which are penetrated by the axle 14.

Disposed upon the axle 14 and between the opposed portions 40 and 41 of the armature carrier 17 is the electrical switch control element 23. The element 23 is preferably formed from a strip of relatively stiff material as, for example, metal and is generally U-shaped as viewed from above. The central body portion 42 is preferably planar and is provided with an integral bent switch actuating member 43. Thus the member 43 may take the form of an integral lug or tab projecting from one surface 44 of the element 23 and as best seen in Figure 6 of the accompanying drawings, such lug or tab may be initially formed by making a U-shaped cut 45. The member 43 is rotated about a generally horizontal axis, that is to say an axis perpendicular to the surface 44 to provide a relatively upper switch closing surface 46 and a relatively lower switch opening surface 47. The forward end of the element 23 is provided with two consecutive right angled bends forming a bearing portion 48 and the set screw supporting portion 49. The set screw 50 threadedly penetrates the orifice in the portion 49 and is adapted to secure the portion 49 and hence the element 23 against rotation with respect to the axle 14. The rear end of the element 23 is provided with a right angled bend followed by an obtuse bend forming the bearing portion 51 and the anchoring portion 52. The bearing portions 48 and 51 are each provided with interaligned orifices through which the axle 14 penetrates. The anchoring portion 52 is provided with a bent lug 53 which engages a correspondingly positioned orifice 54 in the portion 41 of the carrier 17. By virtue of the structure just described, that is to say the lug 53 and the set screw 50; the carrier 17, the electrical switch control element 23, and the axle 14 rotate as a unit, being trunnioned in the free ends of the portions 35 and 36.

The electrical switch 22 includes broadly, a relatively stationary leaf 56 and a relatively movable leaf 57. The leaves 56 and 57 may be composed of Phosphor bronze or similar material having a relatively high degree of resiliency and low electrical resistance, and these leaves may be provided at the relatively free terminals thereof with contact points 58 and 59. The points 58 and 59 may be composed of suitably low resistance material having a comparatively small affinity for oxygen, for example, gold, coin silver, or tungsten. The switch 22 is of "telephone jack" type construction and includes an insulating spacer 60 and insulating washer-bushings generally indicated by reference character 61. The latter may be of the extruded orificed type so that the leaves 58 and 59 are insulated from each other and from the screws 32 and 33 upon which they are supported. The relatively fixed portions of the leaves 56 and 57 are thus maintained in operative position by the nuts 62 and 63 on the rear ends of the screws 32 and 33. The relatively free portion of the leaf 57 is offset by a bend toward the relatively stationary leaf 56 in such manner that when the leaves 56 and 57 are in an unstressed condition the contact points 58 and 59 do not electrically contact each other. The movable leaf 57, as best seen in Figure 5, has an angularly edged terminal 64, the edges of which form an angle of substantially 90° and this terminal is adapted to act as a follower projection which is oscillated in directions substantially parallel to the axis of the axle 14 by the switch actuating member 43 previously described.

By virtue of the angular position of the upper surface 46, when this surface moving upwardly as viewed in Figure 6 strikes against the follower 64, said follower together with the movable leaf 57 is moved toward the leaf 56 causing an electrical contact to take place between the contact points 58 and 59. Upward movement of the surface 46 as viewed in Figure 6 is caused to take place when the oscillator 15 rotates in a clockwise direction as viewed in Figures 1, 2 or 5.

After the switch actuating member 43 passes upwardly beyond the terminal 64, said terminal as well as the movable portion of the leaf 57 springs back to its normal unstressed condition so that the circuit through the contact points 58 and 59 is broken.

By virtue of the angular position of the lower surface 47 of the switch actuating member 43, when this surface moving downwardly as viewed in Figure 6 strikes against the terminal follower 64, said follower together with the movable leaf 57 is moved away from the leaf 56 thus maintaining the open circuit condition existing between the contact points 58 and 59. Downward movement of the surface 47 as viewed in Figure 6 is caused to take place when the oscillator 15 rotates in a counterclockwise direction as viewed in Figures 1 and 5.

The axle 14 is provided with an integral head 66 which has an outer cylindrical surface 67 which is roughened or knurled. This knurled surface is adapted to frictionally engage a supporting arm 71, similar to the supporting arm 22 in Reissue Patent No. 21,579, and as there shown may be connected to any suitable movable part on the advertising device with which the present electromotor may be utilized. The washer 68 and the washer 69 are preferably rotatably disposed

on the axle 14 and in addition to properly positioning the parts also serve to reduce friction thereat when the axle is rotated. The axle 14 is maintained in operative position by the cotter pin 70. It may be noted at this point that the cotter pin 70 is not necessary in order to maintain the axle 14 in operative position when the set screw 69 clamps said axle. The use of the pin 70, however, is desirable in that the position of the oscillator 15 may be circumferentially adjusted with relation to the axle 14 and the parts will be maintained in associated relationship by said pin.

In use the base 11 is placed upon the rear surface of a relatively vertically disposed poster or advertising display (not shown) and secured thereto in any suitable manner as, for example by screws (also not shown) penetrating the orifices 26 in said plate. The normal position of rest taken by the oscillator 15 will depend upon the position of the arm 71 and the relative weight of any other movable advertising device part (not shown) secured to said arm. The oscillator 15 may, for example, take a position of rest shown in Figure 1. The base 11 is then so positioned that the portions 35 and 36 of the frame 13 are in substantial alignment with the portions 40 and 41 of the carrier 17. In such a position the switch actuating member 43 is adapted to move the movable leaf 57 to the circuit closing position thereof as seen in Figure 2. Obviously if by reason of the weight of the advertising part carried on the arm 71 the position of the oscillator 15 is changed, the base 11 may be correspondingly changed.

With the parts thus positioned (see Figure 1) and when the main supply conductors 18 and 19 are connected to a suitable source of electrical energy, the solenoid 12 becomes energized and attracts the armature 16. This attraction causes the armature 16 to move in a clockwise direction in Figure 1 and moves it sufficiently to cause the switch actuating member 43 to pass upwardly beyond the follower terminal 64. The solenoid 12 then becomes deenergized owing to the opening of the circuit and the armature 16 travels in an opposite or counterclockwise direction. A pendulum-like action of the oscillator 15 is thus begun and as soon as the oscillator 15 returns to the position shown by the full lines in Figure 1 the circuit is again closed. The amplitude and frequency of the oscillations of the oscillator 15 will be governed by factors well known in the art to which the present invention relates, such as the magnetic force of the solenoid 12, the weight and distribution of the weight of the oscillator 15, friction, and load. An extreme position of swing in which the armature 16 has passed almost completely through the solenoid 12 is indicated by the dot-dash lines on Figure 1.

After the source of the electricity is disconnected from the main conductors 18 and 19 as, for example when this device is used in connection with a window display and an automatic clock switch disconnects the circuit at a predetermined time, after the inertia remaining in the oscillator 15 has been dissipated, the oscillator comes to a position of rest, substantially that shown in the full lines of Figure 1 and will either stop in a position in which the surface 46 engages the follower terminal 64 or one in which the surface 47 does so. If the surface 46 engages the follower 64, then the device will stop in a position in which the switch 22 is closed. If, on the other hand, the electromotor 10 stops with the

surface 47 in contact with the terminal follower 64, then the switch 22 will be in an open position. In the latter event it is necessary to start the device by manually or otherwise imparting some motion to the oscillator 15 about the axle 14 so that the series of oscillations may begin and continue as described above.

Turning now to the second embodiment of the invention illustrated in Figure 7, for the purpose of avoiding needless repetitions parts corresponding to those of the first embodiment are given the same reference characters with the addition of a prefix "1." The second embodiment differs from the first embodiment in the shape and position of the switch actuating member 143 in which the switch closing surface 146 is disposed at a greater angle with relation to the plane of motion of the member 143 than is the surface 147. The result of this construction is that the wedging action of the surface 146 has a lesser mechanical advantage than does the surface 147 so that after the current to the main conductors is broken, as the inertia of the oscillator 115 becomes dissipated, the oscillator will come to a position of rest in which the surface 146 engages the follower terminal 164. The difference in angularity between the surfaces 146 and 147 is sufficient so that if the oscillator 115 has enough inertia to close the switch and move the member 143 thereabove, then there will be sufficient inertia for the oscillator 115 to move the member 143 down past the terminal follower 164 on its return swing and on its next upward swing the member 143 will be stopped against the terminal 164. The resiliency of the moveable leaf 157 is great enough so that the weight of the oscillator 115 is sufficient to close the contacts 158 and 159.

Thus it may be seen that the electromotor 110 will always be self-starting since it will always come to a position of rest with the switch in a closed position thereof. This feature is of particular advantage where the electromotor itself is connected and disconnected from the main source of electric power by time clocks or similar devices where, for example, it is associated with an advertising display which is operated during the daytime and not operated at night, or vice versa. Another advantage of the self-starting feature permits the electromotor to be incorporated in advertising displays which may not be conveniently reached after they have all been set up for the purpose of starting them by manual operation.

It may thus be seen that I have disclosed a novel and useful electromotor which may be constructed at low cost and which is capable of long periods of operation without attention or servicing.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. A self-starting electro-motor of the reciprocating type having means for connection to a current supply source comprising an electromagnet, an oscillator adapted to be actuated by the electro-magnet when the electro-magnet is energized, an electrical switch including a movable member having a closed position and a normally open position, and a switch actuating member connected to said oscillator and adapted to move the movable switch member to closed position upon movement of said oscillator in one direction and to maintain said movable switch

member in the open position upon movement of said oscillator in the opposite direction, said actuator being formed to arrest said oscillator in a position corresponding to the closed switch position when current supply to said electro-magnet is separately interrupted.

2. A self-starting electro-motor of the reciprocating type having means for connection to a current supply source comprising an electro-magnet, an oscillator adapted to be actuated by the electro-magnet when the electro-magnet is energized, an electrical switch including a movable member having a closed position and a normally open position, angularly disposed edges at the end of said movable switch member, and a switch actuating member connected to said oscillator and adapted to move the movable switch member to closed position upon movement of said oscillator in one direction and to maintain said movable switch member in the open position upon movement of said oscillator in the opposite direction, said actuating member being in the form of a cam having inclined surfaces, the degree of angularity of one of said surfaces being such as to arrest the movement of said oscillator, said actuator arresting said oscillator in a position corresponding to the closed switch position when current supply to said electro-magnet is separately interrupted.

3. An electro-motor comprising an electro-magnet, an oscillator to be attracted by the electro-magnet when it is energized, a unitary switch including a movable member having a closed position and a normally open position, said member having angularly disposed edges at its ends, and a switch actuating member associated with the oscillator, said actuator having inclined surfaces, one of said surfaces serving to arrest movement of the oscillator.

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