

Oct. 6, 1936.

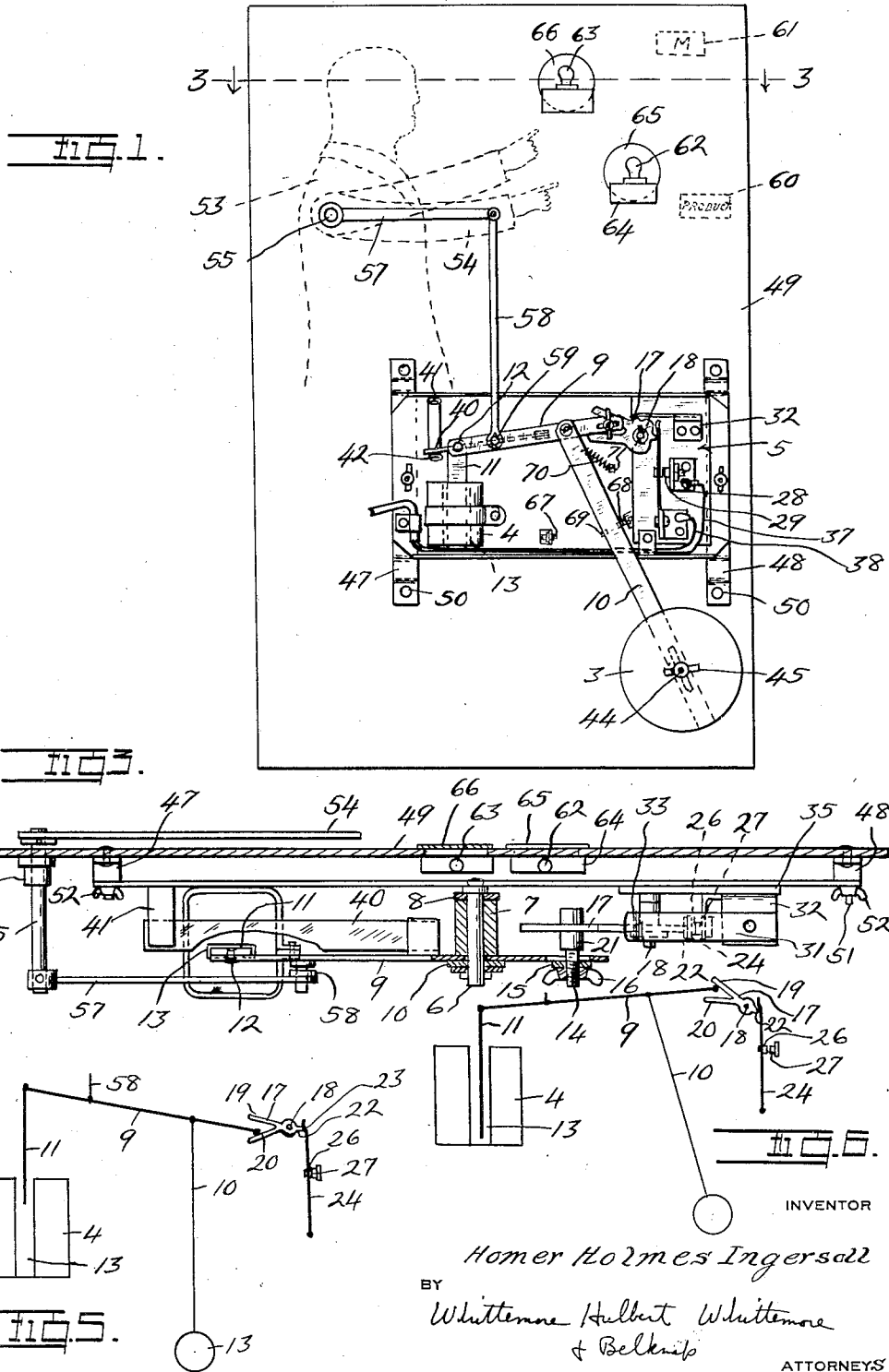
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SOLENOID MOTOR

Filed Jan. 2, 1934

2 Sheets-Sheet 1



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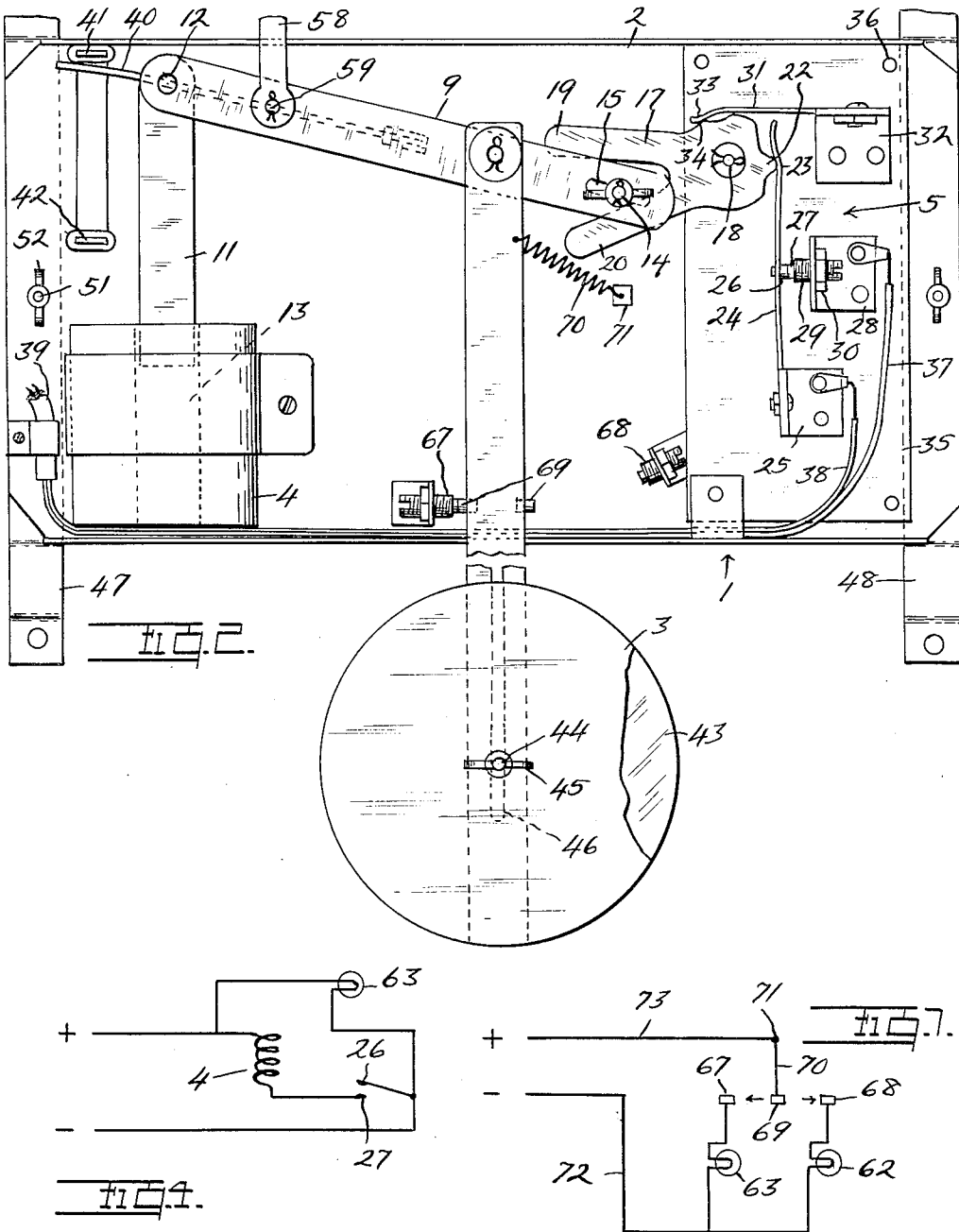
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SOLENOID MOTOR

Homer Holmes Ingersoll, Detroit, Mich.

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5 Claims. (Cl. 172-126)

The invention relates to animated displays and to the motors for operating the same. More particularly the invention relates to improvements in electrically operated solenoid pendulum motors and to the displays animated thereby.

One of the primary objects of the invention is to provide an improved solenoid motor adapted for animated displays and capable of operating quietly and continuously without vibration.

Another important object of the invention is to improve the solenoid construction to render the device more silent and more efficient.

A further object of the invention is to improve the switch operating mechanism for energizing and deenergizing the solenoid to make the same more positive in action, easier to adjust and quieter in operation.

Another object is to provide a motor adaptable for animated display work which is capable of operation under widely varying conditions, both as to electrical power and as to the nature of the mechanical work to be performed. A further object is to provide an animated display which is operated positively, efficiently and noiselessly.

Other objects will be more apparent as the description of the invention proceeds.

In the drawings

Figure 1 is a rear view of an animated display showing the motor mounted thereon;

Figure 2 is an enlarged view of the motor;

Figure 3 is a cross section on the line 3-3 of Figure 1;

Figure 4 is an electric diagram;

Figures 5 and 6 are diagrams showing the operation of the mechanism;

Figure 7 is an electrical diagram of a modified construction.

Referring now particularly to Figure 2, the improved solenoid motor 1 comprises a base 2 on which is mounted a pendulum 3, solenoid 4 and switch mechanism 5. The pendulum is swingingly mounted in any suitable manner but as shown there is a pin 6 extending outwardly from the base plate on which there is the bearing sleeve 7 abutting the thrust washer 8. The sleeve 7 is attached to a cross arm 9 and to the pendulum stem 10 rigidly fixed thereto. The cross arm carries at one end the armature 11 which, as shown, is in the form of a rectangular iron strip of relatively narrow gauge metal. The width of the strip is substantially greater than the thickness and in the preferred construction is at least twice and ordinarily not less than three times the thickness. The armature is pivotally mounted to the cross arm at 12 and is adapted to depend within

the hollow rectangular core 13 of the solenoid 4.

At the opposite end of the cross arm 9 there is a pin 14 adjustable in the longitudinal slot 15 by means of a wing nut 16. The pin projects between the furcations of a toggle member 17 which is pivoted adjacent thereto on the pin 18. The toggle member has the two arms 19 and 20 embracing the pin 14 and extending outwardly from the pivot of the toggle in the form of a U, the arrangement being such that as the pin 14 is adjusted towards the pivot of the toggle member there is less lost motion between the pin and the arms 19 and 20. The pin 14 is preferably provided with a sleeve 21 of rubber or other resilient material. The opposite side of the toggle member is provided with a cam or nose 22 which cooperates with the curved portion 23 of a leaf spring 24. The spring is mounted on a bracket 25 at the opposite end from the curved portion and carries intermediate its ends the movable contact 26. A stationary contact 27 is adjustably carried on a bracket 28 by means of a screw 29 and is held in position by the lock nut 30. 31 is a leaf spring projecting from bracket 32 and having a curved portion 33 engaging the surface 34 of the toggle member to maintain the toggle member in predetermined positions of adjustment. The brackets 25, 28 and 32 and the pivot pin 18 of the toggle are all preferably mounted on an insulated base 35 which in turn is secured to the motor base 2 by the rivets 36. Electric conductors 37 and 38 extend from the brackets 28 and 25 respectively and are connected in series with the windings of the solenoid 4. A flexible electric cord 39 extends the solenoid and is adapted to be connected to the source of electric current.

For limiting the swinging movement of the pendulum, the cross arm 9 has projecting therefrom a leaf spring 40 adapted to contact with the stops 41 and 42. The stops are preferably provided with a resilient material to lessen the noise of contact. The pendulum 3 is preferably composed of one or more disks 43 which are replaceably mounted on the stem 10 by means of the bolt 44 and wing nut 45. The weight of the pendulum may therefore be easily varied by the number of disks used. Preferably also the length of the pendulum may be varied by providing the longitudinal slot 46 in the stem 10.

In the operation of the motor the pendulum is normally at rest in the position illustrated in Figure 5. In this position the toggle 17 causes the contacts 26 and 27 to be closed, thus closing the circuit through the solenoid 4 and drawing the armature 11 toward the center of the solenoid

core. This movement moves the pendulum against gravity into the position illustrated in Figure 6 where the toggle 17 is moved into its second position of adjustment and the nose 22 rides off the curved portion 23 of the spring and permits the contacts 26 and 27 to separate, thus deenergizing the solenoid. The outward movement of the pendulum is resisted by the contact of the spring 40 against the stop 42 and the pendulum then moves towards its initial position by gravity. As it approaches its central position the toggle is again adjusted to the initial position and the contacts 26 and 27 are closed by the action of spring 24, again energizing the solenoid. The momentum of the pendulum carries the same beyond its dead center and the leaf spring 40 limits the movement by striking the upper stop 41. The impulse of the solenoid again causes the pendulum to swing outwardly against gravity and the cycle is repeated.

The power of the motor may be varied by adjusting the pin 14 toward or away from the center of the toggle 17, thereby varying the interval during which the energy of the solenoid is applied to the pendulum; also the frequency of the movement may be varied by adjusting the pendulum. Thus the motor may be adjusted to different conditions as desired. The motor as above described operates very quietly since the resilient stops contribute no noise and the spring contact arrangement is also noiseless. A further factor contributing to the noiselessness is the arrangement of the solenoid and armature.

I have discovered that by making the cross section of the armature and the core of elongated shape, there is less vibration and consequent noise due to the energization of the solenoid. This is probably due to the fact that the magnetic field within the elongated core of the solenoid is more powerful in one direction than in the others, thereby positively forcing the armature in that direction without permitting it to fluctuate in several directions.

The solenoid pendulum motor as above described forms a single compact unit well adapted for use in connection with various displays where animation is desired. The base 2 may be permanently or temporarily mounted on the display but in the preferred form it is resiliently and removably mounted as hereinafter described. 47 and 48 represent leaf springs secured at opposite ends to the display card 49 by rivets 50 or other suitable means. These springs are bowed upwardly in the center, forming a semi-elliptic type spring and are preferably but not necessarily mounted in a vertical position on the display. The base 2 of the motor is suitably mounted on the springs 47 and 48 and in the preferred construction this is done by means of bolts 51 and wing nuts 52 as illustrated. Thus where it is desired to use one motor for several displays the unit may be quickly detached and replaced on corresponding springs on the second display.

The animated display with which my improved motor is associated may vary widely, depending upon the nature of the advertising, but by way of example I have shown a simple display in which a human figure 53 is represented on the display card 49. The arm of the figure is a separate member 54 pivotally mounted on the display card to move from a lower position to an upper position. For mounting the arm there is provided a pin 55 which extends through a bearing 56 and has a crank arm 57 at the rear side of the display card. A connecting rod 58 is connected between

the crank arm and the pin 59 on the motor cross arm 9.

In the lower position of the arm 54 it points to a representation 60 of the product to be advertised, while in the upper position it points to a representation 61 of the trade-mark. If desired flashing illumination may be provided adjacent the product and/or trade-mark and as shown there are the electric bulbs 62 and 63 mounted on sockets 64 at the rear of the display card adjacent translucent portions 65 and 66.

The flashing illumination may be provided in several different ways and my improved pendulum motor is adapted for controlling the same. If desired the switch mechanism 5 may be used for the upper illuminating bulb 63 by connecting said bulb into a circuit through the contacts 26 and 27. This is illustrated in Figure 4. Another method of controlling a flashing light by my improved motor is to provide a separate switch mechanism operable by the movement of the pendulum 3. In this construction two contacts 67 and 68 are provided on opposite sides of the pendulum stem 10 adapted to be alternately engaged by the contact 69 on the stem. The stem is electrically connected by the flexible conduit 70 to a terminal 71 on the display card. As shown in the electrical diagram of Figure 7, the contact 68 is connected to the bulb 62 and the contact 67 is connected to the bulb 63, both of these bulbs being connected to the conductor 72, while the terminal 71 is connected by conductor 73 to the opposite side of the electric line. Thus as shown in Figure 7, the flashing bulbs 62 and 63 are alternately illuminated by the movement of the pendulum 3.

In the above description I have illustrated one form of my invention. It should be understood, however, that the invention may be embodied in various other modified constructions. One of the advantages of my invention is that a motor is provided in a compact unit constructed sturdily and capable of operation without attention for long periods of time. The motor is self-starting and will operate on either direct or alternating current of all frequencies commercially used as well as all voltages from 90 to 130. The motor is provided with adjustments for securing the desired operation under various conditions, including adjustment for speed and power. The invention is capable of embodiment in motors of various sizes and if desired more than one solenoid may be used to increase the power. The electrical contacts are made adjustable so as to compensate for any wear that may take place over a long period of time. The spring contact construction eliminates audible noise and vibration, provides for flexible alignment of the working parts and prevents binding even when the cardboard of the display becomes warped. Thus it is apparent that I have provided an improved solenoid pendulum motor and an improved form of animated display operated thereby.

What I claim as my invention is:

1. A solenoid motor comprising a pendulum, a solenoid, a movable core for said solenoid operatively connected to said pendulum, a pivotally mounted bifurcated arm, an electric switch for energizing and deenergizing said solenoid, a member operatively connected to said pendulum and arranged intermediate the furcations of said arm to alternately engage the same during the swinging of said pendulum, a nose projecting from the opposite side of said arm, a leaf spring

having one end fixed, a curved portion on the other end of said leaf spring engaging said nose and movable thereby, a fixed electric contact and a contact carried by said leaf spring adapted to engage and disengage said fixed contact upon movement of said spring, said contacts forming a switch for said solenoid.

2. A solenoid motor comprising a pendulum, a cross arm connected to said pendulum, a movable core depending from one end of said cross arm into operative relation to said solenoid, resilient means for limiting the swinging movement of said pendulum, an electric switch for energizing and deenergizing said solenoid, a pivoted arm on the opposite side of said cross arm having spaced stops for alternately engaging said cross arm during the swinging thereof and means operated by the intermittent movement of said pivoted arm for energizing and deenergizing said solenoid.

3. A solenoid motor comprising a pendulum, a solenoid, a movable core for said solenoid connected to said pendulum, a bell crank arm on said pendulum, a pin adjustably secured to said bell crank arm and projecting laterally therefrom, a toggle arm having divergent furcations straddling said pin with a variable lost motion therebetween, according to the adjustment of said pin on said bell crank arm, and an electric switch actuated by the swinging of said toggle to alternately open and close an electric circuit including said solenoid.

4. A solenoid motor comprising a plate, a pin projecting therefrom, a pendulum pivotally engaging said pin, a cross strip on said pendulum extending on opposite sides of the pivot pin, a strip of magnetic metal pivotally attached to one arm of said cross strip and depending therefrom, the width of said strip being several times greater than its thickness, a solenoid mounted on said plate and provided with an oblong core opening to receive said strip, a pin adjustably connected to the opposite arm of said cross strip and projecting laterally therefrom, a strip of in-

ulating material mounted on said plate, a toggle arm pivotally mounted on said insulator strip and provided with divergent furcations straddling the pin on the cross strip with a variable lost motion therebetween according to the adjustment of said pin on said cross arm, a switch mounted on said insulator strip and including a spring arm having a contact thereon, a contact adjustable in relation to said first contact, a nose projecting from said toggle arm and engaging said spring arm to alternately close and separate said contacts, and an electric circuit including said switch and solenoid.

5. A solenoid motor comprising a plate, a pin projecting laterally therefrom, a pendulum arm pivotally mounted on said pin, a plurality of pendulum disks detachably clamped to the lower end of said pendulum arm, a cross strip attached to said pendulum arm and extending on opposite sides of said pivot, a strip of magnetic metal pivotally attached to one arm of said cross strip and depending therefrom, being of a width relatively great in relation to its thickness, a solenoid mounted on said plate provided with an oblong core opening for receiving said magnetic strip, a pin adjustably connected to the opposite arm of said cross strip and projecting laterally therefrom, an insulator strip mounted on said plate, a toggle arm pivotally mounted on said insulator strip and provided with divergent furcations straddling the pin on the cross strip with a variable lost motion according to the adjustment of said pin upon said arm, a nose projecting from said toggle arm, a switch including a spring arm mounted on said insulator strip and engaging said nose, a post on said insulator strip, a contact member adjustable on said post, a cooperating contact member on said spring arm, an electric circuit including said switch and solenoid and a resilient arm bearing on a segment on said toggle to frictionally resist movement thereof.

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