March 9, 1937. R. R. SMITH 2,073,321

DISPLAY DEVICE

Filed July 13, 1935

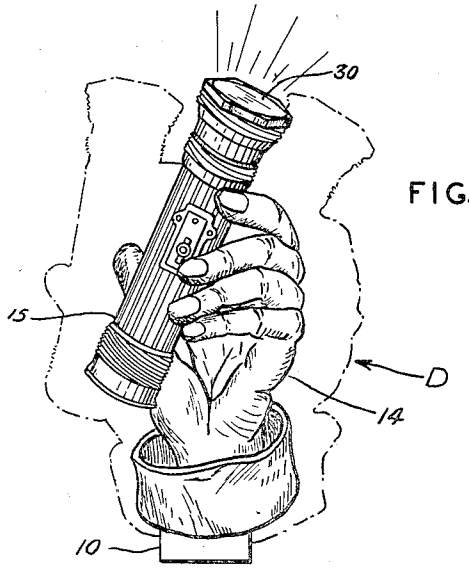


FIG. 1

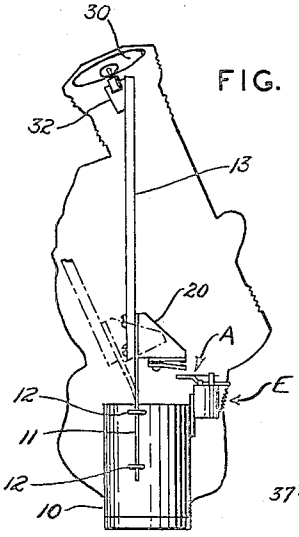


FIG. 2

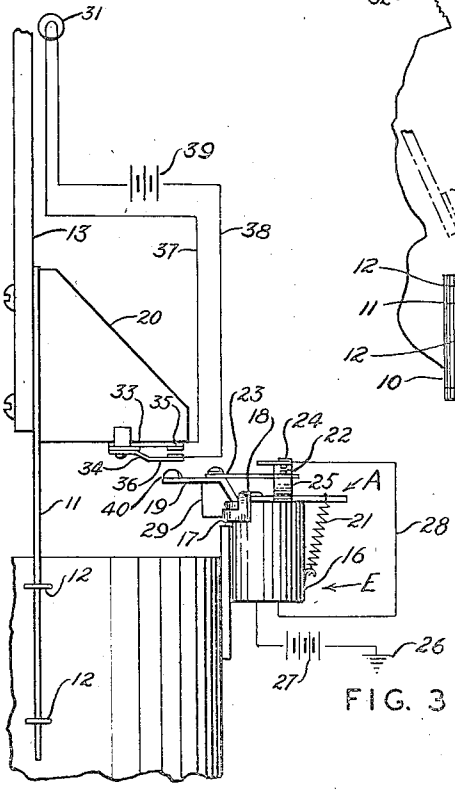


FIG. 3

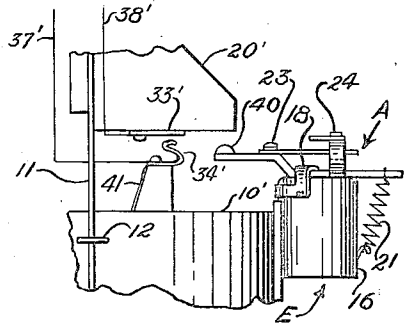


FIG. 4

INVENTOR
RALPH R. SMITH
BY
E. S. Greenewald
ATTORNEY

Patented Mar. 9, 1937

2,073,321

UNITED STATES PATENT OFFICE

2,073,321

DISPLAY DEVICE

Ralph R. Smith, Cleveland, Ohio, assignor, by mesne assignments, to Union Carbide and Carbon Corporation, a corporation of New York

Application July 13, 1935, Serial No. 31,163

12 Claims. (Cl. 40—139)

This invention relates to display devices, and more particularly to such devices wherein successive thrusts are imparted to a movable display member to maintain the latter in motion.

The main object of the present invention is to provide an inexpensive display device of simplified construction which is rigid and strong and requires a minimum amount of energy to maintain the display member in motion. This is accomplished by mounting the display member on a bendable resilient plate which is rigidly secured at one end to a support so that potential energy may be stored in the resilient plate by bending the same. At the end of each swing in one direction, such stored energy becomes operative to oscillate the display member in the opposite direction. Successive thrusts are imparted to the display member, as by the vibrating armature of an electromagnetic motor, to provide an amplitude of oscillation sufficient to maintain the display member in motion, such motor having a low current consumption and being operable by ordinary dry cells for a relatively long period of time.

The above and other objects and advantages of my invention will become apparent as the following description proceeds, having reference to the accompanying drawing, in which:

Fig. 1 is a front view of a display device embodying my invention, in which only the display member and the supporting base are visible;

Fig. 2 is a rear view of the device illustrated in Fig. 1, showing the supporting structure and operating mechanism, the electrical circuit being omitted;

Fig. 3 is an enlarged fragmentary view of the device shown in Fig. 2, and diagrammatically illustrates the electrical circuit of the operating mechanism; and

Fig. 4 is similar to Fig. 3 with the electrical connections omitted, and illustrates a modified arrangement of parts of the device.

Referring to Fig. 2 of the drawing, a portable display device embodying my invention may comprise a supporting base 10 having the lower end of a bendable resilient plate 11, such as a steel leaf spring, rigidly secured thereto. The supporting base may be formed of a block of wood which has sufficient weight and stability to keep the device steady and in an upright position during operation of the device. The wooden block 10 has a relatively long slot in one wall thereof to receive the lower end of the spring plate 11, and this spring plate may be maintained in position by staples 12 secured to each side of the wall.

An arm 13, which may be formed of wood, is secured at its lower end to the leaf spring 11 for supporting a display member D, such as lithographed cardboard, which is attached thereto and illustrated in Fig. 1 to represent a hand 14 holding a flashlight 15. The steel leaf spring 11 is sufficiently strong to provide a rigid support for the display member D and at the same time is resilient and flexible so that a swinging or oscillatory movement can readily be imparted to it and the display member D secured thereto.

Although successive thrusts may be imparted to the display member D at the end of each oscillation, suitable mechanism may be employed in most instances to impart successive thrusts intermittently or periodically to the display member when it is bent or flexed in one direction. Such operating mechanism may comprise a vibratory electromagnetic motor of the type described and claimed in my application Serial No. 25,242, filed June 6, 1935. The electromagnet E of the motor may be mounted on the base 10, and adapted to attract a floating armature A arranged at the upper end of the electromagnet E. The armature A may be provided with projections adapted to fit into recesses on the end of the shell 16 of the electromagnet, and may be maintained in position by a clamping member 17 fixed to the shell 16, the clamping member being provided with inwardly extending arms 18 having bent ends adapted to fit into recesses in the upper side of the armature A.

The armature A is bent intermediate its ends to provide an off-set end 19 which is disposed in the path of movement of a bracket 20 that is secured to the upper end of the leaf spring 11. When the display member D oscillates in the right-hand direction, referring to Figs. 2 and 3, the lower edge of the bracket 20 engages the off-set end 19 of the armature A. This causes the armature to retract from the end of the electromagnet E against the tension of a spring 21, the spring being secured to the shell 16 and armature A and arranged normally to maintain the armature A in its attracted position at the end of the electromagnet E.

When the armature A is retracted from the electromagnet E by the bracket 20, a movable contact 22, which is carried by a leaf spring 23 attached to the off-set end 19 of the armature, engages a fixed contact 24 secured to and insulated from a U-shaped yoke 25 having the arms thereof secured to the end of the shell 16. This completes the vibratory motor circuit from ground at 26 through dry cells indicated at 27, the winding of the electromagnet E, conductor 28, contacts 24 and 22, and leaf spring 23 which may be ground-

ed by a conductor 29 to the clamping member 17. Upon the closing of the contacts 24 and 22, therefore, the electromagnet E is energized and becomes effective to attract the armature A, such movement of the armature causing the off-set end 19 to move upwardly and impart a thrust to the bracket 20 to oscillate the display member D in the left-hand direction.

The thrust imparted to the display member D by the off-set end 19 of the armature is sufficiently strong to rock the display member past its normal vertical position indicated in solid lines in Fig. 2. As the display member moves from the normal vertical position to the position indicated in dotted lines in Fig. 2, potential energy is stored in the leaf spring 11; and, when the display member reaches the limit of its oscillation, this potential energy is converted to kinetic energy to rock or oscillate the display member in the right-hand direction. At one end of each swing, therefore, the potential energy in the leaf spring tends to oscillate the display member in the opposite direction past its normal vertical position, and at the opposite end of each swing the armature A is employed to impart a thrust to the bracket 20 to provide an amplitude of oscillation sufficient to maintain the display member in motion. Stated another way, once the device has started oscillating, the thrust imparted by the armature plus the potential energy stored in the leaf spring 11 at the moment the thrust is imparted is sufficient to oscillate or rock the display member past the normal vertical position and bend or flex the spring 11 so that the potential energy stored in the spring at the end of such oscillation is sufficiently great to oscillate the display member in the opposite direction to receive successive thrusts from the armature. The display member D then continues to swing back and forth in a vertical plane and through a substantial arc having its center at or close to the point of rigid connection of the spring 11 and the block 10, the main bending of the spring occurring at that point. In order that the thrusts imparted to the display member shall not tend to retard the free oscillatory movement of the latter, it is desirable to arrange the electromagnet E in such a position that the armature is effective to impart the thrusts when the display member is at the end of an oscillation or swing and has started or is about to reverse its direction of movement. In this manner the full power of the thrusts are imparted to the display member to accelerate its motion away from the electromagnet E.

Since the spring 21 maintains the armature A in its retracted position, the contacts 22 and 24 are open for the greater part of the time and current is consumed from the dry cells 27 only during the short interval of time that the bracket 20 contacts the off-set end 19 of the armature and retracts the latter from the end of the electromagnet E. This arrangement, combined with the fact that potential energy is stored in the spring 11 at the end of each oscillation of the display member, makes it possible to maintain the display member in motion with a minimum amount of electrical energy, and dry cells may therefore be used to operate the display member for a relatively long period of time.

In many instances it is desirable to light intermittently the entire display member or a portion thereof. In the present embodiment, for example, it may be desirable to simulate the operation of a flashlight by covering the lens portion 30 of the flashlight with transparent paper and mounting a small electric lamp 31 on a block 32 secured to the rear of the display member behind the lens portion 30. The lamp 31 may be intermittently energized in any suitable manner and, as shown in Fig. 3, a pair of flexible leaf springs 33 and 34 may be insulated from each other and attached to the bottom edge of the bracket 20. These leaf springs may carry contacts 35 and 36, respectively, which are connected through conductors 37 and 38 to the lamp 31, an ordinary dry cell 39 being connected in the conductor 38 to provide a source of electrical energy. Each time the display member D oscillates in the right-hand direction, the projection 40 at the off-set end 19 of the armature closes the contacts 35 and 36 to complete the circuit for lighting the lamp 31 to simulate the operation of a flashlight.

Instead of attaching the leaf springs 33 and 34 to the bottom edge of the bracket 20, only one leaf spring 33′ may be secured to the bracket 20′, as shown in Fig. 4, and the cooperating leaf spring 34′ may be secured to a block 41 mounted on the base 10′. In this modification leaf springs of suitable material, such as copper, may be employed without any contacts, and the lamp circuit completed through conductors 37′ and 38′ each time the display member flexes or moves in the right-hand direction to cause the leaf spring 33′ to contact the cooperating leaf spring 34′.

Instead of employing a single bendable plate, a plurality of plates may be employed, the frequency of vibration of any display member being dependent upon the resiliency of the bendable plate or plates used, the weight of the display member, and the position of the center of gravity of the display member. It will therefore be apparent that modifications may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A display device comprising, in combination, a support; a movable display member; a bendable resilient plate having its opposite ends rigidly secured to said support and to said member, respectively; and mechanism operable intermittently to impart a thrust contributing to move said member sufficiently to bend said plate, whereupon the resilience of the latter automatically returns said member to a position to receive successive thrusts.

2. A display device comprising, in combination, a base; a movable display member having an element thereof disposed above said base; a bendable resilient metal plate normally vertical and having its opposite ends rigidly secured to said base and to said element, respectively; and mechanism located at one extremity of the path of movement of said element and energized periodically to impart a thrust to said element to move said member and to bend said plate and store energy therein sufficient to return said element to a position to receive successive thrusts.

3. A display device as claimed in claim 2, in which said mechanism is so located and constructed that a thrust is imparted thereby only when said plate is bent in one direction from its normal vertical position; and such thrust, plus the resilience of the bent plate when a thrust is imparted thereto, is sufficient to move said element and display member in the opposite direction to the other extremity of their paths and to simultaneously bend said plate while storing therein sufficient energy to reverse the direction

of movement of said member and return said element to receive another thrust.

4. A display device comprising, in combination, a support; a display member movable back and forth in a vertical plane; a bendable resilient metal plate disposed perpendicular to said plane and having its opposite ends rigidly secured to said support and to said member, respectively; and mechanism operable periodically to impart a thrust to said member sufficient to bend said plate to a position where the resilience of the latter operates to periodically return said member to a position to receive successive thrusts by said mechanism, said mechanism comprising a movable armature element disposed in the path of and engageable by a part movable with said display member, a normally open electric current supply circuit adapted to be closed by said element when the latter is engaged by such movable part of the display member, and an electromagnet in said circuit adapted, when energized, to actuate said armature element and thereby impart a thrust to said part and display member approximately at the instant the latter begins to move in the reverse direction under the influence of the resilience of said metal plate.

5. A display device comprising the combination of a support, a bendable resilient plate having an end thereof rigidly secured to said support, a display member mounted on the opposite end of said resilient plate and swingable thereby, the potential energy stored in said plate at the end of each swing in one direction tending to swing said display member in the opposite direction, and means for maintaining said display member in motion.

6. A display device comprising the combination of a support, a bendable resilient plate having an end thereof rigidly secured to said support, a display member mounted on the opposite end of said resilient plate, said display member and part of said plate forming a unitary swingable structure capable of swinging through a substantial arc and the energy stored in said plate at the end of each swing in one direction tending to swing said display member in the opposite direction, and means for intermittently imparting thrusts to said swingable structure to provide an amplitude of swing sufficient to maintain said display member in motion.

7. A display device comprising the combination of a support, a bendable resilient plate having an end thereof rigidly secured to said support and a free end swingable in an arc perpendicular to the plane of said plate, a display member mounted on the free end of said plate and swingable therewith, the potential energy stored in said plate at the end of each swing in one direction tending to swing said display member in the opposite direction, means for periodically imparting thrusts to said display member to provide an amplitude of swing sufficient to maintain said display member in motion, a normally open electric circuit including a lamp mounted on said display member, and means for periodically closing said circuit to energize said lamp for an interval of time during each cycle of swing of said display member.

8. A display device comprising the combination of a support, a bendable resilient plate having an end thereof rigidly secured to said support and a freely swingable portion, a display member mounted on the freely swingable portion, the potential energy stored in said plate at the end of each swing in one direction tending to swing said display member in the opposite direction, and means including an electromagnet having an armature cooperating therewith and in the path of movement of a part of said display member for intermittently imparting thrusts to said display member to maintain said display member in motion.

9. A display device as defined in claim 8, including a normally open electric circuit in which said electromagnet is connected, and means operable to close said circuit and energize said electromagnet after said armature is engaged and moved by the part of said display member, such energizing of said electromagnet attracting said armature to impart a thrust to said display member.

10. A display device comprising in combination, a support; a movable display member; an enlongated bendable resilient element having its opposite ends rigidly secured to said support and to said member, respectively; and mechanism operable intermittently to impart a thrust to said member sufficient to bend said element, whereby the resilience of the latter automatically returns said member to a position to receive successive thrusts.

11. A display device comprising the combination of a display member and a base, means for supporting said display member including at least one resilient element having an end thereof rigidly secured to said base, said resilient element being bendable and capable of swinging said display member with the energy stored in said element at the end of a swing in one direction tending to swing said display member in the opposite direction, and means for maintaining said display member in motion after the swinging movement has been started.

12. A display device comprising, in combination, a support; a straight, bendable, resilient and normally vertical plate having a part thereof adjacent one end rigidly secured to said support, the remaining part of said plate being free to swing back and forth through an arc in a vertical plane; a display member rigidly secured to the freely swingable part of said plate; the energy stored in said plate at the end of each swing in one direction tending to swing said plate and said member in the opposite direction; and mechanism, energized at the end of a swing of said plate and said member in one direction, to impart a thrust contributing to swing said plate and said member in the opposite direction.

RALPH R. SMITH.