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L. J. KLEBANOFF ET AL

3,543,122

AUTOMATIC AEROSOL DISPENSER

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2 Sheets-Sheet 1

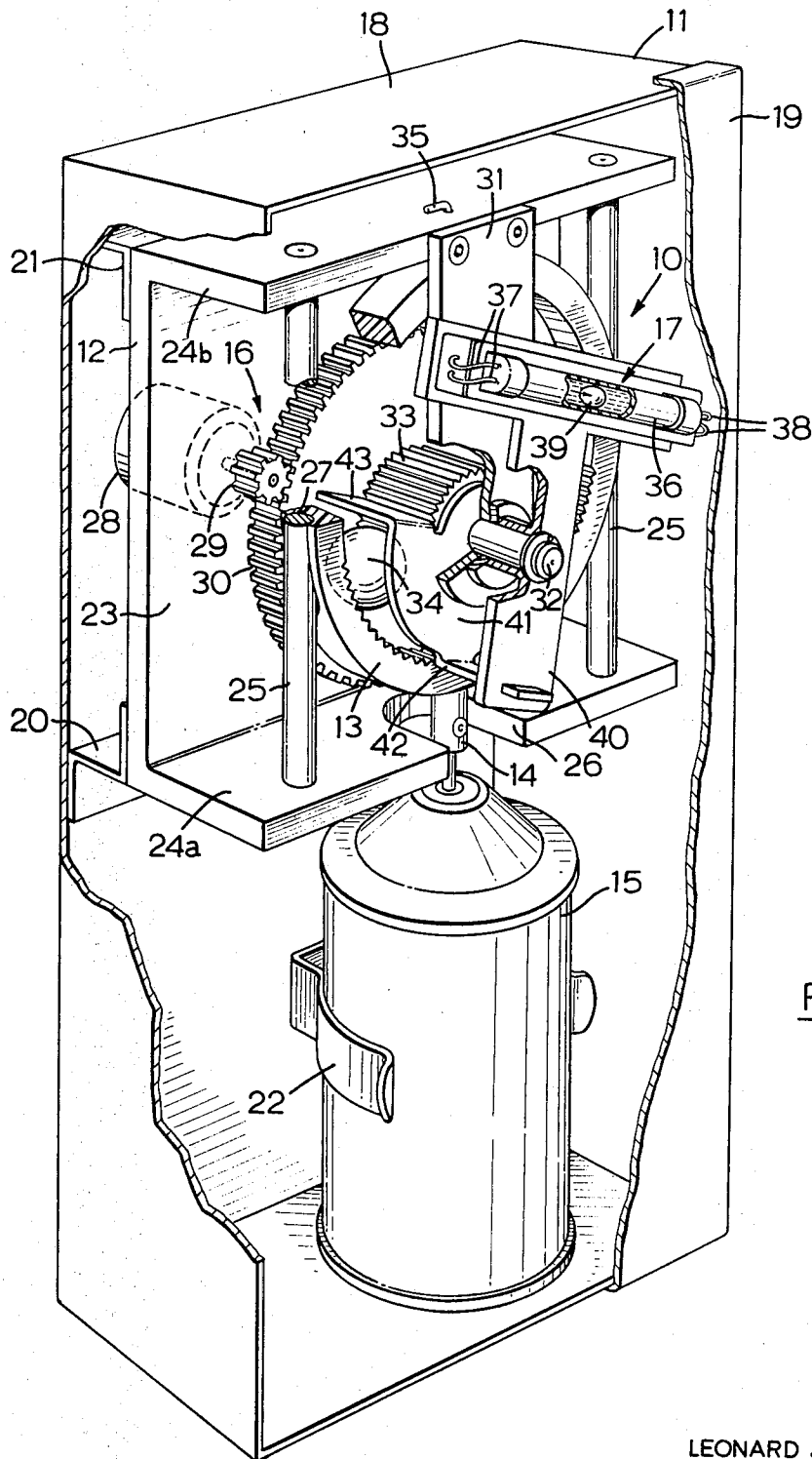


FIG. 1

INVENTORS
LEONARD J. KLEBANOFF
HENRY JAMES TAYLOR

BY
Rogers, Bereskin, & Parr

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FIG. 2

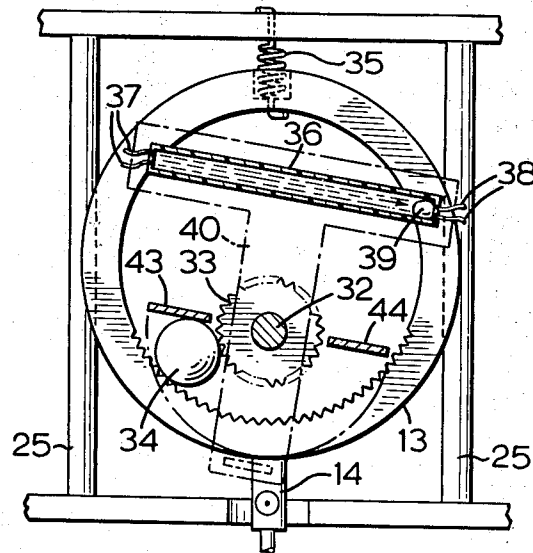


FIG. 3

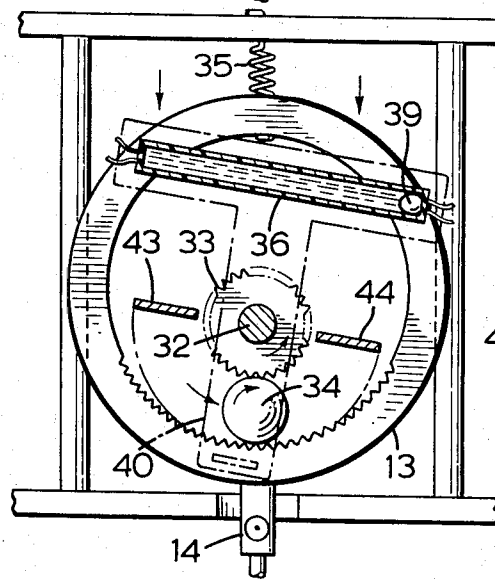
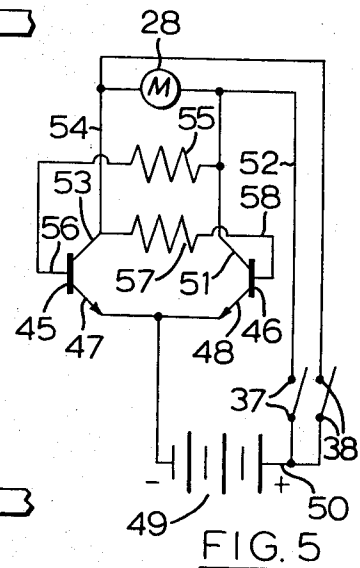
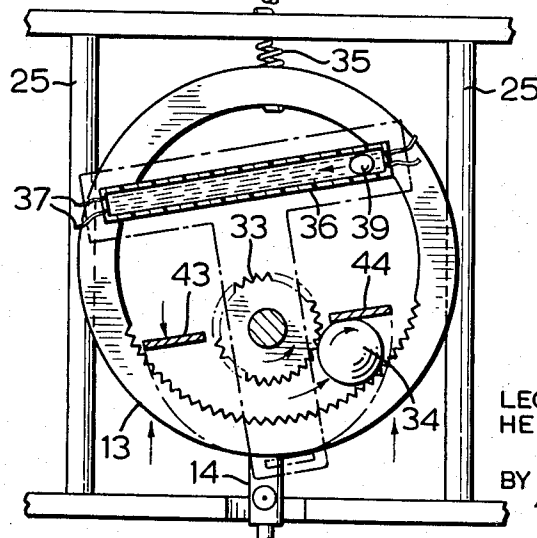


FIG. 4



INVENTORS
LEONARD J. KLEBANOFF
HENRY JAMES TAYLOR

BY *Rogers, Bereskin, & Parr*

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3,543,122

AUTOMATIC AEROSOL DISPENSER

Leonard J. Klebanoff, Willowdale, Ontario, and Henry James Taylor, Don Mills, Ontario, Canada, assignors to Air Guard Control of Canada Limited, Downsview, Ontario, Canada, a corporation

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5 Claims

ABSTRACT OF THE DISCLOSURE

An automatic aerosol dispenser for releasing measured bursts of aerosol spray at timed intervals. Timing is achieved by controlling the length of time required for a globule of mercury to slide down an inclined tube filled with a viscous fluid. Valve actuation is provided by an annular ring which is driven downwardly to open the valve by means of a small rubber ball positioned inside the annular ring. The rubber ball is in engagement with a rotatable motor-driven drum which also is positioned inside the annular ring. The dispenser is preferably battery powered, and battery drain is kept to a minimum as current is drawn only during the brief intervals when the aerosol is being released.

The invention relates to a timing mechanism for automatically periodically actuating a device, and in particular to an automatic timed aerosol dispenser for use with pressurized aerosol containers.

Pressurized aerosol containers have achieved wide usage in dispensing materials such as deodorizers, insecticides, germicides and the like. Such containers are commonly provided with a valve having an upwardly projecting stem carrying a spray nozzle. The valve is opened by depressing the stem, or in some cases, by tilting it to one side. There are two basic types of valves: one, wherein a spray is continuously dispensed as long as the valve is depressed, the other (usually referred to as the metering type) wherein the depression of the valve stem discharges a single measured burst of spray.

There are numerous applications in which it is advantageous to automatically periodically actuate the valve of the aerosol container to dispense a predetermined quantity of spray at periodic timed intervals, and there are numerous automatic dispensers presently on the market. Devices of this kind are commonly provided with an electric motor such as a clock motor, and means operated by the motor for periodically actuating the valve. Many of the prior devices of this kind operate with motors which are designed to be energized by alternating current at the usual mains voltages (e.g., 110 volts) and consequently it is necessary to provide a line cord for connecting the device to an alternating current outlet. Often it is desirable to place the device in a location where there is either no nearby outlet or where the provision of a line cord hanging from the device would be objectionable for reasons of appearance.

The present automatic dispenser is designed to be operated from flashlight batteries or other inexpensive compact batteries, and the arrangement is such that energy is drawn from the batteries only during the brief periods of time when the valve is actuated, for example for periods of five seconds every seven and one-half minutes. Accordingly, the battery drain is kept very low. Timing is provided by a pivotable tube containing a viscous liquid and a globule of mercury. The tube is pivoted about its center, and timing is accomplished by controlling the rate at which the mercury flows from one end of the tube to the other when the tube is inclined by

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a predetermined angle to the horizontal. The timing can be varied by changing the viscosity of the fluid. The inclination of the tube is reversed on successive cycles of operation so that the mercury is continuously travelling from one end of the tube to the other but in opposite directions during successive operating cycles. A small direct current motor is provided for furnishing the required drive for actuating the valve, and a simple valve actuator driven by the motor is provided for actuating the valve at periodic intervals. The valve actuator mechanism uses very few parts, and consequently it is economical to manufacture. A further advantage of the present mechanism is that it is so designed that the valve of the aerosol container is actuated only once during each cycle of operation, even if the motor should continue to coast for several revolutions due to the inertia of its moving parts after the circuit supplying current to the motor has been opened.

A preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:

FIG. 1 is a perspective view, partly broken away, showing a preferred embodiment of the invention,

FIGS. 2, 3 and 4 are diagrammatic sectional views taken on the line 2—2 in FIG. 1 showing the valve actuator mechanism of the invention in various stages of a cycle of operation, and

FIG. 5 is a schematic electrical diagram showing the electrical circuit of the device shown in FIG. 1.

Referring to the drawings, an automatic dispenser according to the invention is generally indicated by reference numeral 10 and it is provided with a housing 11 of any suitable shape. The dispenser 10 includes a frame member 12, actuator means including an annular ring 13 which is adapted to actuate a valve release member 14 of an aerosol container 15, rotary drive means 16 for driving the annular ring 13 against the valve release member 14 to thereby actuate it, and timing means 17 for actuating the drive means 16 at periodic timed intervals.

The housing 11 includes a rear box-like portion 18 and a front cover 19 which can releasably be attached to the rear portion 18. The housing can of course take other forms, but it should be designed to facilitate replacement of the aerosol containers, which in many cases require replacement about once per month. An opening (not shown) of appropriate size is formed in the cover 19 in line with the valve release member 14 to permit the spray to clear the housing.

The frame member 12, which is attached to the rear portion 18 of the housing 11 by means of brackets 20 and 21, is formed of a section of relatively thick walled aluminum channel, and it includes a web 23 and two flanges 24a and 24b extending at right angles from the web 23. A pair of spaced-apart opposed metal rods 25 extend between the flanges 24. The lower flange 24a is provided with a centrally located U-shaped cutout portion 26 for accommodating the valve release member 14. The aerosol container 15 is held in proper position by means of a clip 22 attached to the rear portion 18 of the housing 11. Other clamping means could of course be employed for holding the aerosol container 15 in its proper position.

The valve release member 14 of the aerosol container is actuated by means of the annular ring 13 which has diametrically opposed grooves 27. The rods 25 are partially received in the grooves 27, permitting the annular member to slide upwardly and downwardly. The bottom half of the inner peripheral wall of the annular member 13 is provided with a roughened surface, such as a series of serrations, as shown in FIG. 1. The annular member 13 is driven between an operative position wherein the valve release member is depressed and an inoperative

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position by means of the rotary drive means 16, as follows. A small motor 28, preferably of the direct current type, is provided with a small pinion gear 29 which drives a large spur gear 30. The gear 30 has a shaft 32 which is journaled at its rear end in the web 23. The front end of the shaft 32 is journaled in a rectangular plate 31 which extends between the flanges 24 of the frame 12. A circular drum 33 is secured to the shaft 32 in front of the gear 30, and it is also provided with a roughened surface consisting, for example, of a series of serrations as shown in FIG. 1.

The rotary motion of the drum 33 is converted into the rectilinear motion of the annular member 13 by means of a ball 34 which is positioned in the space between the drum 33 and the inner peripheral wall of the annular member 13. The ball 34 is of hard rubber or other similar material having a reasonably high coefficient of friction. As will be more fully explained below, rotation of the drum 33 causes the ball 34 to travel in a circular path from one side of the drum 33 to the other, and in so doing the annular member 13 is displaced downwardly to thereby actuate the valve release member 14. A spring 35, shown in FIGS. 2-4 inclusive, is connected to the upper end of the annular member 13 and to the upper web 24 of the frame 12. The spring 35 is used for drawing the annular member 13 upwardly after the ball 34 has passed through center.

As indicated above, it is desirable in devices of this kind to cause the valve of the aerosol container to be opened at timed intervals, for example once every seven and a half minutes, more or less. The timing means 17 of the present invention includes an elongated tube 36 having a pair of electrodes 37 and 38 at its respective ends. The tube 36 is filled with a viscous fluid, and it also contains a globule 39 of mercury. As will be explained below, the globule 39 completes the circuit between the respective pairs of electrodes 37 and 38 when the globule rests against one end or the other of the tube 36. The tube 36 is secured to a T-shaped bracket 40 which is pivotally supported on the shaft 32. The T-shaped bracket 40 is connected to a bracket 41, which also is pivotally supported on the shaft 32. The bracket 41 has an outwardly projecting flange 42 secured to the lower end of the T-shaped bracket 40, and a pair of inwardly projecting tabs 43 and 44 positioned at diametrically opposite sides of the drum 33. As can be seen in FIG. 1, the shaft 32 extends through openings in the brackets 40 and 41. The clearance between these openings and the shaft 32 is such that rotation of the shaft 32 does not cause the brackets 40 and 41 to rotate. Instead, the bracket 41 is rotated through a predetermined angle by the action of the ball 34 against either of the tabs 43 and 44 when the ball 34 is being driven from one side of the drum 33 to the other, as will be explained below.

When the globule 39 completes the circuit between the pair of electrodes 37 or 38, the motor 28 is energized and the valve release member 14 is actuated. It is then necessary to reverse the direction of rotation of the motor 28 for the next cycle of operation, in order to again drive the ball downwardly against the annular member 13. This is accomplished by means of an electronic circuit shown in FIG. 5. Switching is performed by means of a pair of NPN transistors 45 and 46 having emitters 47 and 48 which are tied together and connected to the negative terminal of a battery 49. One electrode of the pair of electrodes 37 is connected to one of the electrodes of the pair 38, and a lead 50 joins these common electrodes to the positive terminal of the battery 49. The other electrode of the pair 37 is connected to collector 51 of the transistor 46 by means of a lead 52, and the other electrode of the pair 38 is connected to collector 53 of the transistor 45 by means of a lead 54. A resistor 55 is connected between base 56 of the transistor 45 and the collector 51 of the transistor 46, and a resistor 57 is connected between base 58 of the transistor 46 and the

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collector 53 of the transistor 45. The motor 28 is connected across the leads 52 and 54.

Assuming the timing tube 36 is inclined so that the electrodes 38 are below the electrodes 37, the globule 39 of mercury will travel downwardly along the timing tube 36 and will eventually complete the circuit between the electrodes 38. When this occurs, the transistor 46 will conduct and the potential of the battery 49 will appear across the leads 52 and 54. During the next cycle of operation, the timing tube 36 will be inclined in the opposite direction, and the globule 39 will close the circuit between the electrodes 37 (the circuit between the electrodes 38 will be open). As a result, the lead 52 will be connected to the positive terminal of the battery 49, and the lead 54 will be connected to the negative terminal of the battery 49 through the transistor 45, which now conducts. Thus, the polarity of the voltage applied to the motor 28 is successively reversed during successive cycles, and as a result, the direction of rotation of the motor 28 is successively reversed.

The operation of the dispenser will now be described with reference to FIGS. 2, 3 and 4. Referring to FIG. 2, the annular ring 13 which actuates the valve release member 14 is shown in its inoperative position (maximum upward position), with the T-shaped member 40 inclined downwardly towards the right. Assuming that the globule 39 of mercury has just contacted the electrodes 38, completing the circuit between them, the motor 28 thereupon becomes energized and causes the drum 33 to rotate in a counterclockwise direction when viewed from the front as in FIG. 2. As a result, the ball 34 is driven downwardly in a counterclockwise direction, whereupon the annular member 13 is driven downwardly against the valve release member 14. This causes a spray of aerosol to be released. In FIG. 3 the center of the ball 34 is aligned with the centers of the drum 33 and the valve release member 14. This is the "operative" position of the annular member 13, and in this position the valve release member 14 is sufficiently depressed so as to actuate the valve of the aerosol container 15 to release a charge of aerosol spray. It is important to note that the T-shaped member 40 has not moved during this portion of the motion of the ball 34. While the T-shaped member remains in the position shown in FIGS. 2 and 3, the circuit between the electrodes 38 remains closed, and the motor 28 continues to drive the drum 33. Further rotation of the drum 33 causes the ball 34 to rotate upwardly, still in a counterclockwise direction as shown in FIG. 4, and eventually the ball 34 hits the tab 44 causing the T-shaped member to pivot about its axis until finally the ball 34 comes out of mesh with the drum 33 and the inner peripheral wall of the annular member 13. The position where the ball 34 comes out of mesh defines a limit position of the bracket 41 and hence defines the angle of inclination of the T-shaped member 40. The globule 39 of mercury then proceeds to travel downwardly through the tube 36 towards the electrodes 37, and as soon as contact is broken with the electrodes 38, the current supplied to the motor 28 is interrupted. It is possible the motor 28 may coast for a short period of time due to inertia, but this will not affect the mechanism as further rotation of the drum 33 continues to be in the counterclockwise direction. The ball 34 will not move downwardly again (and hence the annular member 13 remains in its inoperative position) until the direction of rotation of the drum 33 is reversed. The return of the annular member 13 to its inoperative position at the completion of a cycle of operation is assisted by the spring 35.

The globule 39 of mercury will continue to proceed downwardly across the length of the timing tube 36 until eventually it completes the circuit between the electrodes 37. As soon as this occurs, the motor 28 again is energized, but this time the polarity of the voltage applied to the motor 28 is reversed so that the shaft of the motor

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28 rotates in the opposite direction. As a result, the drum 33 will now rotate in a clockwise direction, driving the ball 34 downwardly in a clockwise direction. The further operation of the device is identical to the operation described above, except for the sense of rotation of the moving parts. After the ball 34 has passed through the center it eventually contacts the tab 43, causing the T-shaped member 40 to pivot to its opposite inclination (see FIGS. 2 and 3).

Timing can be controlled by varying the viscosity of the fluid in the timing tube 36. In a prototype of the dispenser, which was designed to dispense spray at intervals of seven and one half minutes, the fluid was a silicone fluid identified by Dow-Corning Silicones Limited, of Toronto, Ontario, as No. 200 damping fluid. This fluid has a viscosity of approximately 15,000 centistokes. The inner diameter of the timing tube 36 was about 0.2", and it was approximately two inches in length. The motor 28 was designed to operate with a battery of approximately three volts, and the pinion gear 29 rotated at a speed of approximately 400 r.p.m. The size of the motor and its speed will of course depend upon the particular application.

It is desirable to release a measured quantity of spray on each occasion the container valve is opened. This can be done either by designing the mechanism so that the valve is opened for a desired period of time, or by using aerosol containers having metering type valves. The use of containers having metering type valves simplifies the design of the mechanism as it is merely necessary to ensure the valve is opened for a minimum length of time (depending on the particular valve) sufficient to draw a measured charge of liquid into the valve.

As an alternative to the electronic circuit shown in FIG. 5 for reversing the battery voltage, it is contemplated that an additional set of batteries could be employed for reversing the motor direction. In such case, the pair of electrodes 37 would be used for completing the circuit between one set of batteries and the motor and similarly the other pair of electrodes 38 would be used for completing the circuit between the other pair of batteries and the motor, the polarity of the voltage across the motor being reversed on successive cycles.

What we claim as our invention is:

1. A timing mechanism for automatically periodically actuating a device such as a valve release member of a pressurized aerosol container, comprising

(a) actuator means movable in rectilinear reciprocation between an operative position wherein said device is actuated and an inoperative position wherein said device is not actuated, said actuator means comprising an annular member slidably attached to a frame and having an inner peripheral wall, an outer peripheral wall and a horizontal central axis, said annular member being movable upwardly and downwardly in a path towards and away from said device and positioned so that a portion of the lower surface of said outer wall engages said device during a portion of the travel of said annular member, a rotatable drum journaled for rotation on said frame, said drum having an axis of rotation which is parallel to and spaced vertically downwards from said axis of said annular member, and a circular member positioned between said drum and said annular member and adapted by virtue of its frictional engagement with said drum and said inner wall of the annular member, to drive said annular member downwardly in response to rotation of said drum in a direction urging said circular member downwards,

(b) controllable rotary drive means for driving said

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actuator means between said operative and inoperative positions and vice versa, including means for converting the rotary motion of said drive means to the rectilinear motion of said actuator means,

(c) means for successively reversing the direction of rotation of said drive means after each cycle of operation, and

(d) timing means for activating said drive means at predetermined periodic intervals of sufficient duration to permit said actuator means to travel from said inoperative position to said operative position and to return to said inoperative position.

2. A timing mechanism as claimed in claim 1 wherein said timing means comprises an elongated timing tube filled with a viscous liquid and containing an electrically conductive body movable from one end of said tube to the other, at least one electrode at each end of the tube positioned for engagement with said conductive body, and means for pivotally supporting said timing tube, said supporting means being reciprocable between a first position wherein the axis of the tube is inclined to the horizontal by a predetermined angle and a second position wherein the axis of the tube is inclined to the horizontal by an angle equal to the reciprocal of said predetermined angle, whereby said body travels from one end of said tube to the other by gravity at a predetermined rate, and means for successively reversing the inclination of said tube after each operating cycle of said timing mechanism.

3. A timing mechanism as claimed in claim 2 wherein said circular member is a ball and wherein the supporting means for the timing tube includes a pair of inwardly extending tabs, said tabs being positioned between said drum and said annular member or diametrically opposite sides of said drum, said tabs being in the path of said ball whereby said tabs are alternately elevated by said ball after successive operating cycles and the inclination of said timing tube is thereby reversed after each successive operating cycle.

4. A timing mechanism as claimed in claim 1 wherein said drive means includes a direct current motor, wherein said timing means includes an electric circuit having a battery for energizing said motor, and wherein said direction reversing means includes electronic circuit means for reversing the polarity of voltage applied to said motor after each cycle of operation.

5. A timing mechanism as claimed in claim 2 wherein said drive means includes a direct current motor, wherein said timing means includes an electric circuit having a battery for energizing said motor, and wherein said direction reversing means includes electronic circuit means for reversing the polarity of voltage applied to said motor after each cycle of operation.

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BENJAMIN DOBECK, Primary Examiner

R. J. HICKEY, Assistant Examiner

U.S. Cl. X.R.

74—3.5; 200—32; 239—70