United States Patent [19]

Rogerson

[11] **3,739,944**

[45] **June 19, 1973**

[54] **AUTOMATIC PERIODICALLY ACTUATED SPRAY DISPENSER**

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[73] Assignee: **Westinghouse Electric Corporation,** Pittsburgh, Pa.

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[21] Appl. No.: **256,733**

[52] **U.S. Cl.** **222/70,** 239/70

[51] **Int. Cl.** **B67d 5/08**

[58] **Field of Search** 222/70, 76, 504; 239/70; 318/443

[56] **References Cited**

UNITED STATES PATENTS

2,928,573 3/1960 Edelstein 222/70

Primary Examiner—Robert B. Reeves
Assistant Examiner—Larry Martin
Attorney—F. H. Henson and E. C. Arenz

[57] **ABSTRACT**

An apparatus for automatically and periodically discharging a metered quantity of spray from an aerosol container is described. A DC motor is directly coupled in positive relationship through a reduction gear train and a valve contacting element with a metering valve of an aerosol container. A timing circuit which couples a battery power source to the DC motor delivers periodic power pulses to energize the motor and actuate the container valve. The spring return force in the valve returns the valve contacting element to its normal position at the end of each power pulse without requiring a disconnection of the positively coupled DC motor.

7 Claims, 5 Drawing Figures

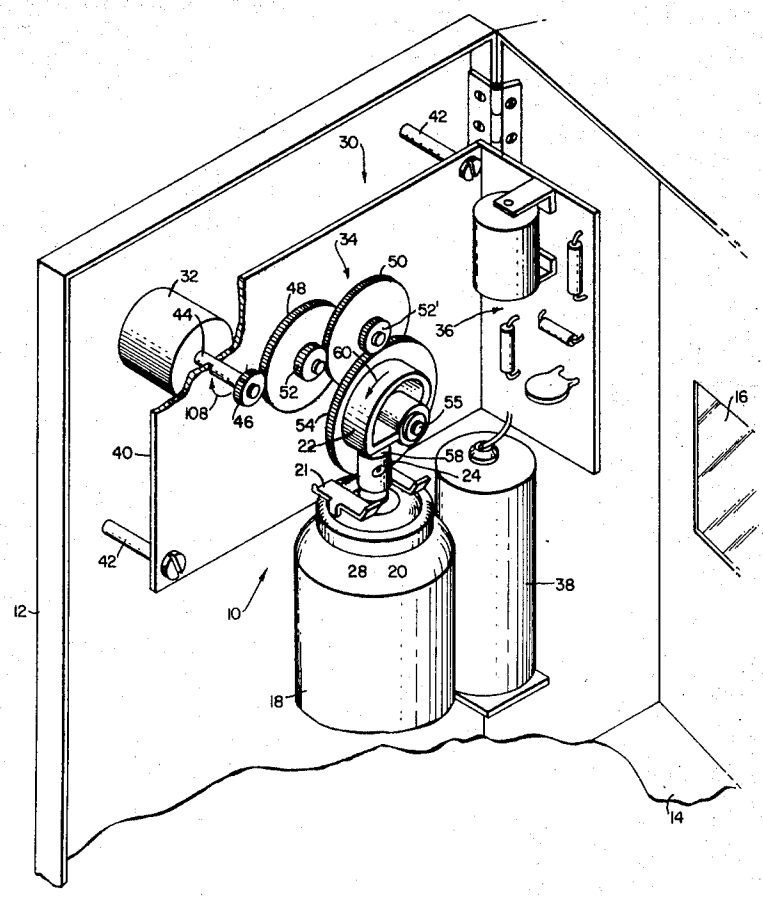
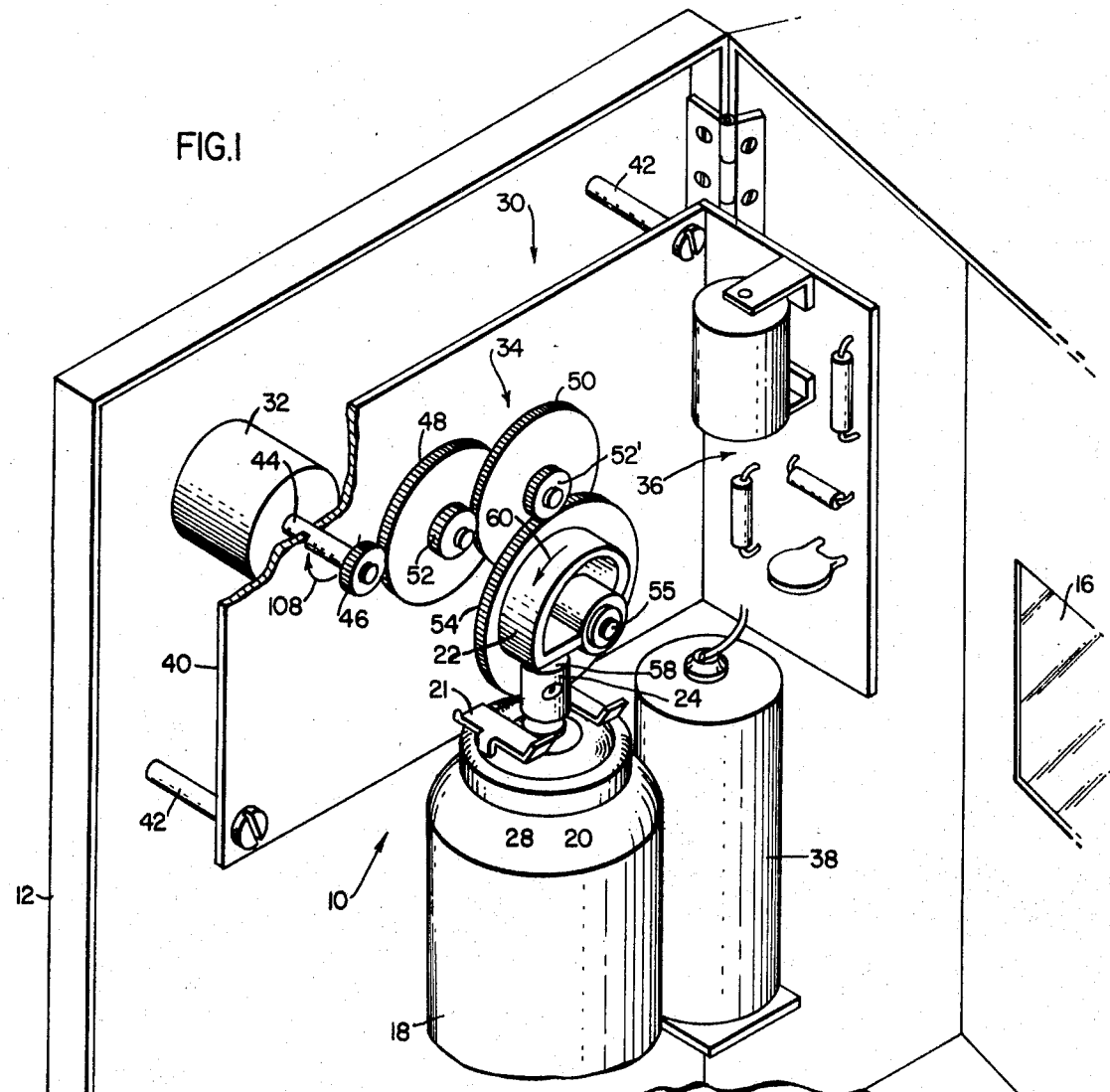


FIG.1



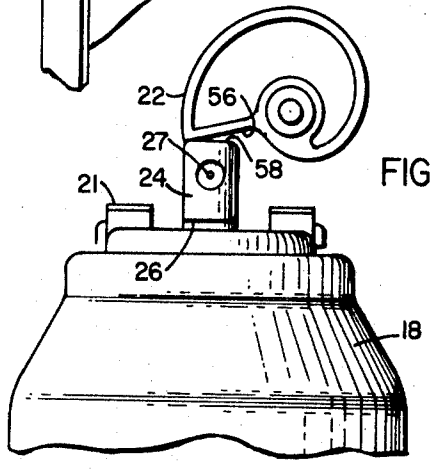


FIG.3

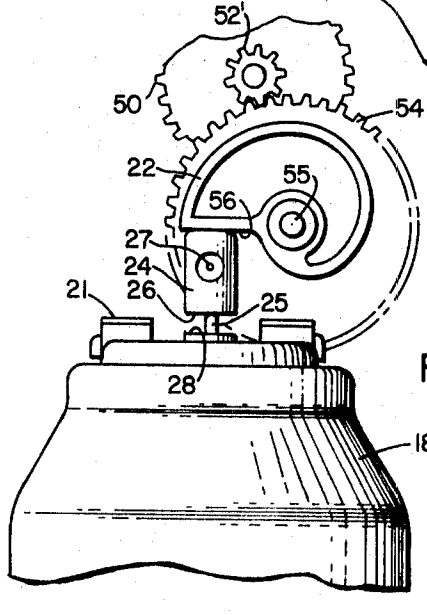


FIG.2

FIG.5

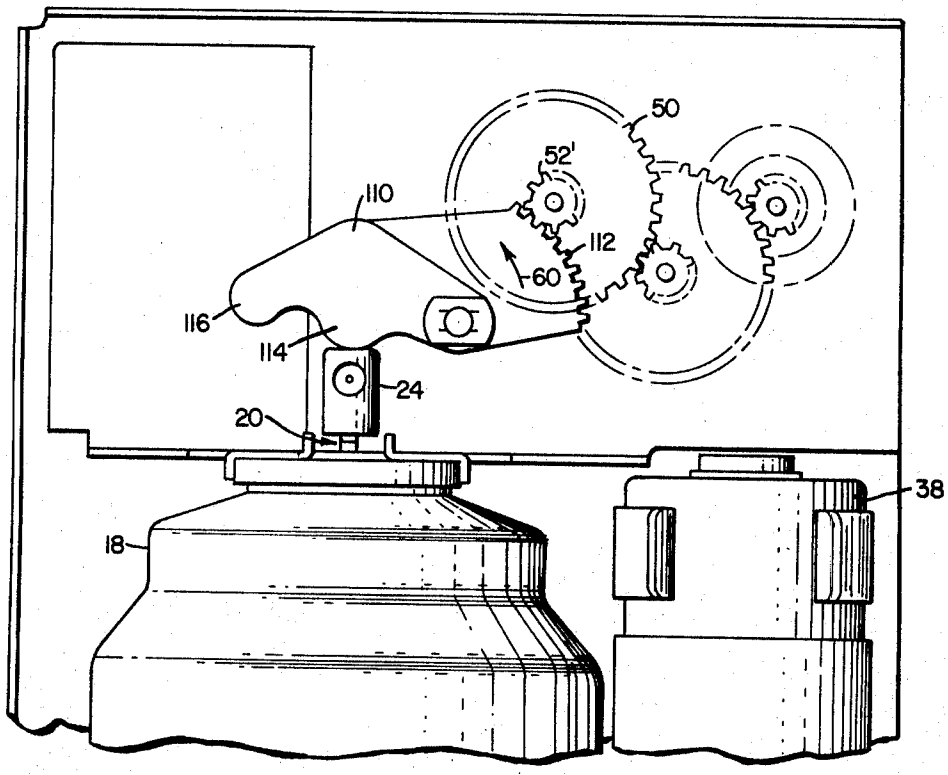
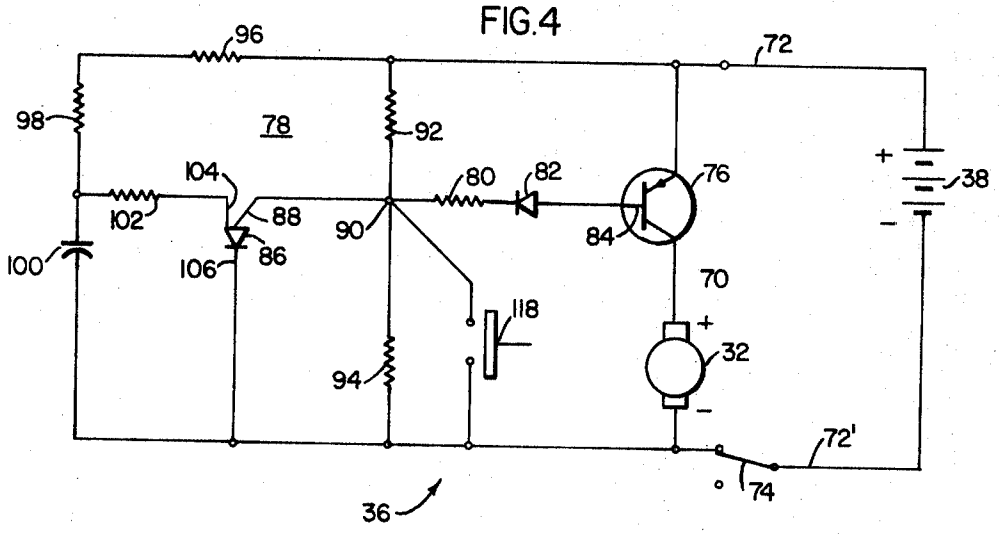

50
52'
110
112
60
116
114
24
20
38
18

FIG.4


96
72
98
78
92
104
80
82
76
38
102
88
90
84
100
106
86
70
118
32
94
72'
74
36

AUTOMATIC PERIODICALLY ACTUATED SPRAY DISPENSER

BACKGROUND OF THE INVENTION

This invention relates to an apparatus for automatically and periodically discharging a metered quantity of spray from an aerosol container. More specifically, this invention relates to an automatic spray dispenser which is capable of operating off commonly available batteries for extremely long time periods.

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

There are numerous applications in which it is advantageous to automatically and periodically actuate the valve of the aerosol container to dispense a predetermined quantity of spray at periodic timed intervals. There are also numerous automatic dispensers presently on the market. Devices of this kind are commonly provided with an electric motor with means for periodically actuating the valve. Other devices of this kind operate with motors which are energized by high voltage alternating current at the usual line potential. Consequently, it is necessary to provide a line cord for connecting such device to the alternating current source. When it is desired to place the device in a location where there is either no nearby outlet or whereby the provision of a line cord would be objectionable, battery electrical power sources are to be employed.

The present automatic aerosol dispenser is designed to operate from flashlight batteries or such other similar inexpensive electric storage units with a minimum of energy drainage being demanded from the battery during the brief time periods when the valve is actuated. In a typical application of an aerosol container in accordance with the invention, the valve is actuated once every 15 minutes for a very brief time in the order of a half a second. Devices for driving a DC motor from batteries to accomplish a periodic actuation from an aerosol container are well known. See for example the U. S. Pat. to Klebanoff et al. No. 3,543,122. In this patent an automatic aerosol dispenser is disclosed wherein a DC motor drives a gear which, in turn, is coupled by means of an eccentric drive to a valve actuator in the form of a ring. The eccentric drive includes a ball which is driven between the ring and a drum to drive the ring against the valve to emit a burst of spray. The ring is spring loaded so that upon reversal of the DC motor, as controlled by a separate reversing element, valve actuation is terminated.

Another DC motor driven automatic aerosol dispensing device is disclosed in the U. S. Pat. to Goldsholl et al. No. 3,289,886. In this patent a DC motor is shown connected through reduction gearing to a cam. The cam, in turn, is engaged by a cam follower which is coupled to a spring loaded valve-engaging element. The valve-engaging element is urged downwardly against the valve. When an undulation on the cam is rotated to an appropriate position by the DC motor, the valve-engaging element is released to depress the valve and a burst of spray is emitted. In addition, the output of the reduction gear train rotates a mechanical delay-switch which periodically energizes the motor for short time periods to rotate the cam 180° for a valve actuation.

The automatic aerosol dispensing devices shown in Klebanoff et al. and Goldsholl et al. include mechanical elements which increase the complexity of the device. For example, the mechanical delays employed in both of these devices require additional structural features which are rotated by the motor. Additional mechanical elements such as the cam in Goldsholl et al. or the eccentric ball mount in Klebanoff et al. are necessary to actuate the output valve of an aerosol container. A spring loading feature employed in the Goldsholl et al. dispenser presents an additional undesired force which must be overcome during rotation of the motor and thus, demands additional energy from the power supply.

In another type of periodically operated aerosol container, a motor may be employed which is continuously rotated on AC power. See for example, the automatic spray dispensers in Montgomery U.S. Pat. No. 3,018,056, Edelstein U.S. Pat. No. 2,928,573 and Kraus U.S. Pat. No. 2,613,108.

In Edelstein, a valve is depressed by a flat metal plate connected to the output shaft of a reduction gear train driven by a synchronous AC motor. The motor is continuously operated, but when the metal plate contacts and depresses the metering valve, an automatic motor reversal occurs. As the flat metal plate is then rotated away from the valve, contact is made with a stop where another motor reversal arises to again advance the flat metal plate to the valve for its actuation. The automatic spray dispenser described in Montgomery utilizes a continuously driven cam to pivot a pair of valve-engaging links in sequence for a metered burst of spray.

Periodically operated solenoids are employed in automatic aerosol dispensers as described in the U. S. patents to Gray No. 3,351,240 and Mangel No. 3,187,949.

In Gray, an electronic timing circuit generates an output pulse which turns an electronic transistor switch on for a time period sufficient to energize a solenoid whose armature is moved to permit the emission of a burst of spray. Both in Mangel and Gray, the armatures of the solenoids form an integral part of a modified valve. Such construction is complex and tends to demand excessive electrical power from limited power sources such as batteries.

SUMMARY OF THE INVENTION

In an automatic spray dispenser in accordance with the invention, a DC motor is positively coupled by a reduction gear train and a valve contacting element to the output valve of an aerosol container. The valve contacting element which normally rests upon the output valve, depresses it upon motor actuation. A timing circuit delivers pulses of electrical power from a battery power source to the motor. As the DC motor is rotated during a power pulse, the valve contacting element depresses the output valve which emits a measured burst of spray.

Motor rotation persists until the valve seats at the end of its stroke. In effect, therefore, the DC motor is stalled towards the end of the power pulse. When power to the DC motor is terminated at the end of a

power pulse, the spring loaded valve is allowed to return the valve contacting element to its normal position. During this return, the DC motor, though being positively connected to the valve contacting element, need not be disconnected, but may be reversely rotated. After a predetermined delay, the timing circuit generates another power pulse to again actuate the aerosol container for another burst of spray.

With an automatic, self-powered spray dispensing device in accordance with the invention, a battery lifetime of the order of one year is obtained. This is obtained with a silent drive structure which presents a very low current drain each time the DC motor is actuated.

With a spray dispenser in accordance with the invention, structural elements such as the spring and cam in Goldsholl et al., or the eccentric drive of Klebanoff et al., have been conveniently deleted. Furthermore, the complex solenoid structures such as used in Mangel and Gray have been bypassed with a spray dispenser of this invention which utilizes commonly available aerosol dispensers without structural modification.

It is, therefore, an object of the invention to provide a quiet, self-powered, automatic spray dispenser which may be operated from batteries for very long time periods with a practical economic valve actuating structure.

BRIEF DESCRIPTION OF DRAWINGS

These and other objects and advantages of an automatic spray dispenser in accordance with the invention may be understood from the following description of an embodiment described in conjunction with the drawings wherein

FIG. 1 is a perspective partial view of an automatic spray dispenser in accordance with the invention;

FIGS. 2 and 3 are each an enlarged frontal view of a valve-contacting element employed on an automatic spray dispenser shown in FIG. 1 and respectively show a normal and actuated position of the valve contacting element;

FIG. 4 is a schematic of a timing circuit employed with the automatic spray dispenser shown in FIG. 1; and

FIG. 5 is a frontal view of an alternate valve driving structure employed in an automatic spray dispenser in accordance with the invention.

DETAILED DESCRIPTION OF EMBODIMENT

With reference to FIGS. 1, 2 and 3, an automatic spray dispenser **10** in accordance with the invention is shown mounted on a back door **12** of a cabinet **14**. The cabinet **14** has an opening **16** through which a burst of spray from an aerosol container **18** can be discharged into a room. The aerosol container **18** is supported on a ledge (not shown) to place its valve **20** beneath a retainer bracket **21** and a valve engaging element **22**. Valve **20** is of the metered type which, upon a downward movement of nozzle **24**, emits a measured amount of spray through stem **25** and opening **27**. The amount of spray usually is of the order of 100 milligrams. The valve nozzle **24** is spring loaded upwards so that a downward or inward force is needed to actuate the valve. The valve motion needed to obtain a burst of spray is small and downward movement of the valve nozzle **24** is limited when its lower surface **26** contacts seat **28**.

A self-powered automatic actuator **30** is used to depress valve **20** and includes a DC motor **32**, a reduction gear train **34**, an electric timing circuit **36** and a supply **38** of DC power in the form of a pair of series connected flashlight batteries. The DC motor **32** and gear train **34** are mounted on a bracket **40**, which is spaced from back door **12** by spacers **42**, to locate the valve actuator **22** directly over nozzle **24**, as shown.

DC motor **32** has an output shaft **44** provided with a pinion **46** which engages a first cluster gear **48** in the reduction gear train **34**. The gear train **34** is shown formed of a number of reductions with first and second cluster gears **48** and **50**, each of which is further provided with pinions **52–52'** respectively to provide the desired torque conversion in a well-known manner.

The output pinion **52'** engages a gear **54** rotatable about axis **55** and which gear is firmly affixed to the valve engaging element **22** or may form an integral part therewith. The valve engaging element **22** has a contact edge **56** which is disposed to engage the top **58** of nozzle **24** when rotated counter-clockwise in the direction of arrow **60**. FIG. **2** clearly illustrates a mechanical advantage obtained by locating the contact area between valve actuating element **22** and surface **58** of nozzle **24** closer to the axis of rotation **55** than the driving contact between pinion **52'** and gear **54**. The DC motor **32**, is thus positively coupled to the valve **20**.

FIG. **4** illustrates electrical details of timing circuit **36** which produces a power pulse on line **70** to drive DC motor **32**. A pair of series connected D sized flashlight batteries (smaller sizes may be employed) deliver a three volt source across a pair of power leads **72–72'**. Lead **72'** is coupled through an on-off switch **74** to the negative input side of motor **32** and lead **72** is connected through an output transistor switch **76** to the positive side of motor **32**. The transistor output switch **76** is controlled by a unijunction timer network **78** which is connected through a current limiting resistor **80** and diode **82** to the base **84** of output transistor **76**.

Unijunction timer network **78** includes a programmable unijunction **86** whose triggering level is a function of the bias potential developed on its gate **88** by the voltage on a junction **90** formed by series coupled resistors **92** and **94**. A charging network formed by series coupled resistors **96, 98** and capacitor **100** provide the desired timing function. A current limiting low value resistor **102** couples capacitor **100** to anode **104** of unijunction transistor **86**. The values of resistors **92, 94, 96** and **98** and the capacitance of capacitor **100** are chosen to develop the desired periodic triggering of unijunction **86**, say once every twelve to fifteen minutes.

During operation of timing network **78**, the bias voltage normally developed at junction **90** is insufficient to overcome the base to emitter voltage of output transistor switch **76** plus the forward voltage of diode **82**. Hence, output transistor switch **76** is normally nonconducting and DC motor **32** remains de-energized. As capacitor **100** is charged through resistors **96** and **98**, the voltage of anode **104** reaches the triggering level for unijunction **86**. At the triggering level the impedance between anode **104** and cathode **106** drops to a low value and capacitor **100** is discharged through resistor **102**. At the same time, the impedance between gate **88** and cathode **106** also drops so that the voltage at junction **90** is pulled to a level which is sufficiently low to establish a forward bias on the base to emitter

junction of output transistor 76 and cause the latter to conduct.

As soon as transistor 76 conducts and current flows through motor 32, the latter starts to turn in the direction of arrow 108 (see FIG. 1) to drive the valve contacting element 22 against nozzle 24 and actuate metered valve 20 as shown in FIG. 3. The conduction of output transistor 76 continues for the time needed to discharge capacitor 100. This time period (generally about half a second) is selected commensurate with the inertia of the mechanic components and the time needed to obtain a burst of spray from the metered valve 20.

When capacitor 100 has discharged to a minimum voltage, which is a function of the characteristics of unijunction transistor 86, the latter's anode to cathode and gate to cathode junctions will again become high impedances. The bias voltage of junction 90 is then re-established, to again bias the base to emitter voltage of output transistor 76 below cut-off and de-energize DC motor 32.

The power pulse from transistor 76 provides sufficient power to drive the nozzle 24 to its seated position, as shown in FIG. 3. In this position, drive motor 32 is stalled and remains that way until the end of the power pulse. When power is no longer applied, the spring action from valve 20 pushes nozzle 24 upwardly and is sufficient to return valve contacting element 22 to its normal position as shown in FIGS. 1 and 2. This return movement effectively reverses the rotational output shaft 44 of DC motor 32, which, in view of the removal of electrical power, is freely permitted.

The power demanded of batteries 38 is a function of the force needed to depress valve 20, the length of stroke to dispense the efficiency of the torque conversion, the standby power consumption (primarily small current drain by resistors 92 and 94), and the frequency of operation. When a low pressure metering valve is employed, such as one which requires a downward pressure of the order of only several pounds, a pair of D size batteries will be sufficient to operate the spray dispenser for an entire year with timing intervals of the order of 15 minutes. The quantity of spray emitted may be increased by increasing the frequency of valve actuations. When the type of spary or the room into which it is discharged so dictate, the quantity of spray emitted with each actuation may be varied with the substitution of a different valve. If then, in addition, an average discharge over extended time periods must be maintained, the timing intervals produced by the timing circuit may be varied to accomplish this.

The pulsed operation of DC motor 32 with its direct positive coupling with valve 20 advantageously dispenses with components such as return springs, motor reversing elements, cams and the like as employed in prior art automatic spray dispensers. The simplicity of an automatic spray dispenser of this invention may further be appreciated with reference to the modification shown in FIG. 5.

In FIG. 5 a valve actuating element is shown in the form of a multilobed extension 110 which forms an integral part with a gear segment 112 driven by pinion 52'. The inner lobe 114 of extension 110 is disposed in contact with nozzle 24 similar to surface 56 of the valve engaging element 22 in FIG. 2. A gear segment 112 is employed since this will provide sufficient rotational drive to depress the valve 20 through its range of about an eighth of an inch. The second lobe 116 is provided at the end of extension 110 for connection to a lever (not shown) extending transversely out of the plane of the drawing and by which one may manually actuate valve 20.

As shown in FIG. 4, a normally open push button switch 118 is further provided for connection between junction 90 and return lead 72'. When this push button 118 is actuated, junction 90 is pulled down in voltage to energize motor 32 as if unijunction 86 had been fired. In this manner, a convenient testing of the spray dispenser may be obtained.

Having thus described an automatic spray dispenser in accordance with the invention, its advantages may be appreciated. The pulsed operation and direct positive coupling between the DC motor and the aerosol container valve provides a highly efficient use of available battery power. The direct gear drive without extraneous spring devices provides a low noise operation with reliable performance over extended time periods.

What is claimed is

1. An apparatus for automatically and periodically discharging a metered quantity of spray from an aerosol container having an outwardly biased valve which emits the metered quantity of spray when inwardly depressed comprising

a DC motor and a valve contacting element disposed to depress the output valve of the aerosol container,

a reduction gear train positively connecting the DC motor to the valve contacting element to deliver sufficient torque to drive the valve contacting element against the output valve and depress the latter upon DC motor energization, said reduction gear train and positively connected DC motor further enabling the bias of the output valve to return the valve contacting element to its normally disposed position when the DC motor is de-energized,

a supply of DC power, and

a timing circuit coupling the DC power supply to the DC motor, said timing circuit producing output power pulses to periodically energize the DC motor for sufficient duration to drive the valve contacting element in a first direction and depress the output valve for a discharge of a metered quantity of spray, the power pulses from said timing circuit being of sufficient duration to seat the output valve and stall the DC motor, said valve contacting element being moved in a reverse direction to its normal position at the end of each power pulse to prepare for a succeeding power pulse from the timing circuit.

2. The apparatus for automatically emitting bursts of spray from an aerosol container as claimed in claim 1 wherein said valve contacting element is provided with an integrally connected gear in meshing relationship with the reduction gear train for positive coupling with the DC motor.

3. The apparatus for automatically emitting bursts of spray from an aerosol container as claimed in claim 2 wherein said valve contacting element is in the form of an extension with a lobe oriented to contact the output valve.

4. An apparatus for automatically and periodically discharging a metered quantity of spray from an aerosol container having an outwardly spring biased valve

which emits the metered quantity of spray when inwardly depressed comprising

a DC motor and a rotatably mounted valve contacting element disposed to depress the output valve of the aerosol container,

a reduction gear train positively connecting the DC motor to the valve contacting element to deliver sufficient torque to rotate the valve contacting element and depress the output valve upon DC motor energization, said reduction gear train further enabling the spring bias of the output valve to return the valve contacting element to its normally disposed position with a reversal of rotation of the positively connected DC motor when the latter is de-energized,

a supply of DC power, and

a timing circuit coupling the DC power supply to the DC motor, said timing circuit producing output power pulses to periodically energize the DC motor for sufficient duration to rotate the valve contacting element in a first direction and depress the output valve for a discharge of a metered quantity of spray followed with a reverse rotation of the valve contacting element and the DC motor at the end of each power pulse to prepare for a succeeding power pulse from the timing circuit.

5. The apparatus for automatically and periodically dispensing a burst of spray as claimed in claim **4** wherein said valve contacting element is provided with a gear operatively engaged by the gear train to drive the valve contacting element into rotation and permit the output valve to cause said reverse rotation of the valve contacting element and the DC motor.

6. The apparatus for automatically and periodically dispensing a burst of spray as claimed in claim **5** wherein said valve contacting element engages the output valve at a location which is radially inwardly relative to the driving point between the gear train and the gear on the valve contacting element for an enhanced mechanical advantage during output valve actuation.

7. The apparatus for automatically and periodically dispensing a burst of spray as claimed in claim **6** wherein said gear on the valve contacting element is in the form of a segment of a gear and is an integral part of the valve contacting element.

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