March 15, 1960 A. L. EDELSTEIN 2,928,573

VALVE ACTUATING ASSEMBLY FOR METERED SPRAY ATOMIZING DEVICES

Filed Feb. 25, 1958

FIG. 2.

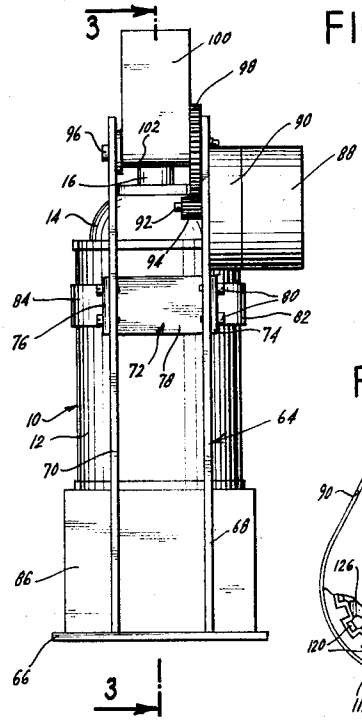


FIG. 1.

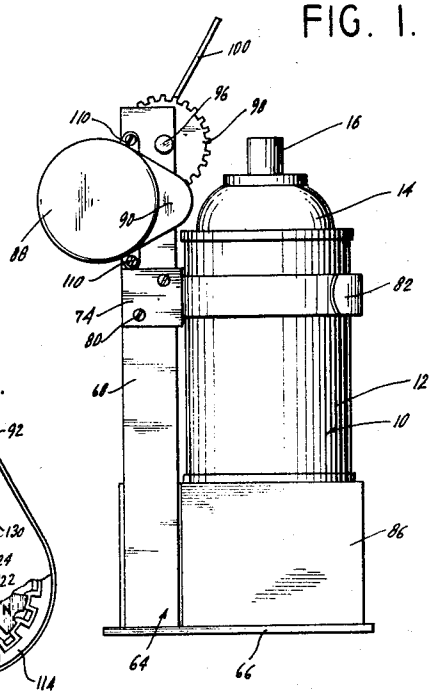


FIG. 6.

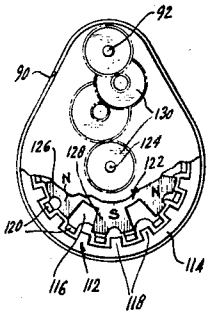


FIG. 3.

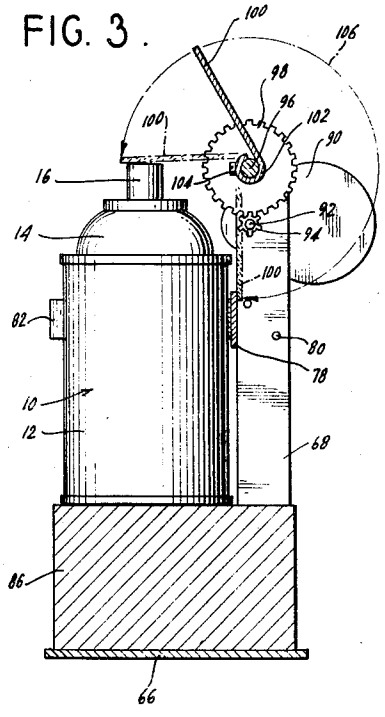


FIG. 4.

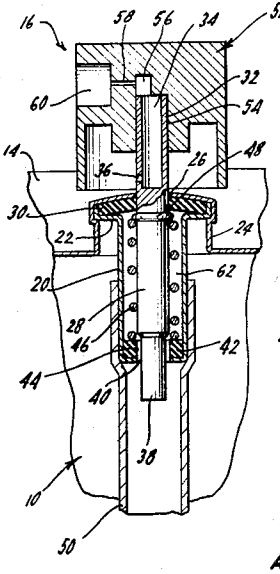
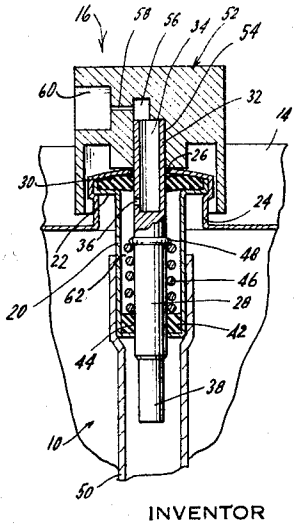


FIG. 5.



INVENTOR
ALBERT L. EDELSTEIN
BY
Amster & Levy
ATTORNEYS

United States Patent Office 2,928,573 Patented Mar. 15, 1960

2,928,573

VALVE ACTUATING ASSEMBLY FOR METERED SPRAY ATOMIZING DEVICES

Albert L. Edelstein, New York, N.Y., assignor to Syncro-Mist Controls, Inc., New York, N.Y., a corporation of New York

Application February 25, 1958, Serial No. 717,406

7 Claims. (Cl. 222—70)

This invention relates to improvements in fluid spray assemblies and in particular to a motor driven valve actuator device for periodically actuating the valve of a pressure-type atomizer or aerosol container.

The use of aerosol containers for emitting fine sprays of atomized liquid into the atmosphere has become increasingly prevalent for the spray application of insecticides, disinfectants, deodorants, room air fresheners and the like. Such aerosol containers are provided with manually-actuated valves controlling the outlet opening, the valves having an upstanding stem which is depressible to release a spray of atomized fluid from the container. There are two types of such valves in current use, one releasing a continuous spray during the period in which its valve stem is depressed, and the other releasing a metered spray of a pre-selected amount no matter how long its valve stem is depressed.

This invention is concerned with a motor-driven device for automatically and periodically actuating the valve of an aerosol container so as to emit a spray of atomized fluid at selected intervals over a long period of time. For example, such an automatic actuator device can be utilized to emit sprays of deodorants or room fresheners at intervals of ten or fifteen minutes throughout the day in restaurants, theatres, air conditioning systems or the like. It may also be used for the spray application of disinfectants in hospitals, sick rooms, or the like, or for the application of insecticides in sealed barns, or other locations.

Motor driven valve actuating devices of this type are known, but these have hitherto been particularly constructed to actuate the valves of the continuously-operable aerosol containers, that is those valves which remain open and emit a continuous spray for so long as the valve stem is depressed. As a result, the actuating device must press down the valve stem and must then almost immediately release it so that too long a spray is not released during one actuation. For this purpose the valve actuating device is provided with spring means for producing a rapid depression of the valve stem and a rather complicated structure for disengaging the actuator member from the valve stem.

According to the present invention, there is provided a valve actuating device which is particularly adapted for the periodic depression of the valve stem of a metered valve whereby at periodic intervals an exact measured amount of atomized fluid is emitted in spray form into the atmosphere. The device is also useful for actuating a continuously-operable valve of an aerosol container.

An object of the invention is the provision of a valve actuating device of the character described in which a synchronous electric motor is utilized to rotate an actuating member, the motor being so constructed as to be reversible between the valve stem and a stop member.

Another object of the invention is the provision of a valve actuating device of the character described which has a minimum of moving parts and is economical in manufacture and in operation.

Additional objects and advantages of the invention will become apparent during the course of the following specification when taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevational view of a valve-actuating device made in accordance with the invention herein and having an aerosol container mounted thereon;

Fig. 2 is a rear elevational view thereof;

Fig. 3 is a central vertical section taken substantially along line 3—3 of Fig. 2;

Figs. 4 and 5 are enlarged vertical sections through the center of the valve assembly of the aerosol container, showing the valve assembly in inoperative and operative positions, respectively; and

Fig. 6 is a top plan view of the synchronous electric motor used in the valve-actuating device, with portions thereof broken away to reveal inner structural detail.

Referring in detail to the drawings, there is shown an aerosol container 10 of the usual type having a can body 12 provided with a neck 14 in which is mounted a metering valve assembly, designated generally by the reference numeral 16.

The neck 14 of the can body 12 has an upstanding central boss 24 within which is secured the top flange 22 of a hollow valve housing 20. The boss 24 has a central circular outlet opening 26 through which extends the valve stem 28. A resilient sealing gasket 30 surrounds the valve stem 28 in the vicinity of the outlet opening 26 and maintains firm engagement with the top wall of the boss 24 and with the flange 22 for providing an air-tight seal about the outlet opening 26, while at the same time permitting the valve stem 28 to slide longitudinally therethrough.

The upper end of the valve stem 28 is in the form of a cylindrical tube 32 having an open top end 34. At the lower end of the tube 32 is a small through aperture 36. The lower end 38 of the valve stem 28 is of reduced diameter, and normally extends through a central opening 40 in the bottom wall of the valve housing 20. A resilient gasket 42 is mounted against the bottom wall of the valve housing 20 and has a central aperture 44 registering with the opening 40 of the valve housing bottom wall. The aperture 44 is of the same size or slightly smaller than the opening 40, and the valve stem lower terminal portion 38 also extends therethrough.

A coiled compression spring 46 is seated at its bottom end on the gasket 42, and at its top end on a shoulder 48 integral with the valve stem 28. The spring 46 normally biases the valve stem 28 to its raised position shown in Fig. 4. In this position, the aperture 36 of the tubular upper valve stem portion 32 is located above the gasket 30 and the lower valve stem portion 38 is located within the openings 40 and 44.

The can body 12 is filled with aerosol material (not shown) which conventionally comprises a Freon carrier in which is dissolved the liquid (antiseptic, insecticide, deodorant, or the like) which is to be dispensed. The Freon carrier is partially in liquid form and partially in gaseous form, that is to say the Freon is in the form of gas under a high superatmospheric pressure above the level of the liquid Freon and material to be dispensed. The bottom end of the valve housing 20 is connected to a tubular pipe 50 which extends downwardly to the bottom of the can body 12 and is immersed in the liquid contained therein. Because of the pressure exerted by the gaseous Freon, the pipe 50 is always filled with liquid Freon and material to be dispensed.

The valve assembly 16 also includes a cap or head piece 52 having a central longitudinal bore 54 in which is press fit over the tubular upper portion 32 of the valve stem 28. The bore 54 communicates with a chamber

56 which is connected by a small bore 58 with the valve outlet opening 60.

The interior of the valve housing 20 is hollow, forming a chamber 62 for receiving a charge of liquid from the can body 12. Because the valve stem lower portion 38 is of lesser diameter than the openings 40 and 44, said openings are uncovered in the raised, inoperative position of the valve stem shown in Fig. 4, and liquid Freon containing liquid to be dispensed is fed through pipe 50 through said uncovered openings 40 and 44 into the liquid chamber 62 because of the pressure of the gas within the can body. The liquid chamber 62 is thus normally filled with a measured amount of fluid representing a metered amount of fluid to be dispensed.

When the valve stem 28 is depressed, against tension of the spring 46, the main valve stem body portion 28 moves downwardly into the aperture 44 of gasket 42, and since the diameter of the valve stem is as large as the aperture 44, the gasket 42 forms an air-tight and liquid-tight seal about the bottom of the valve housing 20. Shortly thereafter, the aperture 36 in the cylindrical tube 32 moves downwardly below the upper sealing gasket 30, providing a path of communication between the liquid chamber 62 and the valve outlet opening 60. The liquid Freon in the liquid chamber 62 is thus placed in communication with the atmosphere and rapidly vaporizes, the gas travelling through the aperture 36, interior of cylindrical valve stem portion 32, chamber 56, bore 58 and out through the outlet opening 60. The escaping gas carries with it the liquid to be dispensed in the form of microscopic droplets which are released as a fine atomized spray through the outlet opening 60. Thus, by one depression of the valve stem 28, a metered amount of spray is released no matter how long the valve stem 28 is held in a depressed position.

The valve actuating assembly of the instant invention is adapted to depress the valve stem of an aerosol container having a metering valve of the type described, and comprises a support frame 64 comprising a base 66 adapted to rest upon a support surface and having a pair of elongated upright posts or standards 68, 70. Mounted upon the posts 68, 70 is a U-shaped metal bracket 72 having a pair of side arms 74 and 76 and a cross-piece 78. The side arms 74 and 76 are secured immovably to the respective posts 68 and 70, as by screws 80, with the cross-piece 78 extending between the front portion of the posts 68, 70 as shown in Fig. 2. The cross-piece 78 on its front surface carries a pair of forwardly-projecting spring arms 82, 84 which embrace an intermediate portion of the container body 12 for holding the aerosol container 10 in mounted position forwardly of the posts 68, 70. A block 86 may be placed upon the base 66 to support a container of small length, such as the container 10 shown in the drawings. If a longer container 10 is used with the valve actuating device, the block 86 may be removed, the longer container then resting directly on base 66.

Mounted on the post 68 as by screws 110, is a synchronous electric motor 88 having a built-in step-down gear train contained in the motor housing 90. The motor 88 is of the synchronous electric type which is adapted to impart to its drive shaft 92 a very small rotational speed, for example, a speed of two revolutions per minute. The drive shaft 92 projects through the post 68 and carries at its free end a pinion gear 94.

The motor 88 is of the self-starting A.C. inductor type such as is disclosed in U.S. Patent No. 2,436,231, issued to Eugene I. Schellens.

Also journalled between the posts 68 and 70 is a rotatable shaft 96 on which a large gear 98 is fixedly mounted for rotation therewith. The gear 98 meshes with the pinion gear 94, and is driven thereby, although at a lesser rotational speed. The shaft 96 also carries a flat metal plate 100 which serves as the valve actuating member of the assembly. The plate 100 is bent at one end to form a circular sleeve 102 which is fixedly secured to the shaft 96 by a set screw 104 or the like, in such a manner that the plate 100 is rotated by the shaft 96 in a circular path indicated by the arrow 106 in Fig. 3. A spacer element 108 may be provided on shaft 96, as shown in Fig. 2, to prevent binding of the plate 100 against the post 70.

The plate 100 is of sufficient length to strike and press downwardly upon the valve cap or head piece 52 at one limit position in the circular path 106, and to strike the bracket cross-piece 78 at the other extreme or limit of the circular path the cross-piece 78 thereupon acting as a stop member for the plate 100, as will be presently explained.

As shown in Fig. 6, the motor 88 includes a stator 112 which is associated with the usual exciting coil (not shown) adapted to be connected to a source of alternating current. The stator is made of a soft iron material suitable for being electrically magnetized by the coil and has an outer terminal portion 114 in the form of a ring, and an inner terminal portion 116. The outer terminal portion 114 is shaped to provide a series of spaced radial magnetic poles 118, while the inner terminal portion 116 is also shaped to provide a series of spaced magnetic poles 120. The alternating current supplied to the coil is effective to polarize both the inner and outer poles of the stator electromagnetically in an alternating manner such that when the inner poles 120 are N, the outer poles 118 are S and vice versa.

The motor 88 also includes a rotor 122 in the form of a circular disc mounted on a shaft 124. The rotor 122 is made of steel or other metal or alloy which is permanently magnetized, and is formed with a series of spaced peripheral pole members 126 and 128 which are notched at their centers to provide a pair of pole arms. As indicated in Fig. 6, the pole members are of alternate and opposite permanent polarity, the pole members 126 being of north polarity and the pole members 128 being of south polarity.

When the motor coil is energized by a source of alternating current, the inner and outer stator poles 118 and 120 are alternately and successively polarized in opposite polarities and their alternating attractions and repulsions of the permanently polarized pole members 126 and 128 of the rotor 122 causes the latter to rotate and supply the drive force of the motor. The rotor shaft 124 is connected by a step-down gear train 130 to the drive shaft 92 for imparting to said drive shaft a slow rate of rotation, for example, a rotational speed of 2 r.p.m.

As is described in the aforementioned Schellens Patent No. 2,436,231, the arrangement of the pole members 118, 120, 126 and 128 is such that upon initial energization, the motor 88 may start in either direction. That is to say, the rotor 122 may begin rotating either in a clockwise direction or a counter-clockwise direction turning its shaft 124 and the motor drive shaft 92 correspondingly. The initial starting direction of the rotor is haphazard and fortuitous depending upon the position of the rotor pole members 126 and 128 relative to the stator pole members 118 and 120 at the time of initial energization, and also depending upon the status of the cycle of the alternating current at the exact time of energization. Once, however, the rotor 122 begins to rotate in either direction, it will continue to rotate in that direction so long as the energization current is uninterrupted.

Because of the tendency of a synchronous motor of the type illustrated by motor 88 to rotate haphazardly in either direction, the Schellens Patent No. 2,436,231 is concerned with the provision of a pair of control gears connected to the motor shaft, which gears are designed so that in meshing relationship, they can turn in only one direction. Consequently, if the rotor tends to start in the wrong direction, the gears bind and lock, so that the rotor is delayed for one-half of the alternating cycle and begins its rotation in the proper selected direction.

In accordance with the present invention, the inability of the motor **88** to select a designated starting direction of rotation is utilized and, therefore, the control gears of the aforementioned Scheilens patent are eliminated from the motor. As a result, when the motor **88** is initially energized, its rotor **122** will begin to rotate in either direction, and when its rotation is physically blocked, it will immediately reverse its direction of operation.

In operation, when the motor **88** is energized, the rotor **122** will begin to rotate in a particular direction, for example, it may begin to rotate in a counter-clockwise direction, driving the motor drive shaft **92** in a clockwise direction. The drive shaft **92**, through its pinion gear **94** will turn the gear **98** in a counter-clockwise direction, turning the shaft **96** and the actuator plate **100** in the same direction, as viewed in Fig. 3. The free end of plate **100** will thus travel along the circular path **106** in the direction of the valve head piece **52** of the mounted container **10**. As the motor continues to rotate, the plate **100** will strike the top of the head piece **52**, as indicated in broken line in Fig. 3, and will depress the head piece **52**, causing the valve assembly **16** to release a metered spray of fluid from the valve outlet opening **60**, in the manner which has been previously described.

The plate **100** will press the head piece **52** downwardly until the head piece engages the neck of the can body **12** and is stopped from further downward movement. The rotation of the rotor **122** in a counter-clockwise direction is thus physically halted, and the rotor **122** then picks up the opposite half of the alternating current cycle, reverses its direction and begins to rotate in a clockwise direction. Clockwise rotation of the rotor **122** thus causes clockwise rotation of the gear **98**, the shaft **96** and the actuator plate **100** carried thereby, lifting the actuator plate **100** from the valve head piece **52** and permitting the spring **46** to lift the valve stem **28** and head piece **52** to their inoperative positions, whereby the housing chamber **62** is fed with a fresh, metered charge of fluid.

The actuator plate **100** then continues to rotate in a counter-clockwise direction along the circular path **106** through an angle of approximately 270°, until its movement is interrupted by the stop member or cross piece **78** of the bracket **72**. The actuator plate **100** thereupon engages the cross piece **78** and is physically stopped thereby from further clockwise rotation, causing the motor **88** to again reverse its direction and to begin rotating the plate **100** in a counter-clockwise direction.

It will thus be apparent that the motor **88** will automatically reverse its direction every time the actuator plate **100** has fully depressed the valve head piece **52** and every time the actuator plate **100** engages and is stopped by the bracket cross piece **78**. As a result, the actuator plate will travel back and forth along the circular path **106** between the valve head piece **52** and cross piece **78** so that it depresses said head piece at periodic intervals. The intervals for releasing the spray from the aerosol container **10** are constant, but may be selectively regulated by proper selection of the motor gearing or of the gear ratio between gears **94** and **98**, or by changing the positioning or the thickness of the stop member or cross piece **78**. In one commercial embodiment, the motor drive shaft had a rate of revolution of 2 r.p.m. and the gears **94** and **98** had a step-down ratio of six to one, with the result that the actuator plate, travelling back and forth through a circular path of 270° was effective to actuate the valve head piece **52** and release a metered spray at intervals of four and one-half minutes.

While a preferred embodiment of the invention has been shown and described herein, it is obvious that numerous additions, changes and omissions can be made therein without departing from the spirit and scope of the invention. For example, while a metered valve aerosol container has been shown and described by way of illustration, it is to be understood that the invention may be equally utilized for the actuation of continuous flowing valves of such containers. In this instance, a slightly longer spray is emitted from the container, the actuator plate depressing the plunger and keeping the valve open during the period of reversing its direction, which period may be one or a few seconds.

What is claimed is:

1. In a valve-actuating assembly for periodically operating a dispensing device having a depressible plunger and including a support for mounting said dispensing device in a fixed position, a self-starting synchronous motor of the type having an electromagnet stator and a permanent magnet rotor whose starting impulse or torque is indeterminate in direction and in which the rotor will reverse its direction of rotation when movement of the rotor in either direction is blocked, a plunger actuating member operatively connected to said rotor and movable thereby along a prescribed path of travel, the motor and actuating member being mounted on said support in such a position as to locate the prescribed path of travel of the actuating member in alignment with the plunger of the mounted dispensing device whereby the plunger actuating member moving toward the plunger along said prescribed path of travel engages and depresses the plunger, the plunger upon depression acting as a fixed stop member to block further movement of the plunger actuating member toward the plunger and to cause said rotor to reverse its direction of rotation and move the plunger actuating member in the opposite direction along said prescribed path of travel away from said plunger, and a stop member fixedly mounted in said prescribed path of travel and spaced from the plunger, said stop member being positioned to engage said plunger actuating member and block further movement thereof in said opposite direction, whereby to cause said rotor to reverse its direction and move the plunger actuating member toward the plunger.

2. In a valve-actuating assembly for periodically operating a dispensing device having a depressible plunger, and including a support for mounting said dispensing device in a fixed position, a synchronous motor adapted to be energized from a source of alternating current, said synchronous motor including a stator and a rotor, each having a plurality of pole elements, said rotor being rotatable in a first direction dependent upon the relative position of the pole elements of said stator and rotor and the phase of the alternating current upon initial energization of said motor, said rotor reversing the direction of its rotation when movement of said rotor in said first direction is blocked, a plunger-actuating member operatively connected to said rotor for movement along a prescribed path of travel, the motor and actuating member being mounted on said support in such a position as to locate the prescribed path of travel of the actuating member in alignment with the plunger of the mounted dispensing device such as to provide a first blocking position along said prescribed path, with the plunger adapted to be contacted and depressed by said actuating member travelling in one direction and serving to block further movement of said plunger-actuating member in said one direction and to reverse the direction of rotation of said rotor, and a stop member mounted on the support and positioned along said prescribed path in spaced relationship to the first blocking position such as to provide a second blocking position in which said stop member blocks further movement of said plunger-actuating member in the opposite direction and reverses the direction of rotation of said rotor, whereby the rotor again moves the plunger-actuating member in said one direction.

3. In a valve-actuating assembly for periodically operating a fluid spray dispensing device having a fluid release valve operable by a depressible plunger, and in-

cluding a support for mounting said dispensing device in a fixed position, a synchronous motor adapted to be energized from a source of alternating current, said synchronous motor including a stator and a rotor, each having a plurality of pole elements, said rotor upon energization of said motor being rotatable in either direction dependent upon the relative position of the pole elements of said stator and rotor and the phase of the alternating current applied to said motor, said rotor being adapted to reverse the direction of its rotation when movement of said rotor in either direction is blocked, a plunger-actuating member operatively connected to said rotor and movable thereby along a prescribed path of travel, the motor and actuating member being mounted on said support in such a position as to locate the prescribed path of travel of the actuating member in alignment with the plunger of the mounted dispensing device such as to provide a first blocking position along said prescribed path, with the plunger adapted to be contacted and depressed by said actuating member travelling in one direction and serving to block further movement of said actuating member in said one direction and to reverse the direction of rotation of said rotor and cause the latter to move the actuating member in the opposite direction in said prescribed path, and a stop positioned along said prescribed path in a location spaced from the first blocking position such as to provide a second blocking position in which said stop blocks further movement of said actuating member in the opposite direction, thereby serving to reverse the direction of rotation of said rotor, said actuating member travelling back and forth in said prescribed path between the first and second blocking positions and actuating the plunger of said dispensing device periodically upon approaching the first blocking position.

4. In a valve actuator device for a pressure-type fluid atomizer container having a dispenser valve operable by depression of a plunger, said device comprising a body frame and mounting means for holding said fluid atomizer container in mounted position on said body frame, an actuator member rotatably mounted on said body frame for rotational movement in a circular path, said actuating member being positioned as to locate the plunger of the mounted container in said circular path in a position to be contacted and depressed by said actuator member, reversible motor means operatively connected to said actuator member for rotating the same along said circular path, and a stop member interposed in said circular path at a point spaced from the mounted position of said plunger, said motor means being adapted to reverse its direction of rotation when its movement is physically interrupted, whereby said actuator member is rotated in alternating reverse directions along said circular path between said plunger and said stop member.

5. In a valve actuator device for periodically actuating a pressure-type fluid atomizer container having a dispenser valve operable by depression of a plunger, said device comprising a body frame and mounting means for holding said fluid atomizer container in mounted position on said body frame; an actuator member rotatably mounted on said body frame for rotational movement in a circular path, the actuating member being so positioned as to locate said circular path in alignment with the plunger of the mounted container and the plunger in a position to be contacted and depressed by said actuator member and thereafter blocking movement of said actuator member, reversible motor means operatively connected to said actuator member for rotating the same along said circular path, and a stop member interposed in said circular path at a point spaced from said plunger, said motor means comprising a self-starting synchronous electric motor having a permanent magnet rotor and an electro-magnetic

stator, the rotor being adapted to rotate in an indeterminate direction when alternating current is applied to the stator and being adapted to reverse itself when its rotational movement in either direction is blocked, said motor reversing its direction alternately when the actuator member engages and is stopped by the plunger and by the stop member, the actuator member travelling in a reciprocating movement along said circular path between the plunger and said stop member whereby said plunger is depressed at periodic intervals.

6. In a valve actuator device for pressure-type fluid atomizer containers having a dispenser valve operable by depression of a valve stem having a head piece, said device comprising a body frame including a base and a pair of upright posts, a mounting bracket fixed to said posts and having a pair of resilient arms for releasably embracing said fluid atomizer container and holding said container in a mounted position forwardly of said posts; an actuator plate rotatably mounted between said posts for rotational movement in a circular path, said actuator plate being positioned to locate said circular path in alignment with the valve stem head piece of the mounted container with the actuator plate adapted to engage and depress said head piece and then be blocked thereby from further movement, reversible motor means mounted on said body frame and operatively connected to said actuator plate for rotating the latter along said circular path, said bracket having a cross piece extending between said upright posts and constituting stop means interposed in said circular path at a point spaced from the head piece of the mounted container, said motor being adapted to reverse its direction of rotation when its movement is physically interrupted by engagement of said actuator plate with said head piece and with the bracket cross piece whereby said actuator member is rotated in alternating reverse directions along said circular path between said head piece and said bracket cross piece.

7. In an assembly for periodically actuating the valve of a fluid spray dispensing device and including a frame mounting said device and an actuating member rotatably mounted on the frame for movement in a circular path between the valve of the mounted device and a fixed portion of the frame with said valve and fixed portion serving as stop means to block the movement of said actuating member in both directions along said circular path, a synchronous electric motor adapted to be energized from a source of alternating current for driving said actuating member in a reciprocating motion along said circular path, said motor including a rotor and a stator each having a plurality of pole elements, said rotor upon energization of said motor being rotatable in either direction dependent upon the relative position of the pole elements of said stator and rotor and the phase of the alternating current applied to the motor, said rotor being adapted to reverse the direction of its rotation when movement of the rotor in either direction is blocked, and means operatively connecting said rotor to said actuating member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,436,231	Schellens	Feb. 17, 1948
2,613,108	Kraus	Oct. 7, 1952
2,788,455	Kohlhagen	Apr. 9, 1957
2,788,925	Ward	Apr. 16, 1957
2,789,673	Tetro	Apr. 23, 1957
2,793,307	Gallagher	May 21, 1957
2,817,560	Barnard et al.	Dec. 24, 1957
2,821,435	Wenner	Jan. 28, 1958
2,821,436	Wenner	Jan. 28, 1958
2,830,142	Smith	Apr. 8, 1958