

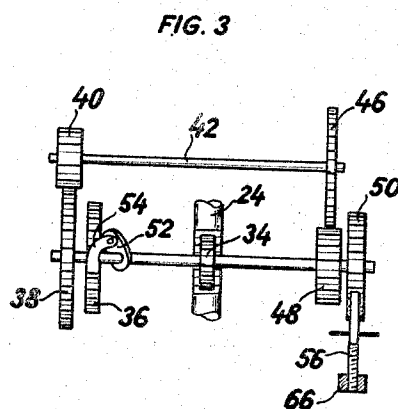
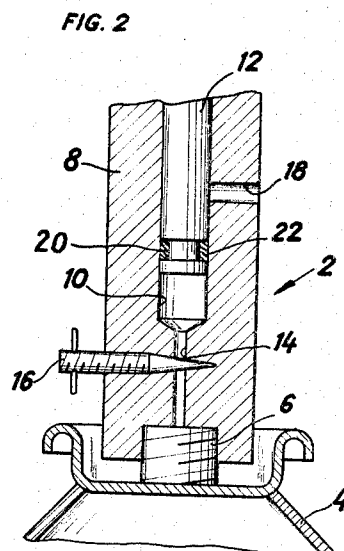
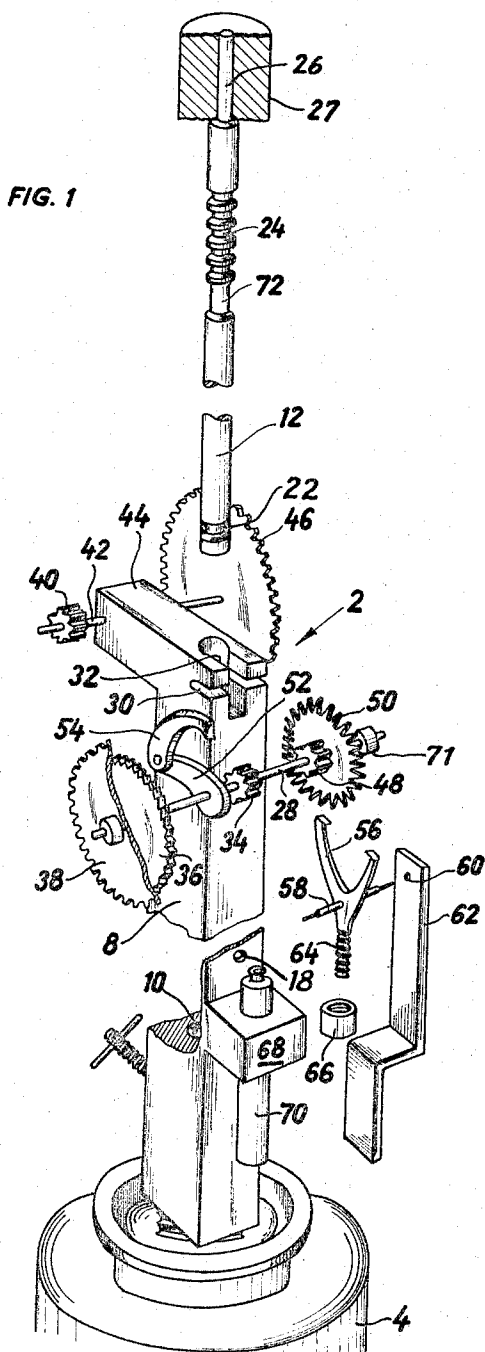
June 20, 1967

W. A. KROPP
DISPENSING DEVICE

3,326,418

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

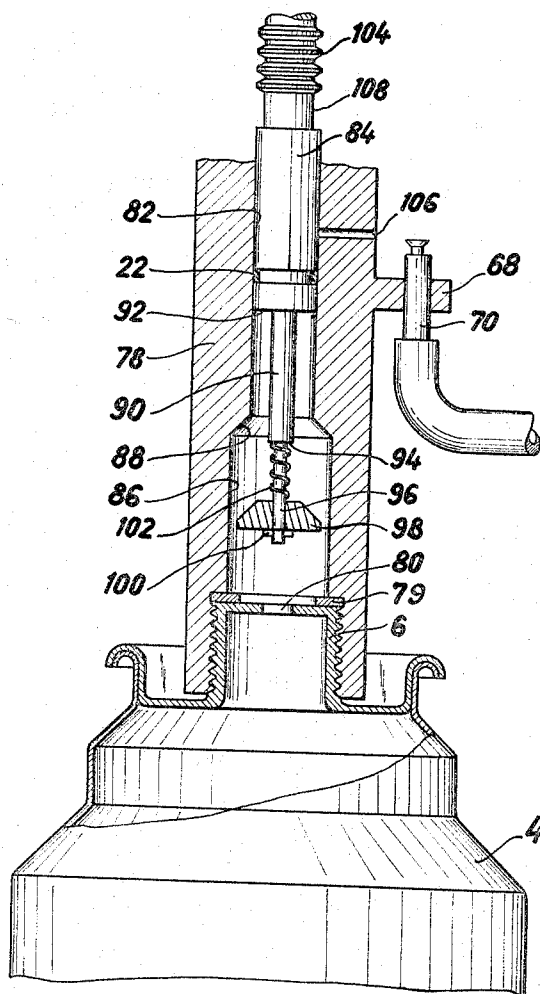


FIG. 4

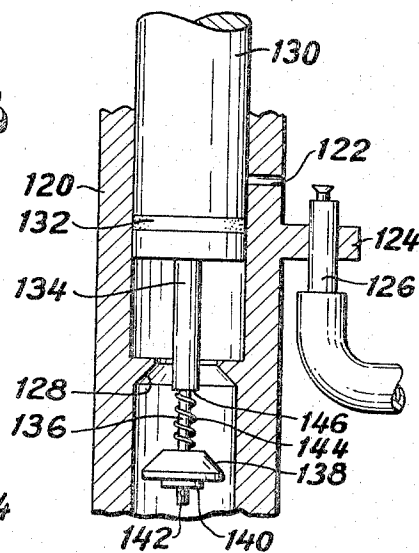


FIG. 5

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1

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DISPENSING DEVICE

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2

The present invention relates to gas-dispensing means, and more particularly to dispensing means of the kind which will cycle automatically at a predetermined but adjustable rate to dispense gas, or gas-borne compounds.

With the growing use of various substances such as medicants, insecticides, and scents in vapor form by use of the so-called "aerosol" cans in which the ingredient is under pressure in the can and is released therefrom by opening of a nozzle, a simultaneous need has arisen for simple and fool-proof apparatus which can be coupled to such an aerosol device and which will release the vapor or gas therefrom at periodic intervals. Such a device, in addition to being simple to operate, should be relatively inexpensive, and should perform its intended function with a minimum of upkeep.

As an example of the need for such a device, the restaurant business may be cited, in which it is becoming common periodically to dispense restaurant scents such as delicatessen aromas at selected intervals during the course of the business day to enhance the consumer appeal of the restaurant. Other occasions are in the home where medicated vapors may be needed to be dispersed in a room containing a sick person. Other similar uses such as dispensing of deodorants, insecticides, disinfectants and larva repellants will readily come to mind.

In the devices now being used, often times they are bulky, are not self-actuated, some require electric power, and are relatively expensive and difficult to service. Because of the size of some such devices, it is also difficult or inconvenient to conceal them from, for example, the public using the restaurant. Therefore, among the several objects and provisions of this invention may be noted the following:

One object of the invention is to provide a relatively inexpensive, compact, apparatus of the class described above; another object is to provide a device of the last named class which is self-actuated and which will operate at predetermined time intervals to dispense a vapor; still another object of the invention is to provide a dispensing apparatus of the cycling type in which the rate of cycling may be conveniently adjusted; a further object of the invention is to provide apparatus of any of the classes described above which may readily be used with available aerosol cans of the material to be dispensed or which may be attached readily to a pressurized container of gas such as dichlorodifluoromethane, and to a separate container of the material to be dispensed; and finally, an object of the invention is to provide apparatus of the above classes which is relatively inexpensive to make, easily maintained, and fool-proof in its operation. Other objects and advantages will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the appended claims.

In the accompanying drawings, in which several of the various possible embodiments of the invention are illustrated:

FIG. 1 is an exploded view of an assembly of parts forming a first embodiment of this invention;

FIG. 2 is a sectional elevation of a portion of the FIG. 1 embodiment, showing a needle-valve arrangement;

FIG. 3 is a schematic plan view showing a gear train and escapement mechanism for operation of the FIG. 1 embodiment;

FIG. 4 is a sectional elevation of a portion of a second embodiment of the invention given to illustrate a different means for creating a differential operating pressure therein during operation of the cycling of the device; and

FIG. 5 is a sectional view of a portion of a third embodiment.

Similar reference characters indicate corresponding parts throughout the several views of the drawings. Dimensions of certain of the parts as shown in the drawings may have been modified or exaggerated for the purpose of clarity of illustration.

The present invention works on a combination of pressure and a clock-work control mechanism, wherein pressure actuating a piston furnishes the driving force, instead of a conventional spring driven clock or an electric motor, and the motions of the parts due to this driving force are controlled by an escapement or governor mechanism. In this invention, the pressure of the gas or vapor pressure in the aerosol can or other pressure device to which the apparatus is connected causes a piston to travel at a given rate under the control of an escape mechanism until a point in the travel of the piston is reached at which the control of the escape mechanism is released, the piston thereafter traveling with a rapid motion to uncover an exit hole in the cylinder wall for the escape of the aerosol compound or propellant gas. In all of the embodiments illustrated herein, the medium to be dispersed is shown as being contained in a separate container attached to the apparatus and being connected to a tube having its exit placed adjacent the exit hole in the cylinder wall to form an atomizer arrangement. As the gas of the can attached to the apparatus exhausts through the hole, it draws dispensable material from the container through the tube, there to be sprayed into the atmosphere. In all embodiments of this invention, as illustrated, the propulsive gas is shown contained in a readily available aerosol can to which the apparatus is easily attached. Of course, it is possible, in these embodiments, if desired, to attach to the apparatus an aerosol can containing both the gas and the medium to be dispensed, the propellant and medium being expelled through the exit hole of the piston cylinder.

Referring now to FIG. 1, the first embodiment of the apparatus of this invention is shown generally by numeral 2, and is attached to an aerosol can 4 which is filled with a propellant, preferably Freon No. 12, which has a constant vapor pressure of about 90 p.s.i. at 75° F. Apparatus 2 is threaded to the nozzle 6 of the aerosol can. (A sealing washer, not shown, may be preferably used to make a gas-tight connection to the can.) Such cans generally have a valve in their nozzles, and when the apparatus 2 is attached, this valve inside the nozzle of the can is disposed to open in a conventional manner which is not herein described, since it is not part of this invention.

Apparatus 2 comprises a solid body 8 which is provided with a cylindrical bore 10 therein adapted to receive in a smooth sliding engagement the piston 12, the body and piston being made, for example, of aluminum, brass, steel or suitable molded synthetic resin. A restricted passageway 14 connects the bore 10 with the open end of the body 8, which is attached to can 4, this passageway being fitted with a needle valve 16 in conventional manner in order to control the flow of gas through the passageway 14 and into bore 10.

In the wall of the cylinder (formed by the body 8 and the bore 10) somewhat above the end of passageway 14 there is provided an exit hole or orifice 18. Orifice 18 is larger in cross section than the passageway 14.

Piston 12 is reciprocable in the bore 10, and at its lower extremity it is provided with the peripheral groove 20 adapted to receive an O-ring 22 for sealing the piston slidably in the bore 10. O-ring 22 may be made, for example, of rubber.

At the upper end of the piston 10 there is provided a series of peripheral serrations or notches 24 which, when the device is assembled, act as a rack for a pinion of the control escape mechanism. A reduced end portion 26 is provided at the furthest end of the piston as a convenient method for placing a weight 27 (or spring bias, if desired) on the piston to furnish a force for returning the piston to a first position.

A control mechanism (in this instance an escape wheel mechanism) is provided as follows: a shaft 28 is journaled in a pair of slots 30 at the upper end of body 8, and is retained in the slots by conventional retaining means such as a plate attachable to body 8 and having extending portions entering a suitable distance into slots 30. A slot 32 is provided which traverses the slots 30 and accepts the pinion 34. Slot 32 intersects the wall of bore 10 so that when shaft 28 and a pinion 34 fastened to the shaft are properly in place, the pinion 34 engages the rack serrations 24. Pinion 34 rotates with shaft 28.

At one end of shaft 28 there is a ratchet wheel 36 which is free to rotate on the shaft. A spur gear 38, free to rotate on the shaft, is fastened to ratchet wheel 36 to rotate therewith, and engages the pinion 40 which is mounted on shaft 42 to rotate the latter, shaft 42 being journaled in the end of a laterally extending arm 44 preferably made an integral part of the body 8. At the other end of shaft 42 there is fastened for rotation by the shaft a spur gear 46 which engages a pinion 48 journaled on shaft 28 but rotating freely thereon. Attached to pinion 48 is an escapement wheel 50 which also rotates freely on shaft 28. A pawl arm 52 adjacent ratchet wheel 36 is attached to a shaft 28 for rotation therewith. A pawl 54 is pivoted at one end thereof to one end of arm 52, with its other end in position to engage the teeth of the ratchet wheel 36. An oscillating arm 56 having pallets is mounted with its pallets in engagement with the escapement wheel 50 in conventional manner by providing a staff 58 on which the arm 56 is mounted, staff 58 being supported in position by having its ends engage a suitable hole 60 at one end of a mounting bracket 62 which is fastened to the body 8, the other bearing hole for staff 58 being a suitably provided bearing hole in body 8.

Arm 56 is of conventional design, and has a dependent stem 64 which is threaded to receive in adjustable engagement the weight 66. The period of escapement can be adjusted by moving the weight 66 up and down (as drawn) in conventional manner.

The bushing 71 and the wall of the member 8 prevent axial motion of the pinion 48 and the escapement wheel 50 on the shaft in order to maintain the escapement wheel in register with the pallet 56 and pinion 48 in engagement with gear 46. Axial motion of the shaft 28 with respect to the body 8 will be restrained by the engagement of the pinion 34 in the slot 32.

Mounted on an extension 68 of the body 8 is the end of a supply tube 70, the exit end of which lies in line with and adjacent the orifice 18 leading into the bore 10. The other end of tube 70 leads into a container of the material to be dispensed.

Operation of this embodiment is as follows:

Starting with the piston 12 all the way into the bore 10, for example, as shown in FIG. 2, the needle valve 16 is opened to admit pressurized gas or pressurized compounds from the container 4 into the chamber below the head of the piston. The pressure will move the piston outwardly of bore 10 (vertically, as drawn). The outward motion of the piston will be governed by the escapement mechanism because as the rack serrations 24 move upwardly, they turn the pinion 34. This in turn drives the

shaft 28, the pawl arm 52, pawl 54 and spur gear 38. Rotation of spur gear 38, and thus pinion 34, is in turn governed through the gear train 38, 40, 46 and 48, by the combination of the escapement wheel 50 and the escapement arm 56.

The relatively slow motion of the piston 12 upwardly under control of the escapement mechanism continues until a portion 72 on the piston 12 just below the last of serrations 24 becomes positioned opposite the pinion 34, portion 72 having no rack serrations so that the pinion 34 no longer engages the piston 12. This point is reached just prior to the end of the piston reaching the exit hole 18. Because the escapement mechanism is no longer in control, the pressure in the chamber of the cylinder below the end of the piston now is permitted to force the piston rapidly outwardly to uncover the exit hole 18. Pressurized gas or a pressurized mixture of gas and other compounds in the chamber of the cylinder now exits through the orifice 18 and across the end of the tube 70 to aspirate from the tube and its attached container the material contained therein.

The orifice 18 releases the pressure or pressurized compound rapidly, and since the passage at 14 is restricted by the needle valve 16, pressure against the end of the piston 10 is relieved which allows the weight or spring bias at the end of the piston to be effective to move the piston downwardly. When the piston moves downwardly, again it closes off the orifices 18, and thus pressure again builds up in the cylinder against the end of the piston to start to move it outwardly again. Also, as the piston moves down, the rack serrations 24 again engage the pinion 34, the pawl arm 52 and pawl 54 now seeking another tooth on the ratchet wheel 36 as the downward motion of the serrations turn the pinion 34, the ratchet, pawl, and pawl arm being disposed to allow downward motion of the piston without operating the entire gear train and escape mechanism. As the pressure builds up in the cylinder, the above cyclic operation is repeated. Adjustment of the cycling rate is made by adjusting the weight 66 on the stem 64 of the arm 56.

Turning now to FIG. 4, there is shown a second embodiment of the invention utilizing the principles of the first embodiment for the control of the motion of the piston outwardly of the cylinder, but utilizing a different means for dropping the pressure at the end of the piston when the exit orifice has been uncovered, in order to permit the piston to return to a first or starting position. In addition, the apparatus now to be described avoids the necessity of using a needle valve with its sometimes attendant tendency to clog.

Again, as in the FIG. 1 embodiment, a body 78 is provided threaded at one end for attachment to the nozzle 6 of an aerosol container 4. A sealing ring 79 of conventional construction is used to seal the end of body 78 to the nozzle 6. The exit orifice of the container 4 is shown at numeral 80 schematically, the aforementioned valve construction being present to open this orifice when the body 78 is screwed on the nozzle 6. (Since such a valve construction is conventionally found in such aerosol cans, it is not fully illustrated herein since it is not a part of this invention.) Body 78 in this embodiment is provided with a bore 82 adapted to receive with a smooth sliding fit the body of a piston 84. Piston 84 is provided with an O-ring 22 as in the previous embodiment and for the same purpose. A second bore 86 is provided in body 78 of larger diameter than bore 82, and the junction of these two bores is chamfered to provide a valve seat 88. Piston 84 is provided with a neck 90 of smaller diameter, leaving a free portion 92 at the end of the piston, and an extending stem 96 is provided, as shown, stem 96 meeting the end of neck 90 to provide shoulder 94. A valve member 98 is slidably mounted on stem 96 and is adapted to seat against the valve seat 88 in one of its positions. Valve member 98 may be held on stem 96 by conventional means, such as the pin 100. A

5

compression spring 102 fits on stem 96 between shoulder 94 and valve member 98, and normally biases the valve member 98 downwardly along the stem.

Piston 84 is provided with the rack serrations 104 similar to the serrations 24 of the FIG. 1 embodiment for the same purpose. An exit port 106 is provided as in the FIG. 1 embodiment. A relief portion 108 below the serrations is provided, together with the escapement mechanism of the FIG. 1 embodiment. The tube 70, and other details are the same in this embodiment as are found in the FIG. 1 embodiment.

Starting with the elements in the position shown in FIG. 4, gas under pressure escapes from the orifice 80 to flow past the open valve seat 88, and reacts against the piston face 92, thus causing the piston 84 to move upwardly (as viewed) under the control of the escapement mechanism. As the piston moves upwardly, it carries with it the valve member 98. Just prior to the end 92 of the piston reaching the exit orifice 106, the relief portion 108 on the piston below the serrations 104 comes adjacent the gear 34 of the escapement mechanism, with the result that the pressure against the working face 92 rapidly forces the piston upwardly to permit the pressurized gas to become expelled through the orifice 106. At this point, the valve member 98 has become seated against the valve seat 88, thus preventing further ingress of gas under pressure into the cylinder chamber above the valve 88. Therefore, with the flow of gas through the exit orifice 106, gas pressure drops in this upper chamber with the result that the piston is now enabled to move downwardly. However, because of the gas pressure against the bottom face of the valve member 98, this member is maintained in seated engagement with its seat 88. As the piston continues to move downwardly, it overcomes the slight compressive resiliency of spring 102, and the face 94 in effect strikes against the top surface of valve member 88 to dislodge the latter from its valve seat. Spring 102 then becomes effective to move the valve member 98 down to the point that it is brought to rest by the cross pin 100. Once this has happened, then the entire cycle repeats itself.

It will be noted that in this construction the relative sizes of the orifices 80 and 106 is not important, although it is preferred that the orifice 106 be approximately the same size as the orifice 80. Also, orifice 106 should not be so large that the aspirating effect across the end of tube 70 is lost.

Referring now to FIG. 5, there is shown a portion of a third embodiment which is a modification of the FIG. 4 embodiment. The rest of the FIG. 5 embodiment is the same as the FIG. 4 embodiment, the difference being the relative proportions of the piston working face and the valve member face.

As shown, body 120 is provided with the orifice 122, and the bracket 124 for holding the tube 126, all as in the FIG. 4 embodiment. A valve seat 128 is provided, and piston 130 which is provided with the O-ring 132, neck 134, and stem 136.

A valve member 138 is slidably received on stem 136 and is retained thereon by conventional means such as the washer 140 and cross-pin 142. A compression spring 144 surrounds the stem 136 and biases valve member 138 away from shoulder 146 formed by the junction of stem 136 and neck 134. Valve member 138, and, correspondingly seat 128, is made smaller in transverse cross-sectional area than the working face of the piston 130.

The operation of this embodiment is as follows: On that part of the cycle when the piston is moving upwardly, the motion of the piston and the relieving of pressure in the piston chamber proper by the orifice 122 is the same as in the FIG. 4 embodiment. However, the return stroke of the piston works the valve member 138 differently from its operation in the FIG. 4 embodiment in that as the piston moves downwardly, it exerts a force against the valve member 138 through the compression

6

spring 144, and the latter stores energy. The gas pressure against the lower face of member 138 keeps the latter seated against the seat 128 until the force exerted by the spring against valve 138 becomes sufficient to unseat the latter. At this point, the stored energy of the spring is released to move valve member 138 away from seat 128 with a snap action.

In view of the above, it will be seen that the several objects of the invention are achieved, and other advantageous results attained.

It is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings, shall be interpreted as illustrative and not in a limiting sense, and it is also intended that the appended claims shall cover all such equivalent variations as come within the true spirit and scope of the invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A control device for releasing a fluid under pressure comprising a body providing a wall enclosing a cylindrical bore, the body being provided with an inlet at one end leading into said bore and a discharge port in the wall remote from the inner end of said inlet; a piston reciprocably slidable in said bore and movable under pressure of said fluid on the inner end thereof from a first position in which said port is closed by the piston to a second position in which said port is opened by the piston; a valve in said body between the inner end of the piston and said inlet for restricting the flow of fluid from said inlet into said bore; the fluid pressure on the inner end of the piston being decreased thereby when said port is opened; a governing mechanism operatively connected to the piston for controlling the rate of the motion of the latter for at least a portion of its travel from said first position to said second position; second means biasing the piston toward said first position, said second means being effective to move the piston to said first position upon decrease of the fluid pressure on said inner end of the piston; and means for releasing the piston from the control of said governing mechanism during a portion of the stroke of the piston in one direction, and for reestablishing said control at a portion of the stroke of the piston in the other direction.

2. A control device for releasing a fluid under pressure comprising a body providing a wall enclosing a cylindrical bore, the body being provided with an inlet at one end leading into said bore and an outlet in the wall remote from the inner end of said inlet; a piston reciprocably slidable in said bore and movable under the pressure of said fluid on the inner end thereof from a first position in which said outlet is closed by the piston to a second position in which said outlet is opened by the piston; first means between the inner end of the piston and said inlet for restricting the flow of fluid from said inlet to said outlet, the fluid pressure on the inner end of the piston being decreased thereby when said outlet is opened; a clockwork mechanism operatively connected to the piston for controlling the rate of the motion of the latter for at least a portion of its travel from said first position to said second position; and second means biasing the piston toward said first position, said second means being effective to move the piston to said first position upon decrease of the fluid pressure on said inner end of the piston.

3. The device of claim 2 in which said first means comprises a needle valve.

7. 4. The device of claim 2 in which said clockwork mechanism includes means for retarding the rate of motion of the piston during said portion of its travel.

5. The device of claim 2 in which said clockwork mechanism includes an escapement mechanism, whereby the piston moves through said portion of travel in steps under the control of said escapement mechanism.

6. The device of claim 2 in which said first means comprises a valve member and a valve seat therefor, the valve member closing against the valve seat when said outlet is opened by the piston, and the piston moving the valve member away from the valve seat as the piston moves from said second position to said first position.

7. The device of claim 6 in which an elongated extension is provided at the inner end of the piston, the valve member being adapted to slide on said extension, and spring biasing means urging the valve member toward a valve-open position.

8. The device of claim 6 in which an elongated extension is provided at the inner end of the piston coaxial therewith, the valve member being adapted to slide on said extension, and spring biasing means urging the valve member toward a valve-open position, said biasing means storing energy for a portion of the motion of the piston toward said first position and said energy being releasable to move said valve member to a valve-open position at a predetermined position of the piston when moving toward said first position.

9. A dispensing device comprising a source of pressurized fluid, a discharge conduit connected to said source, walls forming a chamber connected to said conduit, a discharge port disposed in a wall of said chamber, a piston mounted on said chamber for movement from a first position sealing said port to a second position uncovering said port, a shaft connected to said piston, teeth disposed on

said shaft to form a rack, a pinion driven by the rack, an escapement mechanism governing the rotation of said pinion, said shaft having a toothless portion adjacent the rack not engageable by said pinion, whereby an increase in fluid pressure in said chamber will force said piston to move in controlled steps from said first position until said toothless portion comes opposite the pinion and thereafter rapidly to said second position, and means for returning the piston to the first position when the pressure in the chamber has been reduced.

10. The dispensing device defined in claim 9 wherein means are provided for varying the rate of the escapement mechanism.

11. The dispensing device defined in claim 9 wherein the cross-section of the port is greater than that of the discharge conduit.

12. The dispensing device defined in claim 9 wherein the discharge port and discharge conduit are so proportioned that the rate of flow through the port is greater than through the conduit.

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