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INTERMITTENTLY ACTING FLUID VALVING DEVICE

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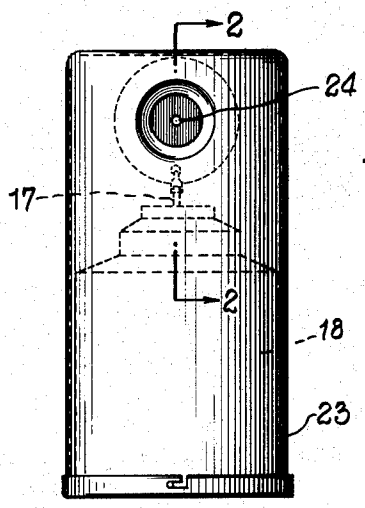
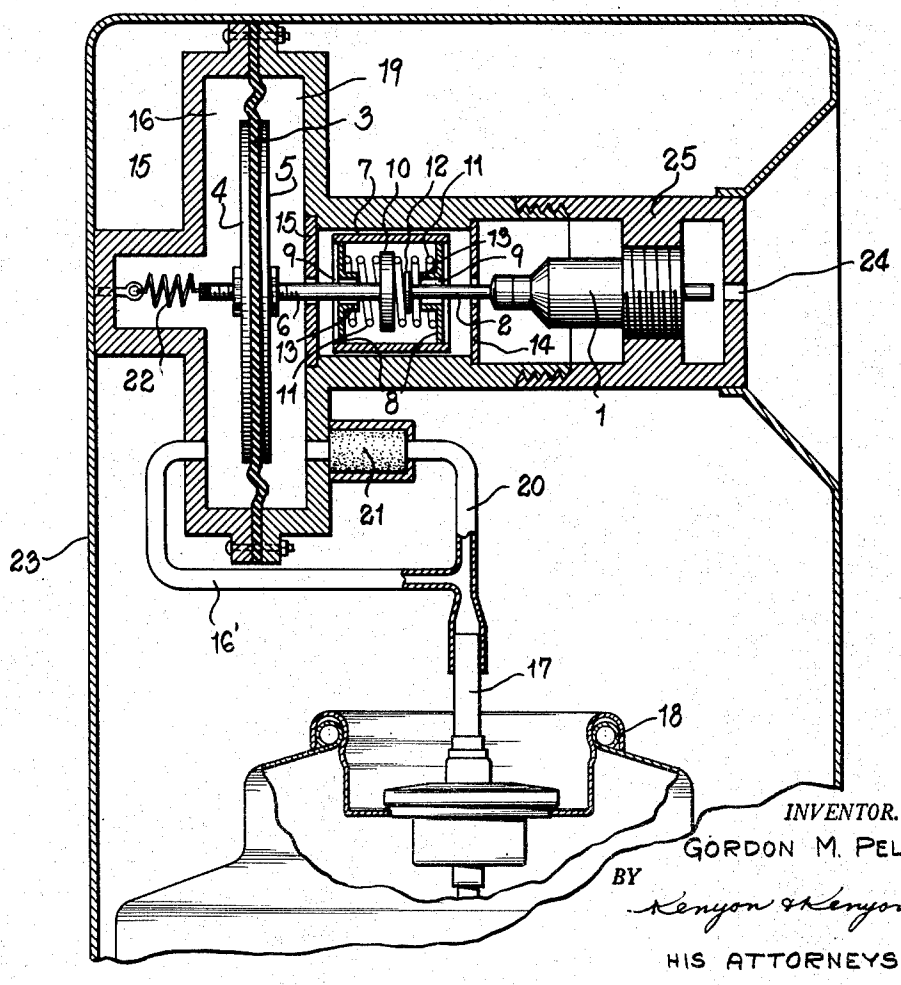


Fig. 1.

Fig. 2.



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INTERMITTENTLY ACTING FLUID VALVING DEVICE

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1 Claim. (Cl. 251—13)

This invention relates to an intermittently acting fluid valving device for fluid under pressure. The device is particularly intended for use with a fluid spray dispensing package of the pressure discharge type. An example of this type of package is disclosed by the N. O. Loven et al. Patent 2,582,262, issued January 15, 1952.

One of the objects is to provide such an intermittently acting valving device in a form that will use the fluid pressure stored in the described type of package to actuate the device so as to effect periodically a brief discharge of the fluid, without this action being adversely affected by changes in the ambient temperature of the package. Devices of this type have heretofore involved the problem that the amount of fluid discharged, resulting in the intermittent sprays, has varied in accord with the temperature of the fluid charge in the package, because this is reflected in differences in the internal pressure of the package. The present invention is intended to overcome this trouble so as to effect a more uniform spray action.

A specific example of a device embodying the invention is disclosed hereinafter with the aid of the accompanying drawing for the purpose of disclosing the principles, construction and operation of the invention.

In the accompanying drawings Figure 1 is a front elevation of the specific example and Figure 2 is a vertical cross section taken on the line 2—2 in Figure 1.

Referring to these drawings, the illustrated device includes a fluid valve **1** which may be an automobile tire valve modified so that its valve stem has a tail extension **2**. A double acting piston **3** is positioned opposite to and spaced from the valve stem extension **2**. Preferably this piston is in the form of a diaphragm having a rigidified working body and a flexible annulus, as is illustrated. This piston has a back **4** causing the piston to advance, to the right in Figure 2, when receiving fluid, and a front **5** causing the piston to retract when receiving fluid pressure.

Means are provided for connecting the piston **3** to the valve stem **2** to close the valve after the piston advances a limited distance and to open the valve after the piston retracts a limited distance. Preferably the valve is opened and shut with a snap action.

As shown, the above means includes a connecting rod **6** extending forwardly from the front of the piston **5** towards the valve stem extension **2** and in alignment therewith. Both ends of the stem **2** and rod **6** are surrounded by a tubular permanent magnet **7** having nonmagnetic end plates **8** in which holes **9** are formed large enough to avoid sliding engagement with the stem **2** and rod **6**. The end of the rod **6** carries a spring abutment **10** having opposite faces engaged by helical compression springs **11** pressing against the abutment **10** and the opposite end plates in the case of the respective springs. Thus the tubular magnet **7** floats about and on the end of the connecting rod **6** in an elastically displaceable or relatively movable manner.

The valve stem extension **2** is provided with a smaller abutment **12** which is not engaged by the springs **11**. The end plates **8** each have inwardly extending collars **13** which may be engaged by the respective adjacent abutments **10** or **12**. When the elastically floating magnet assembly moves far enough to the left, which is the retracting direction of the piston **3**, the right hand collar **13** engages the abutment **12** and pulls on the valve stem extension **2** so as to open the normally closed tire valve **1**. When the right hand collar **13** is free from the

abutment **12** the valve **1** is closed, it being understood that this valve contains a spring biasing it to its closed position.

The described magnet assembly travels between magnetic armatures **14** and **15** which are respectively spaced apart. When the piston **3** advances the abutment **10** compresses the right hand compression spring **11** until this spring stores enough force to overcome the magnetic attraction holding the magnet **7** to the armature **15**, the magnet assembly then quickly moving forwardly with the magnet attaching to the right hand armature **14**. Thus the valve **1** is snapped shut after being held open. When the piston **3** retracts the abutment **10** compresses the left hand spring **11** until the force overcomes the attraction between the magnet and the armature **14**, whereupon the magnet assembly with a snap action becomes attached to the armature **15** and, of course, snaps open the valve **1** by the right hand collar **13** engaging the abutment **12**.

It is to be noted that in between the positions described above the assembly interconnecting the piston and the valve provides a lost-motion action permitting movement of the piston **3** without actuation of the valve.

The back **4** of the piston **3** is enclosed by a back chamber **16** and a fluid conduit **16'** connects this back chamber **16** to the source of fluid pressure as represented by the nozzle **17** of a fluid dispensing package **18** of the pressure discharge type. The valve of this package is, of course, maintained open permanently by any suitable means.

A front chamber **19** encloses the front **5** of the piston **3** and this chamber also connects with the nozzle **17** through a fluid conduit **20**. However, this conduit **20** is provided with a flow reducer in the form of a porous plug **21** which reduces the rate of flow through the conduit **20** to a low value as compared to the rate of flow possible through the conduit **16'**.

Now it is apparent that with both sides of the piston **3** connected to the source of fluid pressure that initially the piston **3** will move to the right because of the pressure in the back chamber **16**, and that as the fluid gains access to the front chamber **19** that a condition of equilibrium will be obtained where the piston **3** is balanced. The front chamber **19** connects through the various openings with the valve **1** which is screwed into an extension **25** of the front chamber **19**, and since the valve **1** is closed the fluid cannot escape from the front chamber **19**.

This condition of equilibrium is overcome by a tension spring **22** positioned in the back chamber **16** and applying a constant bias to the piston **3** in a direction biasing this piston in its retracting direction.

Now it can be seen that as the described condition of equilibrium is approached the spring **22** continues to retract the piston **3** with consequent compression of the left hand spring **11** until the force of the spring **22** is sufficient to break the magnet **7** free from the armature **14**. The lost-motion feature permits movement of the piston prior to this time. At this time the magnet **7** snaps over and becomes attached to the armature **15**.

It can be seen that the abutment **10** exerts a positive push in the event it engages the left hand collar **13** so as to effect the described break-away with consequent opening of the valve **1**. This opening is effected when the magnet assembly snaps to the left, because the right hand collar **13** engages the abutment **12** attached to the valve stem extension **2**.

Now with the valve **1** open the pressure in the back enclosure **16**, or in other words the full pressure from the source **17**, is available on the back of the piston **3** to advance the latter and force the fluid from the front chamber **19** out through the valve **1**. As this action progresses the abutment **10** applies compression to the right hand spring **11** until the valve **1** is snapped shut. After this the pressure again slowly starts to build up in the front chamber **19** by the slow leakage through the porous plug **21**.

In this operation the fluid pressure in the front chamber **19** must always be less than that in the back chamber **16** by the amount of the force applied by the spring **22** to retract the piston **3**. The flow through the porous plug flow reducer **21**, therefore, must always be that

caused by this pressure difference and will be independent of the ambient temperature. Therefore, the discharge rate of the device is substantially constant regardless of temperature.

A device of this character must ordinarily use some form of slow leak or flow reducer and the rate of flow through such a device varies with the pressure. Therefore, with high temperatures the prior art devices intermittently discharge with greater rapidity than at lower temperatures. In the case of the present invention this difficulty is overcome because the rate of flow is dependent only on the mechanical spring which creates the pressure differential between the front and back of the piston.

As shown by Figure 1 the device may be housed in a casing **23** containing the package **18** and provided with a discharge orifice **24** connecting with the valve **1** in the fashion shown by Figure 2.

The magnet assembly shown has the advantage that it eliminates friction, and possible consequent erratic operation. Prior art devices use latches and the like to effect the intermittent action, and these cause trouble in the case of devices like the present one which must be left for long periods unattended.

I claim:

An intermittently acting fluid valving device for fluid under pressure, the device including a fluid valve, a double-acting piston having a back causing the piston to advance when receiving fluid pressure and a front causing the piston to retract when receiving fluid pressure, means for connecting the piston to the valve to close the valve after the piston advances a limited distance and to open the valve after the piston retracts a limited distance, a back chamber enclosing the piston's back, fluid conduit means for connecting the back chamber to said source, a front chamber enclosing the piston's front, fluid conduit means for connecting the front chamber to said source, fluid conduit means for connecting the front chamber to the valve, and means for biasing the piston to retract, the device further including means for reducing the fluid flow through the conduit means for connecting the front chamber to said source, to a slower flow rate than the flow rate through the conduit means for connecting the back chamber to said source, said means for connecting the piston to the valve including a plurality of parts forming a lost-motion connection, a magnet, spring means for interconnecting said magnet with the respective parts of the lost-motion connection, and stationary armatures positioned near to the motion limits of the parts of the lost-motion connection.

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