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(54) **FLUID DELIVERY SYSTEM**

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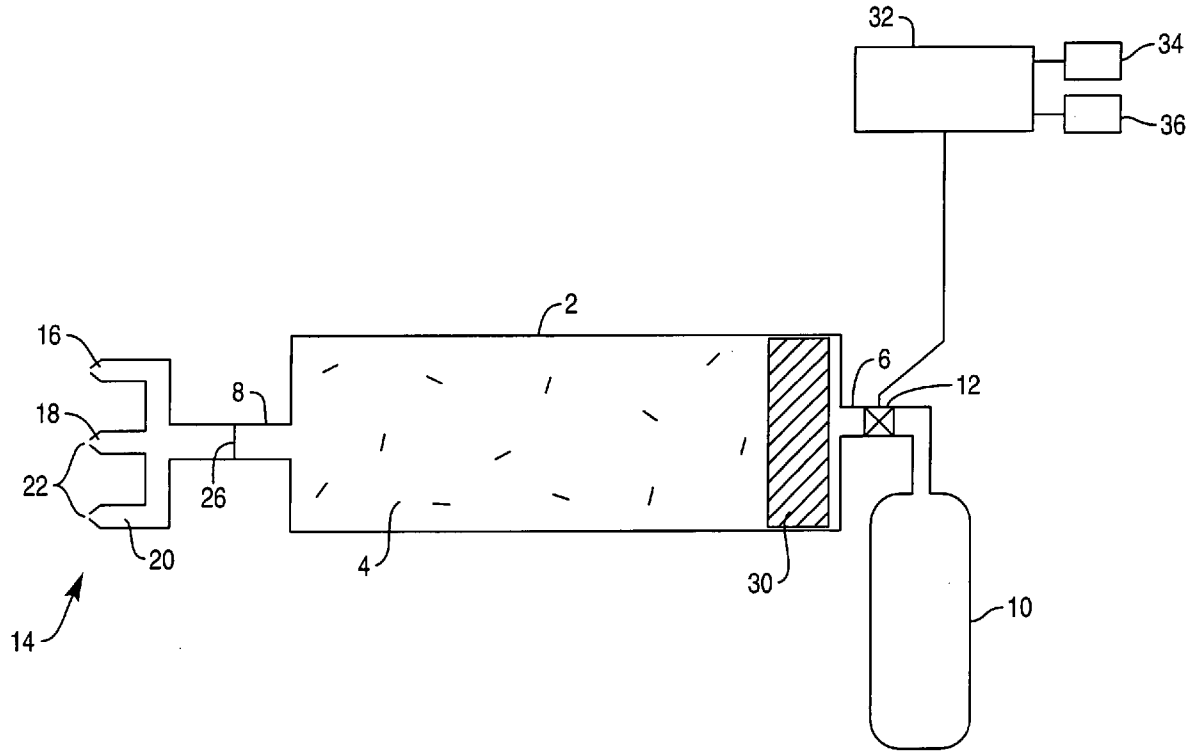
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(57) **ABSTRACT**

A fluid delivery system for degrading valuable items in the event on an attack is provided. A piston **30** is disposed within a cylinder **2**. On demand gas under pressure can be admitted into the cylinder **2** so as to urge the piston to move towards an outlet **8**, thereby expelling fluid **4** irrespective of the orientation of the delivery system.



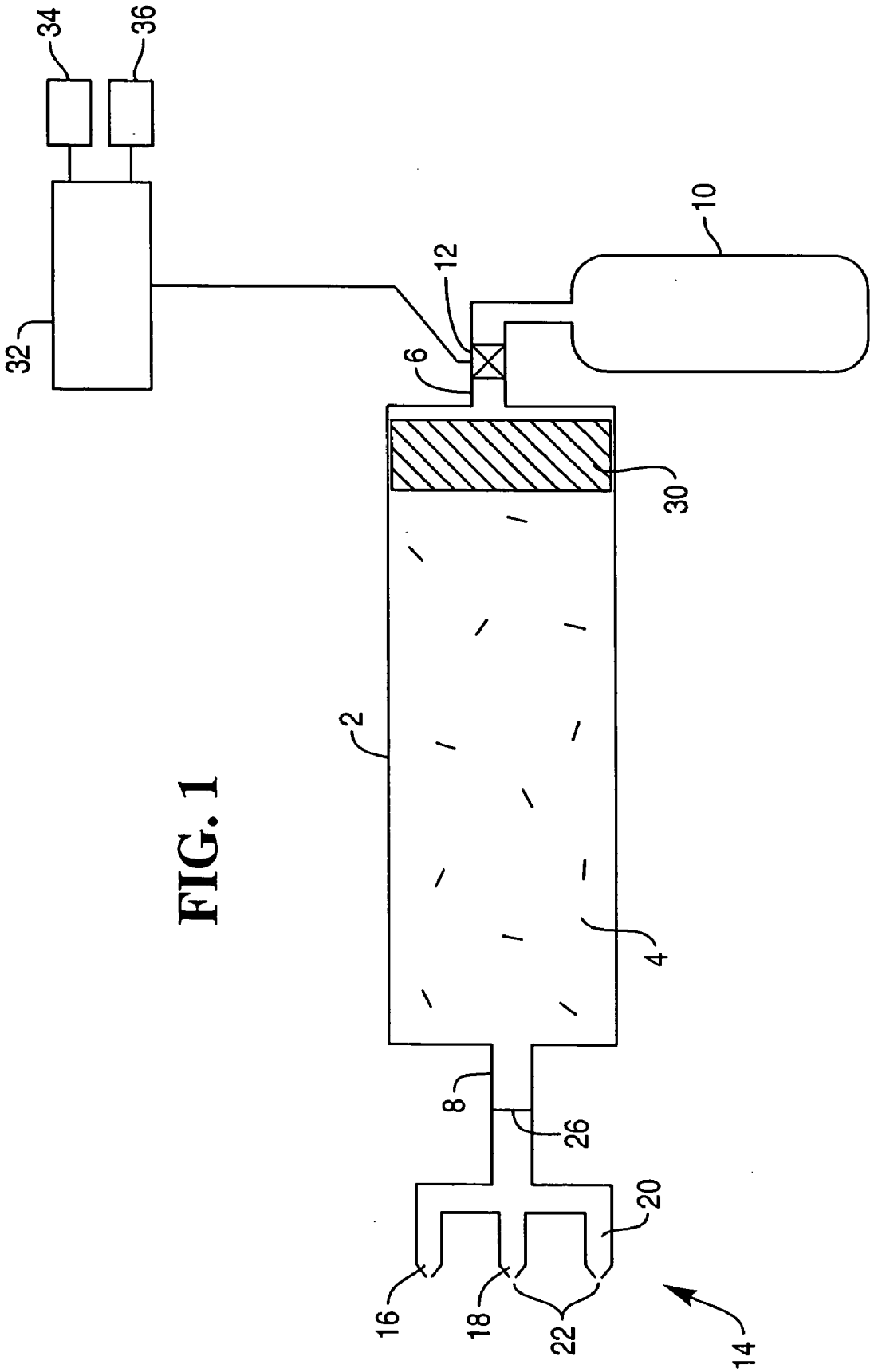


FIG. 1

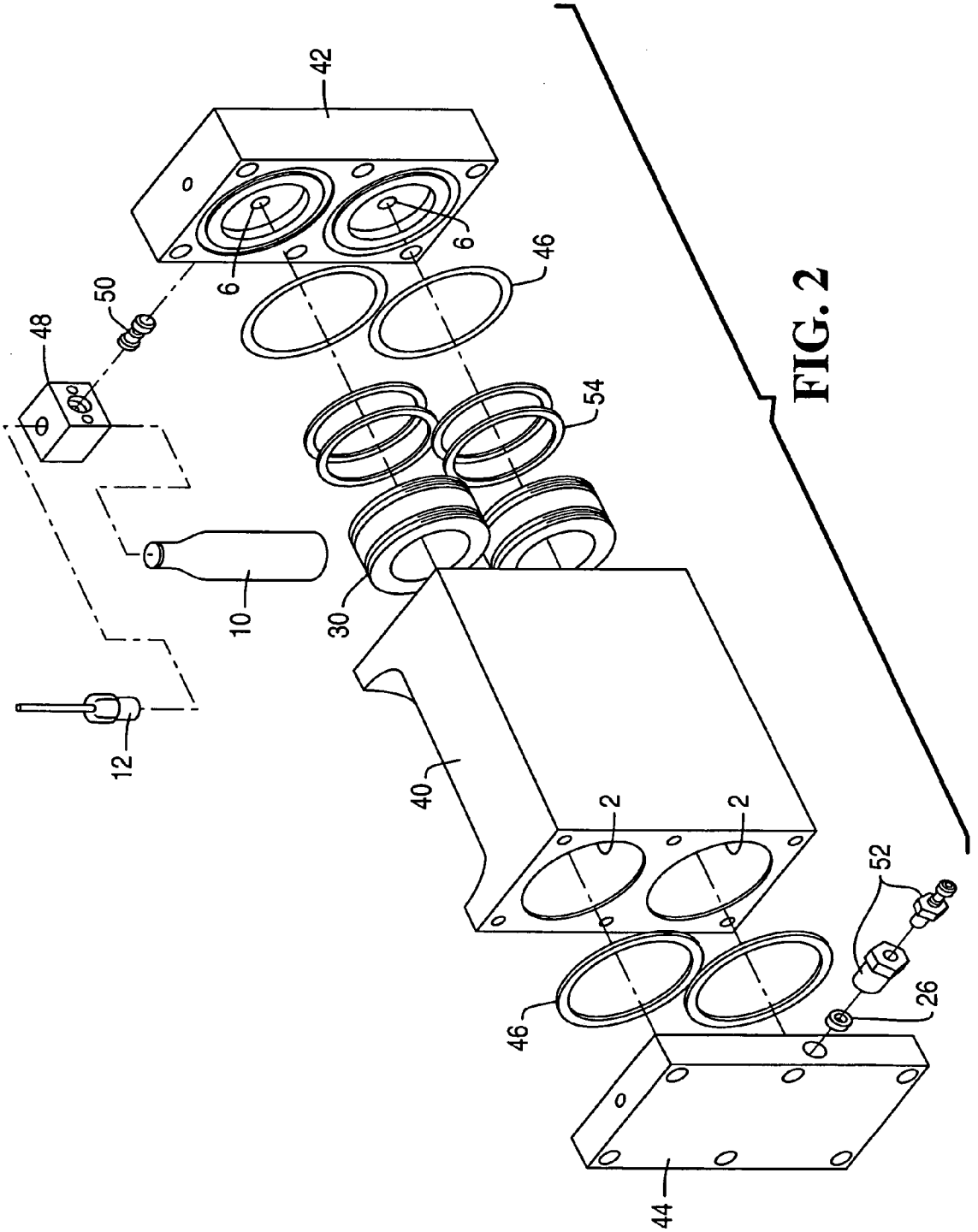


FIG. 2

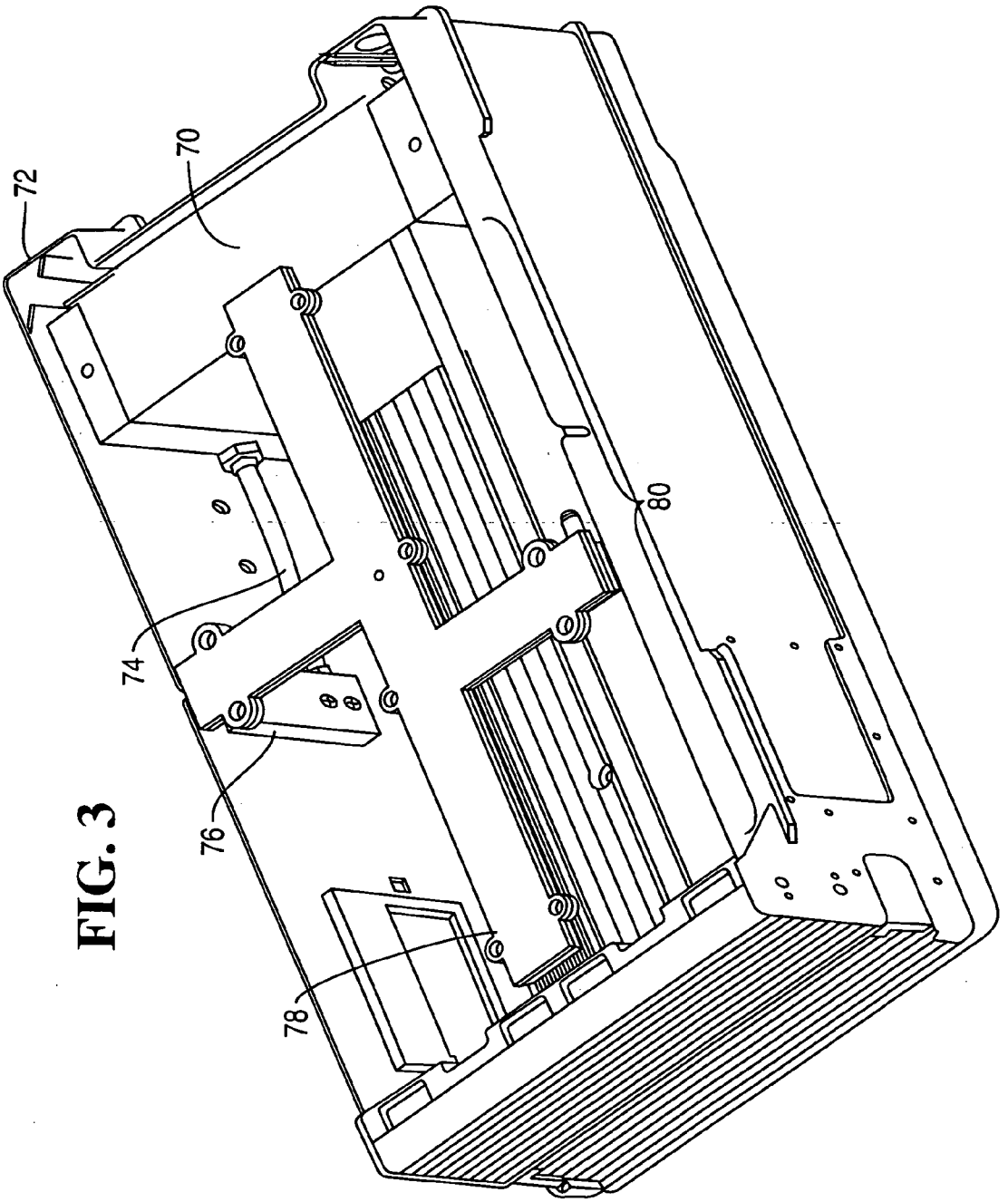


FIG. 3

FLUID DELIVERY SYSTEM

BACKGROUND OF THE INVENTION

[0001] The present invention relates to fluid delivery system forming a degradation unit and to a device including such a degradation unit for transporting valuable items.

[0002] The transportation of valuable items almost inevitably exposes these items to some risk of theft. A particularly commonplace example of the transport of financially valuable items is the transport of cash cassettes for the replenishment of automatic teller machines, otherwise known as ATMs. Typically large amounts of cash are delivered to ATMs in pre-filled cash cassettes. Furthermore, because disruption of service is generally not tolerated by customers, ATMs are replenished before they run out of money. Thus partially empty cash cassettes are removed from the ATMs and transported back to a replenishment facility. The majority of the transportation procedure is carried out within the security of an armored vehicle. However, the guards frequently have to carry loaded ATM cassettes from the van to the bank across public spaces, for example through city centers. During this transportation, the guard is vulnerable to attack and the container containing the loaded cash cassette may be stolen.

[0003] In order to reduce the likelihood of such attacks, the container used by the guard to transport the valuable items includes an automatic degradation system. The degradation system usually comprises a reservoir of fluid, such as ink, and a reservoir of compressed gas which can be controllably admitted into the reservoir of fluid. The admission of gas into the ink reservoir causes the ink therein to become displaced and this is generally expelled via a weighted flexible tube and a spray bar system over the valuables within the container. The weighted flexible tube extends into the ink reservoir such that the end of the tube naturally tends to flop towards the lower side of the reservoir such that the ink delivery system should not be defeatable by inverting the container. However this arrangement only works to a limited extent.

SUMMARY OF THE INVENTION

[0004] According to the first aspect of the present invention, there is provided a fluid delivery system comprising a first cylinder having an outlet and containing a fluid, a piston in substantially fluid sealed sliding engagement within the cylinder and supply means for the selective supply of gas under pressure into the first cylinder so that the piston is urged towards the outlet and the fluid is ejected via the outlet.

[0005] It is thus possible to provide a fluid delivery system in which the provision of a piston within a cylinder ensures that the fluid contained within the cylinder is reliably ejected from the cylinder irrespective of the orientation of the fluid delivery system.

[0006] Preferably the cylinder has an inlet and gas is provided from the supply means to the inlet.

[0007] Preferably the supply means comprises a reservoir of pressurized gas and electrically activated means for releasing gas from the reservoir. The electronically activated means may comprise an element which is urged to puncture a seal thereby allowing the gas to escape from the reservoir.

[0008] Advantageously the outlet of the cylinder is in fluid flow communication with a delivery conduit. The delivery conduit may, for example, be a spray bar which provides multiple fluid flow paths and exit apertures. The use of such a spray bar ensures that the fluid, such as a spoiling agent can be delivered over substantially the whole of a protected space in which it is desired to mark those items in the event of an attack or a presumed attack.

[0009] The fluid contained within the fluid delivery system which serves to mark the items may be a ink or other staining media such that the items are permanently discolored and thereby rendered unusable and worthless. However, alternatively, the fluid may contain invisible markers such that the contents may still be used but that they could be identified with suitable apparatus. One example of an invisible marker is known by the trade name "smart water" and is a solution containing trace elements. The combinations and ratios of trace elements differ from batch to batch so that individual batches can be identified and can be used to associate the valuable item with a particular theft.

[0010] Advantageously the outlet or the fluid delivery path further comprises a burst disk thereby ensuring that the fluid within the delivery system does not inadvertently leak out.

[0011] Advantageously the fluid delivery system may further comprise a second cylinder having a second piston therein. The second cylinder may have an inlet connected to the gas reservoir or to a further gas reservoir such that the second cylinder can also deliver a fluid when the supply means is actuated. The second cylinder may, for example, contain the same fluid as the first cylinder thereby increasing the amount of fluid that can be delivered by the delivery system. However the second cylinder may be operated from a separate gas supply thereby giving the system some degree of fault tolerance.

[0012] In an alternative arrangement, the first and second cylinders may contain different fluids. The fluids may be selected such that they react on mixing in order to give the beneficial or enhanced marking or spoiling effect. Thus, an ink may be provided in one cylinder and a foaming agent and/or surfactant may be provided in the second cylinder and the mixture of the two fluids may result in the production of a colored foam which serves to fill the volume containing the valuable items to be protected.

[0013] Advantageously the cylinder may be closed by a removable opening thereby allowing the fluid contained within the cylinder to be periodically replaced. Advantageously the fluid is contained with a ruptureable fluid reservoir such that operation of the supply means causes the piston to bear against the fluid reservoir and to cause it to open such that its contents may be ejected via the outlet.

[0014] Advantageously the fluid and the piston may be provided within a replaceable unit which itself is inserted into the cylinder.

[0015] As an alternative to having a gas cylinder, a solid state gas generation system may be provided, for example fuel which can be electronically ignited to produce a rapid increase in gas pressure to cause motion of the piston.

[0016] According to a second aspect of the present invention there is provided a container for delivering valuable

items and including a fluid delivery system in accordance with the first aspect of the present invention.

[0017] According to a third aspect of the present invention there is provided a cash cassette for use within an automatic teller machine, wherein the cash cassette includes a fluid delivery system according to the first aspect of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The present invention will further be described, by way of example, with reference to the accompanying drawings in which:

[0019] **FIG. 1** schematically illustrates an ink delivery system constituting an embodiment of the present invention;

[0020] **FIG. 2** is an exploded perspective view of a delivery system constituting an embodiment of the present invention; and

[0021] **FIG. 3** is perspective view of a cash delivery cassette incorporating an ink injection module and constituting an embodiment of the present invention.

DETAILED DESCRIPTION

[0022] The ink delivery system schematically illustrated in **FIG. 1** comprises a cylinder **2** containing a spoiling agent **4** such as an ink. The cylinder **2** has an inlet **6** and an outlet **8**. The inlet **6** is connected to a reservoir of pressurized gas **10**. A control valve **12** is provided between the reservoir **10** and the inlet **6** such that gas can be admitted into the cylinder **2** upon demand. The control valve **12** is generally in the form of a pyrotechnic actuated pin arranged to puncture a closure of the reservoir **10**. The outlet **8** is connected to a spray bar **14** which comprises a plurality of delivery paths **16**, **18** and **20** each having at least one aperture **22** through which the fluid **4** can be delivered. A burst disc **26** is provided in order to prevent the fluid **4** from leaking into the spray bar **14**.

[0023] A piston **30** is provided in substantially fluid sealed sliding engagement within the cylinder **2** and is located adjacent the inlet **6**. A controller **32** for operating the valve **12** is responsive to sensors **34** and **36** amongst other inputs in order to determine whether or not an attempt at theft or attack is occurring to a container protected by the delivery system. The sensors **34** and **36** may comprise one or more of temperature sensors to determine whether an attempt is being made to open the container via thermal cutting or whether an attempt is being made to defeat the delivery system by freezing; motion sensors; sensors for detecting attempts to breach the integrity of the container; timers for determining that the container has not been delivered within an allotted time and the like. In the event that the controller **32** determines that a theft is in progress, it sends a signal to the electrically controlled valve **12** to release pressurized gas from the reservoir **10**. The gas pressure presses against the piston **30** and urges it to move towards the outlet **8**. In so doing, pressure within the cylinder increases thereby causing the burst disc **26** to rupture and then the fluid **4** is expelled through the outlet **8** and the spray bar **20**.

[0024] **FIG. 2** schematically illustrates an embodiment of the invention in greater detail, like parts are referred to by like reference numbers. As can be seen, two cylinders **2** are formed within a block of material **40**. The cylinders **2** are closed by end caps **42** and **44** which are bolted to the block **40**. Seals **46** are provided to ensure that there is no inadvertent leakage of fluid from the cylinders. The gas reservoir **10**, in the form of a $C0_2$ cylinder, such as an 8 gm $C0_2$ cylinder is connected via a T-piece manifold **48** to the inlet end cap **42**. A pyrotechnically operated operating means, known as a protractor **12**, extends into the T-piece manifold opposite the cylinder **10** such that it can rupture a seal of the cylinder thereby allowing gas to escape. A restrictor **50** is provided in an outlet path from the manifold **48** so as to control the rate of flow of gas from the gas reservoir **10** into the cylinders **2**. Gas is delivered via internal delivery ducts in the end piece **42** to inlet apertures **6** of the cylinders. Similarly outlet paths are formed in the end piece **44** which are terminated by a burst disc **26** positioned adjacent to an outlet adapter **52** which may be formed of two inter-operable parts as shown in **FIG. 2**.

[0025] The pistons **30** are provided **0**-ring seals **54** which serve to ensure that the pistons engage in substantially fluid sealed engagement with the cylinder without requiring the use of unnecessarily precise manufacturing tolerances.

[0026] The arrangement shown in **FIG. 2** can be assembled to form an ink injection module **70** which can be placed within the cash space within a cash cassette **72**, as shown in **FIG. 3**. A delivery pipe **74** extends from the ink injection module **70** to an inlet manifold **76** of a spray bar **78**. The spray bar extends along the length of a cash containing region **80** thereby ensuring that ink in the injection module **70** can be sprayed onto all of the cash contained within the region **80** thereby marking all or substantially all of it to some degree in the event of an attempt of theft. The provision of an ink injection module within the cash carrying cassette ensures that the external dimensions of the cassette do not become altered. This is important if the device is to be retrofitted into existing ATMs as it is not possible to economically redefine the layout of such devices. The size of the ink injection module can be varied in accordance with the volume of ink contained therein to suit an operator's requirement concerning the level of stain or probability that any individual note will be stained.

[0027] In the preferred embodiment of the present invention the cylinder body **40** is formed either of an extruded plastic which is resistant to the organic solvents used in the ink/stains typically found in such degradation systems or from Aluminum. The pistons are made of the same material as the cylinder body thereby ensuring that the coefficient thermal expansion is identical to that of the cylinder body. The seals are advantageously of low friction PTFE. It is thus possible to provide a compact and robust spoiling agent delivery system which can operate to deliver the spoiling agent rapidly irrespective of the orientation of the delivery system and/or the container protected by such a delivery system.

What is claimed is:

1. A fluid delivery system comprising:

a first cylinder having an outlet and containing fluid;

a piston in substantially fluid sealed sliding arrangement within the cylinder; and

supply means for the selective supply of gas under pressure into the first cylinder so that the piston is urged towards the outlet and the fluid is ejected from the outlet.

2. A fluid delivery system as claimed in claim 1, wherein the cylinder has an inlet and the means for the selective supply of gas under pressure to the inlet comprises a pressurized gas reservoir and electronically activated means for opening the reservoir.

3. A fluid delivery system as claimed in claim 2, wherein the pressurized gas reservoir contains pressurized carbon dioxide gas.

4. A fluid delivery system as claimed in claim 1, wherein the outlet is connected to a spray bar.

5. A fluid delivery system as claimed in claim 1, further comprising a burst disc in a fluid delivery path following the outlet of the first cylinder.

6. A fluid delivery system as claimed in claim 1, further comprising a second cylinder containing fluid and having an inlet and an outlet, a second piston in substantially fluid sealed sliding engagement therein, and means for the selective supply of gas to the inlet of the second cylinder, wherein gas under pressure is introduced at the inlet, so that the piston is urged towards the outlet and the fluid is ejected from the outlet.

7. A fluid delivery system as claimed in claim 6, wherein the first and second cylinders share common means for the selective supply of gas.

8. A fluid delivery system as claimed in claim 6, wherein a common fluid delivery path follows the outlet of the first and second cylinders.

9. A fluid delivery system as claimed in claim 6, wherein the first and second cylinders contain different fluids.

10. A fluid delivery system as claimed in claim 6, further comprising at least two relatively moveable sections, wherein the contents of a cylinder can be accessed by moving at least one of the sections relative to the other sections.

11. A fluid delivery system as claimed in claim 10, wherein the fluid in a cylinder is further contained within a removable fluid container.

12. A fluid delivery system as claimed in claim 11, wherein the piston contained within a cylinder is further contained within the removable fluid container.

13. A media protection system comprising:

a media container; and

a fluid delivery system comprising (i) a cylinder having an outlet and containing fluid, (ii) a piston in substantially fluid sealed sliding arrangement within the cylinder, and (iii) supply means for the selective supply of gas under pressure into the cylinder so that the piston is urged towards the outlet and the fluid is ejected from the outlet.

14. A media protection system as claimed in claim 13, wherein the media container includes a cash cassette.

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