(54) Title: ELECTRONICALLY CONTROLLED PILL AND SYSTEM FOR DELIVERING AT LEAST ONE MEDICAMENT

(57) Abstract: An electronically controlled pill (100) or medicament delivery system is provided. The pill (100) includes a housing (102); a medicament reservoir (104) for storing a medicament; an electronically controlled release valve or hatch (106) for dispensing one or more medicaments stored in the medicament reservoir (104) while traversing the gastrointestinal tract; control and timing circuitry (108) for opening and closing the valve (106); and a battery (109). The control and timing circuitry (108) opens and closes the valve (106) throughout a dispensing time period in accordance with a preset dispensing timing pattern which is programmed within the control and timing circuitry (108).
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
ELECTRONICALLY CONTROLLED PILL AND SYSTEM
FOR DELIVERING AT LEAST ONE MEDICAMENT

The present invention relates generally to medication delivery systems. More particularly, it relates to an electronically controlled pill and system for delivering at least one medicament.

A medicament is generally administered as a pill or a liquid to be taken at least one time per day. A person may be required to take or be administered several medicaments each day during the same or different times. This requires that the person or his caregiver maintain a log or remember which medicaments to take or administer at different times during the day.

A medicament, such as aspirin, taken by the person generally traverses the gastrointestinal (GI) tract where it is absorbed for treating an ailment or condition. Objects typically pass through the GI tract in 20-40 hours. Several medicaments are available as time-release capsules for releasing portions of the medicament into the body at different times. Time-release capsules utilize chemical reactions between chemical substances in the gastrointestinal tract and the coating of the capsules for dissolving and releasing the medicament. Food, particularly proteins and fats, and the GI chemistry affect the speed of the journey of medicaments through the stomach. As such, medicaments, including medicaments available as time-release capsules, do not follow an exact dispensing or dissolving pattern while traveling through the GI tract.

For example, one person may have more than a “normal” amount of chemical substances in the gastrointestinal tract due to a condition, an earlier-administered medicament, etc. and therefore, cause the coating of the time-release capsule to react quicker than normal. Accordingly, the medicament is released by the time-release capsule at a faster rate than an intended rate. However, another person may have less than the “normal” amount of chemical substance in the gastrointestinal tract and cause the coating of the time-release capsule to react slower than normal, thereby releasing the medicament at a slower rate than the intended rate.

Further, as with traditional medicaments available in non-time-release form, time-release capsules require a person or caregiver maintain a log or remember which medicaments to take or administer at different times during the day. For example, some medicaments must be taken at bedtime, such as NSAIDS for rheumatoid arthritis, to produce fewer gastrointestinal complications, such as indigestion. Other medicaments,
such as the anti-inflammatory corticosteroid medication prednisone, can cause insomnia when taken in high doses, and are typically taken in the morning. Still, other medicaments, such as antihistamines, are typically taken in the evening to prepare for symptoms that often occur in the morning.

The present invention provides an electronically controlled pill or medicament delivery system for delivering or dispensing a medicament according to a preset dispensing timing pattern while traversing through the gastrointestinal tract. The preset dispensing timing pattern is fixed and is not susceptible to a person’s physiological processes and conditions, mood, earlier-administered medicaments, etc. The electronically controlled pill includes control and timing circuitry for controlling the opening and closing of a valve or hatch according to the preset dispensing timing pattern for dispensing a medicament stored within a medicament reservoir of the pill. The electronically controlled pill allows a person to take all pills substantially simultaneously, at say 7:00 am, so that no more pills are required for the day. Medication that does not fit into one electronically controlled pill can be coordinated with other electronically controlled pills for the full day’s payload regimen.

According to the present invention, all of the medicaments required to be taken during a particular time period, for example, during a 24-hour period, can be provided within one or more electronically controlled pills which can all be taken at the same time. The electronically controlled pills can have different dispensing timing patterns, so that a full day’s coverage can be obtained. As such, the present invention also provides a treatment system for administering two or more medicaments at the same time via the one or more electronically controlled pills. Each pill has an independent, preset dispensing timing pattern in order to dispense its medicaments within the body according to a dispensing pattern. The dispensing pattern can be varied from person to person depending on each person’s physical condition, age, gender, ailments, etc. Further, at a preset moment in time during the dispensing timing patterns, the electronically controlled pills present in the body may be programmed to stop dispensing medicament, in the expectation that a new set of pills will be taken. This prevents accidental overdose by having only the most recently taken pills dispensing medicament in the body.

The treatment system of the present invention enables an individual to take all of his medicaments at substantially the same time, e.g., in the morning or in the evening, and not at different times during a particular time period (e.g., a 24-hour period). The
treatment system of the present invention further enables a caregiver to administer once per
day (i.e., once per a 24-hour period) all of the medicaments for each patient of a hospital or
resident of a nursing home (or animals in a shelter or veterinary facility). The system of
the present invention therefore avoids the need for a caregiver to wake up or otherwise
disturb a patient or resident for the sole purpose of administering a medicament, or to track
down a patient or resident who may be in a different part of the hospital or nursing home
for the sole purpose of administering a medicament. The system of the present invention
also reduces the overload required for inventorying, ordering, tracking and logging the
medicaments.

Various embodiments of the present disclosure will be described herein below with
reference to the figures wherein:

FIG. 1 is a schematic diagram of an electronically controlled pill in accordance with
the present invention;

FIG. 2 is a chart illustrating an exemplary preset dispensing timing pattern for the
electronically controlled pill in accordance with the present invention;

FIG. 3 is a schematic diagram of the electronically controlled pill dispensing a
medicament in accordance with the present invention; and

FIG. 4 is a diagram of a kit having a plurality of electronically controlled pills
tailored for administration to a particular individual.

An electronically controlled pill or medicament delivery system according to the
present invention is shown by FIG. 1, and further described with specificity hereinafter.
The electronically controlled pill 100 is a self-contained, electronically controlled medicine
delivery system. As described in detail below, the electronically controlled pill 100
includes programmed electronics that control a release mechanism according to a
dispensing pattern for dispensing a medicament. The pill 100 is made from bio-
compatibles materials such that the pill 100 is bio-compatible for at least the amount of
time it requires to traverse the gastrointestinal tract. The bio-compatible materials are
preferably stable in room temperature, such that the pill has a long shelf life. As used
herein and in the claims the word “medicament” refers to medicines, non-medicinal
substances, contrast agents, gases, fluids, liquids, chemicals, radiological agents, imaging
markers, sensors for monitoring the person’s vitals, etc.

The electronically controlled pill 100 includes an outer shell or housing 102; a
medicament reservoir 104 for storing a medicament; an electronically controlled release
valve or hatch 106 for dispensing the medicaments stored in the medicament reservoir 104; control and timing circuitry 108 for opening and closing the valve 106; and a battery 109. The control and timing circuitry 108 opens and closes the valve 106 throughout a dispensing time period in accordance with a preset dispensing timing pattern as further described below. The preset dispensing timing pattern is pre-programmed and is not susceptible to a person’s physiological processes and conditions, mood, earlier-administered medicaments, etc.

The shell 102 is preferably manufactured from materials used to fabricate implantable devices, including pacemaker leads and cardiac prosthesis devices, such as artificial hearts, heart valves, intraaortic balloons, and ventricular assist devices. These materials include Pellathane® 2363 polyetherurethane series of materials available from Dow Chemical Company and Elastane polyetherurethane available from the Polymer Technology Group, Inc. Other materials include PurSil® and CarboSil® also available from the Polymer Technology Group, Inc.

The amount that the valve 106 is opened at each moment in time (e.g., each second) of the dispensing time period is dependent upon the preset dispensing timing pattern which is programmed within timing circuitry 110 of the control and timing circuitry 108. The dispensing time period is defined as the time period from when the electronically controlled pill 100 is placed in a person’s mouth to the time all of the medicament stored within the medicament reservoir 104 has been dispensed, or the day (24-hour period) has expired. This 24-hour period may be shifted slightly to account for differences in absorption in the stomach versus the colon.

As shown by the exemplary preset dispensing timing pattern illustrated by FIG. 2, at dispensing time periods A, D and F, identical quantities of the medicament are dispensed throughout each of these dispensing time periods. Therefore, during these dispensing time periods, the valve 106 is kept open by the control and timing circuitry 108 to provide a fixed valve opening (or frequency of opening) for dispensing a predictable quantity of the medicament at each moment in time of dispensing time periods A, D and F. Approximately the same amount of medicament is dispensed at each moment in time during dispensing time periods A and F. During dispensing time period D, a higher quantity of medicament is dispensed than during dispensing time periods A and F.

However, at dispensing time periods B, C and E, as shown by FIG. 2, different quantities of the medicament are dispensed at each moment in time. Therefore, during
dispensing time periods B, C and E, the valve opening is varied accordingly by the control and timing circuitry 108 to dispense a quantity of the medicament varying at each moment in time. During dispensing time period B, the quantity of medicament dispensed during each moment in time is increased compared to the previous moment in time; whereas during dispensing time periods C and E, the quantity of medicament dispensed during each moment in time is decreased compared to the previous moment in time.

In accordance with the present invention, during the entire dispensing time period, the control and timing circuitry 108 is programmed for closing the valve 106 and controlling the amount the valve 106 is opened for controlling the size of the valve opening. By controlling the size of the valve opening or frequency of valve opening, such as is enabled by microfluidic systems of inkjet printers and the like, the electronically controlled pill 100 can precisely control the quantity of medicament released during each moment in time (e.g., each second) of the dispensing time period.

By knowing the quantity or approximate quantity of medicament released during each moment in time by referring to a time release pattern, such as the one shown by FIG. 2, one can precisely determine the cumulative amount of medication released over a particular time period of the dispensing time period. For example, one can determine the cumulative amount of medicament released during the first six hours of the dispensing time period, the first two hours until the last hour of the dispensing time period, the entire dispensing time period, etc. One can also determine the amount of medicament dispensed during a particular moment of the dispensing time period, such as at two hours and fifteen minutes after the pill 100 has been administered.

The preset dispensing timing pattern may be varied from one electronically controlled pill 100 to another by programming the control and timing circuitry 108 of each pill 100 to have a different preset dispensing timing pattern. Therefore, two individuals can be administered the same medicament utilizing two different preset dispensing timing patterns. The timing patterns can be determined using a look-up table which correlates one or more characteristics of a person with one or more preset dispensing timing patterns.

For example, a look-up table can correlate at least one of age, gender, weight, etc. with preset dispensing timing patterns. The person would then be administered an electronic pill 100 which is programmed with one of the determined preset dispensing timing patterns. Accordingly, the pill 100 of the present invention enables the same
medicament to be administered to different individuals using different dispensing timing patterns.

Additionally, for young and old people that have difficulty taking or remembering to take pills, the preset dispensing timing patterns are a way to reduce the number of pills taking during a particular time period, e.g., a 24-hour period. All of the medicament required to be administered during the particular time period to an individual can be provided in one pill 100 having a preset dispensing timing pattern for dispensing the medicament according to predetermined quantities during the particular time period. If the payload in one pill is insufficient, then two electronically controlled pills are used to dispense the same medicament, where one pill does not start dispensing the medicament until the other pill has dispensed its medicament, i.e., its dispensing time period has lapsed or ended. Further, the present invention reduces the amount of labor required to administer pills in places like hospitals, nursing homes and veterinary facilities. By reducing the number of times that pills are administered, the number of medicament administration errors can also be reduced.

With reference to FIG. 1, the control and timing circuitry 108 includes timing circuitry 110 programmed with the preset dispensing timing pattern, a start timer mechanism 112, a release controller 114 and a pressure mechanism 116. The start timer mechanism 112 enables activation of the timing circuitry 110. The battery 109 powers the control and timing circuitry 108 in order for each of the electromechanical components to operate during the dispensing time period.

In a preferred embodiment, the start timer mechanism 112 is a micro-electromechanical (MEM) mechanism having a sensor 118 for sensing the presence of a liquid, such as water, saliva, etc. When the pill 100 is taken or administered, the sensor 118 senses the presence of a liquid, and transmits an electrical signal to the timing circuitry 110. In an alternate embodiment the start timer mechanism is a button which is pushed to transmit the electrical signal to the timing circuitry 110. The button is pushed just before the pill 100 is administered to a person or animal.

In another embodiment, this can be achieved by dissolving a thin, water soluble coating that separates two electrical contacts, enabling the switch to close the circuit. In still another embodiment, the switch is manually triggered by the patient or caregiver.

Upon receiving the electrical signal, the timing circuitry 110 begins to clock the dispensing time period and control the release controller 114 by transmitting a signal
thereof. The timing circuitry 110 includes a microprocessor programmed with the preset dispensing timing pattern for relaying the signal to the release controller 114, such that the medicament is dispensed during the dispensing time period substantially according to the preset dispensing timing pattern, such as the one shown by FIG. 2.

The voltage level of the signal relays the size of the valve opening for controlling the quantity of the medicament dispensed at each moment of the dispensing time period substantially according to the preset dispensing timing pattern as shown by FIG. 2. In an alternate embodiment, the signal transmitted by the timing circuitry 110 to the release controller 114 only relays the opening and closing of the valve 106 and not the size of the valve opening.

The release controller 114 is preferably a micro-electromechanical mechanism capable of receiving the signal from the timing circuitry and generating a signal having a variable voltage level to the electronically controlled valve 106 for closing the valve 106 and controlling the size of the valve opening or degree of opening of the valve 106 (in accordance with the voltage level of the received signal). In the simplest case, the release controller 114 is a transistor or D/A circuit that provides voltages to the valve 106 causing it to open or close.

The electronically controlled valve 106 is preferably a micro-electromechanical mechanism capable of being electrically controlled by a signal having a variable voltage levels. Each voltage level corresponds to a different size opening for the valve opening and one voltage level (or no voltage at all, i.e., no signal) corresponds to the valve 106 being closed. The valve 106 is similar in operation to valves used in ink-jet printers for dispensing ink in accordance with the amount that the valve is opened. The valve 106 is characterized as a microfluidic valve for controlling the movement of minute amount of liquids or gases in a miniaturized system.

In an alternate embodiment, the reservoir 104 is a micro-syringe, whereby pressure applied to a plunger of the syringe dispenses the medicament via a needle tip of the micro-syringe which is in fluid communication with an opening in the shell 102. In this embodiment, the opening replaces the valve 106. It is contemplated, however, that a check valve is placed at the needle tip of the micro-syringe to avoid leakage of the medicament during time periods within the dispensing time period where there should be no dispensing according to the preset dispensing timing pattern, and/or for controlling the quantity of medicament dispensed during the dispensing time period.
The pressure mechanism 116 is located outside the medicament reservoir 104 ensuring that the medicament is directed toward the valve 106. In the simplest case, the pressure mechanism 116 is preferably a biodegradable spring as shown by FIGs. 1 and 3. The pressure mechanism 116 can also be another type of spring, a piston, or any mechanism for performing the function of the pressure mechanism 116. That is, for performing the function of applying pressure to a piston-type member 130 when the valve 106 is open to push the piston-type member 130 towards the valve 106. As the piston-type member 130 moves towards the valve 106 pressure within the reservoir 104 causes the medicament to be dispensed as shown by FIG. 3.

In an alternate embodiment, the medicament reservoir 104 is kept under pressure to assure a proper quantity of medicament is dispensed in accordance with the degree of openness of the valve 106, without the need for the pressure mechanism 116. The pressure can be monitored by a pressure sensor which relays the monitored pressure to the control and timing circuitry 108. If the pressure is outside a predetermined range, the circuitry 108 can then adjust the valve opening to increase or decrease the pressure. Naturally, the pressure of the reservoir 104 can be different for each medicament and can depend on the medicament’s viscosity.

It is contemplated that a look-up table or other data structure can be assessed by the circuitry 108 which correlates pressure, degree of valve opening, and other parameters, such as period of time in the dispensing time period, for determining, for example, the degree of valve opening by knowing the pressure, and vice versa. Based on the information obtained by assessing the look-up table, the circuitry 108 can then adjust the pressure, the valve opening, etc. These adjustments can be made in order to substantially track the preset dispensing timing pattern programmed within the pill 100.

According to the present invention, all of the medicaments required to be taken during a particular time period, for example, during a 24-hour period, can be provided within one or more electronically controlled pills 100 which can all be taken at the same time. As such, a treatment system of the present invention provides for two or more medicaments to be administered at the same time via the one or more electronically controlled pills 100. Each pill 100 has an independent, preset dispensing timing pattern in order to dispense its medicaments within the body according to a dispensing pattern. The dispensing pattern can be varied from person to person depending on each person’s physical condition, age, gender, ailments, etc.
The treatment system of the present invention enables an individual to take all of his medicaments at substantially the same time, e.g., in the morning or in the evening, and not at different times during a particular time period (e.g., a 24-hour period). The treatment system of the present invention further enables a caregiver to administer once per day (i.e., once per a 24-hour period) all of the medicaments for each patient of a hospital or resident of a nursing home (or animals in a shelter or veterinary facility). The system of the present invention therefore avoids the need for a caregiver to wake up or otherwise disturb a patient or resident for the sole purpose of administering a medicament, or to track down a patient or resident who may be in a different part of the hospital or nursing home for the sole purpose of administering a medicament.

The present invention also provides a kit 200 as shown by FIG. 4 having two or more electronically controlled pills 100 packaged within a container 202. Each pill 100 is placed within an indenture or recess 201 of the container 202 and each pill 100 has an independent, preset dispensing timing pattern programmed therein. The pills 100 of the kit 200 are custom tailored for an individual (or animal), such that the individual or his caregiver can be provided with the container 202 by a physician, pharmacist, etc.

A timing schedule 204 is provided inside the container indicating when each of the pills 100 of the kit 200 is to be taken, e.g., the time and day of the week. The timing schedule 204 includes an area 206 where a physician, pharmacist, etc. can write the time when the pills 100 for each particular day are to be taken, and circle am or pm. Two or more pills 100 may need to be taken at a particular time of a given day, as shown by FIG. 4, where each pill has a different medicament stored therein and a different preset dispensing timing pattern. As such, an individual can take all of the pills 100 which are indicated to be taken at the particular time of the given day and not take any other pills 100 until the same time the following day.

Since each of the pills 100 of the kit 200 has a programmed preset dispensing timing pattern, there is little or no concern that the medicaments from each pill 100 would interact with each other even though the pills 100 are taken at the same time. For example, one of the pills 100 of the kit 200 can start dispensing immediately, while another pill 100 of the kit 200 would not start dispensing until three hours later.

The described embodiments of the present invention are intended to be illustrative rather than restrictive, and are not intended to represent every embodiment of the present invention. Various modifications and variations can be made without departing from the
spirit or scope of the invention as set forth in the following claims both literally and in equivalents recognized in law.
CLAIMS:

1. A medicament delivery system (100) for dispensing a medicament while traversing the gastrointestinal tract, said system (100) comprising:
   a housing (102);
   a reservoir (104) for storing said medicament within said housing (102);
   a valve (106) in fluid communication with said reservoir (104); and
   control and timing circuitry (108) for controlling said valve (106) for opening and closing said valve (106) for dispensing said medicament, wherein said control and timing circuitry (108) is programmed with a dispensing timing pattern, and wherein said medicament is dispensed substantially according to said dispensing timing pattern.

2. The system (100) according to Claim 1, wherein said housing (102) is manufactured from at least one material selected from the group consisting of Pellethane®, 2363 polyetherurethane series of materials, Elastane polyetherurethane, PurSil®, and CarboSil®.

3. The system (100) according to Claim 1, further comprising a pressure mechanism (116) for applying pressure to a piston-type member (130) for forcing said medicament within said reservoir (104) towards said valve (106).

4. The system (100) according to Claim 3, wherein said pressure mechanism (116) is a spring.

5. The system (100) according to Claim 1, further comprising a battery (109) for powering said control and timing circuitry (108).

6. The system (100) according to Claim 1, wherein said control and timing circuitry (108) comprises a start timer mechanism (112), timing circuitry (110), and a release controller (114), wherein said start timer mechanism (112) transmits a signal to said timing circuitry (110) for clocking a dispensing time period, and wherein said timing circuitry (110) transmits a signal to said release controller (114) for controlling said valve (106) for dispensing said medicament substantially according to said dispensing timing pattern during said dispensing time period.

7. The system (100) according to Claim 1, wherein said dispensing timing pattern correlates an approximate quantity of said medicament to be dispensed during each moment of time during a dispensing time period.

8. The system (100) according to Claim 1, wherein said release controller (114) controls a degree of opening of said valve (106).
9. The system (100) according to Claim 6, wherein said start timer mechanism (112) is a micro-electromechanical (MEM) mechanism having a sensor (118) for sensing the presence of a liquid.

10. The system (100) according to Claim 1, wherein said reservoir is a micro-syringe.

11. A medicament treatment kit (200) comprising:

   a container (202) enclosing a plurality of medicament delivery systems (100) for delivering a medicament while traversing the gastrointestinal tract, wherein each system (100) comprises:
   
   a housing (102);
   
   a reservoir (104) for storing said medicament within said housing (102);
   
   a valve (106) in fluid communication with said reservoir (104); and
   
   control and timing circuitry (108) for controlling said valve (106) for opening and closing said valve (106) for dispensing said medicament, wherein said control and timing circuitry (108) is programmed with a dispensing timing pattern, and wherein said medicament is dispensed substantially according to said dispensing timing pattern; and
   
   a schedule (204) indicating when each of the medicament delivery systems (100) is to be taken.

12. The kit (200) according to Claim 11, wherein each medicament delivery system (100) further comprises a pressure mechanism (116) for applying pressure to a piston-type member (130) for forcing said medicament within said reservoir (104) towards said valve (106).

13. The kit (200) according to Claim 11, wherein said control and timing circuitry (108) comprises a start timer mechanism (112), timing circuitry (110), and a release controller (114), wherein said start timer mechanism (112) transmits a signal to said timing circuitry (110) for clocking a dispensing time period, and wherein said timing circuitry (110) transmits a signal to said release controller (114) for controlling said valve (106) for dispensing said medicament substantially according to said dispensing timing pattern during said dispensing time period.

14. The kit (200) according to Claim 11, wherein said dispensing timing pattern correlates an approximate quantity of said medicament to be dispensed during each moment of time during a dispensing time period.
15. The kit (200) according to Claim 11, wherein said release controller (114) controls a degree of opening of said valve (106).

16. The kit (200) according to Claim 11, wherein at least two of said plurality of said medicament delivery systems (100) have different dispensing timing patterns.

17. A treatment system for administering at least two medicaments comprising:
   a first and second medicament delivery system (100) for dispensing a respective medicament according to a respective dispensing timing pattern while traversing the gastrointestinal tract, each of said first and second systems (100) comprising:
   a housing (102);
   a reservoir (104) for storing said medicament within said housing (102);
   a valve (106) in fluid communication with said reservoir (104); and
   control and timing circuitry (108) for controlling said valve (106) for opening and closing said valve (106) for dispensing said respective medicament, wherein said control and timing circuitry (108) is programmed with said respective dispensing timing pattern, and wherein said respective medicament for each of said systems (100) is dispensed substantially according to said respective dispensing timing pattern.

18. The system according to Claim 17, wherein said first and second medicament delivery systems (100) further comprise a pressure mechanism (116) for applying pressure to a piston-type member (130) for forcing said medicament within said reservoir (104) towards said valve (106).

19. The system according to Claim 17, wherein said control and timing circuitry (108) comprises a start timer mechanism (112), timing circuitry (110), and a release controller (114), wherein said start timer mechanism (112) transmits a signal to said timing circuitry (110) for clocking a dispensing time period, and wherein said timing circuitry (110) transmits a signal to said release controller (114) for controlling said valve (106) for dispensing said medicament substantially according to said respective dispensing timing pattern during said dispensing time period.

20. The system according to Claim 17, wherein each of said respective dispensing timing pattern correlates an approximate quantity of said medicament to be dispensed during each moment of time during a dispensing time period.

21. A medicament delivery system (100) for dispensing a medicament while traversing the gastrointestinal tract, said system (100) comprising:
   a housing (102) having an opening;
a reservoir (104) for storing said medicament within said housing (102) and being in fluid communication with said opening; and

control and timing circuitry (108) for controlling dispensing of said medicament, wherein said control and timing circuitry (108) is programmed with a dispensing timing pattern, and wherein said medicament is dispensed substantially according to said dispensing timing pattern.

22. The system (100) according to Claim 21, wherein said control and timing circuitry (108) comprises a start timer mechanism (112), timing circuitry (110), and a release controller (114), wherein said start timer mechanism (112) transmits a signal to said timing circuitry (110) for clocking a dispensing time period, and wherein said timing circuitry (110) transmits a signal to said release controller (114) for controlling a valve (106) for dispensing said medicament via said opening substantially according to said dispensing timing pattern during said dispensing time period.

23. The system (100) according to Claim 21, wherein said dispensing timing pattern correlates an approximate quantity of said medicament to be dispensed during each moment of time during a dispensing time period.

24. The system (100) according to Claim 22, wherein said release controller (114) controls a degree of opening of said valve (106).
### INTERNATIONAL SEARCH REPORT

#### A. CLASSIFICATION OF SUBJECT MATTER

**A61M31/00**

According to International Patent Classification (IPC) or to both national classification and IPC

#### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61M A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

#### Electronic database consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

#### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>X</td>
<td>FR 2 794 654 A (CENTRE DE TRANSFERT DES MICROTECHNIQUES) 15 December 2000 (2000-12-15) page 5, line 1 - page 6, line 35</td>
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<td>US 5 167 626 A (CASPER ET AL) 1 December 1992 (1992-12-01) the whole document</td>
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Further documents are listed in the continuation of Box C.

**See patent family annex.**

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#### Date of the actual completion of the international search

27 January 2006

#### Date of mailing of the international search report

06/02/2006

Name and mailing address of the ISA/

European Patent Office, P.B. 5816 Patentlaan 2 NL-2280 HV Hilvijk
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Neill, F
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