

Counter Mechanism for a Drug Administration Device

Technical Field

The present disclosure relates to a dose-counting mechanism used in a drug administration device, such as an inhaler, which administers medication via inhalation and counts and displays the number of doses administered from, or the number of dose remaining in, the administration device.

Background

In general, a drug administration device, such as an inhaler, is used to administer medication (e.g., asthma medication) in powdered form or in an aerosol formulation via user inhalation. In such a drug administration device, a quantity of drug equivalent to the designated number of doses is sealed inside, and either a single dose is measured according to the user's operation or the drug is pre-metered into single, measured doses and a quantity of drug equivalent to a single measured dose is administered via user inhalation.

In general, in an apparatus designed for administration of limited amounts of medication, a dose-counting mechanism informing the user of the number of doses administered or remaining is included. There are already known dose-counting mechanisms in which numbers are arranged circumferentially on a circular display disk and, by rotating the display disk every time the drug is administered, the number of doses administered or remaining is displayed on the administration device's display window.

Summary of the Disclosure

However, the overall size of such drug administration device is limited by the requirement that the user be able to hold the device with one hand. Therefore, when the total number of doses is large, such as two or three digits, it is difficult for the above-mentioned disc-shaped dose-counting mechanism to display all relevant numbers on the disk; although an approximate number of doses can be displayed, the display of an accurate record of doses in single units is problematic. Furthermore, it is difficult to include an add-on, for example, an alert display that informs the user when a predetermined number of remaining doses has been reached in the extremely limited space inside the drug administration device.

The purpose of this disclosure is to provide a dose-counting mechanism for use in a drug administration device that can be installed into the limited space inside a drug administration device, accurately display the number of doses administered and perform auxiliary display functions, such as an alert display, in order to resolve the aforementioned issues.

In accordance with the present disclosure, there is provided a dose-counting mechanism for drug administration devices as claimed in claim 1. In certain embodiments, the dose-counting mechanism is integrated for use in a drug administration device, measures and displays the number of doses of a given drug and features: a count display tape member of a band shape on which a set of numbers corresponding to a specified count are displayed, featuring a locking portion formed with a plurality of locking holes equally spaced with each other in the longitudinal direction of the count display tape member; a drive shaft that rotates by a specified angle in response to the rotation of the rotating shaft of the aforementioned drug administration device, which rotates by a given angle each time dosing is performed; a winding drum for winding the aforementioned count display tape member, which is mounted onto a winding shaft that rotates in conjunction with the rotation of the aforementioned drive shaft; a sprocket mounted on a sprocket shaft that rotates in conjunction with the aforementioned drive shaft, featuring a locking claw that engages the locking hole of the aforementioned count display tape member and regulates the display position of the count display unit that represents the number of doses; an unwinding drum that may be slidably mounted with respect to the rotation of the aforementioned unwinding shaft via a frictional material on an unwinding shaft constituted by the aforementioned drive shaft or an unwinding shaft that rotates in conjunction with the aforementioned drive shaft and unwinds the aforementioned count display tape member wound up by the aforementioned winding drum and for which the aforementioned count display member is wound around at the start of use; and an unwinding direction of the aforementioned unwinding drum, which runs counter to the direction of the rotation of the aforementioned unwinding shaft. In other words, the unwinding drum around which the display tape is wound before use of the device may be slidably mounted via a frictional material directly onto the drive shaft, and from which unwinding drum the display tape is wound onto the winding drum; whereby the unwinding drum rotates in counter direction to the rotation of the drive shaft. Alternatively, the unwinding drum around which the display tape is wound before use of the device may be slidably mounted via a frictional material onto an unwinding shaft that is separate to the drive shaft but rotates in conjunction with said drive shaft, and from which

unwinding drum the display tape is wound onto the winding drum; whereby the unwinding drum rotates in counter direction to the rotation of the unwinding shaft. Based on this configuration, a count of the number of doses which is precise at the single-dose level and can be displayed, and, moreover, an alert display can be carried out within the specified count range using a simple structure that employs a thin tape that can be installed in the limited space inside a drug administration device, such as an inhalation device. In particular, due to the fact that the unwinding drum may be slidably mounted with respect to the rotation of the winding shaft via a frictional material and, furthermore, the winding direction for the aforementioned unwinding drum runs counter to the direction of the rotation of the aforementioned drive shaft, a tension is constantly and stably imposed on the count display tape member so the count display tape member firmly engages the locking claw of the sprocket without slackening.

In the dose-counting mechanism associated with one embodiment of the present disclosure, the aforementioned winding drum may be slidably mounted with respect to the rotation of the aforementioned winding shaft via a frictional material on the aforementioned winding shaft. Based on this configuration, it is easy to adjust the balance between the tensile force arising from the unwinding drum and the tensile force arising from the winding drum with respect to the count display tape member. Thus, breakage of the tape member is prevented without causing the power of the sprocket locking claw to deviate in the direction of the locking hole of the count display tape member.

In the dose-counting mechanism associated with one embodiment of the present disclosure, one end of the aforementioned count display tape member is fixed to the aforementioned unwinding drum, and it is possible to configure the apparatus so that the aforementioned locking hole of the aforementioned count display tape member is broken or deformed by the aforementioned sprocket locking claw when the entirety of the aforementioned count display tape member has been unwound. Alternatively, one end of the aforementioned count display tape member is fixed to the aforementioned unwinding drum, and the locking portion of the count display member may be provided in a longitudinal range of a portion of the count display tape member corresponding only to a specified count. Based on this structure, after the specified number of uses is reached, in the event that a special display, such as a warning, is carried out, the display can be maintained via a simple structure.

In the dose-counting mechanism associated with one embodiment of the present

disclosure, the specified display is shown in the part of the aforementioned count display tape member following a specified count, and a display identical to the aforementioned specified display may be shown in the count display base surface member that supports the count display portion of the aforementioned count display tape member from the underside. Based on this structure, after the specified number of uses is reached, in the event that a special display, such as a warning, is carried out, the display can be maintained.

In the dose-counting mechanism associated with one embodiment of the present disclosure, the aforementioned unwinding drum may be slidably mounted onto an unwinding shaft that is configured separately from the aforementioned drive shaft and rotates in conjunction with the rotation of the aforementioned drive shaft, and both of the aforementioned winding shaft and the aforementioned sprocket shaft may be directly driven by either a drive gear mounted onto the aforementioned drive shaft or an idle gear that engages the drive gear. That is, for the winding shaft and sprocket shaft, the winding drum and sprocket are placed apart from the unwinding drum at a distance of at least the diameter of the drive gear without engaging the unwinding gear. Based on this configuration, not only is a precise count display possible in a limited space, as described above, but, because the count display member that winds around the unwinding drum can be configured to a long length in its initial state (the diameter of the unwinding drum can be set to a large number), there is a high degree of freedom in terms of display modes, such as the maximum display count or orientation of the numbers displayed (whether horizontal or vertical).

In the dose-counting mechanism associated with one embodiment of the present disclosure, once the aforementioned count display tape member is unwound from the aforementioned unwinding drum, the count display tape member may engage the aforementioned sprocket via a column member forming a portion of the housing for the dose-counting mechanism housing, and the column member may be formed with a count display base surface member that supports the count display portion of the aforementioned count display tape member from the underside. Based on this configuration, compared with a configuration in which a drum-shaped member, such as a sprocket, is used as the count display base surface member, it is relatively simple to configure the count display surface so that it is a flat shape, making it easy for users to view the count display. Moreover, since a portion of the housing of the dose-counting mechanism is used, compact dimensions for the overall mechanism can be maintained.

As shown above, based on the dose-counting mechanism for drug administration devices constituted by this disclosure, a count of the number of doses that is precise to the single-dose level can be displayed, and, moreover, an alert display can be carried out within the specified count range using a simple structure that employs a thin tape that can be installed in the limited space inside a drug administration device, such as an inhalation device.

Embodiments of the present disclosure will now be described, by way of illustration only, with reference to the accompanying Figures.

Brief Description of the Drawings

Figure 1 shows a perspective view showing an example of a drug administration device employing a dose-counting mechanism constituted by one embodiment of the present disclosure.

Figure 2 shows a front view showing a schematic configuration of the count display tape member used in a dose-counting mechanism constituted by one embodiment of the present disclosure.

Figure 3 shows a plane view schematically showing the internal structure of the dose-counting mechanism constituted by one embodiment of the present disclosure.

Figure 4 shows a cross-sectional view schematically showing the mounting structure of the unwinding drum in the dose-counting mechanism shown in Figure 3.

Figure 5 shows a front view showing a modified example of the count display tape member used in the dose-counting mechanism shown in Figure 3.

Figure 6 shows a plane view schematically showing the internal structure of the dose-counting mechanism constituting another embodiment of the present disclosure.

Figure 7 shows a plane view schematically showing the internal structure of the dose-counting mechanism constituting another embodiment of the present disclosure.

Figure 8 shows a plane view schematically showing the internal structure of the dose-counting mechanism constituting another embodiment of the present disclosure.

Figure 9 shows a plane view schematically showing the internal structure of the dose-counting mechanism constituting another embodiment of the present disclosure.

Hereinafter, embodiments of the present disclosure will be described with reference to the accompanying figures, but the present disclosure is not limited to these embodiments.

5 Figure 1 is a perspective view showing an inhaler [S] that is a drug administration device employing a dose-counting mechanism [C] constituted by one embodiment of the present disclosure. The inhaler [S] may be, for example, a device for the administration by inhalation of an asthma medication featuring a mouthpiece [1] and an inhaler body [3], as well as a rotatable rotary operation unit [5] designed to operate a dosing mechanism that provides
10 the dose of powdered medication that should be inhaled. When the user of the inhaler [S] rotates the rotary operation unit [5] by a specified angle (in one embodiment, $1/5$ of a rotation or 72°) with respect to the body of the inhaler [3], the storage chamber contained inside the inhaler body [3] is filled with medication equivalent to a single dose, and this medication is inhaled by the user via an intake port [7] formed by the upper part of the mouthpiece [1]. The
15 inhaler body [3] is formed from a tubular member that is nearly cylindrical, and a count display window [9], which is an opening formed by the peripheral wall, is included. By using this count display window [9], the number of remaining doses displayed by the dose-counting mechanism [C], which is configured to display and count the number of doses, can be visualized.

 As shown in Figure 2, the dose-counting mechanism [C] displays the count of the
20 number of doses using a count display tape member [11] of a band shape. That is, a predetermined set of numbers showing the number of doses is represented on one side of the count display tape member [11] by, for example, printed text.

 As shown in Figure 3, this count display tape member [11] is wound around an unwinding drum [13] at the beginning of use and is rolled up by a winding drum [15] each time
25 the drug is administered. The winding drum [15] is mounted slidably onto a winding shaft [16] with respect to the rotation of the winding shaft [16] via a frictional material. The winding shaft [16] rotates in concert with, via a gear that is not shown, a drive shaft [17], which rotates in conjunction with the rotation of a rotational shaft of the inhaler [S], which rotates at a fixed angle each time a dose of medication is administered. On the other hand, the unwinding drum [13] is
30 mounted slidably onto the drive shaft [17] with respect to the rotation of the driving shaft [17] via a frictional material specified below. That is, in this embodiment, the drive shaft [17] also serves

as the unwinding shaft of the unwinding drum [13]. The winding drum [15] is driven and rotates along with the rotation of the drive shaft [17], and the dose count displayed in the count display window [9] (Figure 1) is reduced. The dose-counting mechanism [C] of this particular embodiment is configured so that it displays a remaining number of doses, which is obtained by subtracting the number of doses given from a fixed number of total doses (120 doses in this embodiment).

The position of the display member of the count display tape member [11] between the winding drum [15] and unwinding drum [13] is regulated by a sprocket [19] attached to a sprocket shaft [18] that rotates in conjunction with the drive shaft [17] via a gear (not shown) as follows. As shown in Figure 2, one end of the count display tape member [11] in the width-wise direction is formed as a locking portion [11a] that contains a plurality of locking holes [21] equally spaced with each other in the longitudinal direction of the count display member [11]. On the other hand, a locking claw [23] that engages the aforementioned locking holes [21] is provided on the outer peripheral surface of the sprocket [19] in Figure 3. The sprocket [19] has a diameter slightly smaller than that of the winding drum [15], and the unwinding direction [T] of the unwinding drum [13] is set opposite to the rotational direction [R] of the drive shaft [17] (unwinding shaft). Therefore, when the winding drum [15] and sprocket [19] rotate while the locking claw [23] of the sprocket [19] is engaged with the locking holes [21] of the count display tape member [11], the count display tape member [11] is pulled by the unwinding drum [13] and the winding drum [15], a constant stable tension is maintained, the drum firmly engages the sprocket [19] without slackening and the display position of the count display tape member is regulated by the sprocket [19].

The shape of the locking hole [21] is not limited to rectangular shape as shown, but the locking hole [21] may have any shape, for example, circular shape. In the case of the locking hole [21] having circular shape, tensile strength of the locking hole [21] may be significantly increased.

Because the dose-counting mechanism [C] for this embodiment is incorporated into and used in a limited space inside the inhaler [S] (Figure 1), the count display tape member [11] is wound around a drum of small diameter. Therefore, an extremely flexible material may be used to form the count display tape member [11]. For example, PET tape around 20-30 μ m in thickness is particularly suited to this use. However, by adjusting the tension arising from the

fact that the drive shaft [17] is rotated in a direction opposite to the unwinding direction, as stated above, materials of a wide variety of thicknesses, compositions and strengths can be used for the count display tape member [11], and, in addition to PET tape, paper tape, PP tape, etc., can be used.

5 Further, as described above, a frictional material [F] is interposed between the winding shaft [16] and inner peripheral surface of the winding drum [15] as well as between the drive shaft [17] (unwinding shaft) and inner peripheral surface of the unwinding drum [13], respectively, as shown in Figure 4. The frictional material [F] is included to provide a specified amount of friction between the drive shaft [17] and inner peripheral surface of the unwinding
10 drum [13] (winding shaft [16] and inner peripheral surface of the winding drum [15]) and, in one embodiment, an O-ring made of resin is used. By adopting such a configuration, it is easy to adjust the balance between the tension imposed on the count display tape member [11] in Figure 3 by the winding drum [15] and that imposed by the unwinding drum [13], so breakage of the tape member [11] is prevented without causing the force of the sprocket's [19] locking claw
15 [23] to excessively deviate in one direction of the locking hole [21] of the count display tape member [11].

Also, although the dose-counting mechanism [C] may be configured in such a way that it subtracts from a number of administrations equivalent to, for example, 120 doses, when use of the inhaler [S] is started, the first three doses, for example, need not be displayed as part
20 of the subtracted count, and instead a blue alert, or other color alert, may be displayed in the dose count display window. Further, an alert display may be shown when the number of remaining doses is between, for example, 0 and 20 in order to alert the user that the number of doses remaining is decreasing. In addition, when the number of remaining doses reaches 0, a red alert display, for example, may be shown in the dose count display window in order to
25 inform the user that the device can no longer be used. For the present embodiment, by colouring a portion of the count display tape member [11] corresponding to the range of this count [N], it is possible to show the aforementioned alert display via a simple structure. The alert display part [11b] following 0 remaining uses is shown in Figure 2 as an example.

In addition, in one embodiment, one end of the count display tape member [11] is fixed
30 to the unwinding drum [13] and, the device is configured so that the locking hole [21] of the count display tape member [11] is broken or deformed by the locking claw [23] of the sprocket

[19] when the sprocket [19] is turned further to a state in which the count display tape member has been completely unwound. The deformation of the locking hole [21] is effected as extension of the hole pulled by the locking claw [23] when the count display tape member [11] is made of thin and flexible resin material such as PET. Therefore, even if the user operates the inhaler [S] when the number of remaining doses is 0, the count display tape member [11] does not move further and the red alert display showing 0 remaining doses is maintained.

Instead of configuring the device so that the locking holes [21] of the count display tape member [11] are broken or deformed by the locking claw [23] of the sprocket [19] as described above, as shown in Figures 5(a) and 5(b), the locking part [11a] containing locking holes [21] can be arranged only on the part corresponding to a set number of doses prior to the alert display in the count display tape member [11], and either a long hole [25] is established such that the locking claw [23] does not engage the part corresponding to the locking portion [11a] following the alert display part [11b] or this part may also be cut off, as shown in Figures 5(a) and (b).

Alternatively, a predetermined display (in this example, a red alert display) can be shown on the part of the count display tape member [11] following a predetermined number of doses (in this example, at the point where the number of remaining doses is 0), and one end of the count display tape member [11] is configured in such a way that, when tension is applied to the unwinding drum [13], the count display tape member [11] becomes unfixed and a display identical to a predetermined display, which in this example would be a red alert display, can be shown on the count display base surface member [26] that supports the count display part of the count display tape member [11] on the sprocket [19] from the underside. The predetermined display shown on the sprocket [19] can be used independently or combined with any of the above described configuration, for example where the locking holes [21] of the count display tape member [11] are broken or deformed by the locking claw [23] of the sprocket [19] or a long hole [25] can be established in the part that follows the alert display part [11b], or this part may be cut off.

Thus, based on the dose-counting mechanism [C] constituted by this embodiment, a count of the number of doses precise to the single-dose level can be displayed, and, moreover, a warning display can be carried out within the specified count range using a simple structure that employs a thin tape that can be installed into the limited space inside a drug administration

device, such as an inhaler [S]. In particular, since the drive shaft [17] rotates only by a specified amount of degrees in conjunction with the rotation of the rotational shaft of the drug administration device, if the winding drum [15] were attached to the drive shaft [17], it would be necessary to use a large drum diameter in order to roll up a segment of the display on the count display tape member [11] corresponding to one dose; but, since the unwinding drum [13] is attached to the drive shaft [17], as described above, such a drum diameter setting is not needed, and the entirety of the dose-counting mechanism [C] can be created very compactly.

However, arrangements of the unwinding drum [13], winding drum [15] and sprocket [19] are not limited to the example shown in Figure 3. For example, as demonstrated by another embodiment shown in Figure 6, an idle gear [31, 33] can be interpolated between the drive shaft [17] and winding shaft [16], as well as the sprocket shaft [18], and, while setting the rotational direction of these shafts [16, 17, 18] to a unified direction, the rotational direction [R] of the unwinding drum [13] can be configured in such a way that its direction is opposite the unwinding direction [T] of the count display tape member [11]. Also, even when the idle gear [31, 33] is interpolated and the rotational direction of the drive shaft [17], winding shaft [16] and sprocket shaft [18] are set in a unified direction, as shown in Figure 5, part of the count display tape member [11] can be configured in such a way that it is guided by the columnar part [35a] of the housing [35] containing the dose-counting mechanism [C], as in another embodiment shown in Figure 7.

Furthermore, an unwinding shaft [37] can be established separately from the drive shaft [17], as illustrated in another embodiment shown in Figure 8, and, by driving the unwinding shaft [37] using the rotation of the drive shaft [17], the unwinding drum [13] attached to the unwinding shaft [37] can be rotated. In this case as well, the device can be configured in such a way that the unwinding direction [T] of the count display tape member [11] with respect to the unwinding drum [13] is opposite the rotational direction [R] of the unwinding shaft [37]. In this example as well, the unwinding drum [13] may be slidably mounted onto the drive shaft [17] with respect to the rotation of the driving shaft [37] via a frictional material specified above.

Further, in this embodiment, both the winding shaft [16] and sprocket shaft [18] are directly driven by an idle gear that engages a drive gear attached to the drive shaft [17]. That is, the winding shaft [16] and sprocket shaft [18] do not engage the gear of the unwinding shaft [37], and the winding drum [15] and sprocket [19] are placed apart from the unwinding drum

[13] at a distance of at least the diameter of the drive gear on the drive shaft [17]. Based on this configuration, not only is a precise count display possible in a limited space, as described above, but, because the count display tape member [11] that winds around the unwinding drum [13] can be set to a long length in its initial state (in other words, the diameter of the unwinding drum [13] can be set to a large number), there is a high degree of freedom in terms of display modes, such as the maximum display count or orientation of the numbers displayed (whether horizontal or vertical).

In addition, the apparatus is configured so that the portion of the count display tape member [11] between the sprocket [19] and unwinding drum [13] is guided by the other columnar part [35b] of the housing [35], and this columnar part [35b] is used as the count display base surface member [26], which supports the count display part of the count display tape member [11] from the underside. By using this arrangement, compared with a configuration in which a drum-shaped member, such as a sprocket, is used as the count display base surface member [26], it is relatively simple to configure the count display surface so that it is flat, making it easy for users to view the count display. Moreover, since a portion of the housing [35] of the dose-counting mechanism [C] is used, compact dimensions for the overall mechanism can be maintained. In this embodiment as well, the red alert display described above can be shown on the count display base surface member [26].

As shown in another embodiment shown in Figure 9, a projection member [39] as a columnar member may be provided additionally to the embodiment shown in Figure 8. This projection member [39] is located between the columnar part [35b] and the sprocket [19], and provided protrudingly from a base portion, from which the columnar part [35b] is also protruded. The projection member [39] is arranged such that at least a portion of side face of the projection member [39] is positioned inside of an imaginary line [L] (on the side of the sprocket shaft [18] relative to the imaginary line [L]) connecting a portion of the columnar part 35b from which the count display tape member [11] is sent out and a portion of the sprocket [19] at which the count display tape member [11] is received. The count display tape member [11] is fed from the columnar part [15b], via the portion of side face of the projection member [39], to the sprocket [19]. Accordingly, as compared with the case that the projection member [39] is dispensed with, winding angle of the count display tape member [11] around the sprocket [19] becomes larger, that is, contact surface between the count display tape member [11] and the sprocket [19] increases, whereby the count display tape member [11] may be transported more stably.

In addition, in this embodiment, the locking claw [23] of the sprocket [19] is of a shape representing generally semicircle curve in a cross sectional view. According to this configuration, the count display tape member [11] may be transported without disengaged from the locking claw [23] during a normal operation, while the count display member [11] may be pulled with a force that is larger than a retaining force of the unwinding drum [13] to retain the count display member [11] and a frictional force of a member that is located between the unwinding drum [13] and the sprocket [19] and contacts the count display tape member [11] (the columnar part [35b] and the projection member [39] in the example as shown in Figure 9), whereby the locking claw [23] of the sprocket [19] is slipped and disengaged from the locking hole [21] of the count display tape member [11] when the count display tape member [11] is unwound to the end portion thereof. In this way, the sprocket [19] idles and therefore the alert display may be maintained. This configuration of the locking claw [23] of the sprocket [19] may be applied not only to this embodiment but also to any of aforementioned embodiments.

Also in the respective embodiments shown in Figures 8 and 9, in which a member that contacts the count display member [11] is arranged between the unwinding drum [13] and the sprocket [19], the unwinding drum [13] may be slidably mounted with respect to the rotation of the unwinding shaft [37] via the frictional material [F] on the unwinding shaft [37]. In this configuration, it is easy to adjust the balance between the tensile force arising from the winding drum [15] and the tensile force arising from the unwinding drum [13] and the frictional force from the member which is arranged between the unwinding drum [13] and the sprocket [19] and contacts the count display tape member [11] with respect to the count display tape member [11], and therefore breakage of the count display tape member [11] may be prevented.

Furthermore, in the above explanation, a cylindrical inhaler was used as an example of a drug administration device in which the mechanism could be used, but the dose-counting mechanism constituted by this disclosure is not limited to inhalers and can be used in drug administration devices with systems in which a single dose of medication is measured or provided via rotational operation.

In the preceding section, certain embodiments of the present disclosure were described with reference to the figures, but a wide variety of additions, modifications and deletions are possible as and included within the scope of the present disclosure.

Description of Reference Numerals

	1	mouth piece
	3	inhaler body
5	5	rotary operating unit
	9	count display window
	11	Count Display Tape Member
	13	Unwinding Drum
	15	Winding Drum
10	16	Winding Shaft
	17	Drive Shaft
	18	Sprocket Shaft
	19	Sprocket
	21	Locking Hole
15	23	Locking Claw
	25	Long Hole
	26	count display base surface member
	33	idle gear
	35	housing
20	35a	columnar part
	37	unwinding shaft
	C	Dose Counting Mechanism
	F	Frictional Material
	S	Inhaler (Drug Administration Device)
25	N	Count
	T	Unwinding Direction

CLAIMS

1. A dose-counting mechanism for a drug administration device that measures and displays the number of doses of a given drug in the drug administration device, the dose-counting mechanism comprising:

5 a rotating shaft which rotates by a given angle each time dosing is performed,

a count display tape member of a band shape, the count display tape member comprising a display member on which a set of numbers corresponding to a specified count are displayed, the count display tape member comprising a locking portion formed with a plurality of locking holes equally spaced with each other in the
10 longitudinal direction of the count display tape member;

a drive shaft that rotates by a specified angle in response to rotation of the rotating shaft of the drug administration device;

a winding drum for winding the count display tape member, which is mounted on to a winding shaft that rotates in conjunction with the rotation of the drive shaft;

15 a sprocket mounted onto a sprocket shaft that rotates in conjunction with the drive shaft, the sprocket comprising one or more locking claws that engage with at least one of the locking holes of the count display tape member and regulate the position of the display - member to display a number of doses; and

20 an unwinding drum, around which the count display tape member is wound at the start of use, the unwinding drum being mounted slidably on an unwinding shaft via a frictional material, the unwinding shaft comprising a shaft chosen from the drive shaft and a separately provided unwinding shaft that rotates in conjunction with the drive shaft;

25 wherein a direction of rotation of the unwinding drum runs counter to a direction of rotation of the unwinding shaft.

2. A dose-counting mechanism as claimed in Claim 1, wherein the winding drum is slidably mounted on a winding shaft via a frictional material.

3. A dose-counting mechanism as claimed in Claim 1 or Claim 2, wherein the frictional material is a resin O ring.

4. A dose-counting mechanism as claimed in any one of the preceding claims, wherein one end of the count display tape member is fixed to the unwinding drum, and the dose-counting mechanism is configured such that the at least one locking hole of the count display tape member is breakable or deformable by the locking claw when the entirety of the count display tape member has been unwound.

5. A dose-counting mechanism as claimed in any one of the preceding claims, wherein one end of the count display tape member is fixed to the unwinding drum, and the dose-counting mechanism is configured such that at least one locking hole of the count display tape member is shaped so that the locking claw does not engage to the corresponding to the locking portion when the entirety of the count display tape member has been unwound.

6. A dose-counting mechanism as claimed in any one of the preceding claims, wherein one end of the count display tape member is fixed to the unwinding drum, and the locking portion of the count display tape member is provided in a longitudinal range of a portion of the count display tape member corresponding only to a specified count.

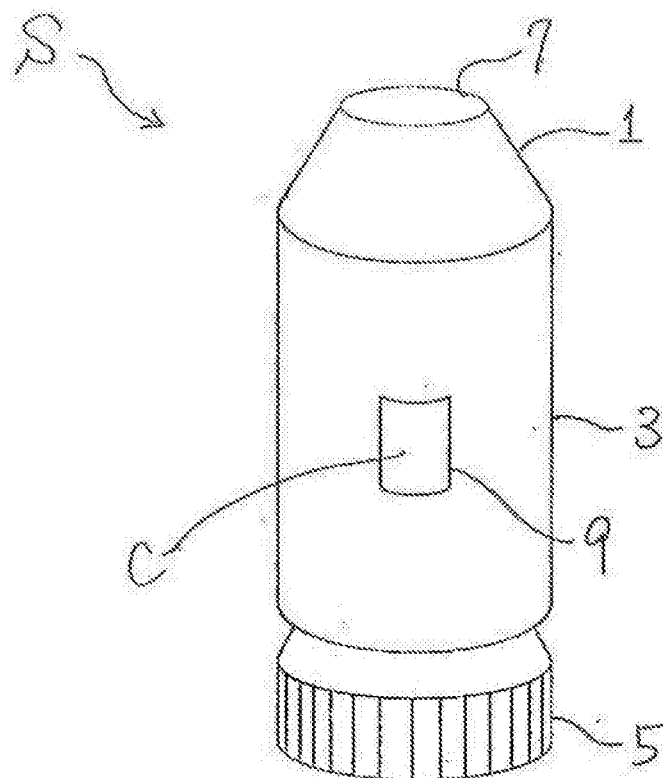
7. A dose-counting mechanism as claimed in any one of the preceding claims, wherein a specified display is shown in a part of the count display tape member following a predetermined count, and a display identical to the specified display is shown in a count display base surface member that supports the count display portion of the count display tape member from the underside.

8. A dose-counting mechanism as claimed in any one of the preceding claims,, wherein the unwinding shaft is provided separately from the drive shaft and both of the winding shaft and the sprocket shaft are directly driven by either a drive gear mounted to the drive shaft or by an idle gear that engages the drive gear.

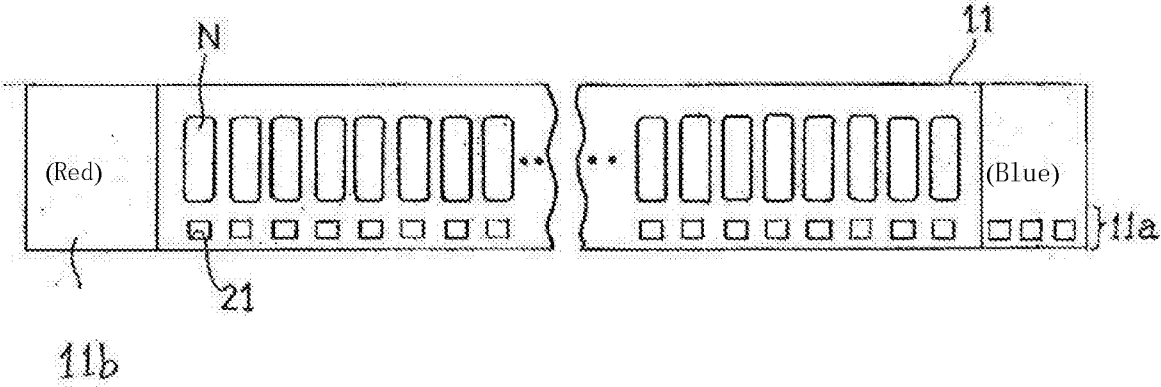
9. A dose-counting mechanism as claimed in any one of the preceding claims, wherein once the count display tape member is unwound from the unwinding drum, the count display tape member engages the sprocket via a column member forming a portion of a housing for the dose-counting mechanism, and the column member is formed with a count display base surface member that supports a count display portion of the count display tape member from

the underside.

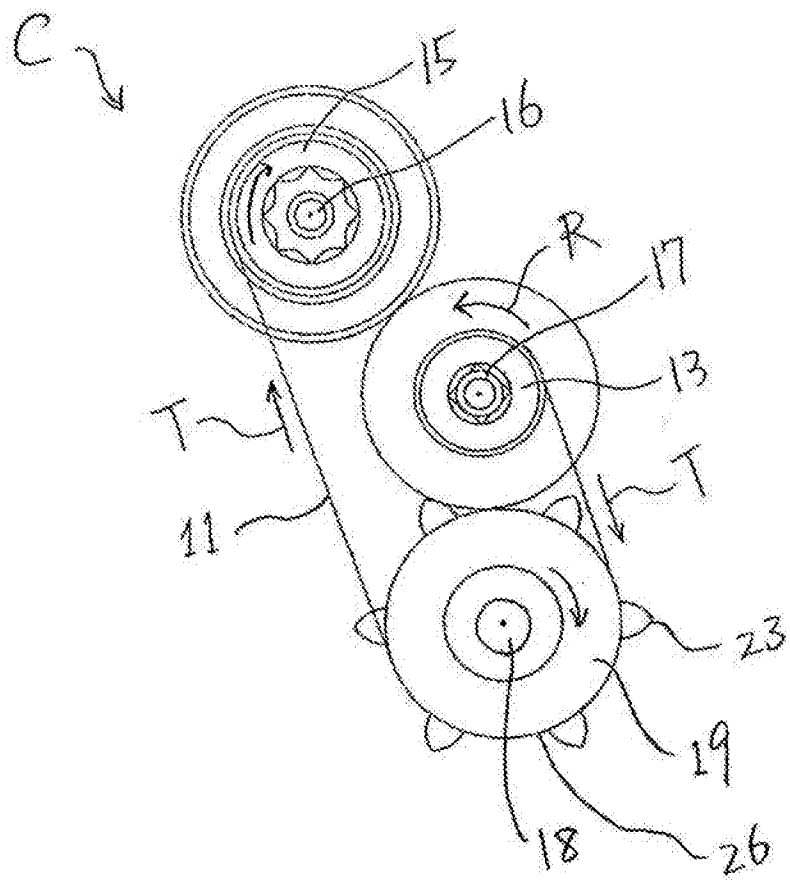
[Figure 1]



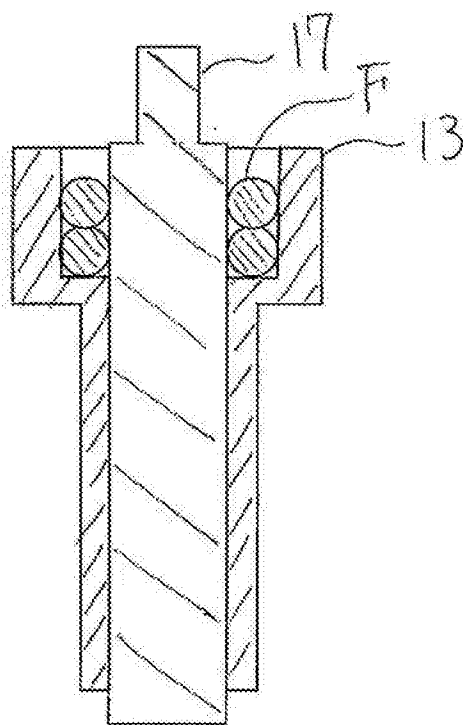
[Figure 2]



[Figure 3]

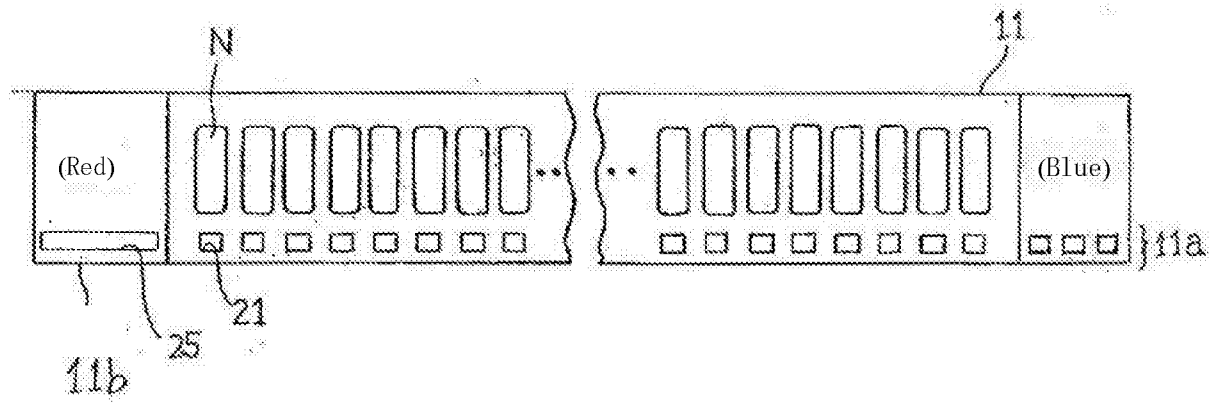


[Figure 4]

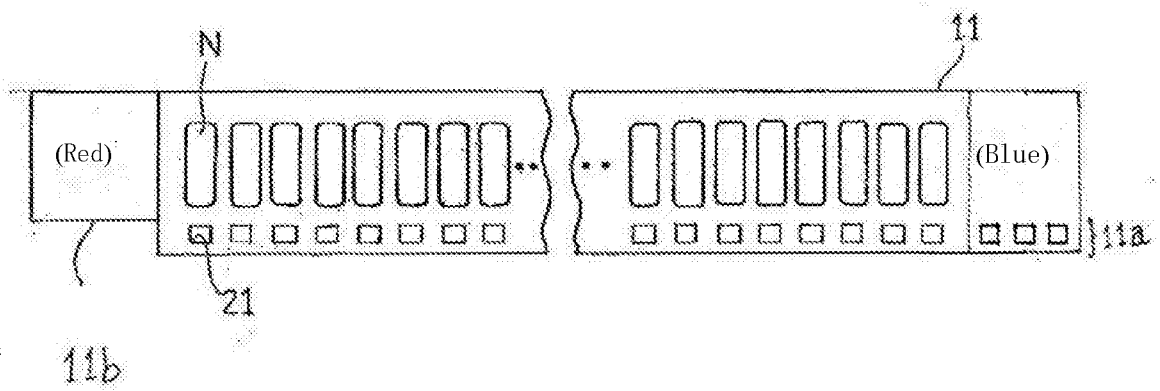


[Figure 5]

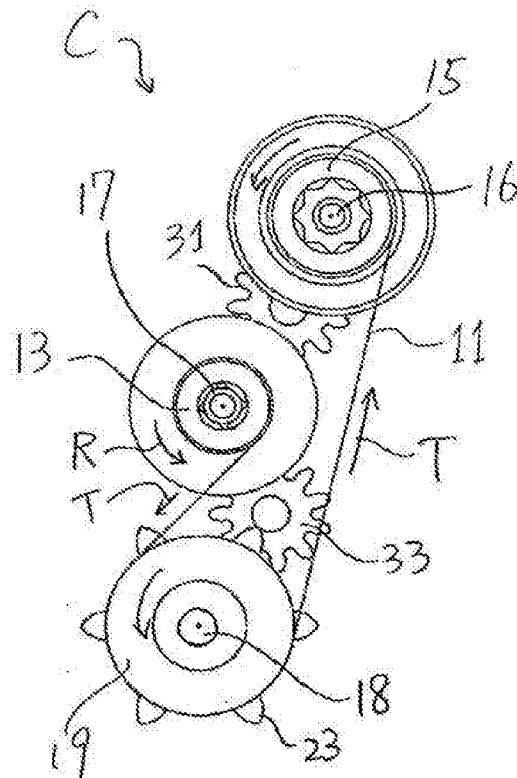
(a)



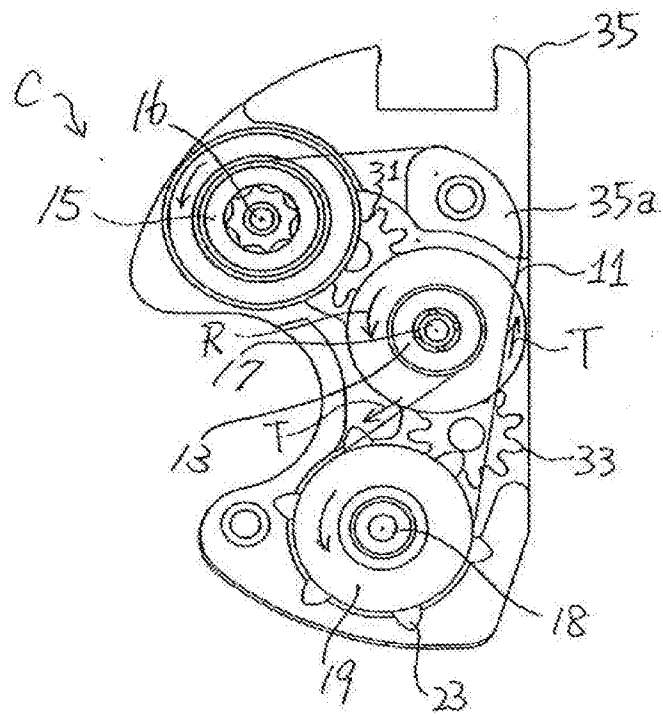
(b)



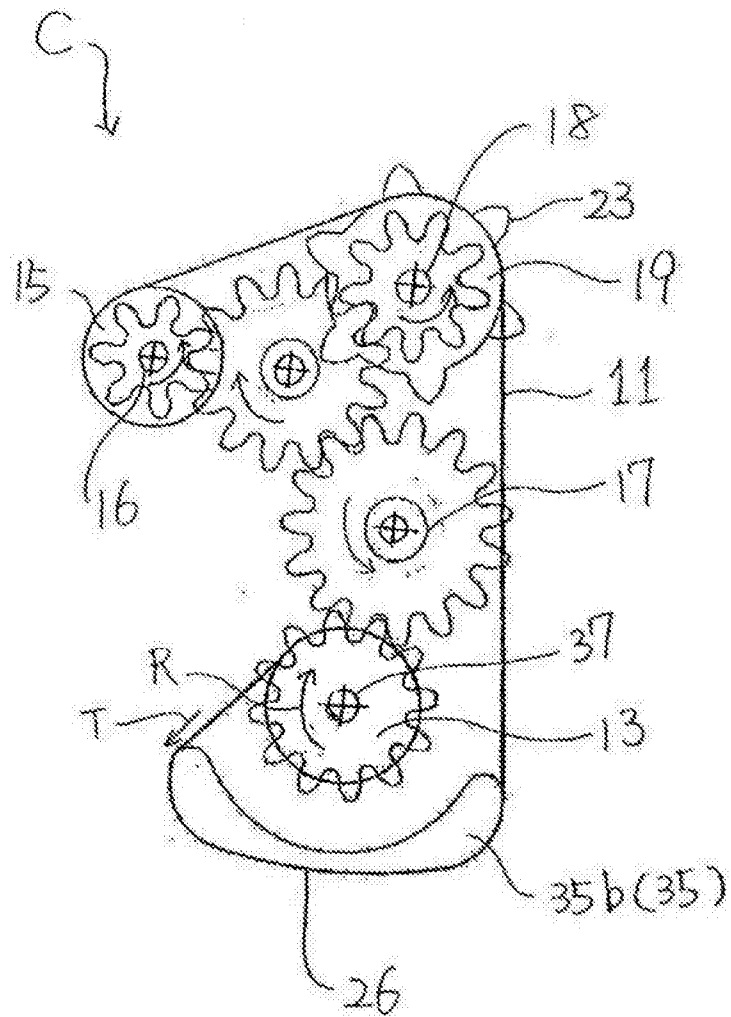
[Figure 6]



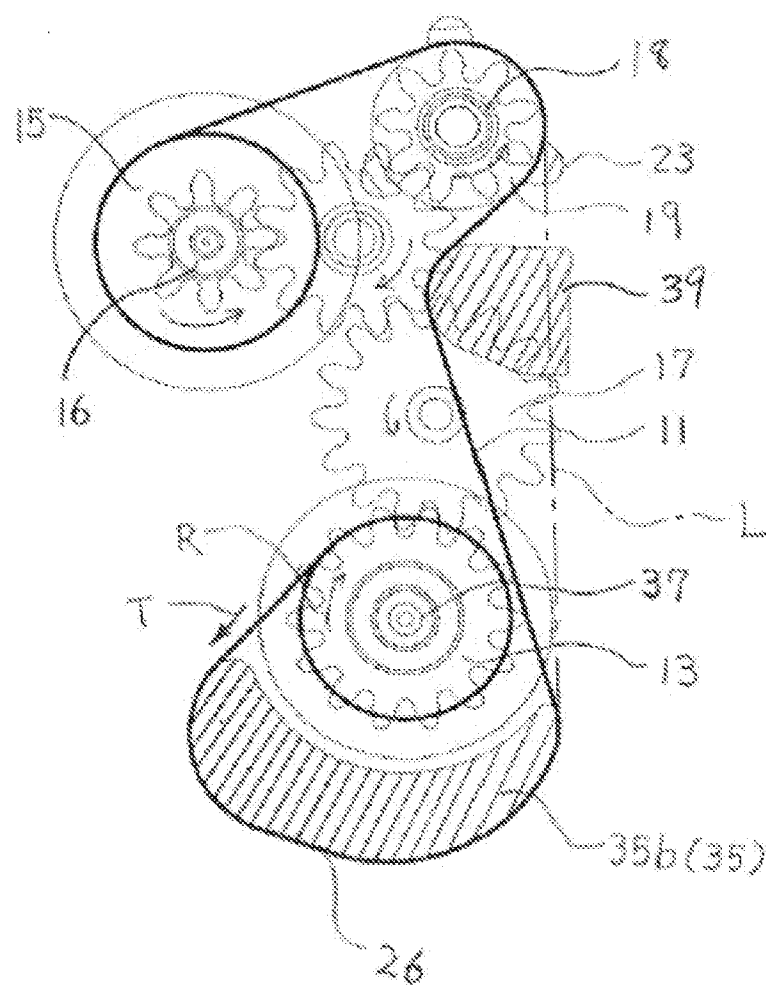
[Figure 7]



[Figure 8]



[Figure 9]



INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2014/051122

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06M1/24
ADD.

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)
G06M A61M

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 514 468 A2 (IVAX PHARMACEUTICALS IRELAND [IE]; NORTON WATERFORD [IE]; TEVA PARMACE) 24 October 2012 (2012-10-24) paragraph [0139]; claims 39-41; figures 6a-6d -----	1-9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

8 July 2014

Date of mailing of the international search report

16/07/2014

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Gélébart, Yves

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2014/051122

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2514468	A2	24-10-2012	
		AU 2011254958 A1	29-11-2012
		CA 2799625 A1	24-11-2011
		CN 102892448 A	23-01-2013
		EA 201291267 A1	30-07-2013
		EA 201300230 A1	30-07-2013
		EA 201300231 A1	30-07-2013
		EA 201300232 A1	30-07-2013
		EA 201300233 A1	30-07-2013
		EA 201300234 A1	30-07-2013
		EA 201300235 A1	30-07-2013
		EA 201300236 A1	30-07-2013
		EA 201300237 A1	30-07-2013
		EP 2436414 A2	04-04-2012
		EP 2502644 A1	26-09-2012
		EP 2514462 A2	24-10-2012
		EP 2514463 A2	24-10-2012
		EP 2514464 A2	24-10-2012
		EP 2514465 A2	24-10-2012
		EP 2514466 A2	24-10-2012
		EP 2514467 A2	24-10-2012
		EP 2514468 A2	24-10-2012
		JP 5497964 B2	21-05-2014
		JP 2013526353 A	24-06-2013
		KR 20130020903 A	04-03-2013
		KR 20130101169 A	12-09-2013
		KR 20130101170 A	12-09-2013
		KR 20130101171 A	12-09-2013
		KR 20130103820 A	24-09-2013
		KR 20130103823 A	24-09-2013
		KR 20130103824 A	24-09-2013
		KR 20130103825 A	24-09-2013
		KR 20130103826 A	24-09-2013
		KR 20130103827 A	24-09-2013
		KR 20130103828 A	24-09-2013
		US 2011283997 A1	24-11-2011
		US 2014096349 A1	10-04-2014
		US 2014096356 A1	10-04-2014
		US 2014096711 A1	10-04-2014
		US 2014096769 A1	10-04-2014
		WO 2011144326 A2	24-11-2011
