(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 December 2020 (10.12.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/247686 A4

(51) International Patent Classification:
A61M 5/31 (2006.01)

(21) International Application Number:
PCT/US2020/036200

(22) International Filing Date:
04 June 2020 (04.06.2020)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

62/857,678	05 June 2019 (05.06.2019)	US
62/860,481	12 June 2019 (12.06.2019)	US

(71) Applicant: **REGENERON PHARMACEUTICALS, INC.** [US/US]; 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US).

(72) Inventors: **ULLA, Sibgat**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **LANGLEY, Trevor**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **HALBIG, Daniel**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **GRYGUS, Bryan**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **SINGH, Prithvi**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **DUMONT, Andrew**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **BECHSTEIN, Justin**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **NETT, David**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **ODEGARD, Jeremy**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **GILLUM, Tasha**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **AINSWORTH, Ryan**; c/o Regeneron Pharmaceuticals, Inc., 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US).

(74) Agent: **HAMIDI, Arash**; Bookoff McAndrews, PLLC, 2020 K Street, NW, Suite 400, Washington, DC 20006 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,

(54) Title: DEVICES AND METHODS FOR PRECISION DOSE DELIVERY

(57) Abstract: Disclosed herein are devices and methods for delivering a predetermined volume of a drug substance or other product including a fluid. An exemplary device may include a body configured to receive a drug substance therein, and a plunger rod disposed at least partially inside the body to distally move a stopper in the body. The device may include a component configured to regulate distal movement of the plunger rod in a priming step and in a subsequent delivery step, so that the device may be accurately primed and may accurately dispense a predetermined volume of a drug substance.

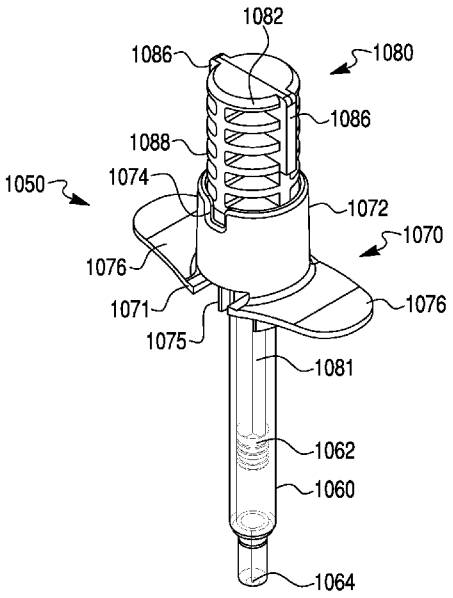

FIG. 1A

WO 2020/247686 A4

[Continued on next page]

MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *with amended claims (Art. 19(1))*

Date of publication of the amended claims:

21 January 2021 (21.01.2021)

AMENDED CLAIMS
received by the International Bureau on 24 Dec 2020(24.12.2020)

[Claim 1] A drug delivery device, comprising:
a body;
a plunger rod including a proximal end portion and a distal end portion disposed partially inside the body, wherein the proximal end portion has a diameter greater than a diameter of the distal end portion;
a protrusion extending from an outer surface of the proximal end portion of the plunger rod; and
a blocking component coupled to a proximal end portion of the body, wherein the blocking component is a flange piece,
wherein, when the protrusion is in a first position relative to the blocking component, the blocking component restricts distal movement of the plunger rod to a first stopping point, and when the protrusion is in a second position relative to the blocking component, the blocking component restricts distal movement of the plunger rod to a second stopping point.

[Claim 2] The drug delivery device of claim 1, further comprising:
a stopper disposed in the body, wherein distal movement of the plunger rod distally moves the stopper; and
a drug substance disposed in the body in between the stopper and a distal end of the body,
wherein distal movement of the plunger rod to the first stopping point primes the drug delivery device, and distal movement of the plunger rod to the second stopping point dispenses a predetermined volume of the drug substance from a distal end of the device.

[Claim 3] The drug delivery device of claim 1, wherein moving the protrusion from the first position to the second position includes twisting the plunger rod relative to the blocking component, such that the protrusion is positioned external to the blocking component when in the second position.

[Claim 4] The drug delivery device of claim 1, further comprising:
a cavity in a proximal side of the blocking component, the cavity sized and configured to receive a distal end of the protrusion, such that a proximal end of the protrusion is positioned external to the cavity when the distal end is received within the cavity,

wherein when the protrusion is in the second position relative to the blocking component, the distal end of the protrusion is positioned proximally from the cavity and disengaged from the proximal side of the blocking component, such that distal movement of the plunger rod moves the distal end of the protrusion into the cavity.

[Claim 5] The drug delivery device of claim 4, wherein the cavity is a first cavity, and further comprising:
a second cavity in a proximal side of the blocking component, the second cavity sized and configured to receive a portion of the protrusion,
wherein the first and second cavity are located on opposite sides of a central longitudinal axis of the drug delivery device.

[Claim 6] The drug delivery device of claim 1,
wherein the plunger rod passes through an opening in the blocking component.

[Claim 7] The drug delivery device of claim 4, wherein, when the protrusion is in the first position relative to the blocking component, the proximal side engages the distal end and restricts distal movement of the plunger rod to the first stopping point; and when the protrusion is in the second position relative to the blocking component, the distal end aligns with the cavity and disengages the proximal side.

[Claim 8] The drug delivery device of claim 7, wherein the proximal end portion of the plunger rod includes an actuation portion that includes a generally cylindrical shape, and wherein the actuation portion further comprises:
a thumb pad on a proximal end of the actuation portion; and
a ring on an exterior surface on a side of the generally cylindrical shape.

[Claim 9] The drug delivery device of claim 7, further comprising:
a proximal collar on the blocking component, wherein the actuation portion partially fits inside the proximal collar.

[Claim 10] The drug delivery device of claim 7, wherein the plunger rod further includes a pair of extensions protruding distally from the actuation portion and the blocking component includes a pair of openings; and
wherein a portion of each extension is configured to be received by one of the pair of openings in the first stopping point to restrict proximal movement of the plunger rod relative to the blocking component.

[Claim 11] The drug delivery device of claim 10, wherein the blocking component includes one or more indents formed along a bottom wall of the blocking component; and
wherein a portion of each extension is configured to be received by the one or more indents upon distal movement of the plunger rod relative to the blocking component to allow distal movement of the plunger rod to the second stopping point.

[Claim 12] The drug delivery device of claim 10, wherein the blocking component includes a pair of internal grooves formed along a sidewall of the blocking component; and
wherein a portion of each extension is configured to be received by at least one of the pair of internal grooves upon rotation of the plunger rod relative to the blocking component to expand the extensions radially-outward from a compressed state to a relaxed state.

[Claim 13] The drug delivery device of claim 1, wherein the protrusion is a first protrusion, and further comprising:
a second protrusion extending from the plunger rod in a direction opposite to the first protrusion.

[Claim 14] The drug delivery device of claim 1, wherein the blocking component is slidably coupled to the body and includes a third cavity and a pair of ribs that extend into the third cavity, wherein the body includes a top flange and the pair of ribs are configured to engage the top flange received in the third cavity; and
wherein the pair of internal ribs are configured to apply a distally-directed force onto the top flange.

[Claim 15] The drug delivery device of claim 1, wherein the blocking component is slidably coupled to the body and includes a pair of movable tabs that are configured to engage the body; and
wherein the pair of movable tabs are laterally deflectable upon receiving the body in the blocking component and are configured to apply a radially-inward directed force onto the body.

[Claim 16] The drug delivery device of claim 1, wherein the blocking component further comprises a pair of finger flanges, and
wherein each of the finger flanges includes a textured surface having a predefined pattern that increases a grip of the blocking component.

[Claim 17] A drug delivery device, comprising:
a body;
a plunger rod having a distal end contacting a stopper inside the body, and a proximal end including an actuation portion with a thumb pad;
a plurality of protrusions extending from the thumb pad to the actuation portion; and
a blocking component disposed on the body, the blocking component including a proximal collar having a proximal-facing surface and a plurality of slots extending past the proximally-facing surface,
wherein, when the protrusions and the slots are in a first configuration relative to one another, the proximally-facing surface abuts against the plurality of protrusions and the blocking component restricts distal movement of the plunger rod to a first stopping point, and when the protrusions and the slots are in a second configuration, the proximally-facing surface is separated from the plurality of protrusions and the blocking component restricts distal movement of the plunger rod to a second stopping point,
wherein, in the second configuration, the slots are aligned with the protrusions and configured to receive the protrusions upon distal movement of the plunger rod.

[Claim 18] The drug delivery device of claim 17, wherein the protrusions and the slots are movable from the first configuration to the second configuration by rotation of the actuation portion about a longitudinal axis in relation to the blocking component, and wherein when the protrusions and the slots are in the second configuration, the protrusions and the slots are not movable to the first configuration.

[Claim 19] The drug delivery device of claim 17, wherein a difference between the first stopping point and the second stopping point is equivalent to a distance that the stopper must travel to expel a predetermined volume of a drug product from a distal end of the body, the distance defined by a depth of the slots from the proximally-facing surface, and wherein the plunger rod is prevented from moving from the second stopping point to the first stopping point.

[Claim 20] The drug delivery device of claim 17, wherein the plurality of protrusions includes two protrusions disposed symmetrically about the actuation portion.

[Claim 21] The drug delivery device of claim 17, wherein the blocking component further comprises a pair of finger flanges.

[Claim 22] The drug delivery device of claim 17, wherein the drug delivery device is a pre-filled syringe.

[Claim 23] The drug delivery device of claim 17, wherein the drug delivery device is changeable:
(a) from a pre-use state to a primed state, by longitudinally moving the plunger rod until the plunger rod reaches the first stopping point;
(b) from the primed state to a delivery state by rotating the plunger rod in relation to the blocking component until the protrusions and the blocking component are in the second configuration; and
(c) from a delivery state to a used state by longitudinally moving the plunger rod until the plunger reaches the second stopping point, and
wherein the drug delivery device is not changeable from the used state to the delivery state, from the delivery state to the primed state, or from the primed state to the pre-use state.

[Claim 24] The drug delivery device of claim 23, wherein the plunger rod includes a neck disposed distally from the actuation portion, wherein the neck interfaces with an opening in the blocking component to prevent proximal movement of the plunger rod.

[Claim 25] The drug delivery device of claim 24, wherein the neck further interfaces with the opening in the blocking component to prevent movement of the drug delivery device from the delivery state to the primed state.

[Claim 26] The drug delivery device of claim 17, wherein when the plunger rod is at the second stopping point, the stopper does not contact a distal end of the body.

[Claim 27] A drug delivery device, comprising:
a body;
a plunger rod extending along a longitudinal axis, including:
a distal portion contacting a stopper inside the body;
a proximal end including a generally cylindrical actuation portion and a thumb pad disposed outside of the body, the thumb pad positioned proximal to the generally cylindrical actuation portion; and
two protrusions extending from opposite sides of the actuation portion in a symmetrical configuration, wherein distally-facing surfaces of the two

protrusions are located at a same longitudinal position along the longitudinal axis; and

a blocking component coupled to the body, the blocking component including:

a collar configured to accept a distal part of the actuation portion; and

two cavities in the collar having proximally-facing openings, wherein each cavity is configured to accept a distal portion of one of the two protrusions;

wherein the plunger rod is longitudinally movable and rotatable about a longitudinal axis relative to the blocking component, and

wherein, when the drug delivery device is in a pre-use state, the protrusions and the cavity openings are not longitudinally aligned, and when the drug delivery device is in a delivery state, the protrusions and the cavity openings are longitudinally aligned.

[Claim 28] The drug delivery device of claim 27, wherein the blocking component further comprises a finger flange, and further comprising:

a ribbed surface on a side of the actuation portion.

[Claim 29] The drug delivery device of claim 27, wherein the plunger rod further includes:

two extensions protruding distally from the actuation portion; and

a plurality of openings in the collar of the blocking component,

wherein a portion of each extension is configured to be received by one of the plurality of openings upon distal movement of the plunger rod relative to the blocking component.

[Claim 30] A method of dispensing a substance from a drug delivery device having a plunger rod and a body, the method comprising:

(a) advancing the plunger rod by a predetermined distance into the body until advancement of the plunger rod is resisted by a stop;

(b) rotating the plunger rod about a longitudinal axis; and

(c) actuating the plunger rod to dispense a predetermined volume of the substance,

wherein none of steps (a), (b), and (c) are reversible.

[Claim 31] The method of claim 30, wherein the drug delivery device further includes a flange piece having a collar, and wherein advancing the plunger rod and actuating the plunger rod comprise pressing an actuation portion of the

plunger rod into the collar of the flange piece until a portion of the actuation portion engages a portion of the collar.

[Claim 32] The method of claim 31, wherein the plunger rod comprises a protrusion and the collar comprises an outer edge, and wherein the outer edge of the collar abuts against the protrusion to resist advancement of the plunger rod.

[Claim 33] The method of claim 31, wherein rotating the plunger rod comprises twisting the actuation portion of the plunger rod relative to the flange piece, until a protrusion on the plunger rod becomes longitudinally aligned with a cavity in the collar of the flange piece, wherein the protrusion separates from an outer edge of the collar when longitudinally aligned with the cavity.

[Claim 34] The method of claim 33, further comprising:
advancing the protrusion into the cavity until the protrusion abuts a distal side of the cavity, wherein the predetermined volume of the substance is dispensed when the protrusion abuts the distal side of the cavity, wherein the collar restricts rotation of the plunger rod when the protrusion is received within the cavity.

[Claim 35] A drug delivery device, comprising:
a body;
a stopper disposed inside the body;
a sleeve having a proximal end and a distal end, the distal end being disposed inside the body, proximally from the stopper; and
a plunger rod disposed at least partially inside the sleeve;
wherein, when the stopper is in a ready position, distal advancement of one of (a) only the sleeve, (b) only the plunger rod, or (c) both the sleeve and the plunger rod together, relative to the body advances the stopper to a primed position, and
wherein, when the stopper is in the primed position, distal advancement of another of (a) only the sleeve, (b) only the plunger rod, or (c) both the sleeve and the plunger rod together, relative to the body advances the stopper to a dose completion position.

[Claim 36] The drug delivery device of claim 35, further comprising:
a removable blocking component disposed between a proximal portion of the sleeve and a proximal end of the body, the blocking component obstructing distal advancement of the sleeve relative to the body,

wherein distal advancement of the sleeve relative to the body after removal of the blocking component advances the stopper to the primed position.

[Claim 37] The drug delivery device of claim 36, wherein the blocking component is a clip removably secured around at least a portion of the sleeve.

[Claim 38] The drug delivery device of claim 35, further comprising:
a removable locking component that couples the plunger rod to the sleeve,
wherein distal advancement of both the sleeve and the plunger rod together relative to the body advances the stopper to the primed position, and
wherein distal advancement of only the plunger rod relative to the body after removal of the locking component advances the stopper to the dose completion position.

[Claim 39] The drug delivery device of claim 38, wherein, in the dose completion position, a proximal end of the plunger rod abuts against a distal end of the sleeve, such that the plunger rod is prevented from advancing distally any further relative to the body.

[Claim 40] The drug delivery device of claim 38, wherein the removable locking component includes one of a pin, a tab, or a bar.

[Claim 41] The drug delivery device of claim 35, further comprising:
a protrusion disposed on the plunger rod; and
an inner protrusion disposed on an interior wall of the sleeve distally to the protrusion of the plunger rod,
wherein distal advancement of only the plunger rod relative to the body advances the stopper to the primed position and causes the protrusion of the plunger rod to contact the inner protrusion of the sleeve, and
wherein distal advancement of both the plunger rod and the sleeve relative to the body, after the protrusion of the plunger rod has contacted the inner protrusion of the sleeve, advances the stopper to the dose completion position.

[Claim 42] The drug delivery device of claim 35, wherein the sleeve includes a finger flange.

[Claim 43] The drug delivery device of claim 35, further comprising:
a stop disposed at a proximal end of the body, the stop sized to block distal advancement of the sleeve or the plunger rod once the stopper is in the completion position.

[Claim 44] A drug delivery device, comprising:

a body;
a plunger rod having a distal portion disposed inside the body and a proximal portion disposed outside a proximal end of the body, the proximal portion having a width greater than a width of the distal portion; and
an obstruction that, in an obstructing position relative to the plunger rod, prevents distal advancement of the plunger rod from a primed position to a dose completion position,
wherein displacement of the obstruction from the obstructing position permits distal advancement of the plunger rod to the dose completion position.

[Claim 45] The drug delivery device of claim 44, further comprising:
a collar affixed to a proximal end portion of the body, the collar surrounding the proximal portion of the plunger rod; and
a collar projection extending radially inward from the collar,
wherein the proximal portion of the plunger rod includes a channel into which the collar projection protrudes, the channel including a circumferential path and an axial dose completion path,
wherein the obstruction comprises the collar projection, which, when disposed in the circumferential path of the channel, prevents distal advancement of the plunger rod to the dose completion position, and
wherein displacement of the obstruction from the obstructing position comprises twisting the plunger rod about a longitudinal axis to align the collar projection with the axial dose completion path.

[Claim 46] The drug delivery device of claim 45,
wherein the channel further includes an axial priming path offset from the axial dose completion path, and connected to the axial dose completion path by the circumferential path,
wherein distal movement of the plunger rod such that the collar projection travels on the axial priming path advances the plunger rod to the primed position.

[Claim 47] The drug delivery device of claim 45, wherein the collar further comprises a finger flange.

[Claim 48] The drug delivery device of claim 44,
wherein the proximal portion of the plunger rod includes a projection extending radially outward, and

wherein the drug delivery device further comprises:
a rotatable alignment component disposed in between the proximal portion of the plunger rod and the body, the alignment component including a channel, the channel sized and configured to accommodate the plunger rod projection,
wherein the obstruction comprises a wall of the channel that blocks a distal axial path of the plunger rod projection when the plunger rod is in the primed position, and
wherein displacement of the obstruction from the obstructing position comprises rotating the alignment component to remove the wall of the channel from the distal axial path of the plunger rod projection.

[Claim 49] The drug delivery device of claim 48, further comprising:
a finger flange coupled to a proximal end portion of the body,
wherein the rotatable alignment component is disposed between the finger flange and the proximal portion of the plunger rod.

[Claim 50] The drug delivery device of claim 44, further comprising:
a flange piece disposed at the proximal end of the body,
wherein the obstruction includes a removable cap that, when in the obstructing position relative to the plunger rod, is disposed partially in between the proximal portion of the plunger rod and the flange piece.

[Claim 51] The drug delivery device of claim 50, wherein removal of the cap allows the proximal portion of the plunger rod to advance to a dose completion position, wherein, in the dose completion position, the proximal portion of the plunger rod contacts the flange piece.

[Claim 52] The drug delivery device of claim 50, wherein the removable cap covers the proximal portion of the plunger rod when in the obstructing position.

[Claim 53] The drug delivery device of claim 44, further comprising:
a collar disposed between the proximal end of the body and the proximal portion of the plunger rod, the collar defining an opening sized to accommodate the proximal portion of the plunger rod upon distal advancement of the plunger rod beyond a primed position;
wherein the obstruction comprises a tab protruding radially outward from the proximal portion of the plunger rod, the tab preventing the proximal portion of the plunger rod from fitting into the opening of the collar, and

wherein a depth of the collar opening coincides with a distance the plunger rod must travel to advance distally to the dose completion position.

[Claim 54] The drug delivery device of claim 53, wherein displacement of the obstruction from the obstructing position comprises either removing the tab or compressing the tab into a side of the proximal portion of the plunger rod.

[Claim 55] The drug delivery device of claim 53, wherein the tab is a first tab, and wherein the obstruction further comprises a second tab protruding radially outward from the proximal portion of the plunger rod in a direction opposite the protruding direction of the first tab.

[Claim 56] The drug delivery device of claim 53, wherein the obstruction comprises a tab that, when in the obstructing position, is disposed between the body and the proximal portion of the plunger rod, and
wherein the plunger rod includes a geometry disposed proximally from the tab, wherein the geometry cannot advance distally past the tab when the tab is in the obstructing position.

[Claim 57] The drug delivery device of claim 56, wherein displacement of the obstruction comprises removing the tab from the drug delivery device by pulling the tab.

[Claim 58] The drug delivery device of claim 56, further comprising:
a flange piece,
wherein a portion of the tab is disposed inside a cavity of the flange piece.

[Claim 59] The drug delivery device of claim 56, wherein displacement of the obstruction comprises removing the tab from the drug delivery device by breaking the tab.

[Claim 60] The drug delivery device of claim 54, wherein the obstruction includes a flange piece that, in the obstructing position, is disposed proximally from the proximal end of the body, between the proximal portion of the plunger rod and the body, and is spaced from the proximal end of the body by a removable blocking component, and
wherein displacement of the obstruction from the obstructing position comprises:
removing the blocking component; and
shifting the flange piece distally towards the proximal end of the body.

[Claim 61] The drug delivery device of claim 44, wherein the plunger rod includes a projection extending radially outward,

wherein the obstruction includes a lever having an end that, in the obstructing position, is located distally from the projection and blocks distal movement of the projection and thereby distal movement of the plunger rod, and

wherein displacement of the obstruction from the obstructing position comprises actuating the lever to remove the end of the lever from its location distal from the projection.

[Claim 62] The drug delivery device of claim 44, wherein distal advancement of the plunger rod beyond the dose completion position is prevented by contact between the proximal portion of the plunger rod and a portion of a flange piece coupled to the body.

[Claim 63] A drug delivery device, comprising:

a body;

a sleeve affixed to the body, the sleeve including a proximal end, a distal end, and an opening disposed in a circumferential wall of the sleeve;

a plunger rod passing through the sleeve, the plunger rod including a distal end portion disposed inside the body, and a radially-extending protrusion;

wherein the plunger rod may be distally advanced into the body from a ready position to a primed position,

wherein, in the primed position, the protrusion of the plunger rod is disposed inside the opening, and further distal advancement of the plunger rod is resisted by contact between the protrusion and a wall of the opening, and

wherein pressure may be exerted on the protrusion to overcome the resistance to further distal advancement of the plunger rod.

[Claim 64] The drug delivery device of claim 63, wherein the opening in the sleeve is a second opening, and the sleeve further includes a first opening disposed in the circumferential wall of the sleeve proximally from the second opening, and a third opening disposed in the circumferential wall of the sleeve distally from the second opening,

wherein, in the ready position, the protrusion of the plunger rod is disposed in the first opening, and further distal advancement of the plunger rod is resisted by contact between the protrusion and a wall of the first opening, and

wherein, after further distal advancement of the plunger rod past the primed position, the protrusion of the plunger rod is disposed in the third opening, and further distal advancement of the plunger rod is prevented.

[Claim 65] The drug delivery device of claim 63, wherein the radially-extending protrusion is a first protrusion, and wherein the plunger rod further includes a second radially-extending protrusion opposite the first protrusion, and wherein squeezing the first and second protrusions towards one another while applying axial pressure in the distal direction on the plunger rod overcomes the resistance to further distal advancement of the plunger rod.

[Claim 66] The drug delivery device of claim 63, wherein the protrusion includes a distally-tapering profile to aid in distal advancement of the plunger rod.

[Claim 67] A drug delivery device, comprising:
a body;
a plunger rod including a distal end portion disposed inside the body and a rotatable element; and
a sleeve affixed to the body, the sleeve including a proximal opening into which the plunger rod may be advanced,
wherein rotating the rotatable element causes distal advancement of the plunger rod to a primed position, and
wherein once the plunger rod is in the primed position, further rotation of the rotatable element is resisted.

[Claim 68] The drug delivery device of claim 66, further comprising:
a collar disposed at a proximal end of the body, an interior of the collar including a proximal threaded portion forming a proximal helical path,
wherein the rotatable element comprises a proximal portion of the plunger rod including a protrusion, wherein the proximal portion of the plunger rod may be rotated about a longitudinal axis to cause the protrusion to travel distally along the proximal helical path, and
wherein once the protrusion reaches the end of the proximal threaded portion of the collar, the plunger rod is in the primed position.

[Claim 69] The drug delivery device of claim 68, wherein once the plunger rod is in the primed position, the plunger rod may be depressed axially into the body to distally advance the plunger rod to a dose completion position.

[Claim 70] The drug delivery device of claim 68, wherein the interior of the collar further includes a distal threaded portion, wherein threads of the distal threaded

portion form a distal helical path offset from, and opposite to, the proximal helical path,
wherein alignment of the protrusion with the distal helical path places the plunger rod in the primed position, and
wherein rotation of the proximal portion of the plunger rod to cause the protrusion to travel distally along the distal helical path causes distal advancement of the plunger rod to a dose completion position.

[Claim 71] A drug delivery device, comprising:
a body;
a plunger rod having along a longitudinal axis defined between a proximal end and a distal end, wherein the proximal end defines a thumb pad that is transverse relative to the longitudinal axis;
a blocking member extending outward from the plunger rod in a radial direction that is transverse to the longitudinal axis, wherein the blocking member is positioned distally from the proximal end; and
a flange piece coupled to a proximal end portion of the body, wherein the flange piece includes a first proximally-facing surface and a second proximally-facing surface that is distal to the first proximally-facing surface;
wherein the plunger rod is configured to abut the blocking member against the first proximally-facing surface when moved distally relative to the flange piece to a first position, separate the blocking member from the first proximally-facing surface when rotated relative to the flange piece from the first position to a second position, and abut the blocking member against the second proximally-facing surface when moved distally relative to the flange piece from the second position to a third position.

[Claim 72] The drug delivery device of claim 71, wherein the first position and the second position are aligned along a same longitudinal plane relative to one another.

[Claim 73] The drug delivery device of claim 71, wherein an entirety of the blocking member is positioned outside the body when the plunger rod is in the first position, the second position, and the third position.

[Claim 74] The drug delivery device of claim 71, wherein the blocking member is circumferentially offset from the second proximally-facing surface when the plunger rod is in the first position, and longitudinally aligned with the second proximally-facing surface when the plunger rod is in the second position.

[Claim 75] The drug delivery device of claim 71, wherein the blocking member is separated from the first proximally-facing surface and the second proximally-facing surface when the plunger rod is in the second position.