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(12) United States Patent
Hernandez

(10) Patent No.: US 11,771,840 B2
(45) Date of Patent: Oct. 3, 2023

(54) **MULTIPLE CONDITION DOSING SYSTEM**

(71) Applicant: **Certa Dose, Inc.**, Denver, CO (US)

(72) Inventor: **Caleb Hernandez**, Denver, CO (US)

(73) Assignee: **CD Acquisitions, LLC**, Denver, CO (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 669 days.

(21) Appl. No.: **16/788,207**

(22) Filed: **Feb. 11, 2020**

(65) **Prior Publication Data**

US 2020/0254186 A1 Aug. 13, 2020

Related U.S. Application Data

(60) Provisional application No. 62/804,068, filed on Feb. 11, 2019.

(51) **Int. Cl.**

A61M 5/00 (2006.01)
A61M 5/315 (2006.01)
A61M 5/31 (2006.01)

(52) **U.S. Cl.**

CPC ***A61M 5/31595*** (2013.01); ***A61M 5/3156*** (2013.01); ***A61M 5/31525*** (2013.01); ***A61M 5/31561*** (2013.01); *A61M 2005/3126* (2013.01); *A61M 2005/3154* (2013.01); *A61M 2205/3379* (2013.01); *A61M 2205/584* (2013.01)

(58) **Field of Classification Search**

CPC .. A61M 2005/3126; A61M 2205/3379; A61M 2205/584; A61M 2005/3125; A61M 5/31525; A61M 5/3156; A61M 5/31561; A61M 5/31595; A61M 2005/3154
See application file for complete search history.

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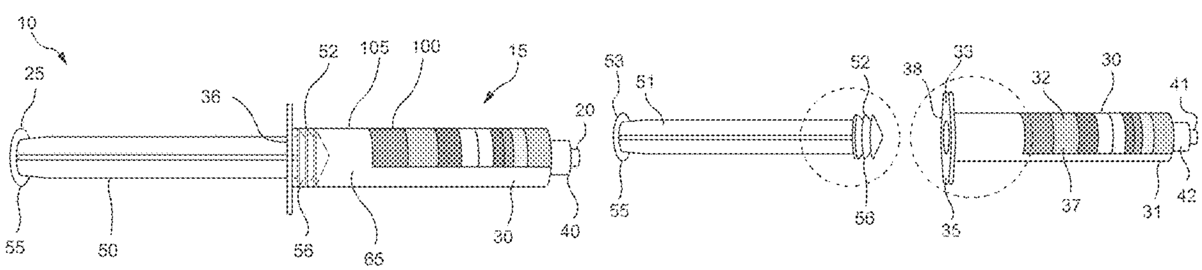
Primary Examiner — Rebecca E Eisenberg
(74) *Attorney, Agent, or Firm* — Neugeboren O'Dowd PC

(57) **ABSTRACT**

A medicine dispensing device and system for administering a selected drug. The medicine dispensing device includes a vessel configured to retain a drug to be dispensed. The medicine dispensing device may comprise a first series of zones of varying widths on a surface of the vessel, with each zone of the first series of zones corresponding to a pre-determined dose of the drug for a first medical condition wherein the first series of zones are correlated to a first series of values of a physical characteristic of a patient; and a second series of zones of varying widths on the surface of the vessel, with each zone of the second series of zones corresponding to a pre-determined dose of the drug for a second medical condition wherein the second series of zones are correlated to a second series of values of the physical characteristic of a patient.

20 Claims, 41 Drawing Sheets



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* cited by examiner

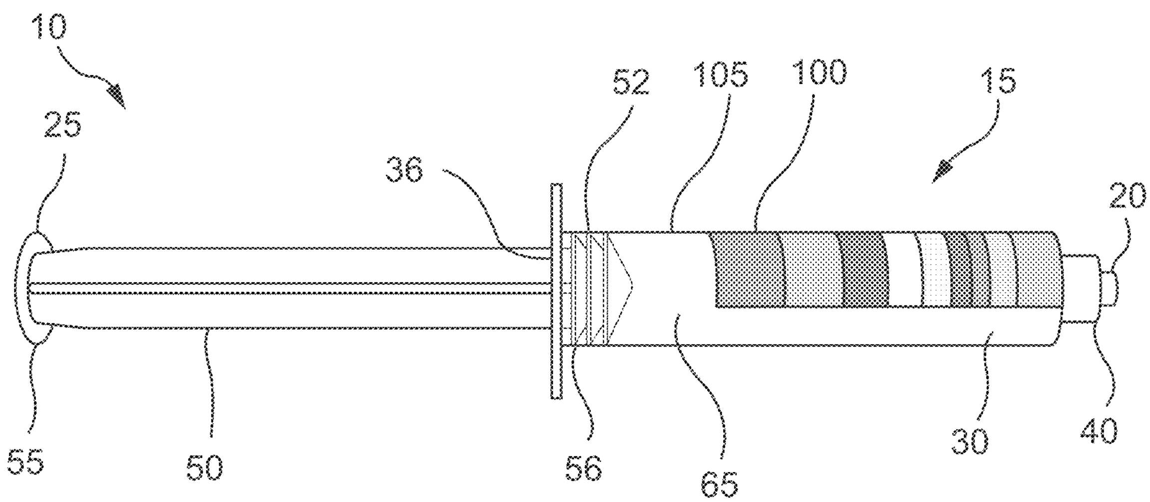


FIG. 1A

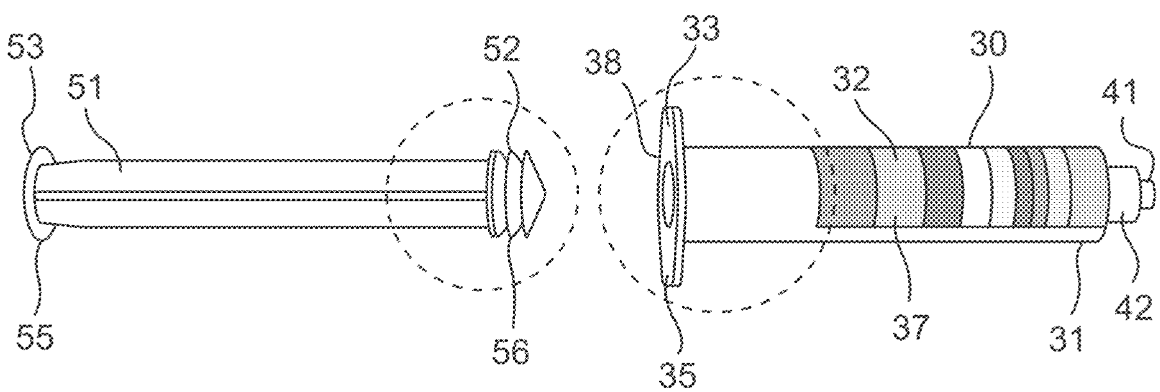


FIG. 1B

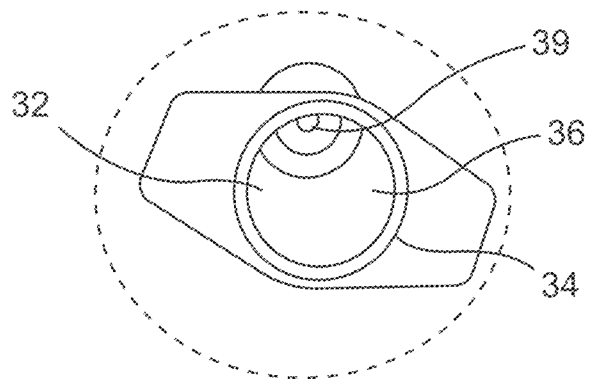


FIG. 1C

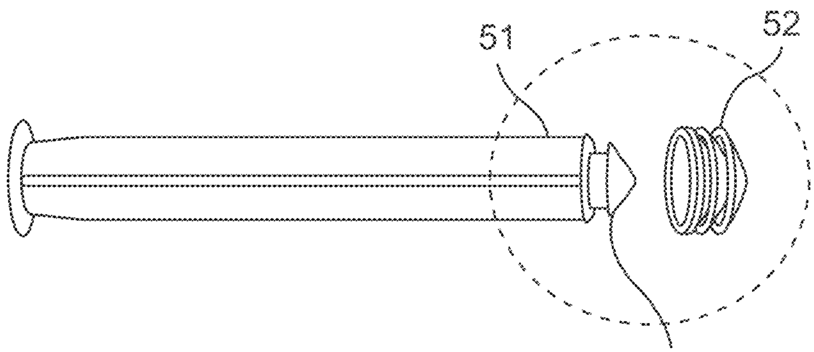


FIG. 1D

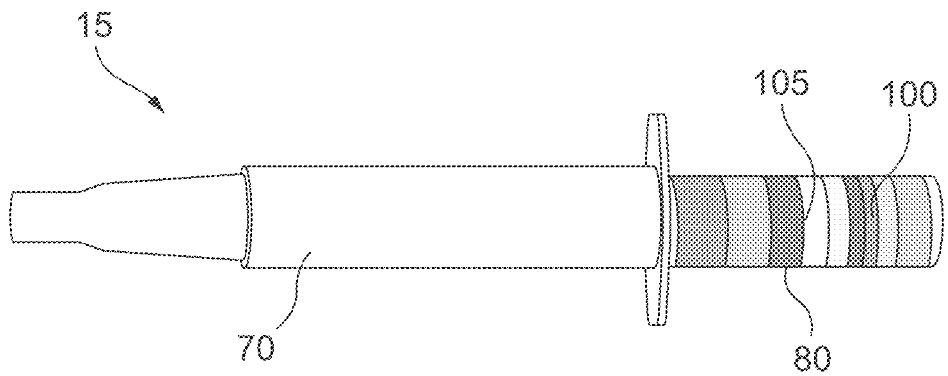


FIG. 2A

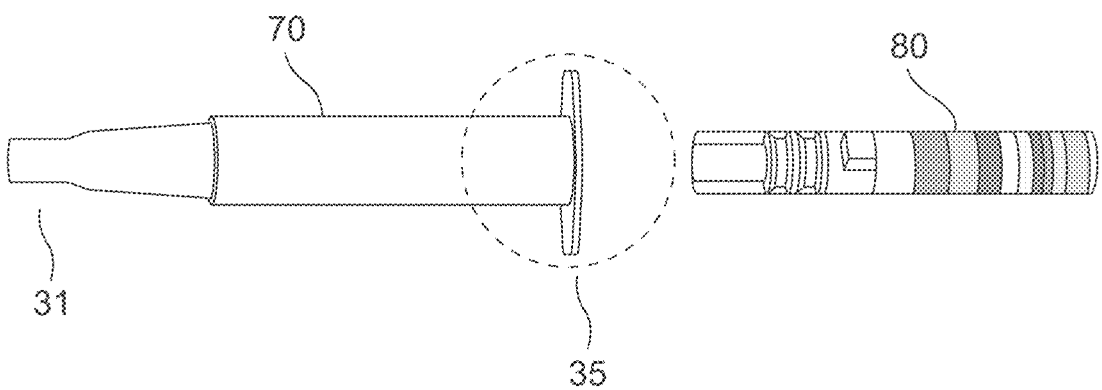


FIG. 2B

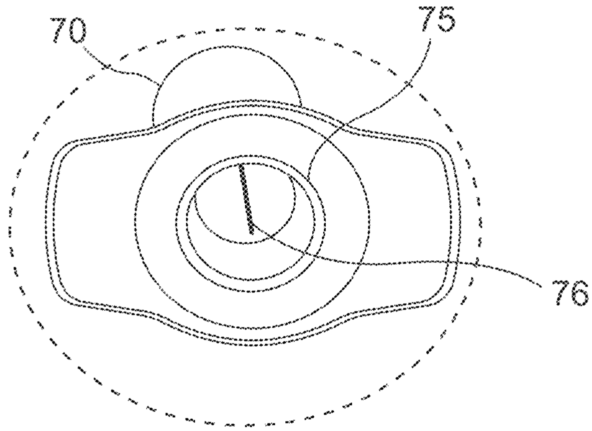


FIG. 2C

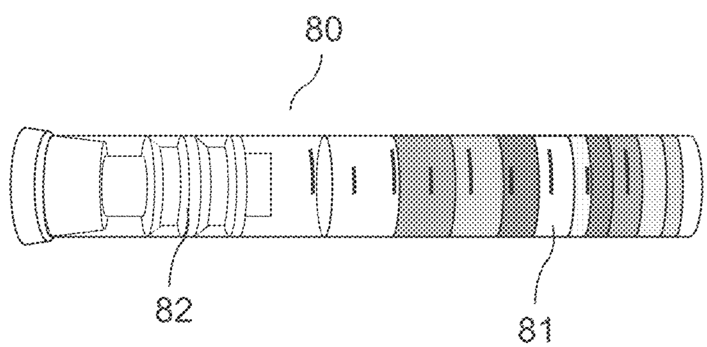


FIG. 2D

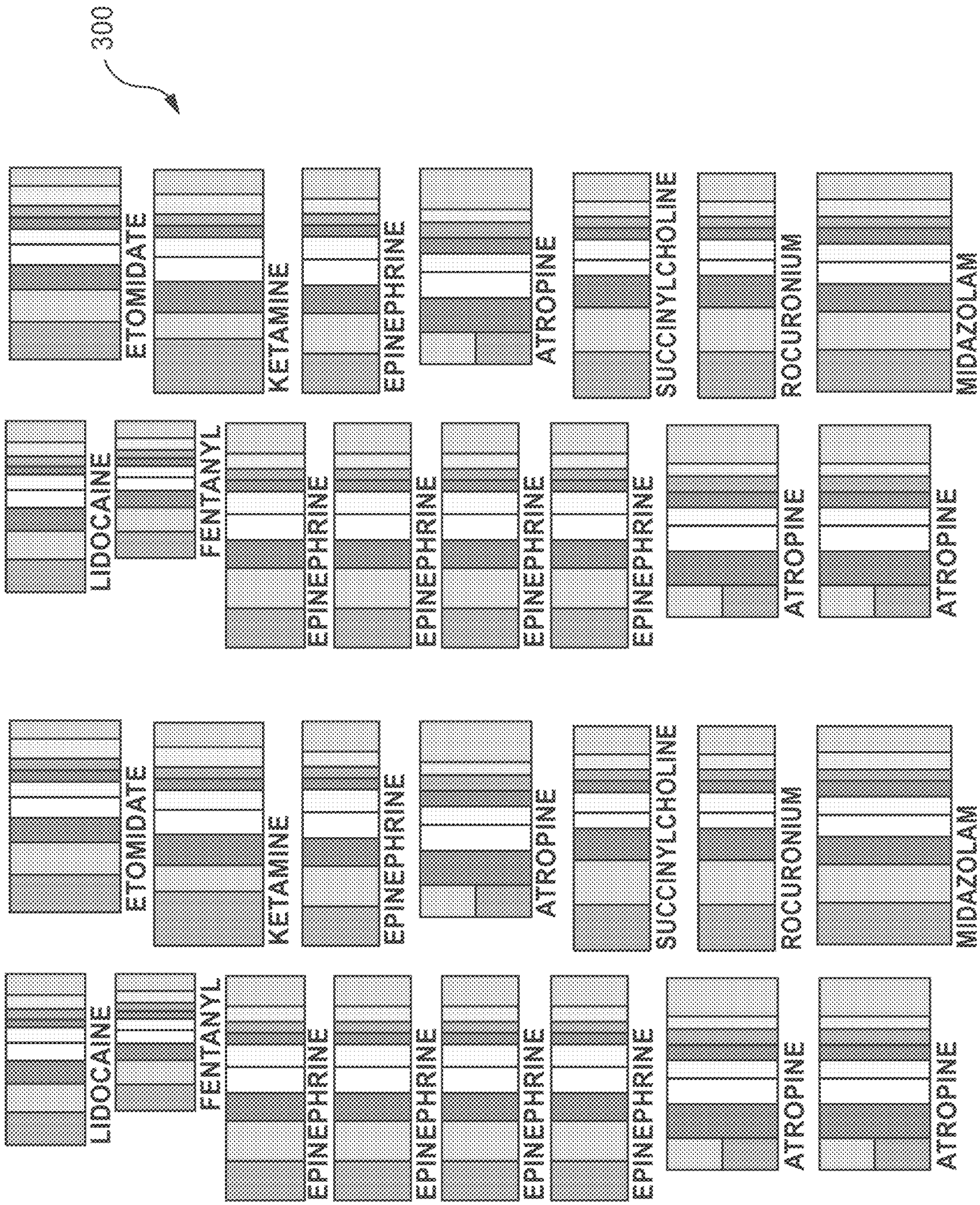

300
ETOMIDATE
KETAMINE
EPINEPHRINE
ATROPINE
SUCCINYLCHOLINE
ROCURONIUM
MIDAZOLAM
LIDOCAINE
FENTANYL
EPINEPHRINE
EPINEPHRINE
EPINEPHRINE
EPINEPHRINE
ATROPINE
ATROPINE
ETOMIDATE
KETAMINE
EPINEPHRINE
ATROPINE
SUCCINYLCHOLINE
ROCURONIUM
MIDAZOLAM
LIDOCAINE
FENTANYL
EPINEPHRINE
EPINEPHRINE
EPINEPHRINE
EPINEPHRINE
ATROPINE
ATROPINE

FIG. 3A

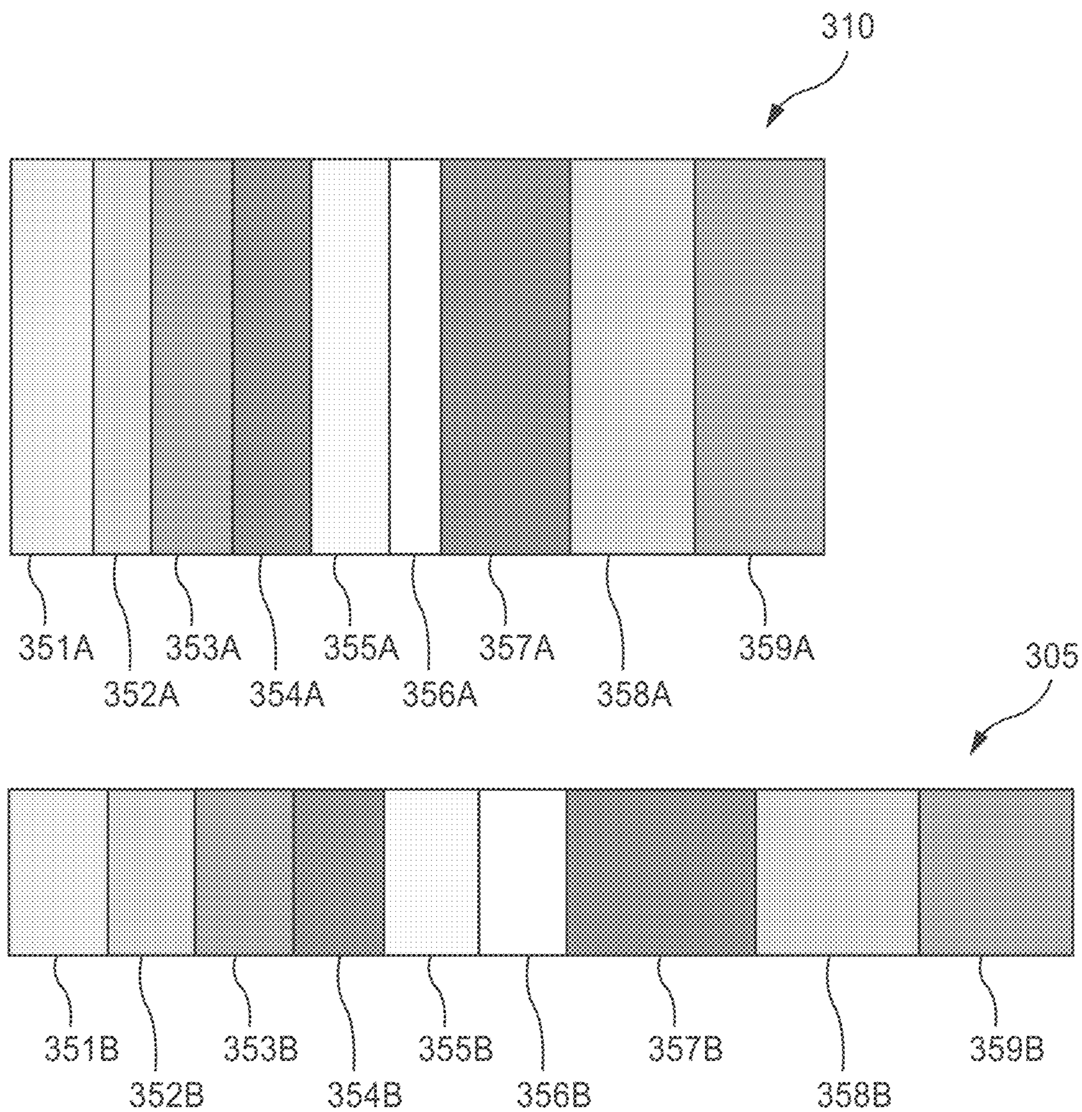

310
351A
352A
353A
354A
355A
356A
357A
358A
359A
305
351B
352B
353B
354B
355B
356B
357B
358B
359B

FIG. 3B

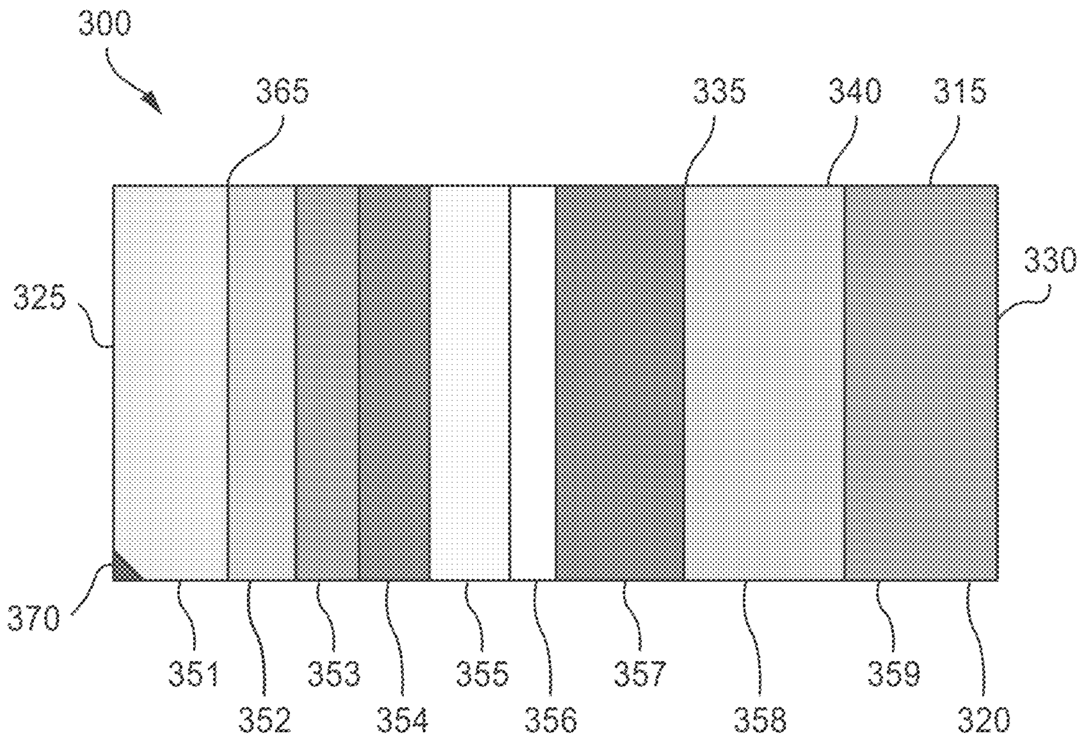

300
365
335
340
315
325
330
370
351
352
353
354
355
356
357
358
359
320

FIG. 3C

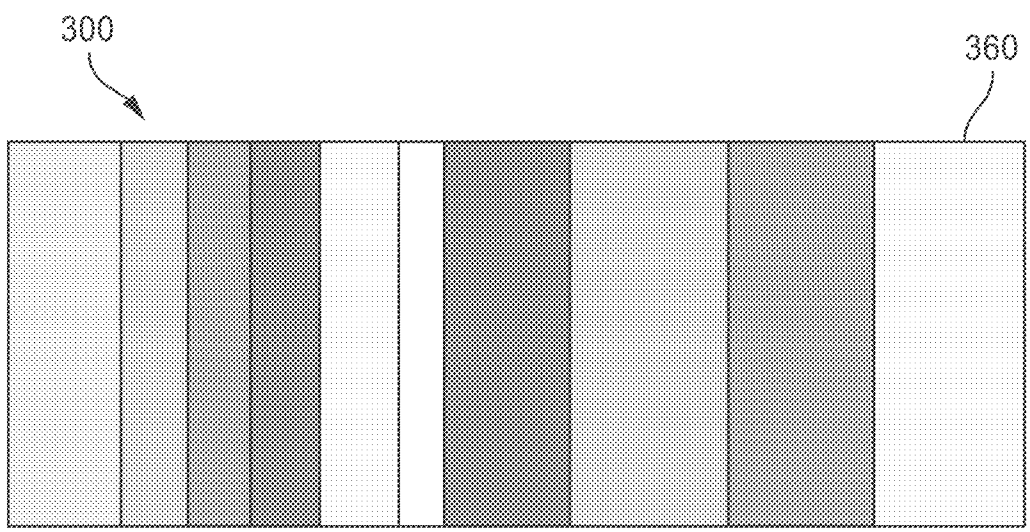

300
360

FIG. 3D

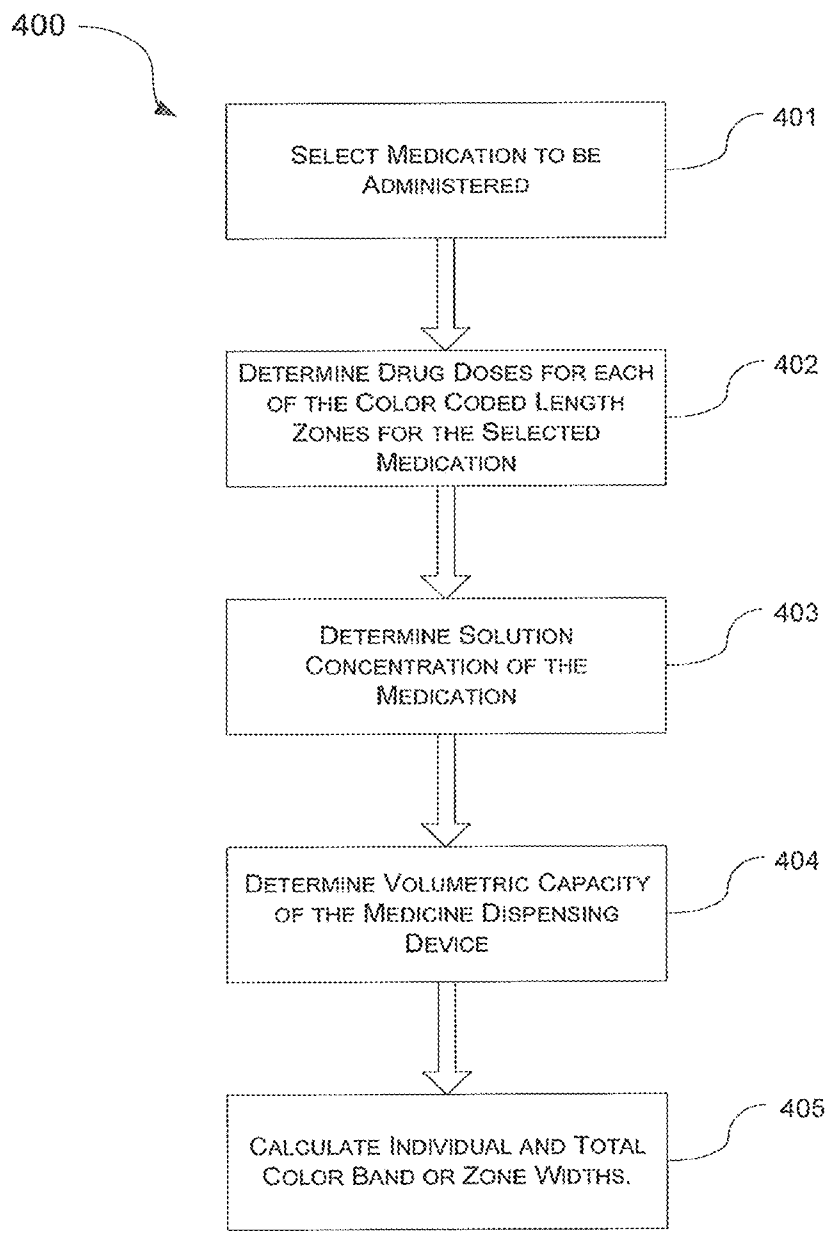

400
Select Medication to be Administered
401
Determine Drug Doses for each of the Color Coded Length Zones for the Selected Medication
402
Determine Solution Concentration of the Medication
403
Determine Volumetric Capacity of the Medicine Dispensing Device
404
Calculate Individual and Total Color Band or Zone Widths.
405

FIG. 4

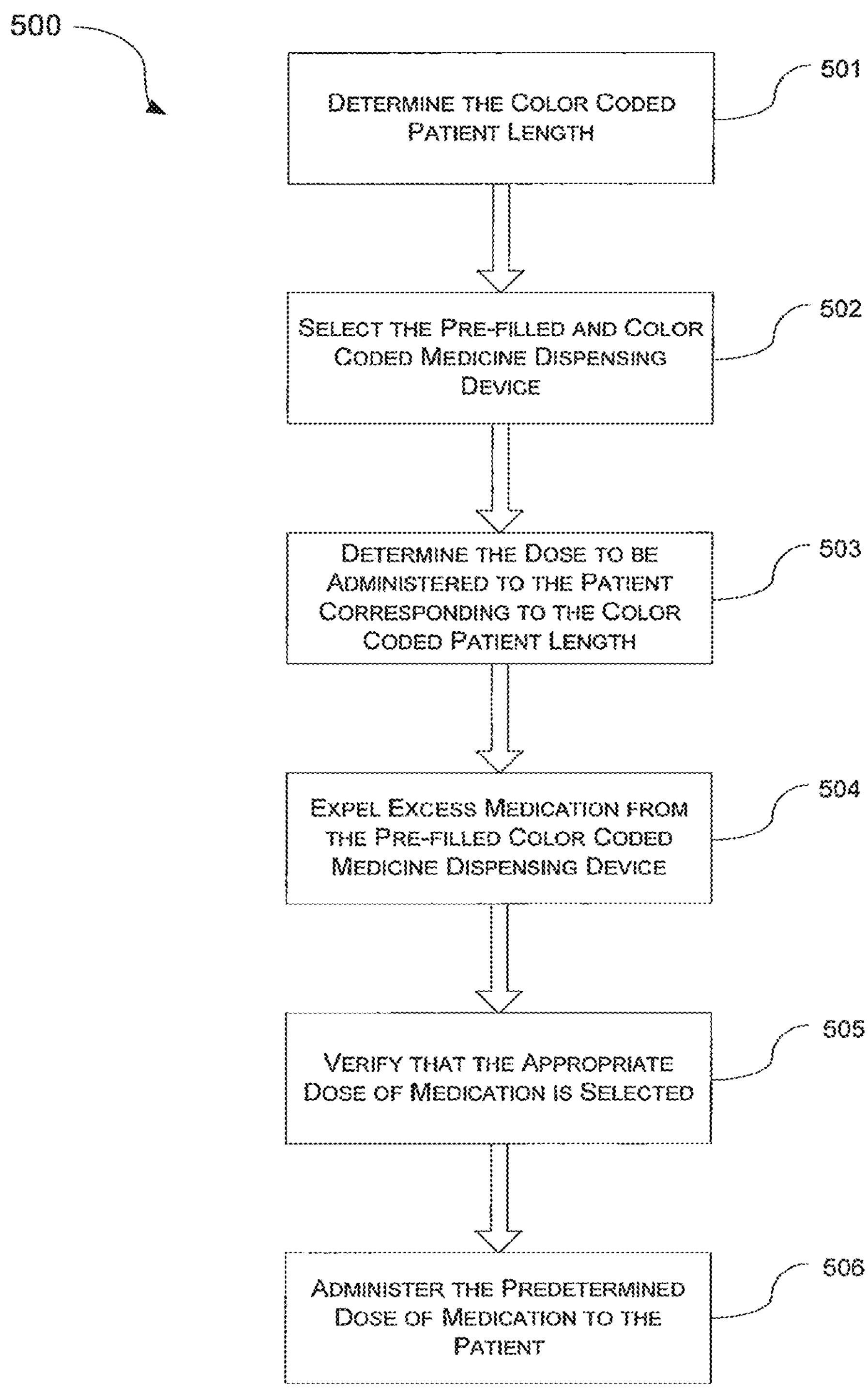

500
Determine the Color Coded Patient Length
501
Select the Pre-filled and Color Coded Medicine Dispensing Device
502
Determine the Dose to be Administered to the Patient Corresponding to the Color Coded Patient Length
503
Expel Excess Medication from the Pre-filled Color Coded Medicine Dispensing Device
504
Verify that the Appropriate Dose of Medication is Selected
505
Administer the Predetermined Dose of Medication to the Patient
506

FIG. 5

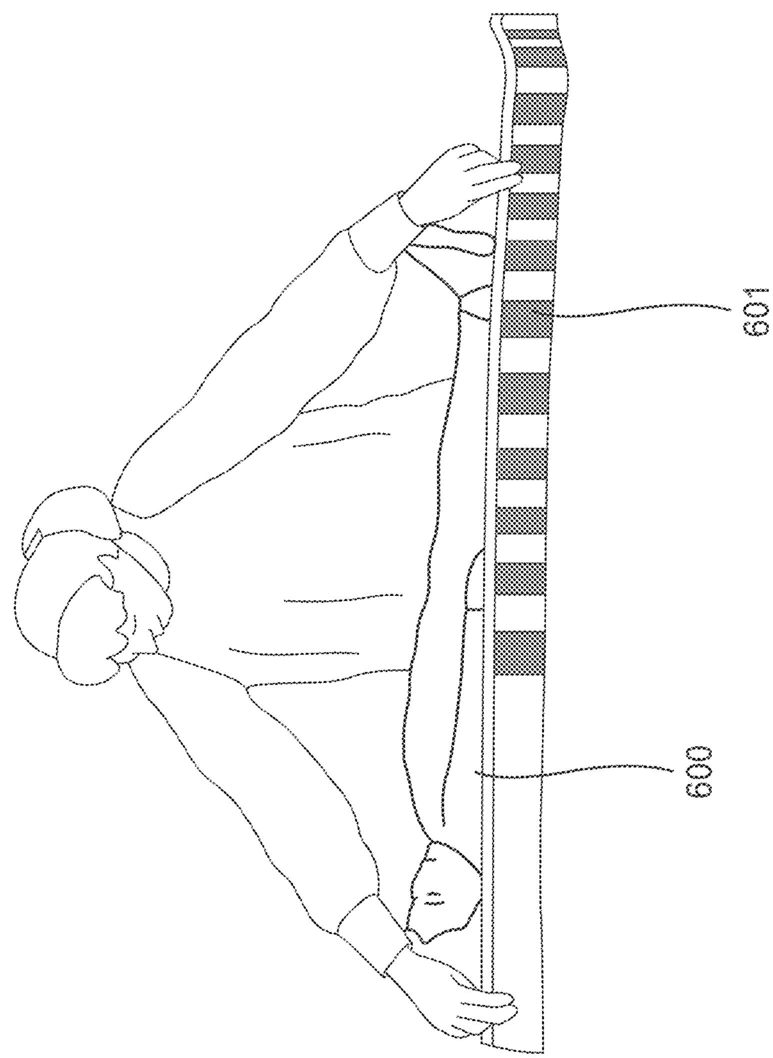
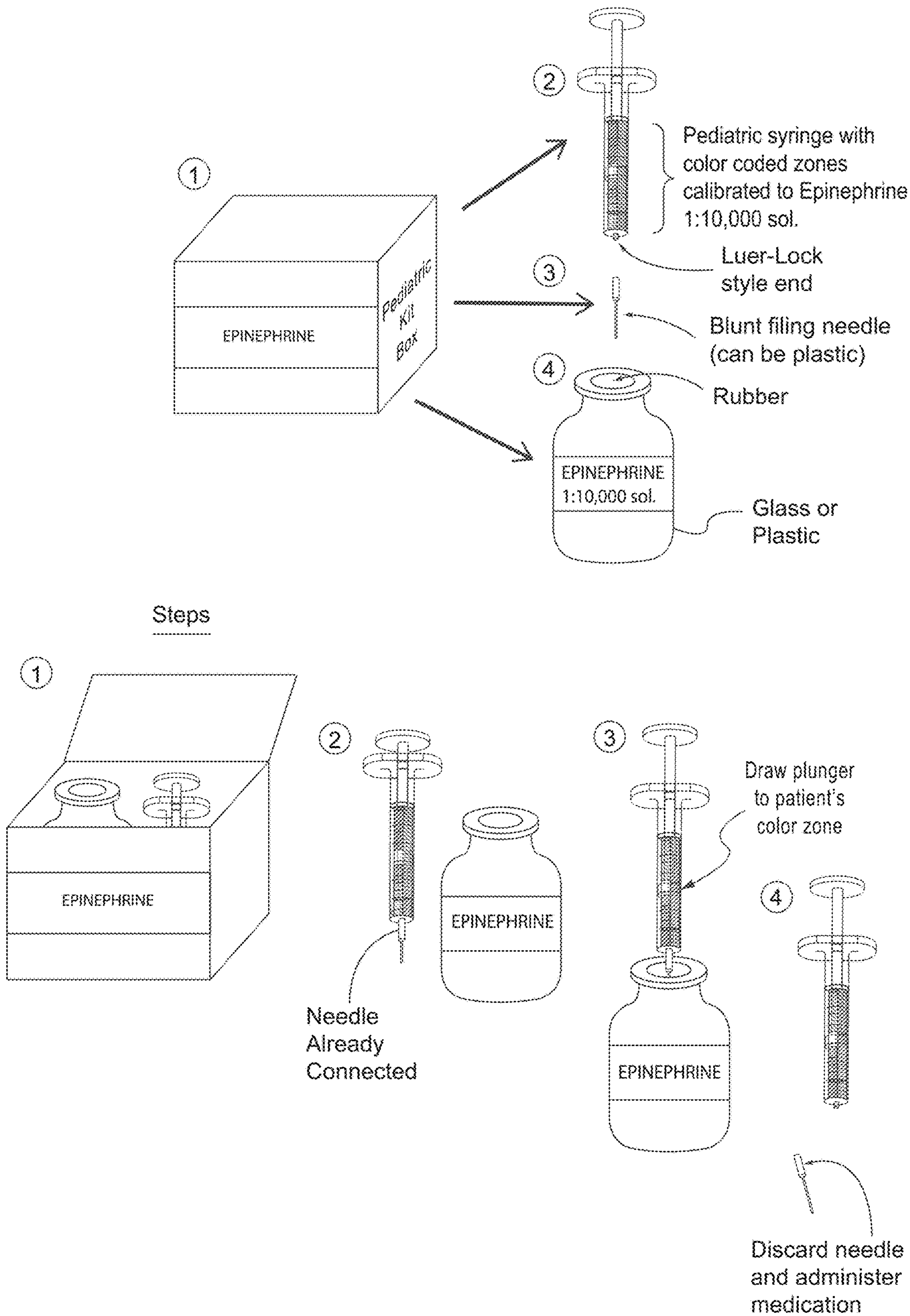


FIG. 6



1
EPINEPHRINE
Pediatric Kit Box
2
Pediatric syringe with color coded zones calibrated to Epinephrine 1:10,000 sol.
Luer-Lock style end
3
Blunt filing needle (can be plastic)
4
Rubber
EPINEPHRINE 1:10,000 sol.
Glass or Plastic
Steps
1
EPINEPHRINE
2
EPINEPHRINE
Needle Already Connected
3
Draw plunger to patient's color zone
EPINEPHRINE
4
Discard needle and administer medication

FIG. 7

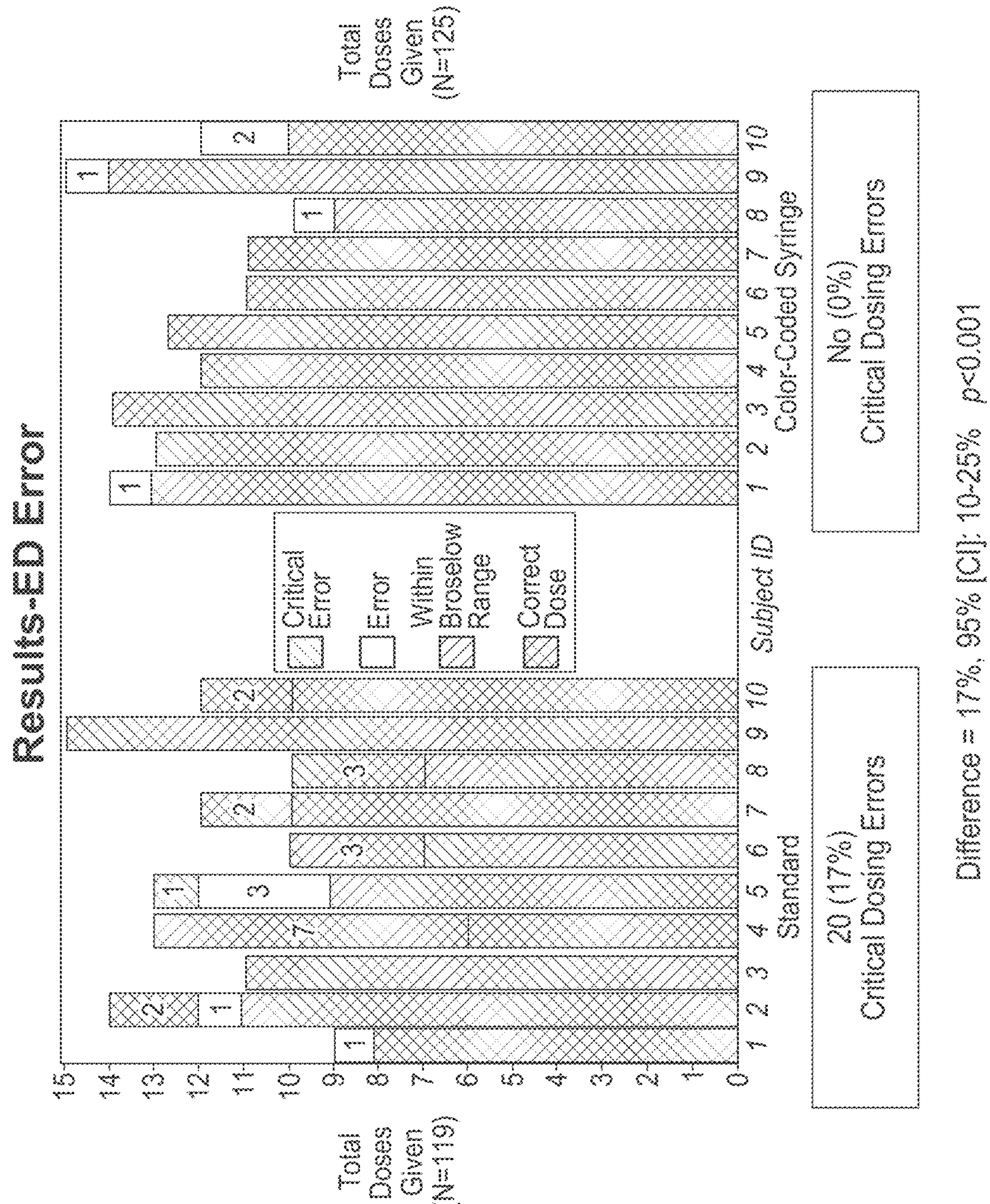

Results-ED Error
Total Doses Given (N=119)
Total Doses Given (N=125)
Critical Error
Error
Within Broselow Range
Correct Dose
Subject ID
Standard
Color-Coded Syringe
20 (17%) Critical Dosing Errors
No (0%) Critical Dosing Errors
Difference = 17%, 95% [CI]: 10-25% p<0.001

FIG. 8A

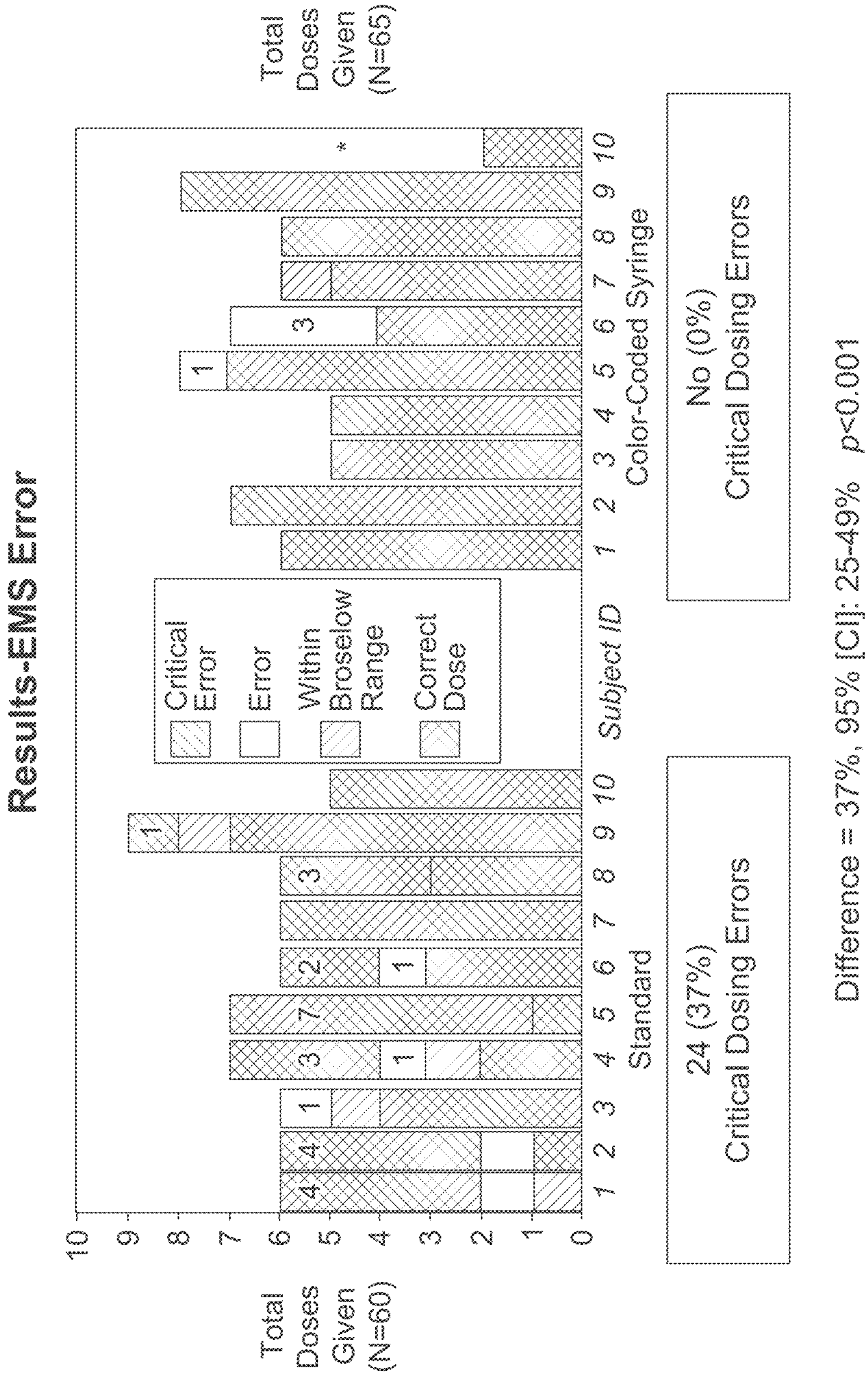
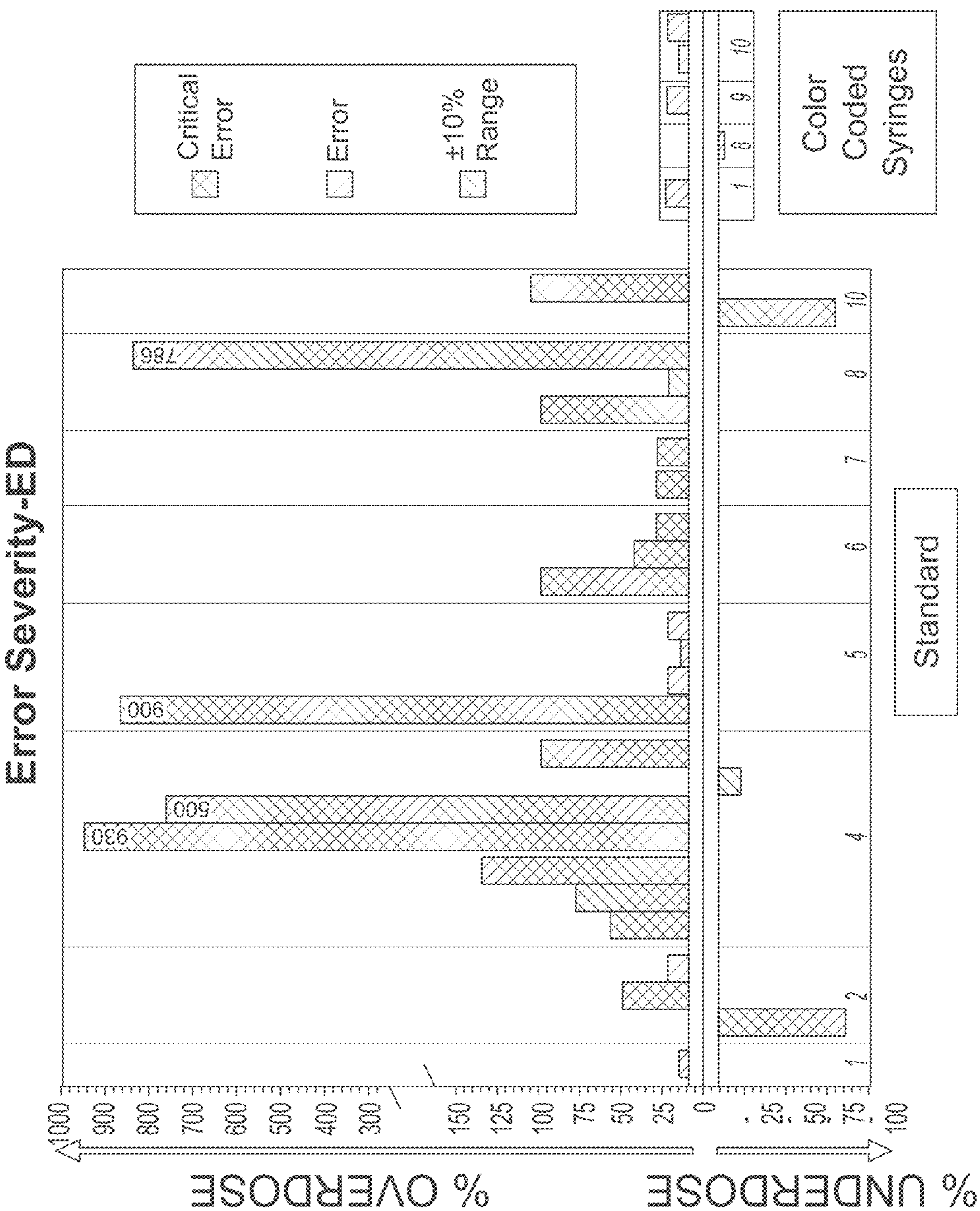

Results-EMS Error
Total Doses Given (N=60)
Total Doses Given (N=65)
0 1 2 3 4 5 6 7 8 9 10
Critical Error
Error
Within Broselow Range
Correct Dose
Subject ID
Standard
Color-Coded Syringe
1 2 3 4 5 6 7 8 9 10
4
4
1
3
1
7
2
1
3
1
1
3
*
24 (37%)
Critical Dosing Errors
No (0%)
Critical Dosing Errors
Difference = 37%, 95% [CI]: 25-49% p<0.001

FIG.8B



Error Severity-ED
Critical Error
Error
±10% Range
Color Coded Syringes
Standard
% OVERDOSE
% UNDERDOSE
1000
900
800
700
600
500
400
300
150
125
100
75
50
25
0
25
50
75
100
930
500
900
786
1
2
4
5
6
7
8
9
10

FIG. 8C

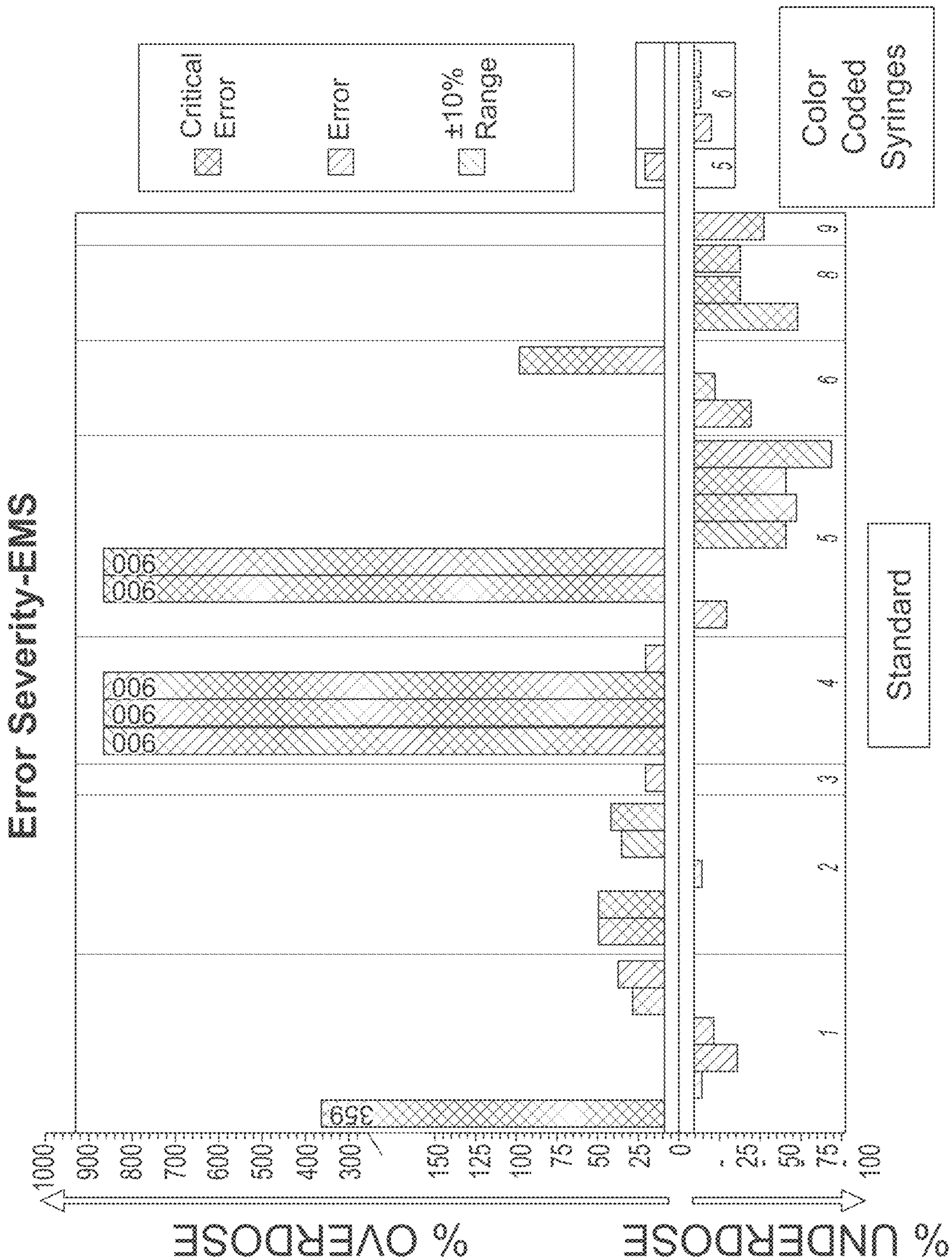

Error Severity-EMS
% OVERDOSE
% UNDERDOSE
1000
900
800
700
600
500
400
300
150
125
100
75
50
25
0
25
50
75
100
359
900
900
900
900
900
1
2
3
4
5
6
8
9
Critical Error
Error
±10% Range
Standard
Color Coded Syringes

FIG. 8D

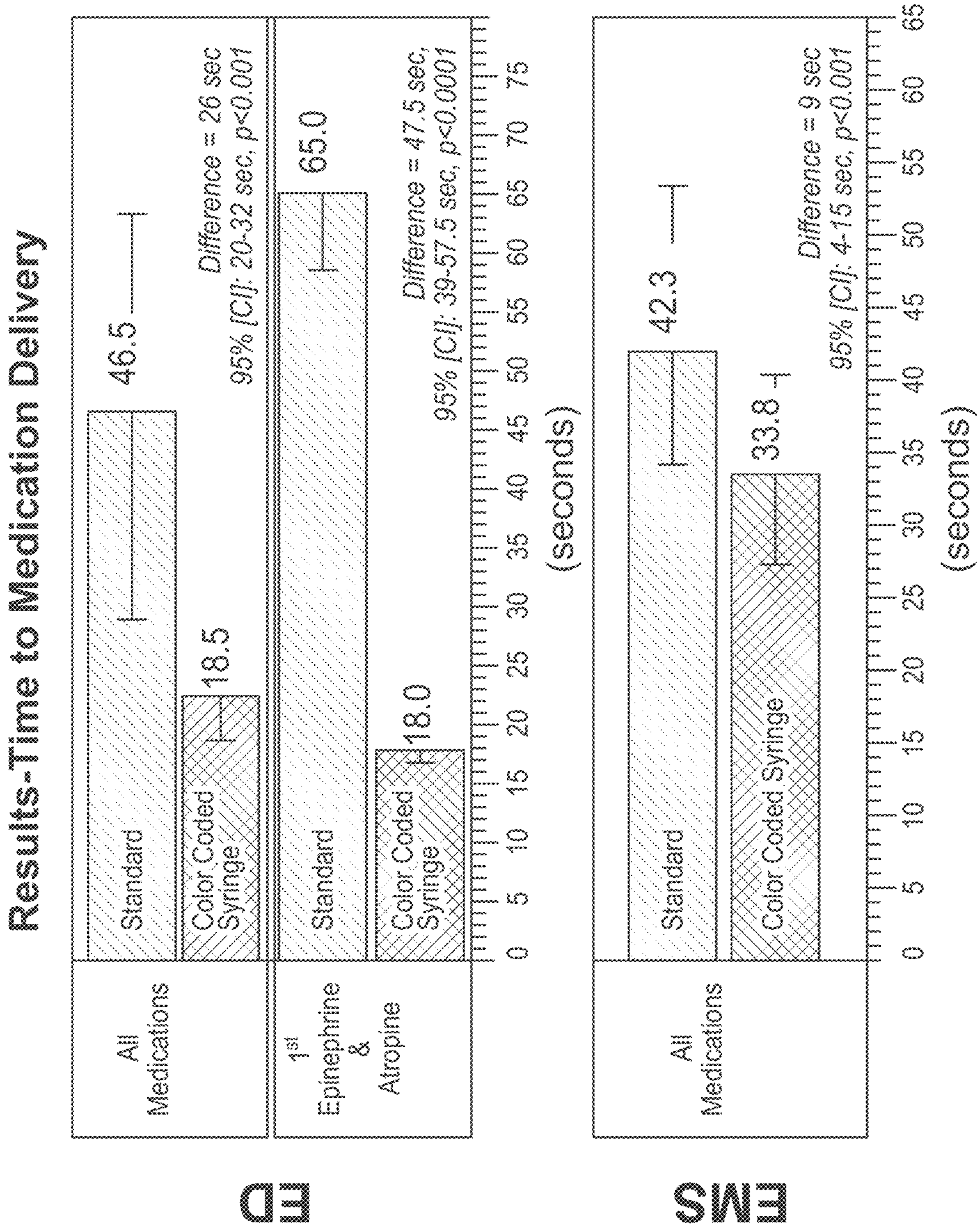

Results-Time to Medication Delivery
ED
EMS
All Medications
1st Epinephrine & Atropine
Standard
Color Coded Syringe
46.5
18.5
65.0
18.0
42.3
33.8
Difference = 26 sec
95% [CI]: 20-32 sec, p<0.001
Difference = 47.5 sec,
95% [CI]: 39-57.5 sec, p<0.0001
Difference = 9 sec
95% [CI]: 4-15 sec, p<0.001
(seconds)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
0 5 10 15 20 25 30 35 40 45 50 55 60 65

FIG. 8E

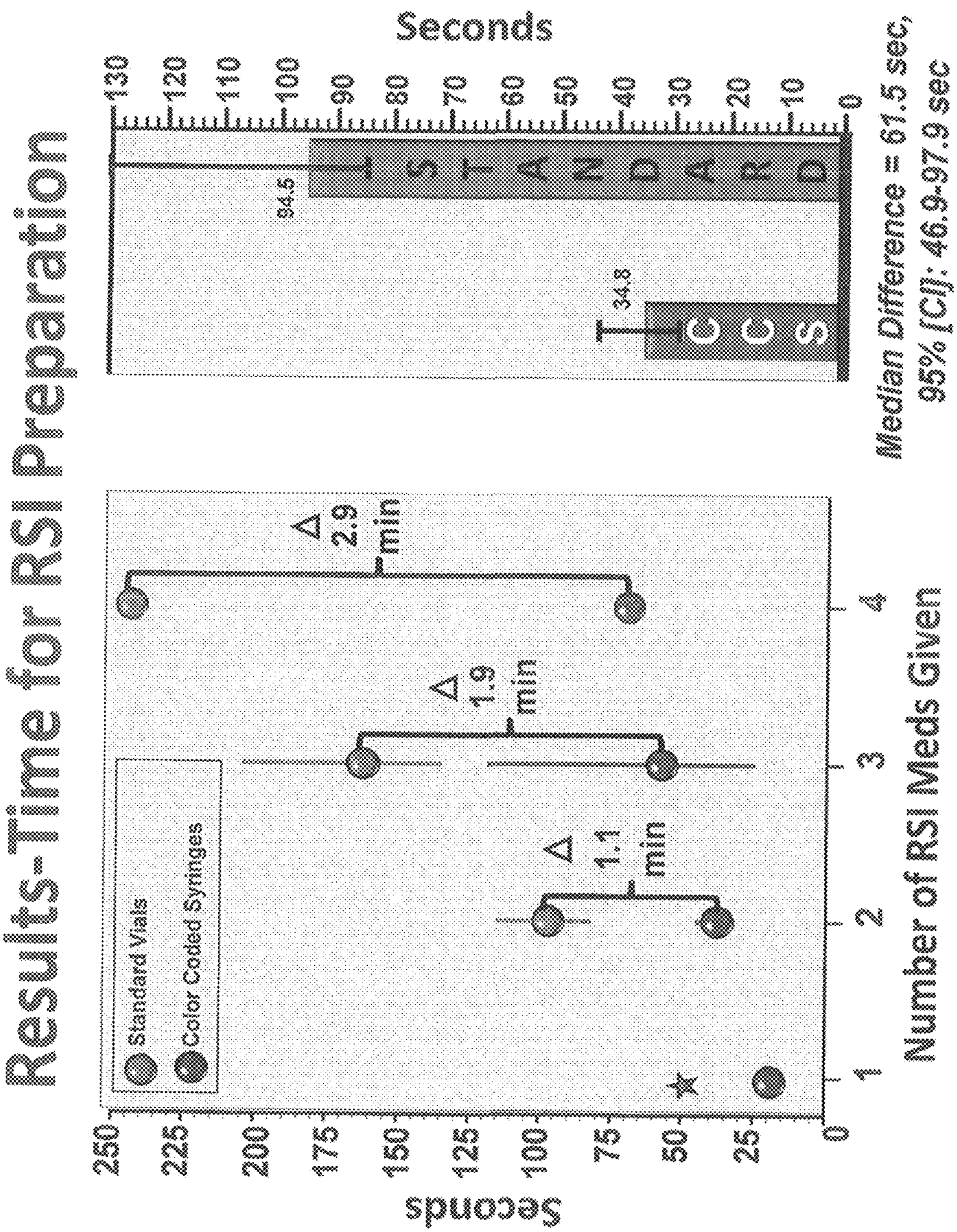

Results-Time for RSI Preparation
Seconds
250
225
200
175
150
125
100
75
50
25
0
1
2
3
4
Number of RSI Meds Given
Standard Vials
Color Coded Syringes
Δ 1.1 min
Δ 1.9 min
Δ 2.9 min
Seconds
130
120
110
100
90
80
70
60
50
40
30
20
10
0
94.5
STANDARD
34.8
CCS
Median Difference = 61.5 sec,
95% [CI]: 46.9-97.9 sec

FIG. 8F

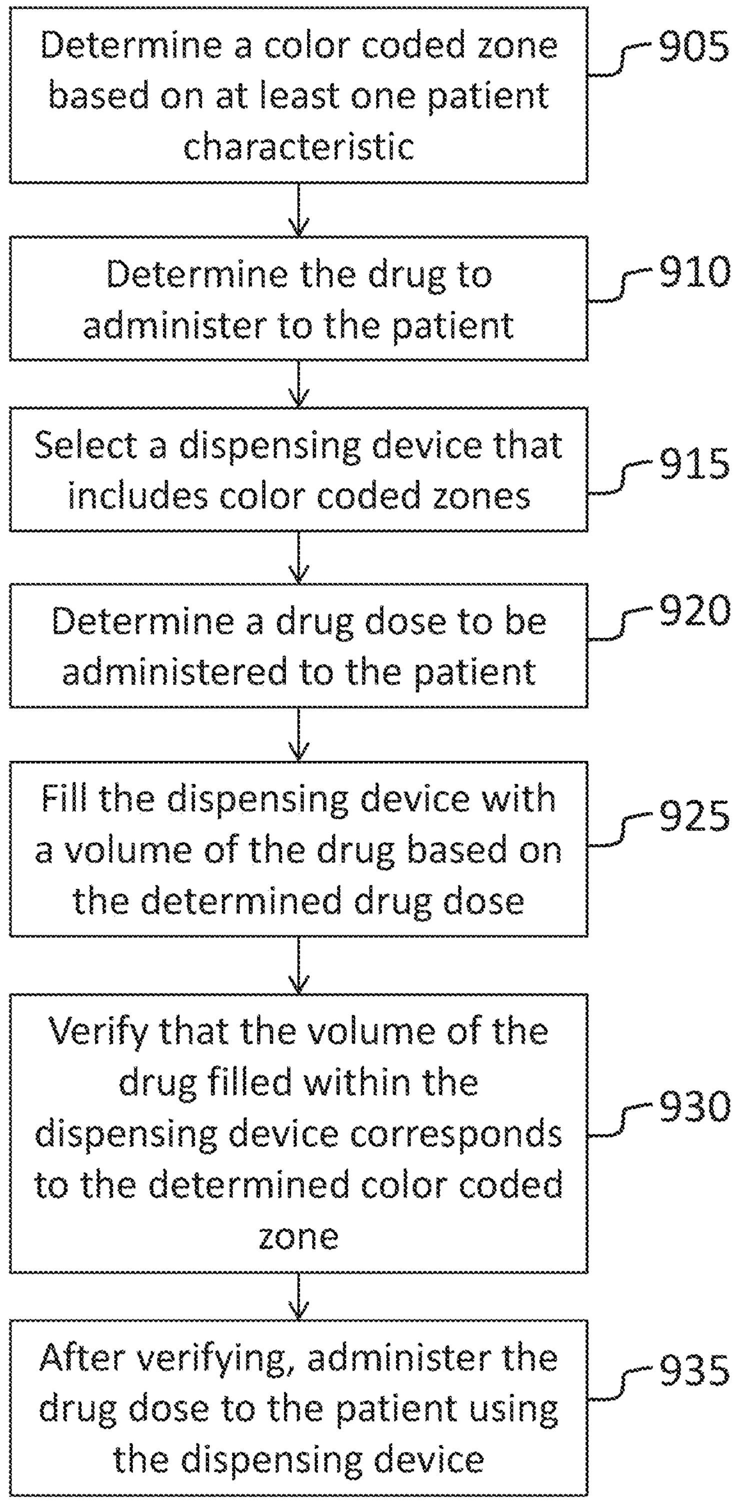

Determine a color coded zone based on at least one patient characteristic
905
Determine the drug to administer to the patient
910
Select a dispensing device that includes color coded zones
915
Determine a drug dose to be administered to the patient
920
Fill the dispensing device with a volume of the drug based on the determined drug dose
925
Verify that the volume of the drug filled within the dispensing device corresponds to the determined color coded zone
930
After verifying, administer the drug dose to the patient using the dispensing device
935

FIGURE 9A

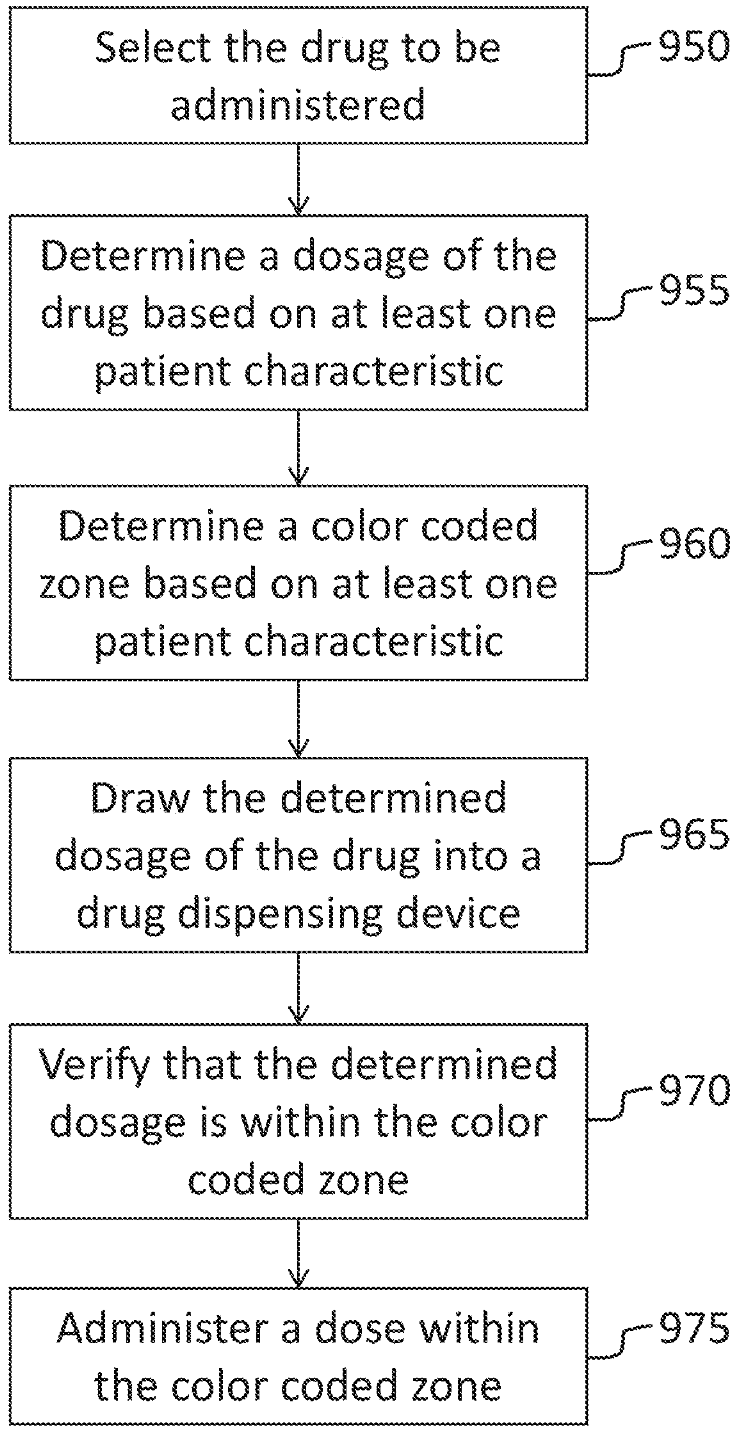

Select the drug to be administered
950
Determine a dosage of the drug based on at least one patient characteristic
955
Determine a color coded zone based on at least one patient characteristic
960
Draw the determined dosage of the drug into a drug dispensing device
965
Verify that the determined dosage is within the color coded zone
970
Administer a dose within the color coded zone
975

FIGURE 9B

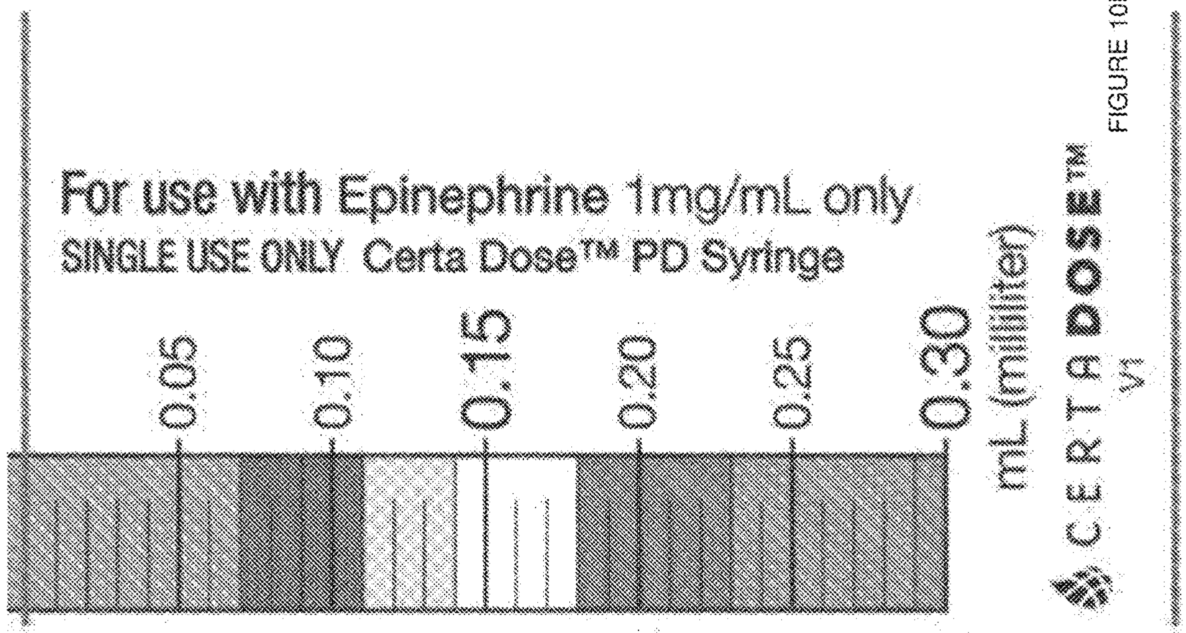


FIGURE 10B

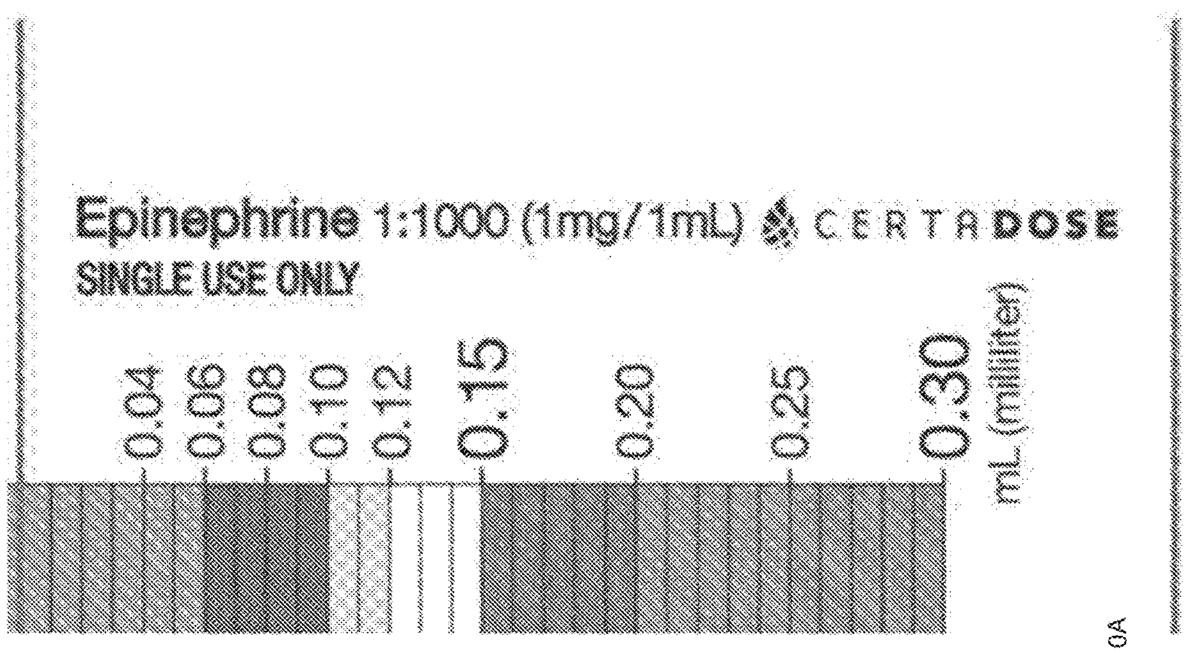


FIGURE 10A

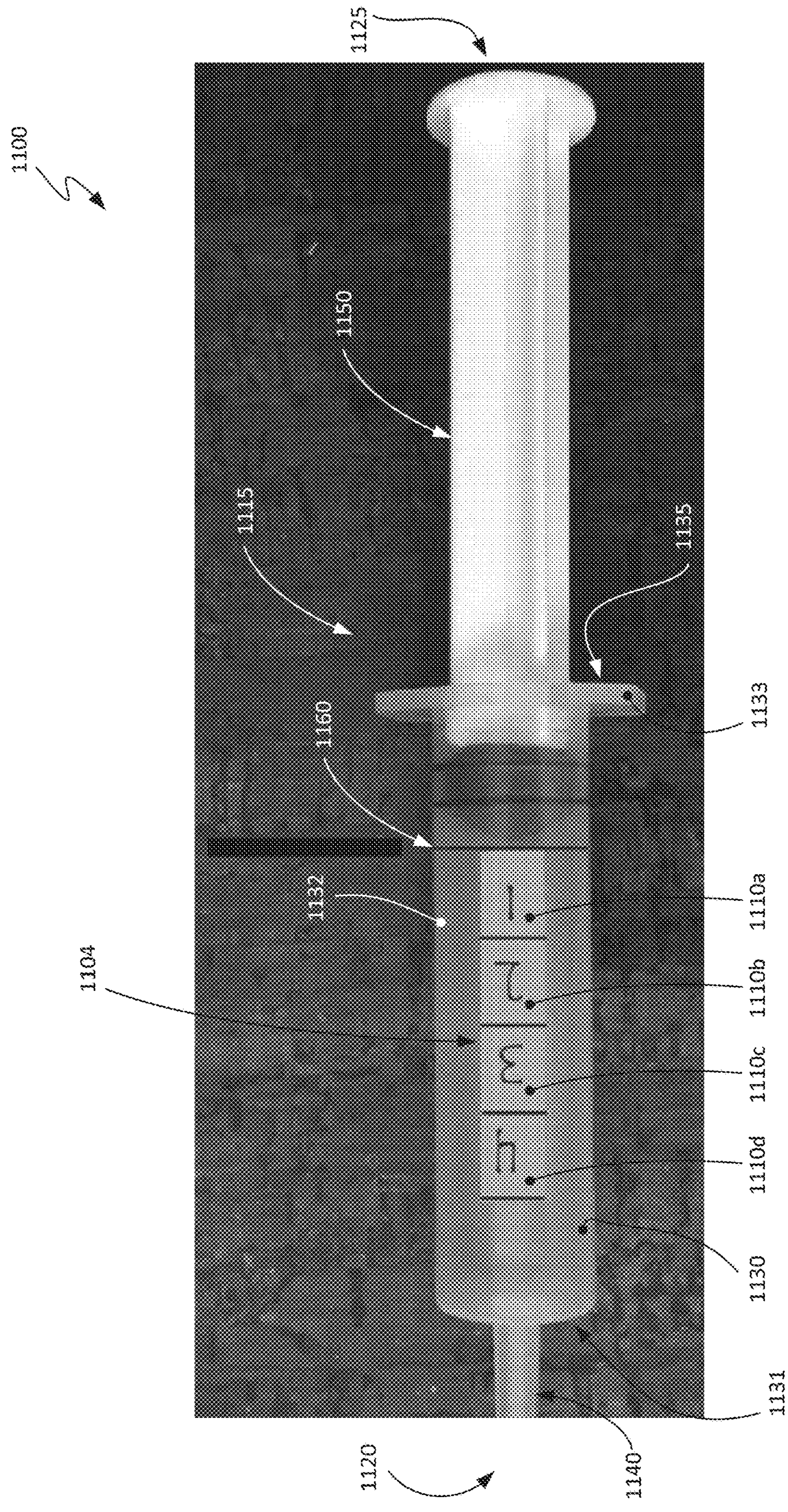

1100
1125
1150
1115
1135
1133
1160
1132
1104
1110a
1110b
1110c
1110d
1130
1131
1140
1120

FIG. 11

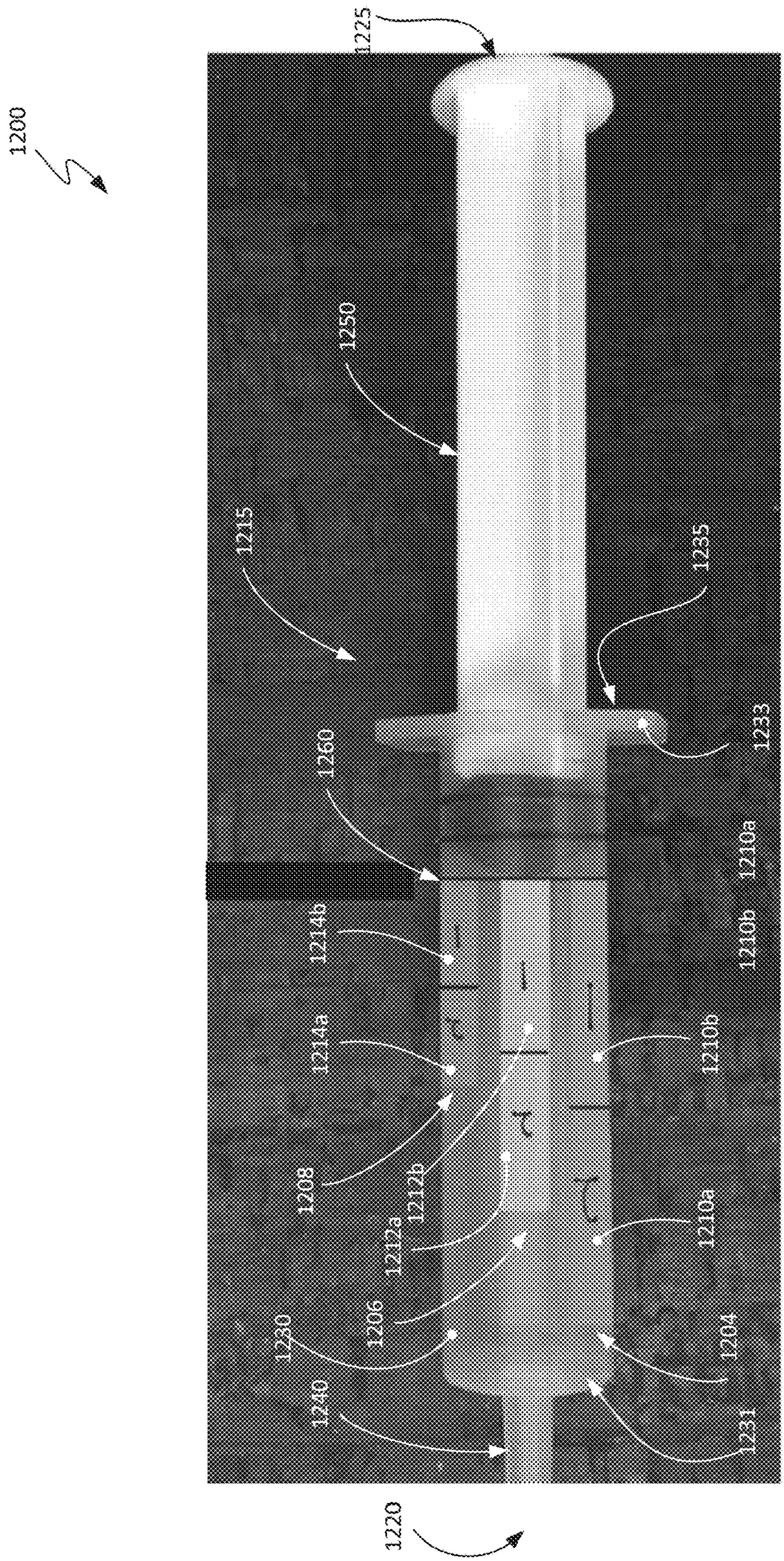

1200
1225
1250
1215
1235
1233
1260
1210a
1214b
1210b
1214a
1210b
1208
1212b
1212a
1210a
1206
1230
1204
1240
1231
1220

FIG. 12

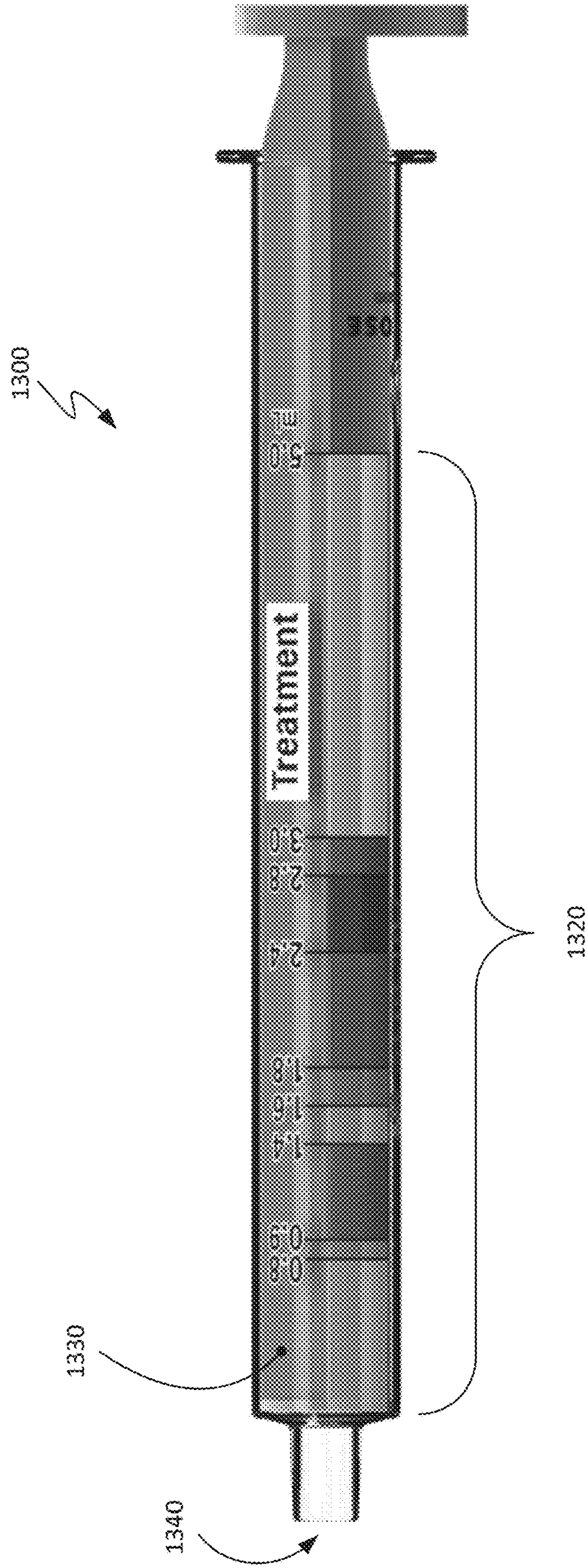


FIG. 13

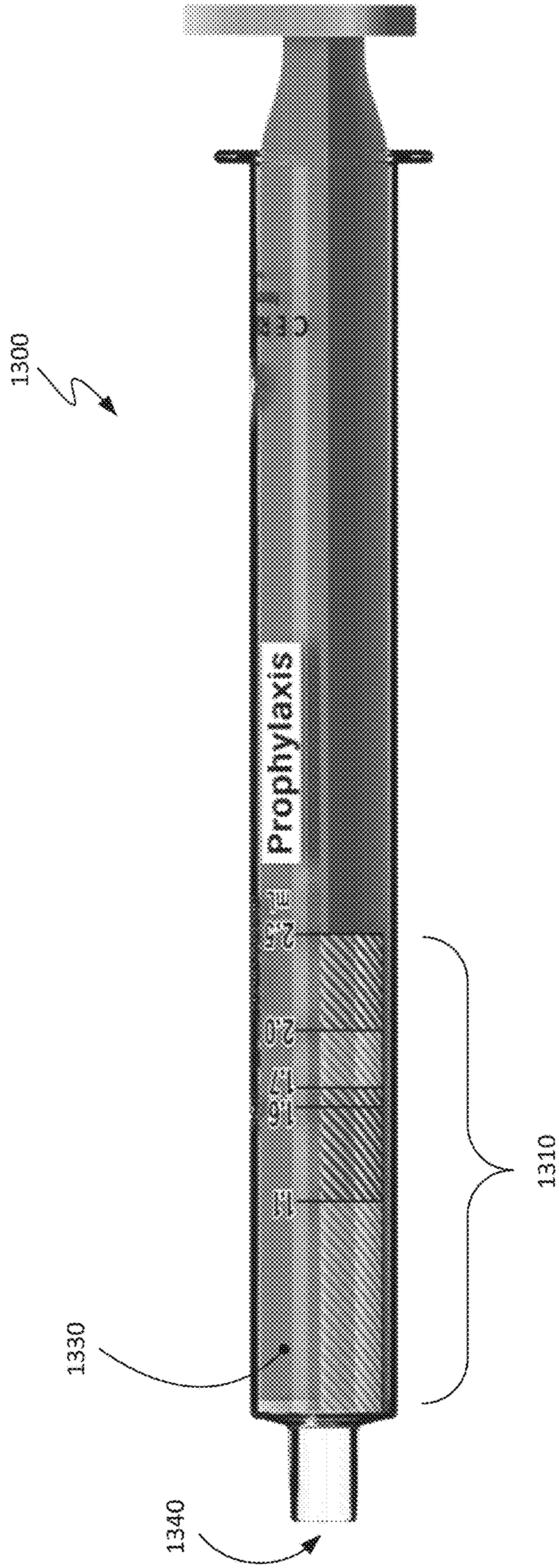


FIG. 14

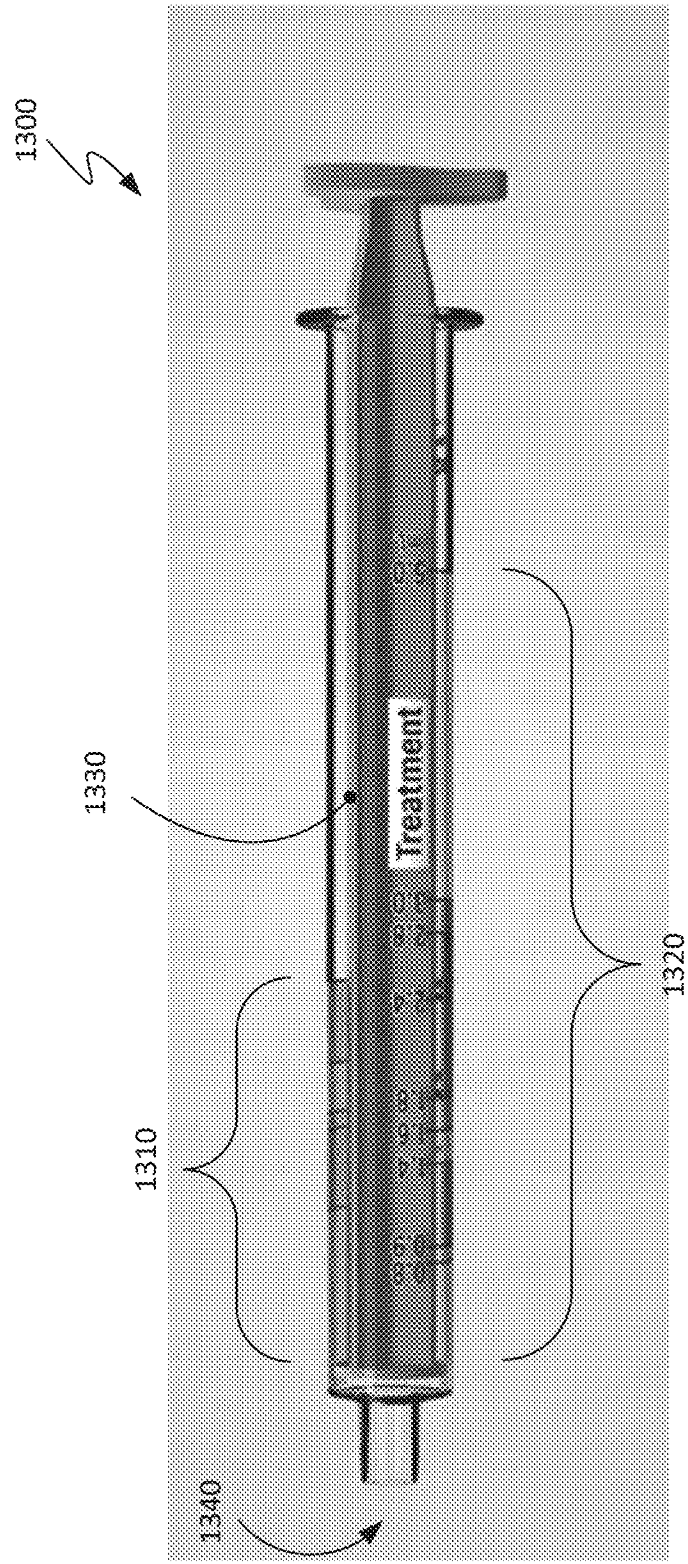


FIG. 15

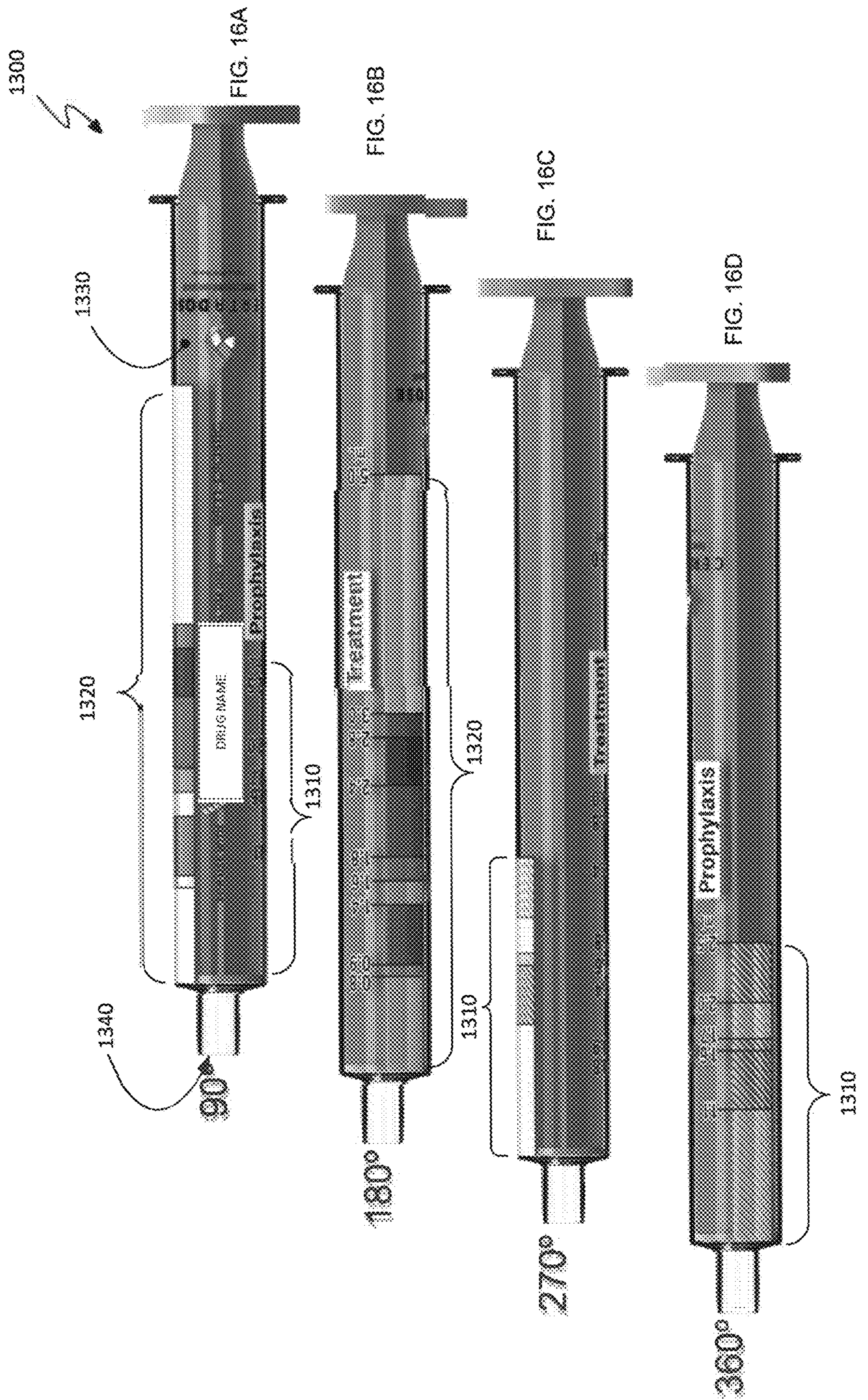

1300
FIG. 16A
FIG. 16B
FIG. 16C
FIG. 16D
1330
1320
1310
1340
Prophylaxis
DRUG NAME
Treatment
Treatment
Prophylaxis
90°
180°
270°
360°

FIG. 16

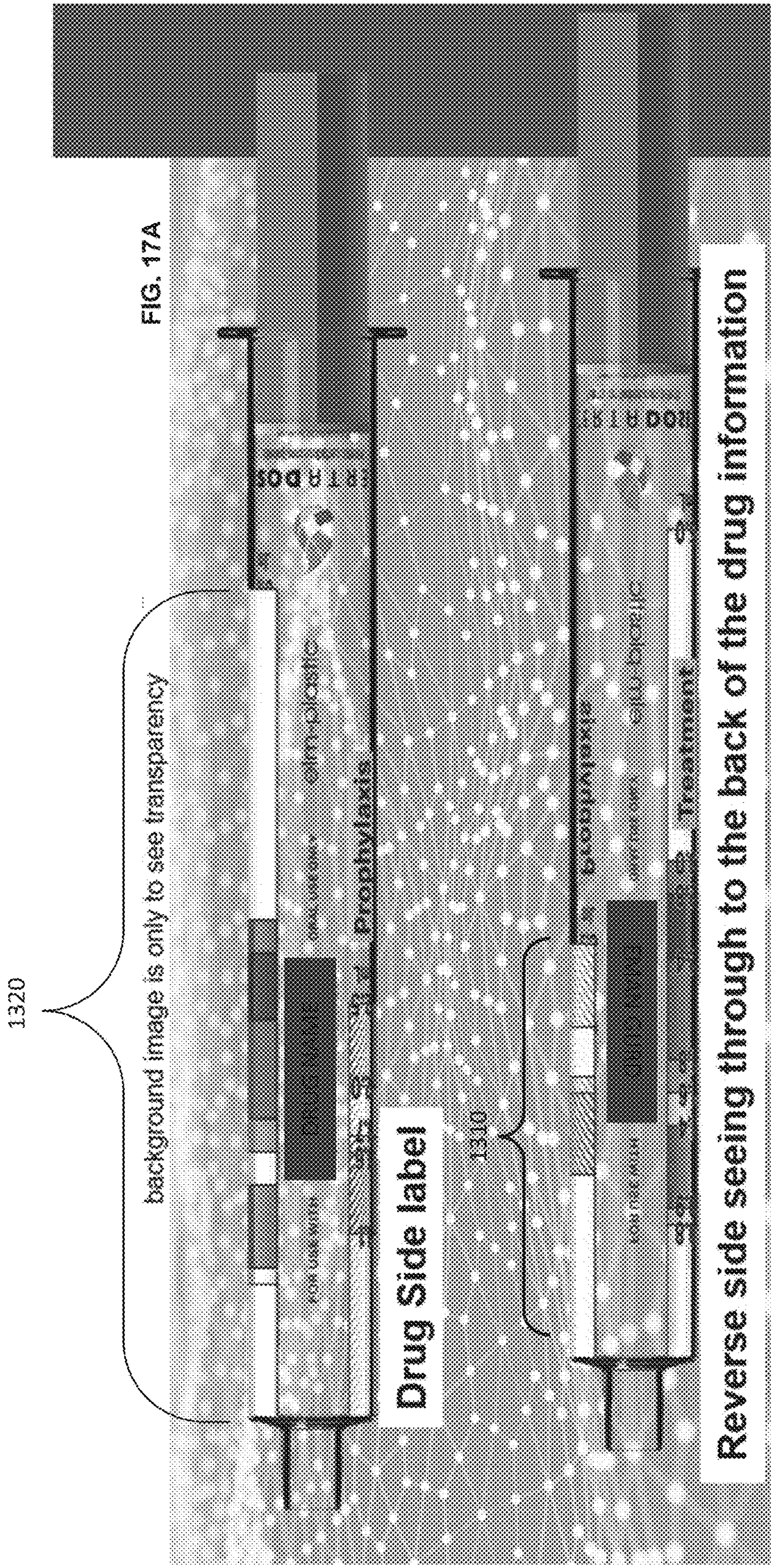
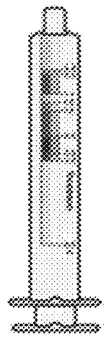


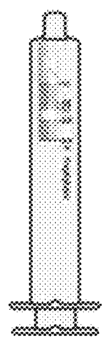
FIG. 17A

FIG. 17B



Your Child ☐ TREATMENT			
	BODY WEIGHT [kg]		DOSE [mg or mL]
Select Dose	Min	Max	
☐	2.6	<3	1.2
☐	3	<4	1.3
☐	4	<5	2.1
☐	5	<7	2.4
☐	7	<8	2.7
☐	8	<9	3.6
☐	9	<10	4.2
☐	10	<12	4.5
☐	12	<20	7.5

FIG. 18A



Your Child ☐ PROPHYLAXIS				
	BODY WEIGHT[a] [kg]		BID DOSE[b] [mg or mL]	TOTAL[c] DAILY DOSE [mg]
Select Dose	Min	Max		
☐	7	< 8	1.6	3.3
☐	8	< 10	2.4	4.8
☐	10	< 12	2.6	5.1
☐	12	< 20	3.0	6.0
☐	20	< 30	3.7	7.5

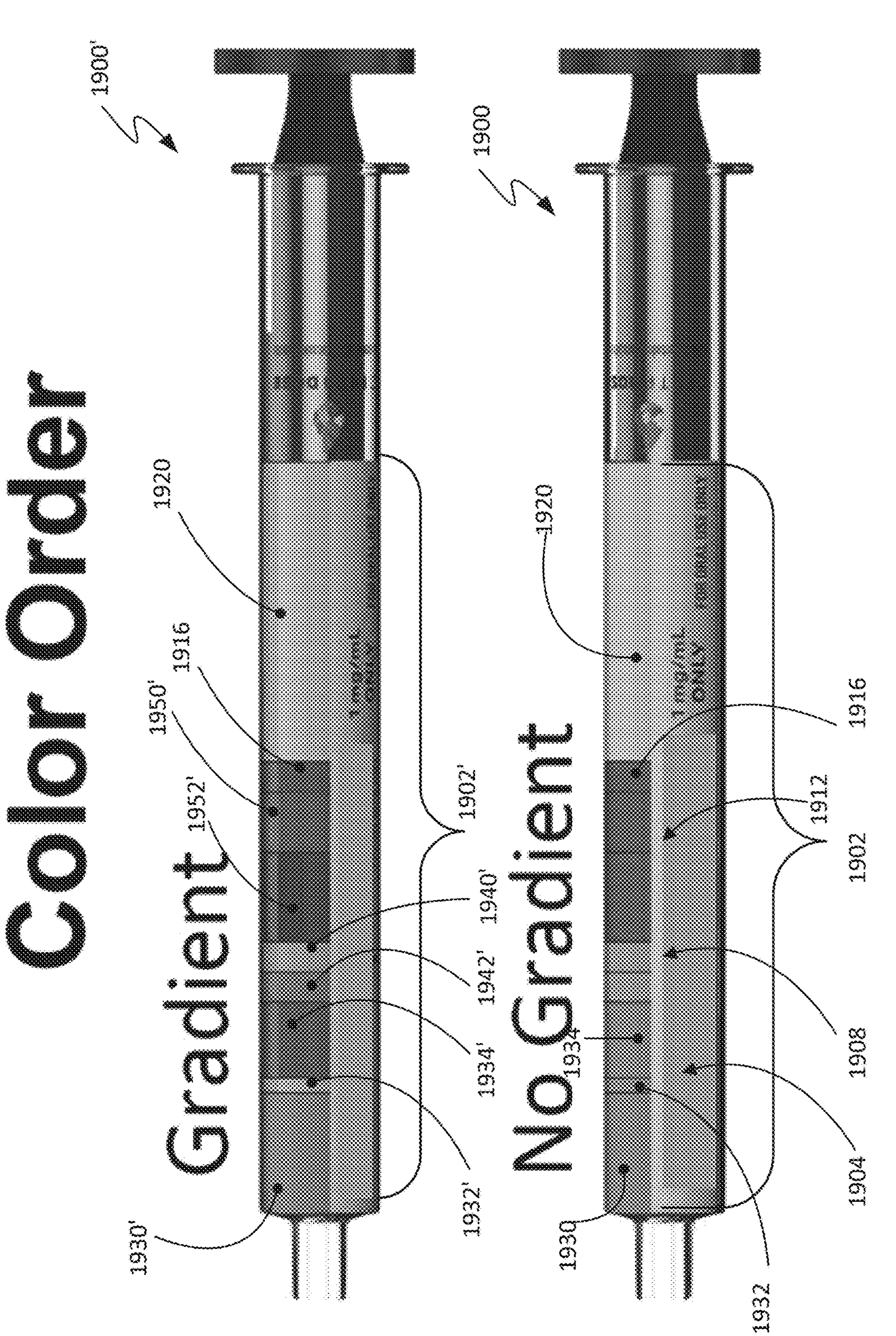
BID = Twice Daily

a. For subjects with a body weight outside of the range provided in this table, please contact the sponsor for dosing information.
b. Oral suspension 0.1% (1 mg/mL)
c. Equivalent to exposure of 10 mg once daily in adults

FIG. 18B

FIG. 19B

FIG. 19A



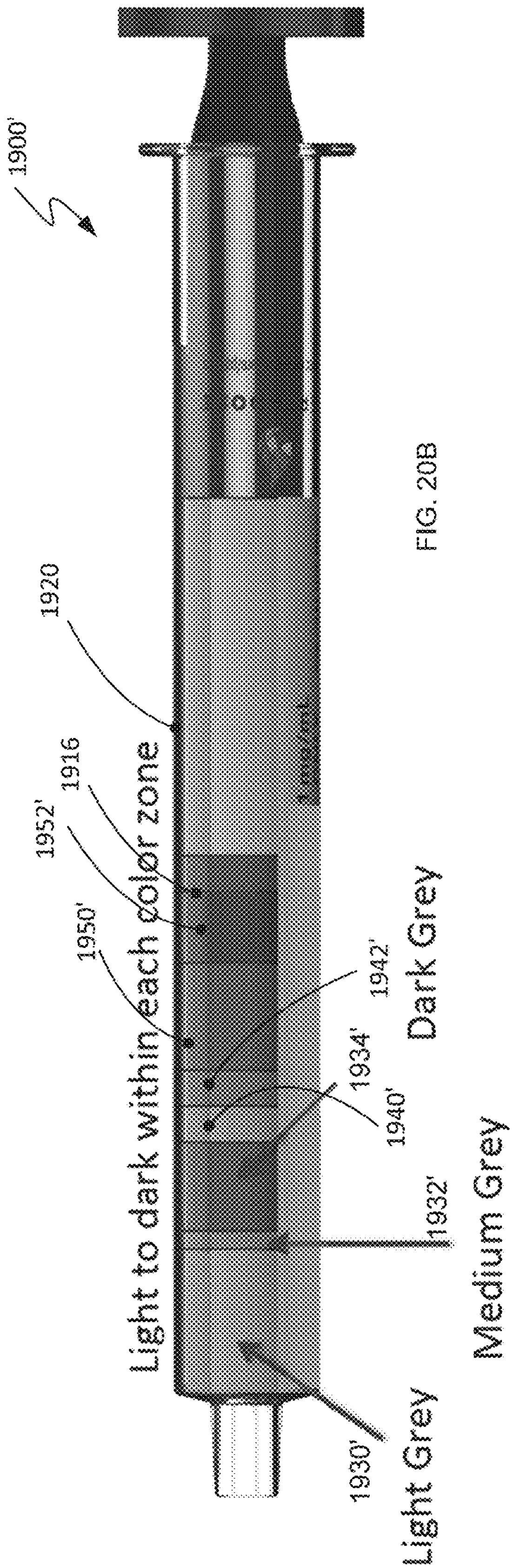


FIG. 20B

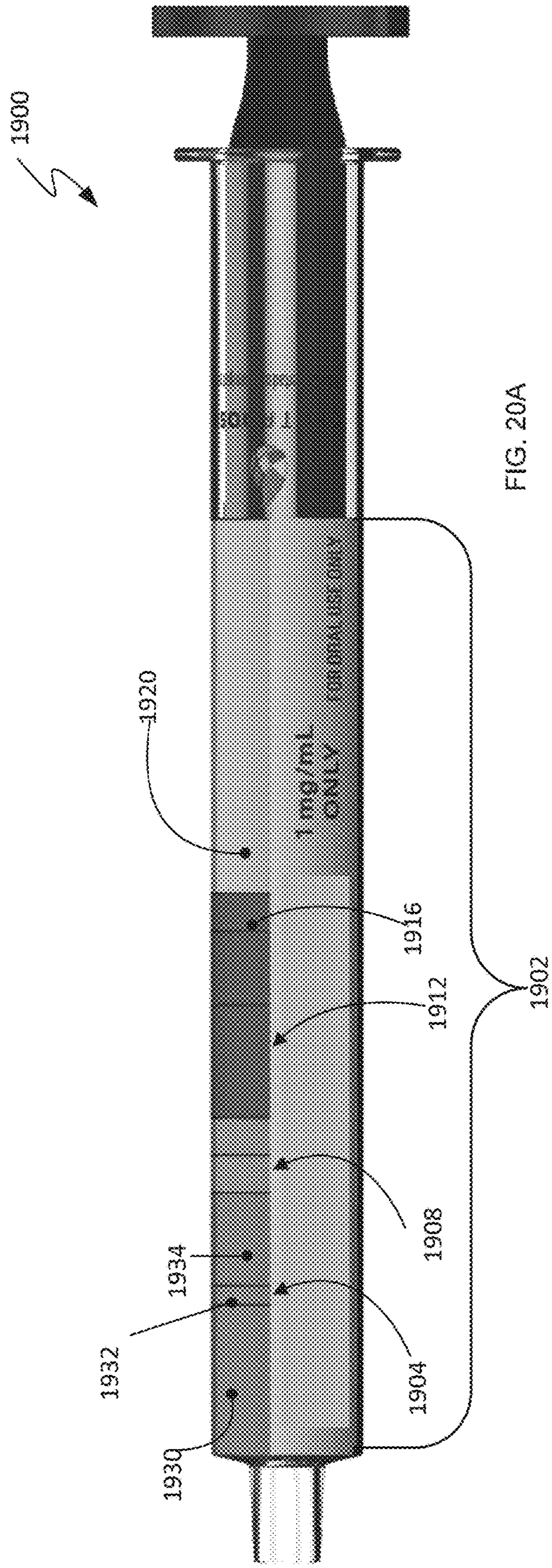


FIG. 20A

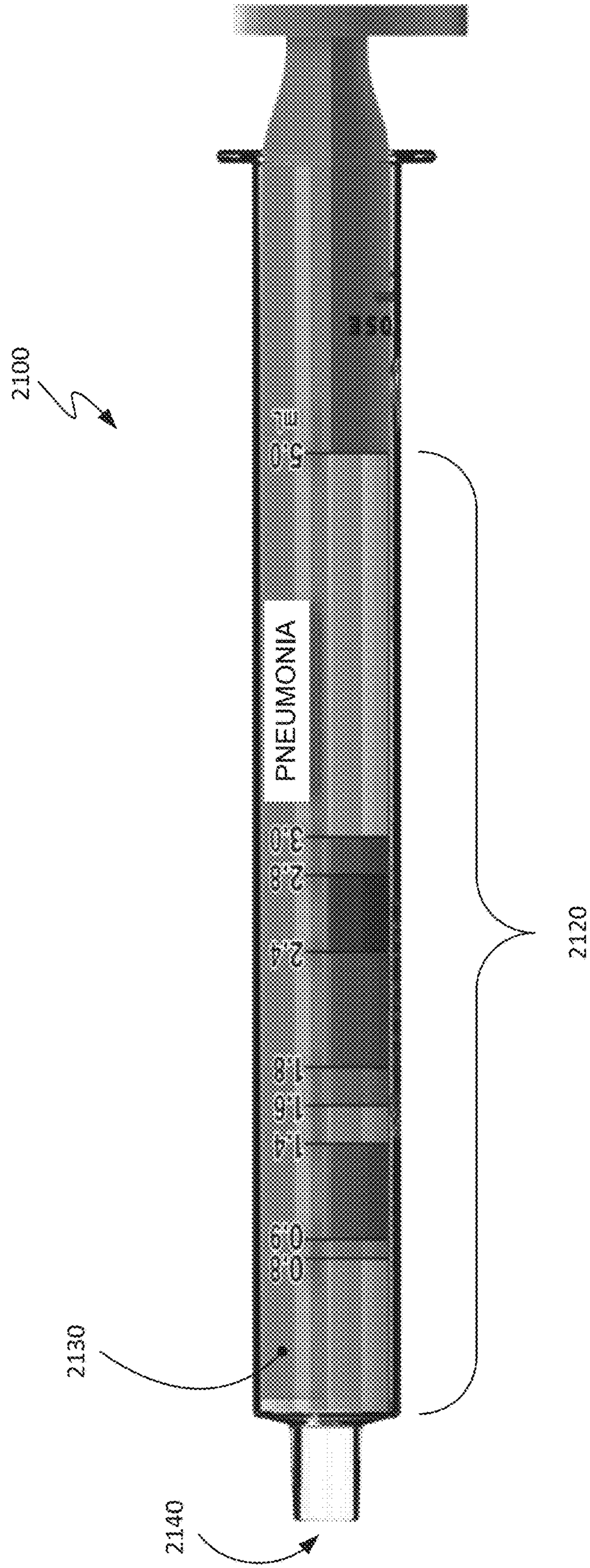


FIG. 21

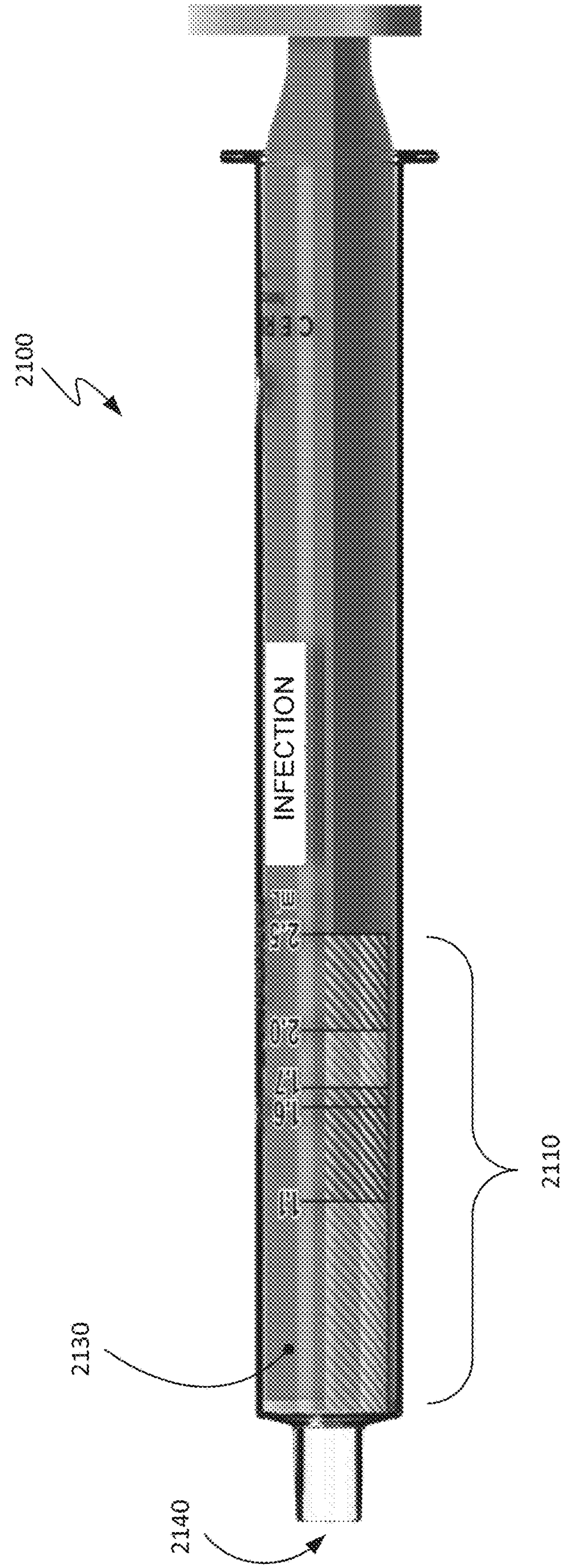


FIG. 22

DRUG X - DOSING FOR PNEUMONIA

Select Dose	BODY WEIGHT [kg] Min	BODY WEIGHT [kg] Max	DOSE [mg or mL]
☐	2.6	<3	0.9
☐	3	<4	1.1
☐	4	<5	1.9
☐	5	<7	2.2
☐	7	<8	2.5
☐	8	<9	3.1
☐	9	<10	3.6
☐	10	<12	10.0
☐	12	<20	15.0

FIG. 23A

DRUG X - DOSING FOR GENERAL INFECTION

Select Dose	BODY WEIGHT* [kg] Min	BODY WEIGHT* [kg] Max	DOSE [mg or mL]
☐	7	< 8	1.1
☐	8	< 10	1.4
☐	10	< 12	5.0
☐	12	< 20	7.5
☐	20	< 30	12.5

FIG. 23B

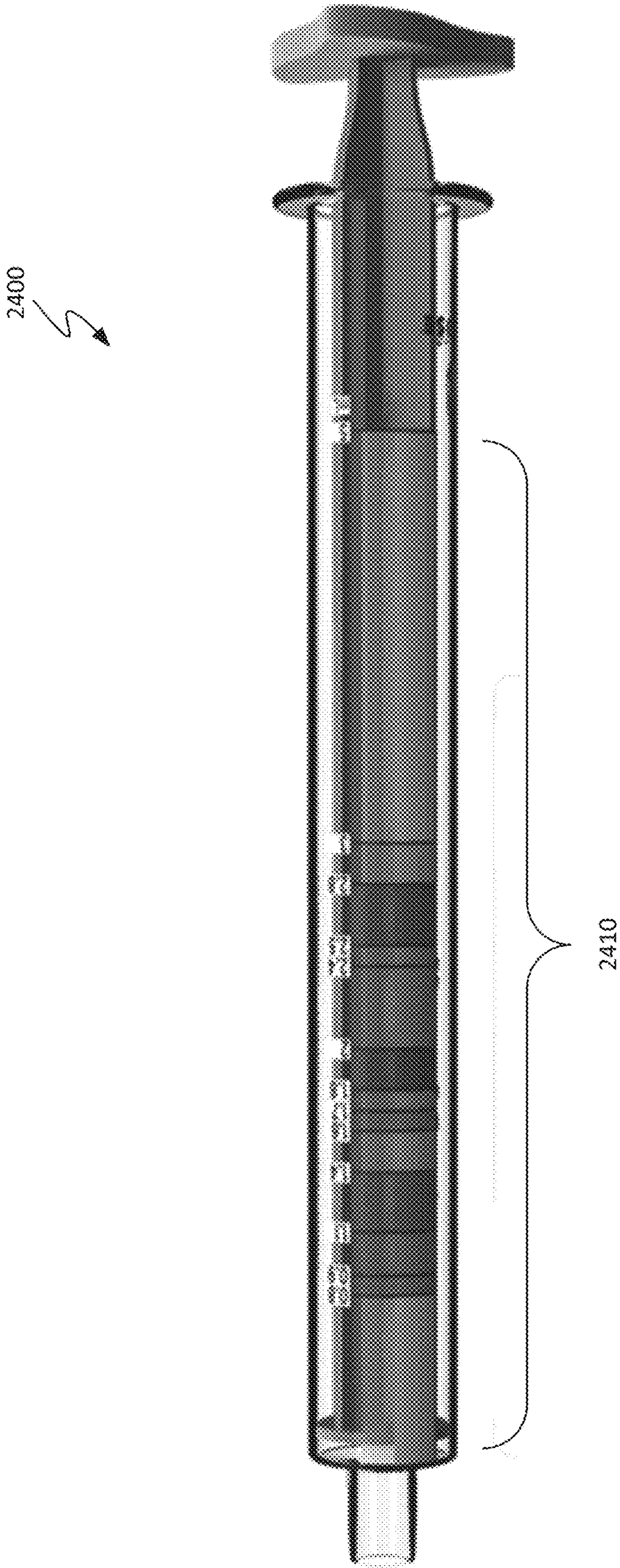


FIG. 24

DRUG 1 / CONDITION 1		
ZONE COLOR		DOSE (mg or mL)
Select Dose		
☐		1.1
☐		1.6
☐		1.7
☐		2
☐		2.5

FIG. 25A

DRUG 1 / CONDITION 2	
ZONE COLOR	DOSE (mg or mL)
	0.8
	0.9
	1.4
	1.6
	1.8
	2.4
	2.8
	3
	5

FIG. 25B

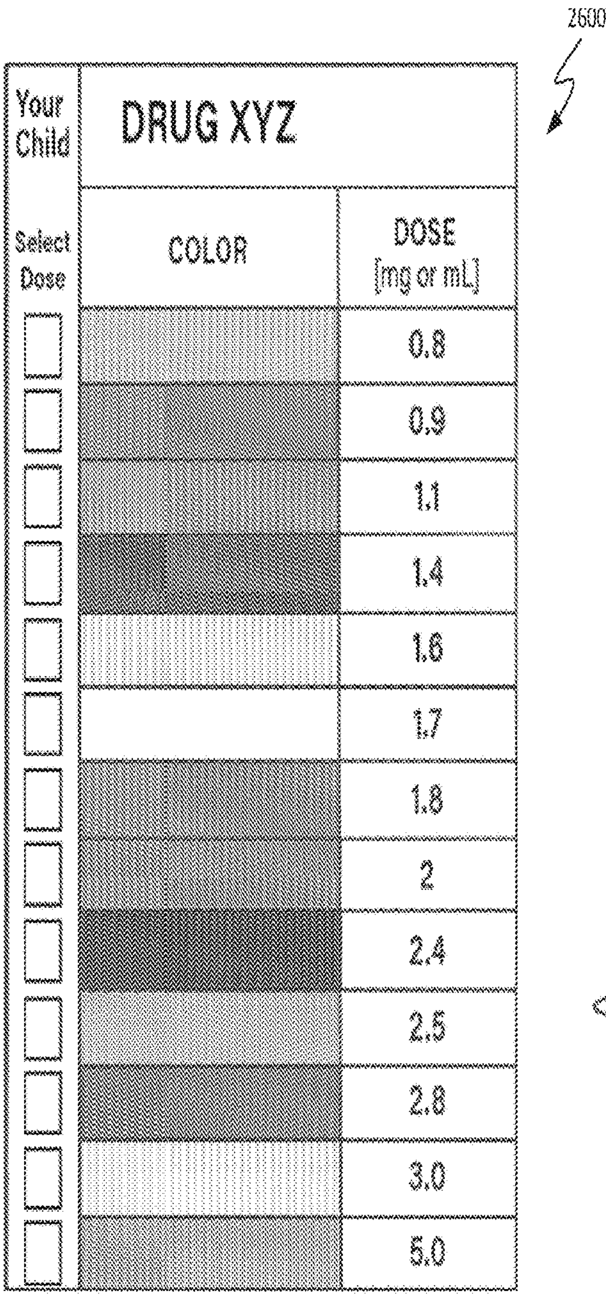


FIG. 26A

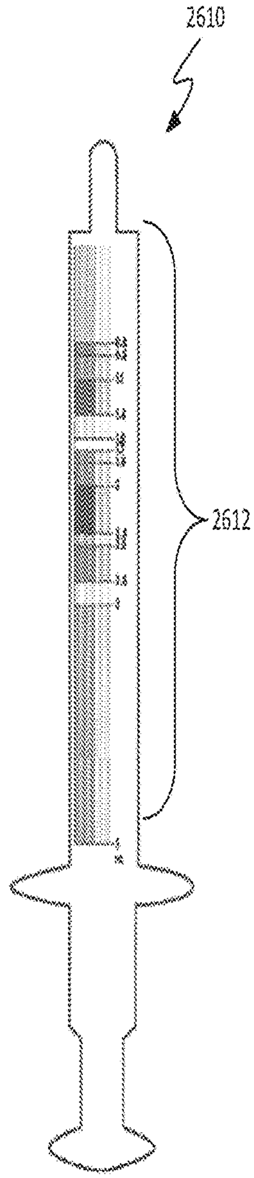


FIG. 26B

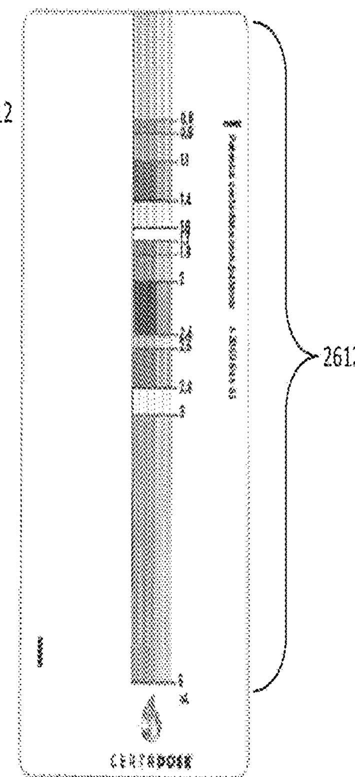


FIG. 26C

2700

Your Child	DRUG XYZ	
Select Dose	COLOR	DOSE [mg or mL]
☐	A	0.8
☐	B	0.9
☐	C	1.1
☐	D	1.4
☐	E	1.6
☐	F	1.7
☐	G	1.8
☐	H	2
☐	I	2.4
☐	J	2.5
☐	K	2.8
☐	L	3.0
☐	M	5.0

FIG. 27A

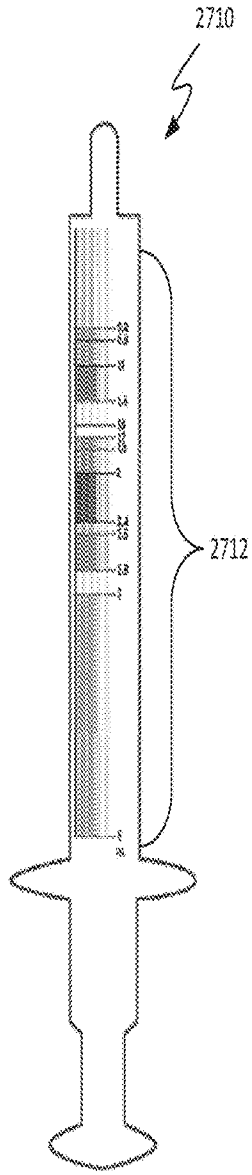


FIG. 27B

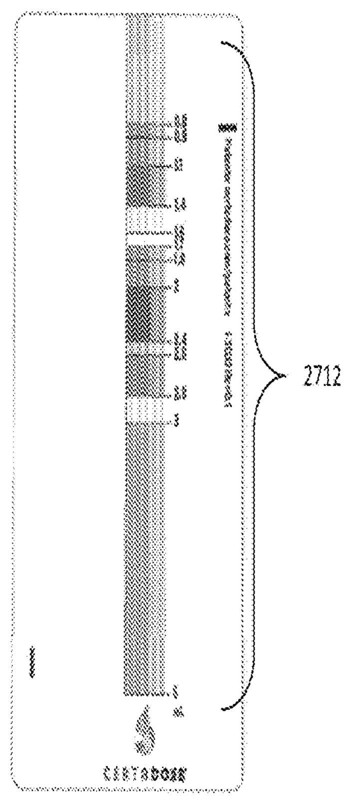


FIG. 27C

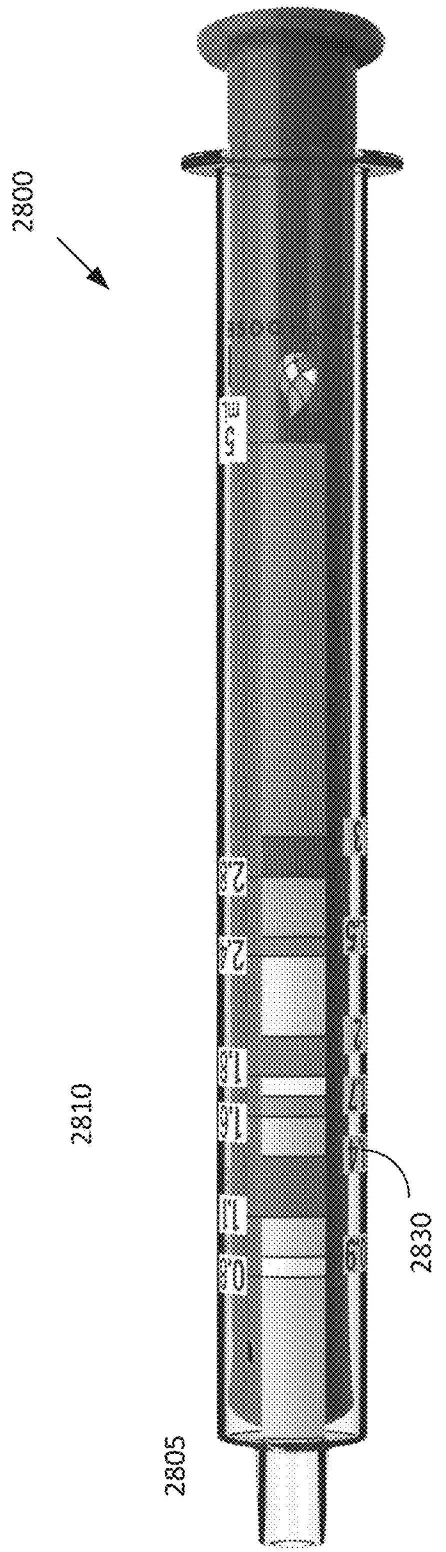


FIG. 28A

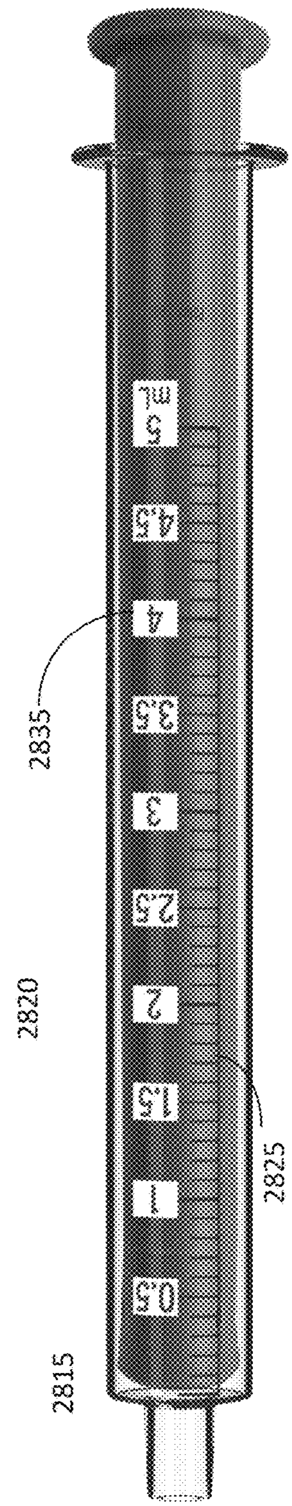


FIG. 28B

2900

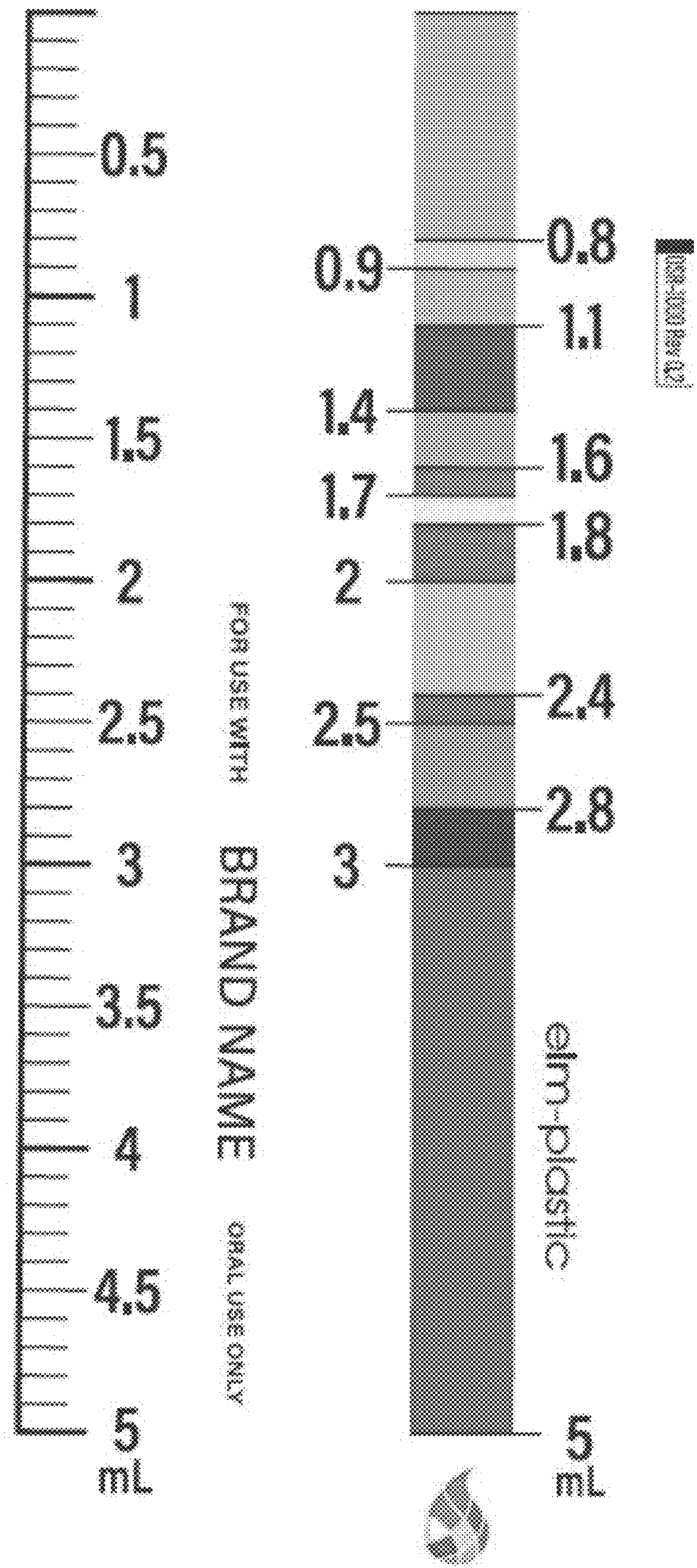

0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
mL
FOR USE WITH
BRAND NAME
ORAL USE ONLY
0.8
0.9
1.1
1.4
1.6
1.7
1.8
2
2.4
2.5
2.8
3
elm-plastic
5
mL

FIG. 29A

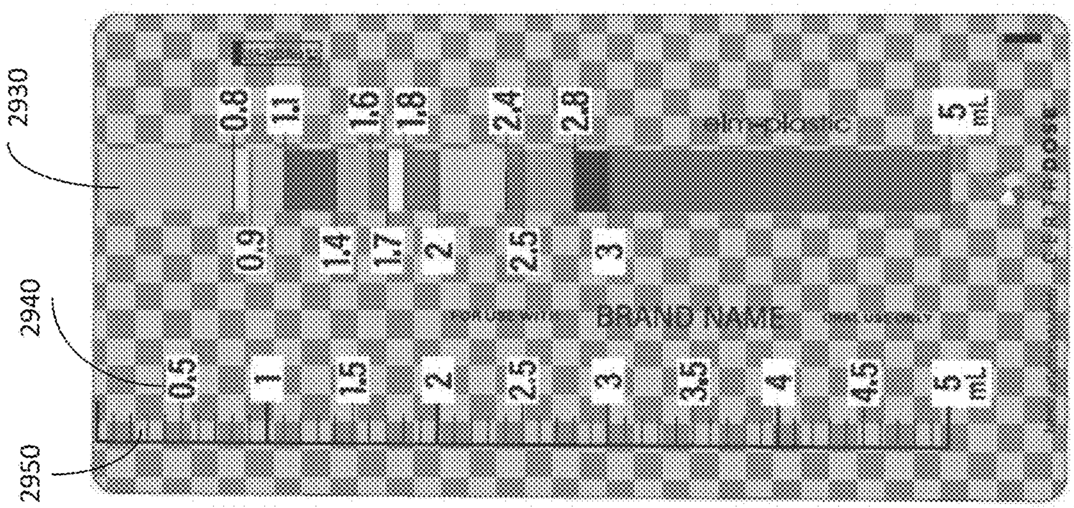


FIG. 29C

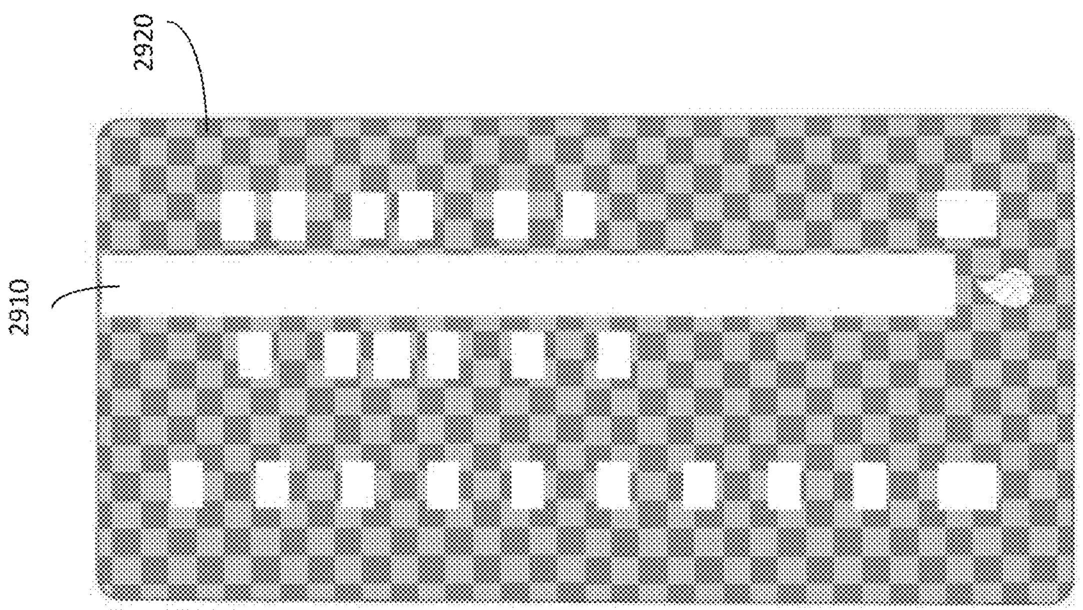


FIG. 29B

MULTIPLE CONDITION DOSING SYSTEM

PRIORITY

The present Application for Patent claims priority to Provisional Application No. 62/804,068, filed Feb. 11, 2019, entitled "MULTIPLE INDICATION DOSING SYSTEM" and assigned to the assignee hereof and hereby expressly incorporated by reference herein.

FIELD OF DISCLOSURE

The present disclosure relates to a medicine-dosing device, and more particularly to a pre-labeled medicine dosing device and method for administering appropriate doses of medicine.

BACKGROUND

Administering proper drug doses accurately and efficiently during an emergency or intensive care situation is of critical importance. This is particularly of essence in an emergency or critical care situations, and especially those that involve pediatric patients as even small dosing mistakes can lead to disastrous consequences. However, even under the best of circumstances and despite the best of efforts of medical personnel, inadvertent mistakes are sometimes made because of the multitude of steps involved in the drug administration process. More specifically, in a typical situation appropriate drug dosage must first be determined, which usually involves multi-step mathematical calculations. This is followed by plurality of steps involved in the actual drug administration process, which may include selection of a correct medicine to be administered or medical dosing device to be used. Because each step carries with it a potential for introducing an error into the overall drug administration process, reducing the number of steps that must be executed can significantly increase the overall accuracy and efficiency of the process.

Drug dosages conventionally are determined based on the weight of the patient. However this method can, at times, be inappropriate and inaccurate especially in the emergency and critical care situations. Thus, at times, patient length can be used, as it allows for a quick and efficient determination of drug dosages, involves the use of a color coded measuring tape for determining the length of a patient. More specifically, the Broselow® Pediatric Emergency Tape is a well-known instrument that correlates easily obtainable patient length to drug dosages. The details of the instrument and the method of its use are disclosed in the U.S. Pat. Nos. 4,716,888 and 6,132,416 to Broselow which are incorporated by reference into the present disclosure. In general, the method involves measuring and coding patient length to one of the color zones provided on the tape and using the color-coded length to determine a drug dosage to be administered to the patient. By segmenting the tape into plurality of color coded zones rather than the typically used inches or centimeters, with each color zone corresponding to a given length range, the length of the patient can be easily read and noted as being of a certain color rather than as a specific measurement in centimeters or inches. In other words, each color-coded length zone corresponds to a certain, predetermined range of the actual lengths as measured in either metric or imperial units. For example, the grey color zone on the tape may correspond to a length range from 42.20 cm to 60.79 cm and the pink color zone on the tape may correspond to the length range from 60.80 cm to 67.79 cm. Thus, a patient whose length falls within the first length range would be coded as gray and a patient whose length falls within the second length range would be coded as pink. The appropriate drug dosages for the two patients would then be selected from a list of predetermined drug dosages listed on the tape. Other commercially available length/weight-based tapes, such as the PediaTape and the Handtevy tape, are used in a similar fashion.

Although the step of determining drug dosages has been greatly simplified with the use of aforementioned method, a number of other issues still remain that often lead to dosing errors or that make the medication administration process inefficient. For instance, in order to arrive at a correct dose of medicine that is to be administered once the medication dosage is determined a number of other calculations, such as those involving, for example, concentration of the medication, still need to be performed. Furthermore, the selection of a correct medicine, an appropriate medicine dosing device or drawing of a correct predetermined volume of medication into the medicine dosing device can each introduce an error or slow down the process of administering medication to the patient. Even in situations when medication dosages are based on dosing systems other than the conventional weight based systems, such as for example patient age, body surface area or volume, dosing inaccuracies may be observed due to the type of calibrations used in such systems. In particular, a typically used constant incremental change in dosages may result in a loss in needed dosing accuracy when such systems are used.

Thus, despite the availability of various techniques designed to simplify the process of drug dosage determination and administration, there still exists a possibility of errors because of the pressure of time and the environment under which the treatment is delivered, as well as the type of dosing systems that are being used. Accordingly, there is need for a device and system for, and method of, accurately and efficiently delivering drugs during an emergency or critical situation, especially to pediatric patients.

SUMMARY

A medicine dispensing device for administering a selected drug is disclosed herein. The medicine dispensing device include a vessel configured to retain a drug to be dispensed by the medicine dispensing device. The medicine dispensing device may comprise a first series of zones of varying widths on a surface of the vessel, with each zone of the first series of zones corresponding to a pre-determined dose of the drug for a first medical condition wherein the first series of zones are correlated to a first series of values of a physical characteristic of a patient; and a second series of zones of varying widths on the surface of the vessel, with each zone of the second series of zones corresponding to a predetermined dose of the drug for a second medical condition wherein the second series of zones are correlated to a second series of values of the physical characteristic of a patient.

Another aspect of the disclosure provides a medicine dispensing system, comprising: a vessel configured to retain a drug to be dispensed by the medicine dispensing device; a series of zones of varying widths on a surface of the vessel, with each zone of the series of zones corresponding to a pre-determined dose of the drug; a first dosing table correlating a first set of zones within the series of zones of varying widths to pre-determined doses of the drug for a first medical condition; and a second dosing table correlating a second set

of zones within the series of zones of varying widths to pre-determined doses of the drug for a second medical condition.

Yet another aspect of the disclosure provides a medicine dispensing system comprising: a medicine dispensing device comprising a vessel configured to retain a drug to be dispensed, comprising at least one series of color-coded zones of varying widths on a surface of the vessel, with each of the color-coded zones corresponding to different drug volumes; and at least one dosing table correlating the at least one series of color-coded zones on the surface of the vessel to a corresponding set of color-coded zones, wherein the corresponding set of color-coded zones on the at least one dosing table represent the different drug volumes.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A-**1**D are perspective views of a medicine-dosing device according to one embodiment of the current disclosure.

FIGS. **2**A-**2**D are perspective views of a medicine-dosing device according to another embodiment of the current disclosure.

FIGS. **3**A-**3**D are plan views of the labels with the color-coded medication doses.

FIG. **4** is flow diagram showing a method of determining and printing the color-coded medication dose labels.

FIG. **5** is flow diagram showing a method of administering a medication using the disclosed pre-filled and marked medicine-dosing device.

FIG. **6** illustrates a measuring instrument used to determine a color-coded length of a patient.

FIG. **7** illustrates an exemplary emergency medical treatment kit for administering a medication according to one embodiment of the current disclosure.

FIGS. **8**A-**8**F includes data showing improvements in the drug delivery using the system and methods of the current disclosure.

FIGS. **9**A-**9**B illustrate alternative methods of administering a medication according to some embodiments.

FIGS. **10**A-**10**B illustrate exemplary labels with the color-coded medication doses according to several embodiments.

FIG. **11** depicts an embodiment of a dosing system including a pre-labeled medicine dosing/dispensing device designed to facilitate delivery of sequential doses of medication to a patient in a safe manner.

FIG. **12** illustrates a dosing system including a pre-labeled medicine dosing/dispensing device designed to facilitate delivery of sequential doses of medication to any one of multiple different-sized patients.

FIGS. **13**, **14**, **15**, **16**, **17**A, and **17**B depict a medicine dispensing device in the form of a syringe **1300** configured to deliver either or both of treatment dosages and prophylaxis dosages of a particular drug.

FIGS. **18**A and **18**B are exemplary tables identifying prophylaxis or treatment doses corresponding to a patient's color zone.

FIGS. **19**A, **19**B, **20**A, and **20**B depict a syringe having a series of multi-segment color-coded bands of varying widths.

FIGS. **21-22** depict a medicine dispensing device in the form of a syringe configured with dosing indications associated with different medical conditions.

FIGS. **23**A and **23**B are exemplary dosing tables for use with the syringe of FIGS. **21-22** which advantageously enable the syringe to deliver the same drug for different medical conditions having different dosing requirements.

FIG. **24** illustrates a syringe having a single color-coded dosing scale.

FIGS. **25**A and **25**B are different dosing tables for a particular drug for use in conjunction with the syringe of FIG. **24** in connection with dosing for different medical conditions.

FIGS. **26**A-**26**C is a first embodiment of a dosing system in which color is used to represent dosing volume for multiple scenarios of medical conditions.

FIGS. **27**A-**27**C is a second embodiment of a dosing system in which color is used to represent dosing volume for multiple scenarios or medical conditions.

FIGS. **28**A and **28**B show an embodiment of a medicine dispensing device according to the present disclosure.

FIGS. **29**A-C show views of a label that may be printed to manufacture a medicine dispensing device of the present disclosure.

DETAILED DESCRIPTION

The present application describes a device, system, and a method for administering proper medication doses to patients. The device and system are configured to address the five rights of medicine delivery; that is, giving the right patient the right drug in the right dose by the right route at the right time. In particular, a pre-marked medicine dosing/dispensing device designed to minimize medication dosing errors, as well as to improve the overall accuracy and efficiency of administering medication, especially in the emergency and critical care situations, is provided.

As discussed in detail below, in one embodiment the medicine dosing device **10** is a syringe **15** that includes an elongate barrel **30** marked with predetermined color-coded volumetric medicine doses **100** and a plunger **50**. The medicine-dosing device, according to one embodiment, may be further pre-filled with a fluid **105** that corresponds to a medication to be administered to a patient. A method for determining specific volumetric doses for a plurality of medications based on different factors is also disclosed. In particular, according to one embodiment the method involves generating labels or marking medical dosing devices with doses that are determined based on, for example, volumetric capacity of medical dosing device and/or drug concentration.

Also, a method for administering proper medication doses using the pre-marked medicine-dosing device is discussed. The method disclosed leads to a significant reduction in the amount of time required to determine and administer a dose of medication to a patient and at the same time decreases the risk that such doses will be miscalculated or otherwise erroneously administered.

DEVICE

For a detailed discussion of the first embodiment of the pre-labeled medicine dosing/dispensing device **10**, reference is now made to FIGS. **1**A-**1**D. As shown in FIG. **1**A, the medicine dosing device **10** according to one embodiment is a syringe **15** that includes a proximal end **25** and a distal end **20** opposite the proximal end. The syringe includes a vessel, such as a syringe barrel **30** at the distal end for holding therein a medicine that is to be dispensed, and a plunger **50** that extends proximally from an opening **36** located at the proximal end **35** of the syringe barrel to the proximal end **55** of the plunger at the proximal end **25**. The syringe barrel and plunger are both manufactured from material such as plastic, glass or any other suitable transparent medical grade material that is inert or will not disrupt the chemical balance of the fluid inside.

As illustrated in FIG. **1**B the syringe barrel **30** is elongate and substantially cylindrical and includes a distal end **31** and a proximal end **35**. The syringe barrel further includes and outer circumferential surface **37** and an inner circumferential surface **38**. A chamber **32** capable of receiving a plunger and retaining a fluid therein is defined by the inner circumferential surface **38** of the barrel between the distal and proximal ends **31** and **35**. A flange **33**, which can serve as a finger grip to provide for an easier handing of the syringe, is integrally formed with the proximal end of the barrel and defines an opening **36** for receiving the plunger. Proximate the opening **36**, along the inner surface of the barrel, is a ridge **34**, shown in FIG. **1**C, that prevents the plunger from slipping out of the barrel once it is engaged with the barrel.

The opening **36** is in communication with the chamber **32** and an orifice **39** located at the distal end **20** of the syringe barrel. A tip **40** for attaching a needle, nozzle or tubing for expelling the liquid contained within the syringe barrel **30** is integrally formed with the distal end **20** of the barrel and in communication with the orifice **39**. The tip may include coaxially positioned inner **41** and outer **42** members. According to one embodiment the tip may include a Luer taper fitting. In some embodiments, the tip may be configured based on the type of drug that the syringe is used to deliver. For example, oral tips may be used on syringes configured for medicines that are oral, and in particular, the oral tip may be different from an intravenous ("IV") or intermuscular ("IM") tip, thereby ensuring that the medicine is delivered by the right route. Similarly, syringes configured for IV and IM drugs may be configured with IV and IM tips, respectively, such that they, too, can only be delivered via the right route.

The plunger **50**, according to one embodiment shown in FIG. **1**B, includes a plunger rod **51** and a rubber or plastic gasket or stopper **52** attached to the distal end **56** of the plunger rod. The gasket forms a tight seal between the inner surface of the barrel and the plunger in order to prevent the contents of the syringe from escaping out the back of the syringe. An annular flange **53** is integrally formed with the proximal end **55** of the plunger rod. The plunger **50** has an elongate shape complementary to that of the chamber **30** and is designed such that it can be pushed along the chamber (inside of the cylindrical barrel or tube) allowing the syringe to expel fluid through the tip **40** or orifice **39** at the distal end of the barrel. Alternatively the plunger can include any other configuration capable of forcing the fluid from inside the chamber **30** through the tip **40** or orifice **39**.

According to one embodiment of the present disclosure, the medicine dosing device may be prefilled with a preselected drug. Initially, when the medicine dosing device is prefilled and the syringe is in the pre-medication administration position, the substantial length of the plunger rod extends longitudinally outside of the syringe barrel. In other words, as shown in FIG. **1**A, prior to the administration of the medicine, only the gasket **52** and the distal end **56** of the plunger rod are initially inside the syringe barrel, at the proximal end **35** of the barrel, with the remaining part of the plunger length outside of the barrel such that its proximal end **55** is in its most extended configuration.

Alternatively, the medicine dosing device may not be prefilled. The medicine dosing device may be marked, for example, with a drug name, concentration, volumetric markings, color coded zones, and/or the like. A medical professional may draw the drug (i.e., the drug with the name marked on the device) with the proper concentration into the medicine dosing device to reach the appropriate volumetric markings and/or color coded zones. In some embodiments, the medicine dosing device comes as a part of a kit that includes a medicine vessel containing the drug to be administered. The drug in the medicine vessel may be drawn into the medicine dosing device immediately prior to the drug administration process. In such embodiments, the plunger rod may remain inside the syringe barrel until the drug is drawn into the syringe.

According to another embodiment shown in FIGS. **2**A, syringe **15** may include an elongate barrel **70** and a plunger **80** marked with predetermined color-coded volumetric medicine doses **100** and/or prefilled with a fluid **105** that corresponds to a medication to be administered to a patient. In this configuration, as illustrated in FIG. **2**C the syringe barrel includes an inner tubular body **75** that is generally coaxially aligned with the larger diameter of the cylindrical barrel. The inner tubular body has a needle **76** coaxially positioned within the inner tubular body and longitudinally aligned with the inner tubular body. The plunger **80**, shown in FIG. **2**D, includes a substantially cylindrical member or vial **81** and a stopper **82**. Because the syringe barrel and the plunger are initially separated, as shown in FIG. **2**B, prior to the administration of the medication, the plunger **80** needs to be inserted into the proximal end **35** of the syringe barrel, such that the stopper **82** fully engages with the inner tubular body **75** and the needle **76**.

According to yet another embodiment of the current disclosure the plunger and/or plunger stopper can be color coded based on the medication contained in the barrel. Such color coding of the plunger can further increase efficiency with which medication is administered and can make the administration even less error prone as visual inspection of the plunger can provide a quick verification of the correctness of the medication to be administered. Alternatively or in addition to the color coded plunger and/or plunger stopper, the plunger and/or plunger stopper may be further marked with the name and/or concentration of the drug to further limit the possibility that a mistake is made.

Alternatively the medicine dosing device can include any vessel, such as for example tube, vial, bag or bottle, capable of containing therein and expelling therefrom a desired medicine. For example, the medicine dosing device could be a bag containing an IV fluid. According to this embodiment, the bag may be marked with a series of color coded zones along with the traditional volume markings When used in combination with the traditional volume markings, the color coded zones could serve as a reminder to the medical personnel of a correct volume of each medication that can be given to a patient based on the patient's color zone. The color coded zones may also be used as a key for entering a correct total volume to be dispensed into the IV pump for a given medication.

The description will now turn to the markings on the surface of the medicine dosing device. In case of a syringe, the markings may be placed along a circumferential surface of the syringe barrel or plunger. As shown in FIGS. **1** through **3**, the markings include a series of substantially translucent bands or zones **100** indicative of the possible medicine doses to be administered to a patient. Although the markings shown in the figures include a series of color coded zones, the markings could also include zones with different patterns, textures, etc. Regardless of the type of the marking used, the markings are either directly imprinted, painted, etched or stained on an inside or outside surface of the medicine dosing device or a label or sleeve may be generated that can be affixed or placed over the outer surface of the medicine dosing device. The applied markings are such that the fluid level, once the device is filled, can be easily seen through the markings.

FIG. **3**A shows a plurality of labels in accordance with one embodiment of the current disclosure. Each label **300** is substantially rectangular in shape and is sized based on the volumetric capacity of the medical dosing device to which the label is to be affixed. In other words, because of the volumetric variations among the medicine dosing devices and as a result of variations in the circumferential outer surface of such devices, the size or dimensions of the label is adjusted accordingly to ensure that it properly covers the outer surface of the of the medical dosing device. For example, when labels are made for syringes with two different volumetric barrel capacities, the label size is either increased or decreased in both length and width to accommodate for the changes in the outer surface of the barrel.

Along with the changes in the label size, appropriate corresponding changes to the widths of the color bands or zones that are printed on the label are also made based on medicine dosing device used to dispense the medication. More specifically, in order to take into account the variations in the volume of a medicine-dispensing device, the changes to the widths of the color bands or zones need to be made in order to maintain the same volumetric dose of medicine across various medicine dispensing devices. For example, as shown in FIG. **3**B, labels for the same medicine loaded into a 10 cc medicine dispensing device and 5 cc dispensing device have two different widths for each color band or zone in order to keep the medicine doses the same for both medicine dosing devices. In other words, in order to dispense the same amount of medication using a 10 cc dispensing device as compared to using a 5 cc dispensing device, the width of the color bands **351**A-**359**A on the label **310** for the 10 cc device would be smaller than the color bands **351**B-**359**B on the label **305** for the 5 cc dispensing device in order to deliver the same amount of medication to the patient.

Similarly, the concentration of the medication that is used also affects the widths of the color bands or zones printed on the label. More specifically, the widths of the color bands or zones are determined based on the concentration of the medication, with the medication at a higher concentration corresponding to a smaller volumetric dose, or smaller band width, than the medication at a lower concentration.

As depicted in FIG. **3**C the label **300** has opposing parallel sides **315** and **320** and opposing parallel ends **325** and **330** and includes a series of consecutive color bands or zones **351** through **359** of varying widths that correspond to the medication doses for patients with a particular characteristic. The characteristic may correspond to patient length (as discussed above), patient weight, patient age, patient surface area/volume, and/or the like. More specifically, each color band has a width that is defined by leading **335** and trailing **340** edges that are parallel to the opposing ends **325** and **330** of the label and which, once the label is affixed to the medicine dispensing device, corresponds in volume to a predetermined dose of medicine appropriate for the patient characteristic of a patient that falls within a predefined color-coded range. In other words, each color band or zone on the label represents a medication dose correlated to respective color-coded length range, weight range, age range, surface area/volume range, or other physiological characteristic.

Still referring to FIG. **3**C, according to one embodiment, nine distinct color bands **351**-**359** can be used to distinguish between nine different doses of medication corresponding to nine distinct color coded patient characteristic ranges. More specifically, each of the colors corresponds to one of nine different doses of a specific medication. As shown in the FIG. **3**C, in one particular implementation, band colors may include grey **351**, pink **352**, red **353**, purple **354**, yellow **355**, white **356**, blue **357**, orange **358** and green **359**, with the grey color band corresponding to the smallest dose of the medication and the green color band corresponding to the largest dose of medication that can be delivered. A solid black line(s) **365** may be utilized at the boundaries between the various color bands or zones to facilitate the process of drug administration as will be discussed in more detail below. Although the discussion will be made with reference to the specific colors shown in the FIGS. **3**A-**3**C, it can be readily appreciated that other colors or markings may be used. Alternatively or additionally, color names may be printed within the band or zone widths in addition to or instead of colors.

According to yet another embodiment shown in FIG. **3**D, a label may include ten different bands of colors with the tenth band **360** corresponding to the largest dose of medication that can be delivered. In this particular embodiment the largest dose can correspond to the universal dose that can be delivered to any patient whose characteristic (e.g., length, weight, etc.) falls outside of the previously disclosed colored ranges. For example, the universal label in accordance with this embodiment can be applied to the universal medicine-dosing device that can be used for both pediatric and adult patients and as such eliminates a need for having two separate medicine dosing systems for the two distinct patient groups.

Although, in the examples provided above a specific number of color bands have been discussed, it should be noted that any number of color bands that allow for more precise medicine dosing can be used. In some cases, the previously defined bands or zones can be further subdivided into sub-band or sub-zone to allow for a more precise medicine dosing. As a non-limiting example, in some embodiments, there may be thirty-six markings (sub-zones) within nine color zones. This may increase precision when administering a drug to a patient.

Also, in accordance with another embodiment of the current disclosure, and as shown in FIG. **3**C one of the label edges can include a mark **370** that would help ensure that the label is correctly affixed or positioned on the syringe or plunger. For example, the label edge that is to be aligned with the distal end of the syringe barrel can be marked in order to prevent affixing the label to the barrel in the reverse direction, and thus leading to the incorrect doses being administered at a later time. For example, the edge of the label with the color band corresponding to the smallest dose can include a mark at its leading edge that facilitates the alignment of the label with a distal end of the syringe barrel.

Furthermore, in accordance with another embodiment as shown in FIG. **3**A, the label may include the name of the medication that is to be administered or any other information that maybe important to ensuring that a correct medication would be administered to the patient. In particular, the name of the medication can be imprinted along the length of the label or any other position as long as it provides for an easy verification of the correctness of the medicine in the medicine-dosing device. Additionally, for drugs that are administered at time intervals, the label may be marked with the corresponding time interval, or a separate calendar, either paper or electronic, may be provided such that the patient and/or medical professionals can keep track of dosing intervals.

METHOD OF DETERMINING AND GENERATING DOSING INFORMATION

The discussion will now turn to a method **400** for determining the medicine doses for a plurality of medications and medicine dispensing devices. In one particular example, shown in FIG. **4**, the method may include generating of a color-coded dose label that can be applied to a selected medical dosing device. As shown in FIG. **4**, the method **400** begins at step **401** during which the selection of the medicine for which the dosing label is to be generated is made. As related to emergency or critical care situation some of the most commonly used medications include, for example, atropine, lidocaine, fentanyl, epinephrine, etomidate, ketamine, succinylcholine, rocuronium, and midazolam to name a few. However, it should be appreciated that the method can be equally applied to any other medication that can be administered using the disclosed medicine dispensing device.

Once the medication for which a label is to be generated is identified, the doses of the drug for each of the color coded characteristic (e.g., length, weight, etc.) zones previously discussed is determined at step **402**. Depending on the drug, the width of the color coded zones may differ. Table 1 below provides doses in mg for some of the above listed drugs. As can be seen in Table 1, the doses for each drug differ not only based on the type of the drug but also based on the length (i.e., characteristic) of the patient. Thus, for example, as shown in Table 1, a dose for a patient falling within the yellow color-coded length zone is 26 mg for succinylcholine and 13 mg for rocuronium. In case the same drug is to be administered to two different patients whose length falls within different color coded lengths, two different medication doses would be used as shown. For example, in the case of epinephrine, with one of the patient lengths being coded as red and the other as blue, the dose of medication to be administered to each patient would be 0.085 mg and 0.21 mg, respectively. Alternatively, doses of the drug may be determined based on dosing recommendations other than those based on the length of the patient, such as, for example, the patient's weight, age, surface area/volume, and/or the like.

After the dose to be administered to the patient is determined at step **402**, the drug concentration for the drug selected in step **401** is then determined at step **403**. The concentration of the drug is directly related to the volume that needs to be administered. In other words, a smaller volume of the same medication needs to be administered for a solution with a higher concentration than for a solution with a lower concentration.

The next step, step **404**, involves selection of a medicine dispensing device to which the label is to be applied. As described above, because medicine dispensing devices come in various volumetric sizes, a medicine dispensing devices conversion factor that is based on the length and width of the medicine dosing device and/or the concentration of the medication may be used to take into account the variations in size and/or shape of different medicine dispensing devices for which the label is to be generated. Thus, once the medicine dispensing device of a particular volume is selected for administering the selected medication, a corresponding conversion factor listed in Table 1 can be used in order to calculate both the individual color band/zone widths and a total band widths that correspond to the determined medication doses (step **405**). More specifically, the width of each color band/zone that corresponds to the determined medication dose is calculated based on the dose of the drug to be administered, the solution concentration and medicine dispensing device volumetric capacity. According to one embodiment all of the calculations may be performed by a computer processing unit (CPU) in response to a user provided input.

Applying of the label to the medicine dosing device may take place once the width of each color band or zone is determined and the label is printed. For instance, when the label is to be applied to a syringe having a barrel and a plunger, with the barrel designed for holding the medicine that is to be dispensed, the label may be place along the outer circumferential surface of the barrel by aligning one of the edges of the label that corresponds to a color band of the smallest dosing with the distal edge of the syringe barrel of the medicine dispensing device **10**. Alternatively, in a syringe in which a plunger serves as a vessel for holding the medicine, the label may be placed along the outer circumferential surface of the plunger by aligning one of the edges of the label that corresponds to a color band of the smallest dosing with the proximal end of the medicine dosing device.

Although the pre-calculated band/zone widths for each of the selected medication, medicine dispensing device volumetric capacity and solution concentration may be printed on a label that can be applied to the medicine dispensing device, the dosing information may also be directly imprinted, etched, stained or painted on the medicine dispensing device. Alternatively, the dosing information can be printed on a sleeve that can be placed over the medicine dispensing device.

Depending on the embodiment, the appropriately labeled medicine-dosing device may be prefilled with a desired medication, with the fluid volume corresponding to the maximum dose that can be administered to the patient whose, for example, length falls within the maximum length zone. When the medicine dosing unit is prefilled with the selected medication the label can be applied either before or after the medicine dosing device is filled. In case the medicine dosing device is filled with a selected medication immediately prior to the medication administration process, as might be the case when the medicine dosing device is included as a part of a kit that includes the medical dosing device and a vessel filled with a drug to be administered, an empty pre-labeled medicine dosing device is supplied for use. Accordingly, a fluid volume that corresponds to a predetermined dose for a given patient may be drawn into the pre-labeled medicine dosing device from the container immediately prior to drug administration.

TABLE 1

Drug	Color-Coded Length	Dose (mg)	Concentration (mg/ml)	Medicine Dosing Device (cc)	Conversion Factor (mm/cc)	Color band or zone width (mm)	Total Distance (mm)
Epinephrine	Gray	0.04	0.1	3	16	6.4	6.4
	Pink	0.065	0.1	3	16	4	10.4
	Red	0.085	0.1	3	16	3.2	13.6
	Purple	0.1	0.1	3	16	2.4	16
	Yellow	0.13	0.1	3	16	4.8	20.8

TABLE 1-continued

Drug	Color-Coded Length	Dose (mg)	Concentration (mg/ml)	Medicine Dosing Device (cc)	Conversion Factor (mm/cc)	Color band or zone width (mm)	Total Distance (mm)
	White	0.17	0.1	3	16	6.4	27.2
	Blue	0.21	0.1	3	16	6.4	33.6
	Orange	0.27	0.1	3	16	9.6	43.2
	Green	0.33	0.1	3	16	9.6	52.8
Fentanyl	Gray	12	50	3	16	3.84	3.84
	Pink	20	50	3	16	2.56	6.4
	Red	25	50	3	16	1.6	8
	Purple	32	50	3	16	2.24	10.24
	Yellow	40	50	3	16	2.56	12.8
	White	50	50	3	16	3.2	16
	Blue	63	50	3	16	4.16	20.16
	Orange	80	50	3	16	5.44	25.6
	Green	100	50	3	16	6.4	32
Midazolam-RSI	Gray	1.2	1	12	5.16	6.192	6.129
	Pink	2	1	12	5.16	4.128	10.32
	Red	2.5	1	12	5.16	2.58	12.9
	Purple	3.2	1	12	5.16	3.612	16.512
	Yellow	4	1	12	5.16	4.128	20.64
	White	5	1	12	5.16	5.16	25.8
	Blue	6.3	1	12	5.16	6.708	32.508
	Orange	8	1	12	5.16	8.772	41.28
	Green	10	1	12	5.16	10.32	51.6
Ketamine	Gray	6.75	10	6	8	5.4	5.4
	Pink	13	10	6	8	5	10.4
	Red	17	10	6	8	3.2	13.6
	Purple	20	10	6	8	2.4	16
	Yellow	26	10	6	8	4.8	20.8
	White	33	10	6	8	5.6	26.4
	Blue	42	10	6	8	7.2	33.6
	Orange	50	10	6	8	6.4	40
	Green	66	10	6	8	12.8	52.8
Etomidate	Gray	0.9	2	5	9	4.05	4.05
	Pink	2	2	5	9	4.95	9
	Red	2.5	2	5	9	2.25	11.25
	Purple	3.2	2	5	9	3.15	14.4
	Yellow	4	2	5	9	3.6	18
	White	5	2	5	9	4.5	22.5
	Blue	6.3	2	5	9	5.85	28.35
	Orange	8	2	5	9	7.65	36
	Green	10	2	5	9	9	45
Atropine	Gray	0.1	0.1	5	9	9	9
	Pink	0.13	0.1	5	9	2.7	11.7
	Red	0.17	0.1	5	9	3.6	15.3
	Purple	021	0.1	5	9	3.6	18.9
	Yellow	0.26	0.1	5	9	4.5	23.4
	White	0.33	0.1	5	9	6.3	29.7
	Blue	0.42	0.1	5	9	8.1	37.8
	Orange	0.5	0.1	5	9	7.2	45
	Green	0.5	0.1	5	9	0	45
Succinylcholine	Gray	8	20	3	16	6.4	6.4
	Pink	13	20	3	16	4	10.4
	Red	17	20	3	16	3.2	13.6
	Purple	20	20	3	16	2.4	16
	Yellow	26	20	3	16	4.8	20.8
	White	30	20	3	16	3.2	24
	Blue	40	20	3	16	8	32
	Orange	53	20	3	16	10.4	42.4
	Green	66	20	3	16	10.4	52.8
Rocuronium	Gray	4	10	3	16	6.4	6.4
	Pink	7	10	3	16	4.8	11.2
	Red	9	10	3	16	3.2	14.4
	Purple	10	10	3	16	1.6	16
	Yellow	13	10	3	16	4.8	20.8
	White	16	10	3	16	4.8	25.6
	Blue	21	10	3	16	8	33.6
	Orange	27	10	3	16	9.6	43.2
	Green	33	10	3	16	9.6	52.8
Lidocaine-RSI	Gray	6	20	3	16	4.8	4.8
	Pink	10	20	3	16	3.2	8
	Red	13	20	3	16	2.4	10.4
	Purple	15	20	3	16	1.6	12
	Yellow	20	20	3	16	4	16
	White	25	20	3	16	4	20

TABLE 1-continued

Drug	Color-Coded Length	Dose (mg)	Concentration (mg/ml)	Medicine Dosing Device (cc)	Conversion Factor (mm/cc)	Color band or zone width (mm)	Total Distance (mm)
	Blue	32	20	3	16	5.6	25.6
	Orange	40	20	3	16	6.4	32
	Green	50	20	3	16	8	40

METHOD OF ADMINISTERING DRUGS

The medicine dosing device assembled according to the steps discussed above may be used to safely and efficiently deliver drugs. FIG. **5** is a flow diagram **500** of a method for administering drugs to a patient using the disclosed medicine dosing device **10** according to one embodiment. In this particular example, the disclosed method provides steps for efficiently administering a selected medicine to a patient from a prefilled and pre-marked medicine dosing device. As shown in the figure, the method begins at step **501** at which a color-coded length or any other physical characteristic of the patient is determined. In case of the length, a Broselow tape or any other similar type of instrument that provides color-coded length ranges can be used at this step. As shown in FIG. **6**, the color coded length may be obtained by placing a patient **600** along the tape **601** and noting the color-coded length of the patient on the tape. Alternatively, any other physiological characteristic, such as for example, weight, age, body surface area or volume, that can be color coded and correlated to medication doses can be used.

Once the patient length or any other physiological characteristic is determined and/or coded to a specific color range, a prefilled medicine dispensing device **10** containing medication to be administered is selected at step **502**. The medication selection is verified by either reading the name of the medication imprinted along the outer surface of the pre-filled medicine dispensing device or by verifying the color of the plunger rod as discussed above.

After the color code for the patient length or other characteristic is determined and noted and the correctness of the medicine to be administered is verified, the appropriate dose of medication to be dispensed or its corresponding volume is determined at step **503**. The appropriate dose may be determined by a physician or other medical professional who calculates the appropriate dose based on at least one patient characteristic. The calculated dose may be a precise amount of a drug to be administered. Additionally, the physician or other medical professional who administers the medication may determine a color code for the patient based on at least one patient characteristic. For example, if the patient length or other characteristic is determined as falling within the blue color range on the measuring tape, the volume of medication to be administered to the patient will be the volume within the blue color band or zone on the medicine dosing device.

Because (in this embodiment) the medicine dispensing unit is prefilled with medication, the appropriate dose of medicine can be obtained by purging any excess of medication from the prefilled syringe until the calculated volume (dose) of the medication is reached as indicated in step **504**. In other words, with the prefilled volume of the medicine dispensing device may correspond to the maximum dose that can be administered to a patient. Therefore, unless the calculated dose is the maximum possible dose, some of the medication has to be purged from the prefilled medicine-dosing device prior to administering of the drug.

Thus, according to one embodiment the plunger is pushed along the inside of the barrel toward the distal end **31** of the barrel until the proximal end of the plunger **54** arrives at the calculated dose. Once the administering medical professional has purged the excess medicine such that the calculated dose is the only medication that remains in the medicine dosing device, the administering medical professional verifies that the calculated dose, and the amount of medication that remains in the medicine dosing device, is within the color coded range determined for the patient. For example, in case of the above mentioned patient whose length or other characteristic was coded as being blue, with the blue band having a leading edge proximate the distal end of the barrel and the trailing edge proximate the proximal end of the barrel, the plunger is pushed toward the distal end of the barrel until the distal end of the plunger is aligned with the calculated dose, and then the administering medical professional ensures that the plunger is between the leading edge and trailing edge of the blue band. Once all the excess fluid is purged from the prefilled dosing device per step **504**, the correctness of the medicine dose is verified at step **505** and the medicine is then administered to the patient at step **506**.

Alternatively, according to another embodiment, the medicine-dosing device can be used to administer drugs to patients following another method. In particular, the method for administering drugs can begin with the selection of an emergency medical treatment kit that includes a drug to be administered to the patient. As shown in FIG. **7**, the medical treatment kit may include a container, such as box, bag, pouch or any other suitable container capable of holding the medicine dosing device therein, labeled on the outside surface with the name of the medication contained in the container among other things. For example, according to one embodiment, in addition to having the name of the drug listed on the label, the label may also include information on the concentration of the drug and/or instruction on how to use the kit to administer the drug. The medical treatment kit may further include a pre-marked medicine dosing device, such as for example a syringe, with the color-coded zones calibrated to the different drug doses for the selected drug. The syringe markings may also include the name of the drug that is to be delivered or any other information that may be helpful in ensuring that the drug is correctly delivered to the patient. The medical treatment kit may also include a needle, such as a blunt filling needle that can be plastic or made of any other suitable material, for facilitating drawing of the drug into the syringe. The medical treatment kit may also contain a container, such a bottle, vial, etc., for holding the drug that is labeled with the drug name on the outside of the container. The container may include a stopper or a lid that helps to contain the drug inside the container. The stopper or lid may be made from, for example, rubber or any other suitable material that can be easily punctured with the filling needle, such that the drug from the container can be easily drawn into the medicine-dosing device.

If more than one drug is included in the kit, the corresponding vials and syringes for each drug may be positioned within the packaging to ensure that there is no confusion as to which vial corresponds to which syringe. Additionally, differently colored plungers will help to ensure that the correct medication is given to the patient in the correct order. For example, in a situation where two drugs are being administered in a specified order, the kit may include a first drug in a first vial with a first syringe marked with the color zones for the first drug, and a second drug in a second vial with a second syringe marked with the color zones for the second drug. To ensure that the first vial and first syringe do not get confused with the second vial and second syringe, the plungers in the syringes may be colored. The color of the label and/or lid of the first vial may be marked with the same color as the plunger of the first syringe, and the color of the label and/or lid of the second vial may be marked with the same color as the plunger of the second syringe. This way, when the drug is being administered, the administrating medical professional can easily to make sure that the correct vial/drug-syringe combination is being used.

Alternatively or additionally, when the drugs need to be delivered in a particular order, the ends of the plungers may be marked numerically to indicate the order in which the drugs are to be delivered. For example, if the first drug to be administered has a green plunger and the second drug to be administered has a yellow plunger, the end of the green plunger may have a number "1" on the end and the end of the yellow plunger may have a number "2" on the end. The vials may also be marked numerically.

In case drug doses are based on patient's length, the color-coded length of the patient may be determined using an instrument such as a Broselow tape or any other similar type of device that provides color-coded length ranges as discussed above with reference to FIG. **6**. Alternatively, other patient characteristics may be used to determine a color coded range. Appropriate volume of the drug to be administered may be subsequently determined based on the patient length, and the patient length may be correlated to a color code. The determined drug volume may be then drawn into the medicine-dosing device, and the administering medical professional verifies that the determined drug volume is within the color code corresponding to the patient. Once the dose is verified, the drug can then be administered to the patient. According to one embodiment as shown in FIG. **7**, when the medicine-dosing device is a syringe with a pre-attached filling needle, the filling needle might be disposed of prior to the administration of the medication.

As shown in FIGS. **8**A and **8**B, eliminating the step of calculating doses that need to be administered in the high stress environment, as well as eliminating the steps of selecting appropriate medicine dosing device helps to eliminate critical dosing errors, such as critical over dose or critical under dose errors, that usually arise when conventional devices and methods are used. Also, frequency and severity of non-critical errors as compared to the traditional methods can be reduced as shown in FIGS. **8**C and **8**D. Lastly, as shown in FIGS. **8**E and **8**F, time to prepare and deliver medication, as well as time to deliver medications when preparing for rapid sequence intubations (RSI) may be significantly reduced when the medicine-dosing device according to the current disclosure is used as compared to the conventional devices. As such the pre-labeled medicine dispensing device designed and used in accordance with the disclosed embodiments provides for more simplified, accurate and efficient drug delivery in emergency and critical care situations.

In another embodiment, the dose may be calculated, and the color band/zone may be used to verify that the calculated dose is within a safe range based on at least one patient characteristic. For example, a precise dosage may be calculated based on a patient characteristic, such as patient weight, and to ensure that calculated dose is safe to give a patient, the person administering the drug ensures that the dose is within the correct color band/zone before administering the drug. The color bands/zones may be smaller for certain medications that require more precision. In such situations, a smaller range, or even exact precision, may be required in the correlation between the patient characteristic and the dosage.

By first calculating a dose and then verifying that the determined dose is within a safe range (i.e., color zone) for the patient, errors in dosing can be avoided because everyone in the chain of drug delivery is able to identify when an error has been made. For example, a physician may calculate a dose, but a nurse (or a second doctor) may administer the medication to the patient. If an error in calculation occurs, or if the administering medical professional misreads the calculated dose, the administering professional will know that an error is made before administering the drug to the patient, because the dose is outside of the color zone that corresponds to the patient. (In some embodiments, the patient's color zone may be determined at the time the drug is administered, may be marked on the patient's chart—such as with a marker, barcode that can be scanned, etc.—or the child may be asked to wear an arm band in the color that corresponds to the child's safe color zone.)

FIG. **9**A shows an exemplary flow chart of such an embodiment. A color coded zone may be determined based on at least one patient characteristic **905**. The patient characteristic may be a patient length, patient weight, patient age, patient surface area/volume, and/or the like. In some embodiments, the color coded zone may be determined based on patient weight, such as by using the chart shown in FIG. **9**C and/or **9**D. The drug to be administered to the patient may be determined **910**, and a pre-marked dispensing device may be selected **915**. In some embodiments, the pre-marked dispensing device may be specifically tailored to the drug (e.g., both the drug name and concentration) being administered to the patient, and the device may have a series of color coded zones that correspond to drug doses that can be administered. The color coded zones may be of varying widths, and may correspond to volumes of the drug that are safe to administer to patients with at least one physical characteristic and/or within a range of the at least one physical characteristic.

A drug dose to be administered to the patient may be determined **920**. In some embodiments, the determination of the drug dose is based on calculations made by a physician or other medical professional. For example, the physician may know that a patient having a certain physical characteristic, such as a weight within a predetermined range, should receive a certain amount of the drug (e.g., based on FDA guidelines). The amount of a drug to be given to a patient may be in units of weight (e.g., milligrams). When delivering a drug in liquid form, however, the units are in terms of volume (e.g., milligrams/milliliter). Thus, the medical professional must determine how many milliliters of the drug to deliver to the patient in order to give the proper dose (e.g., milligrams) of the drug to the patient.

Once the drug dose has been determined, the dispensing device may be filled with a volume of the drug based on the determined drug dose **925**. The person administering the drug, such as a physician, nurse, technician, physician assistant, and/or the like, may verify that the volume of the drug filled in the dispensing device corresponds with the determined color coded zone **930**. Assuming the volume is within the zone, the drug dose may be administered to the patient using the dispensing device **935**. In some embodiments, if the volume is not within the zone, the dose may not be administered to the patient. For example, the drug dose may be re-determined. In other embodiments, the dose may be administered as long as it is not above the determined zone.

FIG. **9**B shows another exemplary flow chart of such an embodiment. The drug being administered may be selected **950**, and a dose of the drug may be determined and/or calculated **955**. The dose may be based on a patient characteristic, such as a patient length, patient weight, patient age, patient surface area/volume, and/or the like. A color coded zone may also be determined based on the same or based on a different patient characteristic **960**. The calculated dose may be drawn into the drug dispensing device **965**. For example, when the drug dispensing device is a syringe, the calculated dose may be drawn into the syringe from a vial. The syringe may be marked with a plurality of color coded zones, as shown in FIG. **10**B. In order to ensure that a safe dose is administered, the calculated dose should be within the determined color coded zone **970**. If the determined dose is within, and in some embodiments less than, the color coded zone, the dose is administered to the patient **975**. If the determined dose is not within the color coded zone—for example, if the determined dose is greater than the color coded zone—the dose is not administered. The excess drug may be expelled from the drug dispensing device, or the dose may be re-calculated (re-determined) in order to ensure that the calculations were performed correctly.

FIGS. **10**A-B show exemplary color coded zones for a drug, epinephrine, at a concentration of 1 mg/1 mL. The color coded zones shown in FIG. **10**A may be used when the color coded zone is used to determine the dose to be administered to the patient (e.g., using the process shown in FIGS. **5** and **7**A). In these embodiments, the patient length is used to determine the color coded zone, and the color coded zone determines the dose to be administered to the patient. In a typical implementation of the disclosed embodiments, a medical professional administering a drug may fill the syringe with the drug to the level of the maximum dose for the color coded zone corresponding to the patient. For example, if the patient's length (or weight, etc.) falls within the white zone, the medical professional administers 0.15 mL of the drug. This may be a slight overdose for patients at the low end of the white color coded zone, and a slight underdose for patients at the high end of the white color coded zone (of course, the slight overdose/underdose is within a safe range of doses for patients that fall within the white zone). In other embodiments, the doses corresponding to the color zone may be an accurate dose for patients at the low end of their respective color coded zone, and may be a slight underdose for patients in the middle and high end of the color zone.

FIG. **10**B shows color coded zones that may be used when the processes shown in FIGS. **9**A-**9**B are used. Here, the calculations may be precise, and the colors are used to double check that the dose is in a safe range. Because dose is calculated and the color coded zones are used to verify that a proper dose is applied, the color coded zones can be more accurate. As was discussed with reference to FIGS. **9**A-**9**B, the administering professional fills a syringe to a level corresponding to the exact dose calculated for the patient and then ensures that the calculated dose is included within the color coded zone corresponding to the patient.

In the embodiment of FIG. **10**B the zones are not configured so that a slight overdose/underdose is administered to patients on either side of each zone. Instead, each color zone extends only to the maximum acceptable dose for any patient within a zone (e.g., to the maximum acceptable dose for the lightest or shortest patients within the zone). As a result, the volumes of the color coded zones are shifted between FIG. **10**A and FIG. **10**B. As an example, consider a case in which a patient weighs 14 kg, and is therefore at the top of the 'yellow' range. In the embodiment of FIG. **10**A, the patient would receive 0.12 mL of epinephrine. In the embodiment of FIG. **10**B, the dose may be calculated to be 0.14 mL of epinephrine. When this dose is in the medicine dosing device, the administering professional sees that the dose is appropriate for the yellow zone, double checks that the patient is categorized for the yellow zone, and then administers the drug. Thus, although the patient receives a higher dose in the embodiment of FIG. **10**B, this higher dose is accurate and safe. To the contrary, if a physician were to calculate that the patient should receive 0.20 mL of the drug, the administering professional would see that this dose falls in the blue zone; knowing that the patient is categorized within the yellow zone, the administering professional would not administer the drug. This prevents an overdose of the medication and ensures that the patient receives the correct amount of the drug.

In an exemplary implementation, if a physician calculates a dose for the patient of 0.15 mL, the medical professional administering the drug will fill the syringe (whether by dispelling the drug from a pre-filled device or drawing medication into the device) to the 0.15 mL marker. Next, the medical professional checks the patient's color coded zone. If the patient is within the white zone, the professional administers the drug; if the patient is within any other zone, the medical professional does not administer the drug, and instead ensures that the dose is recalculated. In some embodiments, it may be particularly important for the medical professional to ensure that the patient is not overdosed with medication. Thus, if the patient is within a color zone that is higher than the calculated dose, the administering medical professional may administer the drug and then ensure that the remainder of the dose is given (e.g., a 'blue' zone patient may be given a 'white' zone dose, followed by the remaining dose at a later time. Thus, the 0.15 mL dose may be administered, and then if the proper dose should have been 0.20 mL, the remaining 0.05 mL may be administered.)

Attention is now directed to FIG. **11**, which depicts an embodiment of a dosing system including a pre-labeled medicine dosing/dispensing device **1100** designed to facilitate delivery of sequential doses of medication to a patient in a safe manner As shown, the dosing device **1100** is printed, labeled or otherwise marked with a color dosing bar **1104** having four dosing segments **1110**. In one embodiment the color dosing bar **1104** is of a color (i.e., green) that is correlated with a parameter of a patient (e.g., the patient's weight or length). Each of the dosing segments **1110** identifies a volume of the medication corresponding to a given medication dose to be provided to the patient. For example, a first dosing segment **1110***a* corresponds to a first dose to be provided to the patient, a second dosing segment **1110***b* corresponds to a second dose to be provided to the patient, a third dosing segment **1110***c* corresponds to a third dose to be provided to the patient, and a fourth dosing segment **1110***d* corresponds to a fourth dose to be provided to the patient.

The dosing system of FIG. **11** has particular utility in situations in which the practice of medicine requires that sequential doses of the same medicine be provided to a patient. Such situations often arise in the context of emergency treatment where available resources and time may be limited. For example, in an emergency situation involving a cardiac arrest, the same dose of a particular medicine must generally be given to the cardiac patient during each of a number of successive 3-minute intervals. In some situations up to 20 doses of a medication must be sequentially given to a patient before the patient can be safely transported to a hospital setting for further treatment. When conventional dosing instruments are utilized in such emergency scenarios, critical time can be lost in calculating/measuring medicine dose as well as in getting different preparations of the medicine ready for administration to the patient.

These shortcomings of conventional dosing approaches can be overcome by utilizing the sequential dosing system of FIG. **11**. Specifically, the dosing segments **1110** enable a predetermined number (4 in the case of FIG. **11**) doses of a medication to be prepared in advance and sequentially delivered to a patient through the device **1100**. In one embodiment an operator of the dosing device **1100** need not perform any mathematical calculations in order to arrive at a correct sequence of dosages to be delivered to a patient. For example, once a parameter of the patient (e.g., weight or length) has been correlated to a particular dosing color (green in the case of FIG. **11**), a dosing device **1100** having a color dosing bar **1104** having a color the same as the dosing color correlated with the patient is selected. The dosing segments **1110** then effectively serve to inform the operator of the dispensing device of the proper volumes of medication to be administered in each successive dose in light of the patient's size, concentration of the medication, and desired medication dose (e.g., mg/kg of body weight) without requiring the operator to engage in any calculations. This sequential delivery of multiple, pre-prepared doses of medication through a single instrument in a manner not requiring a medical professional to engage in mathematical calculations or the like to determine dosing levels is not possible using conventional syringes or other conventional drug delivery devices.

Referring to FIG. **11**, the medicine dosing device **1100** according to one embodiment is a syringe **1115** that includes a proximal end **1125** and a distal end **1120** opposite the proximal end. The syringe includes a vessel, such as a syringe barrel **1130** for holding therein a medicine that is to be dispensed, and a plunger **1150** that extends proximally from an opening located at the proximal end **1135** of the syringe barrel to the proximal end of the plunger at the proximal end **1125**. The syringe barrel **1130** and plunger **1150** are both manufactured from material such as plastic, glass or any other suitable transparent medical grade material that is inert or will not disrupt the chemical balance of the fluid inside.

As illustrated in FIG. **11**, the syringe barrel **1130** is elongate and substantially cylindrical and includes a distal end **1131** and a proximal end **1135**. A chamber **1132** capable of receiving a plunger and retaining a fluid therein is defined by the inner circumferential surface of the **1130** barrel between the distal and proximal ends **1131** and **1135**. A flange **1133**, which can serve as a finger grip to provide for an easier handing of the syringe, is integrally formed with the proximal end of the barrel and defines an opening for receiving the plunger **1150**. Proximate this opening, along the inner surface of the barrel, may be a ridge (not shown), that prevents the plunger from slipping out of the barrel once it is engaged with the barrel.

The opening defined by the flange **1133** is in communication with the chamber **1132** and an orifice located at the distal end **1120** of the syringe barrel. A tip **1140** for attaching a needle, nozzle or tubing for expelling the liquid contained within the syringe barrel **1130** is integrally formed with the distal end **1120** of the barrel and in communication with the orifice. In some embodiments, the tip may be configured based on the type of drug that the syringe is used to deliver. For example, oral tips may be used on syringes configured for medicines that are oral, and in particular, the oral tip may be different from an intravenous ("IV") or intermuscular ("IM") tip, thereby ensuring that the medicine is delivered by the right route. Similarly, syringes configured for IV and IM drugs may be configured with IV and IM tips, respectively, such that they, too, can only be delivered via the right route.

In one embodiment the barrel **1130** is marked with a reference line **1160** (zero line). In cases in which the syringe barrel **1130** is pre-filled with medication, syringe doses may be calculated from the proximal end **1135** of the barrel **1130** or from the reference line **1160**. Sequential doses may then be delivered to a patient where each dose comprises a volume of medication corresponding to one of the dosing segments **1110**.

If the syringe **1115** is provided to an operator in an empty state, the syringe **1115** would be filled by the operator with medication from, for example, a medication vial. In this case the orientation of the label **1104** would be reversed relative to the orientation shown in FIG. **11**. That is, the label **1104** would be oriented such that the dosing segment **1110** corresponding to the first of multiple sequential doses of the medication would be proximate the distal end **1120** of the barrel **1130** and the dosing segment **1110** corresponding to the last dose would be relatively closer to the proximal end **1135**. The medication within the vial may be drawn into the syringe **1115** immediately prior to administering of the sequential doses. In such embodiments, the plunger rod **1150** may remain inside the syringe barrel **1130** until the medication is drawn into the syringe **1115**. Either approach saves valuable time for the operator relative to the case in which single-dose syringes are used, since these require the operator to refill the syringe from the medication vial prior to administering each sequential dose. Use of the syringe **1115** also obviates the need for the operator to externally track how many doses have actually been provided to a patient, since the volume of medication remaining in the syringe will explicitly indicate how many doses remain in the barrel **1130** relative to the full state of barrel **1130**.

The disclosed sequential dosing system is also pertinent to situations in which ambulances or other mobile medical care systems must stock a limited supply of medication ready for a vast array of patient needs. These medications may have to meet the needs of a diverse population of patients and it is not feasible or practical to have multiple preparations of the same medication ready (e.g., cardiac arrest medication). One way of addressing these needs is to use color-coding in the form of, for example, multiple color bars, to represent various size patients on the same dosing device while still preserving sequential dosing function by partitioning each color bar into multiple dosing segments.

Turning now to FIG. **12**, an illustration is provided of a dosing system including a pre-labeled medicine dosing/dispensing device **1200** designed to facilitate delivery of sequential doses of medication to any one of multiple different-sized patients. As shown, the dosing device **1200** is printed, labeled or otherwise marked with three color dosing bars **1204**, **1206**, **1208**, each of which is respectively partitioned into two dosing segments **1210**, **1212**, **1214**. In one embodiment the color dosing bars **1204**, **1206**, **1208** are respectively colored blue, gold and orange, with each different color being correlated with a different patient size. Each of the dosing segments **1210**, **1212**, **1214** identifies a volume of the medication corresponding to a given medication dose to be provided to a patient correlated with a corresponding one of the color dosing bars **1204**, **1206**, **1208**. For example, a first dosing segment **1210***a* of color dosing bar **1204** corresponds to a first dose to be provide to a patient correlated with the dosing color blue, and a second dosing segment **1210***b* of corresponds to a second dose to be provided to the same patient.

Like the system of FIG. **11**, he dosing system of FIG. **12** has particular utility in situations in which the practice of medicine requires that sequential doses of the same medicine be provided to a patient. Such situations often arise in the context of emergency treatment where available resources and time may be limited. For example, in an emergency situation involving a cardiac arrest, the same dose of a particular medicine must generally be given to the cardiac patient during each of a number of successive 3-minute intervals. In some situations up to 20 doses of a medication must be sequentially given to a patient before the patient can be safely transported to a hospital setting for further treatment. When conventional dosing instruments are utilized in such emergency scenarios, critical time can be lost in calculating/measuring medicine dose as well as in getting different preparations of the medicine ready for administration to the patient.

These shortcomings of conventional dosing approaches can be overcome by utilizing the sequential dosing system of FIG. **12**. Specifically, the dosing segments **1210**, **1212**, **1214** enable a predetermined number (**2** in the case of FIG. **12**) doses of a medication to be prepared in advance and sequentially delivered to a patient through the device **1200**. In one embodiment an operator of the dosing device **1200** need not perform any mathematical calculations in order to arrive at a correct sequence of dosages to be delivered to a patient. For example, once a parameter of the patient (e.g., weight or length) has been correlated to a particular dosing color (blue, gold or orange in the case of FIG. **12**), a dosing device **1200** having a color dosing bar **1204**, **1206**, **1208** having a color the same as the dosing color correlated with the patient is selected. The dosing segments **1210**, **1212**, **1214** of the one of the color dosing bars **1204**, **1206**, **1208** correlated with the patient then effectively serve to inform the operator of the dispensing device of the proper volumes of medication to be administered in each successive dose in light of the patient's size, concentration of the medication, and desired medication dose (e.g., mg/kg of body weight) without requiring the operator to engage in any calculations. This sequential delivery of multiple, pre-prepared doses of medication through a single instrument in a manner not requiring a medical professional to engage in mathematical calculations or the like to determine dosing levels is not possible using conventional syringes or other conventional drug delivery devices.

Referring to FIG. **12**, the medicine dosing device **1200** according to one embodiment is a syringe **1215** that includes a proximal end **1225** and a distal end **1220** opposite the proximal end. The syringe includes a vessel, such as a syringe barrel **1230** for holding therein a medicine that is to be dispensed, and a plunger **1250** that extends proximally from an opening located at the proximal end **1235** of the syringe barrel to the proximal end of the plunger at the proximal end **1225**. The syringe barrel **1230** and plunger **1250** are both manufactured from material such as plastic, glass or any other suitable transparent medical grade material that is inert or will not disrupt the chemical balance of the fluid inside.

As illustrated in FIG. **12**, the syringe barrel **1230** is elongate and substantially cylindrical and includes a distal end **1231** and a proximal end **1235**. A chamber capable of receiving the plunger **1250** and retaining a fluid therein is defined by the inner circumferential surface of the **1230** barrel between the distal and proximal ends **1231** and **1235**. A flange **1233**, which can serve as a finger grip to provide for an easier handing of the syringe, is integrally formed with the proximal end of the barrel and defines an opening for receiving the plunger **1250**. Proximate this opening, along the inner surface of the barrel, may be a ridge (not shown), that prevents the plunger from slipping out of the barrel once it is engaged with the barrel.

The opening defined by the flange **1233** is in communication with the chamber of the syringe **1215** and an orifice located at the distal end **1220** of the syringe barrel. A tip **1240** for attaching a needle, nozzle or tubing for expelling the liquid contained within the syringe barrel is integrally formed with the distal end **1220** of the barrel and in communication with the orifice. In some embodiments, the tip **1240** may be configured based on the type of drug that the syringe is used to deliver. For example, oral tips may be used on syringes configured for medicines that are oral, and in particular, the oral tip may be different from an intravenous ("IV") or intermuscular ("IM") tip, thereby ensuring that the medicine is delivered by the right route. Similarly, syringes configured for IV and IM drugs may be configured with IV and IM tips, respectively, such that they, too, can only be delivered via the right route.

In one embodiment the barrel **1230** is marked with a reference line **1260** (zero line). In cases in which the syringe barrel **1230** is pre-filled with medication, syringe doses may be calculated from the proximal end **1235** of the barrel **1230** or from the reference line **1260**. Sequential doses may then be delivered to a patient where each dose comprises a volume of medication corresponding to one of the dosing segments **1210**, **1212**, **1214**.

If the syringe **1215** is provided to an operator in an empty state, the syringe **1215** would be filled by the operator with medication from, for example, a medication vial. In this case the orientation of the dosing bars **1204**, **1206**, **1208** would be reversed relative to the orientation shown in FIG. **12**. That is, the dosing bars **1204**, **1206**, **1208** would be oriented such that the dosing segment **1210**, **1212**, **1214** corresponding to the first of multiple sequential doses of the medication would be proximate the distal end **1220** of the barrel **1230** and the dosing segment **1210**, **1212**, **1214** corresponding to the last dose would be relatively closer to the proximal end **1235**. The medication within the vial may be drawn into the syringe **1215** immediately prior to administering of the sequential doses. In such embodiments, the plunger **1250** may remain inside the syringe barrel **1230** until the medication is drawn into the syringe **1215**. Either approach saves valuable time for the operator relative to the case in which single-dose syringes are used, since these require the operator to refill the syringe from the medication vial prior to administering each sequential dose. Use of the syringe **1215** also obviates the need for the operator to externally track how many doses have actually been provided to a patient, since the volume of medication remaining in the syringe will explicitly indicate how many doses remain in the barrel **1230** relative to the full state of barrel **1230**.

SYRINGE WITH PROPHYLAXIS AND TREATMENT DOSING INDICATORS

Attention is now directed to FIGS. **13-17**, which depict a medicine dispensing device in the form of a syringe **1300** configured to deliver either or both of treatment dosages and prophylaxis dosages of a particular drug. As shown, the syringe **1300** includes a first series of color-coded zones of varying widths **1310** corresponding to prophylaxis dosages and a second series of color-coded zones of varying widths **1320** corresponding to treatment dosages. In the embodiment of FIG. **13** the first series of color-coded zones **1310** and the second series of color-coded zones **1320** are separated by approximately 180° on an external surface of a barrel **1330** of the syringe **1300**. Each of the color-coded zones within the first series of zones **1310** and the second series of zones **1320** corresponds to a pre-determined dose of the drug that is correlated to one of the physical characteristics of a patient. The first series of zones **1310** and the second series of zones **1320** are each marked such that the smallest dose of the drug to be administered corresponds to a color-coded zone that is proximate an opening **1340** through which the particular drug is to be dispensed.

The syringe **1300** advantageously enables both prophylaxis and treatment doses of a drug to be given from the same syringe. In this case the medication concentration in the syringe **1300** is the same for prophylaxis and treatment applications, but different dosage levels will typically be prescribed for prophylaxis and treatment. In a typical usage scenario a doctor or health care provider will instruct a caregiver which dosing option (i.e., prophylaxis or treatment) is needed and instructs the caregiver to determine the color zone associated with the patient. This enables the caregiver to fill the syringe with either the prophylaxis or treatment dose corresponding to the patient's color zone by consulting the dosing tables of FIGS. **18**A and **18**B (which are for illustrative purposes only and are not associated with a particular drug) and administer the corresponding dose to the patient using the syringe.

DISPENSING DEVICE WITH MULTI-SHADE COLOR BANDS

Turning now to FIGS. **19** and **20**, a syringe **1900** having a series of multi-segment color-coded bands of varying widths **1902** is illustrated. As shown, the syringe **1900** includes a grey dosing band **1904**, pink dosing band **1908**, red dosing band **1912**, purple dosing band **1916** and a yellow dosing band **1920**. In one embodiment certain of the dosing bands may be partitioned into multiple segments. For example, the grey dosing band **1904** may be partitioned into a first grey segment **1930**, a second grey segment **1932** and a third grey segment **1934**, each corresponding to a different range of patent weight or other physical characteristic of the patent. In the embodiment of FIGS. **19**A and **20**A, each of the first grey segment **1930**, second grey segment **1932** and third grey segment **1934** are of the same shade of grey. In the embodiment of FIGS. **19**B and **20**B, the grey dosing band **1904** includes a light grey segment **1930'**, a medium grey segment **1932'**, and a dark grey segment **1934'**. Similarly, in the embodiments of FIGS. **19**B and **20**B, the pink dosing band **1908** includes a light pink segment **1940'** and a dark pink segment **1942'**. The red dosing bank **1912** may be similarly partitioned into a light red segment **1950'** and a dark red segment **1952'**

SYRINGE SYSTEM PROVIDING DOSING INDICATIONS FOR MULTIPLE DIFFERENT CONDITIONS

As is known, in particular cases drug manufacturers may offer certain drugs in only a single concentration. For example, it may not be feasible for a drug manufacturer to provide multiple concentrations of a drug used to treat a rare medical condition. Similarly, a given drug (e.g., penicillin) may be used to treat relatively more serious conditions (e.g., pneumonia) in addition to less serious conditions (e.g., an ear infection). Since a more serious condition may require a larger dose than a less serious condition, a color-coded syringe correlated to a physical parameter of a patient such as those described herein may be unable to simultaneously accommodate the dosing schemes for both the more and less serious conditions.

For example, consider a situation in which penicillin is being used to treat two twin children, one having been diagnosed with an ear infection and the other with pneumonia. Assume each of the twins weighs 10 kg. and that the relevant pharmacy has only one concentration of penicillin for children (e.g., 100 mg per 5 ml). In this case a doctor may order 100 mg of penicillin per day for the one of the twins having an ear infection ("twin A") and 200 mg of penicillin per day for the twin diagnosed with pneumonia ("twin **13**"). So twin A would receive 5 ml of penicillin per day and twin B would receive 10 ml. per day. Even though twin A and twin B weigh the same and the penicillin concentration for each is the same, each would receive a different dose (volume of medication) since dosing is dependent upon the underlying diagnosis and not just the size of the child or concentration of the medication.

In accordance with one aspect of the disclosure, one way that a pharmaceutical company or other provider of medicine could address this situation would be to provide a syringe having dual dosing indications or scales on the same syringe. Each dosing indication on the syringe would be associated with a particular medical condition or diagnosis and would have its own legend (e.g., color coding or marking scheme). In this type of system the colors within each dosing indication scheme could still match a standard system for weight, but hash marks or other indicia could be used to differentiate the scales.

Attention is now directed to FIGS. **21-22**, which depict a medicine dispensing device in the form of a syringe **2100** configured with dosing indications associated with different medical conditions. In this way the same syringe **2100** can be used to deliver a particular drug to treat the different medical conditions. As shown, the syringe **2100** (the main drug-retaining body of which may also be referred to as a "vessel") includes a first series of color-coded zones of varying widths **2110** corresponding to dosages for a first medical condition and a second series of color-coded zones of varying widths **2120** corresponding dosages associated with a second medical condition. In the embodiment of FIGS. **21-22**, the first series of color-coded zones **2110** and the second series of color-coded zones **2120** are separated by approximately 180° on an external surface of a barrel **2130** of the syringe **2100**. The surface of the vessel is substantially cylindrical, and each of the markings, such as colors, zones, lines, and names of drugs, conditions, and indications may be written or printed in some manner upon the surface of the vessel. Labels may be printed and affixed to the vessel to create these writings or markings, as will be described later in the disclosure.

Each of the color-coded zones within the first series of zones **2110** and the second series of zones **2120** corresponds to a pre-determined dose of the drug that is correlated to one of the physical characteristics of a patient. The first series of zones **2110** and the second series of zones **2120** are each marked such that the smallest dose of the drug to be administered corresponds to a color-coded zone that is proximate an opening **2140** through which the particular drug is to be dispensed. It is contemplated that in embodiments, the vessel may comprise one or more additional series of zones to support dosing for one or more additional medical conditions.

As may be appreciated from the exemplary dosing tables depicted in FIGS. **23**A and **23**B, the dual indications on the syringe **2100** advantageously enable the same syringe **2100** to deliver the same drug for different medical conditions having different dosing requirements. In a typical usage scenario a caregiver will determine the color zone associated with a patient and determine the appropriate dose to be dispensed by consulting the one of the tables in FIGS. **23**A and **23**B applicable to the patient's medical condition (the values within the tables of FIGS. **23**A and **23**B are for illustrative purposes only and are not associated with a particular drug). This enables the caregiver to fill the syringe with the dose corresponding to both the patient's color zone and medical condition or diagnosis and administer the corresponding dose to the patient using the syringe **2100**.

FIGS. **24**-**25** illustrate an alternative approach for using a single syringe to provide doses of the same drug for different medical conditions or diagnoses. Specifically, FIG. **24** illustrates a syringe **2400** having a single color-coded dosing scale **2410**. In this single color-coded dosing scale **2410**, consecutive colors may be used to correspond to different dosing tables. For example, FIGS. **25**A and **25**B are different dosing tables for a particular drug for use in conjunction with the syringe **2400** in dosing for different medical conditions. The colors within the dosing tables of FIGS. **25**A and **25**B correspond to the colors within the color-coded dosing scale **2410**, but colors from the dosing tables of FIG. **25**A may be interspersed with colors from the dosing tables of FIG. **25**B.

In this way the dosage volumes within the dosing tables of FIGS. **25**A and **25**B are matched to corresponding color-coded dosing zones of the scale **2410**. In the embodiment of FIGS. **24** and **25**, the color-coded zones of the scale **2410** and dosing tables of FIGS. **25**A and **25**B could be agnostic relative to patient weight. That is, the dosing tables of FIGS. **25**A and **25**B could simply be used to map dosing volumes to different color-coded volume zones included within the scale **2410** on syringe **2400** (i.e., the different color-coded zones being interspersed with one another). In one embodiment a physician, pharmacist, nurse or other authorized medical personnel would determine the zone corresponding to a patient's size or weight and communicate this zone information or color to the patient or caregiver responsible for delivering the drug dispensed by the syringe **2400**. it is contemplated that different color-coded zones could also correspond to different medical conditions, at that each color would therefore correspond to a patient size, weight, and condition for the drug.

Alternatively, the scale **2410** could correspond to a color-coded dosing scale based on weight that is peculiar to a particular drug. In this case the tables of FIGS. **25**A and **25**B could be used to determine doses for different medical conditions provided that the color-coded zone within the scale **2410** corresponding to the patient's size or weight is known.

Attention is now directed to FIGS. **26**A-C and FIGS. **27**A-C, which illustrate alternate embodiments of dosing systems in which color is used to represent dosing volume for multiple scenarios in a manner that is not explicitly tied to patient weight. The embodiments of FIGS. **26**A-C and FIGS. **27**A-C may find application in, for example, situations in which it is desired to provide volumetric dosing indications for multiple conditions (e.g., ear infection and pneumonia) Where a different volume may be prescribed for patients of a different size or scenarios (e.g., prophylaxis and treatment) where the same volume may be prescribed for patients of different size.

Referring to the dosing system of FIGS. **26**A-**26**C, FIG. **26**A illustrates a dosing table **2600** for use with a color-coded syringe **2610** depicted in FIG. **26**B. A color-coded label **2612** attached to an exterior surface of the barrel of the syringe **2610** is shown flattened out in FIG. **26**C. Although the dosing table **2600** explicitly references only volumes associated with color-coded zones, each color-coded zone may implicitly be correlated with patient weight with respect to a given scenario or condition (e.g., prophylaxis/treatment or infection/pneumonia). As an example, consider the case in which a 14 kg child is prescribed a treatment dose of 1.4 ml (1 mg/kg dose) and a 28 kg child is prescribed a prophylaxis dose of 1.4 ml (0.5 mg/kg). As shown, this corresponds to the purple zone in the dosing table of FIG. **26**A. The patient or caregiver would then utilize the syringe of FIG. **26**B to then administer the child a dose of medication corresponding to the purple zone (1.4 ml).

The dosing system of FIGS. **26**A-C, in which correlation with weight or patient size is implicit rather than explicit, is advantageously flexible from a manufacturing and medical indication perspective. Moreover, the system improves dosing accuracy by limiting the number of possible doses on a standard graduated syringe to the ranges that are commonly used for one or more indications, and correlates these to color. This serves as a cognitive forcing strategy designed to reduce dosing errors in a manner consistent with that advocated by, for example the Institute of Safe Medical Practice (ISMP)

Referring now to the dosing system of FIGS. **27**A-**27**C, FIG. **27**A illustrates a dosing table **2700** for use with a color-coded syringe **2710** depicted in FIG. **27**B. A color-coded label **2712** attached to an exterior surface of the barrel of the syringe **2710** is shown flattened out in FIG. **27**C. The dosing system of FIGS. **27**A-**27**C is substantially similar to the dosing system of FIGS. **26**A-**26**C. However, in the dosing system of FIGS. **27**A-**27**C the color-coded zones in the table **2700** further include alphabetic labels to further enhance dosing accuracy. For example, again considering the case of a condition requiring a dose of 1.4 ml, a physician or pharmacist could convey the does information by prescribing a does corresponding to one or more of both zone "D" and the "purple" color zone. By specifying an alphabetic label in addition to a color zone the risk of erroneous dosing is further reduced.

FIGS. **28**A and **28**B show an embodiment of the a medicine dispensing device **2800** according to the present disclosure. The medicine dispensing device **2800** has a single color-coded scale **2810** on a first side **2805** and a linear volumetric scale **2820** on a second side **2815**. The single color coded scale **2810** may comprise one or more zones corresponding to dosing tables for one or more conditions. In embodiments, the single color-coded scale

2810 may correspond to two dosing tables, each dosing table being particular to one medical condition to be treated by the same drug, and colors from each of the two dosing tables may be interspersed along the single color-coded dosing scale.

As shown, the medicine dispensing device **2800** is transparent apart from the single color-coded scale **2810**, the lines **2825** of the linear volumetric scale **2810**, and the numeric indicators **2830** and **2835** along the single color-coded scale **2810** and the linear volumetric scale **2810**, respectively. The numeric indicators **2830** and **2835** may comprise black text on an opaque white background to provide improved visual contrast of the numbers as compared to black text on a translucent background. The design of the medicine dispensing device **2800** allows a person administering a dose to see easily the drug within the device in relation to both the color code and the numeric value of the dose.

FIGS. **29**A-C show a flat label **2900** which may be printed and affixed to a transparent vessel of a medicine dispensing device to manufacture one according to the present disclosure (e.g., the medicine dispensing device **2800**). FIG. **29**A shows a view with a white background for clarity, but in embodiments, a manufacturing process may comprise printing a label with white blocks **2910** on a transparent material as shows in FIG. **29**B and then printing a color coded scale **2930** and numerals **2940** on the white blocks **2910**, and printing a linear volumetric scale **2950** on the transparent material **2950**. This method may be used to easily manufacture medicine dispensing devices of similar size with different color dosing scales that correspond to different drugs, different scenarios, and different conditions.

To summarize the overall features and functions of the medicine dispensing system previously described in FIGS. **21**-**29**C, the dosing system is comprised of these aspects: A) a color pattern on the device (e.g., syringe), with bars of varying widths correlating to doses, B) one or more tables that have the same colors in the same order (in one table) or split up (into one or more tables), with the colors matching the colors on the syringe and correlating to a specific volume on the syringe, and C) the volume marked by a color can match the dose that is selected for a particular condition.

For example, there could be two or more tables each with the colors on the syringe. Both are for the same antibiotic. However, a "Table 1" is for ear infections (for which the dose is 0.25 mL per Kg) and a "Table 2" is for pneumonia. Pneumonia is a more serious disease, so it requires twice the amount of antibiotic to kill the bacteria (so it uses a dose 0.5 mL per KG of a child's body weight). In this case, if a 10 kg child is on both tables they will be associated with the following corresponding doses, volumes, and colors:

(Table 1) 2.5 ml once a day (yellow)

Table 2) 5 ml once a day (red)

Further, Table 1 also has a 5 mL dose (Red, for a 20 kg child with ear infection) and Table 2) has a 2.5 mL dose (Yellow: it's for a 5 kg child with pneumonia).

In this system, the syringe does not change, but the tables can change to use the same syringe in a different way depending on the medical condition the patient is being prescribed the medication for. Such a system is advantageous from a supply chain and manufacturing as syringes are more expensive than printing a dosing table (or many dosing tables) on the side of the box or a piece of paper. Therefore, the system allows the user to have the same syringe, but different dosing for other medical conditions by using different tables.

Alternatively, the system can employ just one table that has all colors on it and only the volume on the table. This can be used for a doctor or pharmacist to choose how that volume is used based on the weight of the patient. In this embodiment of the system, doses are based off of volume only, and not on weight. The medical professional can do the math and then assign just a the number and/or color to the patient, so the patient can reliably give the correct dose themselves (e.g., at home) and not forget or make mistakes. This is a simple system for lay people to identify their dose on a syringe, because they only have one number (and/or color) to worry about.

Example embodiments of the devices, systems and methods have been described herein. As may be noted elsewhere, these embodiments have been described for illustrative purposes only and are not limiting. Other embodiments are possible and are covered by the disclosure, which will be apparent from the teachings contained herein. Thus, the breadth and scope of the disclosure should not be limited by any of the above-described embodiments but should be defined only in accordance with claims supported by the present disclosure and their equivalents. Moreover, embodiments of the subject disclosure may include methods, systems and devices which may further include any and all elements/features from any other disclosed methods, systems, and devices, including any and all features corresponding to scientific data exchange. In other words, features from one and/or another disclosed embodiment may be interchangeable with features from other disclosed embodiments, which, in turn, correspond to yet other embodiments. Furthermore, one or more features/elements of disclosed embodiments may be removed and still result in patentable subject matter (and thus, resulting in yet more embodiments of the subject disclosure). Still further, some embodiments are distinguishable from the prior art due to such embodiments specifically lacking one or more features which are found in the prior art. In other words, claims to some embodiments of the disclosure may include one or more negative limitations to specifically note that the claimed embodiment lacks at least one structure, element, and/or feature that is disclosed in the prior art.

What is claimed is:

1. A medicine dispensing device, comprising:

a vessel configured to retain a drug to be dispensed by the medicine dispensing device;

a first series of zones of varying widths on a surface of the vessel, with each zone of the first series of zones corresponding to a pre-determined dose of the drug for a first medical condition wherein the first series of zones are correlated to a first series of values of a physical characteristic of a patient; and

a second series of zones of varying widths on the surface of the vessel, with each zone of the second series of zones corresponding to a pre-determined dose of the drug for a second medical condition wherein the second series of zones are correlated to a second series of values of the physical characteristic of a patient, wherein each zone has a unique visual indicium and wherein a codified combination of weight, medical condition, and volume corresponds to the unique visual indicium.

2. The medicine dispensing device of claim **1** wherein the surface of the vessel is a cylindrical surface, first series of zones being separated from the second series of zones by approximately 180 degrees on the cylindrical surface.

3. The medicine dispensing device of claim **1**, wherein each zone of the first series of zones and each zone of the second series of zones is visually denoted by a different color.

4. The medicine dispensing device of claim 1, wherein at least one of the zones is translucent.

5. The medicine dispensing device of claim 1, wherein a name of at least one of the first medical condition or the second medical condition is written on the surface of the vessel.

6. The medicine dispensing device of claim 1, wherein the drug is in a liquid form.

7. The medicine dispensing device of claim 1, wherein a name of the drug is written on the surface of the vessel.

8. The medicine dispensing device of claim 1, wherein each zone of the second series of zones comprises a visual pattern that is different from each zone of the first series of zones.

9. The medicine dispensing device of claim 1, wherein a portion of vessel is translucent or transparent in an area surrounding the first or second series of zones.

10. A medicine dispensing system, comprising:

a vessel configured to retain a drug to be dispensed by a medicine dispensing device;

a series of zones of varying widths on a surface of the vessel, with each zone of the series of zones corresponding to a pre-determined dose of the drug;

a first dosing table correlating a first set of zones within the series of zones of varying widths to pre-determined doses of the drug for a first medical condition; and

a second dosing table correlating a second set of zones within the series of zones of varying widths to pre-determined doses of the drug for a second medical condition;

wherein each zone on the surface of the vessel has a unique visual indicium corresponding to a unique combination of weight, medical condition, and volume found in the first or second dosing table.

11. The medicine dispensing system of claim 10, wherein each zone of the first set of zones and each zone of the second set of zones is visually denoted by a different color, thereby indicating a plurality of different colored dosing table zones.

12. The medicine dispensing system of claim 11, wherein each of the plurality of different colored dosing zones corresponds to a matching color for each zone of the series of zones on the surface of the vessel, thereby creating a plurality of matching color surface zones.

13. The medicine dispensing system of claim 11, wherein each of the plurality of different color dosing zones are associated with a letter.

14. The medicine dispensing system of claim 10, wherein at least one of the zones of the series of zones is translucent.

15. The medicine dispensing system of claim 12, wherein at least some of the matching color surface zones corresponding to the first dosing table are interspersed with at least some others of the matching color surface zones corresponding to the second dosing table.

16. The medicine dispensing system of claim 10, wherein each zone of the first set of zones is visually denoted by a different pattern than each zone of the second set of zones.

17. The medicine dispensing system of claim 10, wherein the first dosing table comprises a name of the drug and a name of the first medical condition and the second dosing table comprises the name of the drug and a name of the second medical condition.

18. The medicine dispensing system of claim 10, wherein a name of the drug is written on the surface of the vessel.

19. The medicine dispensing system of claim 10, wherein a portion of vessel is translucent or transparent in an area surrounding the series of zones.

20. The medicine dispensing system of claim 10, comprising one or more additional dosing tables correlating one or more additional zones within the series of zones of varying widths to pre-determined doses of the drug for one or more additional medical conditions.

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