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Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a
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- as to the applicant's entitlement to claim the priority of the
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(54) Title: SELF-STIRRING SYRINGE DEVICES AND SYSTEMS

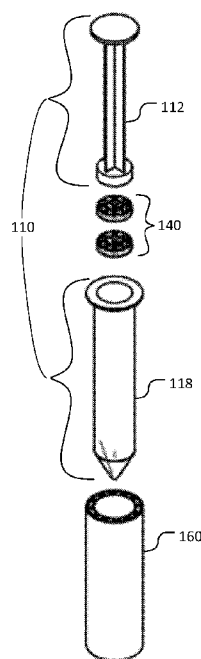


FIG. 1

(57) Abstract: Self-stirring syringe devices and systems can be used to facilitate solution homogeneity as a controlled fluid infusion rate from a syringe pump is maintained. In some embodiments, the self-stirring syringe devices incorporate one or more stirring members loaded with magnets that are placed within the syringe. An external magnetic field is generated to spin the stirring members, thereby creating turbulence to stir the fluidic contents within the syringe.

SELF-STIRRING SYRINGE DEVICES AND SYSTEMS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Application Serial No. 62/346,772, filed on June 7, 2016. This disclosure of the prior application is considered part of
5 (and is incorporated by reference in) the disclosure of this application.

BACKGROUND

1. Technical Field

This document relates to self-stirring syringes and methods for their use. For
10 example, this document relates to self-stirring syringes and syringe pumps that are designed to facilitate homogeneity of the fluid in the syringe as a controlled fluid infusion rate is maintained.

2. Background Information

15 During a fluidic drug infusion into a patient, it is typically desirable that the drug be substantially homogeneous throughout the duration of the infusion. In some cases, some contents of the fluidic drug being infused may tend to separate, stratify, or dispersed solids in the fluidic drug may tend to settle out. Agitation of the fluidic drug during the infusion can counteract such tendencies, and thereby promote fluidic
20 drug homogeneity.

SUMMARY

This document provides self-stirring syringes and methods for their use. For example, this document provides self-stirring syringes and syringe pumps that are designed to facilitate fluidic homogeneity as a fluidic drug is infused into a patient.
25 Some embodiments of the self-stirring syringe devices provided herein incorporate discs loaded with magnets that are placed within the syringe. An outer stator sleeve device surrounding a portion of the syringe is used to generate a dynamic external magnetic field that induces spinning of the discs, thereby stirring the contents within the syringe.

30 In one implementation, a kit for adapting a syringe to be a self-stirring syringe includes: (a) one or more stirring members, each stirring member of the one or more stirring members being magnetic, each stirring member of the one or more stirring

members sized to be movable within a barrel of the syringe; and (b) a stator that defines a lumen sized to slidably receive the barrel of the syringe, the stator comprising two or more cores that each comprise a coiled winding of electrically conductive wire. While electrical current is passing through the coiled winding of electrically conductive wire, an electromagnetic field is generated from the respective
5 core. Each stirring member of the one or more stirring members is magnetically responsive to the electromagnetic field.

Such a kit for adapting a syringe to be a self-stirring syringe may optionally include one or more of the following features. Each stirring member of the one or
10 more stirring members may be disc-shaped. Each stirring member of the one or more stirring members may be rod-shaped. The stator may include four or more cores. The kit may also include a drive system for controllably supplying the electrical current to each core of the two or more cores.

In another implementation, a self-stirring syringe system includes: (i) a
15 syringe comprising a plunger and a barrel that slidably receives the plunger; (ii) one or more stirring members, each stirring member of the one or more stirring members being magnetic, each stirring member of the one or more stirring members sized to be movable within the barrel of the syringe; and (iii) a stator that defines a lumen sized to slidably receive the barrel of the syringe. The stator includes two or more cores that
20 each comprise a coiled winding of electrically conductive wire. While electrical current is passing through the coiled winding of electrically conductive wire, an electromagnetic field is generated from the respective core. While the one or more stirring members are disposed within the barrel and the barrel is disposed within the lumen of the stator, each stirring member of the one or more stirring members is
25 responsive to the electromagnetic field such that the electromagnetic field can cause a rotation of each stirring member of the one or more stirring members.

Such a self-stirring syringe system may optionally include one or more of the following features. The system may also include a syringe pump that can receive the stator while the syringe is disposed within the lumen of the stator. The syringe pump
30 may be operable to dispense a solution from the syringe concurrent with the rotation of each stirring member of the one or more stirring members. Each stirring member of the one or more stirring members may be disc-shaped. Each stirring member of the one or more stirring members may be rod-shaped. The stator may include four or

more cores. The system may also include a drive system for controllably supplying the electrical current to each core of the two or more cores.

In another implementation, a method of using a self-stirring syringe system includes: (a) positioning one or more stirring members within a barrel of a syringe, 5 each stirring member of the one or more stirring members being magnetic, each stirring member of the one or more stirring members sized to be movable within the barrel of the syringe; (b) disposing a solution within the barrel of the syringe; (c) while the one or more stirring members and the solution are within the barrel of the syringe, positioning the barrel of the syringe within a lumen defined by a stator, the 10 stator comprising two or more cores that each comprise a coiled winding of electrically conductive wire, wherein, while electrical current is passing through the coiled winding of electrically conductive wire, an electromagnetic field is generated from the respective core; and (d) while the barrel of the syringe is positioned within the lumen defined by the stator, supplying electrical current to each core of the two or 15 more cores, wherein said supplying electrical current causes responsive rotation of each stirring member of the one or more stirring members.

Such a method of using a self-stirring syringe system may optionally include one or more of the following features. In some embodiments, the supplying electrical current is supplied by a drive system that controllably supplies the electrical current to 20 each core of the two or more cores. The method may also include dispensing the solution from the syringe. The dispensing may be facilitated by a syringe pump coupled with the syringe and the stator. The dispensing may occur concurrently with the responsive rotation of each stirring member of the one or more stirring members.

Particular embodiments of the subject matter described in this document can 25 be implemented to realize one or more of the following advantages. In some cases, fluidic drugs have a tendency to stratify, separate, settle out, or otherwise become inhomogeneous. Using the self-stirring syringe devices and methods provided herein, such drugs can be maintained in a generally homogeneous state. The self-stirring syringes can be operated during processes such as infusion. Accordingly, 30 homogeneity of the drug can be advantageously facilitated throughout the duration of the infusion process. In some cases, standard syringes can be adapted for operation as a self-stirring syringe in accordance with the inventive concepts provided herein.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to

which this invention pertains. Although methods and materials similar or equivalent to those described herein can be used to practice the invention, suitable methods and materials are described herein. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety. In
5 case of conflict, the present specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting.

The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description herein. Other features, objects, and
10 advantages of the invention will be apparent from the description and drawings, and from the claims.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of an example self-stirring syringe
15 system in accordance with some embodiments provided herein.

FIG. 2 is a side view of the self-stirring syringe system of FIG. 1 in an assembled configuration.

FIG. 3 is a perspective view of an example stirring member in accordance with some embodiments provided herein.

20 FIG. 4 is a plan view of the stirring member of FIG. 3.

FIG. 5 is a perspective view of an example stator that can be used as part of the self-stirring syringe system of FIG. 1.

FIG. 6 is a perspective view of another example stirring member in accordance with some embodiments provided herein.

25 FIG. 7 is an exploded view of the stirring member of FIG. 6 and a barrel portion of a syringe.

FIG. 8 is an end view of the barrel portion of the syringe of FIG. 7 with the stirring member of FIG. 6 contained therein.

Like reference numbers represent corresponding parts throughout.
30

DETAILED DESCRIPTION

This document provides self-stirring syringe devices, systems, and methods for their use. For example, this document provides self-stirring syringes and syringe pumps that are designed to facilitate drug homogeneity as a controlled fluid infusion

rate is maintained. In some embodiments, the self-stirring syringe devices incorporate one or more discs loaded with magnets that are placed within the syringe. An external magnetic field is generated to spin the discs, thereby stirring the contents within the syringe.

5 Referring to **FIGS. 1 and 2**, an example self-stirring syringe system 100 can be used to facilitate fluidic drug homogeneity. Broadly speaking, self-stirring syringe system 100 includes a syringe 110, one or more stirring members 140, and a stator 160. Syringe 110 includes a plunger 112 and a barrel 118. In some embodiments, syringe 110 can be a standard type of syringe.

10 A solution (e.g., a pharmaceutical agent, chemotherapy agent, and any other type of medical fluid) can be contained within barrel 118 and retained in barrel 118 by plunger 112. The one or more stirring members 140 can also be disposed within barrel 118 and retained in barrel 118 by plunger 112. That is, the one or more stirring members 140 can be contained within syringe 110 along with the solution. The one
15 or more stirring members 140 can be mechanically free to spin within barrel 118. The one or more stirring members 140 can be magnetized, as described further below. The assembled syringe 110 containing the one or more stirring members 140 and solution can be placed within stator 160 for use as a self-stirring syringe system.

In use, stator 160 generates a dynamic magnetic field that inductively acts on
20 the magnetized one or more stirring members 140. More particularly, stator 160 can cause the one or more stirring members 140 to spin within barrel 118. Accordingly, the one or more stirring members 140 can agitate the solution contained within syringe 110. Such agitation can facilitate the creation and maintenance of homogeneity of the solution.

25 In some cases, self-stirring syringe system 100 can be used in conjunction with a syringe pump (not shown). In such a case, self-stirring syringe system 100 can be in operation (i.e., the one or more stirring members 140 can be spinning to agitate the solution contained within syringe 110) while the solution is dispensed from syringe 110 by the syringe pump. Accordingly, self-stirring syringe system 100 can
30 facilitate solution homogeneity as a controlled infusion of the solution is performed using a syringe pump.

Referring to **FIGS. 3 and 4**, an example stirring member 200 comprises a disc-like configuration. In the depicted embodiment, stirring member 200 includes a generally cylindrical peripheral frame 210, magnets 220a, 220b, 220c, 220d, fins 230,

and a hub 240. Magnets 220a, 220b, 220c, and 220d are coupled to peripheral frame 210. Fins 230 extend between hub 240 and peripheral frame 210.

In some embodiments, magnets 220a, 220b, 220c, and 220d are overmolded such that magnets 220a, 220b, 220c, and 220d are embedded within material (e.g., a thermoplastic material).

Stirring member 200 is configured to rotate about central axis 202 while in use with self-stirring syringe system 100 (FIGS. 1 and 2). In use, magnets 220a, 220b, 220c, and 220d are attracted by, and/or repelled from, magnetic fields created by stator 160 (as described further below). The magnetic fields created by stator 160 are dynamic and sequenced so as to induce rotation of stirring member 200.

One or more stirring members 200 can be included in self-stirring syringe system 100. For example, without limitation, in some embodiments one, two, three, four, five, six, seven, eight, nine, ten, or more than ten stirring members 200 can be included in self-stirring syringe system 100.

In some embodiments, the polarities of magnets 220a, 220b, 220c, and 220d are arranged such that the north pole of each magnet 220a, 220b, 220c, and 220d is radially outward and the south pole of each magnet 220a, 220b, 220c, and 220d is radially inward (toward hub 240). In some embodiments, the polarities of magnets 220a, 220b, 220c, and 220d are arranged such that the south pole of each magnet 220a, 220b, 220c, and 220d is radially outward and the north pole of each magnet 220a, 220b, 220c, and 220d is radially inward (toward hub 240). In some embodiments, the polarities of magnets 220a, 220b, 220c, and 220d are arranged such that the north poles of some magnets 220a, 220b, 220c, or 220d are radially outward and the south poles of the other magnets 220a, 220b, 220c, or 220d are radially inward (toward hub 240).

As stirring member 200 is rotating, fins 230 create turbulence to stir the solution in which stirring member 200 is disposed. Fins 230 can have any suitable shape such as, but not limited to, foils, blades, plates, contoured plates, and the like, and combinations thereof. In some embodiments, fins 230 extend beyond the geometric envelop of peripheral frame 210.

In some embodiments, hub 240 includes a magnet. Such a magnet can serve to separate adjacent stirring members 200 contained within a syringe. For example, when adjacent stirring members 200 have magnets in hub 240, and like poles of the magnets are facing each other, the magnetic forces between the magnets of the

adjacent stirring members 200 will repel so as to advantageously separate adjacent stirring members 200. In some embodiments, a shaft can be positioned through hub 240 of two or more stirring members 200, and the two or more stirring members 200 can be maintained in a spaced apart relationship along the shaft.

5 Referring to **FIG. 5**, an example stator 300 can be used with self-stirring syringe system 100 (FIGS. 1 and 2). In the depicted embodiment, stator 300 includes a cylindrical periphery 310 and a plurality of cores 320. The plurality of cores 320 define a lumen 340 that can slidably receive a syringe (e.g., FIG. 2).

In the depicted embodiment, twelve cores 320 are included. However, twelve
10 cores 320 are not required in all embodiments. In some embodiments, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, or more than sixteen cores 320 are included. The cores 320 can be equally spaced around cylindrical periphery 310. For example, when four cores 320 are included, each core 320 can be spaced at 90° apart from each other. In the depicted
15 embodiment, each core 320 of the twelve cores 320 is spaced at 30° apart from each other.

Each core of the plurality of cores 320 can include a coiled winding of wire thereon that can generate an electromagnetic field while electric current is passing through the wire. Using a commercially available motor drive system (not shown),
20 the currents supplied to each core 320 can be sequentially controlled (turned on and off) so that rotary motion is induced to a stirring member. In some cases, a three-phase AC motor drive system can be used. In some cases, a brushless DC motor drive system can be used. In general, any suitable commercially available or custom designed drive system can be used to supply electric current to the cores 320 in the
25 desired sequential manner.

In some embodiments, the plurality of cores 320 are made of an insulating material. In some embodiments, the plurality of cores 320 are made of an electrically conductive material. In some such embodiments, individual cores of the plurality of cores 320, while individually electrically conductive, are electrically insulated from
30 each other.

Referring to **FIGS. 6–8**, another example stirring member 400 can be used with self-stirring syringe system 100 (FIGS. 1 and 2). Stirring member 400 is rod-shaped and configured to rotate about central axis 402 (FIG. 6) while in use with self-stirring syringe system 100 (as depicted by arrow 420 in FIG. 8).

One or more stirring members 400 can be included in self-stirring syringe system 100. For example, without limitation, in some embodiments one, two, three, four, five, six, seven, eight, nine, ten, or more than ten stirring members 400 can be included in self-stirring syringe system 100.

5 In the depicted embodiment, stirring member 400 comprises a plurality of individual magnets 410 that are stacked together. The individual magnets 410 are arranged such that one end of stirring member 400 has a north pole and the opposite end of stirring member has a south pole. In use, the poles of stirring member 400 are attracted by, and/or repelled from, magnetic fields created by stator 160. The
10 magnetic fields created by stator 160 are dynamic and sequenced so as to induce rotation of stirring member 400 (as depicted by arrow 420).

 In some embodiments, the individual magnets 410 are encased within a sleeve material or coating. Such a sleeve material or coating can be biocompatible and inert. In some embodiments, stirring member 400 is flexible so that when the syringe is
15 close to empty the plunger of the syringe can deform stirring member 400 to reduce the amount of dead space within the syringe.

 While this specification contains many specific implementation details, these should not be construed as limitations on the scope of any invention or of what may be claimed, but rather as descriptions of features that may be specific to particular
20 embodiments of particular inventions. Certain features that are described in this specification in the context of separate embodiments can also be implemented in combination in a single embodiment. Conversely, various features that are described in the context of a single embodiment can also be implemented in multiple
25 embodiments separately or in any suitable subcombination. Moreover, although features may be described herein as acting in certain combinations and even initially claimed as such, one or more features from a claimed combination can in some cases be excised from the combination, and the claimed combination may be directed to a subcombination or variation of a subcombination.

 Similarly, while operations are depicted in the drawings in a particular order,
30 this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order, or that all illustrated operations be performed, to achieve desirable results. In certain circumstances, multitasking and parallel processing may be advantageous. Moreover, the separation of various system modules and components in the embodiments described herein should not be

understood as requiring such separation in all embodiments, and it should be understood that the described program components and systems can generally be integrated together in a single product or packaged into multiple products.

Particular embodiments of the subject matter have been described. Other
5 embodiments are within the scope of the following claims. For example, the actions recited in the claims can be performed in a different order and still achieve desirable results. As one example, the processes depicted in the accompanying figures do not necessarily require the particular order shown, or sequential order, to achieve desirable results. In certain implementations, multitasking and parallel processing
10 may be advantageous.

WHAT IS CLAIMED IS:

1. A kit for adapting a syringe to be a self-stirring syringe, the kit comprising:
 - one or more stirring members, each stirring member of the one or more stirring members being magnetic, each stirring member of the one or more stirring members sized to be movable within a barrel of the syringe; and
 - a stator that defines a lumen sized to slidably receive the barrel of the syringe, the stator comprising two or more cores that each comprise a coiled winding of electrically conductive wire,
 - wherein, while electrical current is passing through the coiled winding of electrically conductive wire, an electromagnetic field is generated from the respective core, and wherein each stirring member of the one or more stirring members is magnetically responsive to the electromagnetic field.
2. The kit of claim 1, wherein each stirring member of the one or more stirring members is disc-shaped.
3. The kit of claim 1, wherein each stirring member of the one or more stirring members is rod-shaped.
4. The kit of claim 1, wherein the stator comprises four or more cores.
5. The kit of claim 1, further comprising a drive system for controllably supplying the electrical current to each core of the two or more cores.
6. A self-stirring syringe system comprising:
 - a syringe comprising a plunger and a barrel that slidably receives the plunger;
 - one or more stirring members, each stirring member of the one or more stirring members being magnetic, each stirring member of the one or more stirring members sized to be movable within the barrel of the syringe; and
 - a stator that defines a lumen sized to slidably receive the barrel of the syringe, the stator comprising two or more cores that each comprise a coiled winding of electrically conductive wire,

wherein, while electrical current is passing through the coiled winding of electrically conductive wire, an electromagnetic field is generated from the respective core, and

wherein, while the one or more stirring members are disposed within the barrel and the barrel is disposed within the lumen of the stator, each stirring member of the one or more stirring members is responsive to the electromagnetic field such that the electromagnetic field can cause a rotation of each stirring member of the one or more stirring members.

7. The system of claim 6, further comprising a syringe pump that can receive the stator while the syringe is disposed within the lumen of the stator, wherein the syringe pump is operable to dispense a solution from the syringe concurrent with said rotation of each stirring member of the one or more stirring members.

8. The system of claim 6, wherein each stirring member of the one or more stirring members is disc-shaped.

9. The system of claim 6, wherein each stirring member of the one or more stirring members is rod-shaped.

10. The system of claim 6, wherein the stator comprises four or more cores.

11. The system of claim 6, further comprising a drive system for controllably supplying the electrical current to each core of the two or more cores.

12. A method of using a self-stirring syringe system, the method comprising:

positioning one or more stirring members within a barrel of a syringe, each stirring member of the one or more stirring members being magnetic, each stirring member of the one or more stirring members sized to be movable within the barrel of the syringe;

disposing a solution within the barrel of the syringe;

while the one or more stirring members and the solution are within the barrel of the syringe, positioning the barrel of the syringe within a lumen defined by a stator, the stator comprising two or more cores that each comprise a coiled winding of

electrically conductive wire, wherein, while electrical current is passing through the coiled winding of electrically conductive wire, an electromagnetic field is generated from the respective core; and

while the barrel of the syringe is positioned within the lumen defined by the stator, supplying electrical current to each core of the two or more cores, wherein said supplying electrical current causes responsive rotation of each stirring member of the one or more stirring members.

13. The method of claim 12, wherein said supplying electrical current is supplied by a drive system that controllably supplies the electrical current to each core of the two or more cores.

14. The method of claim 12, further comprising dispensing the solution from the syringe, wherein said dispensing is facilitated by a syringe pump coupled with the syringe and the stator.

15. The method of claim 14, wherein said dispensing occurs concurrently with said responsive rotation of each stirring member of the one or more stirring members.

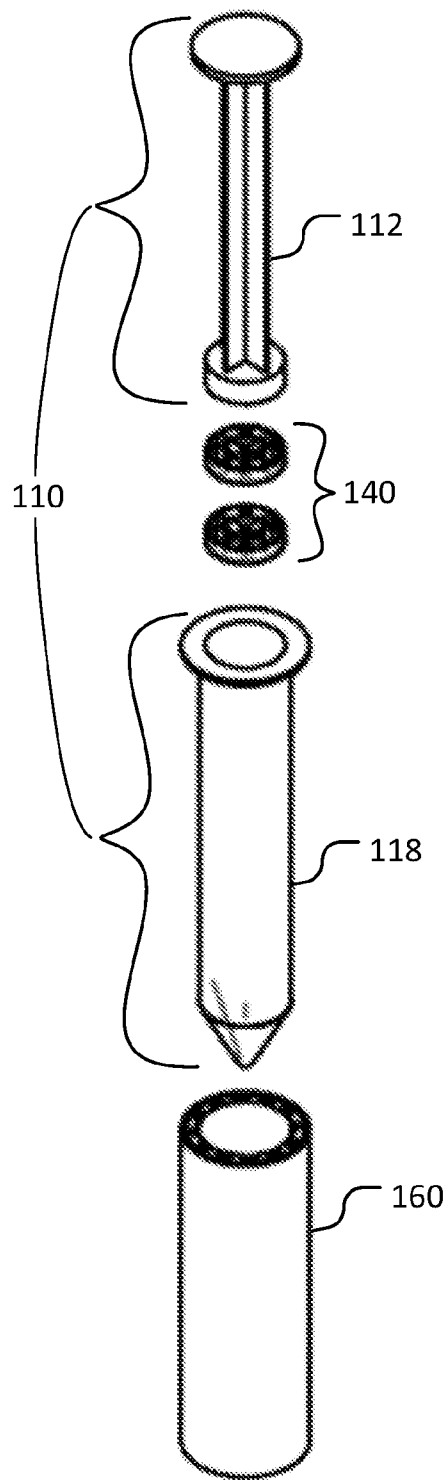


FIG. 1

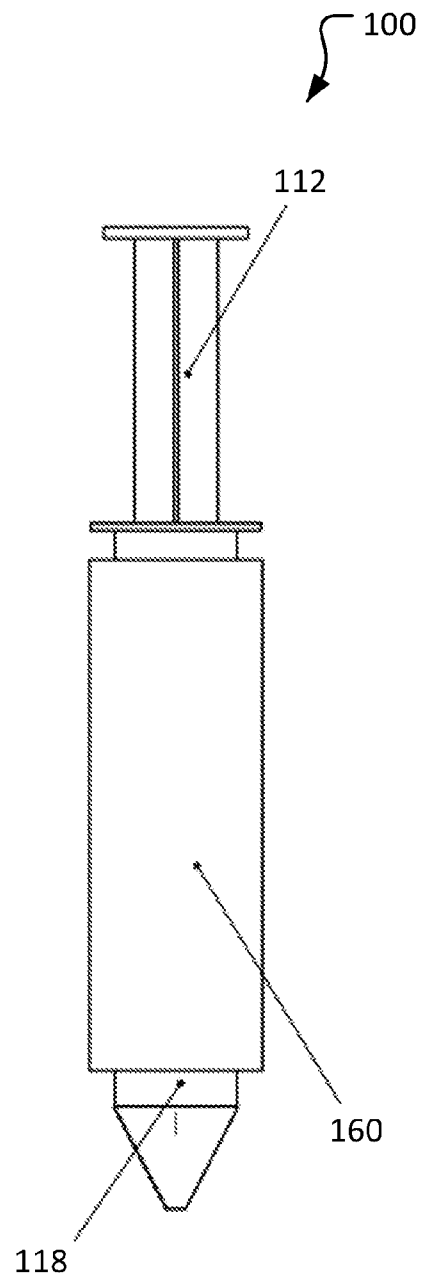


FIG. 2

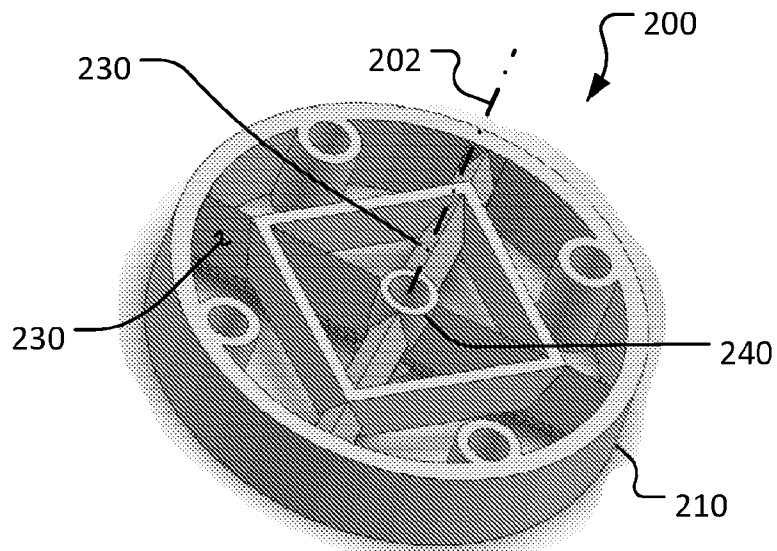


FIG. 3

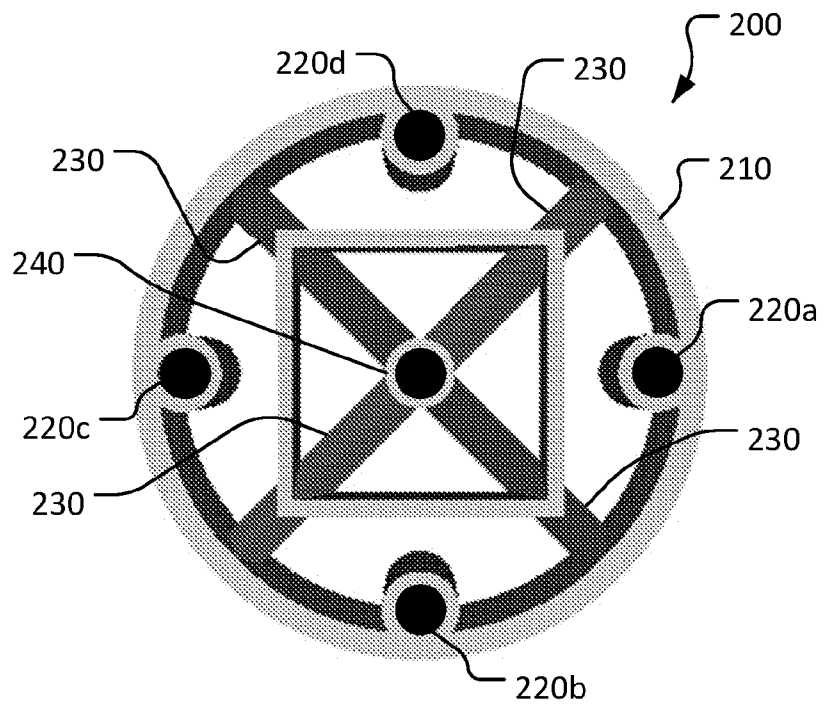


FIG. 4

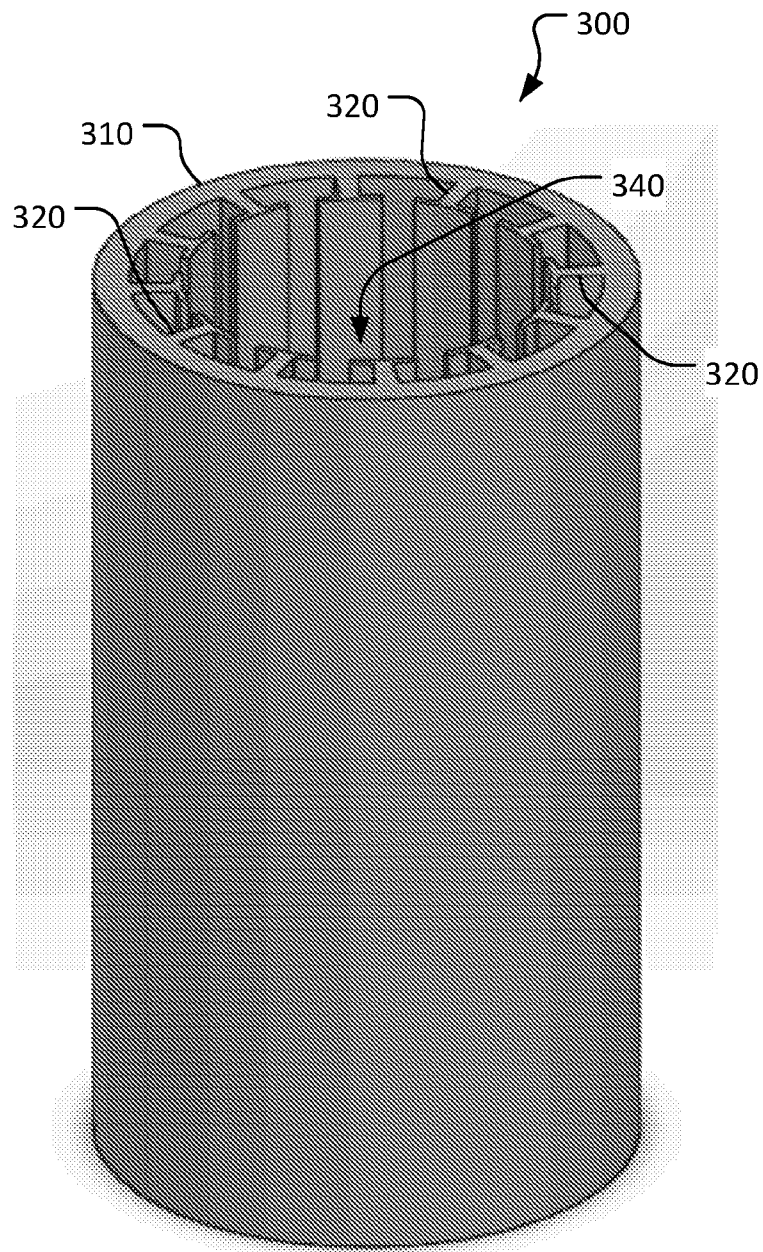
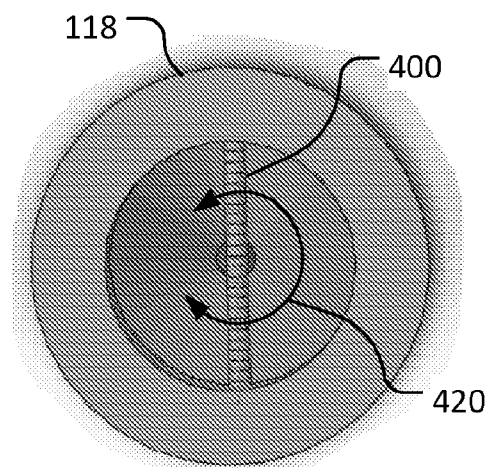
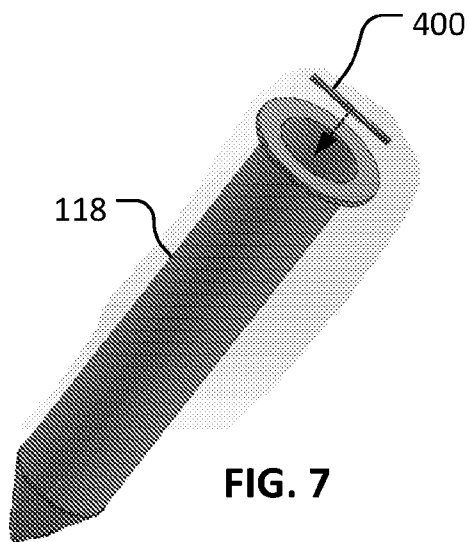
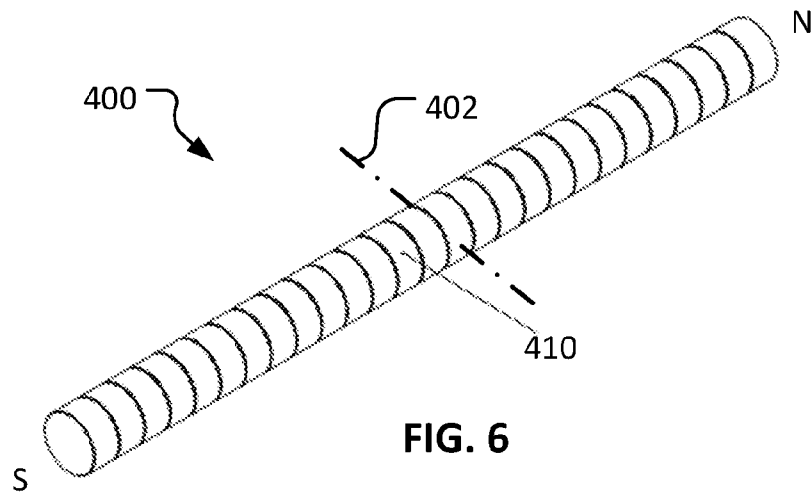


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 17/31732

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: claims 1-11, drawn to a self stirring syringe

Group II: claims 12-15, drawn to method of using a self-stirring syringe

The inventions listed as Groups I - II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

----- see continuation sheet -----

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-11

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 17/31732

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(8) - A61M 5/178, B01F 13/08 (2017.01)
 CPC - B01F 13/08, A61F 5/178, A61M 1/025, A61M 1/0204

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History Document

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

See Search History Document

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

See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 6,706,020 B1 (URICH) 16 March 2004 (16.03.2004) Entire document, especially Abstract, col 2, ln 10-19, col 5, ln 33-48 and FIG. 2.	1, 4-7, 10-11 ----- 2-3, 8-9
Y	US 5,725,500 A (MICHELER) 10 March 1998 (10.03.1998) Entire document, especially Abstract, col 3, ln 40-51, col 6, ln 30-50 and FIGS. 13-17.	2, 8
Y	TW 201103644 A1 (POWER LIGHT TECH CO LTD) 01 February 2011 (01.02.2011) Entire document, especially Abstract, para[0017]- para[0018] and FIGS.	3, 9
A	DE 3934024 A1 (WILDANGER HANS JOERG) 18 April 1991 (18.04.1991) Entire document.	1-11
A	US 5,352,036 A (HABER et al.) 04 October 1994 (04.10.1994) Entire document.	1-11
A	US 6,033,377 A (RASMUSSEN et al.) 07 March 2000 (07.03.2000) Entire document.	1-11
A	US 8,469,924 B2 (NGUYEN et al.) 25 June 2013 (25.06.2013) Entire document.	1-11

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

☐ See patent family annex.

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Date of the actual completion of the international search

21 August 2017

Date of mailing of the international search report

18 SEP 2017

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INTERNATIONAL SEARCH REPORT

International application No.

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----- Continuation of Box III: Observations where unity of invention is lacking (Continuation of item 3 of first sheet) -----

Group II includes the special technical features of method steps including particular use steps (claim 12) disposing a solution within the barrel of the syringe; while the one or more stirring members and the solution are within the barrel of the syringe, positioning the barrel; electrical current causes responsive rotation, not required by Group I.

Group I-II are related to an apparatus (Group I) and method(s) of using the apparatus (Group II). These groups therefore share the technical features of the apparatus of claim 1, however, these shared technical features fail to provide a contribution over the prior art of US 6,706,020 B1 (ULRICH). Ulrich describes a kit for adapting a syringe to be a self-stirring syringe (Abstract, FIG. 2; col 5, ln 35-40), the kit comprising: one or more stirring members (agitation element 15 ... ball, FIG. 2; col 5, ln 40-41), each stirring member of the one or more stirring members being magnetic (ferromagnetic or magnetic agitation element: col 2, ln 10-19), each stirring member of the one or more stirring members sized to be movable within a barrel of the syringe (FIG. 2; col 5, ln 40-41) and a stator that defines a lumen (magnetic collar 17, FIG. 2; col 5, ln 33-40) sized to slidably receive the barrel of the syringe (FIG. 2; col 5, ln 25-26), the stator comprising two or more cores that each comprise a coiled winding of electrically conductive wire (individually activated coils 16, FIG. 2; col 5, ln 33-40), wherein, while electrical current is passing through the coiled winding of electrically conductive wire, an electromagnetic field is generated from the respective core, and wherein each stirring member of the one or more stirring members is magnetically responsive to the electromagnetic field (col 5, ln 33-42).

Thus, Groups I-II lack unity of invention because they do not share a same or corresponding special technical feature providing a contribution over the prior art.

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