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(54) **Title:** SHOOTING-POT ASSEMBLY HAVING RESIN-MIXING ASSEMBLY

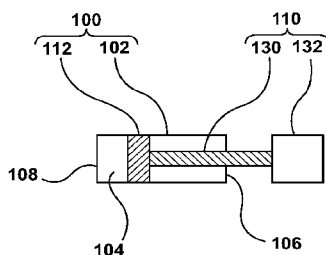


FIG. 2A

(57) **Abstract:** The inventors have researched a problem associated with known molding systems that inadvertently manufacture bad-quality molded articles or parts. After much study, the inventors believe they have arrived at an understanding of the problem and its solution, which are stated below, and the inventors believe this understanding is not known to the public. Shooting pots are used in the injection molding machinery to generate pressure required to fill mold cavities with molten plastic. A piston displaces some volume of the molten plastic, increasing the pressure and forcing resin into one or a number of mold cavities. Shooting pots do not generally mix the incoming melt stream very well. A homogenous melt stream entering a mold assembly is very important for both part quality and cycle time.



SHOOTING-POT ASSEMBLY HAVING RESIN-MIXING ASSEMBLY**TECHNICAL FIELD**

5 An aspect generally relates to (but is not limited to) a shooting-pot assembly.

SUMMARY

10 The inventors have researched a problem associated with known molding systems that inadvertently manufacture bad-quality molded articles or parts. After much study, the inventors believe they have arrived at an understanding of the problem and its solution, which are stated below, and the inventors believe this understanding is not known to the public.

15 Shooting pots are used in the injection molding machinery to generate pressure required to fill mold cavities with molten plastic. A piston displaces some volume of the molten plastic, increasing the pressure and forcing resin into one or a number of mold cavities. Shooting pots do not generally mix the incoming melt stream very well. A homogenous melt stream entering a mold assembly is very important for both part
20 quality and cycle time.

To resolve the above identified problem, at least in part, there is provided, according to at least one aspect, a shooting-pot assembly (**100**), comprising: a plunger-receiving chamber assembly (**102**); and a resin-mixing assembly (**112**) being
25 received, at least in part, in the plunger-receiving chamber assembly (**102**).

Other aspects and features of the non-limiting embodiments will now become apparent to those skilled in the art upon review of the following detailed description of the non-limiting embodiments with the accompanying drawings.

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DETAILED DESCRIPTION OF THE DRAWINGS

The non-limiting embodiments will be more fully appreciated by reference to the following detailed description of the non-limiting embodiments when taken in
35 conjunction with the accompanying drawings, in which:

FIGS. 1A, 1B, 2A, 2B, 3A, 3B, 3C, 3D depict schematic representations of examples of a shooting-pot assembly (**100**).

The drawings are not necessarily to scale and may be illustrated by phantom lines, diagrammatic representations and fragmentary views. In certain instances, details not necessary for an understanding of the embodiments (and/or details that render other details difficult to perceive) may have been omitted.

DETAILED DESCRIPTION OF THE NON-LIMITING EMBODIMENT(S)

FIGS. 1A, 1B, 2A, 2B, 3A, 3B, 3C, 3D depict the schematic representations of the examples of the shooting-pot assembly (**100**). The shooting-pot assembly (**100**) may include components that are known to persons skilled in the art, and these known components will not be described here; these known components are described, at least in part, in the following reference books (for example): (i) "Injection Molding Handbook" authored by OSSWALD/TURNIG/GRAMANN (ISBN: 3-446-21669-2), (ii) "Injection Molding Handbook" authored by ROSATO AND ROSATO (ISBN: 0-412-99381-3), (iii) "Injection Molding Systems" 3rd Edition authored by JOHANNABER (ISBN 3-446-17733-7) and/or (iv) "Runner and Gating Design Handbook" authored by BEAUMONT (ISBN 1-446-22672-9). It will be appreciated that for the purposes of this document, the phrase "includes (but is not limited to)" is equivalent to the word "comprising." The word "comprising" is a transitional phrase or word that links the preamble of a patent claim to the specific elements set forth in the claim that define what the invention itself actually is. The transitional phrase acts as a limitation on the claim, indicating whether a similar device, method, or composition infringes the patent if the accused device (etc) contains more or fewer elements than the claim in the patent. The word "comprising" is to be treated as an open transition, which is the broadest form of transition, as it does not limit the preamble to whatever elements are identified in the claim.

Generally speaking, with reference to all of the FIGS, the shooting-pot assembly (**100**) includes (and is not limited to): a plunger-receiving chamber assembly (**102**), and (ii) a resin-mixing assembly (**112**) received, at least in part, in the plunger-receiving chamber assembly (**102**).

Referring now to FIG. 1A, there is depicted a first example of a schematic representation of the shooting-pot assembly (100). In accordance with FIG. 1A, the shooting-pot assembly (100) includes (and is not limited to) a resin-receiving end (106) that is configured for fluid connection with a melt-preparation assembly (200). Examples of the melt-preparation assembly (200) include, by way of example and not limited to: an extruder unit, a reciprocating screw unit, a twin screw unit, a single screw unit combined with a shooting pot, etc. In addition, the shooting-pot assembly (100) includes (and is not limited to) a resin-ejection end (108) that is configured for fluid connection with a mold assembly (202). The mold assembly (202) may include one or more mold cavities.

Referring now to FIG. 1B, there is depicted a second example of a schematic representation of the shooting-pot assembly (100). In accordance with FIG. 1B, the shooting-pot assembly (100) includes (and is not limited to) the resin-ejection end (108) that is configured for fluid connection with a melt-distribution assembly (204), and the melt-distribution assembly (204) is fluidly connected to the mold assembly (202). The melt-distribution assembly (204) may also be called a hot runner assembly or a cold runner assembly, etc. It will be appreciated that many variations may be realized in view of the foregoing, such as: (i) the melt-preparation assembly (200) may be provided with the shooting-pot assembly (100), (ii) the mold assembly (202) may be provided with the shooting-pot assembly (100), (iii) the melt-distribution assembly (204) may be provided with the shooting-pot assembly (100), and (iv) a molding system (900) may be provided with the shooting-pot assembly (100). In addition, the molding system (900) may be provided with a combination of the shooting-pot assembly (100), the melt-preparation assembly (200), the mold assembly (202), and the melt-distribution assembly (204). In addition, the molding system (900) may be provided with a combination of the shooting-pot assembly (100), the melt-preparation assembly (200), and the melt-distribution assembly (204), and for this case, the mold assembly (202) is provided by another vendor. The shooting-pot assembly (100) may be positioned and/or may be used in an envelope defined by a platen system of the molding system (900), such as an injection-molding system for example. The platen system may include a stationary platen and a movable platen that is moveable relative to the stationary platen.

Referring now to FIG. 2A, there is depicted a cross-sectional view of a third example of the shooting-pot assembly (100). The shooting-pot assembly (100) is adapted so that the plunger-receiving chamber assembly (102) defines a resin-flow passageway (104) extending, at least in part, between a resin-receiving end (106) and a resin-ejection end (108). The resin-mixing assembly (112) is configured to mix, at least in part, a resin made to move along the resin-flow passageway (104) of the plunger-receiving chamber assembly (102) from the resin-receiving end (106) to the resin-ejection end (108). More specifically, the shooting-pot assembly (100), as depicted in FIG. 2A, further includes (and is not limited to): a plunger assembly (110) configured to: (i) be reciprocatably movable along the plunger-receiving chamber assembly (102), and (ii) move, at least in part, a resin along the a resin-flow passageway (104) of the plunger-receiving chamber assembly (102) from the resin-receiving end (106) to the resin-ejection end (108). According to the example of FIG. 2A, the resin-mixing assembly (112) is entirely positioned in the resin-flow passageway (104) of the plunger-receiving chamber assembly (102). According to the example of FIG. 2A, the resin-mixing assembly (112) is supported by the plunger assembly (110). It will be appreciated that according to other variations, position the resin-mixing assembly (112), for example, may be at the inner surface of the plunger-receiving chamber assembly (102) without interference with operation of the plunger assembly (110). By way of example, the plunger assembly (110) includes (and is not limited to): a rod assembly (130), and a rod actuator (132) configured to actuate reciprocatable movement of the rod assembly (130). It will be appreciated that a method of operating the shooting-pot assembly (100) includes (and is not limited to): receiving, at least in part, the resin-mixing assembly (112) in the plunger-receiving chamber assembly (102). The method may further include (and is not limited to): mixing, at least in part, the resin made to move along a resin-flow passageway (104) of the plunger-receiving chamber assembly (102) from the resin-receiving end (106) to the resin-ejection end (108), the resin-flow passageway (104) extending, at least in part, between the resin-receiving end (106) and the resin-ejection end (108). The rod actuator (132) is configured such that the rod assembly (130) may be forced to move in a forward and backward axial direction along the plunger-receiving chamber assembly (102). Moving the rod assembly (130) backwards refills the plunger-receiving chamber assembly (102). Once the plunger-receiving chamber assembly (102) is full according to a specified shot size (for example but not limited to this example), moving the rod assembly (130) forwards displaces a volume of the resin,

thus pressurizing the resin and pushing (ejecting) the resin out from the resin-ejection end (108).

Referring now to FIG. 2B, there is depicted a perspective view of a fourth example of the shooting-pot assembly (100), in which the resin-mixing assembly (112) includes (and is not limited to) a mixer body (150). Mixer passages (152) are defined by the mixer body (150). A central stem passage (154) is also defined by the mixer body (150). A stem assembly (120) extends from a distal end of the plunger assembly (110). The stem assembly (120) is removably connected to the plunger assembly (110). The tip of the stem assembly (120) includes first stop (122) that is removably connected to the plunger assembly (110). The central stem passage (154) is configured to slidably receive the stem assembly (120), and then the first stop may be connected to the tip of the stem assembly (120).

Referring now to FIGS. 3A, 3B, 3C, 3D, there are depicted a perspective view of a fifth example of the shooting-pot assembly (100) in various states of operation.

Referring now to FIG. 3A, generally speaking, the resin-mixing assembly (112) is slidably connected to the distal end of the plunger assembly (110), and the resin-mixing assembly (112) faces the resin-ejection end (108) of the plunger-receiving chamber assembly (102). More specifically, the plunger assembly (110) includes (and is not limited to): a stem assembly (120), a first stop (122), and a second stop (124). The stem assembly (120) extends from a distal end of the plunger assembly (110), and the stem assembly (120) faces the resin-ejection end (108). The first stop (122) extends, at least in part, radially from the stem assembly (120). The second stop (124) extends, at least in part, radially from the stem assembly (120). The second stop (124) is set apart from the first stop (122). The stem assembly (120) is configured to accommodate movement of the resin-mixing assembly (112) between the first stop (122) and the second stop (124) along the stem assembly (120) of the plunger assembly (110), so that the resin-mixing assembly (112) faces the resin-ejection end (108) of the plunger-receiving chamber assembly (102). For the case where the resin-mixing assembly (112) abuts the second stop (124), the resin-mixing assembly (112) prevents flow of the toward the resin-ejection end (108). For the case where the resin-mixing assembly (112) is set apart from the second stop (124), the resin-mixing assembly (112) permits flow of the toward the resin-ejection end (108).

For the case where the resin-mixing assembly (112) abuts the first stop (122), the resin-mixing assembly (112) avoids contact with the resin-ejection end (108).

5 According to the fifth example of shooting-pot assembly (100), the resin flows from resin-receiving end (106) to resin-ejection end (108) in a first in first out manner so that improved flushing out of the plunger-receiving chamber assembly (102), less degradation of the resin due to over heating, reduced time for color changes, etc. As well, the resin-mixing assembly (112) is integrated with the rod assembly (130) so that there is no further need of a check valve or a shut-off valve. The resin may only
10 require enough back pressure to fill the plunger-receiving chamber assembly (102). According to known shooting pot chambers, they are used in the following manner: they are filled from a front (i.e., a plunger-facing side) and thus the first resin to fill the chamber is the last resin to leave the chamber in accordance with a first in last out (FIFO) manner. The FIFO approach or manner may cause significant problems in
15 color change applications and resin degradation as there is not a clean flush-out of the molten resin from the known shooting pot chamber for each cycle. In sharp contrast to the examples of the shooting-pot assembly (100) of FIGS. 3A to 3D, the opposite is approach is depicted in which the resin flows in accordance with a first in and first out manner; the resin enters resin-receiving end (106) and then exists resin-
20 ejection end (108), so thus the resin is flushed out of the shooting-pot assembly (100) more readily.

Referring now to FIG. 3A, the shooting-pot assembly (100) is depicted as being filled with the resin, and the resin is ready to be ejected or pushed out from the resin-
25 ejection end (108). The resin-mixing assembly (112) is positioned or placed in a checked position; that is, the resin-mixing assembly (112) does not permit further flow of resin from the resin-receiving end (106) to the resin-ejection end (108). The resin-mixing assembly (112) is depicted as abutting the second stop (124). The rod actuator (132), depicted in FIG. 2A, will be actuated to push the rod assembly (130)
30 toward the resin-ejection end (108). The resin-mixing assembly (112) may include or may define tortuous holes or passages to further improve mixing of the resin.

Referring now to FIG. 3B, the rod assembly (130) has been moved closer to the resin-ejection end (108) so that the resin, at least in part, has been ejected from the
35 resin-ejection end (108) of the plunger-receiving chamber assembly (102), so that

the mold assembly (202) may be filled with the resin (for example). The resin-mixing assembly (112) remains in the checked position; that is, the resin-mixing assembly (112) abuts the second stop (124).

5 Referring now to FIG. 3C, the plunger assembly (110) is retracted so that the tip of the rod assembly (130) is moved away from the resin-ejection end (108). During retraction of the rod assembly (130), the plunger-receiving chamber assembly (102) may be refilled, at least in part, with fresh (new) resin. The resin-mixing assembly (112) is depicted in an unchecked position; that is the resin-mixing assembly (112)
10 no longer abuts the second stop (124) so that resin may flow through the passages defined by the resin-mixing assembly (112). As the resin is made to flow toward the resin-ejection end (108), the resin-mixing assembly (112) moves toward and then abuts the first stop (122).

15 Referring now to FIG. 3D, the plunger assembly (110) is further retracted so that more resin may flow past the resin-mixing assembly (112) thus refilling the portion of the plunger-receiving chamber assembly (102) closest to the resin-ejection end (108), which may be called the front end of the plunger-receiving chamber assembly (102). The resin-mixing assembly (112) mixes the resin that passes through and past
20 the resin-mixing assembly (112) as the plunger-receiving chamber assembly (102) receives fresh resin entering from the resin-receiving end (106).

When the rod assembly (130) is drawn backward toward the resin-receiving end (106), the resin may leak through the holes or passages defined by the resin-mixing
25 assembly (112), thus refilling the plunger-receiving chamber assembly (102) with new resin. When the rod assembly (130) is moved in a forward direction toward the resin-ejection end (108), a portion of the rod assembly (130) covers the holes of the resin-mixing assembly (112) thus the resin is prevented from passing through the resin-mixing assembly (112), and so that a pressure may be generated on the
30 forward side of the resin-mixing assembly (112) that faces the resin-ejection end (108).

It will be appreciated that generally, the resin-mixing assembly (112) mixes, in use, the resin stream as the resin refills the plunger-receiving chamber assembly (102).
35 According to one option, to further promote mixing of the resin prior to the resin

leaving or exiting from the resin-ejection end (108), the resin-mixing assembly (112) may be arranged in such a way to direct melt from an outside of the resin stream to mix with the resin located on the inside of the resin stream. According to another option, to further promote mixing of the resin, prior to the resin leaving or exiting from the resin-ejection end (108), a helical screw geometry (300) may be included along a length of the plunger assembly (110). As the plunger assembly (110) is made to move through the resin, the resin may be forced to move through the helical screw geometry (300) and thus further promote mixing of the resin.

ADDITIONAL DESCRIPTION

The following clauses are offered as further description of the examples of the shooting-pot assembly (100): Clause (1): a shooting-pot assembly (100), comprising: a plunger-receiving chamber assembly (102); and a resin-mixing assembly (112) being received, at least in part, in the plunger-receiving chamber assembly (102). Clause (2): the shooting-pot assembly (100) of any clause mentioned in this paragraph, wherein: the plunger-receiving chamber assembly (102) defines a resin-flow passageway (104) extending, at least in part, between a resin-receiving end (106) and a resin-ejection end (108); and the resin-mixing assembly (112) is configured to mix, at least in part, a resin being made to move along the resin-flow passageway (104) of the plunger-receiving chamber assembly (102) from the resin-receiving end (106) to the resin-ejection end (108). Clause (3): the shooting-pot assembly (100) of any clause mentioned in this paragraph, further comprising: a plunger assembly (110) being configured to: (i) be reciprocatably movable along the plunger-receiving chamber assembly (102), and (ii) move, at least in part, a resin along the a resin-flow passageway (104) of the plunger-receiving chamber assembly (102) from the resin-receiving end (106) to the resin-ejection end (108). Clause (4): the shooting-pot assembly (100) of any clause mentioned in this paragraph, wherein: the resin-mixing assembly (112) is entirely positioned in the resin-flow passageway (104) of the plunger-receiving chamber assembly (102). Clause (5): the shooting-pot assembly (100) of any clause mentioned in this paragraph, wherein: the resin-mixing assembly (112) is supported by the plunger assembly (110). Clause (6): the shooting-pot assembly (100) of any clause mentioned in this paragraph, wherein: the resin-mixing assembly (112) is slidably connected to a distal end of the plunger assembly (110), and the resin-mixing assembly (112) faces the resin-ejection end

(108) of the plunger-receiving chamber assembly (102). Clause (7): the shooting-pot assembly (100) of any clause mentioned in this paragraph, wherein: the plunger assembly (110) includes: a stem assembly (120) extending from a distal end of the plunger assembly (110), the stem assembly (120) facing the resin-ejection end (108);
5 a first stop (122) extending, at least in part, radially from the stem assembly (120); a second stop (124) extending, at least in part, radially from the stem assembly (120), the second stop (124) being set apart from the first stop (122); wherein the stem assembly (120) is configured to accommodate movement of the resin-mixing assembly (112) between the first stop (122) and the second stop (124) along the
10 stem assembly (120) of the plunger assembly (110), so that the resin-mixing assembly (112) faces the resin-ejection end (108) of the plunger-receiving chamber assembly (102), for the case where the resin-mixing assembly (112) abuts the second stop (124), the resin-mixing assembly (112) prevents flow of the toward the resin-ejection end (108), for the case where the resin-mixing assembly (112) is set
15 apart from the second stop (124), the resin-mixing assembly (112) permits flow of the toward the resin-ejection end (108), and for the case where the resin-mixing assembly (112) abuts the first stop (122), the resin-mixing assembly (112) avoids contact with the resin-ejection end (108). Clause (8): the shooting-pot assembly (100) of any clause mentioned in this paragraph, wherein: the plunger assembly
20 (110) includes: a rod assembly (130); and a rod actuator (132) configured to actuate reciprocable movement of the rod assembly (130). Clause (9): the shooting-pot assembly (100) of any clause mentioned in this paragraph, wherein: the resin-receiving end (106) is configured for fluid connection with a melt-preparation assembly (200). Clause (10): the shooting-pot assembly (100) of any clause
25 mentioned in this paragraph, wherein: the resin-ejection end (108) is configured for fluid connection with a mold assembly (202). Clause (11): the shooting-pot assembly (100) of any clause mentioned in this paragraph, wherein: the resin-ejection end (108) is configured for fluid connection with a melt-distribution assembly (204), and the melt-distribution assembly (204) fluidly connected to a mold assembly (202).
30 Clause (12): the shooting-pot assembly (100) of any clause mentioned in this paragraph, wherein: the resin-mixing assembly (112) includes a helical screw geometry (300) along a length of the plunger assembly (110).

It will be appreciated that the assemblies and modules described above may be
35 connected with each other as may be required to perform desired functions and

tasks that are within the scope of persons of skill in the art to make such combinations and permutations without having to describe each and every one of them in explicit terms. There is no particular assembly, components, or software code that is superior to any of the equivalents available to the art. There is no particular mode of practicing the inventions and/or examples of the invention that is superior to others, so long as the functions may be performed. It is believed that all the crucial aspects of the invention have been provided in this document. It is understood that the scope of the present invention is limited to the scope provided by the independent claim(s), and it is also understood that the scope of the present invention is not limited to: (i) the dependent claims, (ii) the detailed description of the non-limiting embodiments, (iii) the summary, (iv) the abstract, and/or (v) description provided outside of this document (that is, outside of the instant application as filed, as prosecuted, and/or as granted). It is understood, for the purposes of this document, the phrase "includes (and is not limited to)" is equivalent to the word "comprising." It is noted that the foregoing has outlined the non-limiting embodiments (examples). The description is made for particular non-limiting embodiments (examples). It is understood that the non-limiting embodiments are merely illustrative as examples.

WHAT IS CLAIMED IS:

1. A shooting-pot assembly (**100**), comprising:
 - a plunger-receiving chamber assembly (**102**); and
 - 5 a resin-mixing assembly (**112**) being received, at least in part, in the plunger-receiving chamber assembly (**102**).
2. The shooting-pot assembly (**100**) of claim 1, wherein:
 - the plunger-receiving chamber assembly (**102**) defines a resin-flow
 - 10 passageway (**104**) extending, at least in part, between a resin-receiving end (**106**) and a resin-ejection end (**108**); and
 - the resin-mixing assembly (**112**) is configured to mix, at least in part, a resin being made to move along the resin-flow passageway (**104**) of the plunger-receiving chamber assembly (**102**) from the resin-receiving end (**106**) to the resin-ejection end
 - 15 (**108**).
3. The shooting-pot assembly (**100**) of claim 2, further comprising:
 - a plunger assembly (**110**) being configured to:
 - (i) be reciprocatably movable along the plunger-receiving chamber assembly
 - 20 (**102**), and
 - (ii) move, at least in part, a resin along the a resin-flow passageway (**104**) of the plunger-receiving chamber assembly (**102**) from the resin-receiving end (**106**) to the resin-ejection end (**108**).
- 25 4. The shooting-pot assembly (**100**) of claim 2, wherein:
 - the resin-mixing assembly (**112**) is entirely positioned in the resin-flow passageway (**104**) of the plunger-receiving chamber assembly (**102**).
5. The shooting-pot assembly (**100**) of claim 2, wherein:
- 30 the resin-mixing assembly (**112**) is supported by the plunger assembly (**110**).
6. The shooting-pot assembly (**100**) of claim 2, wherein:
 - the resin-mixing assembly (**112**) is slidably connected to a distal end of the plunger assembly (**110**), and the resin-mixing assembly (**112**) faces the resin-ejection
 - 35 end (**108**) of the plunger-receiving chamber assembly (**102**).

7. The shooting-pot assembly (100) of claim 2, wherein:

the plunger assembly (110) includes:

a stem assembly (120) extending from a distal end of the plunger assembly (110), the stem assembly (120) facing the resin-ejection end (108);

a first stop (122) extending, at least in part, radially from the stem assembly (120);

a second stop (124) extending, at least in part, radially from the stem assembly (120), the second stop (124) being set apart from the first stop (122);

wherein the stem assembly (120) is configured to accommodate movement of the resin-mixing assembly (112) between the first stop (122) and the second stop (124) along the stem assembly (120) of the plunger assembly (110), so that the resin-mixing assembly (112) faces the resin-ejection end (108) of the plunger-receiving chamber assembly (102),

for the case where the resin-mixing assembly (112) abuts the second stop (124), the resin-mixing assembly (112) prevents flow of the toward the resin-ejection end (108),

for the case where the resin-mixing assembly (112) is set apart from the second stop (124), the resin-mixing assembly (112) permits flow of the toward the resin-ejection end (108), and

for the case where the resin-mixing assembly (112) abuts the first stop (122), the resin-mixing assembly (112) avoids contact with the resin-ejection end (108).

8. The shooting-pot assembly (100) of claim 2, wherein:

the plunger assembly (110) includes:

a rod assembly (130); and

a rod actuator (132) configured to actuate reciprocable movement of the rod assembly (130).

9. The shooting-pot assembly (100) of claim 2, wherein:

the resin-receiving end (106) is configured for fluid connection with a melt-preparation assembly (200).

10. The shooting-pot assembly (100) of claim 2, wherein:

the resin-ejection end (108) is configured for fluid connection with a mold assembly (202).

11. The shooting-pot assembly (100) of claim 2, wherein:

the resin-ejection end (108) is configured for fluid connection with a melt-distribution assembly (204), and the melt-distribution assembly (204) fluidly connected to a mold assembly (202).

12. The shooting-pot assembly (100) of claim 2, wherein:

the resin-mixing assembly (112) includes
a helical screw geometry (300) along a length of the plunger assembly (110).

13. A melt-preparation assembly (200) having the shooting-pot assembly (100) of any preceding claim.

14. A mold assembly (202) having the shooting-pot assembly (100) of any preceding claim.

15. A melt-distribution assembly (204) having the shooting-pot assembly (100) of any preceding claim.

16. A molding system (900) having the shooting-pot assembly (100) of any preceding claim.

17. A method of operating a shooting-pot assembly (100), the method comprising:
receiving, at least in part, a resin-mixing assembly (112) in a plunger-receiving chamber assembly (102).

18. The method of claim 16, further comprising:

mixing, at least in part, a resin being made to move along a resin-flow passageway (104) of the plunger-receiving chamber assembly (102) from a resin-receiving end (106) to a resin-ejection end (108), the resin-flow passageway (104) extending, at least in part, between the resin-receiving end (106) and the resin-ejection end (108).

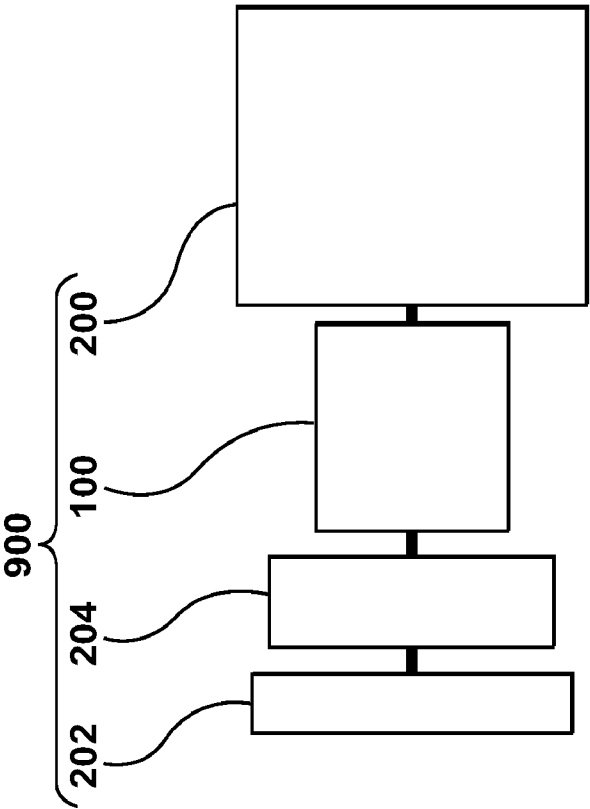


FIG. 1A

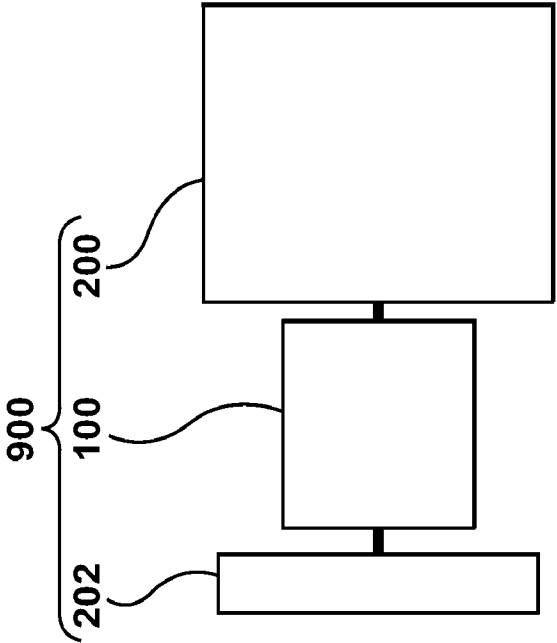


FIG. 1B

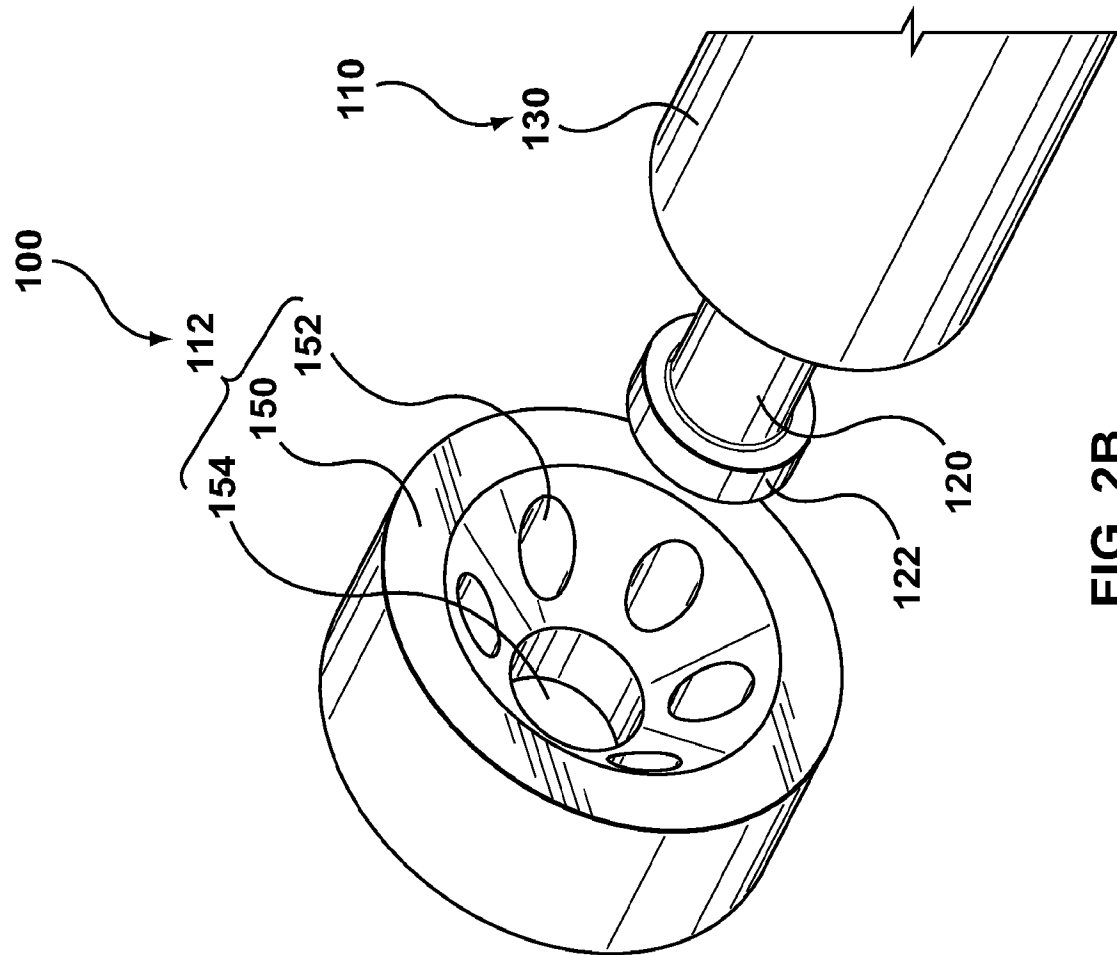


FIG. 2B

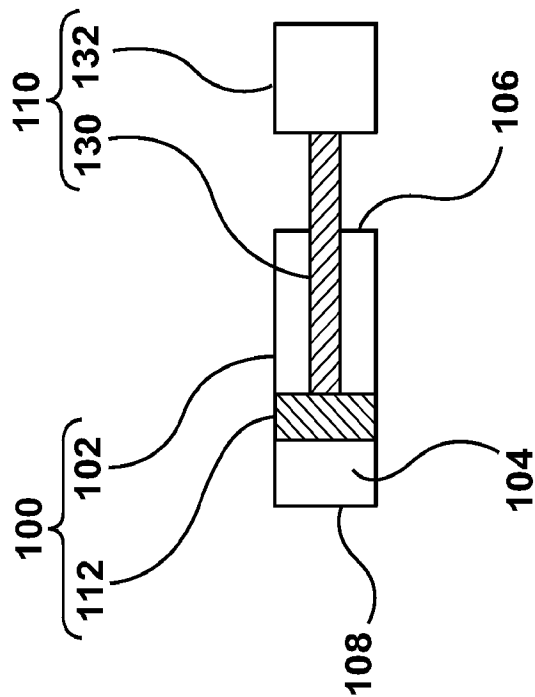


FIG. 2A

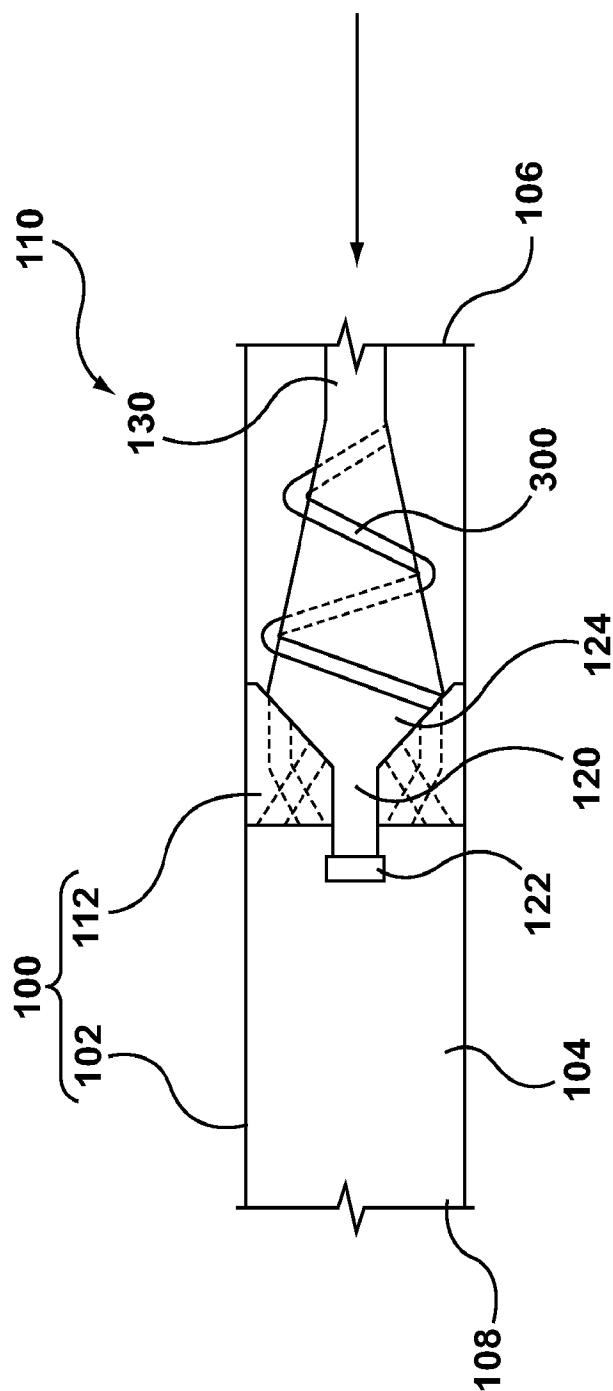


FIG. 3A

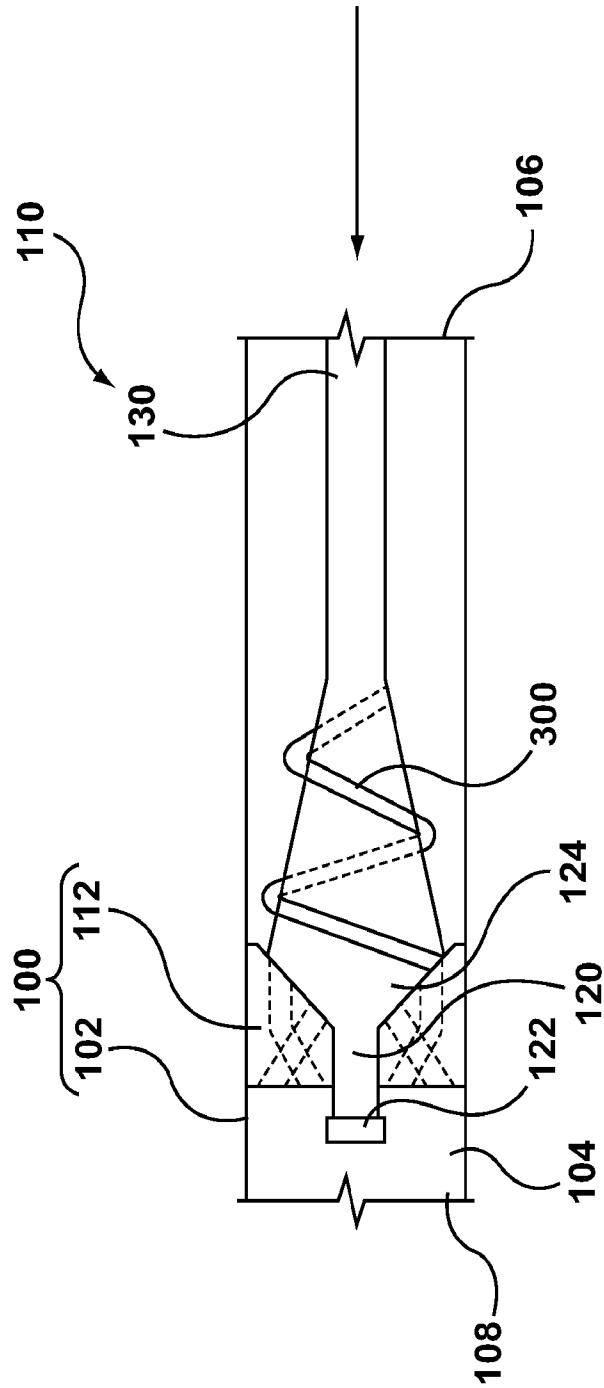


FIG. 3B

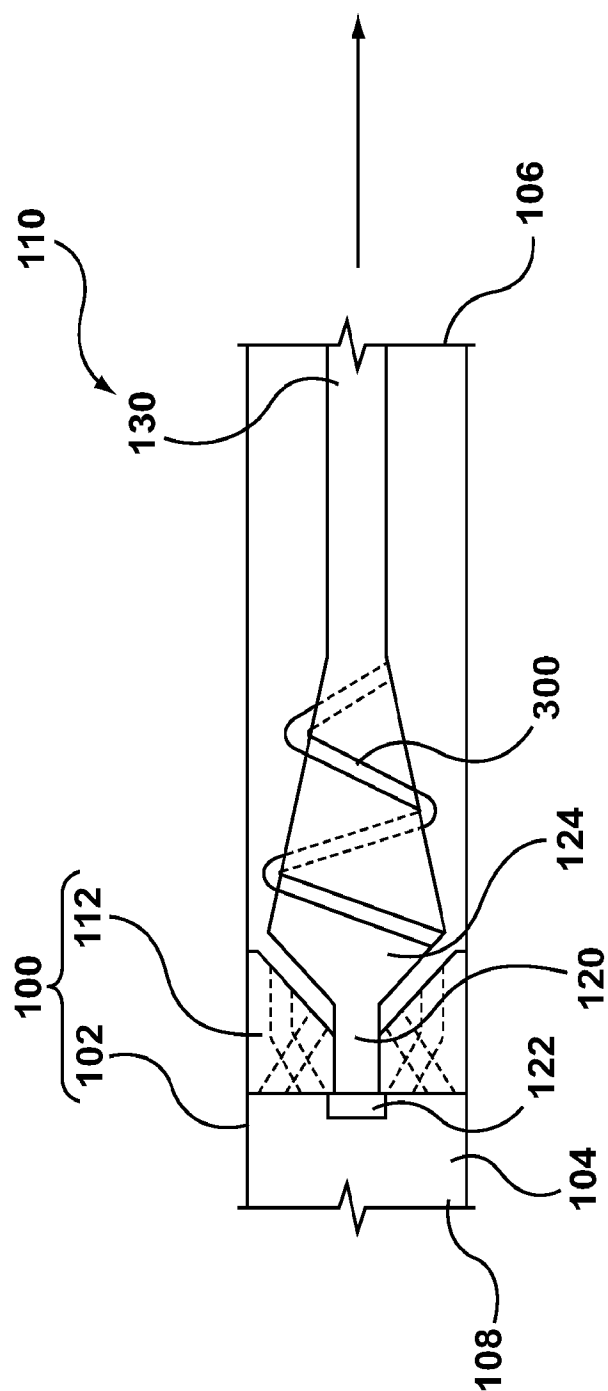


FIG. 3C

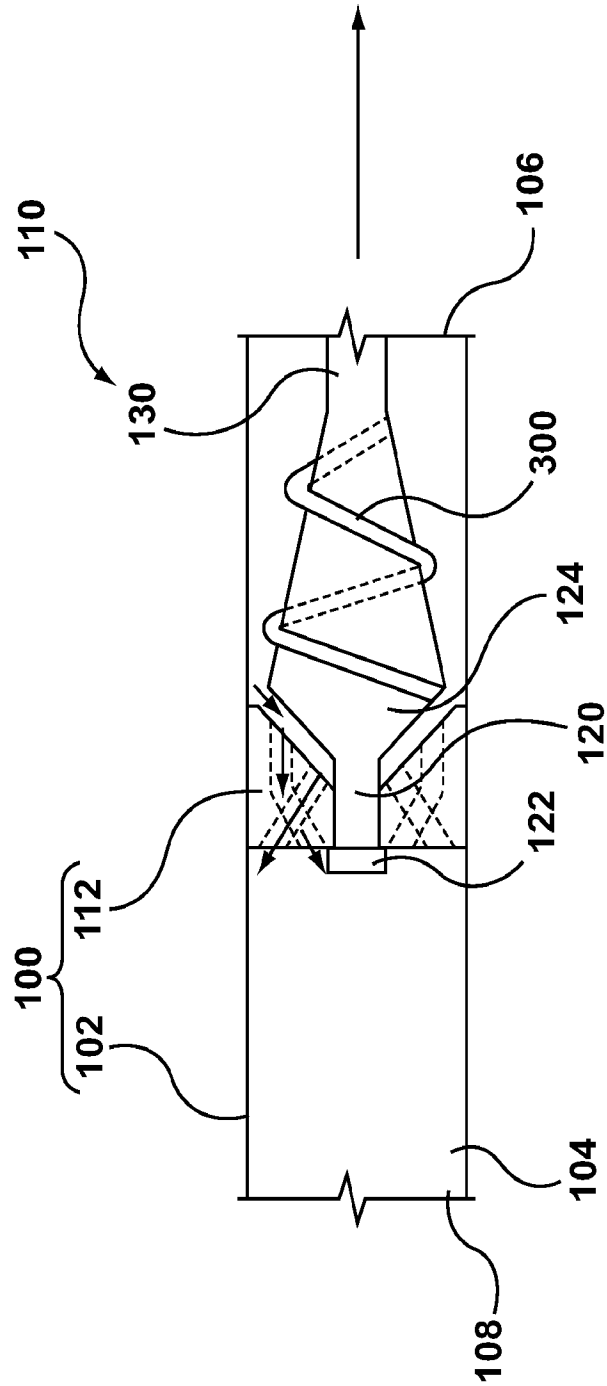


FIG. 3D

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/041981

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B29C 45/52 (2012.01)

USPC - 425/562

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)

IPC(8) - B29C 45/23, 45/52, 45/70 (2012.01)

USPC - 137/614; 251/120; 366/82; 425/398, 562, 568, DIG224

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

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

PatBase

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2005/0233020 A1 (MANDA et al) 20 October 2005 (20.10.2005) entire document	1-13, 17
Y	US 2006/0164911 A1 (NIKOLAI et al) 27 July 2006 (27.07.2006) entire document	1-13, 17
Y	US 2007/0065538 A1 (WEATHERALL et al) 22 March 2007 (22.03.2007) entire document	6, 12
Y	US 2008/0063869 A1 (MORTAZAVI) 13 March 2008 (13.03.2008) entire document	9

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

* Special categories of cited documents:

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

02 August 2012

Date of mailing of the international search report

16 AUG 2012

Name and mailing address of the ISA/US

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PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2012/041981

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.: 14-16 , 18
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:

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.:

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.