(51) International Patent Classification:
A61M 5/178 (2006.01) B29C 45/00 (2006.01)

(21) International Application Number:
PCT/US2013/052507

(22) International Filing Date:
29 July 2013 (29.07.2013)

(25) Filing Language:
English

(26) Publication Language:
English

(30) Priority Data:
61/681,212 9 August 2012 (09.08.2012) US

(71) Applicant: WEST PHARMACEUTICAL SERVICES, INC. [US/US]; 530 Herman O. West Drive, Exton, PA 19341 (US).

(72) Inventor: LUNDEQUIST, Jon; 1834 W. Goldfinch Ave., Chandler, AZ 85248 (US).


Published: — with international search report (Art. 21(3))

(54) Title: ADAPTER FOR A SYRINGE

(57) Abstract: An adapter for a syringe includes a base portion, a flange portion and a cavity formed therebetween. The base portion has a first end, an opposing second end, and a first aperture configured to at least partially surround and engage at least a portion of a barrel of the syringe. A longitudinal slot extends through the base portion from the first end toward the opposing second end. A longitudinal axis of the adapter extends from the first end toward the opposing second end. The flange portion is spaced apart from the base portion along the longitudinal axis and has first and second finger plates which extend laterally outwardly from the longitudinal axis. A reinforcing member extends from the second end of the base portion to the flange portion.

FIG. 1
TITLE OF THE INVENTION

[0001] Adapter for a Syringe

CROSS-REFERENCE TO RELATED APPLICATIONS


BACKGROUND OF THE INVENTION

[0003] The present invention relates generally to an accessory for a syringe and, more particularly, to an adapter which may be removably installed onto a syringe.

[0004] Syringes are known in the art as medical devices utilizable for delivering medicament to a patient. Conventional syringes typically include a barrel which houses medicament and a plunger. The plunger includes a piston with a plunger head on a distal end of the piston. The plunger head forces the medicament out of a distal end of the barrel during injection. From the distal end of the barrel, the medicament passes through an elongated pointed needle having an interior bore and into the patient.

[0005] Traditionally, empty syringes are filled with medicament and administered to patients by a medical professional. More recently, syringes are prefilled with set dosages allowing for self-administration by a patient or by another non-medical professional. To facilitate handling by a medical professional, non-medical professional or a patient, accessories have been developed for conventional syringes that provide a surface or structure for the medical professional, non-medical professional or patient to grip or engage. Such accessories are commonly referred to as finger flanges. For syringes that already include a flange, such as at the proximal end of the barrel, finger flanges effectively extend the gripping surface for the medical professional, non-medical professional or patient.

[0006] However, conventional finger flanges suffer from some drawbacks. Specifically, conventional finger flanges can be difficult to install on a syringe, particularly for a patient. Also, conventional finger flanges often do not adequately grip the syringe, particularly for syringe designs that do not include a proximal flange.

[0007] Also, whether conventional syringes are empty or prefilled, complications can arise when the plunger becomes accidentally dislodged from the proximal end of the barrel, thereby
rendering the syringe unusable. To prevent dislodging of the plunger, different backstop accessories have been developed for attachment to conventional syringes.

[0008] U.S. Patent No. 5,667,495 to Bitdinger et al., addressed this problem by attaching a backstop to a syringe barrel having a flange positioned at the proximal end of the syringe barrel. The backstop comprises parallel top and bottom plates, which form a pocket that receives the flange of the syringe barrel. The bottom plate is positioned below the flange, and has an aperture that conforms to the exterior circumference of the syringe barrel. The top plate is positioned above the flange, and has an aperture that is centered around a proximal opening of the barrel. The diameter of the top plate aperture is smaller than the diameter of the plunger head, which prevents the plunger head from inadvertently leaving the syringe barrel, thereby creating a plunger brake. However, the backstop of Bitdinger et al. can only be used with syringes barrels that have a proximal flange with a specific geometry.

[0009] There have also been attempts to make a backstop device for syringe barrels having either no flange or minimal flange geometry. U.S. Patent No. 5,607,399 to Grimard et al., discloses a backstop that attaches to a syringe barrel. The backstop has a retaining wall and a finger plate. The finger plate further comprises an aperture, which is centered around the proximal end of the syringe barrel. The retaining wall is integrally formed onto the bottom of the finger plate and centers around the aperture. The retaining wall snap-fits to a portion of the outer circumference of the syringe barrel, eliminating the need for a flange on the syringe barrel. The aperture diameter is smaller than the diameter of the plunger head, thereby creating a plunger brake. The finger plate also provides the user with leverage during injection of the medicament.

[0010] A 90° corner forms where the finger plate and the retaining wall meet. Without an interior groove on the retaining wall, the 90° corner prevents the retaining wall from maintaining intimate contact with the outer circumference of the syringe barrel. In order to produce interior grooves, special molds are needed to injection mold the backstop, which makes manufacture both costly and difficult.

[0011] The retaining wall may be continuous, which provides flexural strength to the finger plate much like an I-beam. The retaining wall may also contain a plurality of discontinuous sections, which impart greater resiliency when snap-fitting the backstop to the syringe barrel. However, the discontinuous sections undermine the strength imparted by the continuous wall. Without the I-beam support, there is a greater likelihood that the finger plate will deform during
the injection of medicament - especially for higher viscosity medicaments, which require a greater force applied to the plunger.

[0012] There have also been attempts to develop plateless backstops. In U.S. Patent No. 5,803,918 to Vetter et al., an annular piece is attachable by snap-fit to a portion of the outer circumference of a syringe barrel. A lip is located on a proximal end of the syringe barrel. An arm having a tip extends from the annular piece, over the lip of the syringe barrel, through the proximal opening of the syringe barrel, and into the interior of the syringe barrel. Inside of the barrel, the arm tip rests behind a plunger head that is connected to a plunger. The placement of the arm tip prevents the plunger from being inadvertently dislodged. Two diametrically opposite wings extend from the annular piece at right angles, forming a finger rest.

[0013] The backstop of Vetter et al. can only be used with plungers having a backbone geometry that tapers toward the plunger head. Because the annular piece is the only component that provides structural integrity to the backstop, the annular piece cannot contain discontinuous sections, which limits the snap-fitting resiliency of the backstop. Because the arm is in intimate contact with the lip of the syringe barrel, the backstop can only be used with syringe barrels having specific flange geometry. Vetter et al. also provides a separate slide backstop that can be used with syringe barrels having larger flanges, however, the slide backstop is a separate piece of hardware. Having multiple pieces of hardware not only increases cost, but unskilled or infirm individuals are more likely to be confused and misuse a syringe when having to select the correct backstop from multiple pieces of hardware.

[0014] Accordingly, there is a continuing need for an improved finger flange device that overcomes, alleviates, or mitigates one or more of the aforementioned drawbacks and deficiencies of conventional devices. For example, it would be desirable to create a finger flange accessory or an adapter that can be easily and preferably removably installed onto the barrel of any syringe. It would also be desirable to create a reinforced backstop accessory that can be used with syringe barrels of a wide variety of proximal flange geometries.

BRIEF SUMMARY OF THE INVENTION

[0015] Briefly stated, one aspect of the present invention relates to an adapter for a syringe including a base portion having a first end, an opposing second end, and a first aperture configured to at least partially surround and engage at least a portion of a barrel of the syringe.
A longitudinal axis of the adapter extends from the first end toward the opposing second end. The adapter further includes a longitudinal slot extends through the base portion from the first end toward the opposing second end, a flange portion spaced apart from the base portion along the longitudinal axis, a cavity formed between the base portion and the flange portion, and a reinforcing member extending from the second end of the base portion to the flange portion. The flange portion has first and second finger plates which extend laterally outwardly from the longitudinal axis.

[0016] In another aspect, the present invention is directed to an adapter for a syringe including a base portion having a first end, an opposing second end, and a base aperture configured to at least partially surround and engage at least a portion of a barrel of the syringe. A longitudinal axis of the adapter extends from the first end toward the opposing second end. The adapter further includes a flange portion spaced apart from the base portion along the longitudinal axis. The flange portion has first and second finger plates which extend laterally outwardly from the longitudinal axis and a flange aperture positioned between the first and second finger plates.

[0017] In another aspect, the present invention is directed to a method for manufacturing an adapter for a syringe. The adapter includes a base portion, a longitudinal slot extending through the base portion, a flange portion longitudinally spaced apart from the base portion, and a reinforcing member extending from the base portion to the flange portion. The method includes providing a mold body having a mold cavity, inserting polymeric material in a single direction into the mold cavity, allowing the polymeric material to cool until substantially solidified, and producing the adapter for a syringe.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0018] The following detailed description of the invention will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the drawings an embodiment which is presently preferred. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown.

[0019] In the drawings:

[0020] Fig. 1 is a top rear perspective view of an adapter in accordance with a preferred embodiment of the present invention mounted to a syringe;
Fig. 2 is a top front perspective view of the adapter of Fig. 1;
Fig. 3 is a bottom plan view of the adapter of Fig. 1;
Fig. 4 is a rear elevational view of the adapter of Fig. 1;
Fig. 5 is a bottom front perspective view of the adapter of Fig. 1;
Fig. 6 is a bottom front perspective view of the adapter of Fig. 1 mounted to a syringe;
Fig. 7 is a side elevational view of the adapter of Fig. 1;
Fig. 8 is a rear top perspective view of the adapter of Fig. 1; and
Fig. 9 is a top plan view of the adapter of Fig. 1 mounted to a syringe.

DETAILED DESCRIPTION OF THE INVENTION

Certain terminology is used in the following description for convenience only and is not limiting. The words "right," "left," "lower," and "upper" designate directions in the drawings to which reference is made. The words "inwardly" and "outwardly" refer to directions toward and away from, respectively, the geometric center of various component parts and designated parts thereof. Unless specifically set forth herein, the terms "a," "an," and "the" are not limited to one element but instead should be read as meaning "at least one". The terminology includes the words noted above, derivates thereof, and words of similar import.

Referring to the drawings in detail, wherein like numerals indicate like elements throughout the several views, Figs. 1-2 show a first preferred embodiment of an accessory or adapter, generally designated 10, for a syringe, generally designated 12, and/or in combination with the syringe 12. As such, Figs. 1-2 show a complete syringe assembly in accordance with the present invention. The adapter 10 is preferably initially an accessory or separate component from the syringe 12, such that the adapter 10 can be easily installed onto at least a portion of the syringe 12 and/or is selectively removable therefrom. More preferably, the adapter 10 is snap-fitted onto a portion of the syringe 12. The adapter 10 provides a user with an ergonomic advantage, as compared to use of the syringe 12 without the adapter 10, while increasing the overall ease-of-use of the syringe 12. The adapter 10 may be installed onto the syringe 12 by a pharmacist, doctor and/or any other healthcare provider, or the adapter 10 may be installed by the consumer, patient or individual for self-injection.

The syringe 12 includes a barrel 13 having an open proximal end 42 and an opposing distal end 16. A plunger 14 is installed within the interior of the syringe barrel 13 through the
open proximal end 42. The plunger 14 comprises a plunger rod 60, a plunger head 40, and a
thumb rest 38. An elongated needle or cannula 20 is secured to the distal end 16 of the syringe
barrel 13. The syringe 12 is typical of syringes known in the art and commercially available.

Before injection, the plunger head 40 is located at the proximal end 42 of the syringe
barrel 13, leaving the syringe barrel 13 open to house medicament (not shown). For injecting the
medicament, a distal end 20a of the needle 20 is inserted into the patient and the practitioner or
other person applies force to the thumb rest 38, forcing the plunger 14 into the syringe barrel 13
and moving the plunger head 40 from the proximal end 42 of the syringe barrel 13 toward the
distal end 16. As the plunger head 40 moves, the medicament is forced out of the distal end 16
of the syringe barrel 13, through an internal bore of the elongated needle 20, and into the patient.

Referring to Figs. 3-9, there is shown in greater detail the adapter 10 in accordance
with the preferred embodiment of the present invention. Referring to Figs. 5 and 9, the adapter
10 includes a base portion 56 and a flange portion 26. The flange portion 26 is preferably
spaced-apart from the base portion 56 at a predetermined distance along a longitudinal axis X of
the adapter 10. The base portion 56 has a generally U-shaped body with a first or upper end 56a
and an opposing second or lower end 56b. The base portion has a height 66 that extends
between the first and second ends 56a, 56b (see Fig. 7). The longitudinal axis X of the adapter
10 extends from the first end 56a toward, and more particularly to, the second end 56b of the
base portion 56. The base portion 56 also has a generally open front end 76 and an opposing rear
end 64. A lateral axis S of the adapter 10 extends from the open front end 76 toward, and more
particularly to, the rear end 64 of the base portion 56. The lateral axis S of the adapter 10
extends generally perpendicular to the longitudinal axis X.

The base portion 56 preferably includes first and second gripping members 22 and a
base aperture 78 located between the first and second gripping members 22. More particularly,
the base aperture 78 is formed between the upper and lower ends 56a, 56b and the front and rear
ends 76, 64 of the base portion 56. Each gripping member 22 is preferably made of a resiliently
flexible material and has a generally curved or arcuate shape. The base aperture 78 has a
generally circular cross-sectional shape and is configured to at least partially surround and
engage a portion of the syringe barrel 13. More particularly, the base aperture 78 is configured
to tightly surround and engage a portion of the outer circumference of the syringe barrel 13, as
shown in Fig. 9. As such, the base aperture 78 has an inner diameter that is preferably
substantially equal to or at least slightly smaller than an outer diameter of the syringe barrel 13 in order to provide a tight fit between the syringe barrel 13 and the base portion 56.

[0035] The gripping members 22 extend arcuately between the front end 76 and the rear end 64 of the base portion 56, so as to conform to the shape of the syringe barrel 13. Each of the gripping members 22 is also provided with a respective flexure point 62. More particularly, at a position along the length of each of the gripping members 22, the gripping member 22 transitions from a relatively larger thickness 50 proximate the rear end 64 of the base portion 56 to a relatively smaller thickness 52 proximate the front end 76 of the base portion 56 (see Fig. 3). The points of transition are flexural points 62 about which the gripping members 22 may flex outwardly, away from a geometric center of the adapter 10, when the adapter 10 is being snap-fitted onto the syringe barrel 13. It will be appreciated by those skilled in the art that each relative thicknesses 50, 52 may vary depending on material selection, final application, customer specifications and the like.

[0036] Referring to Figs. 3 and 8, in one embodiment, each of the gripping members 22 is provided with an inwardly projecting protrusion 34. More preferably, the inwardly projecting protrusions 34 are securing bulges 34 which project axially inwardly, along the lateral axis S, and are located on the interior surface of the gripping members 22 at the front end 76 of the base portion 56. In one embodiment, each securing bulge 34 is formed by a localized increase in the thickness of the gripping members 22 at the front end 76. However, it will be understood that the securing bulges 34 may be formed by any appropriate method or manner, such as projections which are adequately secured or attached to the gripping members 22 (e.g., by fasteners, welding, adhesives, and the like). The geometry of the securing bulge 34 is not critical to the present invention. For example, the shape of each securing bulge 34 may be circular, semi-circular, ellipsoidal, semi-ellipsoidal, triangular, trapezoidal, or the like.

[0037] Referring to Figs. 5 and 7, at the front end 76, each of the gripping members 22 is also preferably provided with a nipple or bump 28. More preferably, each bump 28 projects downwardly toward the flange portion 26, along the longitudinal axis X, and thus extends generally perpendicularly to the securing bulges 34. The geometry of the bumps 28 is not critical to the present invention. For example, each bump 28 may be hemispherical, quarter-spherical, cubical, tetrahedral, or the like. When the adapter 10 is positioned on a syringe barrel 18 that has a proximal flange 18 (shown in phantom in Fig. 6), the bumps 28 are configured to
engage the flange 18 to provide additional mechanical resistance and further secure the syringe barrel 13 to the adapter 10.

[0038] At the front end 76, the base portion 56 is provided with an insertion opening 82 through which the syringe barrel 13 passes during placement of the adapter 10 on the syringe barrel 13. The gripping members 22 are thus spaced apart from each other at the front end 76 by the span 54 of the insertion opening 82. The securing bulges 34, the span 54 of the insertion opening 82 is at least slightly smaller than the outer diameter of the syringe barrel 13, as shown in Fig. 6. As a result, sufficient pressure must be utilized to snap-fit the adapter 10 onto the outer circumference of the syringe barrel 13, as described in more detail below.

[0039] Referring to Figs. 4 and 8, at the rear end 64 of the base portion 56, there is provided a longitudinal slot 32 which extends through the base portion 56 from the first end 56a toward the second end 56b, along the longitudinal axis X. More preferably, the longitudinal slot 32 extends through the rear end 64 of the base portion 56 from the first end 56a completely to the second end 56b. The longitudinal slot 32 is a resiliency separator which imparts greater resiliency to the trailing end 56b of the base portion 56 when the adapter 10 is positioned on the syringe barrel 13. The gripping members 22 are thus axially separated from each other at the rear end 64 of the base portion 56 by the resiliency separator 32.

[0040] It will be understood by those skilled in the art that while only one resiliency separator 32 is depicted, the quantity, location, and dimensions of the resiliency separator 32 may vary. For example, instead of a single resiliency separator 32 proximate to the center of the rear end 64 (as shown in Figs. 4 and 8), two or more separators of equal or smaller dimensions may be positioned at spaced apart locations along the rear end 64.

[0041] The resiliency spacer 32 preferably has a generally trapezoidal cross-sectional shape, as shown in Fig. 8. However, it will be understood that the resiliency separator 32 may be rectangular, square, triangular, circular, and the like in shape, as long as it imparts sufficient resiliency to the base portion 56.

[0042] Referring to Figs. 3-5, the adapter 10 preferably further comprises a flange portion 26 having an upper or first end 26a and an opposing bottom or second end 26b. Since the flange portion 26 is longitudinally spaced apart from the base portion 56, a cavity 84 is formed between the base portion 56 and the flange portion 26, and more particularly between the lower end 56b of the base portion 56 and the upper end 26a of the flange portion 26.
[0043] The flange portion 26 preferably includes first and second finger plates 70 which extend laterally and radially outwardly away from the longitudinal axis X of the adapter 10 along the lateral axis S. Each of the finger plates 70 preferably has a cross sectional shape that is at least slightly arcuate, and more preferably at least slightly concave. More preferably, when viewing the finger plates 70 from above (i.e., from the upper end 26a of the flange portion 26), at least a portion of the finger plates 70 appears concave, such that the flange portion 26 overall has a concave shape. Referring to Figs. 4 and 8, after the adapter 10 is snap-fitted onto the syringe barrel 13 and the syringe is ready for use, the user may apply a force to the underside (i.e., the second, bottom end 26b) of each finger plate 70 in order to obtain leverage during injection. The arcuate finger plates 70 enhances the ergonomic feel of the adapter 10 during use.

[0044] Each of the finger plates 70 also preferably has a varying thickness between the first and second ends 26a, 26b of the flange portion 26. Each of the finger plates 70 preferably has a generally triangular shaped cross-section. More preferably, the distal tips 70a of each of the finger plates 70 are rounded off. However, it will be understood that the distal tips 70a of the finger plates 70 need not be rounded, and instead may be formed as sharp edges or some other edge geometry. It will also be understood that the finger plates 70 need not have a triangular shape, but instead may be circular, square, rectangular, trapezoidal and the like as long as they provide a sufficient gripping surface for a user.

[0045] Referring to Figs. 3 and 6, each of the finger plates 70 preferably includes at least one indentation or recess 48 formed therein. More preferably, each finger plate 70 includes a plurality of indentations or recesses 48 formed therein. As such, less material is required for the manufacture of the adapter 10. The recesses 48 may be formed in the surface of either the first, top end 26a or the second, bottom end 26b of each finger plate 70. Preferably, the recesses 48 are formed in the surface of the second, bottom end 26b of each finger plate 70. The shape of each recess 48 is not critical. For example, each recess 48 may be triangular, circular, square, rectangular, trapezoidal and the like in cross-sectional shape. In one embodiment, a mold path 46 may split each recess 48 into two or more sub-recesses 48 in order to facilitate the delivery of material during injection molding. The additional material provided by the mold path 46 also increases the mechanical strength of the finger plates 70.

[0046] The flange portion 26 also preferably includes a flange aperture 72 located between the opposed outwardly extending first and second finger plates 70. As such, the flange aperture
72 is generally located in a geometric center of the flange portion 26 and has a generally open front end 86 and an opposing generally closed rear end 88. Preferably, the flange aperture 72 has a U-shaped cross-section.

[0047] Referring to Figs. 4 and 7-8, the adapter 10 further preferably comprises a reinforcing member 30 which extends between the base portion 56 and the flange portion 26. More particularly, the reinforcing member 30 extends between the second, bottom end 56b of the base portion 56 and the first, top end 26a of the flange portion 26. The reinforcing member is preferably integrally formed with the base portion 56 and with the flange portion 26. More preferably, the reinforcing member is integrally formed with an exterior portion of the base portion 56, opposite to the base aperture 82 and proximate the rear end 64 of the base portion 56. The flange aperture 72 is preferably positioned directly on top of, and flush with, an interior 30a of the integral reinforcing component 30.

[0048] Preferably, the integral reinforcing member 30 is a single, continuous member which provides I-beam support to the adapter 10. Preferably, the reinforcing member 30 has a generally arcuate shape, but it will be understood that the reinforcing member 30 may be generally straight in shape. Despite the presence of one or more discontinuous sections or resiliency separators 32 in the base portion 56, the reinforcing member 30 provides additional mechanical strength to the adapter 10 and facilitates installation of the adapter 10 on the syringe barrel 13, without undermining the mechanical strength needed for the installed adapter 10 to withstand forces applied during the delivery of high viscosity and other medicaments. As shown in Fig. 4, the thickness 68 of the reinforcing member 30 may vary in particular applications depending on the desired mechanical strength, processing limitations, material selection, and the like.

[0049] Referring to Figs. 3 and 5-6, the integral reinforcing member 30 preferably surrounds the exterior of at least a portion of the base portion 56, allowing for the bottom or second end 56b of the base portion 56 to remain uncovered by the reinforcing member 30. As such, the base portion 56 has a sufficient thickness 50, measured in a direction of the lateral axis S, transverse to the longitudinal axis X, of the adapter 10, in order to accommodate syringe barrels having either no flange or any flange geometry, while also maintaining intimate, strong, and engaging contact between the base portion 56 and the syringe barrel 13, as shown in Fig. 6. As such, according to the present invention, no interior groove is required in the base portion 56 for
maintaining intimate contact with a variety of flange dimensions and a variety of flanges may be properly snap-fitted within the cavity 84 between the base portion 56 and the flange portion 26.

Referring to Figs. 3-5, in one embodiment, to further ensure that the proximal flange 18 (if present) of the syringe 12 is tightly held within the cavity 84, the adapter 10 preferably includes a securing ring 24 located within the flange aperture 72 and spaced-apart from the base portion 56 by the cavity 84. The securing ring 24 preferably has a U-shaped cross-section with a generally open front end 24a, an opposing generally closed rear end 24b, and a securing aperture 90 therebetween. However, it will be understood that the securing ring 24 may have an alternative cross-sectional shape, such as circular, elliptical, oval and the like. The securing ring 24 also preferably extends generally parallel to the base portion 56, as shown in Fig. 4.

The securing ring 24, and more particularly the closed rear end 24b, is preferably secured to the flange portion 26 by a connecting arm 36. One end of the connecting arm 36 is preferably formed integrally with the rear end 88 of the flange aperture 72 and the other end of the connecting arm is preferably formed integrally with the rear end 24b of the securing ring 24. The connecting arm 36 thus connects to the perimeter of the flange aperture 72, as shown in Figs. 3 and 5. It will be appreciated by those skilled in the art that multiple connecting arms 36 may be used to connect the securing ring 24 to the perimeter of the flange aperture 72, if desired. It will also be appreciated by those skilled in the art that the placement of each connecting arm 36 may vary along the perimeter of the flange aperture 72. Preferably, the length of the connecting arm 36 is established such that the connecting arm 36 and the rear end 64 of the base portion 56 share the same radial origin point. It will also be appreciated by those skilled in the art that the rear end 24b of the securing ring 24 may contain one or more discontinuous sections (not shown).

The base portion 56 and the securing ring 24 are preferably separated by a distance 58, which is at least slightly greater than the height of the proximal flange 18 of the syringe barrel 13, along the longitudinal axis X, as shown in Figs. 4 and 6. More preferably, the distance 58, which corresponds to a height of the cavity 84, is at least slightly greater than the height of the flange of any other syringe barrel with which the adapter 10 may potentially be used. More particularly, the distance 58 between the securing ring 24 and the base portion 56 allows the adapter 10 to accommodate a wide range of flange heights or thicknesses.
The open front end 24a of the securing ring 24 is preferably configured to receive the plunger rod 60 of the syringe 12 therethrough. In one embodiment, a span or diameter 74 of the securing aperture 90 is at least slightly larger than the diameter of the plunger head 40, such that as the plunger 14 and, more particularly the plunger head 40, move toward the proximal end 42 of the syringe 12, the plunger head 40 may be removed from the syringe barrel 13 and pass through the securing aperture 90.

In another embodiment, the securing ring 24 functions as a backstop. In such an embodiment, the span or diameter 74 of the securing aperture 90, and more particularly of the generally open front end 24a of the securing ring 24, is preferably at least slightly smaller than the diameter of the plunger head 40. As such, as the plunger head 40 moves toward the proximal end 42 of the syringe barrel 13, the securing ring 24 engages a proximal surface of the plunger head 40, and such engagement prevents the plunger head 40 from being inadvertently dislodged or removed from the syringe barrel 13, creating a backstop. A clearance is provided between the securing ring 34 and the plunger rod 60 so that the plunger 60 is able to move freely within the syringe barrel 13.

The adapter 10 can be manufactured by injection molding polymeric materials including polyethylene, polypropylene, polyurethane, polysiloxane, and other suitable materials. The adapter 10 can be produced using a single direction of mold draw requiring no complex mechanical slides or other moving tooling components not parallel with mold opening. The arrangement of the base portion 56, integral reinforcing member 30, flange portion 26, securing ring 24, and connecting arm 36, allow polymeric materials to be injection molded as a single shot, and therefore all of the adapter 10 components are integrally formed as a single piece. The result is a cost-effective and robust manufacturing process superior to the manufacturing processes used by previously designed backstops.

More particularly, the method of manufacturing the adapter 10 includes inserting the polymeric material into the mold cavity of a mold body (not shown). Preferably, the material is injected in a single flow direction. After injection, the polymeric material is allowed to cool until substantially solidified within the mold cavity. Finally, the solidified and cooled adapter 10 is removed from the mold body. Having a single direction of draw in a mold provides a robust and cost-effective manufacturing process.
In use, the plunger rod 60 is installed into the interior of the syringe barrel 13, and the adapter 10 is positioned at the proximal end 42 of the syringe barrel 13. The proximal flange 18 (if present) of the syringe barrel 13 is positioned between the securing ring 24 and the base portion 56 of the adapter 10. The user then presses the syringe barrel 13 into the base portion 56 so that the snap-fitting gripping members 22 flex outwardly at the flexural points 62 until the syringe barrel 13 passes by both securing bulges 34, enters the base aperture 78, and engages the rear end 64 of the base portion 56. The snap-fitting gripping members 22 then unflex and snugly engage a portion of the outer-circumference of the syringe barrel 13 at the proximal end 42.

After the syringe barrel 13 is snap-fitted onto the adapter 10, an upper end 18a of the proximal flange 18 (if present) of the syringe 12 is adjacent the lower end 56a of the base portion 56 and an lower end 18b of the proximal flange 18 (if present) is adjacent the upper end 24a of the securing ring 24. More preferably, the upper and lower ends 18a, 18b of the proximal flange 18 directly engage the lower end 56a of the base portion 56 and the upper end 24a of the securing ring 24, respectively. In one embodiment, the upper end 24a of the securing ring 24 engages both the lower end 18b of the proximal flange 18 of the syringe barrel 13 and the proximal end of the plunger head 40. By engaging the plunger head 40, the securing ring 24 prevents the plunger rod 60 from be inadvertently removed from the interior of the syringe barrel 13.

The user then places a finger under each finger plate 70 and presses the thumb rest 38 of the plunger 60, causing the plunger head 40 to move from the proximal end 42 of the syringe barrel 13 toward the distal end 16. As the plunger head 40 moves toward the distal end 16, the medicament is injected into the patient. During injection, the outer circumference of the syringe barrel 13 maintains a tight and secure fit with both the securing bulges 34 and the rear end 64 of the base portion 56, thereby preventing the syringe barrel 13 from being dislodged from the adapter 10 even under the forces required to inject high viscosity medicament. The integral reinforcing member 30 provides the mechanical strength necessary for the flange portion 26 to withstand deformation without compromising the structural integrity of the adapter, particularly during the delivery of high viscosity medicament. The positioning of the integrally formed reinforcing member 30 (i.e., proximate a side of the base portion 56) also results in a set back
distance created adjacent the base portion 56 that provides space for accommodating syringe barrels that have a wide variety of proximal flange geometries.

[0060] It will be appreciated by those skilled in the art that changes could be made to the embodiment described above without departing from the broad inventive concepts thereof. It is understood, therefore, that this invention is not limited to the particular embodiment disclosed, but it is intended to cover all modifications within the spirit and scope of the present invention as defined by the appended claims.
CLAIMS

I claim:

1. An adapter for a syringe comprising:
   a base portion having a first end, an opposing second end, and a first aperture configured to at least partially surround and engage at least a portion of a barrel of the syringe, a longitudinal axis of the adapter extending from the first end toward the opposing second end;
   a longitudinal slot extending through the base portion from the first end toward the opposing second end;
   a flange portion spaced apart from the base portion along the longitudinal axis, the flange portion having first and second finger plates which extend laterally outwardly from the longitudinal axis;
   a cavity formed between the base portion and the flange portion; and
   a reinforcing member extending from the second end of the base portion to the flange portion.

2. The adapter of claim 1, wherein the base portion includes a resiliently flexible first gripping member and a resiliently flexible second gripping member, the first and second gripping members being spaced apart from each other at the by the longitudinal slot.

3. The adapter of claim 1, wherein the first aperture has a front end and an opposing rear end, a lateral axis of the adapter extending from the front end to the opposing rear end in a direction perpendicular to the longitudinal axis, the front end having an insertion opening through which the barrel of the syringe passes, and the longitudinal slot being formed at the rear end.

4. The adapter of claim 3, wherein the base portion includes a first gripping member and a second gripping member, the first and second gripping members being spaced apart from each other at the front end by the insertion opening and at the rear end by the longitudinal slot.

5. The adapter of claim 3, wherein each of the first and second gripping members has an inwardly projecting projection at the front end of the first aperture.
6. The adapter of claim 1, wherein the reinforcing member is formed integrally with the base portion and the flange portion.

7. The adapter of claim 1, wherein the flange portion includes a second aperture positioned between the first and second finger plates.

8. The adapter of claim 1, further comprising a securing ring positioned within the second aperture which functions as a backstop.

9. The adapter of claim 1, wherein the cavity is configured to receive a flange of the barrel of the syringe.

10. The adapter of claim 1, wherein each of the first and second finger plates has a cross-sectional shape that is at least slight arcuate.

11. An adapter for a syringe comprising:
    a base portion having a first end, an opposing second end, and a base aperture configured to at least partially surround and engage at least a portion of a barrel of the syringe, a longitudinal axis of the adapter extending from the first end toward the opposing second end; and
    a flange portion spaced apart from the base portion along the longitudinal axis, the flange portion having first and second finger plates which extend laterally outwardly from the longitudinal axis and a flange aperture positioned between the first and second finger plates.

12. The adapter of claim 11, further comprising a backstop positioned within the flange aperture, the backstop having a U-shaped body surrounding a backstop aperture.

13. A method for manufacturing an adapter for a syringe including a base portion, a longitudinal slot extending through the base portion, a flange portion longitudinally spaced apart from the base portion, and a reinforcing member extending from the base portion to the flange portion, the method comprising:
    providing a mold body having a mold cavity;
    inserting polymeric material in a single direction into the mold cavity;

- 16 -
allowing the polymeric material to cool until substantially solidified; and producing the adapter for a syringe.

14. The method of claim 13, wherein the polymeric material is selected from the group consisting of polyethylene, polypropylene, polyurethane, and polysiloxane.
**INTERNATIONAL SEARCH REPORT**

**International application No**
PCT/US2013/052507

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. A61M5/178 A61M5/31 B29C45/00

**A. ADD.**

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

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

A61M B29C

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

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

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>WO 2/070053 AI (BECTON DICKINSON FRANCE [FR]; BARRELLE LAURENT [FR]; JANSEN HUBERT [FR]) 12 September 2002 (2002-09-12) page 11, line 12 - line 26; figures 2,7,8</td>
<td>1, 2, 5-7, 9-11, 13</td>
</tr>
<tr>
<td>A</td>
<td>-----</td>
<td>3, 4, 8, 14</td>
</tr>
<tr>
<td>X</td>
<td>FR 2 876 034 AI (PLASTIC OMNIUM CI E [FR]) 7 April 1, 2006 (2006-04-07) page 6, line 6 - line 18</td>
<td>11, 12</td>
</tr>
</tbody>
</table>

[X] Further documents are listed in the continuation of Box C.  
[X] See patent family annex.

* Special categories of cited documents:

- **“A”** document defining the general state of the art which is not considered to be of particular relevance
- **“E”** earlier application or patent but published on or after the international filing date
- **“L”** document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- **“O”** document referring to an oral disclosure, use, exhibition or other means
- **“P”** document published prior to the international filing date but later than the priority date claimed
- **“T”** later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- **“X”** document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- **“Y”** document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- **“Z”** document member of the same patent family

**Date of the actual completion of the international search**

19 November 2013

**Date of mailing of the international search report**

27/11/2013

**Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016**

Authorized officer

Dai nti th, Ni chol a

Form PCT/ISA/210 (second sheet) (April 2000)
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>FR 2 830 199 AI (BECTON DICKINSON FRANCE [FR]) 4 April 2003 (2003-04-04) abstract</td>
<td>1-12</td>
</tr>
</tbody>
</table>
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 64(a).

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

see additional sheet

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. [X] As all searchable claims could be searched without effort justifying an 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.

Form PCT/ISA/21 0 (continuation of first sheet (2)) (April 2005)
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>WO 02070053 AI</td>
<td>12-09-2002</td>
<td>AT 296135 T</td>
<td>15-06-2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 60204293 DI</td>
<td>30-06-2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 60204293 T2</td>
<td>02-02-2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1372772 AI</td>
<td>02-01-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 20045233 11 A</td>
<td>05-08-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 02070053 AI</td>
<td>12-09-2002</td>
</tr>
<tr>
<td>FR 2876034 AI</td>
<td>07-04-2006</td>
<td>NON E</td>
<td></td>
</tr>
<tr>
<td>DE 102005005468 AI</td>
<td>17-08-2006</td>
<td>NON E</td>
<td></td>
</tr>
<tr>
<td>FR 2830199 AI</td>
<td>04-04-2003</td>
<td>NON E</td>
<td></td>
</tr>
<tr>
<td>US 5700247 A</td>
<td>23-12-1997</td>
<td>DE 69622949 DI</td>
<td>19-09-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69622949 T2</td>
<td>28-11-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 0764450 AI</td>
<td>26-03-1997</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ES 2181834 T3</td>
<td>01-03-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP H09 103486 A</td>
<td>22-04-1997</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 5607399 A</td>
<td>04-03-1997</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 5700247 A</td>
<td>23-12-1997</td>
</tr>
</tbody>
</table>
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-10

Claims 1 to 4 concern an adapter having a base portion having an aperture for receiving a syringe body and resiliently flexible first and second gripping members being spaced apart by a longitudinal slot, wherein the aperture has an insertion opening at a front end of the aperture and the slot at the rear end of the insertion opening. The technical effect lies in the increased flexibility of the gripping members. Claims 5 to 10 comprise further embodiments thereof.

2. claims: 11, 12

The subject-matter of dependent claim 11 is broader than that of claim 1, and so for the question of unity, the subject-matter of dependent claim 12 must be taken into consideration. Claim 12 concerns a backstop positioned within the flange aperture which prevents the plunger from dislodging.

3. claims: 13, 14

Claims 13 and 14 concern the method steps of an injection molding process and have no technical features common with either of the other groups.