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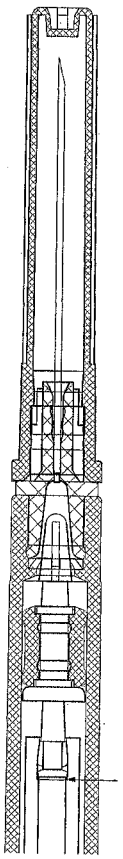
(54) Title: SINGLE USE SYRINGE



(57) Abstract: A single use syringe (20) comprising a hollow barrel (22) having a longitudinal axis X extending in a longitudinal direction and including a first engagement formation (74) formed on an internal wall of said hollow barrel (22). The syringe (20) includes a needle tip (24) in fluid communication with the barrel (22), and a plunger (28) insertable within the barrel (22). The plunger (28) having a stem (29) and a head (34) separably connected to the stem (29). The head (34) including a second engagement formation (46). The plunger (28) being displaceable through a longitudinal stroke in the longitudinal direction, to a captive position at an end of the stroke in which the first engagement formation (74) engages the second engagement formation (46), thereby securing the plunger (28) within the barrel (22). In the captive position, the stem (29) is adapted to separate from the head (34) if an attempt is made to longitudinally displace the stem (29) in either an insertion or retraction direction of the stroke, by application of a predetermined longitudinal force, such that the head (34) remains secured within the barrel (22).

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Single Use Syringe

Field of the Invention

The present invention relates to a single use syringe. In particular, the present invention relates to a self-destructing syringe suitable for single delivery of medication and vaccinations.

Background of the Invention

The risk of disease transmission resulting from the re-use of syringes is a serious problem around the world, and in particular in developing and third world countries. Diseases such as HIV (Human immunodeficiency virus) and Hepatitis B along with other blood borne diseases are readily transmitted between persons when a syringe is reused multiple times. Such problems are particularly prevalent among intravenous drug users who commonly share the same syringe without adequate sterilisation between users.

In addition, in some developing countries which lack suitably developed health standards, syringes used for medical purposes such as immunisations are poorly sterilised and subsequently re-used. This is known to sometimes result in the transmission of blood born diseases between patients when inadequate methods of sterilisation are practiced.

Single-use syringes are known. However, a problem with such syringes is that they are typically significantly more expensive to manufacture than conventional syringes which permit repeated use. Accordingly, in applications such as large-scale immunisations, the significant additional expense associated with using existing single-use syringes is not generally feasible in developing or third world countries.

Object of the Invention

It is the object of the present invention to overcome or substantially ameliorate at least one of the above disadvantages, or at least to provide a useful alternative.

Summary of the Invention

In a first aspect, the present invention provides a single use syringe comprising;

a hollow barrel having a longitudinal axis extending in a longitudinal direction and including a first engagement formation formed on an internal wall of said barrel;

a needle tip in fluid communication with said barrel; and

a plunger insertable within said barrel, said plunger having a stem and a head separably connected to said stem, said head including a second engagement formation;

said plunger being displaceable through a longitudinal stroke in said longitudinal direction to a captive position at an end of said stroke in which said first engagement formation engages said second engagement formation, thereby securing the plunger within the barrel,

wherein in the captive position, the stem is adapted to separate from the head if an attempt is made to longitudinally displace the stem in either an insertion or retraction direction of the stroke, by application of a predetermined longitudinal force, such that said head remains secured within said barrel.

The stem and head are preferably connected by a frangible region of the plunger.

The frangible region preferably includes a clevis shaped projection connected to the stem and a pin connected to the head.

The frangible region preferably includes four lugs which frangibly connect the pin to the clevis shaped portion.

The first engagement formation preferably includes one or more teeth formed on an internal wall of the barrel, and the second engagement formation includes a shoulder formed on the head and being engageable with the one or more teeth.

The predetermined longitudinal force required to separate the stem from the head is preferably between about 5N and 15N.

In a second aspect, the present invention provides a single use syringe comprising;

a hollow barrel having a longitudinal axis extending in a longitudinal direction and including a first engagement formation formed on an internal wall of said barrel,

a needle tip in fluid communication with said barrel;

a plunger insertable within said barrel, said plunger having a stem and a head separably connected to said stem, said head having a second engagement formation; and

a detent arrangement associated with said barrel and said plunger,

said plunger being displaceable through a longitudinal stroke in said longitudinal direction to a captive position at an end of said stroke in which said first engagement formation engages said second engagement formation, thereby securing the plunger within the barrel,

wherein said detent arrangement is configured to inhibit displacement of said plunger in said longitudinal direction as said plunger approaches said captive position.

The detent arrangement preferably includes a first detent portion formed on the internal wall of the barrel and a second detent portion formed on the stem, the first detent portion being adapted to engage the second detent portion as the plunger approaches the captive position.

The first detent portion preferably includes a projection that projects from the internal wall of the barrel into a hollow of the barrel, thereby locally reducing a transverse cross section of the hollow.

The second detent portion preferably includes a protuberance formed on the stem.

The protuberance is preferably deformable upon engagement with the projection.

The protuberance preferably includes two ribs protruding from opposing sides of the stem.

Each rib preferably includes a central portion connected to the stem at first and second ends, such that an aperture is defined between the central portion and the stem.

In a third aspect, the present invention provides a single use syringe comprising;

a hollow barrel having a longitudinal axis extending in a longitudinal direction and including a first engagement formation formed in said barrel;

said barrel having a hollow extending between a leading end of said barrel and a trailing end of said barrel, said hollow comprising a leading hollow portion and a trailing hollow portion separated by a restriction defined by said first engagement formation,

a needle mount mounted within said leading hollow portion,

a needle tip mounted on said needle mount,

a plunger insertable within said trailing hollow portion, said plunger having a stem and a head separably connected to said stem, said head including a second engagement formation; said plunger being displaceable through a longitudinal stroke in said longitudinal direction to a captive position at an end of said stroke in which said first engagement formation engages said second engagement formation, thereby securing the plunger within the trailing hollow portion.

The needle mount preferably includes a radially extending lip which is captively received within a corresponding annular groove formed within the leading hollow portion.

In a fourth aspect, the present invention provides a method of forming a barrel of a syringe, said method including the steps of;

locating a blank of plastic within a die having a longitudinal axis extending in a longitudinal direction, and

pressing said blank from a first side sides along said longitudinal axis, thereby forming a leading hollow portion for receipt of a needle mount,

pressing said blank from a second opposing side thereby forming a trailing hollow portion for receipt of a plunger,

wherein said pressing from said first side and said pressing from said second side also forms a first engagement formation for engaging the plunger, said first engagement formation being defined by a restriction which separates said leading hollow portion and said trailing hollow portion.

The step of forming the first engagement formation preferably includes forming one or more moulded teeth.

Brief Description of the Drawings

Preferred embodiments of the present invention will be described by way of example only, with reference to the accompanying drawings, in which;

Fig. 1 is a sectional side view of a single use syringe;

Fig. 2 is a cross-sectional view of the plunger of the syringe of Fig. 1;

Fig. 3 is a detailed cross-sectional view of the trailing end of the plunger of Fig. 2;

Fig. 4 is a detailed view of the leading end of the plunger of Figs. 2 to 3;

Fig. 5 is a leading end view of the barrel of the syringe of in Fig. 1;

Fig. 6 is a cross-sectional side view of the leading end of the barrel of the syringe of Fig. 1;

Fig. 7 is a cross-sectional side view of the syringe of Fig. 1 after completion of an injecting operation;

Fig. 8 is a cross-sectional side view of a needle mount of the syringe of Fig. 1;

Fig 9 is a leading end view of the needle mount of Fig. 8;

Fig. 10 is a cross-sectional side view of a rubber piston seal of the syringe of Fig. 1;

Fig. 11 is a cross-sectional side view of a needle cap for covering the needle of the syringe of Fig. 1; and

Fig. 12 is a cross-sectional side view of the leading end of the syringe of Fig. 1 with the needle cap.

Detailed description of the preferred embodiments

A single use syringe is depicted in the drawings and indicated by the reference numeral 20. As seen in Fig. 1, the syringe 20 includes a hollow barrel 22 having a longitudinal axis X, and the barrel 22 is connected to a stainless steel needle tip 24, located at the leading end 26 of the barrel 22. The barrel 22 is made from a clear plastic material, enabling the volume of fluid contained therein to be externally seen. The syringe 20 also includes a plunger 28 which is insertable into an opening formed in the trailing end 30 of the barrel 22.

Figs. 2 to 4 show the plunger 28 in isolation. The plunger 28 includes a head 34 which is insertable into the trailing hollow end 30 of the barrel 22. The plunger 28 also includes a stem 29 separably connected to the head 34. The head 34 and the stem 29 are connected by a frangible region 48 of the plunger 28, and the plunger 28 is displaceable through a longitudinal stroke in the longitudinal direction, to a captive position towards an end of the stroke. The captive position is typically reached when the head 34 has travelled through at least 95% of the stroke, and in the captive position, the head 34 is secured thereby preventing movement of the head 34 through said stroke in either an insertion or retraction direction.

As seen in Figs. 2 and 4, the head 34 has two annularly projecting shoulders 36, 38 which act as a support to retain a flexible piston seal 40 which is shown in Fig. 10.

The piston seal 40 is manufactured from a synthetic rubber and has raised annular rings on its outer surface, which interferingly contact the inner wall of the barrel 22, to form a liquid tight seal. A hole 41 is formed through the piston seal 40, for seating the piston seal 40 on the head 34, between the shoulders 36, 38.

The head 34 terminates at a tapered projection 42 with a rounded tip positionable at the needle tip 24 end of the syringe 20, such that the diameter of the tapered projection 42 increases as it progresses towards the stem 29, and terminates at a second engagement formation 46 in the form of an annular shoulder 46. The projection 42 is connected to a neck 44 of the head 34 having a smaller diameter than the shoulder 46, such that the annular shoulder 46 extends radially beyond the neck 44.

The frangible region 48 of the plunger 28 is best seen in Fig. 4. The frangible region 48 preferably includes a clevis shaped formation 49 connected to the stem 29, which is formed by two opposing arms 50 which each extend parallel to the longitudinal axis Y of the plunger 28. The arms 50 are separated by a space 52, through which the axis Y passes. The frangible region 48also includes a pin 54 connected to the head 34 and

projecting into the space 52 between the opposing arms 50, such that the pin 54 is co-axial with the axis Y.

The end 56 of the pin 54 is attached on two sides to the arms 50 by two frangible lugs 51. The pin 54 has a region 58 in which the diameter steps up to an increased diameter, which commences near the ends of the arms 50. At the region 58 of increased diameter, the pin 54 is also connected to the end portion of the arms 50, by two further frangible lugs 53. Accordingly, the head 34 is connected to the stem 29 at four locations, which are the frangible lugs 51, 53. The dimensions of the frangible lugs 53 are preferably 0.4mm by 0.3mm, and the dimensions of the frangible lugs 51 are preferably 0.0175mm by 0.3mm.

While the stem 29 is connected to the head 34, a gap 60 is present between the base 59 of the clevis shaped formation 49 and the end 56 of the pin 54.

The trailing end of the plunger 28 has a finger pad 62 formed therein, which provides a surface that a user can press to drive the plunger 28 into the barrel 22.

Fig. 6 shows the barrel 22, which is formed by a plastic moulding operation, in which it is pressed or stamped in a die, such that forces are applied to the leading end 26, along the longitudinal axis X of the barrel 22 such that a leading hollow 23a is formed in the blank. A force is also applied in an opposite direction along the longitudinal axis X of the barrel 22 such that a trailing hollow 23b is also formed in the blank between the leading and trailing ends 26, 30 of the barrel 11.

The pressing operation also forms a first engagement portion defined by a restriction which separates the leading hollow portion 23a and the trailing hollow portion 23b. The step of forming the first engagement formation preferably includes forming one or more moulded teeth. An advantage of the forming process, is that it permits the teeth to be formed during the same process as the forming of the leading and trailing hollow portions 23a, 23b.

A detent arrangement is associated with the barrel 22 and the plunger 28 in the form of a first detent portion 71 formed on an inner wall of the barrel 22 in the form of a projection 71, and a corresponding second detent 64 portion in the form of a protuberance 64 on said stem 28. The projection 71 is engageable with the protuberance 64, such that the detent arrangement is configured to inhibit displacement of the plunger 28 in the longitudinal direction as the plunger approaches the captive position.

As shown in Fig. 7, the initial opening of the barrel 22 at the trailing end 30 has a tapered region 65, such that the entrance to the trailing hollow portion 23b is sufficiently wide to permit a user to easily insert the head 34 and the rubber piston seal 40 into the

trailing hollow portion 23b. The tapered region 65 is adjacent to the first detent portion 71 which is embodied in the form of a projection 71 that projects from the internal wall of the barrel 22 into the hollow within the barrel 22 thereby locally reducing the transverse cross section of the hollow. The protuberance 64 preferably includes two ribs 64a, 64b protruding from opposing sides of the stem 29. Each rib 64a, 64b includes a central portion connected to the stem 29 by first and second ends, such that an aperture is defined between the central portion and the stem 29.

Adjacent to the projection 71 towards the leading end 26, the transverse cross sectional area of the trailing hollow portion 23b increases, such that the projection 71 acts as a restriction, locally reducing the transverse cross-sectional area of the trailing hollow portion 23b.

The needle 24 is permanently mounted to a needle mount 66 in the form of a needle holding bush 66 which is best seen in Fig. 8. The needle mount 66 has a radially extending lip 68 which engages with a corresponding annular groove 70 within the barrel 22, and best seen in Fig. 6. When the annular lip 68 of the needle mount 66 is snapped into the annular groove 70, the needle 24 permanently connects with the syringe 20. A generally cone shaped hollow 72 with a rounded end is formed in the trailing end of the needle mount 66.

Referring to Figs 5 and 6, the first engagement formation 74 is in the form of four teeth 74 formed within the barrel 22 toward the leading end 26, and adjacent to and trailing the annular groove 70. In an alternative arrangement not shown in the drawings, there may be more or less than four teeth 74. The teeth 74 project diagonally inwardly within the hollow barrel 22, such that the teeth 74 project toward the leading end 26 of the barrel 22.

As seen in Fig. 6, there is a space 76 formed between each tooth 74 and the wall of the barrel 24. The teeth 74 are elastically deformable, and the teeth 74 are preferably spaced evenly around the circumference of the barrel 22.

The syringe 20 includes a needle cap 80 which covers the tip of the needle 34, and engages with the needle mount 66 by a snap lock.

The operation of the syringe 20 will now be described. When an injection of liquid in the form of medication or an immunisation is to be administered, a medical practitioner removes the needle cap 80 which exposes the needle tip 24. The practitioner then applies a force with his/her thumb to the finger pad 62, to drive the piston 34 into the barrel 22. As the piston 34 gets close to the end of its stroke such that the head 34 is

approaching the leading end 26 of the barrel 22, the protuberance 64 of the stem 29 enters into the tapered region 65, and subsequently engages the projection 71 of the barrel 22.

At this point of the insertion process, the protuberance 64 is in contact with and engages the projection 71, which inhibits movement of the plunger 28 in the insertion direction, thereby increasing the force required to insert the plunger 28 any further in the longitudinal direction. The user can feel an increased drag force, and is hence aware without visually looking at the syringe 20 that the head 34 is nearing the designated "fill" position.

Inserting the head 34 any further within the barrel 22 at this point will cause the barrel 22 to captively engage the head 34, thereby preventing the syringe 20 from being used.

The user then inserts the needle 24 into a vial of liquid (not shown) and subsequently retracts the stem 29 away from the needle 24 end of the syringe 20, to draw a quantity of the liquid into the barrel 22. The drawing operation is conducted when the user places the first and second fingers of one hand under two flanges 65 formed on the underside of the finger pad 62, located on either side of the stem 29. Markings on the side of the barrel 22 indicate the volume of the liquid contained therein, such that a desired dosage of liquid can be measured. The rubber piston seal 40 prevents leakage between the piston 34 and the inside wall of the hollow barrel 22.

The user then holds the syringe with the needle facing upwardly and applies a further force with his/her thumb to the finger pad 62, to again drive the piston 34 into the barrel 22. Any air present in the barrel 22 is then expelled from the syringe 20, leaving liquid only within the barrel 22.

The needle 24 is then inserted into a patient's muscle tissue or a vein as required, and the contents of the barrel 22 are injected into the patient by applying a further force to the finger pad 62. As the head 34 approaches the end of its stroke, the cone shaped projection 42 enters into the corresponding cone shaped hollow 72 within the needle mount 66. The shoulder 46 then comes into contact with the teeth 74, and as a further force is applied, the teeth 74 are elastically displaced radially towards the inner wall of the barrel 22. The shoulder 46 then passes the end of the teeth 74, and the teeth 74 spring back to their original position, restraining the shoulder 46 against being retracted from the barrel 22. At this stage, the injection is complete and the cone shaped head 42 is captively seated within the corresponding cone shaped hollow 72, such that substantially all of the liquid has been ejected from the barrel 22.

At this stage if a user makes an attempt to longitudinally displace the head stem 29 by applying a force to the stem 29 in either the insertion or retraction directions by application of a predetermined longitudinal force, the stem 29 separates from the head 34 by rupture of the four frangible lugs 51, 53, such that the head 34 remains secured within the barrel 22. The force required to rupture the four frangible lugs 51, 53 is typically in the range of 5N to 15N. However, this may be set to a desired level by altering the cross sectional area of the frangible lugs 51, 53.

Fig. 8 shows the syringe 20 after completion of the injecting procedure, in which the head 34 has separate from the stem 29. In the event that the stem 29 and head 34 are not separated upon the completion of the injection cycle, the separation will occur if an attempt is subsequently made to retract the head 34 from the barrel 22, or further insert the head 34 into the barrel 22.

When the injection is complete, the complete syringe 20 is disposed of in a sharps container.

Although the invention has been described with reference to specific examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms.

Claims

1. A single use syringe comprising;

a hollow barrel having a longitudinal axis extending in a longitudinal direction and including a first engagement formation formed on an internal wall of said barrel;

a needle tip in fluid communication with said barrel; and

a plunger insertable within said barrel, said plunger having a stem and a head separably connected to said stem, said head including a second engagement formation;

said plunger being displaceable through a longitudinal stroke in said longitudinal direction to a captive position at an end of said stroke in which said first engagement formation engages said second engagement formation, thereby securing the plunger within the barrel,

wherein in the captive position, the head is secured thereby preventing movement of the head through said stroke, and said stem is adapted to separate from the head if an attempt is made to longitudinally displace the stem in either an insertion or retraction direction of the stroke, by application of a predetermined longitudinal force, such that said head remains secured within said barrel.

2. The syringe of claim 1, wherein the stem and head are connected by a frangible region of said plunger.

3. The syringe of claim 2, wherein the frangible region includes a clevis shaped projection connected to said stem and a pin connected to said head.

4. The syringe of claim 3, wherein said frangible region includes four lugs which frangibly connect the pin to said clevis shaped portion.

5. The syringe of any one of the preceding claims, wherein the first engagement formation includes one or more teeth formed on an internal wall of said barrel, and said second engagement formation includes a shoulder formed on said head and being engageable with said one or more teeth.

6. The syringe of any one of the preceding claims, wherein said head includes a piston seal adapted to sealingly engage an inner wall of said barrel, wherein said second engagement formation is located at a leading side of said piston seal.

7. The syringe of any one of the preceding claims, wherein said predetermined longitudinal force required to separate the stem from the head is between about 5N and 15N.

8. The syringe of any one of the preceding claims, wherein said captive position is reached when said head has travelled through at least 95% of said stroke.

9. A single use syringe comprising;

a hollow barrel having a longitudinal axis extending in a longitudinal direction and including a first engagement formation formed on an internal wall of said barrel,

a needle tip in fluid communication with said barrel;

a plunger insertable within said barrel, said plunger having a stem and a head separably connected to said stem, said head having a second engagement formation; and

a detent arrangement associated with said barrel and said plunger,

said plunger being displaceable through a longitudinal stroke in said longitudinal direction to a captive position at an end of said stroke in which said first engagement formation engages said second engagement formation, thereby securing the plunger within the barrel,

wherein said detent arrangement is configured to inhibit displacement of said plunger in said longitudinal direction as said plunger approaches said captive position.

10. The syringe of claim 9, wherein said detent arrangement includes a first detent portion formed on said internal wall of said barrel and a second detent portion formed on said stem, said first detent portion being adapted to engage said second detent portion as said plunger approaches said captive position.

11. The syringe of claim 10, wherein said first detent portion includes a projection that projects from said internal wall of said barrel into a hollow of said barrel, thereby locally reducing a transverse cross section of said hollow.

12. The syringe of claim 11, wherein said second detent portion includes a protuberance formed on said stem.

13. The syringe of claim 12, wherein said protuberance is deformable upon engagement with said projection.

14. The syringe of either of claims 12 or 13, wherein said protuberance includes two ribs protruding from opposing sides of said stem.

15. The syringe of claim 14, wherein each rib includes a central portion connected to the stem at first and second ends, such that an aperture is defined between the central portion and said stem.

16. The syringe of any one of the preceding claims, wherein said second engagement formation is integrally formed with said barrel.

17. A single use syringe comprising;

a hollow barrel having a longitudinal axis extending in a longitudinal direction and including a first engagement formation formed in said barrel;

said barrel having a hollow extending between a leading end of said barrel and a trailing end of said barrel, said hollow comprising a leading hollow portion and a trailing hollow portion separated by a restriction defined by said first engagement formation,

a needle mount mounted within said leading hollow portion,

a needle tip mounted on said needle mount,

a plunger insertable within said trailing hollow portion, said plunger having a stem and a head separably connected to said stem, said head including a second engagement formation; said plunger being displaceable through a longitudinal stroke in said longitudinal direction to a captive position at an end of said stroke in which said first engagement formation engages said second engagement formation, thereby securing the plunger within the trailing hollow portion.

18. The syringe of claim 15, wherein said needle mount includes a radially extending lip which is captively received within a corresponding annular groove formed within said leading hollow portion.

19. A method of forming a barrel of a syringe, said method including the steps of;

locating a blank of plastic within a die having a longitudinal axis extending in a longitudinal direction, and

pressing said blank from a first side sides along said longitudinal axis, thereby forming a leading hollow portion for receipt of a needle mount,

pressing said blank from a second opposing side thereby forming a trailing hollow portion for receipt of a plunger,

wherein said pressing from said first side and said pressing from said second side also forms a first engagement formation for engaging the plunger, said first engagement formation being defined by a restriction which separates said leading hollow portion and said trailing hollow portion.

20. The method of claim 19, wherein said step of forming said first engagement formation includes forming one or more moulded teeth.

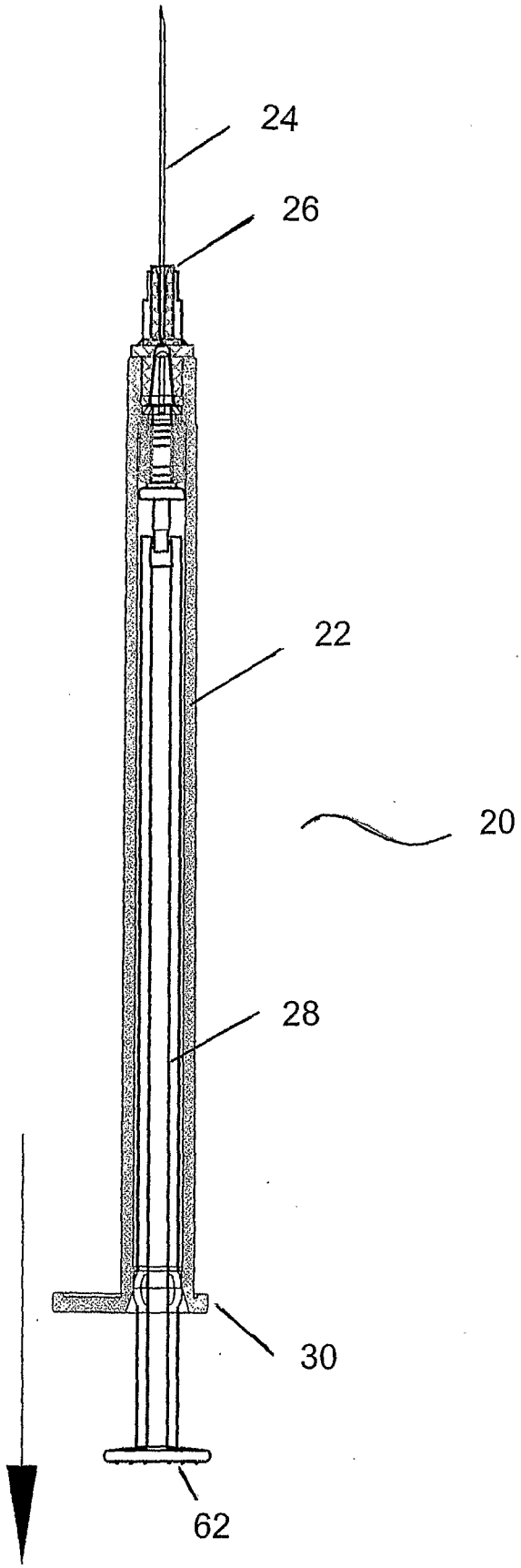


FIGURE 1

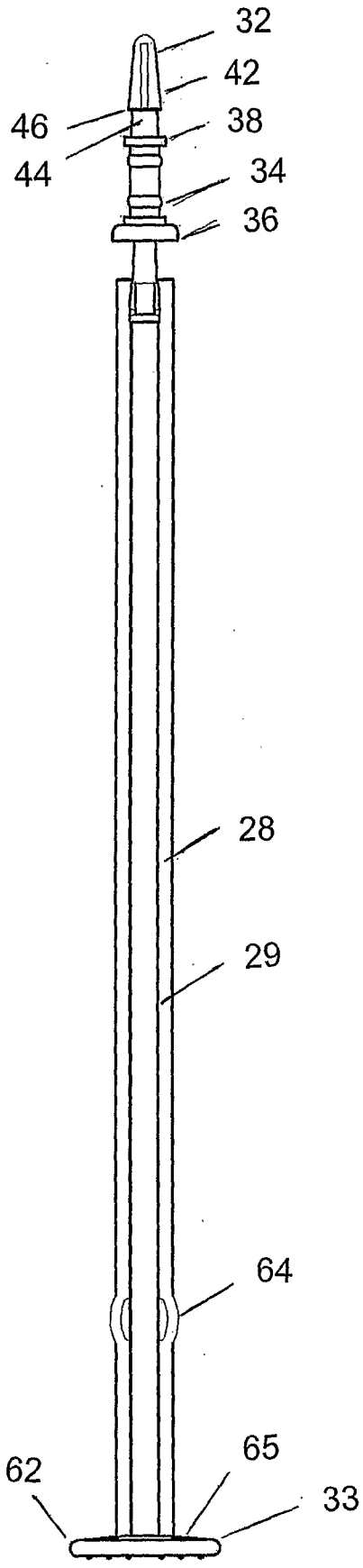


FIGURE 2

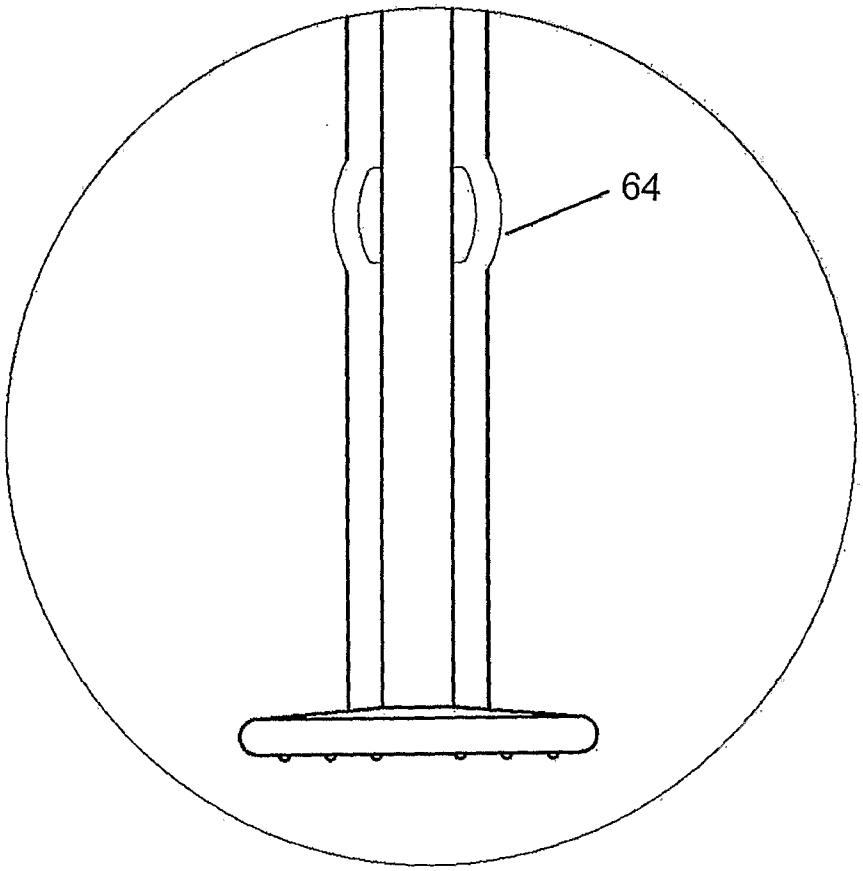


FIGURE 3

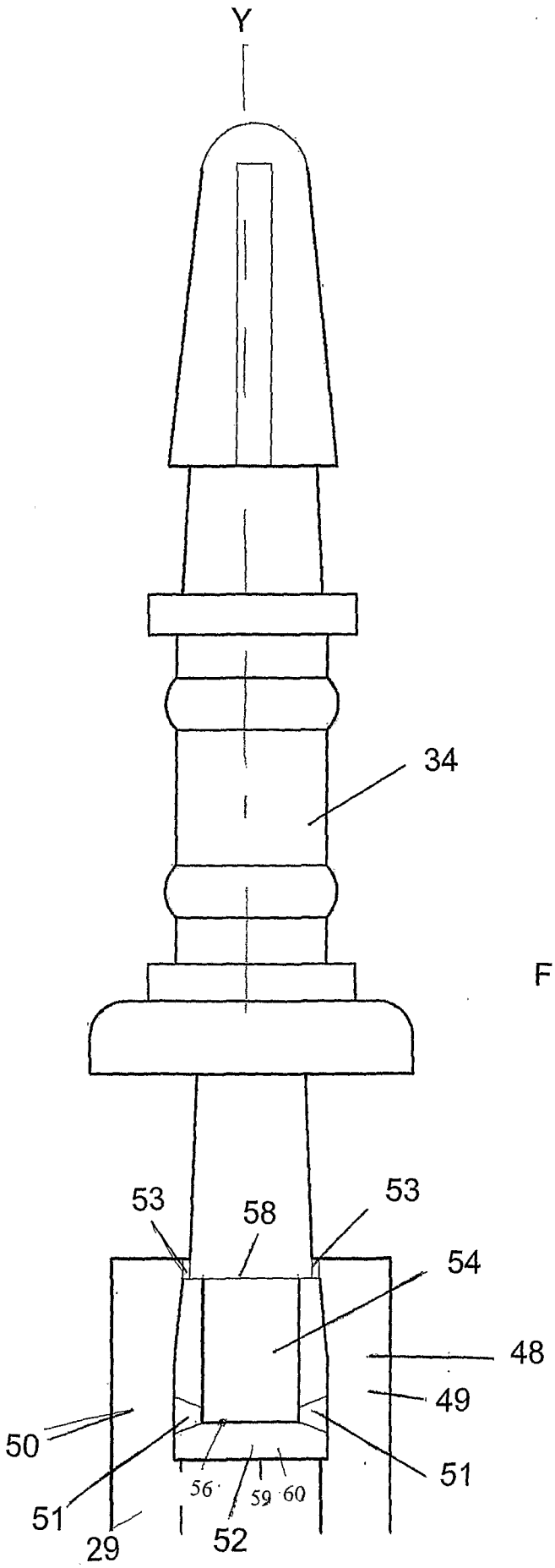


FIGURE 4

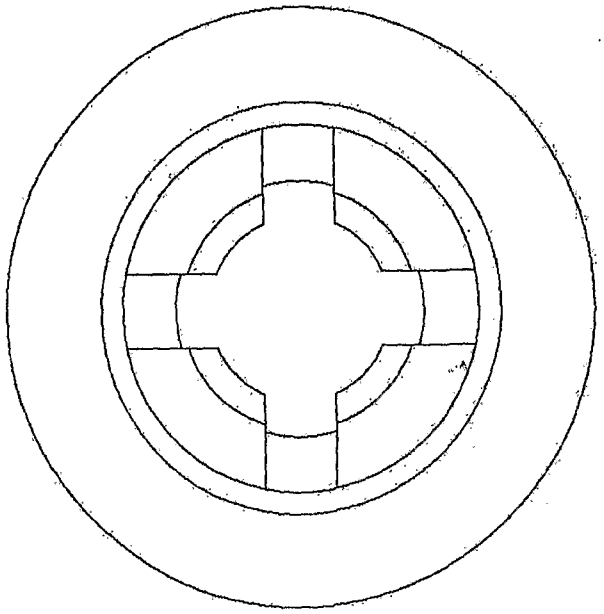


FIGURE 5

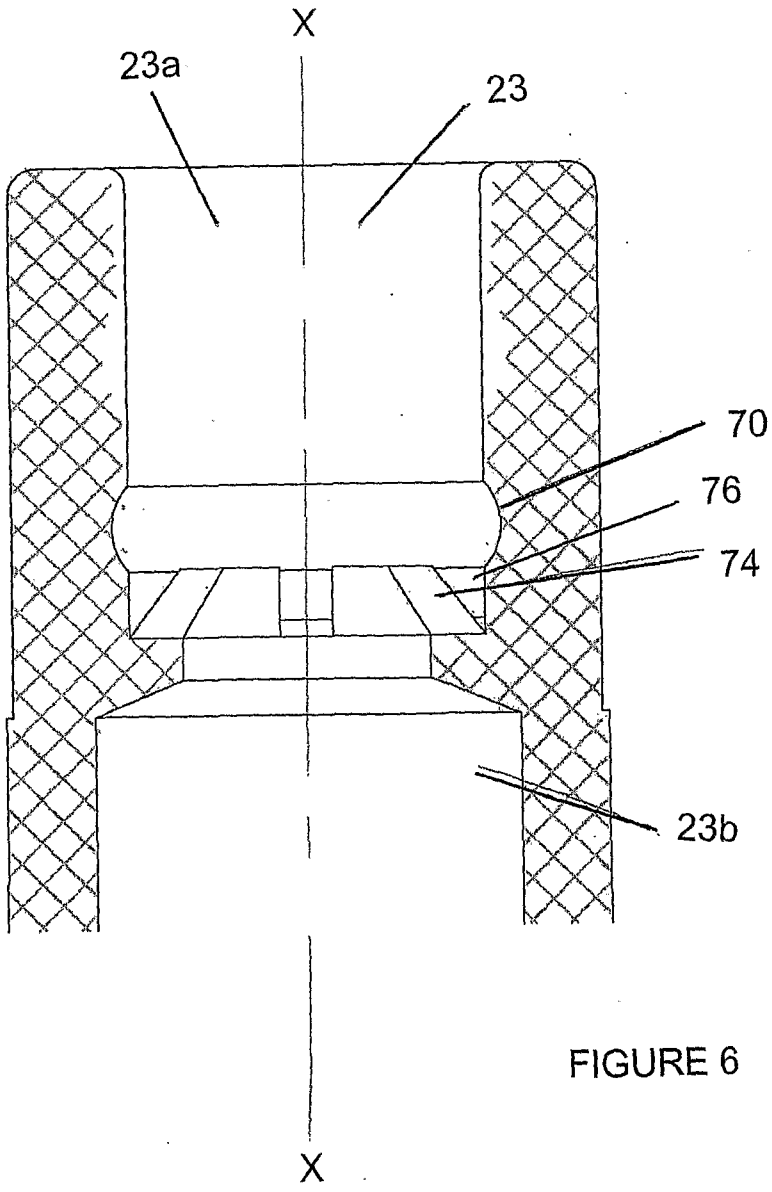
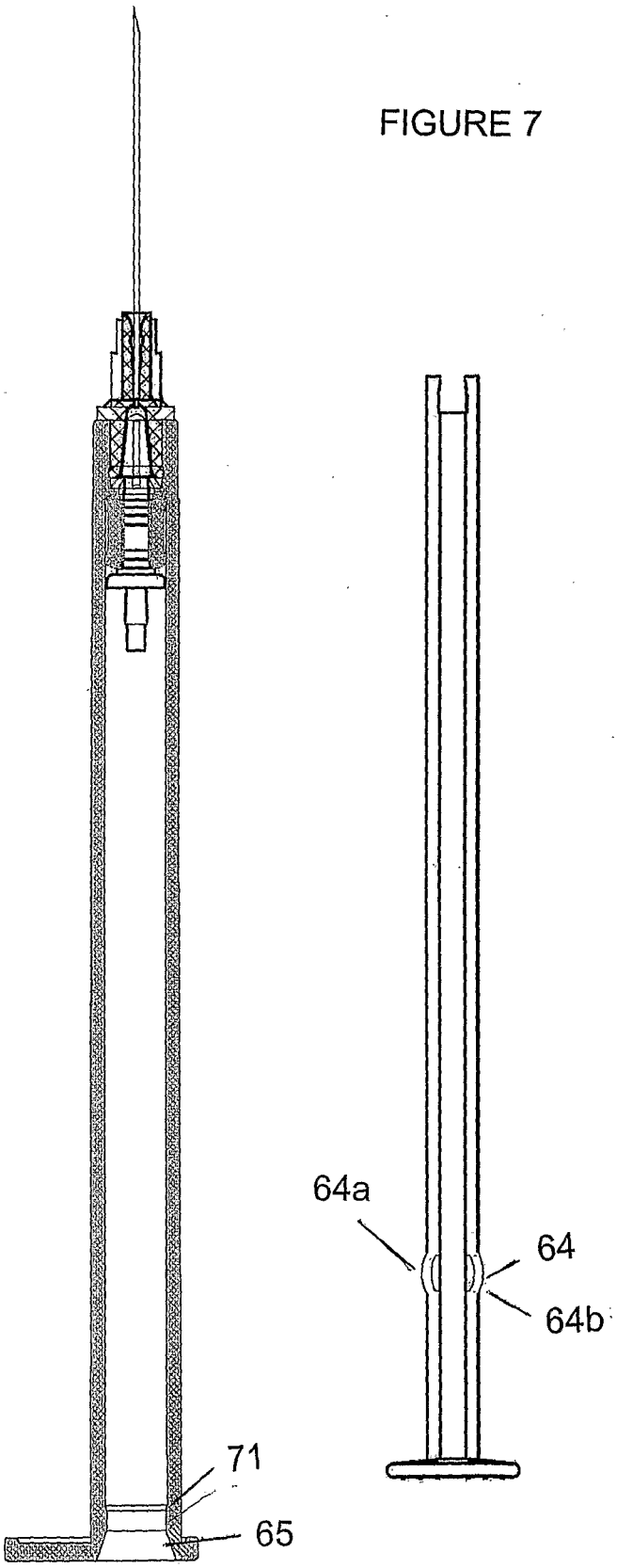


FIGURE 6

FIGURE 7



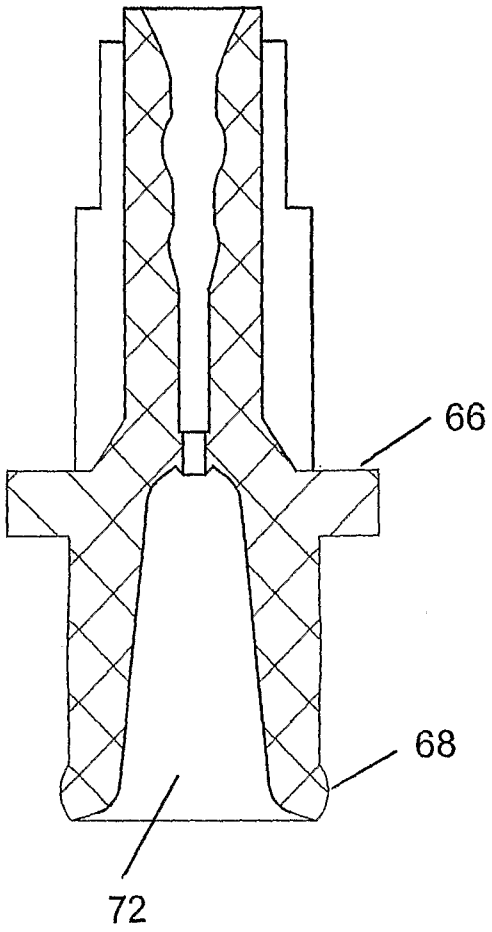


FIGURE 8

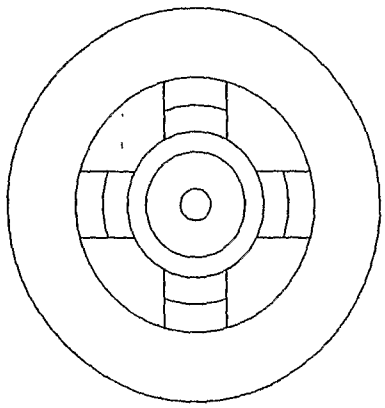


FIGURE 9

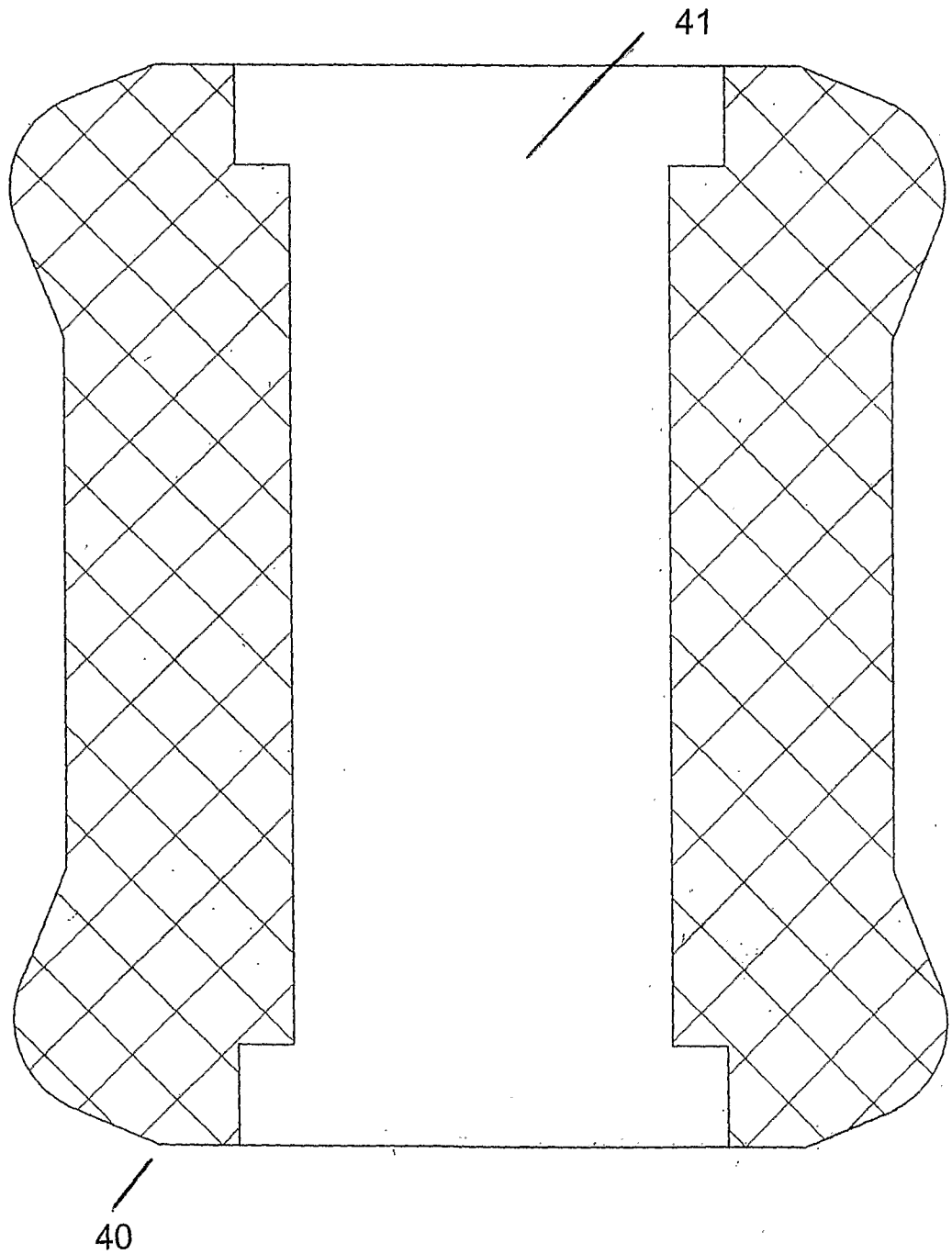


FIGURE 10

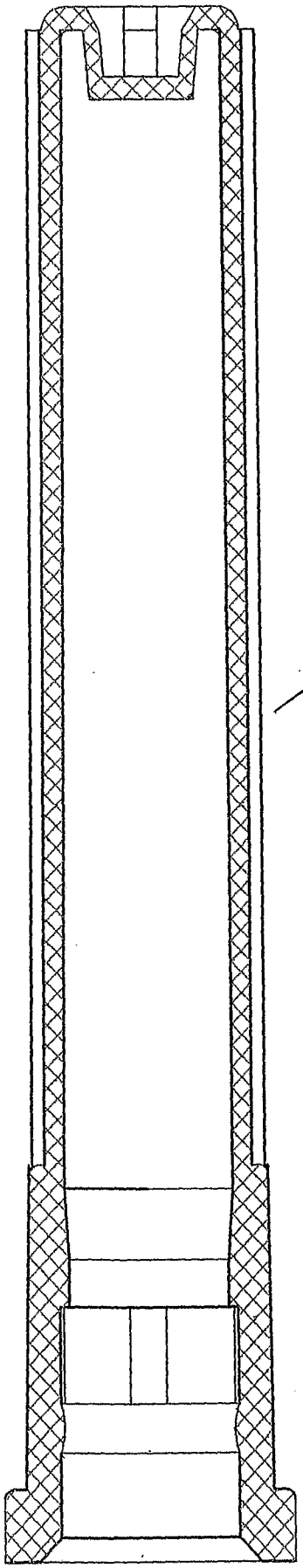


FIGURE 11

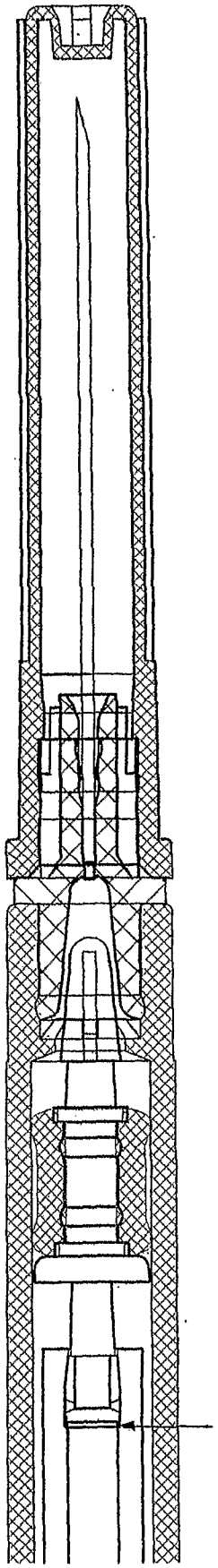


FIGURE 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2006/001228

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. ***A61M 5/50*** (2006.01) ***A61M 5/315*** (2006.01)

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)

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)
DWPI: A61M 5/--, B29D IPC & keywords: (syringe, plunger, rod, stem, piston, head, engage, lock, catch, secure, retain, frangible, break, disconnect, detent, inhibit, stroke, manufacture, die, blank, press, restriction) and similar terms

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 2004/0176722 A1 (CAPES et al.) 9 September 2004 See the entire document, in particular, figures 1, 5-7, paragraphs [0004], [0025]-[0030].	1-8, 17-20 9-16
X Y	US 2005/0240149 A1 (LU) 27 October 2005 See the entire document.	1-8, 17-20 9-16
X Y	WO 1988/010127 A1 (AGVEN MEDICAL CORPORATION LIMITED) 29 December 1988 See the entire document, in particular, figures 6-9, 12-14, 28a-28d, 32.	1-8, 17-20 9-16
X Y	US 4775364 A (ALLES) 4 October 1988 See the entire document, in particular, figure 4 and columns 2-3.	1-8, 17-20 9-16

[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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 October 2006	10 NOV 2006
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer **SUE THOMAS** Telephone No : (02) 6283 2454

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2006/001228

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	US 4932941 A (MIN et al.) 12 June 1990	
X	See the entire document.	1-8
Y		9-16
	EP 0409134 A1 (COMERCIAL MARIAE, S.L.) 23 January 1991	
X	See the entire document.	1-8, 17-20
Y		9-16
	US 5415638 A (NOVACEK et al.) 16 May 1995	
Y	See the abstract; figures 65, 66; column 33, line 14-column 34, line 57.	9-16
	The features of the single-use syringes of any one of US 2004/0176722 A1, US 2005/0240149 A1, WO 1988/010127 A1, US 4775364 A, US 4932941 A, or EP 0409134 A1 are intended to be combined with the feature of a detent arrangement configured to inhibit displacement of the plunger as the plunger approaches a captive position from US 5415638 A.	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2006/001228

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:
See annexed 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.:

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/AU2006/001228

Supplemental Box
(To be used when the space in any of Boxes I to VIII is not sufficient)

Continuation of Box No: III

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

In assessing whether there is more than one invention claimed, I have given consideration to those features which can be considered to potentially distinguish the claimed combination of features from the prior art. Where different claims have different distinguishing features they define different inventions.

This International Searching Authority has found that there are different inventions as follows:

- Claims 1 to 18 are directed to a single use syringe. The syringe comprises a hollow barrel with a longitudinal axis extending in a longitudinal direction and including a first engagement formation formed on the internal wall of the barrel, a needle tip in fluid communication with the barrel, and a plunger insertable within the barrel. The plunger has a stem and a head separably connected to the stem, said head including a second engagement formation. The plunger is displaceable through a longitudinal stroke in the longitudinal direction to a captive position at the end of the stroke, wherein the first engagement formation engages the second engagement formation thereby securing the plunger in the barrel. It is considered that the combination of the above features comprises a first distinguishing feature set.

- Claims 19 and 20 are directed to a method of forming a barrel of a syringe. The method includes the steps of locating a plastic blank within a die having a longitudinal axis extending in a longitudinal direction, pressing the blank from a first side along the longitudinal axis to form a leading hollow portion for a needle mount, and pressing the blank from a second side to form a trailing hollow portion for receipt of a plunger. The process of pressing the blank to form the first and second sides forms a first engagement formation for engaging the plunger, and the first engagement formation is defined by a restriction which separates the leading and trailing hollow portions. It is considered that the method steps described above comprise a second distinguishing feature set.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

Each of the abovementioned groups of claims has a different distinguishing feature and they do not share any feature which could satisfy the requirement for being a special technical feature. Because there is no common special technical feature it follows that there is no technical relationship between the identified inventions. Therefore the claims do not satisfy the requirement of unity of invention *a priori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2006/001228

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	2004176722	WO	2004078243				
US	2005240149	NONE					
WO	1988/010127	AU	19574/88	BR	8807587	CN	1030188
		DK	666089	EG	18569	EP	0368883
		ES	2011350	GR	88100416	IN	169618
		OA	9106	PT	87806	US	5047017
		ZA	8804409				
US	4775364	NONE					
US	4932941	NONE					
EP	0409134	BR	9003474	CA	2021249	DD	296615
		ES	2014802	IE	902580	JP	3131270
		PT	94710				
US	5415638	AU	54202/90	AU	84449/91	BR	9007247
		CA	2049972	CN	1100958	EP	0463086
		EP	0551287	MX	9101086	US	5030208
		US	5112318	US	5122124	US	5205827
		US	5263933	US	5360404	US	5462531
		US	5520649	US	5688240	US	5858000
		US	6033386	US	6117113	US	6344031
		US	6878131	US	2002065489	US	2005192541
		WO	1990/011099	WO	1992/005821		

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX