

INJECTION DEVICE

FIELD OF THE INVENTION

- 5 The present invention relates to an injection device. In particular, the injection device is suited, but not limited for administering subcutaneous injection to an individual.

BACKGROUND ART

- 10 The following discussion of the background to the invention is intended to facilitate an understanding of the present invention only. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was published, known or part of the common general knowledge of the person skilled in the art in any jurisdiction as at the
15 priority date of the invention.

Throughout the specification, unless the context requires otherwise, the word “comprise” or variations such as “comprises” or “comprising”, will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

- 20 Furthermore, throughout the specification, unless the context requires otherwise, the word “include” or variations such as “includes” or “including”, will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

- 25 Individuals or patients suffering from diabetes typically require periodic injection of medicament comprising insulin into their body for the regulation of blood sugar level. Such periodic injections may be administered by a patient himself through known devices such as insulin pens, or by qualified medical professional(s) in a clinic or hospital.

In a hospital context, multi-dose vials containing vaccines are commonly used. Such multi-dose vials are shared amongst multiple patients. Typically, before administration of a dosage of insulin, a device such as a syringe with needle attached is used to extract the dosage from a multi-dose vial. To avoid
5 contamination, safety procedures such as the use of a sterilized new syringe and a needle for each different patient have to be strictly followed. However, due to human error or lapses in adherence to procedures, contamination may still occur.

In addition to contamination due to procedural lapses, the medical
10 professional(s) may also be at risk of contamination due to accidental needle prick or injury arising from used needles.

As part of compliance with safety procedures, syringes and needles utilized in hospitals are to be disposed after administration of the medicinal dosage to patients. Therefore, the cost of such syringes and needles (collectively known
15 as an injection device) will have to be kept relatively low. Such low-cost devices do not have enhanced safety feature for minimizing needle injury to the medical professional, unlike a comprehensive insulin pen for personal and multiple usage.

In view of the above, there therefore exists a need to provide a cost-effective
20 and simple injection device that could reduce contamination to a minimum and at the same time enhance safety for medical professionals.

It is therefore an object of the invention to meet the above needs at least in part.

SUMMARY OF THE INVENTION

In accordance with an aspect of the invention there comprises an injection
25 device comprising a barrel having a first end for a needle to protrude therefrom; a needle assembly having a double-pointed hollow needle and a resilient element operable to bias the double-pointed hollow needle away from the first end of the barrel; and a mechanism operable to cause the cartridge to be punctured by the first end of the double-pointed hollow needle, and to

simultaneously cause the second end of the double-pointed hollow needle to protrude from the barrel and be held in the protruded position.

5 Preferably, the barrel comprises a second end shaped and dimensioned to receive the mechanism, needle assembly or cartridge.

10 Preferably, the mechanism comprises a rubber plug having a first portion and a second portion such that the second portion is arranged to urge the cartridge against the first end of the double-pointed hollow needle and the first portion rest on the second end of the barrel.

15 Preferably, the barrel comprises a first part and a second part, wherein the first part contains the needle assembly and the second part contains the cartridge and mechanism.

Preferably, the first and second part are joined together via coupling means.

Preferably, the coupling means comprises screw threads.

20 Preferably, the mechanism comprises a. a rubber plug having a first portion and a second portion such that the second portion is arranged to urge the cartridge against an inner wall of the second part of the barrel; and b. the coupling means such that as the first and second parts are coupled together, the cartridge is punctured by the first end of the double-pointed hollow needle, and the second
25 end of the double-pointed hollow needle is protruded from the barrel and held in the protruded position.

30 Preferably, the mechanism comprises a pair of flaps arranged proximate to the second end of the barrel to prevent the cartridge from being ejected from the barrel due to the resilient element.

BRIEF DETAILS OF THE DRAWINGS

5 In order that this invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings, which illustrate preferred embodiments of the invention by way of example only, wherein:

Fig. 1a shows a perspective view of an injection device in accordance with an
10 embodiment of the invention;

Fig. 1b shows an exploded view of the injection device in accordance with the embodiment illustrated in Fig. 1a;

Fig. 2 illustrates the assembly and use of the device of Fig. 1a;

Fig. 3a shows a perspective view of an injection device in accordance with
15 another embodiment of the invention;

Fig. 3b shows an exploded view of the injection device in accordance with the embodiment illustrated in Fig. 3a;

Fig. 4 illustrates the assembly and use of the device of Fig. 3a;

Fig. 5a shows a perspective view of an injection device in accordance with yet
20 another embodiment of the invention;

Fig. 5b shows an exploded view of the injection device in accordance with the embodiment illustrated in Fig. 5a; and

Fig. 6 illustrates the assembly and use the device of Fig. 5a.

Other arrangements of the invention are possible and, consequently, the
25 accompanying drawings are not to be understood as superseding the generality of the description of the invention.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Throughout the description, the term 'injection device' broadly includes
30 syringes, needles, injection pens etc.

In accordance with an embodiment of the invention there comprises an injection device 10. With reference to Fig. 1a and Fig. 1b, the device 10 comprises a cylindrical barrel 12, a needle assembly 14, a plug 16 and a plunger 18. The device 10 is used to receive a cartridge 20, preferably containing a single dosage of a fluid composition for administration to an individual. Non-exhaustive examples of the fluid composition may be a vaccine or a medicament for treating diabetes having active ingredient insulin.

The cylindrical barrel 12 operates as a container to hold various components together. Cylindrical barrel 12 is preferably a one-part barrel 12. The cylindrical barrel 12 comprises a first end 12a and a second end 12b. First end 12a comprises a hole for a needle 24 to protrude or retract therefrom. Second end 12b comprises an opening for receiving the needle assembly 14, the cartridge 20, the plug 16 and plunger 18. The use of the cylindrical barrel 12 greatly aids in assembly of the various components because the various components can be slidably received within the cylindrical barrel 12. Such simple assembly is readily suited to high volume automated production and represents a significant improvement in assembly costs compared to other devices.

The needle assembly 14 comprises a needle holder 22, the needle 24, and a resilient element 26. The needle 24 is a double-pointed hollow needle preferably, but not limited to be suitable for insertion into the subcutaneous layer of an individual/patient. Some fluid compositions, such as the medicament for treating diabetes having active ingredient insulin, are preferably injected subcutaneously i.e. in the subcutis lying between the cutis and a muscle membrane which cover the underlying muscles. If insulin is injected into the muscle tissue, it will be absorbed in the body too quickly and an unwanted drop in the blood sugar may result. In order to prevent intramuscular injection of insulin, it is possible to inject insulin into a lifted skin fold. Alternatively, the needle 24 can be adapted to be suitable for insertion into the subcutaneous layer of an individual/patient by being preferably short so that insulin may be injected directly without the skin fold. The needle 24 may be about 4 millimeters

(mm) to about 16 mm, about 6 mm to about 16 mm, about 8 mm to about 12 mm, about 4 mm to about 10 mm, about 4 mm to about 8 mm or about 4 mm to about 6 mm.

5 The needle holder 22 is shaped to be similar to the cylindrical barrel 12 and has a diameter slightly smaller than the cylindrical barrel 12 for insertion into the cylindrical barrel 12. The needle holder 22 comprises a slot 22a shaped and sized for the double-pointed needle 24 to insert therethrough and be held in position. In use, the hollow needle 24 allows fluid composition to flow from a punctured cartridge 20 to the needle 24.

10 The plug 16 comprises a first portion 16a and a second portion 16b. The plug 16 is preferably a rubber plug 16. The first portion 16a has a diameter similar to the diameter of the cylindrical barrel 12. The second portion 16b has a diameter slightly smaller than the diameter of the cylindrical barrel 12 such that when slidably received into the cylindrical barrel 12, the second portion 16b is inserted
15 into the cylindrical barrel 12 and the first portion 16a sits snugly on the opening of the second end 12b. In operation, the plug 16 is operable to engage the cartridge 20 and activate the cartridge 20 for use. Once the plug 16 is pushed in place the needle 24 is protruded from the first end 12a of the cylindrical barrel 12.

20 The plunger 18 comprises a first portion 18a and a second portion 18b. The first portion 18a has a diameter similar to the diameter of the cylindrical barrel 12. Extending from the first portion 18a is the second portion 18b that comprises protrusions or flanges 18c operable to contact the second portion 16b of the plug 16 and facilitates sliding movement along the length of the cylindrical barrel
25 12. In operation, the plunger 18 is utilized to contact the cartridge 20 to urge the fluid composition out of the cartridge 20 into the needle 24.

The cartridge 20 comprises a first end 20a operable to interface with the second end 16b of the plug, and a second end 20b that can be punctured by the double-pointed needle 24 when a sufficient force is applied to the cartridge 20
30 against the needle 24. Cartridge 20 further comprises a rubber seal 20c arranged at first end 20a. When the second end 20b of the cartridge is

punctured, the plunger 18 contacts the rubber seal 20c and pushes the rubber seal 20c towards the second end 20b, thereby urging the fluid composition out of the cartridge 20.

The resilient element 26 may be in the form of a spring.

5 With reference to Fig. 2, the various components may be assembled to form the device 10 in a sequence as follows. The needle assembly 14 is first received within the cylindrical barrel 12 and arranged such that the needle 24 is prevented from protruding from the first end 12a of the cylindrical barrel 12 by the spring 26, which operates to urge the needle assembly 14 away from the
10 first end 12a of the cylindrical barrel 12. As such, the risk of accidental needle prick or injury is eliminated. Furthermore, there is no need for an additional component, such as a safety shield, to prevent accidental needle prick or injury. In this arrangement, one end of the spring 26 contacts the first end 12a of the cylindrical barrel 12, and the other end of the spring 26 contacts the needle
15 holder 22. Next, the cartridge 20 containing the fluid composition is inserted into the cylindrical barrel 12. It is to be appreciated that the cartridge 20 contacts the needle assembly 14 but is not punctured in the absence of a large enough force to urge the cartridge 20 against the needle 24.

The plug 16 is next inserted into the cylindrical barrel 12. As the plug 16 is
20 inserted into the cylindrical barrel 12:

- i. The second portion 16b of the plug 16 urges against the first end 20a of the cartridge; and pushes the cartridge 20 towards the first end 12a of the cylindrical barrel 12;
- ii. The cartridge 20 in turn pushes against the needle assembly 14
25 towards the first end 12a of the cylindrical barrel 12; and
- iii. The spring 26 is compressed.

The above continues until one end of the needle 24 is protruded from the first end 12a, and the other end of the needle 24 punctures the cartridge 20, thereby allowing fluid to flow from the cartridge 20 to the hollow needle 24. As the plug
30 16 is pushed within the cylindrical barrel 12, the second portion 16b of the plug 16 contacts the inner surface of the cylindrical barrel 12 and prevents the spring

26 from pushing the needle assembly 14 out of position or causing the protruded needle 24 to be retracted.

Once one end of the needle 24 is protruded from the cylindrical barrel 12 and the other end of the needle punctures the cartridge 20, the device 10 is ready
5 for usage, i.e. for injecting the fluid composition such as insulin into an individual.

In use, the plunger 18 is pushed into the cylindrical barrel 12 through the plug 16 and contacts the rubber brush/seal 20c. As the seal 20c moves, fluid composition is urged out of the cartridge 20 to the needle 24. Upon usage, the

10 plug 16 and plunger 18 may be simply removed from the cylindrical barrel 12.

Once the plug 16 is removed, the spring 26 operates to urge the needle assembly 14 away from the first end 12a of the cylindrical barrel 12. The needle 24 then simultaneously retracts from the first end 12a as the needle assembly 14 is urged away from the first end 12a. The device 10 may then be

15 disposed/handled safely without the needle protruding from the cylindrical barrel 12, hence minimizing the risk of needle pricks or injury. Further, the risk of contamination is also reduced because of the avoidance of multi-dosage vials. Instead, a cartridge 20 comprising a single dosage suitable for a patient is used.

The components used are also relatively cheap, and could be easily mass-produced. For instance, the plunger 18, plug 16 and cylindrical barrel 12 may be
20 made from synthetic plastics material, and thus can be disposed of economically after a single use. Each device 10 can also be disposable.

Consequently, the device 10 is commercially viable to make, such that the production costs are reasonable compared with the costs of other injection
25 devices. This contrasts with other devices, the cost of which must be supported by repeated reuse. In addition, a person skilled in the art would appreciate that each reuse requires sterilization, which adds further to the cost of other devices.

Furthermore, before being sterilised, the spent cartridge and notably, the used needle have to be removed and disposed of, which exposes the user to the risk
30 of needle pricks or injury. In addition, the vectors of some very serious diseases

are known to be resistant to regular sterilisation. In contrast, device 10 is inexpensive, safe and convenient to use.

In accordance with another embodiment of the invention there comprises an injection device 100. Instead of having a one-part barrel 12 for holding the
5 needle assembly, plug and plunger, the cylindrical barrel 12 is modified to have coupling means 130 for coupling with a needle cap assembly 140.

In the device 100, the additional needle cap assembly 140 is introduced to house the needle assembly 14. This embodiment is suitable for use with a prefilled insulin pen.

10 With reference to Fig. 3a and Fig. 3b, wherein like numerals reference like parts, the cylindrical barrel 12 is used to receive a cartridge 20 containing a single dosage of a fluid composition. The fluid composition may be a vaccine or a medicament for treating diabetes having active ingredient insulin.

The needle cap 142 comprises a hole for one end of the needle 24 to protrude
15 therefrom. The other end of the needle 24 is aligned with a hole formed on the modified barrel 12' such that when the needle cap assembly 140 is coupled to the cylindrical barrel 120, the other end of the needle 24 operate to puncture the cartridge 20 simultaneously when the cylindrical barrel 120 is coupled to the needle cap assembly 140.

20 The needle 24 is preferably a double-pointed hollow needle.

The modified barrel 12' comprises coupling means 130 for coupling with the needle cap assembly 140. The coupling means may be in the form of screw threads 130 on the cylindrical barrel 120 and the needle cap assembly 140.

With reference to Fig. 4, the device 100 is assembled in a sequence as follows.

25 The cartridge 20 containing the fluid composition is inserted into the modified barrel 12' and rests against an end proximate to the screw threads 130 of the modified barrel 12'. The plug 16 is next inserted into the modified barrel 12' to hold the cartridge 20 in place.

The needle cap assembly 140 houses the needle holder, needle and spring
30 arranged such that as the needle cap 142 is coupled with the modified barrel 12' via the screw threads 130, one end of the needle protrudes from the needle

cap 142, while the other end of the needle punctures the cartridge 20 and compresses the spring 26.

The device 100 is ready for usage.

5 In use, the plunger 18 is pushed through the plug 16 and contacts the rubber brush/seal 20c to urge the fluid contents out of the cartridge 20 to the needle 24. Once used, the needle cap assembly 140 may be detached or decoupled from the cylindrical barrel 120. Upon decoupling, the needle 24 simultaneously retracts. The device 100 may then be handled or disposed safely without causing accidental needle pricks or injuries.

10 Comparing the device 100 and device 10, if the overall length of the device is to be the same, with a shorter modified barrel 12', the second portion 16b of plug 16 to hold the cartridge 20 in place will have a shorter length.

Fig. 5a and Fig. 5b illustrates yet another embodiment of the invention, which omit the requirement of a plug 16. In the embodiment depicted in Fig. 5a and
15 Fig. 5b, the assembly is similar to the arrangement shown in Fig. 1a and Fig. 1b except that the open-end 12b of cylindrical barrel 12 comprises a resilient means 310. Resilient means 310 comprises two flaps 310a, 310b positioned proximate to the open-end 12b. As the cartridge 20 is inserted into the cylindrical barrel 12, the outer surface of the cartridge 20 pushes against the
20 flaps 310a, 310b, which in turn are compressed and pushed towards the inner walls of the cylindrical barrel 12. When the cartridge 20 is fully inserted, the cartridge 20 no longer exerts a lateral force on the flaps 310a, 310b which push the flaps 310a, 310b against the inner wall of the cylindrical barrel 12. The flaps in turn are no longer compressed and therefore are able to return to its original
25 shape, thereby resisting the top surface of the cartridge 20 from sliding out of the cylindrical barrel 12 due to the force acted by spring 26. The flaps 310a, 310b are dimensioned such that they allow the portion 18b of plunger 18 to easily enter the cylindrical barrel 12 to discharge the fluid composition, but once the plunger is fully inserted, the portion 18a of the plunger 18 act against the
30 flaps 310a, 310b to ply open the same. The cartridge 20 may then be easily ejected out from the cylindrical barrel 12 due to the action of spring 26. At the

same time, the needle 24 is also automatically retracted due to the same action by spring 26.

In some embodiments, a hook or stopper mechanism may be formed on the cartridge 20, the hook or stopper mechanism operable to perform similar
5 function as the flaps 310. Such a mechanism functions to cause the cartridge to be punctured by the first end of the double-pointed hollow needle, and to simultaneously cause the second end of the double-pointed hollow needle to protrude from the cylindrical barrel 12 and be held in the protruded position.

10 If the overall length of the device of embodiment Fig. 5b is of a similar length to the length of device 10, 100, then in the absence of a plug 16, it is to be appreciated that the length of the cartridge 20 may be longer to achieve a similar activation of the needle 24.

In some embodiments, the cartridge 20 may not be filled with any fluid
15 composition or vaccine. In these embodiments, there will be an additional step of filling the cartridge 20 with the necessary vaccine or fluid composition before inserting the filled cartridge 20 into the cylindrical barrel.

In some embodiments, the cartridge 20 may be formed of a composite material comprising an inner layer made of glass and outer layer made of plastic. In
20 operation, the inner layer of the cartridge 20 is in contact with the fluid composition. Such an arrangement is advantageous as certain medicament/vaccine may react with plastic, and the inner glass layer effectively prevents any unintended chemical reaction to take place between the fluid composition and the outer plastic layer. The outer plastic layer functions as a
25 covering to protect the inner fragile glass layer.

It is to be appreciated that the various components including plunger 18, plug 16, cartridge 20, needle assembly 14, barrels 12, 12', needle cap assembly 140, resilient/hook 310 may be mixed and matched to form further
30 embodiments. The various components, singly or in plurality may also be provided in the form of a kit for users.

In the various embodiments described, it is to be appreciated that the plug 16, resilient means 310 and the coupling means 130 function singly or in combination as a mechanism operable to cause the cartridge to be punctured by the first end of the double-pointed hollow needle, and to simultaneously
5 cause the second end of the double-pointed hollow needle to protrude from the barrel and be held in the protruded position. Such an arrangement is advantageous in that the needle in the injection device is generally at the retracted state until activated when the needle is protruded. Once utilized, the needle is retracted and the device may be safely disposed. It is to be
10 understood that the above embodiments have been provided only by way of exemplification of this invention, and that further modifications and improvements thereto, as would be apparent to persons skilled in the relevant art, are deemed to fall within the broad scope and ambit of the present invention described herein.

15 It would be further appreciated that although the invention covers individual embodiments, it also includes combinations of the embodiments discussed. Therefore, features described in one embodiment not being mutually exclusive to a feature described in another embodiment may be combined to form yet further embodiments of the invention.

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CLAIMS

1. An injection device comprising
a barrel having a first end for a needle to protrude therefrom;
a needle assembly having a double-pointed hollow needle and a resilient
5 element operable to bias the double-pointed hollow needle away from the first
end of the barrel; and
a mechanism operable to cause the cartridge to be punctured by the first
end of the double-pointed hollow needle, and to simultaneously cause the
second end of the double-pointed hollow needle to protrude from the barrel and
10 be held in the protruded position.
2. The injection device according to claim 1, wherein the barrel comprises a
second end shaped and dimensioned to receive the mechanism, needle
assembly or cartridge.
- 15 3. The injection device according to claim 2, wherein the mechanism
comprises a rubber plug having a first portion and a second portion such that
the second portion is arranged to urge the cartridge against the first end of the
double-pointed hollow needle and the first portion rest on the second end of the
20 barrel.
4. The injection device according to claim 1, wherein the barrel comprises a
first part and a second part, wherein the first part contains the needle assembly
and the second part contains the cartridge and mechanism.
- 25 5. The injection device according to claim 4, wherein the first and second
part are joined together via coupling means.
6. The injection device according to claim 5, wherein the coupling means
30 comprises screw threads.

7. The injection device according to any one of claims 4 to 6, wherein the mechanism comprises

a. a rubber plug having a first portion and a second portion such that the second portion is arranged to urge the cartridge against an inner wall of the second part
5 of the barrel; and

b. the coupling means such that as the first and second parts are coupled together, the cartridge is punctured by the first end of the double-pointed hollow needle, and the second end of the double-pointed hollow needle is protruded from the barrel and held in the protruded position.

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8. The injection device according to claim 2, wherein the mechanism comprises a pair of flaps arranged proximate to the second end of the barrel to prevent the cartridge from being ejected from the barrel due to the resilient element.

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