Dec. 18, 1951 P. KOLLSMAN 2,578,812

INJECTION SYRINGE

Filed Dec. 20, 1947

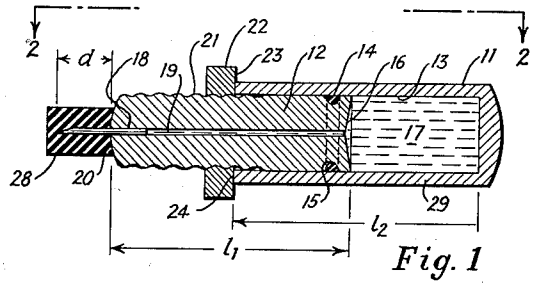

Fig. 1

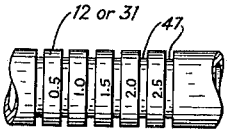

Fig. 5

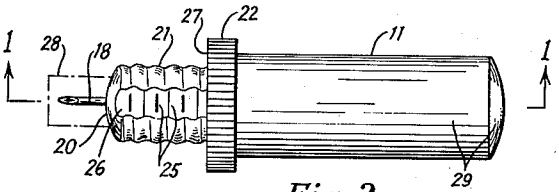

Fig. 2

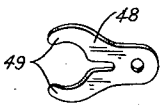

Fig. 6

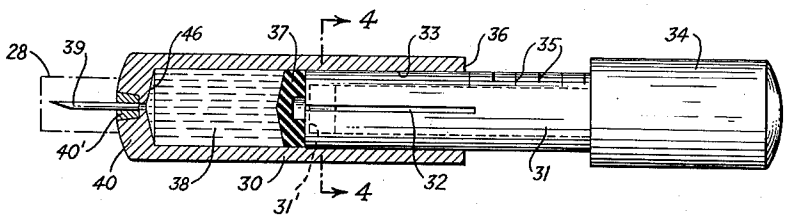

Fig. 3

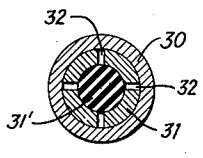

Fig. 4

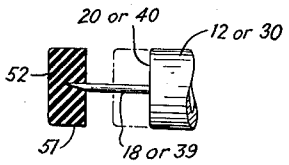

Fig. 7

INVENTOR.
PAUL KOLLSMAN
BY
Howard S. Russell
his ATTORNEY

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INJECTION SYRINGE

Paul Kollsman, New York, N. Y.

Application December 20, 1947, Serial No. 792,991

7 Claims. (Cl. 128—220)

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This invention relates to improvements in devices for hypodermic or intra-muscular injection of medicinal compositions. The invention provides, among other improvements, a syringe which is extremely simple to operate, one single manipulation of the syringe being sufficient to apply it to the patient, insert the needle and eject the medicinal composition therefrom.

The simple construction and mode of operation of the syringes embodying the present invention makes these syringes particularly suited for self administration of medicinal compositions by the patient himself. The peculiar construction proposed by the invention renders syringes embodying the inventive features practically fool-proof in that the construction not only compels correct application of the syringe and proper control of the depth of insertion of the needle, but also insures sterility of all the important parts of the syringe up to the very moment of use.

The invention also provides a form of syringe which serves as an ampule for storing a predetermined volume of a medicinal composition from which the composition may be discharged into body tissue without previous transfer from a separate ampule or to a separate syringe.

These and numerous other features, advantages and objects of the invention will appear more fully from the detailed description which follows accompanied by drawings showing, for the purpose of illustration, preferred embodiments of the invention. The invention also consists in certain new and original features of construction and combination of elements hereinafter set forth and claimed. Although the features characteristic of this invention which are believed to be novel will be particularly pointed out in the claims appended hereto, the invention itself, its objects and advantages, and the manner in which it may be carried out may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part of it in which:

Figure 1 is a cross-sectional view of a syringe embodying the invention, a section being taken on line 1—1 of Figure 2;

Figure 2 is a plan view of the syringe shown in section in Figure 1;

Figure 3 is a side view, partly in section, of the modified form of syringe;

Figure 4 is a section taken on line 4—4 in Figure 3;

Figure 5 is a fractional side view of a plunger member having grooves therein into which a movable stop may be inserted;

Figure 6 is a perspective view of a stop member attachable to the plunger shown in Figure 5; and

Figure 7 is a fractional side view, partly in section, of a form of sealing plug adapted to

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form a stop for limiting the depth to which the needle may be inserted into body tissue.

In the following description and in the claims, various details will be identified by specific names for convenience. The names, however, are intended to be generic in their application. Like reference characters refer to like parts in the several figures of the drawings.

In the drawings accompanying and forming part of this application, certain specific disclosure of the invention is made for the purpose of explanation of the broader aspects of the invention, but it is understood that the details may be modified in various respects without departure from the principles of the invention and that the invention may be applied to other structures than the ones shown.

The subject matter of this application is related to the subject matter of co-pending applications directed to devices of the general type disclosed herein.

Application Serial No. 792,992, filed December 20, 1947, discloses and claims a syringe designed for one-time use and so arranged that it cannot be reused.

Application Serial No. 792,993, filed December 20, 1947, discloses and claims a tubular needle seal for a syringe which prevents contamination of the needle and is blow-off proof in that it will not blow off if the syringe fluid is subjected to a sudden rise in pressure, for example by dropping the syringe.

Application Serial No. 792,994, filed December 20, 1947, discloses and claims a syringe having a narrow visible and optically enlarged passage leading to the inner end of the needle to facilitate observation, and expulsion of, gas bubbles in the syringe chamber.

Application Serial No. 792,995, filed December 20, 1947, discloses and claims an improved form of non-creeping plunger seal.

The syringe shown in Figures 1 and 2 comprises a barrel 11 in which a plunger 12 is telescopically movable. The plunger 12 is tightly sealed with respect to the interior surface 13 of the barrel by a gasket 14 which rests in a groove 15 of the plunger and frictionally engages the interior surface 13 of the barrel 11.

In the illustrated form of syringe, the rear surface 16 of the plunger forms a movable wall of a chamber 17 adapted to contain a charge of medicinal fluid confined between the barrel 11 and the plunger 12.

A hollow injection needle 18, preferable of substantially constant outer diameter, is mounted in the plunger 12 and communicates with the chamber 17 through a hollow passage 19 extending through the plunger. The needle 18 projects from the front end surface 20 of the plunger a distance d equal to the depth to which the needle

is to be inserted into the body tissue. Preferably the exposed length of the needle *d* is made equal to or smaller than the outside diameter of the plunger 12 so as to compel application of the syringe by placing the needle substantially at right angles to the surface of the skin of the patient.

The front end surface 20 is substantially flat and comprises an area large enough to provide sufficient resistance for ejection of the medicinal composition from the syringe without causing discomfort to the patient by reason of excessive local pressure.

The plunger may be provided with adjustable stop means to permit step-by-step discharge of the contents of the syringe. In the form of syringe shown in Figures 1 and 2, the outside surface of the plunger 12 is provided partially or entirely with a shallow thread 21 engaged by an internally threaded ring 22 whose back surface 23 cooperates with a front surface 24 on the barrel 11 and forms an adjustable stop limiting the depth to which the plunger 12 may be telescoped into the barrel 11.

A graduation 25 formed on a flat surface 26 of the plunger 12 and suitably calibrated in volumetric units permits accurate adjustment of the ring 22 on the plunger 12 so that any desired fractional volume may be discharged from the syringe. The graduation 25 cooperates with and is read against the front surface 27 of the ring 22.

The syringe shown in Figures 1 and 2 is primarily designed for filling with a medicinal fluid composition at the plant or laboratory of the producer, the volume of the fluid being sufficient for a single injection or a series of injections by operating the syringe in repeater fashion with the aid of the adjustable stop ring 22 as hereinbefore explained. After initial filling, the syringe is sealed by placing over the needle 18 a sealing plug 28 preferably of rubber or any other suitable material to prevent discharge of the fluid therefrom in the event the syringe is accidentally subjected to telescoping force and to maintain the front end of the syringe sterile.

Small air bubbles accidentally trapped in the chamber 17 during the filling of the syringe may easily be removed by placing the filled syringe in an upright position thus causing the bubbles to rise and collect near the passage 19. Collection of the bubbles is facilitated by the conical shape of the rear surface 16 of the plunger 12 as shown in the drawings. Slight telescoping movement of the plunger 12 with respect to the barrel 11 forces the bubbles out through the passage 19 and the needle 18.

The syringe shown in Figures 1 and 2 is used as follows. After removal of the sealing plug 28 from the injection needle 18, the device is ready for immediate use. It is applied to the body of a patient by grasping it at the barrel 11 which provides a finger grip surface or portion 29. The point of the needle 18 is placed on the patient's skin and pressure is then exerted in the direction of the needle 18 to insert the needle into the body tissue. This force does not cause any discharge from the syringe because in the initial state in which the plunger gasket 14 is stationary with respect to the barrel surface 13 the friction therebetween is relatively great and is equivalent to a multiple of the force required for inserting the needle to its full length.

The needle 18 penetrates the tissue until the front end surface 20 of the plunger comes to rest on the patient's skin whereafter the force exerted at the barrel is opposed by an equal pressure exerted by the skin against the front surface 20. This is sufficient to overcome the friction of the gasket 14, and the barrel 11 then moves telescopically over the plunger causing the fluid to be discharged through the passage 19 and the needle 18 into the patient's body tissue. The discharge continues until either the plunger reaches its end position in the barrel or until the adjustable ring 22 engages the front surface 24 of the barrel in the case of partial discharge.

After complete discharge of the fluid from the syringe, the syringe is discarded. The low production price and the difficulty of removal of the plunger from the barrel due to its peculiar construction discourages attempts of re-using it.

Figure 3 illustrates a modified form of syringe comprising a barrel 30 within which a plunger 31 is telescopically movable. The plunger may be made from tubular round stock. It is slotted at 32 and an elastic plug 31′ is inserted between the slotted plunger portions to provide sufficient frictional engagement of the plunger with the interior surface 33 of the barrel. The plunger may have an enlarged finger operable grip portion 34 and may be provided with graduations 35 readable against the back surface 36 of the barrel.

A movable seal or piston 37, preferably separate from the plunger 31 is telescopically movable in the barrel and forms a seal of the fluid chamber 38 against the plunger 31.

An injection needle 39 is mounted in the front end 40 of the barrel by means of a taper plug 40′ and communicates with the interior of the chamber 38. Since the seal 37 is not attached to the plunger, it cannot be removed from the barrel by withdrawal of the plunger. Refilling of the syringe is thus discouraged by the difficulty of removing the seal from the barrel.

Air or gas bubbles accidentally trapped in the chamber 38 may be removed by placing the syringe in an upright position causing the bubbles to collect at the conical end surface 46 of the chamber 38. Slight movement of the plunger 31 then expels the bubbles through the needle 39. Experience has shown that movable seals or pistons 37 of elastic material have a tendency slightly to creep back at the rim portion after the pressure by the plunger on the seal is released. Such creeping of the seal 37 may cause a small air bubble to be drawn into the chamber through the needle. Creeping of the seal 37 is prevented by frictional fit of the plunger 31 within the barrel 30. The elastic plug 31′ which forces the slotted ends of the plunger 31 apart and against the wall 33 of the barrel provides sufficient friction to check any creeping of the seal, the frictional force being greater than the elastic force of deformation of the seal 37 at the rim portion tending to move the seal back slightly.

The syringe shown in Figure 3 is likewise designed for one-time use to be filled at the laboratory or factory. It may be sealed by an appropriate sealing plug 28 for shipment and storage in sterile condition until the time of its use.

When the syringe of Figure 3 is to be used, the sealing cap 28 is removed from its needle 39 and the front end 40. The syringe is grasped by the finger operable portion 34 of the plunger 31 and is placed on the patient's skin. No fluid is expelled from the syringe during the insertion of the needle since the resistance of the needle to insertion is not sufficient to overcome the fric-

tion of the movable seal 37. After the needle 39 is completely inserted into the tissue, further movement of the piston 31 is opposed by reaction of the skin against the front end 40 of the barrel. This resistance is sufficient to overcome the frictional resistance of the movable seal 37 and liquid is now forced out through the needle 39.

A modified form of stop means for the plunger 12 or 31 of the syringes of Figures 1 and 3 is shown in Figures 5 and 6. The plunger is provided with a plurality of circumferential grooves 47 into which a movable stop 48 fits. The stop 48 is preferably made of plastic sheet material and has a jaw shaped portion 49 adapted frictionally to engage any of the grooves 47 in the plunger. Attachment of the stop 48 limits the freedom of telescoping movement of the piston 12 or 31, respectively, the end of the pre-set stroke being reached when the stop abuts the end surface 24 or 36 of the barrel, respectively.

Figure 7 illustrates an alternate form of plug construction for the needle 18 or 39. A sealing plug 51 is attached to the front end of the needle and seals it. Prior to use of the syringe, the front surface 52 of the plug 51 is sterilized and the plug 51 is not removed but the needle 18 or 39 is forced through the plug causing the plug to move against the front surface 20 or 40 of the plunger or barrel 12 or 30, respectively, as indicated in broken lines in Figure 7. In this position, the plug 51 forms a stop limiting the depth to which the needle may be inserted into the body tissue.

The invention thus provides a syringe which, because of its simplicity, is inexpensive to manufacture by modern mass production methods. The cost of the syringe is so small as to make one-time use and discarding after use more profitable than re-use of the syringe involving inspection, sterilization and re-filling. Syringes embodying the present invention are extremely simple to operate and may be used by the patient with far greater ease and convenience and safety than conventional forms of syringes since no accurate gauging of the depth of insertion of the needle is required and since the operation of syringes embodying the invention is considerably simpler than the operation of conventional syringes.

The invention obviously is not restricted to the particular embodiments herein shown and described. Numerous modifications, additions, omissions, substitutions and other changes may be made without departing from the spirit and the essence of the invention, as defined in the claims appended hereto. All such changes will be apparent to persons skilled in the art familiar with the disclosure of the invention and do not involve a departure from the spirit and the teachings of the invention.

What is claimed is:

1. An injection syringe comprising, in combination, a barrel member; a plunger member telescopically fitting into said barrel member and forming a variable volume chamber therewith adapted to contain a charge of medicinal fluid, one of said members having a substantially flat front end surface of substantially continuous curvature and free from projections, said surface being of a diameter substantially equal to that of said one member for engaging and resting against the body portion of a patient into which the fluid is to be injected, the other member being adapted to be manually grasped for telescoping movement relatively to said one member; sealing means for sealing the plunger member with respect to the barrel member; a hollow injection needle fixedly mounted in said one member communicating with said chamber, said needle projecting from said front end surface and being of uniform thickness from said surface to the needle point, said surface by resting against the body portion of the patient determining the depth to which the needle is insertable, said other member having a finger grip portion for manual operation of the syringe by pressure exerted at said finger grip portion in the direction of said needle, causing insertion of said needle until said end surface comes to rest against the patient's body and thereafter causing injection of said fluid through said needle by telescoping movement of said members by reason of the resistance to such pressure by said one member bearing against the patient's skin.

2. An injection syringe comprising, in combination, a barrel member; a plunger member telescopically fitting into said barrel member and forming a variable volume chamber therewith adapted to contain a charge of medicinal fluid, one of said members having a substantially flat front end surface of substantially continuous curvature and free from projections, said surface being of a diameter substantially equal to that of said one member for engaging and resting against, the body portion of a patient into which the fluid is to be injected, the other member being adapted to be manually grasped for telescoping movement relatively to said one member; sealing means for sealing the plunger member with respect to the barrel member; a hollow injection needle fixedly mounted in said one member communicating with said chamber, said needle projecting from said front end surface and being of uniform diameter from said surface to the needle point, said surface by resting against the body portion of the patient determining the depth to which the needle is insertable, said other member having a finger grip portion for manual operation of the syringe by pressure in the direction of the needle causing insertion of said needle until said end surface comes to rest against the patient's body and thereafter causing injection of said fluid through said needle by the telescoping movement of said member by reason of the resistance to such pressure by said one member bearing against the patient's skin; and adjustable stop means on said plunger member, said stop means bearing against said barrel member for limiting the extent to which the plunger member may be moved into said barrel member.

3. An injection syringe comprising, in combination, a barrel member; a plunger member telescopically fitting into said barrel member and forming a variable volume chamber therewith adapted to contain a charge of medicinal fluid; sealing means for sealing the plunger member with respect to the barrel member; a hollow injection needle mounted in one of said members communicating with said chamber, said needle projecting from the front end surface of said one member; said other member having a finger grip portion for manual operation of the syringe by pressure in the direction of the needle; and a pierceable sealing plug on said needle, said plug having a thickness less than the length of the needle, said plug being adapted to seal the point of the needle and adapted to be pierced and slid along said needle against said front end surface

upon exertion of pressure at said finger grip portion in the direction of said needle, whereby said plug forms a stop limiting the depth to which the needle may be inserted into body tissue.

4. An injection syringe comprising, in combination, a barrel member; a plunger member having a threaded outer surface telescopically fitting into said barrel member and forming a variable volume chamber therewith adapted to contain a charge of medicinal fluid, one of said members having a substantially flat front end surface of a diameter substantially equal to that of said one member for engaging and resting against, the body portion of a patient into which the fluid is to be injected, the other member being adapted to be manually grasped for telescoping movement relatively to said one member; sealing means for sealing the plunger member with respect to the barrel member; a hollow injection needle fixedly mounted in said one member communicating with said chamber, said needle projecting from said front end surface; an internally threaded ring on, and adjustable with regard to, the threaded plunger surface, the end of said barrel member forming an abutment stop for said ring to determine the depth to which said plunger member may be telescoped into said barrel member, said front end surface of said one member forming a stop limiting the depth to which said needle is insertable, said other member having a finger grip portion for manual operation of the syringe by pressure exerted at said finger grip portion in the direction of said needle, causing insertion of said needle until said end surface comes to rest against the patient's body and thereafter causing injection of said fluid through said needle by telescoping movement of said members by reason of the resistance to such pressure by said one member bearing against the patient's skin.

5. An injection syringe comprising, in combination, a barrel; a plunger telescopically fitting into said barrel and forming a variable volume chamber therewith adapted to contain a charge of medicinal fluid, said plunger having a graduation extending longitudinally of the plunger, said plunger further having a passage therethrough leading from said chamber to the front end of the plunger, said front end having a surface adapted to rest against the body portion of a patient into which the fluid is to be injected; sealing means for sealing the plunger with respect to said barrel; a hollow injection needle mounted on said plunger communicating with said passage, said needle projecting from said front end surface, the front end surface forming a stop limiting the depth to which said needle is insertable, said barrel having a finger grip portion for manual operation of the syringe by pressure exerted at said finger grip portion in the direction of said needle, causing insertion of said needle until said end surface comes to rest against the patient's body; and stop means adjustably attachable to said plunger, said stop means cooperating with said barrel for limiting the extent to which the plunger may be moved into said barrel.

6. An injection syringe comprising, in combination, a barrel member; a plunger member telescopically fitting into said barrel member and forming a variable volume chamber therewith adapted to contain a charge of medicinal fluid, one of said members having a substantially flat front end of a diameter substantially equal to

that of said one member for engaging and resting against, the body portion of a patient into which the fluid is to be injected, the other member being adapted to be manually grasped for telescoping movement relatively to said one member; sealing means for sealing the plunger member with respect to the barrel member; a hollow injection needle mounted in said one member communicating with said chamber, said needle projecting from said front end surface and being of uniform diameter from said surface to the needle point, said surface by resting against the body portion of the patient determining the depth to which the needle is insertable, said other member having a finger grip portion for manual operation of the syringe by pressure exerted at said finger grip portion in the direction of said needle, causing insertion of said needle until said end surface comes to rest against the patient's body, whereby the depth of insertion of said needle is positively limited.

7. An injection syringe comprising, in combination, a barrel member; a plunger member telescopically fitting into said barrel member and forming a variable volume chamber therewith adapted to contain a charge of medicinal fluid, one of said members having a front end surface adapted to engage, and rest against, the body portion of a patient into which the fluid is to be injected, the other member being adapted to be manually grasped for telescoping movement relatively to said one member; sealing means for sealing the plunger member with respect to the barrel member; a hollow injection needle mounted in said one member communicating with said chamber, said needle projecting from said front end surface a total distance less than the outside diameter of said one member, the projecting portion of said needle being of substantially uniform outside diameter, said front end surface being adapted to rest against the body portion of the patient to determine the depth to which the needle is insertable, said other member having a finger grip portion for manual operation of the syringe by pressure exerted at said finger grip portion in the direction of said needle, causing insertion of said needle until said end surface comes to rest against the patient's body, whereby the depth of insertion of said needle is positively limited.

PAUL KOLLSMAN.

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