

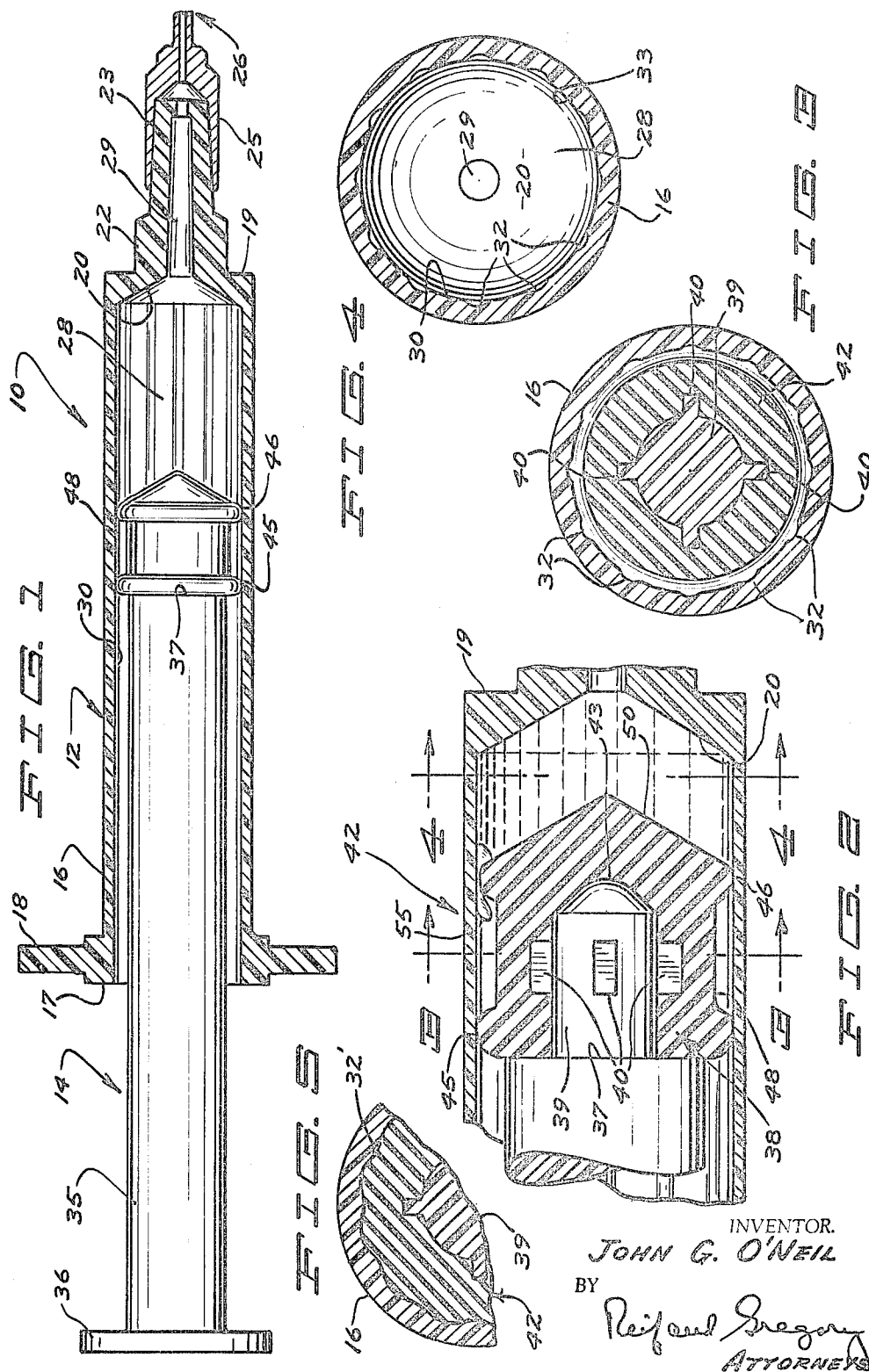
Dec. 13, 1966

J. G. O'NEIL

3,291,128

HYPODERMIC SYRINGE CONSTRUCTION WITH SEALABLE VENT MEANS

Filed Jan. 24, 1964



1

2

3,291,128 HYPODERMIC SYRINGE CONSTRUCTION WITH SEALABLE VENT MEANS

John G. O'Neil, 5156 Sheridan Ave. S.,
Minneapolis, Minn.

Filed Jan. 24, 1964, Ser. No. 340,094
6 Claims. (Cl. 128—218)

The invention herein relates to an improvement in the construction and function of a hypodermic syringe.

More particularly the invention herein has to do with improvement in releasing or discharging trapped air from the barrel of the syringe after a liquid medicament has been drawn therein.

It is an object of this invention therefore to provide an improvement in the construction of the inner wall of the barrel of the syringe and in the construction of a co-operating piston whereby the manipulation of the piston releases or discharges trapped air from said barrel.

It is a further object of this invention to provide an improvement in the piston and barrel construction of a syringe such that the manipulation of the piston to release or discharge trapped air from said barrel does not cause the discharge of liquid medicament from within said barrel.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawings in which like reference characters refer to similar parts throughout the several views and in which:

FIG. 1 is a view in horizontal section with an end portion thereof broken away;

FIG. 2 is a view on an enlarged scale of a fragmentary portion of the structure in FIG. 1;

FIG. 3 is a view in vertical cross section taken on line 3—3 of FIG. 2 as indicated;

FIG. 4 is a view in vertical section taken on line 4—4 of FIG. 2 as indicated; and

FIG. 5 is a fragmentary view of a modification of the structure shown in FIG. 3.

With reference to the drawings, a hypodermic syringe 10 of a conventional outer design is shown comprising a barrel portion 12 and a plunger 14. Said barrel portion and plunger will be formed of a suitable plastic material, such as polystyrene which has proved to be resistant to practically all solvents and medicaments and it is also suitable for use in connection with high temperatures such as where steam sterilization is practiced.

Said barrel portion 12 comprises a straight cylindrical body 16 having about its open entrance or mouth end 17 a peripheral flange 18 providing a finger hold. At its other or forward end said barrel is shown having an end wall 19 having an inner wall portion 20 of frusto conical configuration. Said end wall has a forwardly extending neck portion 22 having a forwardly extending further reduced and somewhat tapered shank portion 23. The hub portion 25 of a conventional needle 26 is shown in operating position fitting snugly over said shank. The major portion of said needle is broken away having no patentable significance relative to the invention herein.

Said cylindrical body 16 has a chamber 28 therein in direct communication with a passage 29 extending through said neck and shank portions.

Formed within the inner wall 30 of said body portion 16 are a plurality of longitudinally extending grooves 32 here illustrated as being parallel and as being rounded in cross section preferably having a depth on the order of .003 to .005 inch with the radius on the groove being on the order of .010 to .015 inch and thus forming relatively

shallow grooves. In the present embodiment said inner wall 30 is illustrated having a dozen such grooves with lands 33 therebetween. The number of grooves may vary as may be desired. Said grooves are shown on a magnified scale.

Said plunger 14 is insertable into said body 16 through said mouth end 17. In the present embodiment said plunger is indicated as having a cylindrical rod portion 35 terminating at its outer end in a handle portion 36 here shown in the form of a disc or plate. The diameter of said rod portion 35 will be somewhat less than the interior diameter of said body portion 16 for free slidable movement therein. Said rod portion 35 has a forward end wall 37 having a forwardly projecting tip 38 here being shown as a cylindrically formed body portion 39 comprising substantially centrally thereof and normal to the axis thereof ears or projections 40 spaced thereabout, said cylindrical portion having a substantially lesser width than the diameter of said rod portion. Said ear portions are here shown to be four in number which construction is considered to be very satisfactory.

Removably seated on said plunger tip 38 is a piston 42 formed of a suitable elastic material, preferably a material formed of natural or synthetic rubber.

Said piston will have an interior configuration 43 to correspond to that of said plunger tip 38 to be snapped thereover into releasably locked position to be functionally integral therewith for both axial and rotative movement. Said piston abuts and overlies the end wall 37 of the plunger rod 35 and has extending thereabout adjacent said end wall a rear annular rib 45, and spaced axially thereof is a forward annular rib 46 with an annular recess 48 therebetween defining the facing walls of said ribs. The face or front wall 50 of said plunger is coneshaped to approximate the configuration of said inner wall 20 of the barrel 16.

Said annular ribs 45 and 46 will be formed of such dimensions as to have diameters somewhat oversized relative to the internal diameter of said barrel 16 with reference to the surface of the inner wall 30 of said barrel.

Said ribs will be formed of a material such as natural or synthetic rubber or of a suitable plastic material. Said material must have adequate body or hardness for the purpose as will hereinafter be indicated and preferably will have a hardness on the order of 40 to 60 durometer as measured in the rubber industry. Said material further must have sufficient elasticity or resilience in connection with said hardness to have the capacity to be readily deformed within the confinement of said barrel 16 to establish and maintain sealing engagement with the grooves configuration of the inner wall of said barrel, whether the piston 42 is at rest or in motion being moved axially of said barrel.

The degree of elasticity or resilience must be such that the ribs will have the capacity to re-form quickly to re-establish sealing engagement with the wall 30 upon rotation or partial rotation of said piston. Critical consideration must be given to the interval of time required for said ribs to re-form or re-establish sealing engagement with said wall 30 as it is during this interval of time that passage is provided for the release or discharge of trapped air from said barrel, but there must not be sufficient passage provided for the leakage or discharge of the medicament from said barrel.

Operation

The applicant provides a syringe barrel and piston construction particularly adapted to release or discharge the air bubbles which are present and trapped in liquid medicament within the barrel.

It is a common practice to draw medicine into a hypodermic syringe from a bottle equipped with a self-sealing diaphragm by piercing the diaphragm with the needle of the syringe and withdrawing liquid therefrom by drawing the plunger rearwardly in the barrel of the syringe from the point of the front wall 20 therein.

Air that is trapped in the bottle of medicament and air that is present in the passage 29 of the syringe and in the passage of the needle enters into the barrel of the syringe as medicine is drawn thereinto. This air will form into one or more bubbles. Bubbles of air located at the foot of the passage 29 are readily discharged by a slight forward movement of the plunger. However, bubbles of air are difficult to dislodge when they are trapped at the bottom of the filled portion of the barrel at the surface 50 of the piston or at a point where the wall 50 of the piston engages the side wall 30 of the barrel. There is a tendency for bubbles of air to settle at these points and they become difficult to dislodge. Even a sharp tapping of the syringe frequently is not sufficient to break loose air bubbles thus located in an effort to have them rise to the foot of the passage 29.

Applicant's structure makes possible a quick and expeditious discharge of said air bubbles.

When the barrel of the syringe has been filled with a desired dosage of the medicament and a bubble 55 is lodged at a point of engagement of the surface 50 of the piston and the wall 30 of the barrel as illustrated in FIG. 2, the operator will grasp the rod 35 firmly between his fingers and rotate the rod and piston quickly. The rod does not need to be given a complete rotation. As soon as rotation of the rod is commenced, the ribs 45 and 46 of the piston will be dislodged sufficiently from the grooves 32 to break the sealing engagement therebetween for a sufficient length of time to provide an open passage through which the air bubble 55 may pass. Said air bubble will be expelled rearwardly to by-pass the ribs of the piston under the influence of the pressure of the fluid in the barrel, which fluid is under greater than atmospheric pressure. The ribs 45 and 46 of the piston are formed to accommodate themselves very nicely to the grooves 32 to form a positive sealing engagement therewith, but a quick partial rotation of the rod 35 will sufficiently dislodge the ribs from the grooves to provide passage for the air bubble just prior to the time during which the ribs will again re-form themselves into a new sealing engagement with the grooves 32. However there is not a sufficient passage or opening formed for the discharge of any liquid.

The projections of ears 40 formed integral with the plunger tip 38 provide a secure engagement with the piston whereby said portion 38 and the piston 42 are securely functionally integrated.

A modification of applicant's structure is shown in FIG. 5 wherein ribs 32' are substituted for the grooves 32 but wherein all other portions of the syringe structure are the same. The function with the presence of the ribs is identical to that above described in connection with the grooves 32.

Thus it is seen that I have provided a simple and effective improvement in the construction of a syringe which permits a quick and expeditious discharge of air bubbles trapped in the medicament within the barrel of the syringe.

It will of course be understood that various changes may be made in the form, details, arrangement and proportions of the parts, without departing from the scope of applicant's invention which, generally stated, consists in a construction capable of carrying out the objects above set forth, in the parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:

1. A hypodermic syringe of the type described having in combination,

a cylindrical barrel,
a plunger extending within said barrel,
a piston carried at the inner end of said plunger,
said barrel having a plurality of longitudinally extending grooves formed in the inner wall thereof,
said piston having an annular flexible rib thereabout,
said rib being oversized sufficiently in diameter with respect to the diameter of said barrel to have sufficient compression upon being received within said barrel to initially deform into sealing engagement with said grooves, and

said rib being formed of an elastic material on the order of rubber of such a durometer that upon rotation of said rib in breaking said initial sealing engagement, a lag time for venting is allowed during which said rib establishes a resealing engagement with said grooves and said barrel in its changed position.

2. The structure set forth in claim 1, wherein said rib is formed of a rubber material having an elasticity on the order of 40-60 durometer.

3. A hypodermic syringe of the type described having in combination,

a cylindrical barrel,
said barrel having a plurality of grooves formed in the inner wall thereof and extending longitudinally substantially the full extent of said barrel,
a plunger extending within said barrel,
a piston carried at the inner end of said plunger,
an annular flexible rib about said piston,

said rib having a diameter of such size with respect to the diameter of said barrel and the depth of said grooves as to have sufficient compression to deform into an initial sealing engagement with said grooves upon being received within said barrel, and
said rib being arranged and constructed of a rubber material of such durometer that upon said rib being rotated to break said initial sealing engagement of said rib and said grooves, lag time is allowed for venting during which time said rib deforms itself into resealing engagement with said grooves.

4. The structure set forth in claim 3, wherein said rib is formed of a rubber material having an elasticity on the order of 40-60 durometer.

5. A hypodermic syringe of the type described having in combination,

a cylindrical barrel,
a plunger extending within said barrel,
a piston carried at the inner end of said plunger,
said barrel having a plurality of parallel grooves formed in the inner wall thereof and extending substantially the full length thereof,

said grooves having a depth on the order of .003 to .005 inch and a radius on the order of .010 to .015 inch, an annular rib extending about said piston,

said rib formed of a rubber-like material having elasticity on the order of 40-60 durometer and having an over-sized diameter with respect to the diameter of said barrel such that it initially deforms into sealing engagement with said grooves upon being received within said barrel, and

said elasticity of said rib being such that upon rotation of said rib breaking its initial sealing engagement, a lag time for venting is allowed prior to said rib deforming itself into resealing engagement with said ribs.

6. A hypodermic syringe of the type described having in combination,

a cylindrical barrel,
said barrel having a plurality of grooves formed in the inner wall thereof and extending longitudinally thereof,

a piston disposable within said barrel,
said piston being sufficiently elastic to be deformable and having a diameter of such over size with respect

5

to the diameter of said barrel as to provide sufficient compression with respect to said elasticity for said piston upon being received within said barrel to initially deform into sealing engagement with said grooves, and

said elasticity of said piston being on the order of rubber of 40-60 durometer whereby lag time is allowed for venting upon said piston being rotated to break its initial sealing engagement and during which lag time said piston deforms itself into re-sealing engagement with said grooves.

5

10

6

References Cited by the Examiner

UNITED STATES PATENTS

2,607,344	8 1952	Brown	128—218
2,724,385	11/1955	Lockhart	128—261
2,895,773	7/1959	McConnaughey	92—245
2,971,802	2/1961	Kennemer et al.	92—169 X
3,016,896	1/1962	Van Sickle	128—218

RICHARD A. GAUDET, *Primary Examiner*.

DALTON L. TRULUCK, *Examiner*.