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S. KOLODNY ET AL
METHOD OF MANUFACTURING GLASS SYRINGES WITH
INTERCHANGEABLE PISTONS AND BARRELS
Original Filed May 25, 1950

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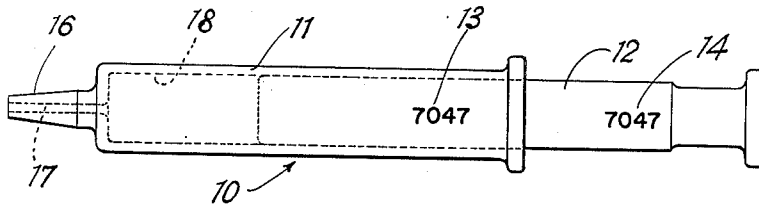


FIG. 1

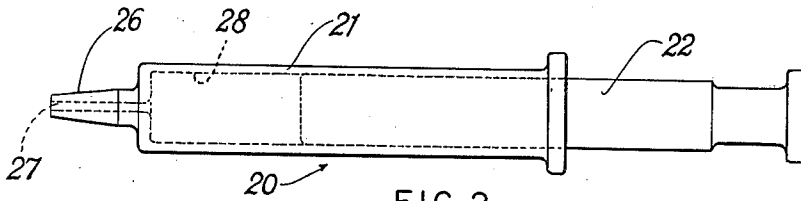


FIG. 2

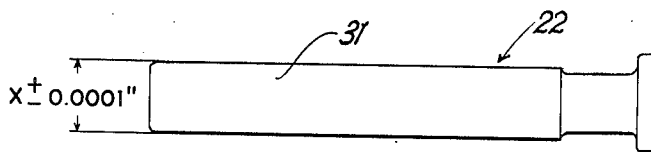


FIG. 3

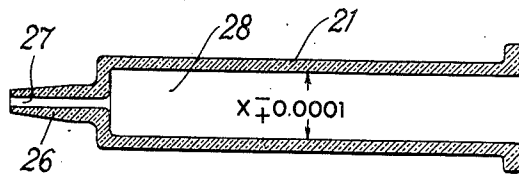


FIG. 4

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METHOD OF MANUFACTURING GLASS
SYRINGES WITH INTERCHANGEABLE
PISTONS AND BARRELS

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164,138. Divided and this application July 5,
1951, Serial No. 235,264

2 Claims. (Cl. 51—283)

1

This invention relates to glass hypodermic syringes and, more particularly, to novel syringes of this type in which the pistons and barrels of syringes of a given cubic capacity may be readily interchanged without loss of effective pumping power. This application is a division of our co-
pending application Serial No. 164,138, filed May 25, 1950.

In the present manufacture of glass hypodermic syringes, each piston must be carefully finished to match a particular barrel. When so matched, the mating piston and barrel are marked with identical identifying serial numbers so that, thereafter, each piston can be assembled with its mating barrel. Except by remote chance, no piston will have a pressure-tight fit with any barrel other than the one it has been finished to fit.

These syringes, after assembly, are required to pass a test in which the syringe must retain from 20 to 70 lbs./sq. in. pressure, depending on size, for at least 30 seconds. This test requires a substantially hermetic seal between the cylindrical surface of the piston and the inner cylindrical surface of the barrel chamber. As the barrel chambers, when ground to insure linearity and axial alignment, are of differing internal diameters, each barrel must have a piston carefully finished to match its chamber.

This has many advantages, such as the necessity, during manufacture, of assembling the syringe and measuring its capacity before the capacity graduations are individually applied to the barrel surface. Furthermore, when a group of syringes are disassembled for sterilizing for example, matching of the correspondingly numbered barrels and pistons is a time consuming and exacting operation. When a piston is broken, for example, its mating barrel becomes useless and is usually discarded.

In accordance with the present invention, it has been found that these disadvantages can be eliminated by finishing all pistons, for syringes of one capacity, to a predetermined standardized dimension, and correspondingly finishing all barrels of such capacity syringes to a mating standardized dimension. While attempts have hitherto been made to provide glass hypodermic syringes with interchangeable pistons and barrels, they have been unsuccessful. With the present invention, in a group of syringes of equal capacity, any piston can be used with any barrel and fully meet the above-mentioned pressure test.

The invention involves the grinding of the piston, on a centerless grinder, to a predetermined diameter, after which the piston is lapped with

2

an optical powder in a chemical and/or oil solution to a finish of $\pm 0.0001''$ relative to such dimension (herein termed "X"). The barrel chambers are likewise ground to dimension "X," which is dependent upon the syringe capacity, and then lapped with a diamond solution to a tolerance of $\pm 0.0001''$ relative to "X." When so finished any barrel assembled with any piston will meet the pressure test.

For an understanding of the invention principles, reference is made to the following description and the accompanying drawing. In the drawing:

Fig. 1 is an elevation view of a prior art glass hypodermic syringe.

Fig. 2 is a corresponding elevation view of the invention syringe.

Fig. 3 is an elevation view of the piston.

Fig. 4 is an axial sectional view of the barrel.

Referring to Fig. 1, which illustrates a glass hypodermic syringe 10 of the present type, the barrel 11 and piston 12 thereof are not interchangeable. Consequently, the barrel and piston carry matching serial numbers, indicated at 13 and 14, so that, after disassembly for cleaning or the like, the piston 11 can be reassembled with its uniquely matching barrel 10.

One of the requirements of such a glass hypodermic syringe is that, under test, with the passage 17 of nipple 16 closed, the chamber 18 of barrel 11, having its outer end closed by piston 12, hold a pressure of 70 pounds per square inch for 30 seconds. This requires a very close, ground fit between the outer surface of piston 12 and the surface of chamber 18, as well as exact axial alignment thereof.

In the usual manufacture of glass syringes, the barrel and piston are formed, the barrel surfaces are ground to assure true axial alignment throughout the length of chamber 18, and then a piston is ground to provide a tight-fit within a particular barrel, as well as to assure axial alignment of the piston surface. When a particular barrel and a particular piston have been so mated as to have a fit tight enough to meet the above pressure test, they are then marked with identical serial numbers. This assures each piston being always assembled with its own matched barrel.

This arrangement has many disadvantages. For example, should either the piston or barrel of a particular syringe be broken, the unbroken syringe member must be discarded. It is only by a remote chance that an unbroken piston, for example, could possibly match another barrel,

and trying to find such a match would be a tedious procedure without any certainty of ultimate success.

Additionally, the graduation markings on the surface of the barrel can be placed thereon only after the barrel and piston have been properly finished to the required tight fit. The capacity of the barrel is then accurately measured and the graduations applied. This requires individual measurement and marking of each syringe, a costly and time consuming process.

These glass syringes are used in large quantities in hospitals, for example, and after each use, the syringes must be disassembled for sterilization. Usually, a large number of syringes are sterilized at the same time. After sterilization, each syringe barrel must be reassembled with its mating piston. This requires a selection of a particular barrel, for example, and a time consuming search for its correspondingly numbered piston. The operation is further complicated by the fact that the sterilized elements must be handled by tweezers, thus further lengthening the time required in sorting and assembling.

The present invention obviates the foregoing disadvantages by providing glass syringes in which the barrels and pistons are mutually interchangeable and any piston has a tight enough fit in any barrel to meet the pressure test of holding 20 to 70 lbs./sq. in. for 30 seconds. Referring to Fig. 2, it will be noted that the barrel 21 and piston 22 of the invention syringe 20 are characterized by the lack of matching identification serial numbers.

In the manufacture of syringe 20, piston 21 (Fig. 3) is ground on a centerless grinder to assure linearity and axial alignment. The piston surface 31 is then lapped with a fine optical grinding powder suspended in a suitable solution of chemicals and/or oils. Precision gauges are used to position and check the piston during the grinding and lapping.

The piston is thus finished to a tolerance of ± 0.0001 " with respect to the dimension required for a given capacity syringe, this dimension being denoted "X" in Fig. 3. As known to those skilled in the art, glass hypodermic syringes are standardized as to capacity as measured in cubic centimeters (cc.), the standard sizes generally being 1, 2, 5, 10, 20, 30, 50 and 100 cc. The most common sizes are 2, 5, 10 and 20 cc.

The barrel 21 has the surface of chamber 28 ground, as on a centerless grinder, to insure linearity and axial alignment. The surface of chamber 28 is then lapped, with a diamond solution, for example, to the required dimension "X" (Fig. 4) with a tolerance of -0.0001 ", the grinding being carried to a precision substantially twice that customarily used. Precision gauges are used for positioning and measurement of chamber 28 during the grinding and lapping.

When a group of barrels and a group of pistons have been finished in accordance with the invention procedure, any piston can be inserted in any barrel and the assembly will meet the test of holding 20 to 70 lbs./sq. in. for 30 seconds. When disassembled, there is no need to assemble any particular piston with a selected barrel, thus eliminating the tedious sorting and matching procedure hitherto necessary. Should either a barrel or a piston be broken, the unbroken piston or barrel can be assembled with

any other barrel or piston, respectively, eliminating wastage of unbroken elements. A further feature is that the graduation marks can be uniformly applied to all barrels of the same capacity, no special measuring and application technique being required. Of course, each piston fits only the barrels of a given capacity syringe. For example, the piston of a 5 cc. syringe will fit any 5 cc. barrel, but will not fit a 2 cc. or 10 cc. barrel.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles thereof, it should be understood that the invention may be otherwise embodied without departing from such principles.

What is claimed is:

1. The method of manufacturing glass hypodermic syringes, of the same cubic capacity, which comprises providing a plurality of cylindrical glass pistons of substantially the same diameter; precision grinding and optically lapping the surface of each piston to the same predetermined diameter with the tolerance of the diameter at any point along the linear extent thereof being 0.0001 inch; providing a plurality of cylindrical glass barrels of substantially the same internal diameter; and precision grinding and optically lapping the internal surface of each barrel to said same predetermined diameter with the tolerance of the inside diameter at any point along the linear extent thereof being 0.0001 inch; whereby every one of said pistons will have a sliding sealing fit in any one of said barrels and the respective barrels and pistons may be indiscriminately interchanged without affecting the pressure retaining properties of the syringes.

2. The method of manufacturing glass hypodermic syringes, of the same cubic capacity, which comprises providing a plurality of cylindrical glass pistons of substantially the same diameter; precision grinding and optically lapping the surface of each piston to the same predetermined diameter with the tolerance of the diameter at any point along the linear extent thereof being 0.0001 inch; providing a plurality of cylindrical glass barrels of substantially the same internal diameter; precision grinding and optically lapping the internal surface of each barrel to said same predetermined diameter with the tolerance of the inside diameter at any point along the linear extent thereof being 0.0001 inch; and applying identically spaced and located capacity graduations to each of said barrels; whereby every one of said pistons will have a sliding sealing fit in any one of said barrels and the respective barrels and pistons may be indiscriminately interchanged without affecting the pressure retaining properties of the syringes.

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