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3,378,007

DISPOSABLE HYPODERMIC SYRINGE

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Fig. 1.

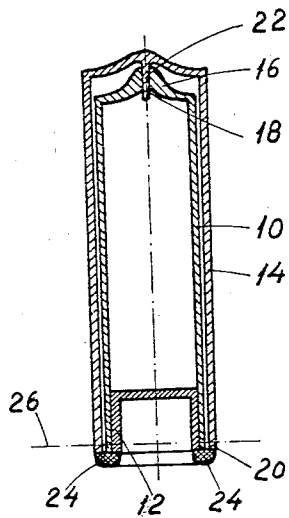


Fig. 2.

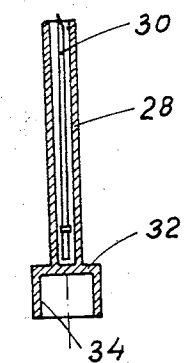
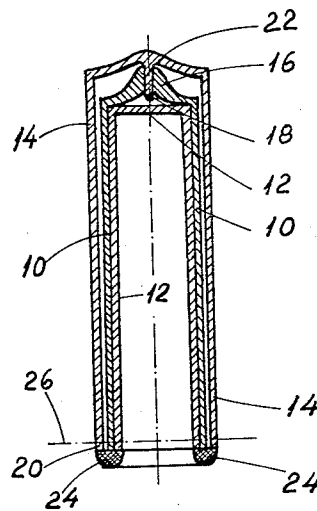


Fig. 3.

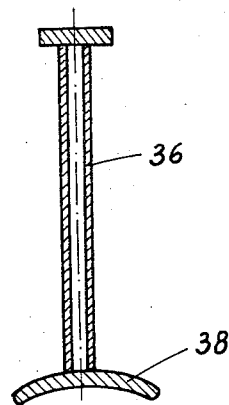


Fig. 4.

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DISPOSABLE HYPODERMIC SYRINGE

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3,014/64

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This invention concerns a disposable hypodermic syringe comprising a hollow cylinder, the barrel, which is open in the rear end and partly closed in the front end by a needle-holder or needle having a central bore, and furthermore comprising a plunger slidably received in the interior of the barrel and is constituted by a hollow cylinder which is open in the rear end and closed in the front end, the syringe also being provided with a substantially cylindrical protecting cover which encloses it from the front end to the rear end and which is open in the rear end and in its front end provided with a centrally mounted pin or similar projection projecting inwardly and engaging in and closing the bore in the needle-holder.

Various hypodermic syringes are known which are arranged substantially in this manner. Usually they comprise a great many parts for which reason they are comparatively costly to make and mount. A particular difficulty in such hypodermic syringes consists in that it is difficult to seal them tightly, that is to say not only liquid-tight but also tight against bacterial contamination. From the specification to the Swedish Patent No. 174,260 it is known to fit the plunger in a tightening way into the interior of the barrel merely by the friction between the said two members, whereas a tightening around a needle-holder with a needle mounted therein in the front end of the syringe is brought about by means of a special cap or protective cover clamped under a ring-shaped fastening means provided with flanges. In other syringes of the general type stated, for instance as known from the U.S. patent specifications Nos. 2,831,483 and 3,026,872, the sealing between the plunger and the barrel is also brought about only by friction or mutual contact between the said two members and therefore cannot be reliable in respect to bacterial contamination. If desired, in such cases a protective cap, which encloses the injection-needle or cannula and the front of the barrel, may be slidably engaging in a tightening manner the slightly conical barrel. This sealing may well be liquid-tight, but is not certain to be tight against bacteria, especially there may be a risk of bacterial contamination when the barrel and cap are made from a resilient material and subjected to mechanical impacts.

In a syringe known from the specification to the British Patent No. 671,612, a tight fitting between the plunger and the barrel is ensured by aid of a washer of elastic material embracing externally both the tube-shaped barrel and the tube-shaped plunger which are both of glass. However, this does not in all circumstances ensure hermetic, bacteria-tight sealing and this system is not applicable to syringes made from comparatively soft or resilient materials, for instance plastics.

The use of known hypodermic syringes, the types described hereinabove as well as other types, as packaging for injection-liquids is troublesome, partly because they often consist of quite many parts and particularly because of difficulties in filling with injection liquid and in sterilizing the liquid filled in. The sterilization of syringes in which liquids have been filled in is usually only possible in cases where mechanical sealing is employed in connection with the use of elastic materials. As mentioned before, however, this usually results in deficient bacteria-tightness of the sealing. Hypodermic syringes which are

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dispensed in sterile condition must be packed in such a manner that the interior of the syringe and the needle or needle-holder are protected against bacterial contamination; this packaging is often made by means of cartons or bags. However, such outer packagings are vulnerable and easily damaged and when damaged, they become easily penetrable to bacteria.

It is the object of the present invention to overcome the various disadvantages mentioned and to provide a disposable hypodermic syringe of the general type stated, consisting of only few parts which are easily assembled and which are sealed in a completely satisfactory manner easy to carry out in practice. A particular object of the invention is to provide a syringe which can be sterilized with or without containing injection liquid, whichever is preferred, in other words to provide a syringe which according to wishes for any particular specimen thereof may either be used as a packaging for injection liquid and thereafter as a syringe for injecting this liquid, or may be an ordinary empty disposable syringe to be filled with injection liquid immediately before use.

According to the invention, these objects are achieved when the rear ends of the barrel, the plunger and the protective cover are substantially flush with each other (in a direction perpendicular to the common axis thereof) and are sealed to each other, preferably by a fusion seam or welded seam. Thereby a perfectly hermetical seal is obtained, both of the needle-holder or seat and of the space inside the barrel, and no bacterial contamination can take place under ordinary circumstances, that is without a vigorous mechanical impact. Any further outer packaging is superfluous, in so far as the sterility of the syringe or its contents is concerned. The production of the syringe including its protective cover is easy, since the entire aggregate consists of very few parts all having a very simple shape, and since the hermetical sealing may be carried out in one operation. The sealing together of all the said three parts furthermore involves the particular advantage that the protective cover cannot be displaced relative to the barrel. The sterilization of the syringe thus sealed is very simple to carry out whether the syringe contains injection liquid or not.

For instance from the specification to the U.S.A.-Patent No. 2,856,923, hypodermic syringes of substantially the same general type as the present one are known, which are adapted to contain one or more needles or cannulas in a special case in the syringe, for instance provided in the plunger. This useful measure may advantageously be combined with the present disposable syringe and in a particularly expedient manner if the case for the needles at its closed rear end has a circular flange with a ring-shaped rim or projection having approximately the same outer diameter as the inner diameter of the plunger, the rear end, that is the end opposite to the open front end of the said case being flush with the rear end of the barrel, the plunger and the protective cover and being sealed to these. It is thereby obtained that the needle-case is reliably secured to the other parts of the syringe and that all parts may be easily sterilized in one operation. The needle-case is freed in the same operation as that used for breaking the sealing of the syringe.

The protective cover may expediently be adapted to serve as a piston-rod after having been removed from the barrel, for instance thereby that the said protective cover or at least its front part is compressible or for instance has a wavy appearance in cross-section. It thereby becomes unnecessary to provide the syringe with a separate piston rod, but it is also possible, if desired, to supply a separate piston-rod.

In the following an embodiment of the syringe according to the invention will be described more fully with reference to the drawings. In the drawings:

FIG. 1 shows in longitudinal section an embodiment of the said syringe in sealed condition, the plunger of the syringe being in a position it has when the syringe contains injection liquid;

FIG. 2 shows a longitudinal section of the same syringe, the plunger being in the position it has when the syringe does not contain liquid;

FIG. 3 shows a longitudinal section of a needle-case for the syringe shown on FIGS. 1-2; and

FIG. 4 shows a longitudinal section of a piston-rod for the plunger of the syringe shown on FIGS. 1-2.

The disposable syringe, according to the invention is made from a suitable material such as glass, thermoplastic or thermosetting resins, or thin metal tin, or sheet metal, preferably from plastics such as polyolefins, polyesters or nylon, and it consists essentially of three parts, viz. a barrel 10, a plunger 12 and a protective cover 14. The barrel 10 essentially has the form of a circular hollow cylinder which is open in the rear end and in the front end has a seat or holder 16 for an injection-needle, said holder 16 being of known shape and for instance conical and being provided with a central bore 18 for the needle. The plunger 12 is also circular-cylindrical, open in the rear end and closed in the front end by a wall substantially perpendicular to the axis of the plunger. Finally, also the protective cover 14 is substantially circular-cylindrical in its rear end 20, it is open, in its front end it is closed and provided with a central inwardly projecting pin or similar projection 22. When the syringe is mounted with the protective cover enclosing the barrel, the projection 22 fits in and closes the central bore 18 in the needle-holder 16. The ring-shaped space between the inner side of the protective cover and the outer side of the barrel may be very narrow or somewhat wider, i.e. it may be relatively narrower or wider than shown on the drawing, though preferably narrower. On the other hand, the plunger 12 should be closely fitting in the barrel although it is not ordinarily supposed to provide a bacteria-tight engagement and should of course be able to slide in the barrel, so as to suck up or inject the injection liquid.

As will appear from FIGS. 1 and 2, the rear end of the three cylindrical members, that is barrel 10, plunger 12, and protective cover 14 are substantially flush with each other in a direction perpendicular to the axes thereof, regardless how far the plunger has been inserted into the barrel 10. When mounting the syringe, the plunger is adapted, for instance by being cut to the desired length, so as to place its rear edge in the said position, flush with the rear ends of the barrel and the protective cover. Thus, if the syringe is to be mounted, packed, stored, and transported in the empty condition, nothing, or only a small part of the length of the plunger is cut off and the plunger is placed in the barrel with its rear end flush with the rear end of the barrel. If, on the other hand, the syringe is to be mounted and liquid should be filled into it prior to its storing or transport, a length of the plunger corresponding to the desired amount of liquid is cut off from the open rear end of the plunger before or after it is placed in the barrel. It is also possible to manufacture plungers having different lengths corresponding partly to empty syringes, partly to syringes with different desired amounts of content.

The mounting is carried out in the manner that the plunger 12 is placed in the barrel 10, after which, if it has not been done previously, the length of the barrel 10 is adapted according to wishes, that is according to the desired amount of liquid, if any. If liquid is to be filled into the syringe at once, said liquid is preferably poured in through the bore 18 in the needle-holder 16, after which the protective cover 14 is mounted with its pin 22, projecting into the bore 18, and closing same. It is also possible to first mount the barrel in the protective cover with the pin closing the bore in the needle-holder, and subsequently fill in the liquid, thereafter inserting the plunger and adjusting its length, if necessary. The mounting of

the empty syringe is brought about in largely the same manner, except that no liquid is filled into the barrel, and in that case, it will normally not be necessary to adapt the plunger, since it will normally be manufactured in a length fitting to the empty barrel.

In either case, the mounting of the three parts of the syringe, with or without liquid, into the barrel, is carried out in such a manner that the three rear edges, of the plunger, barrel, and cover respectively, are substantially flush with each other, and is followed by sealing. If the said three parts have been made from a thermoplastic substance, for instance polypropylene, the sealing is simply carried out so that the three cylinders are fused together at the three rear edges, which results in a fusion seam or ring 24, formed by all three layers. The fusing together of the three cylindrical layers at their rear ends may, for instance take place in a suitable ring-shaped groove in a thermostat-heated heating block or in a directly heated ring-shaped glass. The three layers may also be united by being glued or welded together, for instance by aid of high-frequency current or ultrasound. The choice of sealing method is made having regard among others to the type of material. If the cylinder is to be dispensed in empty condition prior to sealing, the plunger is entered as far as possible in the barrel, as shown in FIG. 2, no liquid is filled in, but the sealing is carried out as described. After being sealed, the entire syringe is bacteria-tight, hermetically sealed and the cover bacteria-tight placed around the other parts of the syringe and sealed thereto. Whether the parts of the syringe have been assembled with or without content of injection liquid, the entire aggregate may now be sterilized.

Immediately prior to use, the syringe is made ready for use so that all of the three cylindrical members, the protective cover, the barrel, and the plunger are cut through along a line indicated in FIGS. 1 and 2, with the reference numeral 26, which must be placed before the area 24 of fusion, welding or glueing together the three cylindrical layers, that is between and preferably closely adjacent to this area and the front end of the syringe. For this cutting operation it is possible to use a special instrument in the form of a pair of tweezers equipped with two small knives, but it is also possible to use for instance ordinary knives or scissors.

If the syringe is mounted in empty condition or only contains a small amount of liquid, the hollow space in the plunger may be used for a case 28 (FIG. 3), for an injection-needle 30. The case 28, which is open in the front end and over the major part of its length is cylindrical having a smaller outer diameter than the inner diameter of the plunger, has in its closed rear end a flange 32 which may be integral with the wall which closes the said rear end. At its edge, the said flange has ring-shaped rim 34 projection in the rear direction and this cylindrical rim or ring 34 has approximately the same outer diameter as the inner diameter of the plunger. The case may be inserted in the plunger with its open front end inwardly in the plunger, the rear edge of the ring or rim 34 being substantially flush with the rear edge of the barrel 10, the plunger 12 and the protective cover 14, and may be fused, welded or glued to these three cylindrical members in the same operation in which the three said parts are sealed to each other. The syringe thus equipped with a needle-case is made ready in the same manner as the syringe without a needle-case.

After cutting along line 26, the protective cover 14 is removed from the barrel 10; in some cases the cover 14 may be used as a piston-rod, for instance if at least its foremost parts are sufficiently compressible or pliable to be inserted into the plunger, but on the other hand sufficiently rigid to be used as a piston-rod. This may for instance be achieved by making the foremost parts of the cover 14 with a wavy or ribbed cross-section. It is also possible to use a special piston-rod 36 with a handle 38, see FIG. 4.

When an injection-needle has been placed in the bore in the needle-holder, the syringe is ready for use, either directly to inject the liquid contained therein, or after having been caused to suck up injection-liquid from another container.

I claim:

1. A disposable syringe comprising a hollow barrel, said barrel being substantially cylindrical and open in the rear end and partly closed in the front end by a needle-holder provided with a central bore, a hollow, substantially cylindrical plunger being fittingly and slideably received in the said barrel, said plunger being open in the rear end and closed by a wall in the front end, said barrel with its inserted plunger being enclosed in a substantially cylindrical protective cover, said cover being open in the rear end and closed in the front end, the front end of the protective cover being provided with a central pin projecting inwardly and engaging in said central bore in the said needle-holder, in which the respective lengths of the said plunger, the said barrel and the said protective cover are adapted to each other in such manner that their respective open rear ends are substantially flush with each other, viewed in a direction perpendicular to their respective longitudinal axes, said three rear ends being sealed hermetically to one another.

2. A disposable syringe as claimed in claim 1, in which the sealing consists of an area wherein the three said rear ends are fused together.

3. A disposable syringe as claimed in claim 1 being empty with respect to liquid, in which the plunger is positioned with its closed front end closely adjacent to the partly closed end of the barrel, the length of the plunger being adapted to its said position in such manner that its rear end is flush with the rear ends of the barrel and the protective cover, the entire combination being sterilized in assembled and sealed condition.

4. A disposable syringe as claimed in claim 1 and containing a desired amount of injection liquid, in which the plunger is situated in such position that the space between the closed front end of said plunger and the partly closed front end of the barrel is substantially filled with said liquid, the length of said plunger being adapted so as to place its rear end substantially flush with the rear ends of said barrel and said protective cover, the entire combination being sterilized in assembled and sealed condition.

5. A disposable syringe as claimed in claim 1, in which at least the foremost part of the protective cover is compressible so as to serve as piston-rod by being inserted in the plunger.

6. A disposable syringe comprising a hollow barrel being substantially cylindrical and open in the rear end and partly closed in the front end by a needle-holder provided with a central bore, a hollow, substantially cylindrical plunger being fittingly and slidably received in said barrel, said plunger being closed in the front end by a wall and being open in the rear end, said plunger furthermore being placed in the barrel with its closed front end in proximity to the partly closed front end of said barrel, a needle-case being removably positioned in the interior of the said plunger, said needle-case being open in the front end and closed in the rear end, the rear end of the needle case being provided with a circular flange having a ring-shaped rim projecting in its rear direction, said ring having substantially the same outer dimension and shape as the inner dimension and shape of the plunger, said needle-case, plunger and barrel being enclosed in a substantially cylindrical protective cover which is open in the rear end and closed in the front end, the said front end of said protective cover being provided with a central pin projecting inwardly and engaging in said central bore in the said needle-holder, the respective rear ends of the said plunger, said barrel and said protective cover being substantially flush with each other and with the rearmost edge of the said ring-shaped rim projecting in the rear direction from the needle-case, the said three rear ends of the plunger, the barrel and the cover being sealed hermetically to each other and to the said rearmost edge of the rim of the needle-case, the entire combination being sterilized in assembled and sealed condition.

7. A disposable syringe as claimed in claim 6, in which at least the foremost part of the protective cover is compressible so as to serve as piston-rod by being inserted in the plunger.

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