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2,602,447

DEVICE FOR HYPODERMIC INJECTIONS

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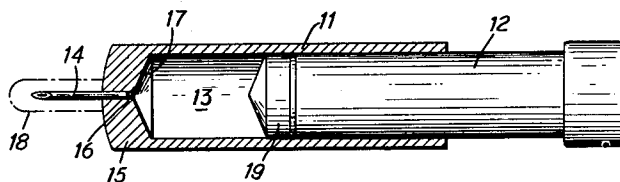


Fig. 1

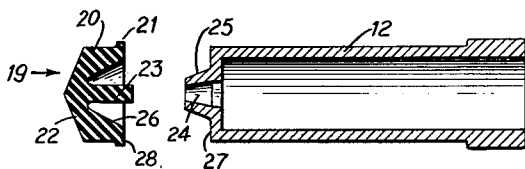


Fig. 2

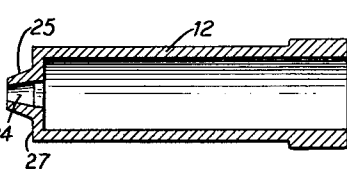


Fig. 3

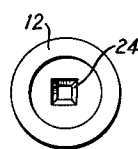


Fig. 4

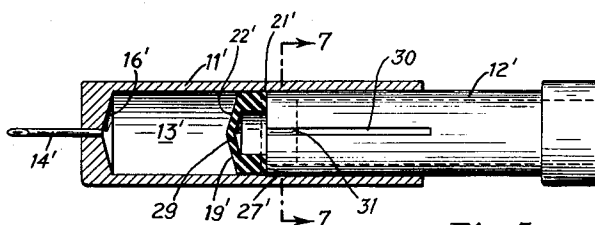


Fig. 5

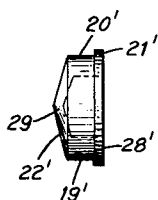


Fig. 6

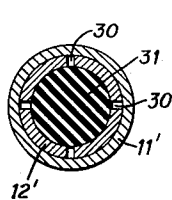


Fig. 7

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DEVICE FOR HYPODERMIC INJECTION

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Application December 20, 1947, Serial No. 792,995

2 Claims. (Cl. 128—218)

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This invention relates to improvements in devices for hypodermic or intra-muscular injection of medicinal fluids.

The invention has particular application to so-called injector ampules, a novel device which, in effect, is a combination of an ampule and a syringe. An injection ampule contains a predetermined volume of fluid which may be stored in it in a similar manner as in a conventional ampule and is equipped with a hypodermic needle so that the fluid may be injected directly from the ampule without previous transfer to a separate syringe.

Injector ampules have numerous advantages over conventional injection syringes requiring filling from a separate ampule. One of the most important features is the immediate readiness of an injector ampule for injection, eliminating the necessity of preparing, sterilizing, and filling an injection syringe, which is time consuming, requires a certain amount of skill and is dependent on the availability of sterilizing equipment.

Injector ampules are designed to be sterilized by the manufacturer before filling, are sealed, and are furnished to the user in sterile condition requiring only removal of a needle seal before actual use.

Injection ampules are relatively simple of construction, are inexpensive to manufacture, and are primarily designed for one-time use, the low production cost making refilling uneconomical.

The disposability, after use, of injector ampules brings with it further features of safety and convenience; a new sharp needle is available for each injection since the needle forms a permanent non-removable part of each device, the volume of the fluid is accurate, and the device is free from air or gas bubbles.

This invention is concerned with certain structural features and matters of design of important elements of injector ampules.

Injector ampules basically consist of a barrel within which a plunger is telescopically movable, thus forming a variable volume chamber for the fluid. A hollow injection needle mounted in the device is in communication with the chamber. A movable seal is provided to seal the barrel with respect to the plunger.

Movable seals of the type customarily employed in conventional injection syringes are generally not satisfactory for injector ampules because of certain inherent characteristics. Tightness of the seal, for example, is far less critical in an ordinary syringe than it is in an injector ampule. A minor leak leading to the loss of a small amount of fluid is not fatal in an ordinary syringe since loss of fluid is the only detrimental result of the failure of the seal. In an injector ampule, however, in which a predetermined

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volume of fluid is stored over a substantial period of time, the tightness of the seal affects the sterility of the contents.

Experience has shown that seals of the construction customarily formed in ordinary injection syringes are not satisfactory in injector ampules. Attempts to make the conventional seal tighter by a change in dimensions likewise do not bring satisfactory results. Seals are customarily made of an elastic material such as natural or synthetic rubber. A tighter fit between the seal and the wall, against which the seal acts, produced by an increase of the dimensions of the seal results in an objectionable behavior of the seal which may be called "creeping." If, for example, the plunger and seal of a syringe are moved in the direction to expel air bubbles from the syringe chamber, the seal is somewhat distorted by reason of its frictional engagement with the barrel wall along which it slides. As soon as the moving force on the plunger is released, the seal tends to return to its normal undistorted condition and creeps back a small but certain distance whereby air is drawn in through the needle.

The invention provides improvements which overcome this objectionable behavior of the seal. The invention provides a tight seal particularly suited for maintaining the contents of an injector ampule tightly enclosed in order to safeguard sterility, the seal being free from the objectionable tendency of creeping, so that after movement of the seal or plunger no enlargement of the chamber volume occurs, and no air is drawn in through the needle. In this manner, freedom from air of the contents of the injector ampule is insured.

The aforementioned and various 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 herein-after 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 this application in which:

Figure 1 is a side view partly in cross-section of an injector ampule embodying the invention;

Figure 2 is a cross-sectional side view of the plunger seal of the injector ampule of Figure 1;

Figure 3 is a cross-sectional side view of a

form of plunger used in the injector ampule of Figure 1;

Figure 4 is an end view of the plunger shown in Figure 3;

Figure 5 is a side view, partly in section, of a modified form of injector ampule;

Figure 6 is a side view of the plunger seal of the injector ampule of Figure 5; and

Figure 7 is a section taken on line 7-7 of Figure 5.

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. Corresponding reference characters refer to corresponding parts in the several figures of the drawings.

In the drawings accompanying and forming part of this specification, certain specific disclosure of the invention is made for the purpose of explanation of 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 copending applications directed to devices of the general type disclosed herein.

Application Serial No. 792,991, filed December 20, 1947, now Patent No. 2,578,812 granted Dec. 18, 1951 discloses and claims a syringe in which the depth of insertion is automatically controlled and limited, and in which stop means are provided permitting measured partial discharge.

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, now Patent No. 2,578,813 granted Dec. 18, 1951 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, now Patent No. 2,578,814 granted Dec. 18, 1951 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.

The injector ampule shown in Figure 1 comprises a barrel 11 in which a plunger 12 is telescopically movable. A variable volume chamber 13 is formed by the barrel and plunger and a hollow injection needle 14 mounted in the front end 15 of the barrel communicates with the chamber 13 through a passage 16.

The front wall 17 of the chamber 13 is preferably tapered so that air or gas bubbles accidentally trapped in the chamber 13 will collect at the end of the passage 16 if the injection ampule is held in a substantially vertical position.

The end of the needle 14 may be sealed by a sealing cap diagrammatically indicated at 18, the precise construction of the sealing cap being no part of the subject matter of this invention.

The chamber 13 is sealed against the plunger 12 by a sealing member or plug 19 shown in greater detail in cross section in Figure 2.

The sealing plug 19 is preferably made of an

elastic material such as natural or synthetic rubber and comprises a forward guiding portion 20 having a diameter sufficiently large to slide in the bore of the barrel 11 substantially without compression of the guiding portion in the direction of the radius of the plug. A rearward sealing portion 21 has a diameter larger than the internal diameter of the bore of the barrel 11 to produce a liquid and pressure-tight seal of relatively narrow width, the width of the sealing portion 21 being only a fraction of the width of the guiding portion 20.

The forward surface 22 of the plug is preferably shaped to conform with the forward surface 17 of the chamber 13.

A central stem 23 is frictionally insertable into, and is lightly held in, an aperture 24 in the forward end of the plunger 12. The aperture 24 may be square to prevent formation of an airtight seal between the plunger 12 and the plug 19. The forward portion 25 of the plunger 12 is shaped to fit the substantially cone-shaped rear surface 26 of the sealing plug 19.

When the plug 19 is attached to the cone-shaped forward end 25 of the plunger 12, the cone-shaped end 25 forms a substantially rigid core resisting collapsing of the rearward portion of the plug in a radial direction.

The flat forward surface 27 of the plunger 12 supports the rear surface 28 of the plug immediately adjacent the sealing portion 21 so that any deformation of the sealing portion 21 by reason of its tight fit in the barrel 12 is limited to radial compression. Deformation of the sealing plug in a direction parallel to its axis, the cause of objectionable creeping, is prevented.

The connection between the plug 19 and the plunger 12 by reason of insertion of the stem 23 into the aperture 24 is such as to provide for easy separation in the event the plunger is withdrawn, so that the position of the sealing plug is not disturbed by withdrawal of the plunger. The connection, however, is sufficiently firm to prevent the plunger from dropping out of barrel 11 if the device is held in a vertical position.

The bodies of the barrel 11 and of the plunger 12 are conveniently shaped to permit fabrication of the bodies by molding them from synthetic plastic material requiring no further machining. The plug 19 is also of a shape which may be molded of natural or synthetic rubber and is ready for assembly without further form shaping operations.

The injector ampule shown in Figure 1 is preferably filled after assembly by fluid under pressure injected through the needle. The pressure of the fluid moves the sealing plug 19 and the plunger 12 in a direction away from the needle passage 16 until a predetermined volume is reached. The injector ampule is then disconnected from the filling device and is placed in a vertical position. This causes air and gas bubbles accidentally trapped in the chamber 13 to collect at the needle passage 16 where they are visible if the barrel housing 11 is made from a clear, transparent plastic composition. Actuation of the plunger 12 forces the air bubbles out of the chamber 13 through the needle 14. The sealing plug 19 undergoes no deformation during this operation in a direction substantially parallel with the direction of travel, the sole deformation of the sealing portion 21 being in a radial direction, any tendency of deformation in an axial direction being opposed by the flat forward surface 27 of the plunger 12.

When the sealing plug 19 comes to rest, it remains at rest and there is no tendency of creeping back so that the volume of the chamber is not enlarged and no air is drawn into the chamber through the needle 14.

A modified form of injector syringe is shown in Figure 5, details being illustrated in Figures 6 and 7. Primed reference numerals are employed to indicate elements corresponding to those of the device of Figure 1.

A plunger 12' is telescopically movable in a barrel 11' in which a hollow injection needle 14' is mounted, communicating with the interior chamber 13' through a passage 16'. A sealing plug 19' is movable in the bore of the barrel 11' and rests with its rear surface 28' against the forward surface 27' of the plunger 12'.

The sealing plug 19' has a resiliently deformable central portion 29 adapted to be rearwardly deflected by pressure acting on the forward surface 22' of the plug. The plug has a peripheral guiding portion 20' and a sealing portion 21' lying immediately adjacent the forward surface of the plunger 12'.

The plunger 12' is frictionally held in the bore of the barrel by reason of its forward end being slotted at 30. The slotted portion contains a resilient center plug 31 tending to force the slotted portions against the interior wall of the barrel 11' whereby the plunger is frictionally held in whatever position it happens to be. The frictional engagement between the plunger 12' and the barrel 11' however, is not so great as to interfere with the operation of the device, the friction just being sufficient to prevent the plunger 12' from becoming separated from the barrel when the device is being handled, for example held in a vertical position.

The injector ampule of Figure 5 is preferably filled by forcing fluid under pressure into the chamber 13' through the needle 14'. It is used and operated in the same manner as the device shown in Figure 1. The operation of the sealing plug 19', however, differs from that of the plug shown in Figures 1 and 2 in the following particulars.

When the plunger 12' is actuated in the direction to expel fluid from the chamber 13', a certain amount of pressure is set up in the chamber 13' by reason of the flow resistance of the narrow bore of the needle 14'. This pressure acts on the relatively thin central portion 29 of the plug and causes it to be deflected rearwardly as long as the pressure persists. When the plunger 12' comes to rest, the center portion 29 of the sealing plug tends to return to its original position by reason of its resiliency, causing an additional small volume of fluid to be expelled. This action of the plug compensates for any tendency of creeping so that, even if the sealing plug were to creep back, no air will be drawn into the chamber 13'.

The invention thus provides improved structural details for injection ampules insuring that the fluid charge of the injector ampules constructed in accordance with the invention is free from entrapped air or gas bubbles so that injector ampules may be used without previous checking or inspection for bubbles and without any preparation other than the removal of a needle seal applied by the manufacturer.

Obviously, the present invention is not restricted to the particular embodiments of the in-

vention herein described and illustrated. Numerous modifications, additions, omissions, substitutions and various other changes may be made without departure from the spirit and the essence of the invention as defined in the appended claims. All such changes will suggest themselves to persons skilled in the art after consideration of the disclosure and do, therefore, not involve a departure from the spirit and the teachings of this invention.

What is claimed is:

1. A combination ampule and injection syringe for forming and injecting a predetermined volume of medicinal fluid comprising, a barrel; a sealing plug of elastic material telescopically movable in said barrel for forming a variable volume chamber with said barrel adapted to contain a charge of fluid, said sealing plug having a forward guiding portion of a diameter sufficiently large to slide in said barrel substantially without compression of the guiding portion and a rearward sealing portion of a diameter larger than the inside diameter of said barrel; a hollow injection needle communicating with said chamber; and a plunger telescopically movable in said barrel, said plunger having a front surface adapted to engage the rear surface of said plug immediately adjacent said sealing portion to prevent elastic distortion of said sealing portion in the direction of travel of said plug in said barrel, said plunger further having a resiliently compressible portion of a diameter, measured unconstrained, larger than the internal diameter of the barrel for frictionally engaging the inner surface of said barrel thereby tending to arrest said plunger in said barrel.

2. A combination ampule and injection syringe for storing and injecting a predetermined volume of medicinal fluid comprising a barrel forming a chamber adapted to contain a charge of fluid; a hollow injection needle mounted in said barrel; a plunger member telescopically movable in said barrel; a sealing member of elastic material, separate from said plunger member, said sealing member being telescopically movable in said barrel and having a guiding portion of a diameter sufficiently large to slide in said barrel substantially without compression, and a sealing portion of a diameter larger than the inside diameter of said barrel, one of said members being provided with a boss and the other of said members having a hole smaller than said boss for receiving and holding said boss in a compressed state, whereby said two members may be severably connected.

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