April 18, 1950 J. D. HULSMANN 2,504,127

METHOD OF PRODUCING HYPODERMIC UNITS

Filed March 17, 1943

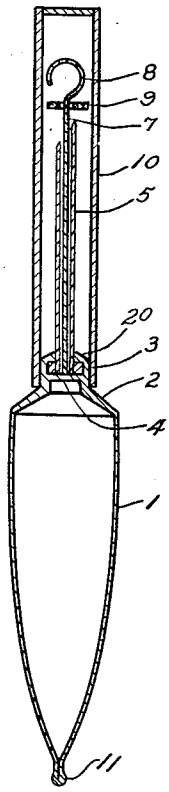


Fig. 1

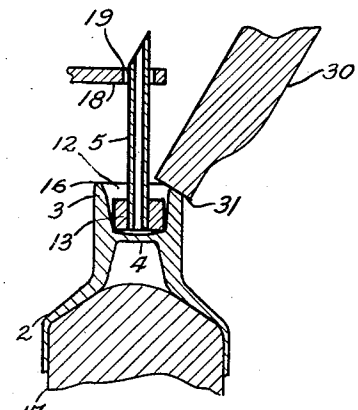


Fig. 2

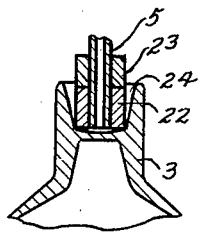


Fig. 3

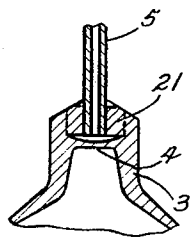


Fig. 4

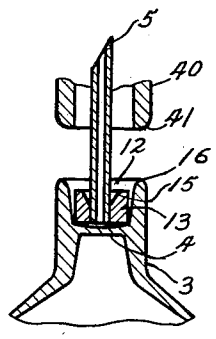


Fig. 5

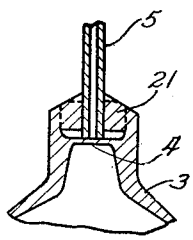


Fig. 6

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Patented Apr. 18, 1950

2,504,127

UNITED STATES PATENT OFFICE

2,504,127

METHOD OF PRODUCING HYPODERMIC UNITS

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Application March 17, 1943, Serial No. 479,397

2 Claims. (Cl. 128—216)

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This invention relates to articles commonly known as hypodermic units, enabling medicines and other substances to be promptly and efficiently administered by injection directly from sterile original packages; and it relates particularly to hypodermic units of the type shown in United States Patent No. 2,219,301, comprising a hermetically-sealed collapsible soft-metal tube having an integrally-extruded, readily-pierceable blind discharge end, a hypodermic needle immovably secured to the tube, with the lumen of the needle communicating with the outside of the blind end, and a stiff wire longer than, and carried in the lumen of, the needle, for piercing the blind end.

The hypodermic units shown and described in that patent are simple, inexpensive to manufacture, and characterized by exceptional ease, convenience, and dependability in use. In the production of such hypodermic units on a large scale, however, it has been found that the securing of the needle to the tube accounts for an inordinate proportion of the cost of the unit, primarily because the needle must first be rigidly secured to a base, and the base must be machined within a narrow tolerance (since in the case of a hub, for example, one too small would be difficult to force into frictional engagement with the tube neck, and one too large would be pulled off on removal of a tightly-fitting protective cover).

It is the object of this invention to provide improved hypodermic units which are exceptionally simple in construction and inexpensive to manufacture, and a simple and efficient method of producing such units.

Essentially, the improved hypodermic unit of this invention comprises a collapsible soft-metal tube with a hollow neck having an integrally-extruded, readily-pierceable partition in its bore and an integral inward extension above the partition, and a hypodermic needle in the bore above the partition and united with the extension, the lumen of the needle communicating with the outside of the partition.

These improved hypodermic units are produced by a method essentially comprising extruding a collapsible soft-metal tube with a hollow neck having an integral readily-pierceable partition in its bore, inserting in the outer cavity provided by the partition and neck wall a centrally-perforated metal disc, inserting a hypodermic needle into the perforation, and soldering the neck to the needle.

The invention will be described in detail in connection with the accompanying drawing, wherein:

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Fig. 1 is an axial section of a complete hypodermic unit embodying the invention.

Fig. 2 is an enlarged fragmentary axial section of the unit shown in Fig. 1 before completion of the assembly thereof, and illustrating a mode of assembly, the needle being shown relatively shortened for convenience of illustration;

Fig. 3 is an enlarged fragmentary axial section of an alternative form of hypodermic unit embodying the invention, before completion of the assembly;

Fig. 4 is an enlarged fragmentary axial section of another alternative form;

Fig. 5 is an enlarged fragmentary axial section of another alternative form, before completion of the assembly, and illustrating an alternative mode of assembly, the needle being shown relatively shortened for convenience of illustration; and

Fig. 6 is an enlarged fragmentary axial section of another alternative form.

Referring first to Fig. 1, the assembled unit shown comprises a collapsible soft-metal tube 1 having a conventionally-shaped shoulder 2, an unthreaded neck 3, and an integral partition 4 in the bore of the neck. The shoulder and neck of the tube are preferably thicker than the body of the tube, for rigidity; and the partition 4 is relatively thin, at least at its center, so as to be readily pierceable by a stiff wire. A hypodermic needle 5 is immovably (and rigidly) secured to the tube (with its lumen communicating with the outside of the partition) by being united with an integral inward extension 20 of the neck. Within the lumen of the needle is a stiff, pointed wire 7 having its outer end modified to form a head or handle 8, the wire being long enough to puncture the partition 4 when thrust inwardly; and the wire has impaled thereon a guard disc 9 of thick paper or other protective material which will not dull the point of the hypodermic needle, to safeguard the needle from contamination and the fingers from being pricked. (Alternatively, the wire may be so shaped as to perform these functions without a guard disc.)

A protective cover 10 of synthetic plastic or the like, preferably transparent, such as Celluloid or Hycoloid (a cellulose nitrate plastic), is frictionally engaged with the outside of the tube neck 3, the engagement being tight enough to exclude contaminants but permitting the cover to be readily pulled off for use of the hypodermic unit.

The hypodermic unit shown in Fig. 1 is assembled as follows: [Before assembly, the tube

to be embodied in the unit is punched from a slug of tin, for example, in the form indicated in Fig. 2, i. e., is extruded with the integral partition 4 situated deep within the bore of the neck and providing with the wall of neck 3 a substantially-cylindrical outer cavity 12; and a cylindrical disc 13, thinner than the depth of the outer cavity and adapted to fit loosely therein, and having a cylindrical axial perforation adapted to receive slideably a hypodermic needle, is punched out of brass, for example.] The tube is held upright on an axially-rotatable mandrel 17; the disc is inserted in the cavity; a hypodermic needle 5 (the cannula itself, cut flat at one end and with the conventional point at the other) is slid into the perforation in disc 13 until the flat end is substantially flush with the lower face of the disc, the needle being thereby held upright with its lumen in communication with the outside of partition 4; a small amount of flux is deposited on the needle adjacent the disc; a holding member 18 having a cylindrical aperture 19 larger than the needle is brought down axially to a position below the tip of the needle; an electrically-heated soldering iron 30, whose soldering face 31 is inclined slightly upwards towards the needle, if brought down to the position shown in Fig. 2 [i. e., through the position in which it contacts the rim 16 and, while melting the neck wall 3, to a position intermediate the rim and the top of disc 13, where it is held by a stop member (not shown)]; and the mandrel 17 is spun around at least once (and preferably several times). As the tube is rotated, the metal of the neck wall melts and flows inwardly, surrounding and uniting with the side and upper face of disc 13 and with needle 5, thus providing in effect an integral inward extension 29 of the neck united with the needle (as shown in Fig. 1). The needle is thereby immovably (and rigidly) secured to the tube with its lumen in communication with the outside of partition 4. After the soldering operation is finished, the soldering iron is retracted from its stop position, and the holding member is moved upwardly, leaving the unit free for removal from the mandrel.

Alternatively (and preferably), the disc 13 is formed (as by punching) of the same soft metal as the collapsible tube, in which case the axially-sectioned assembly (Figs. 4 and 6) will exhibit consolidation (coalescence) of the neck wall and the disc. Such consolidation may be partial, but optimally (as shown in Figs. 4 and 6) the consolidation involves all but the lower face of the disc and the outside of the partition, and the height of the disc and depth of the cavity are so proportioned that the metal for the soldering is derived in part from the disc (as indicated by dotted lines). Manifestly, such embodiment provides the greatest possible union of the needle with the neck wall, the portion 21 being in effect a large integral inward extension of the neck wall united to the needle.

In assembling the hypodermic units, the needle is attached to the tube as explained hereinbefore, the wire 7 is inserted into the lumen of the needle, and the protective cover 10 is attached. The collapsible tube is then filled with the desired medicine or other substance—inter alia, narcotics (especially morphine tartrate), tetanus antitoxin, or insulin—in the usual manner through its open end, and that is suitably closed, preferably hermetically sealed, as by electrically forming a bead-weld 11. Alternatively (and this is an advantage of the hypodermic units of this invention), the tube may first be filled and sealed, and then positioned in a suitably apertured support for assembly with the needle, wire, and cover.

Alternatively, the perforation in disc 13 (cf. Figs. 2, 3, and 5) may be adapted to receive snugly the needle 5, and this snug fit utilized in assembling the hypodermic unit. Thus, the needle may be first slipped into the disc perforation and used as a handle to insert the disc into cavity 12. Alternatively, also, as shown in Fig. 5, the cylindrical axial perforation in disc 13 may have a countersink 15, to facilitate entry of the molten metal into any space between the perforation and the needle, and provide a larger area for union of the neck-wall extension with the needle.

The movements of the soldering iron 30 and/or holding member 18 with respect to the tube and needle as described hereinbefore may obviously be reversed; i. e., the loosely assembled tube, disc, and needle may be moved axially upwards to bring the needle into aperture 19 and the tube into contact with the soldering iron and to the position shown in Fig. 2, the assembly rotated by its mandrel support, and then retracted until the needle is free of the holding member 18. Also, the soldering iron 30 may be brought into the position shown in Fig. 2 by a motion perpendicular to the axis of the unit and held there while the unit is rotated. In any event, the soldering operation must be so conducted that no damage is done to the outside of the neck wall 3 which would interfere with the attachment of protective cover 10.

The soldering iron may be heated other than electrically; and it may be replaced by one or more soldering irons traversing the rim of the neck wall, or—as shown in Fig. 5—by an annular soldering iron 40 whose rim 41 is of the same diameter as rim 16 of the neck wall (in which case the tube assembly need not be rotated, the soldering iron being merely slipped over the needle and brought down axially to a stop position intermediate the rim of the neck wall and top of the disc). Also induction heating (with or without rotation of the tube-and-needle assembly), or any other means for bringing sufficient heat to the rim of neck wall to make the metal flow may be used instead of a soldering iron. Alternatively, also, the solder for the union of the needle with the neck wall may be supplied by the disc (as described hereinafter) or may be supplied directly to the soldering iron in the conventional manner. Manifestly, the entire soldering operation may be designed to proceed without manual assistance or control. A needle-holding member (cf. 18 in Fig. 2) is not required for the soldering operation, but is advantageous when the operation involves rotation of the needle-and-tube assembly.

The discs shown in Figs. 2 and 5 may be replaced by a pair of discs (or an integral, two-layer disc formed from a laminated blank) as shown in Fig. 3, the lower disc or layer 22 being of brass or other non-solder metal and the upper disc or layer 23 being of tin, lead-tin, or other solder; and the use of such discs may be advantageous, as when the tubes are formed of lead or tin-coated lead, and the neck wall therefore cannot readily supply the solder. In such case, as shown in Fig. 3, the cavity 24 is made relatively shallow, so that the soldering iron may contact the upper disc 23, which melts and furnishes the solder to unite neck wall 3 with needle 5; and the resulting unit,

like that shown in Fig. 1, has an integral inward extension of the neck wall above a disc in the outer cavity.

As shown (with exaggeration) in Figs. 2 to 6 inclusive, the lower face of disc 13 and the outside of partition 4 are preferably out of contact, to minimize the possibility of coalescence of the disc and partition. Such spacing may be effected by suitably shaping the lower face of the disc (not shown) and/or the outside of the partition during the production of the disc and/or tube. Thus, as shown in Figs. 2 to 5 inclusive, the outside of partition 4 may be dished; or, as shown in Fig. 6, the spacing may be effected by the disc being stopped by the rounded junction of the partition with the wall of the outer cavity. Also, as indicated in Fig. 6, the needle may slide (or be pushed) down until its flat lower end rests on the outside of the partition. The bond effected between the neck wall, the disc, and the needle by the soldering operation is herein referred to generally as a "union" of the metal parts, and as a "consolidation" of the metal where an actual weld is formed (cf. the coalescence of the neck wall and disc in Figs. 4 and 6).

The term "solder" is used herein in its dictionary-approved broad meaning; i. e., as defining a metal or metallic alloy used, when melted, to join metallic surfaces; tin, tin-lead, and the low-melting tin-lead-bismuth solders being especially suited for the purposes of this invention. The disc (or the lower layer of the pair of, or laminated, discs) need not be of a non-solder metal, such as brass, but may be formed of a solder, and is preferably of the same composition as the tube (e. g., tin, lead, tin or lead composition, or tin-coated lead).

The completed unit may be heat-sterilized in the usual manner. Alternatively, and preferably, a sterilizing agent is incorporated in the contents of the tube; and the operative surfaces of the unit (the point, lumen, and outside of the needle 5, the outside of the partition 4, and the portion of the wire 7 within the lumen of the needle) are covered with a film of non-volatile physiologically-innocuous material containing a sterilizing agent, as described in Nitardy application Serial No. 447,467, filed June 17, 1942, now abandoned.

The unit of this invention is used in the same manner as the hypodermic units shown in U. S. Patent No. 2,219,301. Thus, the protective cover is first removed, and the wire, as by pressure on its head, thrust inwardly to puncture the partition 4. The wire is then withdrawn, the needle introduced into the subject, and the tube squeezed between the fingers to inject the contents thereof into the subject.

The invention may be variously otherwise embodied—for example as to shapes, proportions, and arrangements of the several elements—within the scope of the appended claims.

I claim:

1. The method of producing a hypodermic-unit comprising extruding a collapsible soft-metal tube with a hollow neck having an integral readily-pierceable partition in its bore, inserting in the outer cavity provided by the partition and neck wall a centrally-perforated metal disc thinner than the depth of the cavity, inserting a hypodermic needle in the perforation, bringing a heated soldering iron into contact with the rim of the neck wall and to a position intermediate the rim and the top of the disc, and rotating the tube-disc-and-needle assembly relative to the soldering iron to make the rim of the neck wall flow and unite with the needle.

2. The method of producing a hypodermic-unit comprising extruding a collapsible soft-metal tube with a hollow neck having an integral readily-pierceable partition in its bore, inserting in the outer cavity provided by the partition and neck wall a centrally-perforated metal disc thinner than the depth of the cavity, inserting a hypodermic needle in the perforation, bringing over the tip end of the needle a holding member permitting axial rotation of the needle, bringing a heated soldering iron into contact with the rim of the neck wall and to a position intermedate the rim and the top of the disc, and axially-rotating the tube-disc-and-needle assembly to make the rim of the neck wall flow and unite with the needle.

JOHANNES D. HULSMANN.

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