June 20, 1961 D. A. HAMILTON 2,989,053

HYPODERMIC NEEDLE

Filed Jan. 17, 1956

FIG. 5.

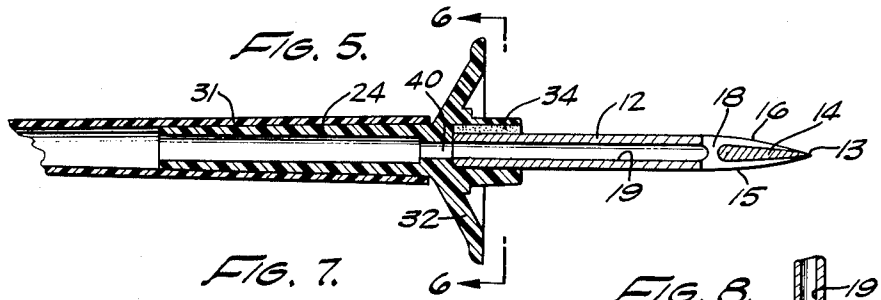



FIG. 7.

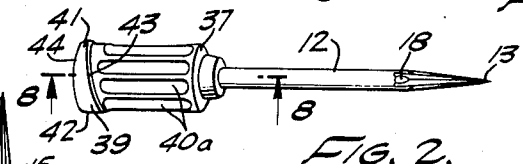



FIG. 8.

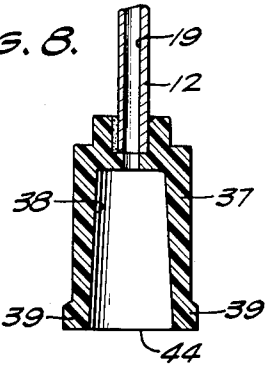



FIG. 1.

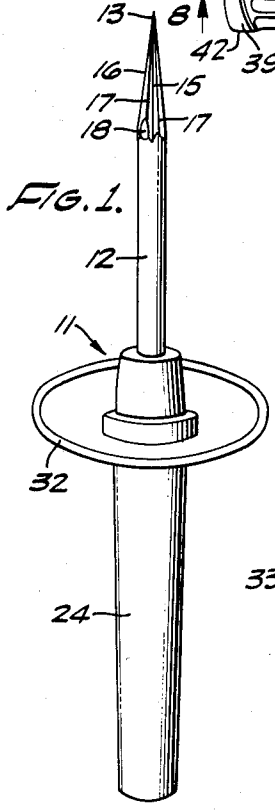



FIG. 2.

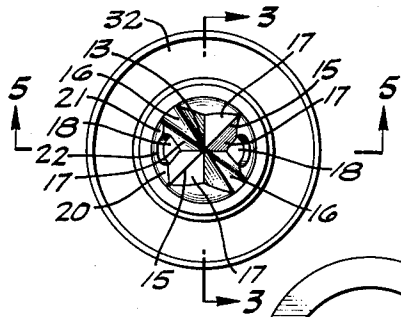
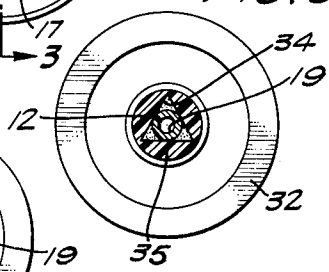



FIG. 6.



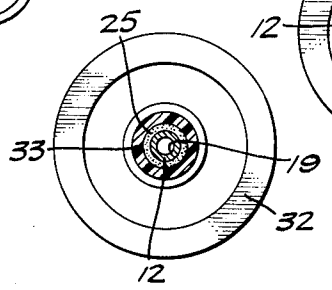




FIG. 9.

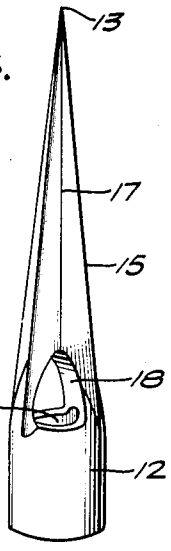
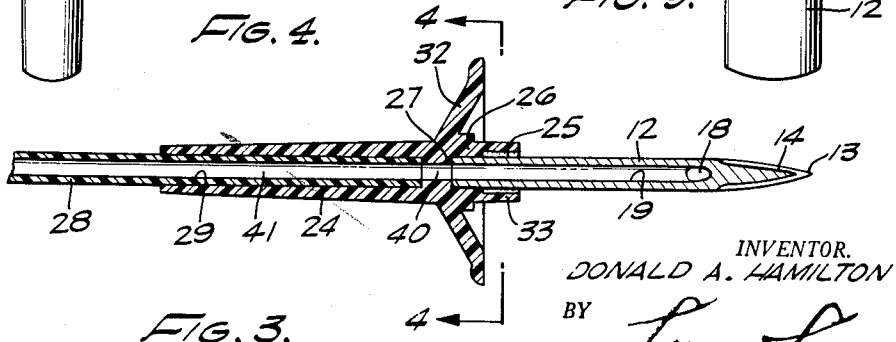



FIG. 4.

FIG. 3.




INVENTOR.
DONALD A. HAMILTON
BY
Lyon & Lyon
ATTORNEYS

United States Patent Office 2,989,053 Patented June 20, 1961



2,989,053

# HYPODERMIC NEEDLE

Donald A. Hamilton, Burbank, Calif., assignor to Don Baxter, Inc., Glendale, Calif., a corporation of Nevada

Filed Jan. 17, 1956, Ser. No. 559,627
15 Claims. (Cl. 128—221)

This invention relates to an improved hypodermic needle and particularly to one which is inexpensive, easy to make with a wide variety of hubs, and easily attached to an administration set.

Hypodermic needles are used to administer therapeutic substances by subcutaneous, intramuscular or intravenous injection. Similarly, they may be used to draw fluid samples from the veins or other portions of the body. Hypodermic needles are also used to pierce rubber stoppers, or entry devices on flexible plastic bags, to establish communication with the insides of parenteral solution containers.

Ordinary hypodermic needles have a beveled point formed by cutting obliquely across a hollow tube. Such points tend to core or abrade the material they puncture. The large cutting area cuts, irritates, or traumatizes the tissues. Tissue damage and chemical release caused by the irritation and trauma increase pain, scar tissue formation and the tendency of blood to clot. Moreover, the design of the needles leads to defects, such as ragged or burred edges, shovel-nosed points, fish-hook points, and contamination by dirt, cutting compounds, or abrasive dust. Sharpness of the needles is also a problem. If a needle is made sharp enough, the point is easily damaged; if not, pain and trauma associated with the injection are greatly increased. This pain is sometimes so severe that procaine is used to facilitate injections.

When beveled point needles are used to pierce rubber stoppers, the large cutting area makes them difficult to insert. This is particularly serious with large needles if the stopper has a thick diaphragm to prevent leakage around the needle or to aid resealing after the needle is withdrawn.

Many new designs of needles have been disclosed but none of them have replaced the beveled point needle with an attached metal hub. Such needles are expensive and are usually reused many times before they are discarded. When used repeatedly, these needles become dull and despite resharpening they are often not as sharp as they should be. Before use, each needle must be carefully cleaned, rinsed with nonpyrogenic distilled water and sterilized. The possibility of transmitting virus diseases, like infectious hepatitis, is particularly serious. When using needles for self-medication, patients often do not exercise the necessary care, and injury and infection may result.

Recently, expendable metal needles have been supplied with some administration sets for parenteral solutions. They must be made cheaply, however, and often leak at the joint between the hub and cannula. When the needle is used to connect a donor set to an evacuated container, such leaks may allow air to dissipate the vacuum. Moreover, these needles may contain slivers and other contaminating material, and careful cleaning and inspection is necessary.

Donor sets designed to draw blood from a donor into an evacuated bottle usually have attached needles. The importance of a firm joint between the needle and the tubing is shown by the specifications of the Armed Forces Medical Procurement Agency which requires the joint to withstand a physical pull of 35 pounds. To meet this rigorous specification, the plastic tube has been attached to metalized or roughened areas of the hub or cannula, the hubs have been furnished with ridges and grooves, and various types of plastic, metal or rubber collars have



been tried. All of these devices add to the expense of the set and none of them have been entirely satisfactory.

It is the object of this invention to provide an inexpensive, expendable hypodermic needle.

It is the further object of this invention to provide a hypodermic needle which is easily inserted through tissues or rubber stoppers; which will not core or abrade the material it punctures; which can be manufactured easily and cheaply; and which will make a clean slit in the material through which it passes.

A still further object of the invention is to provide a hypodermic needle which has the advantages of both a metal cannula and a plastic hub; which will withstand any force which may be applied to it in use; which can be easily made with a wide variety of hubs; which can be easily and permanently attached to the plastic tubing of an administration set; and which can provide a constant lumen through the cannula, hub, and connecting tubing.

Other objects will become apparent from the following description of the preferred examples of the invention and the accompanying drawings in which:

FIGURE 1 is a perspective of my invention.

FIGURE 2 is an end view of the invention looking down on the point of the needle.

FIGURE 3 is a sectiotn taken on the line 3—3 of FIGURE 2.

FIGURE 4 is a section taken on the line 4—4 of FIGURE 3.

FIGURE 5 is a section taken on the line 5—5 of FIGURE 2 showing a modification of the hub.

FIGURE 6 is a section taken on the line 6—6 of FIGURE 5.

FIGURE 7 is a perspective of a modified form of my invention.

FIGURE 8 is a section taken on the line 8—8 of FIGURE 7.

FIGURE 9 is an enlarged perspective view of the point of the needle shown in FIGURE 1.

Referring now to the figures, the hypodermic needle generally indicated at **11** is provided with a cannula **12** having a sharp center point **13**. A solid blade **14** is preferably made of metal or other material which will hold a good edge and which will slide into the vein easily. The blade is provided with sharp cutting edges **15**. Other edges **16** arise from the blade. These edges **16** may be dull spreading edges or they may be another set of cutting edges. If spreading edges are used, they stretch the pierced material over the sharp edges **15** to facilitate cutting. Channels **17** are provided between each pair of cutting and spreading edges. Holes **18** connecting with the central bore **19** of the cannula **12** are located in the base of two of the channels **17** so that the shoulders **20** and **21** formed at the juncture of the cutting and spreading edges **15** and **16** with the tubular cannula **12** hold the pierced material away from the hole. The exposed end **22** of the cannula shaft along the edge of the hole **18** may be depressed below the shoulders **20** and **21** to further prevent coring of the pierced material and also to force fluid from the needle to run longitudinally along the channel **17**.

The hub **24** may be made of metal or molded from a plastic material resistant to sterilizing. Thermoplastic materials, such as vinyl chloride resins, vinyl chloride-acetate resins, vinyl-vinylidene chloride resins, polyethylene, cellulose acetate, "nylon" and other polyamide resins, styrene, butadiene-styrene copolymers, or butadiene-acrylonitrile copolymers may be used. Thermosetting plastics such as phenolic resin may also be used. If a transparent material is used, blood can be drawn back into the hub lumen **40** to indicate that the needle is in place for an intravenous injection. Conversely, failure of the blood to draw back into the lumen **40** indicates the

needle is suitably positioned for an intramuscular injection. A slightly resilient plastic will give an excellent seal between the hub and the rigid connecting member of a syringe, or assembling jig. Moreover, such hubs will not freeze to the connecting member.

The hub **24** is attached to the cannula **12** by a layer of adhesive in the space **25** which may be approximately 0.002 to 0.008 inch thick. Centering of the cannula **12** by the tight cylindrical section **26** assures that adhesive will be distributed evenly in the space **25** around the cannula **12**. At the base of the cannula an annular boss having a shoulder **27** prevents the cannula from entering too far into the hub and permits pressure to be placed on the cannula by pushing on the hub **24**. The hub lumen **40** serves to provide a constant lumen from the cannula bore **19** to the plastic tube bore **41**. The plastic tube **28** is attached in the hub **24** by cement or adhesive. The inside bore **29** of the hub may be tapered slightly to allow for variations in the diameter of the tube **28**. The hub **24** may also have an outside taper so that a large tube **31** (FIGURE 5) can be fastened on the outside of the hub **40** if desired. If the needle is for intravenous use the finage **32** is omitted and the hub **24** should be at least 1¼ inches long. This facilitates grasping it between a thumb and two fingers so that the operator can make the venipuncture without contacting blood from the injection site.

The hub **24** may be provided with a flange **32** to help force the needle through a rubber stopper. A protector hub **33** receives the open end of a sterile protector (not shown) over the cannula **12**.

FIGURES 5 and 6 show a hub with a slightly different structure for attaching the cannula. The cannula **12** fits into the space **34** which is a prism substantially triangular in cross section. The flat sides **35** serve to center the cannula **12**, thus avoiding need for the tight-fitting section **26** of FIGURES 3 and 4. Adhesive in the space **34** attaches the hub **24** firmly to the base of the cannula **12**. By this means, the cannula is centered without the close tolerance of the previous design. Thus, less trouble is encountered from shrinkage of the plastic hub or variation in the cannula diameter. In addition, a longer adhesive area, and therefore a stronger bond, is provided.

FIGURES 7 and 8 show a needle adapted for attachment to a lock-type connecting member on a syringe or other device. The hub **37** is provided with a cannula **12** attached as shown in FIGURES 3–6. The hub **37** may be cylindrical or may be somewhat larger at its base **44** than at the cannula end. Serrations **40***a* are preferably provided to facilitate grasping the hub. The hub has a tapered bore **38**, the open end of which lies in the base **44**. Two locking shoulders **39** are provided on opposite sides of the hub. The locking shoulders **39** have a narrow side **41** of approximately 0.03 inch and taper to a wide side **42** of approximately 0.06 inch. Thus, each locking shoulder is tapered along the edge **43**. There are no undercuts on the hub **37** so that it may be molded in a two-cavity mold. The hub **37** may be made of a plastic material which is slightly resilient and thus gives a very tight fit. Likewise, it can be made of a self-lubricating plastic so that it is easy to remove from the syringe. By using this type of hub, it is unnecessary to put a complete thread on the inside of the syringe connecting member, a dimple or boss being sufficient. The usual wrench slots are also unnecessary. Thus the syringe can be made more easily and cheaply.

A particularly suitable construction of the invention has been made by molding the hub **24** from rigid polyvinyl chloride. This is then attached to cannula **12** by a polyamide-epoxy adhesive located in the space **25** or **34**. A force of more than 100 pounds usually will not pull the cannula and hub of this needle apart. Other adhesives such as amine and polyamine cured epoxy adhesives, acrylic adhesives and solvent-type vinyl adhesives have proved suitable though less effective. The flexible, transparent tube **28** or **31** may be solvent-bonded to the polyvinyl chloride hub **24**.

The point and blade of this hypodermic needle pierce and cut the tissue instead of tearing it. The spreading edges hold the tissue tightly against the sharp cutting edges so that less force is required, thus causing less trauma. If only two cutting edges are used, the hole through which the cannula enters is a straight slit and reseals completely when the needle is removed. The shoulders of the cutting or spreading edges hold the vein walls away from the cannula, so that flow in or out of the cannula is not stopped by a collapsed vein. The cannula may be made from the usual cold-drawn stainless steel tubing, other tubing, or from flat sheet stock. It is sometimes necessary to add more material from which the points may be formed and this is done by placing a rod in the tubing during the forming operation. This needle is particularly suited for manufacture from flat sheet stock. Such stock can be rolled to form a tube at a much lower cost than the cold-drawn tubing usually used. The seam may be placed along a protected part of the needle. Moreover, the blank of flat sheet stock may be shaped to provide the extra material needed to form the point.

The needle of this invention formed in this manner is sharp enough to penetrate most materials easily. If necessary, the point and exposed cutting edges are easily sharpened. When the point **13** is observed in an optical comparator looking straight at the flat cutting blade or at right angles to the blade, the minimum radius of the point is found to be .008 to .015 inch. An ordinary beveled point hypodermic needle, observed by looking straight at the beveled surface or at right angles to the beveled surface, has the minimum point radius of .001 to .005 inch. The unexpected ease with which the point of this invention penetrates a thick rubber diaphragm is apparently due to the spreading edges **16** which stretch the pierced material over the sharp edges **15** to facilitate cutting.

This needle is inexpensive enough to be discarded after a single use. For this reason it is best marketed in a clean, sharp, sterile condition, ready for use. The needle combines all the advantages of the metal cannula with the advantages of a plastic hub. Moreover, the joint between the metal cannula and the hub is stronger than most metal-to-metal joints. The cannula is less apt to break because it has not been heated or soldered. The give of the plastic hub eliminates areas of shearing stress at the joint. The assembled needle may be sterilized by heat or gas without damage.

I claim:

1. A hypodermic needle comprising: a cylindrical, hollow, stainless steel cannula; a solid, pointed, triangular blade on one end of said cannula; cutting edges on the sides of said blade; rounded ridges in the center of the blade and arising therefrom; channels located between the cutting edges and the ridges; holes located at the base of at least two of said channels and communicating with the interior of the hollow cannula; the exposed end of the cannula shaft being depressed along the edge of said holes; a molded polyvinyl chloride hub on the end of said cannula opposite the point; a boss on said hub adapted to receive a sterile protector; a flange on said hub to aid pushing the needle through a resistant material; a hub shaft having an interior tapered surface adapted to be connected to a flexible plastic tube; a bore through said hub; a section of said bore adapted to fit tightly against the base of the cannula shaft; a space between said cannula shaft and hub adapted to receive an adhesive; a polyamide-epoxy adhesive in said space; and a uniform lumen through said cannula shaft, hub, and plastic tube.

2. A hypodermic needle comprising: a cylindrical, hollow, metal cannula; a sharp-pointed blade on the end of said cannula; cutting edges along the sides of said blade;

ridges arising from said blade; channels located between the cutting edges and the ridges; holes located in said channels and communicating with the interior of the cannula; a molded plastic hub on the end of the cannula shaft opposite the point; a tapered hub shaft adapted to be connected to a flexible plastic tube; a bore through said hub; a section of said bore adapted to hold the cannula in place; a space between said cannula and hub; and an adhesive in said space.

3. A hypodermic needle comprising: a cannula; a plastic hub; a bore through said hub; a tapered section at one end of the bore; a plastic tube attached in said tapered section; a section of the bore substantially the same diameter as the outside of the cannula; a section of the bore around the cannula having a diameter .004 to .016 inch larger than said cannula; and an adhesive in said larger section of the bore attaching the hub firmly to the cannula.

4. A hypodermic needle comprising: a cylindrical, hollow cannula; a pointed blade on the end of said cannula; cutting edges along the sides of said blade; ridges arising from said blade; channels located between the cutting edges and the ridges; at least one hole located at the base of a channel and communicating with the interior of the cannula; and means of attaching a tube to said cannula.

5. A hypodermic needle comprising: a cannula; a pointed blade on said cannula; cutting edges on said blade; means in addition to said blade for stretching pierced material over said cutting edges; at least one hole communicating with the interior of the cannula; a channel leading from said hole to the point of said blade; and a hub attached to said cannula.

6. A hypodermic needle comprising: a cannula; a plastic hub; a bore through said hub; an annular boss in said bore contacting on one side the base of said cannula; a flexible plastic tube inserted in said bore and seated against the other side of said boss; and a substantially uniform lumen through said cannula, boss, and plastic tube; a section of said bore adapted to center the cannula; a section of the bore around the cannula having a space between the cannula and the hub; and a resilient adhesive material in said space.

7. A hypodermic needle comprising: a cannula; a molded polyvinyl chloride hub; a boss on said hub adapted to receive a sterile protector; a hub shaft having an interior tapered surface adapted to be connected to a flexible plastic tube; a bore through said hub and shaft; a section of said bore adapted to fit tightly against the base of the cannula; a space between said cannula and hub adapted to receive an adhesive; a polyamide-epoxy adhesive in said space; and a uniform lumen through said cannula shaft, hub, and plastic tube.

8. A hypodermic needle comprising: a cannula; a hub; a bore through said hub; a section of said bore having a triangular cross-section, the sides of said section contacting the base of the cannula; spaces in the apexes of said triangular cross-section; and a resilient adhesive in said spaces.

9. A hypodermic needle comprising; a cannula; a hub; a bore through said hub; an annular boss in said bore against which the base of said cannula is seated; a section of the bore adjacent said boss fitting snugly around the cannula; a section of the bore having a space between the cannula and the hub; and an adhesive in said space.



10. A hypodermic needle comprising: a hub having a bore; a cannula; a first section of the hub bore telescoped with and fitting tightly around a portion of the cannula; a second section of the bore telescoped with a second portion of the cannula, said second section of the bore having a larger diameter than the cannula, whereby a space is provided between the cannula and the hub; and an adhesive in said space.

11. A hypodermic needle as set forth in claim 10 wherein the first section of the bore telescopes with the end of the cannula opposite the point and the second section of the bore telescopes with the section of the cannula adjacent said first section.

12. A hypodermic needle as set forth in claim 10 wherein the first section of the bore is in the shape of a long cylinder thus holding the cannula in axial alignment with the hub.

13. A hypodermic needle assembly comprising: a plastic hub having a bore; a cannula having a point and a bore; a portion of said cannula telescoped into one end of said hub and attached therein; a flexible plastic tube having a bore, the diameter of which is substantially the same as the diameter of the cannula bore; and a portion of said tube telescoped into the end of the hub opposite the cannula and attached therein.

14. A hypodermic needle assembly as set forth in claim 13 wherein the bore section of the hub to which the plastic tube is attached tapers progressively inwardly toward the cannula receiving end of the hub.

15. A hypodermic needle assembly as set forth in claim 13 wherein the walls of the hub define an annular boss projecting radially into the bore; the base of the cannula is seated against one side of said boss; the end of the flexible tube is seated against the other side of said boss; and the respective walls of the cannula, boss, and flexible tube define a uniform cylindrical passageway therethrough.


**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 564,581 | Baker | July 28, 1896 |
| 648,858 | Dolge | May 1, 1900 |
| 1,100,799 | Wedig | June 23, 1914 |
| 2,638,897 | Poitras | May 19, 1953 |
| 2,697,438 | Hickey | Dec. 21, 1954 |
| 2,716,982 | Ryan | Sept. 6, 1955 |
| 2,744,528 | Barrett et al. | May 8, 1956 |
| 2,746,455 | Abel | May 22, 1956 |
| 2,764,978 | Everett | Oct. 2, 1956 |
| 2,794,435 | Stevens | June 4, 1957 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 1,064,223 | France | Dec. 23, 1953 |
| 1,098,628 | France | Mar. 9, 1955 |
| 160,527 | Australia | Jan. 12, 1955 |