

[54] **HYPODERMIC ANESTHETIC INJECTION METHOD**

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[57] **ABSTRACT**

[51] Int. Cl.⁴ **A61M 31/00**

[52] U.S. Cl. **604/51; 604/207; 604/154; 433/89**

[58] Field of Search **604/51, 152, 154, 207, 604/228, 20; 433/84-85, 89-90, 119**

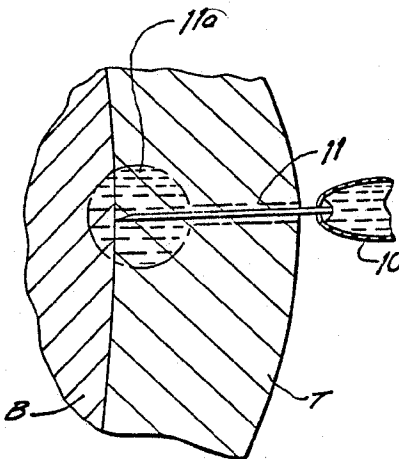
A method and apparatus for effecting painless hypodermic needle administration of liquid anesthetics particularly in dentistry in which the needle is carried on a light wand and the anesthetic is delivered to the needle by motive means independently of the operator's fingers during penetration of the needle, with both the rates of penetration and expression of liquid being controlled to achieve intermediate numbing followed by a high rate of liquid expression, if desired, to achieve full anesthesia of the site.

[56] **References Cited**

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4 Claims, 3 Drawing Sheets



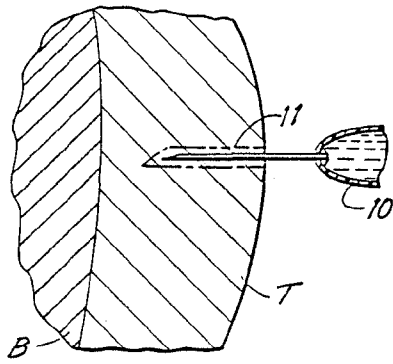


FIG. 1A

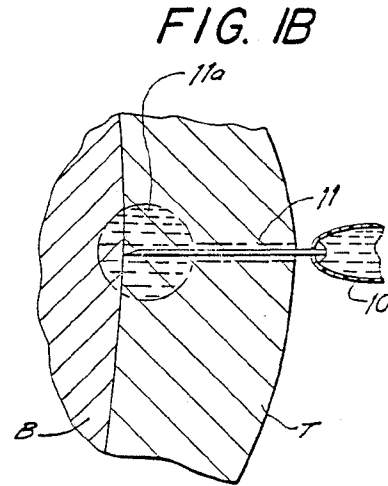


FIG. 1B

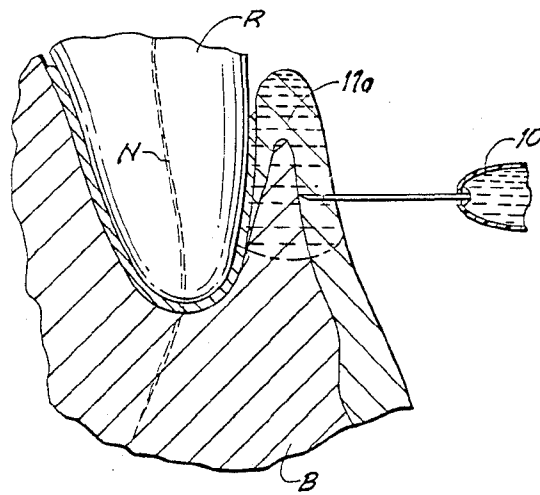


FIG. 2A

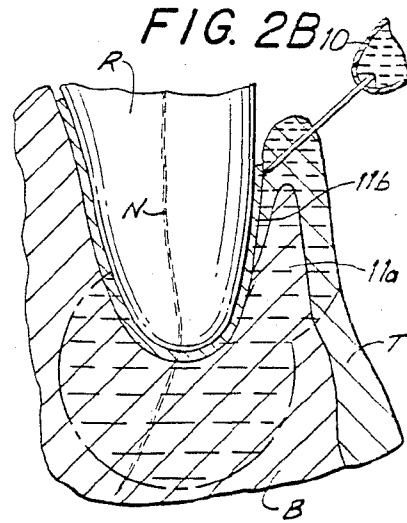


FIG. 2B

FIG. 3

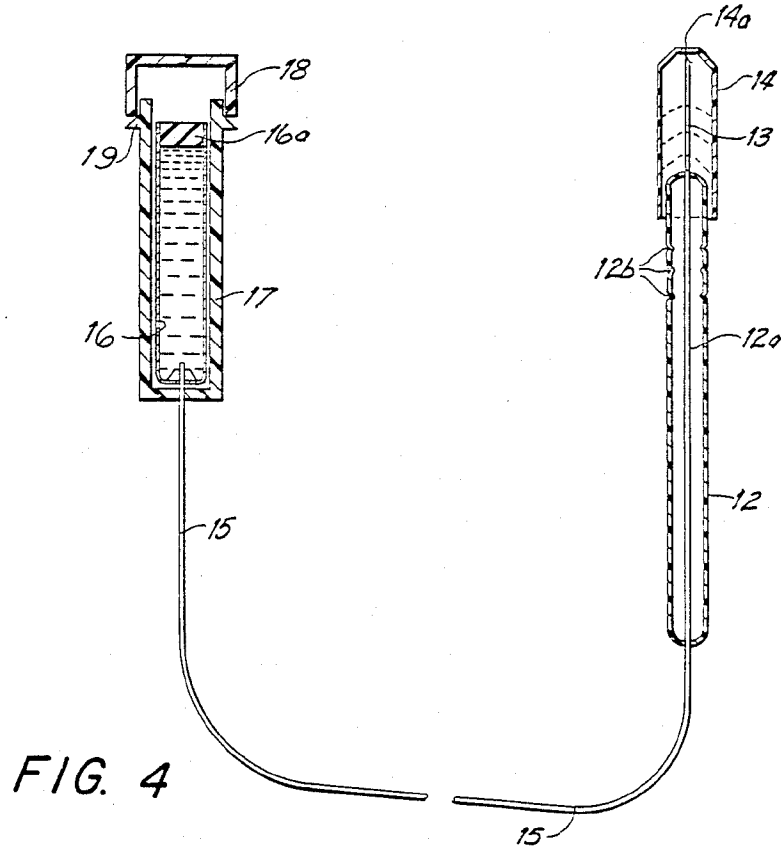
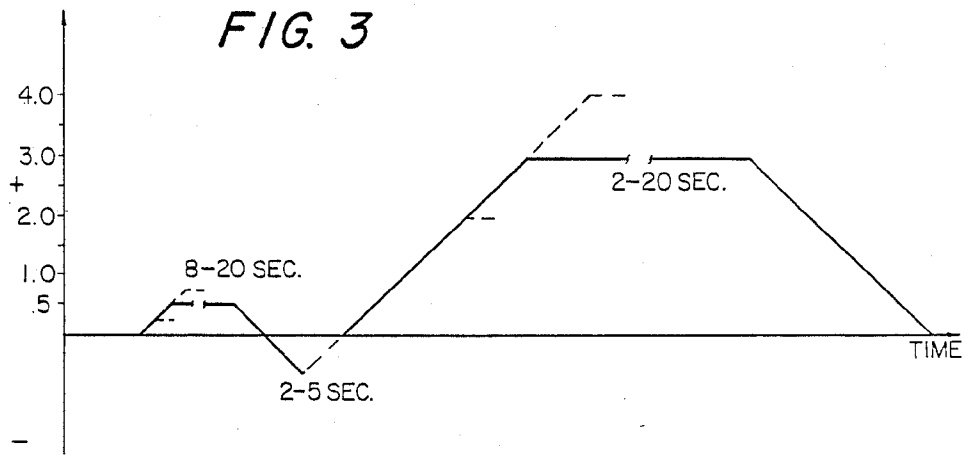


FIG. 4

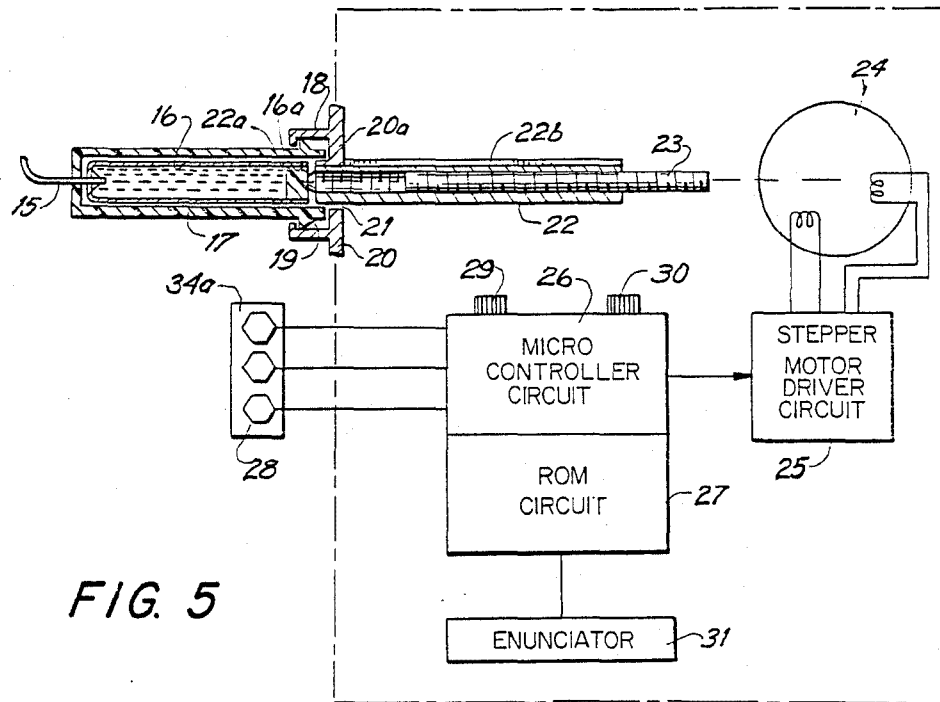


FIG. 5

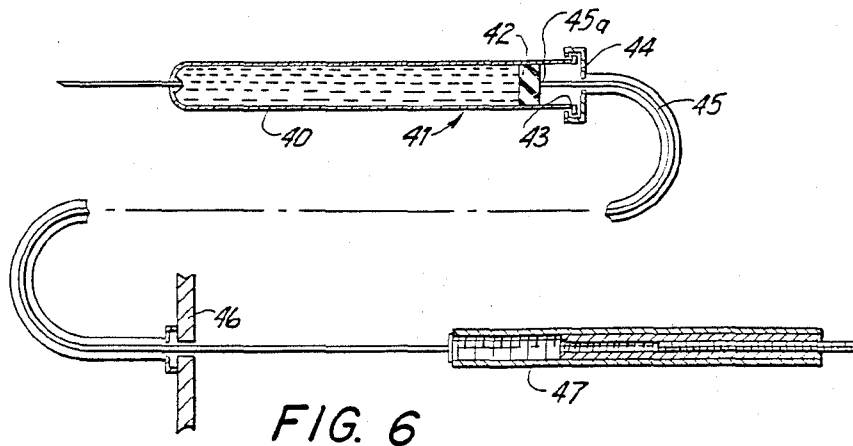


FIG. 6

HYPODERMIC ANESTHETIC INJECTION METHOD

This invention relates to hypodermic anesthetic injection apparatus and methods, particularly as applied to dentistry.

BACKGROUND OF THE INVENTION

Almost 100 years ago the excruciating pain of dental extraction, drilling and reconstruction was eliminated by the invention of local anesthetics. Ever since, however, one smaller but often agonizing pain has remained; ironically, it is the pain of the hypodermic injection itself. All practical attempts to eliminate it have failed. While narrow gauge, sharp hypodermic needles can be inserted into the soft fleshy tissues of say an upper arm essentially without pain save possible psychological pain, the pain of a hollow needle inserted into the hard, relatively inelastic gum and mouth tissues to engage the bone which carries the nerves to the teeth, is more often than not real. It is also complex. Pain can be felt when the needle first punctures the firm tissue and thereafter as the needle tip cuts through the tissue. Pain can be felt if the needle scrapes the bone membrane and even greater pain can be felt if the injected liquid mass distends and tears the tissue, particularly the interior tissue, away from the bone in one of the most sensitive portions of the body, before absorption and numbing occur. And pain can be felt if either the dentist or the patient or both are not steady, causing traumatic lateral displacement of the embedded needle.

The present state of the art in hypodermic anesthetic injections, particularly dental injections, is at best a hit or miss art reflecting the skill and luck of the operator rather than being a scientifically repeatable procedure. The tools are clumsy and ill-suited to their task, making the administration of local anesthetics in dentistry one of the less pleasant procedures for both the dentist and the patient alike.

The present invention has for its object to eliminate pain in all phases of and for all types of hypodermic anesthetic injection including four in dentistry considered most difficult and painful: the palatal, the mandibular, the interligamentary, and the maxillary anterior.

Another object of the invention is to provide a factory-sterilized, assembled and sealed hypodermic syringe sub-assembly of needle, handle and anesthetic vial, fully charged with anesthetic to provide an unbroken chain of sterility from manufacture to patient.

Another object of the invention is to provide a universal hypodermic syringe which can be used for all known dental injection procedures, which is pleasant and easy to use and which affords the dentist extraordinarily acute tactile response characteristics essential to good dentistry.

Another object of the invention is to provide a local anesthetic injection apparatus and method which reduces the amount of anesthetic required to perform dental procedures.

BRIEF DESCRIPTION OF THE INVENTION

Nerves exit from the brain as large bundles or trunks. Much like a tree, the major nerves branch into smaller bundles. This branching continues until finally the nerves become individual fibers and spread in and around the cells of most all tissues in the body. On a microscopic level each nerve fiber is composed of cells

aligned end on end and interconnected at each end by a synapse. When a stimulus is applied to a nerve ending, an electrical impulse or signal is transmitted from nerve cell to nerve cell and regenerated across each synapse, until it reaches the brain, where it is interpreted as pain, cold, hot, etc. When a local anesthetic solution is applied to a nerve, it blocks the signal transmission. The brain therefore receives no sensory information from the part affected by the anesthetic. At the cellular level this effect is immediate. It is believed that it occurs when the anesthetic comes in contact with a nerve part, rendering it instantly inoperative.

It is the object of dental injections to render the nerve bundles which supply the teeth and supporting structures free of pain sensation. These nerve bundles pass from the brain through the jaw bone to the teeth and gums. In instances in which the bone is spongy such as in the upper jaw (maxilla) the anesthetic can be placed at the outside bone surface adjacent to the tooth. The solution is absorbed by the porous bone and infiltrates to the tooth nerve. In other instances where the jaw bone is dense as it is in the lower jaw (mandible), the dentist must either block the nerve before it enters the jaw or he may attempt to force the anesthetic into the ligament space between the tooth root and the bone.

In all cases there is a delay before the anesthetic solution penetrates through the various tissues, and until it disables all of the fibers in the nerve bundle. During the injection procedure the needle point severs through tissues which contain live nerve endings causing pain, the injected anesthetic solution stretches these same tissues causing pain, and if the needle is moved laterally in these same tissues, it causes pain, all before the nerves in the main trunk are blocked.

The present invention provides a means whereby the nerves are disabled in the area of the injection and in the path of the needle before pain sensation is perceived. The needle is held in a stabilized trajectory and advanced slowly at a rate preferably, for example, not to exceed 6 mm/sec. through the tissues, and a flow of anesthetic solution is established concomitantly at a constant slow rate of 0.25 to 1.0 cc. per minute, surrounding the moving needle with a sheathing of anesthetic solution. Since nerve disability is instantaneous, needle penetration cannot be perceived as pain. When the needle reaches bone, if the constant and painless rate of flow of anesthetic is continued, tissue numbness occurs prior to tissue stretching. Once the surrounding tissues have been rendered numb, the rate of flow can be increased to expedite the procedure.

The instrument in accordance with one preferred embodiment of the invention, includes a low-inertia needle and elongated handle assembly either connected by a flexible conduit to an anesthetic vial, or itself containing an anesthetic vial, all of which can be pre-sterilized and disposable; stabilizing means for referencing needle movement and position to the site; and an activator or pump to expel extremely small volumes of anesthetic at a controlled rate, from the vial to the needle tip and, selectively, relatively larger volumes at high flow rates.

The needle assembly can comprise a narrow pencil-grip handle to allow the thumb and forefinger of the operator to implant the needle delicately to sense the essential proximity to bone while the other fingers stabilize the needle assembly against a fixed reference such as the teeth. In the case of the mandibular injection which is deep in the sides of the mouth at the ascending

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