A hypodermic needle for connection with a hypodermic syringe attachment and which comprises at least two electrode elements, an inner one of which conveys fluid as a conventional hypodermic needle and the two of which combine as a probe having a tip-end stimulation zone when connected with an electrical supply.
COMBINED ELECTRODE AND HYPODERMIC SYRINGE NEEDLE

BACKGROUND OF THE INVENTION

This invention relates to a hypodermic syringe needle which embodies an electrode (or electrodes) for applying electrical stimulus to a patient. The needle/electrode in accordance with the present invention (as hereinafter defined) is adapted to be employed in conjunction with an electrical locator/stimulator, such as that disclosed in the Applicant's co-pending U.S. Patent application No. 47786/68, and with a hypodermic syringe attachment.

Thus, the present invention has its applications in surgical work where, inter alia, it is required that a surgeon (or anaesthetist) locate the position of a sensory or motor nerve, which is disposed beneath the skin and tissue of a patient and that the nerve be identified (by the application of electrical stimulus) and, thereafter, be treated by the injection of a selected medicament.

Hereinafter, the steps of locating and identifying a particular nerve or tissue and, thereafter, of treating that nerve or tissue by injection have been performed as separate and independent functions.

SUMMARY OF THE INVENTION

The present invention however obviates such prior art techniques by providing a hypodermic needle consisting of at least two electrode elements which are separately connectable to an electrical supply, an inner one of said electrodes comprising a hollow tubular electrode which is connectable with a hypodermic syringe attachment and the outer one of said electrodes being a hollow tubular electrode which is electrically insulated from said inner electrode. Further, separate electrodes may be located within the insulated space between the inner and outer electrodes and be separately connectable to, for example, electrical sensory-recording apparatus.

A needle in accordance with one embodiment of the present invention consists of two coaxial electrodes, each being of stainless steel cylindrical tubing, and an inner one of which has a hub portion at its upper end for connection in the normal manner to a hypodermic syringe attachment. Thus, the inner electrode has the appearance of a more or less conventional hypodermic needle.

The outer electrode is spaced coaxially from the inner electrode and is permanently separated therefrom along its full length by a suitable insulating material. The outer electrode is also formed with a hub portion at its upper end.

The hub portions of the inner and outer electrodes are adapted to be separately connected through flexible leads with an electrical supply such as an electronic nerve locator/stimulator. The lower end of both the electrodes terminates in a common bevelled plane (which constitutes the "tip" of the needle) and the area defined by the inner and outer electrodes at this "tip" constitutes a stimulation zone. A portion of the length of the outer electrode, intermediate to its hub and lower end, may be encapsulated in a molded sleeve of sterilizable thermosetting plastic material, whereby the needle may be conveniently held by an anaesthetist during manipulation and fitting of the syringe attachment. Such sleeve may extend to and partially encapsulate the hub portion of the needle and be apertured to define terminal socket portions for electrical connectors to the hubs. The outer electrode, or the exposed lower end thereof, may be coated with a material having a low coefficient of friction, such as polytetrafluoroethylene (PTFE).

In use, the needle is connected with an electronic locator/stimulator and inserted into a patient, and, by adopting well known techniques, precise location and identification of a sensory nerve or motor nerve may be achieved. Having located and identified a particular nerve, a hypodermic syringe is attached to the needle (while the needle remains in the patient) and a medicament injected as required. Alternatively, location and identification of a particular nerve may be performed with the syringe preattached to the needle.

More specifically, the needle, when connected (through flexible leads) with the locator/stimulator device described in the above referenced co-pending application, is inserted into the patient to approximately half the anticipated depth of the nerve to be located from the surface. Thereafter, the output potential of the locator/stimulator is adjusted to approximately 10 volts, and the needle is advanced closer to the anticipated position of the nerve. A single pulse output from the locator/stimulator is then utilized to test for response to stimulation.

Upon a response being produced in the patient, the voltage is then reduced below that point where no further response is demonstrated. The needle/electrode is then re-advanced and further tests are made for response to single pulse stimulation. This procedure is repeated until such time as a response can be evoked with a voltage pulse of approximately 1 volt amplitude. At this point, the stimulating tip of the needle should be very close to the nerve to be, for example, blocked.

When the nerve has been located with adequate precision, a local anesthetic is injected through the needle/electrode (which has until this point been employed purely as a probe) until response to stimulation is no longer demonstrated.

The needle/electrode is retained in position while further stimulation and physical examination is employed to confirm that a satisfactory nerve block has been achieved. In the presence of a satisfactory block, motor response to stimulation usually can be demonstrated by applying a potential of approximately 10 volts to the located nerve.

The needle/electrode above defined has obvious advantages in assisting in the reduction of the dosage of local anesthetic or other chemical agents, thus minimizing the risks of drug reaction. Further advantages lie in being able to block nerves which are difficult to locate, particularly deep nerves or those subject to wide anatomical variation, and in blocking specific nerve branches or fiber groups without impairing adjacent fibers.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood from the following description of preferred embodiments thereof taken in conjunction with the accompanying drawings wherein,
FIG. 1 represents an exploded assembly elevation view of needle/electrode, hypodermic syringe and electrical connectors for the needle/electrode.

FIG. 2 is a magnified view of the encircled end of the needle/electrode of FIG. 1.

FIG. 2A is a view, similar to that of FIG. 2, showing a modified form of the needle/electrode, FIG. 3 is an enlarged elevation view, partly in section, of the needle/electrode of FIG. 1.

FIG. 4 is a section of the needle/electrode taken along plane 4-4 of FIG. 3, and

FIG. 5 is an enlarged elevation view, partly in section, of a modified form of the needle/electrode.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIG. 1, there is shown a needle/electrode denoted generally 10 which is adapted to be secured in a conventional manner, by way of a Luer fitting, to lower end 11 of a dispensing means, such as a hypodermic syringe attachment 12. The needle/electrode 10 comprises two electrodes, as hereinafter described, and U-shaped electrical connector clips 13 are connectable to the respective electrodes.

The connector clips 13 are, in turn, electrically connectable through a two-core flex 14 with output terminals 15 of a locator/stimulator apparatus 16.

The needle/electrode 10 does, as abovementioned, consist of two coaxial electrodes 17 and 18 with each being formed of stainless steel.

The inner electrode 17 has a hub portion 19 (i.e., a Luer fitting) at its upper end for connection to the syringe attachment 12 and a lower needle portion 20 having a smooth lumen 21. That is, the inner electrode 17 has the appearance of a conventional hypodermic needle.

The outer electrode 18 is spaced co-axially from the inner electrode 17 and the two electrodes are separated by a suitable insulating material 22. The suitability of the insulating material 22 is dependent upon its insulating properties over the low voltages employed and upon its ability to withstand sterilization temperatures or sterilizing chemicals. One material found suitable for the purpose is an epoxy resin.

The outer electrode is also formed with a hub portion 24 at its upper end which, as illustrated in FIGS. 1 and 3, is similar to the hub portion 19 of the inner electrode, and it has a lower needle portion 25 having a smooth outer surface. Thus the outer electrode 18 has also the appearance of a conventional hypodermic needle.

A permanent connection is made between the hub portions 19 and 24 of the respective electrodes by an epoxy resin or a thermosetting plastic material.

The needle portions 20 and 25 of the electrodes 17 and 18 terminate in a common bevelled plane, which constitutes the tip 26 of the needle, and the area defined by the inner and outer electrodes at the tip constitutes a stimulation zone.

As illustrated in part in FIG. 2A, additional fine wire electrodes 27 may be located in the space between the inner and outer electrodes 17 and 18. Such electrodes 27 may be separately electrically connectable, at a point (not shown) between the hub portions 19 and 24 of the inner and outer electrodes, to electrical sensory-recording apparatus (also not shown) by way of a multi-core flex.

Referring now to FIG. 5 wherein the same reference numerals are employed to identify the like parts of the preceding figures, there is illustrated a needle/electrode which is in part encapsulated in a molded sleeve 28 of a sterilizable thermosetting plastic material. The sleeve 28 extends over a major portion of the hub portions 19 and 24 of the two electrodes and for approximately half the length of the outer needle 25.

Terminal apertures 29 are molded in the sleeve in alignment with contact sockets 30 in the respective hubs for reception of resilient contact pins (not shown).

With this arrangement the needle/electrode may be conveniently handled as a probe prior to fitting of the syringe attachment 12.

Variations and modifications may be made in the embodiments above described without departing from the scope of the appended claims.

What is claimed is:

1. A hypodermic needle comprising two hollow tubular electrodes, one electrode being disposed within the other, means electrically insulating the outer electrode from the inner electrode, means disposed on one of the electrodes for attachment to a dispensing means, electrically conducting means on each electrode for connection to a power supply, and each electrode having a lower tip end, the tip ends of said electrodes terminating in a common plane.

2. The hypodermic needle as claimed in claim 1 wherein said inner and outer electrodes are coaxial.

3. The hypodermic needle as claimed in claim 1 including at least one further electrode located within the insulating means between the inner and outer electrodes, and means electrically connecting the further electrode with an external apparatus.

4. The hypodermic needle as claimed in claim 3 wherein said further electrode comprises a fine wire electrode.

5. The hypodermic needle as claimed in claim 1 wherein the lower tip end of both the inner and outer electrodes terminates in a bevelled plane, with the inner and outer electrodes in said plane defining an intermediate stimulation zone.

6. The hypodermic needle as claimed in claim 1 wherein the inner and outer electrodes both terminate in upper respective hub portions, with the hub portion of the inner electrode fitting within that of the outer electrode.

7. The hypodermic needle as claimed in claim 1 including a molded sleeve of insulating material covering the needle over a portion of its length.

8. A hypodermic needle comprising two hollow tubular electrodes, one of said electrodes being disposed within the other electrode in coaxial relationship, means electrically insulating the outer electrode from the inner electrode, said inner electrode having an upper hub portion, means for attaching the upper hub portion to a dispensing means, electrical conductor means on each electrode for connection to a power supply, each electrode having a lower tip end, and the lower tip ends of said electrodes terminating in a common plane.

* * * * *
Disclaimer


Hereby enters this disclaimer to all claims of said patent.