

[54] **MUSCLE BIOPSY NEEDLE**
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[*] Notice: The portion of the term of this patent subsequent to Jan. 2, 1991, has been disclaimed.

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 330,184, Feb. 7, 1973, abandoned.
[52] **U.S. Cl.**..... **128/2 B; 128/310; 128/347**
[51] **Int. Cl.²**..... **A61B 10/00**
[58] **Field of Search**..... **128/2 B, 2 R, 310, 305, 128/347**

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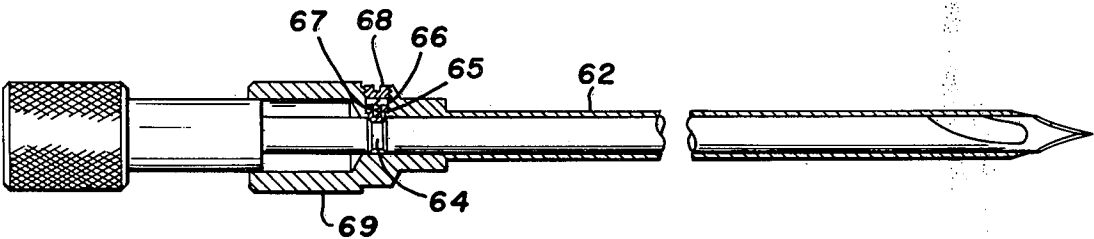
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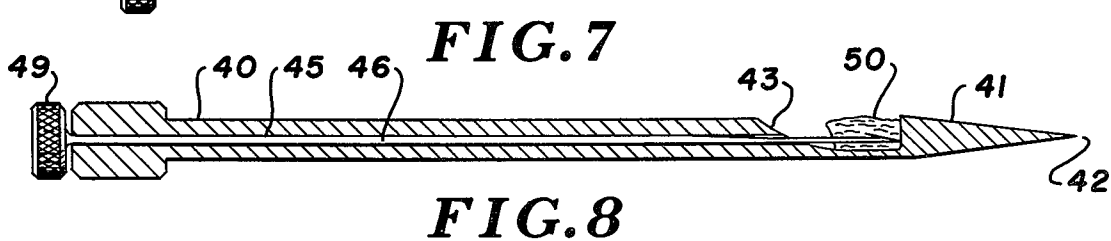
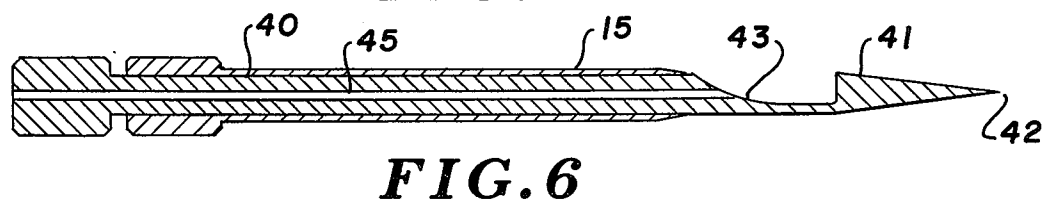
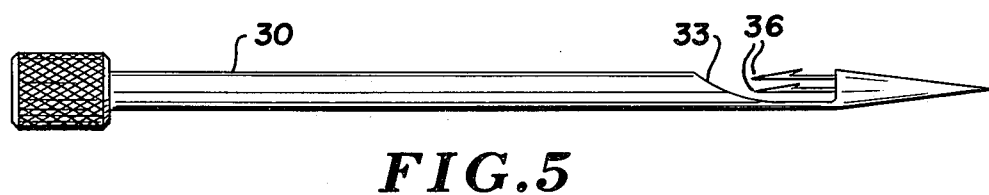
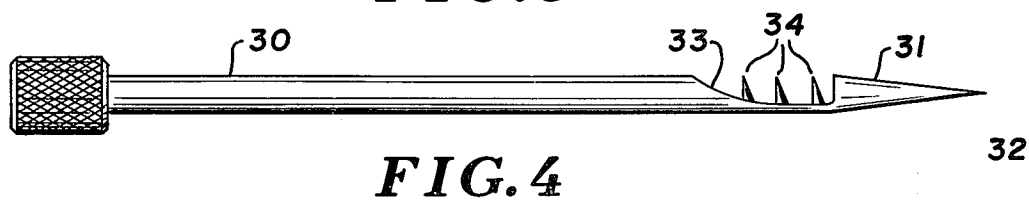
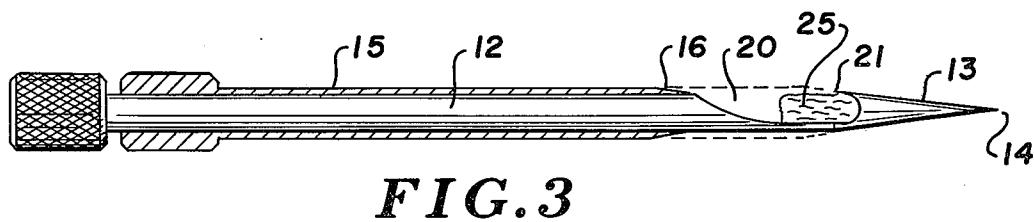
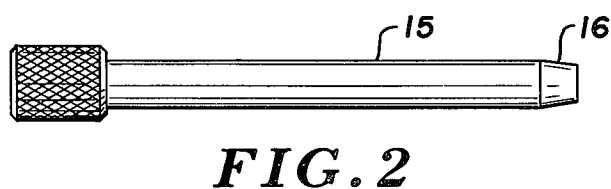
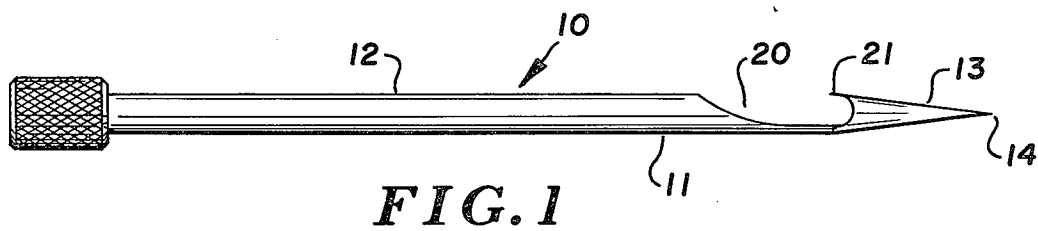
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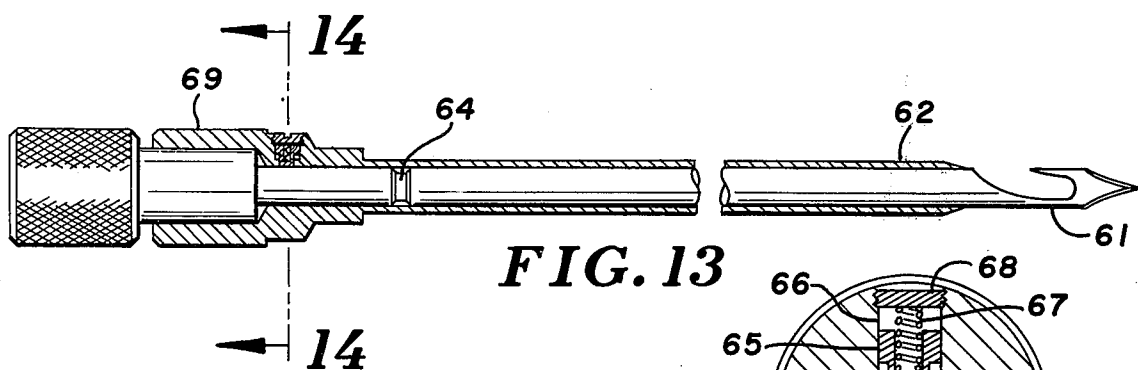
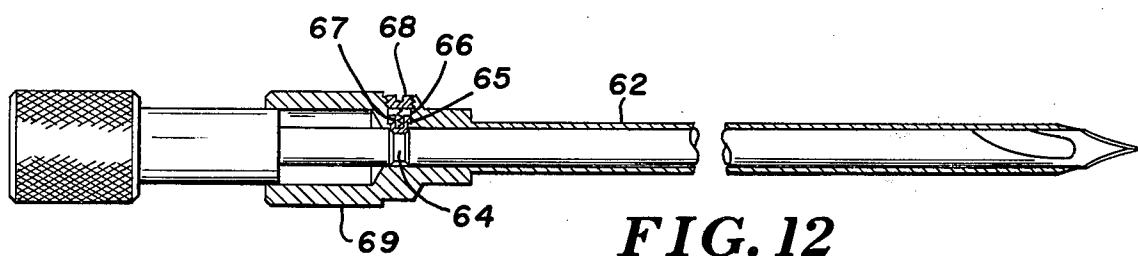
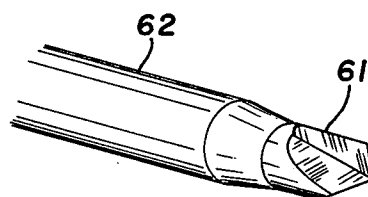
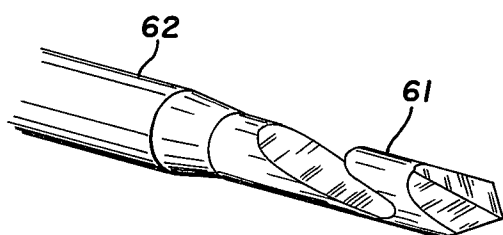
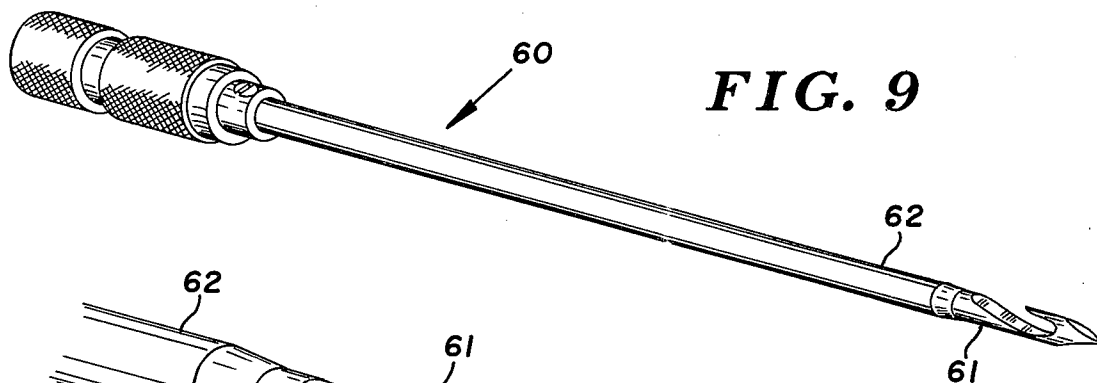
[57] **ABSTRACT**

Means for obtaining muscle tissue specimens from a body and comprising a generally cylindrical shaft having a tapered and pointed distal puncturing and cutting tip, and with coaxially disposed sheath means having a sharpened forward cutting edge slidably enveloping the shaft. A sample receiving cavity is formed in the shaft and is provided with a generally sharpened hook in the forward portion of the cavity. The hook has a point directed toward the proximate end of the shaft and comprises an overhanging barb forming a portion of the sample retaining cavity. The sheath is slidable over the shaft between retracted and extended dispositions, with the forward edges of the sheath enclosing the barb when the sheath is in its forward predetermined disposition, and with the sharpened tip of the barb being exposed when the sheath is in retracted disposition. The forward sharpened cutting edge of the sheath forms a cutting edge which separates that portion of the sample retained within the sample receiving cavity from the bulk of the tissue, with the separation being in the form of a clean extraction cut. For removal of the sample, simple retraction of the device is possible.

4 Claims, 14 Drawing Figures







MUSCLE BIOPSY NEEDLE

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a continuation-in-part of co-pending application Ser. No. 330,184, filed Feb. 7, 1973 and entitled "MUSCLE BIOPSY NEEDLE", now abandoned, which application constitutes an improvement over that device disclosed and claimed in co-pending application Ser. No. 265,280, filed June 22, 1972 and entitled "MUSCLE BIOPSY DEVICE", now U.S. Pat. No. 3,800,783.

BACKGROUND OF THE INVENTION

The present invention relates generally to an improved biopsy device, and more particularly to a means for obtaining muscle tissue or other fibrous samples. The biopsy apparatus of the present invention is particularly adapted to obtain such samples without requiring the patient to undergo unusual or extensive surgical procedures, and without the requirement that large openings be established or formed within the body.

In the gathering of biopsy samples for clinical diagnosis, certain characteristics, conditions as well as the nature of the sample can be determined by pathological examination. For such examination to be meaningful for the clinical diagnosis, the biopsy sample material must be obtained in sufficient and adequate quantities and also in undamaged condition.

At the present time, a variety of specific biopsy instruments are being utilized for obtaining specimens, with certain of these methods and apparatus making use of cylindrical punches having barbed hooks disposed thereon. However, such instruments are normally cumbersome when being utilized for obtaining biopsy specimens from fibrous or muscular tissue, and may suffer the disadvantage of either damaging the sample or of obtaining extremely minute quantities for pathological examination. Accordingly, it is deemed desirable to utilize a device which reduces the complexity of the procedure for the patient as well as the operator, thereby reducing the incidents of complications resulting therefrom, and also to utilize apparatus which neither damages nor destroys the specimen when being obtained.

SUMMARY OF THE INVENTION

Briefly, in accordance with the present invention, a biopsy means is provided for obtaining fibrous or muscle tissue specimens from a body, the means comprising a cylindrical shaft having a tapered pointed distal puncturing and cutting tip. A sample retaining cavity is formed in the shaft and is arranged with an overhanging forwardly disposed obliquely formed barb providing a generally sharpened hook forwardly of the cavity. The hook is spaced from the tip and remote from the tapered point of the blade, the hook forming an overhanging barb enclosing a portion of the sample retaining cavity. A hollow sheath is arranged to slidably envelope the shaft and the sheath is provided with a tapered forward cutting edge in continuation with the taper formed on the shaft, to thereby form an extension of the pointed puncturing and cutting tip. The sheath is slidably over the shaft between predetermined retracted and extended dispositions, with the forward edges of the sheath enclosing the entire axial extent of the barb when the sheath is in predetermined forward or extended disposition and with the sharpened in-

wardly directed tip of the barb being exposed when the sheath is in retracted disposition.

Thus, the sheath is disposed so as to cover the sample receiving cavity and the hook means and to provide a controllable cutting means while being moved forwardly from open to closed dispositions. The device is utilized to puncture the body with its forward sharpened tip with a stabbing push while the sheath encloses the barbed portion, and when the pertinent area or zone to be examined is reached, the sheath is withdrawn, while the blade is advanced so as to engage fibrous tissue or muscular tissue within the hook or barb zone. When the tissue has been gathered, the sheath is then moved forwardly preferably with radial twisting or otherwise advanced over the area being covered by the blade until the predetermined forward point is reached so as to sever the gathered tissue and capture it within the specimen retaining cavity zone adjacent the barb or hook. The apparatus with its smooth outer contour is then withdrawn and the biopsy specimen utilized for its intended purpose of examination for diagnostic purposes.

Therefore, it is a primary object of the present invention to provide an improved biopsy gathering device, particularly adapted to gather fibrous or muscular tissue without requiring unusual or difficult surgical procedures.

It is still a further object of the present invention to provide an improved device for obtaining biopsy specimens which device obtains specimens with minimal discomfort for the patient, and with a resulting minimal degree of damage or exposure to damage for the gathered specimen.

It is yet a further object of the present invention to provide an improved device for obtaining biopsy specimens which reduces the complexity of the procedures for the operator, and thereby reduces the extent of complications resulting therefrom.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims, and accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view of the biopsy device of the present invention, and illustrating the cylindrical shaft with the sleeve portion being removed therefrom;

FIG. 2 is a side elevational view of the sleeve portion which cooperates with the portion of the device illustrated in FIG. 1;

FIG. 3 is a side elevational view illustrating the cylindrical shaft of FIG. 1 having the sleeve element of FIG. 2 disposed thereover, and illustrating, in phantom, the disposition of the forward portion of the sheath when in extended disposition over the shaft portion;

FIG. 4 is a view similar to FIG. 1, and illustrating the disposition of gripping hooks formed within the sample retaining cavity;

FIG. 5 is a view similar to FIG. 4, and illustrating a second form of gripping hook which may be utilized to immobilize or otherwise firmly grip specimens within the sample receiving cavity;

FIG. 6 is a sectional view taken through the diameter of a cylindrical shaft similar to that device illustrated in FIG. 1, with a through-bore being formed therein to receive a sample retaining hook element, such as that illustrated in FIG. 7;

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FIG. 7 is a side elevational view of a sample gathering hook which is utilized in combination with the device illustrated in FIG. 6;

FIG. 8 is a vertical sectional view taken through the diameter of the shaft of FIG. 6, and illustrating the sample gathering hook of FIG. 7 in place within the cylindrical shaft device of FIG. 6, and further illustrating a sample being retained within the sample receiving cavity, it being noted that the sheath means is shown removed from the device of FIG. 8;

FIG. 9 is a perspective view of a biopsy device of the present invention, which includes a predetermined stop element disposed along the length of the cylindrical shaft, FIG. 9 illustrating the cylindrical shaft with the sleeve portion in retracted disposition thereover;

FIG. 10 is a detail perspective view on a slightly enlarged scale, of the tip portion only of the device in the disposition illustrated in FIG. 9;

FIG. 11 is a view similar to FIG. 10, but showing the sleeve portion in its forwardly extended disposition;

FIG. 12 is a sectional view taken through the diameter of the modification illustrated in FIG. 9, and illustrating the sleeve in predetermined forward disposition;

FIG. 13 is a view similar to FIG. 12 and illustrating the sleeve in retracted disposition; and

FIG. 14 is a vertical sectional view taken along the line and in the direction of the arrows 14—14 of FIG. 13.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In accordance with the preferred modification of the present invention, and with particular attention being directed to FIGS. 1, 2, and 3, the biopsy means generally designated 10 comprises a cylindrical shaft portion or element 11, the shaft having a shank portion 12 along with a tapered pointed distal puncturing and cutting tip 13, terminating in a point 14. A hollow sheath means 15 is arranged to slidably envelope the shaft 11 and provides a hollow shaft receiving sleeve for the shaft 11. The tip end or edge of the forward surface of the sheath is tapered as at 16 to form a cutting edge, with this taper being generally in continuation with the taper formed on the blade to form an extension of the pointed puncturing and cutting tip area 13. It will be appreciated that the taper formed on the tip 13 of shank 12 may be either cylindrical in form, or may comprise a bevel-like end which in effect slices across the diameter of the shaft to form a sharpened, generally semi-cylindrical cutting or puncturing surface.

A slot is formed in the shaft means 11 as at 20, and is arranged obliquely to the central axis of the shaft to form a generally sharpened hook in the shaft at a point spaced from the tip 14. The lateral edges of the upper portion of the blade remaining after the slot has been formed are, of course, tapered so as to form a generally sharpened hook as at 21, with these lateral edges being sharpened so as to form a sharpened cutting edge. The overhanging portion of the hook is, as indicated, spaced from the tip of the blade.

It will be noted, therefore, that the hook 20 has a point 21 which is directed toward the proximate end of the blade and comprises an overhanging barb partially enveloping the sample-retaining cavity 20 with opposed walls.

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The sample retaining cavity is preferably formed in a plane which is disposed substantially parallel to the axis of the shaft to form a hook or barb element. This sharpened tip area and cooperating sample retaining cavity plane has been found to diminish or otherwise reduce the tendency to damage the specimen to be obtained.

In use, therefore, the operator initially places the sheath over the shaft and advances the sheath to cover the sample retaining cavity at the tip portion of the structure, and urges the device forward with a stabbing push. Upon reaching the tissue area to be examined, the operator extends the blade forwardly while retracting the sheath, and urges the shaft forwardly. When the blade has entered the muscle or other fibrous tissue to a desired extent, the sheath is then forced forwardly with relative rotation about the shaft, if desired, and is thereby utilized to cut away or shear the muscle tissue which has become held within the sample retaining cavity of the device, that is, the material retained within the specimen retaining cavity, as is indicated in detail in FIG. 3 as at 25. With the sample thus retained, the device is retracted from the body and the sample then made available for examination for diagnostic purposes.

Attention is now directed to that embodiment of the device illustrated in FIG. 4 of the drawing, wherein there is illustrated a cylindrical shaft element 30 having a sharpened tip portion as at 31 terminating in a pointed cutting edge 32, and with an intermediate sample retaining cavity 33 being formed along the shaft 30. Sample retaining cavity 33 is provided with a plurality of upstanding sample engaging hooks or teeth 34—34 which have sharpened tip portions adapted to capture the tissue and retain it conveniently within the sample retaining cavity. In this embodiment, a sleeve similar to that sleeve element 15 illustrated in FIG. 2 will be employed, with the manner of employment being similar to that illustrated in FIG. 3.

Attention is now directed to FIG. 5 of the drawings wherein a still further modification is illustrated wherein the shaft 30 is provided with axially extending inwardly directed hooks 36—36 which are arranged to engage tissue coming within the confines of sample retaining cavity 33. The function, structure and use of the device illustrated in FIG. 5 is similar to that described in connection with FIG. 4 hereinabove.

Attention is now directed to FIGS. 6, 7 and 8 wherein still a further embodiment of the apparatus is shown. In this embodiment, the cylindrical shaft 40 is provided having a sharpened forwardly extending tip 41 terminating in point 42. A sample retaining cavity is formed in the shank of the shaft 40 as at 43, with the purpose of this cavity being the same as that illustrated in the embodiments of FIGS. 1—5 inclusive. A central or axial bore is formed within shaft 40 as at 45, with this bore being arranged to receive the sample retaining hook element 46 therewithin. Hook element 46 terminates in a tip 47, having a barb formed therein with a barbed zone being shown at 48. For purposes of controlled disposition of element 46 within shaft 40, a knurled head is provided as illustrated at 49.

In FIG. 8, the element 46 is shown inserted within the bore 45 formed in shaft 40 and biopsy specimen or sample 50 is illustrated as being retained or held within the confines of sample retaining cavity 43. Also, as is apparent in the illustration of FIG. 6, sleeve 15 is received over the circumference of shaft 40 in the man-

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ner as has been illustrated in connection with the structures of FIGS. 1-5 inclusive.

Attention is now directed to the embodiment illustrated in FIGS. 9-14 inclusive wherein the biopsy means generally designated 60 is shown, with this device being generally similar to that shown and described in connection with FIGS. 1-8 inclusive hereinabove. In this embodiment, however, the cylindrical shaft 61 having a sleeve element 62 disposed thereover, is provided with an annular detent slot 64 about the proximate end of the cylindrical shaft. It is the purpose of this annular detent to receive spring-biased plunger 65 therewithin, spring-biased plunger having been disposed within bore 66 formed in sleeve 62, with spring 67 assisting in biasing the plunger 65 downwardly. Set screw 68 is provided to fully capture the assembly.

The axial disposition of the annular slot 64 is predetermined so as to provide a continuous cutting edge from the sharpened tip to the outer circumference of the sleeve 62, and also to enable the surgeon to ascertain when this predetermined position has been reached.

Thus, in operation, the device is placed in its operative disposition as illustrated in FIG. 12, and inserted into the body to the extent necessary to reach the area or zone to be examined. Upon reaching this point, the shaft is continually advanced into the zone, with the sleeve being permitted to become retracted until the disposition is reached as illustrated in FIG. 13. At this point, the surgeon, by grasping the knurled gripping portion 69 of the sleeve, will rotate the sleeve radially while advancing the sleeve portion only forwardly into the body. This motion cuts away the area captured within the barbed zone, with the cut being clean, decisive, and uniform. The integrity of the sample is accordingly preserved. Upon reaching the disposition of FIG. 12, the plunger 65 drops into the slotted area 64, and the entire device is then removed.

The structures of the present invention provide an opportunity to obtain samples of relatively large size because of the broad base of the cylindrical structure. The sharp edges of the sheath are arranged to rotationally cut the fibrous bundle as the device enters the muscle, this being accomplished without causing unusual damage to either the sample or residual tissue. This procedure is also accomplished without unusual or difficult surgical procedures involved.

I claim:

1. Biopsy means for obtaining muscle tissue specimens from a body and comprising:

- a. blade means comprising a generally cylindrical shaft and having a shank portion with an inwardly tapered pointed distal puncturing and cutting tip;
- b. hollow tubular sheath means slidably enveloping said blade means with free axial and arcuate rotational motion of said sheath means relative to said cylindrical shaft and providing a hollow blade re-

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ceiving sleeve with the circumferential distal tip end of said sheath terminating along a plane normal to the tubular axis and being tapered inwardly at the distal tip end in continuation with the taper formed on said blade and forming an extension of said pointed puncturing and cutting tip;

- c. a sample receiving slot formed in said blade means and forming a sample retaining cavity in said blade at a point spaced from the distal tip thereof and disposed adjacent the surface of said shaft along said shank portion and adjacent said tapered zone;
- d. said sheath being slidable over said blade between retracted and extended dispositions, with the forward edges of said sheath enclosing said sample receiving slot when said blade is in said retracted disposition and with the said sample receiving cavity being exposed when said blade is in said extended disposition; and

e. detent means being formed along said cylindrical shaft, and a mating plunger member is provided along the axial length of said sheath means, the arrangement being such that when said distal tip end of said sheath reaches the proximate end of the taper formed on said blade, said plunger is received within said detent means.

2. The biopsy means as defined in claim 1 being particularly characterized in that said sample receiving slot is arranged obliquely to the central axis of said shaft to form a generally sharpened hook in said blade means at a point spaced from the distal tip thereof, said hook having a point directed toward the proximate end of said blade and comprising an overhanging barb forming an upper wall of a sample retaining cavity within said blade means, the edge portions of said overhanging barb being sharpened to present a cutting edge.

3. The biopsy means as defined in claim 1 being particularly characterized in that sample engaging hook means are provided within the confines of said sample receiving slot.

4. The biopsy means as defined in claim 1 being particularly characterized in that a bore is formed within said cylindrical shaft, and a sample engaging hook means is provided in combination with said biopsy means, said sample engaging hook means being slidably received axially within said bore and with the hook means being disposed within said slot when said hook means is advanced into said slot, with said hook means including a shaft having a gripping handle at one end thereof and a sample engaging hook at the other end thereof, with said shaft having a length greater than the axial distance from the forward end of said sample receiving slot to the proximal end of said cylindrical shaft so as to be sufficient to carry said hook means into the confines of said sample retaining cavity.

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