



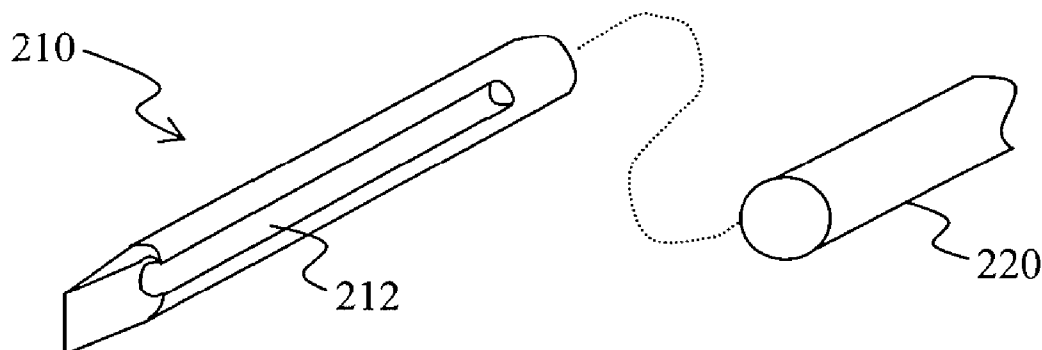
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(19) **United States**(12) **Patent Application Publication**
Wegener et al.(10) **Pub. No.: US 2011/0190661 A1**(43) **Pub. Date: Aug. 4, 2011**(54) **TISSUE SPLITTING BIOPSY NEEDLE****Related U.S. Application Data**(75) Inventors: **Paul T. Wegener**, New York, NY (US); **Ryochi Enishi**, Gunma (JP); **Saverio Bettuzzi**, Montecchio Emilia (IT); **Takeyoshi Sakashita**, Nasushiobara City (JP)

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B26D 7/06 (2006.01)(52) **U.S. Cl.** **600/567**; 83/651; 83/100(57) **ABSTRACT**(21) Appl. No.: **12/738,238**(22) PCT Filed: **Oct. 24, 2008**(86) PCT No.: **PCT/US08/81059**§ 371 (c)(1),
(2), (4) Date: **Sep. 3, 2010**

Tissue splitting biopsy devices and methods use a needle portion and a sheath portion that are configured such as to allow simultaneous sectioning of a tissue to produce two tissue samples with corresponding surfaces using motion of the needle portion relative to the sheath portion. Most preferably, the needle portion has a chisel blade tip and at least two cavities opposite to each other and at the same distance from the tip, while the sheath portion has a sharpened front edge.



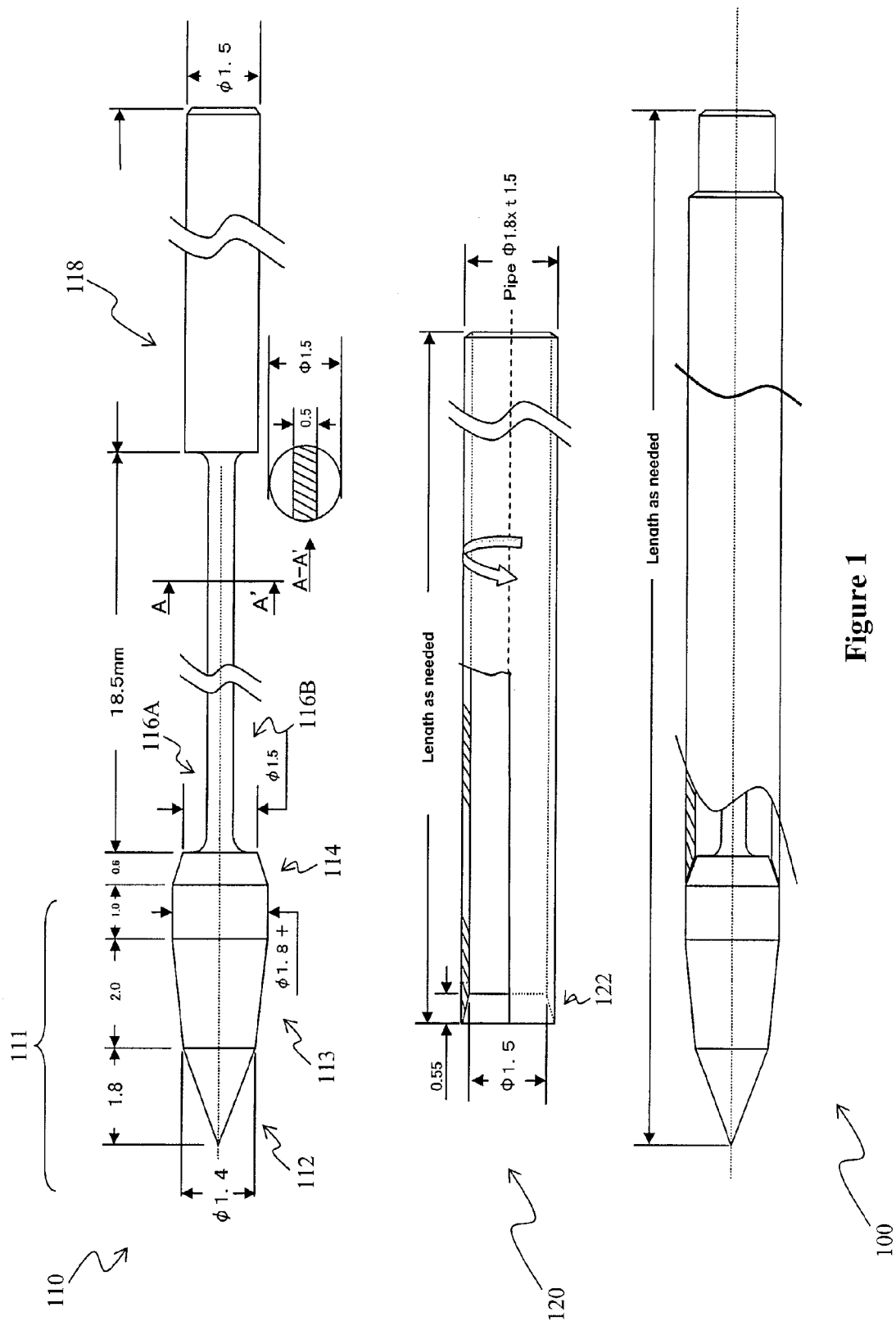


Figure 1

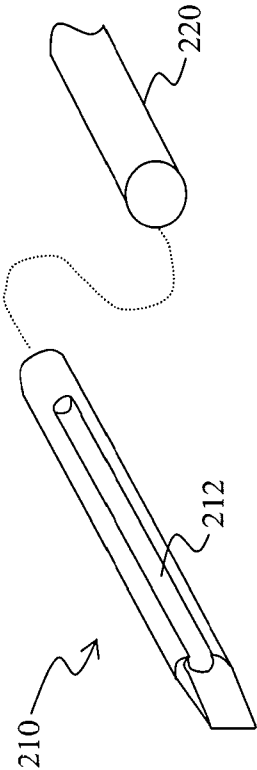


Figure 2

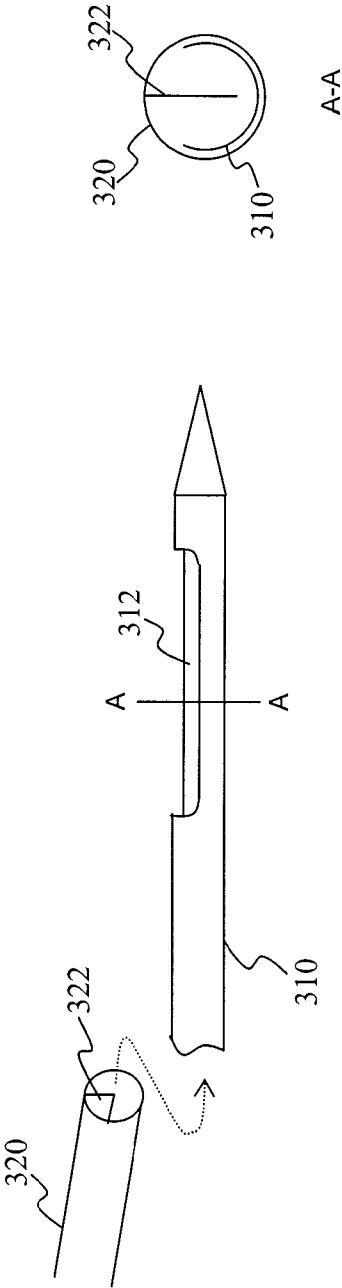


Figure 3

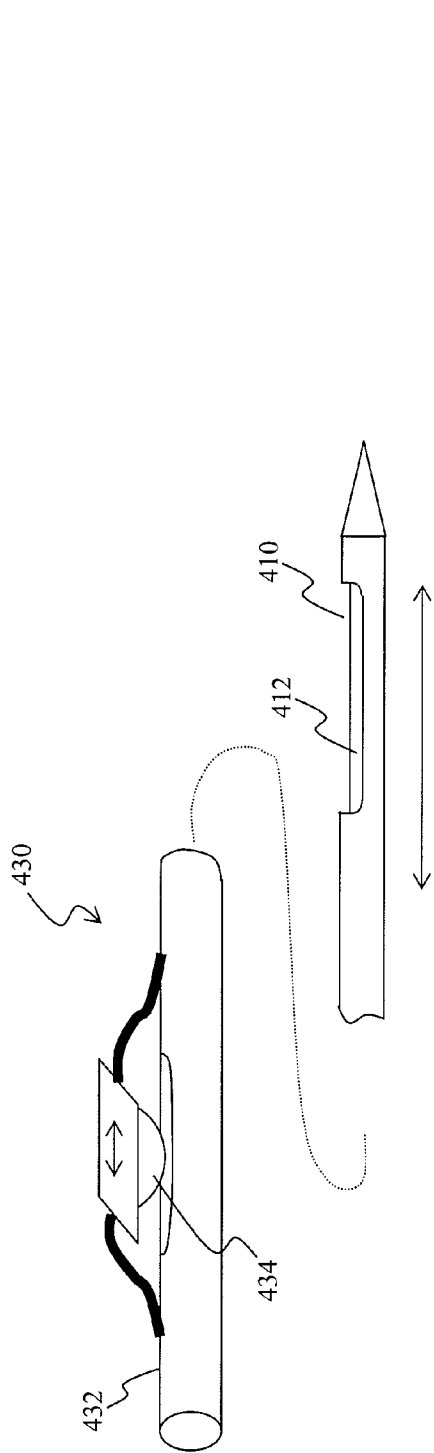


Figure 4

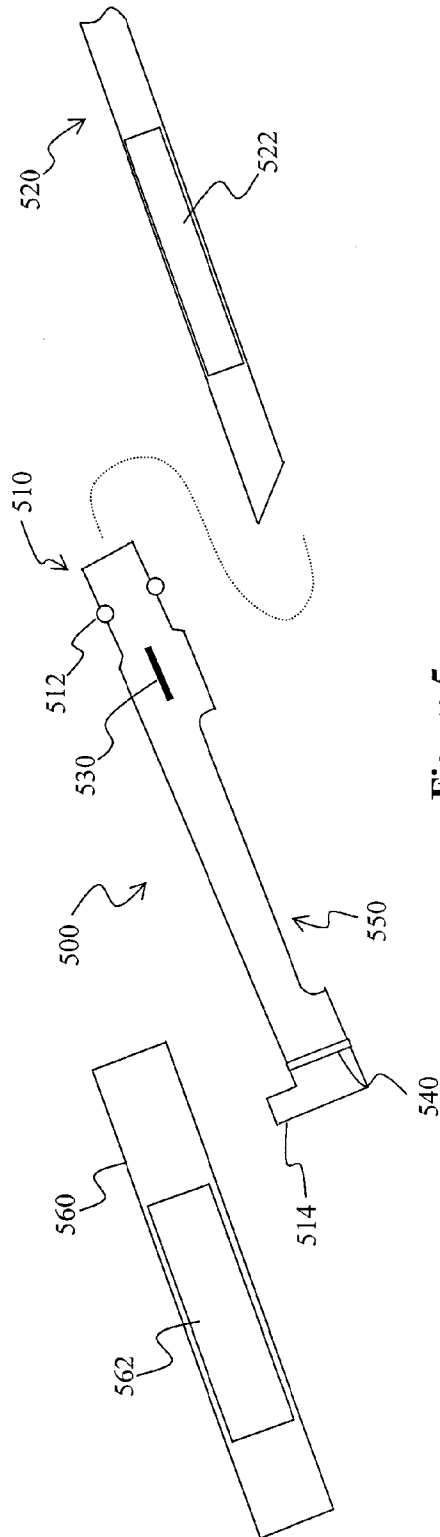


Figure 5

TISSUE SPLITTING BIOPSY NEEDLE

[0001] This application claims priority to our copending U.S. provisional patent application with the Ser. No. 60/982,686, filed Oct. 25, 2007, and which is incorporated by reference herein.

FIELD OF THE INVENTION

[0002] The field of the invention is medical devices, especially as it relates to biopsy needles that produce multiple adjacent tissue samples.

BACKGROUND

[0003] Biopsies are often indispensable tools for accurate diagnosis and/or staging of a disease as blood-based tests typically provide only indirect evidence of tissue status, and current imaging analysis often lacks sufficient resolution and information density.

[0004] Most commonly, a biopsy is performed using a biopsy gun in which one or more needles are advanced into the target tissue, typically under ultrasound or MRI guidance. A typical biopsy needle and gun is described in U.S. Pat. No. 5,971,939. Where desired, sample acquisition and movement may be assisted using vacuum in the needle as illustrated in U.S. Pat. No. 5,027,827. These and all other extrinsic materials discussed herein are incorporated by reference in their entirety. Furthermore, where a definition or use of a term in an incorporated reference is inconsistent or contrary to the definition of that term provided herein, the definition of that term provided herein applies and the definition of that term in the reference does not apply. A core of tissue is then removed along with the biopsy needle, and the core is immersed in a fixative or frozen after removal from the needle.

[0005] The core is subsequently embedded in paraffin and cut, or cryo-sectioned for mounting on a microscope slide prior to staining, nucleic acid analysis, or other analysis. Unfortunately, the processing steps for visual analysis of tissue (e.g., fixation, paraffin embedding, and staining) and molecular biological analysis of tissue (e.g., in-situ PCR, fluorescence in-situ hybridization, etc.) are in many cases incompatible and thus require multiple tissue samples to be taken from the area under investigation.

[0006] Multiple-sample biopsies can be performed in numerous manners using certain devices and methods known in the art. For example, U.S. Pat. No. 5,415,182 describes a biopsy gun in which an array of needles is fired into the suspect tissue. Alternatively, as disclosed in EP 1 545 318 B1, a single biopsy needle has a plurality of separate sample cavities to allow sampling in multiple locations. In still further known devices, multiple radially arranged windows in a cannula in conjunction with an internal cutter are used to generate a plurality of samples in proximal location to each other as taught in U.S. Pat. No. 5,944,673. Alternatively, multiple samples in relative proximity can be obtained using a system in which a cannula has multiple openings and in which a spiral blade is advanced to section the samples from the tissue as described in U.S. Pat. No. 6,530,891. While such devices advantageously allow collection of multiple samples from a single area, various disadvantages nevertheless remain. For example, where a malignancy is relatively small or distributed irregularly across a tissue (e.g., various malignancies in the prostate), the collected samples often fail to be

co-located in the same area of interest. Therefore, the above devices often fail to provide consistent and representative samples.

[0007] The same difficulties exist in still further known devices where multiple biopsies can be taken serially through a single sample window or needle with a flexible retractable tip cover as disclosed in U.S. Pat. No. 6,149,607 and WO2007/021903A2, and U.S. Pat. No. 7,137,956, respectively. While such devices allow collection of multiple samples in multiple areas of interest, samples produced with these devices typically fail to produce tissue of the same area of interest.

[0008] To overcome at least some of the difficulties associated with multiple samples from the same area, certain biopsy devices have been described in which a sample is cut from the tissue of interest via a cannula or needle in which the tissue is further sectioned as the cannula or needle advances. For example, FIG. 6 in U.S. Pat. No. 5,823,971 illustrates a cannula in which a cutting wire is placed across the front cutting edge of a round cannula. In such devices, the tissue core is split in the cannula as the cannula advances and cuts the core from the tissue via rotation. Similarly, U.S. Pat. App. No. 2008/0114265 teaches an open-ended needle tip that cuts a cylinder of tissue as the needle advances through the tissue. An internal separator structure then splits the cylinder and maintains the split products in separate cavities from which they can be removed by removing an outer cover sheath that covers the cavities when the needle is inserted into the area of interest. While such devices and methods at least conceptually produce two samples from the same location, numerous difficulties nevertheless remain. Most significantly, as the tissue is forced through the lumen of the cannula or needle, tissue distortion due to friction along the inside of the cannula or needle, and/or compression due to the added volume of the blade/separator structure will occur and lead to loss of tissue and tissue integrity, which is particularly pronounced in the device of the '265 application as the inner lumen is significantly smaller than the cutting tip lumen.

[0009] In an attempt to avoid such drawbacks, a biopsy core can be split after removal from the needle in longitudinal direction before processing. However, such post-harvest splitting requires considerable expertise and equipment typically not available in the clinic at which the biopsy is taken. Moreover, even where great care is taken to split the biopsy core equally, consistent splitting is rarely achieved throughout the entire length of the core.

[0010] Therefore, while numerous devices and methods for biopsies are known in the art, all or almost all of them suffer from one or more disadvantages. Most significantly, correlation of the corresponding areas is typically not possible as non-adjacent surfaces are generally obtained in such devices and methods. Consequently, there is still a need to provide improved devices and methods for biopsies.

SUMMARY OF THE INVENTION

[0011] The inventive subject matter is drawn to various devices and methods to produce biopsy samples having corresponding surfaces in a manner that helps preserve tissue integrity and that allows for manual or automated sampling. In most preferred aspects of the inventive subject matter, a biopsy device has a needle portion that upon movement of the needle portion through the tissue incises the tissue to so produce or initiate formation of corresponding tissue surfaces, which are then received in respective cavities in the

needle portion. A sheath portion having a sharpened front end then severs tissue samples carrying the corresponding surfaces from the tissue by moving along the needle portion (in sliding and/or rotating motion) to so secure the samples in the device for retrieval.

[0012] In one especially preferred aspect, a biopsy device includes a needle portion and a sheath portion, wherein the needle portion has a closed incising tip and further has two cavities on opposite sides positioned such that at least part of each cavity has the same distance from the tip, and wherein the sheath portion has a sharpened front edge that allows sectioning of respective tissue that is at least partially disposed in the two cavities.

[0013] Most typically, the closed incising tip is configured as a chisel blade, and/or has an incising proximal end and a distal end in which the distal end is thinner than a portion of the tip between the proximal end and the distal end. Where desired, the tip may comprise a slit in longitudinal direction to accommodate at least part of a blade. It is further generally preferred that at least 70% of the longitudinal dimension of the two cavities have the same distance from the tip. Furthermore, it should be appreciated that while the two cavities are generally separate cavities, the cavities may also form a contiguous opening through the needle portion. Additionally, the needle portion may be configured to allow application of a partial vacuum to at least one of the cavities. With respect to the sharpened edge of the sheath portion it is generally preferred that the edge has an inside chamfer. In such configurations, it is particularly preferred that the inside chamfer will matingly engage with the thinner (typically angled) distal end.

[0014] In another especially preferred aspect, a biopsy device comprises a needle portion and a sheath portion that are configured and positioned relative to each other to allow simultaneous sectioning of a tissue to produce two tissue samples with corresponding surfaces using a motion of the needle portion relative to the sheath portion.

[0015] Most preferably, the needle portion in such devices comprises a closed incising tip that is configured as a chisel blade, and/or further includes two cavities on opposite sides of the needle portion that are positioned such that at least part of each cavity has the same distance from the tip. It is still further preferred that where the needle portion has a cavity and where the sheath portion includes a blade, the sheath portion and the needle portion are configured such that the blade can move along a longitudinal axis of the cavity as the sheath portion is moved relative to the needle portion.

[0016] Therefore, and viewed from a different perspective a method of facilitating or performing a biopsy will include a step of providing a biopsy device that includes a needle portion and a sheath portion, wherein the needle portion and the sheath portion are configured to allow simultaneous sectioning of a tissue to produce two tissue samples with corresponding surfaces using motion of the needle portion relative to the sheath portion. In a further step, a user is advised to advance the biopsy device to a target area and to move the needle portion in the target area relative to the sheath portion to so produce the two tissue samples.

[0017] In especially preferred methods, the needle portion has a closed incising tip that is configured as a chisel blade, and/or includes at least two cavities on opposite sides of the needle portion that are positioned such that at least part of two cavities have the same distance from the tip. It is further preferred that the needle portion is configured to allow appli-

cation of a partial vacuum to at least one cavity in the needle portion, and/or that the sheath portion is moved in a rotational and a transverse movement. In further contemplated aspects, movement of the needle portion relative to the sheath portion is driven by an automated mechanism that is coupled to the needle portion and the sheath portion.

[0018] Various objects, features, aspects and advantages of the inventive subject matter will become more apparent from the following detailed description of preferred embodiments, along with the accompanying drawings in which like numerals represent like components.

BRIEF DESCRIPTION OF THE DRAWING

[0019] FIG. 1 is a schematic illustration of one exemplary biopsy device according to the inventive subject matter.

[0020] FIG. 2 is a schematic illustration of another exemplary biopsy device according to the inventive subject matter.

[0021] FIG. 3 is a schematic illustration of a further exemplary biopsy device according to the inventive subject matter.

[0022] FIG. 4 is a schematic illustration of a yet another exemplary biopsy device according to the inventive subject matter.

[0023] FIG. 5 is a schematic illustration of an exemplary post-biopsy core splitting device according to the inventive subject matter.

DETAILED DESCRIPTION

[0024] The inventor has discovered that multiple biopsy cores with two or more corresponding tissue surfaces can be taken from the same area of interest without substantial compression or other distortion of the surfaces. Most preferably, contemplated methods and devices split the tissue first with a needle (e.g., via cutting or other physical separation) to thereby produce the corresponding surfaces that are then received in respective sample cavities. Most preferably, the cutting and receiving are performed in separate locations and as the needle travels through the tissue. The samples are then cut from the tissue using a second implement, and most typically a sheath that coaxially moves along the biopsy needle (wherein the movement may be transverse, or transverse and in a rotating manner). Alternatively, or additionally, the sheath may comprise a blade that (further) sections the tissue sample in the cavity or cavities. Thus, it is preferred that the devices according to the inventive subject matter will allow (simultaneous) sectioning of a tissue to produce two tissue samples with corresponding surfaces using a motion of the needle portion relative to the sheath portion. As used herein, the term "corresponding surfaces" refers to surfaces that are generated by cutting or tearing of a tissue. Therefore, corresponding surfaces will represent the same plane of the tissue through which the cut or tear propagated.

[0025] Consequently, it should be appreciated that especially preferred biopsy devices will have at least one needle portion and at least one sheath portion. The needle portion will typically have a closed incising tip and at least two cavities (preferably on opposite sides and positioned such that at least part of each cavity has the same distance from the tip), while the sheath portion will have a sharpened front edge that allows sectioning of respective tissue that is at least partially disposed in the two cavities.

[0026] For example, in one preferred aspect of the inventive subject matter, a biopsy device has a configuration as schematically illustrated in FIG. 1 (here: exemplary dimensions

indicated in millimeters, other dimensions also suitable), where the device **100** includes a needle portion **110** and a sheath portion **120**. Most typically, the needle portion has a tip **111** with an incising proximal end **112** that is preferably formed as a chisel blade and a distal end **114** that preferably has a thinner cross section (e.g., via an angled portion relative to an axis parallel to the longitudinal axis of the needle portion). It is especially preferred that the distal end **114** is shaped such as to accommodate the sharpened end portion **122** of the sheath portion to thereby avoid formation of a transition between the sheath and the needle portion that would allow tissue to be cut by the sharpened end portion as the device is advanced to the target tissue. Most typically, the portion **113** that is located between the distal end and the proximal end of the tip is configured to allow further separation of the tissue incised by the proximal end. Therefore, the portion **113** will typically have an angled section (angle relative to an axis parallel to the longitudinal axis of the needle portion). However, it should be appreciated that a non-angled geometry is also contemplated, including rounded geometries.

[0027] Following the distal end, the needle portion includes at least one, and more typically two sample receiving cavities **116A** and **116B**. It is generally preferred that the needle portion **110** has at least one, and more typically at least two sample receiving cavities, where the two cavities have the same configuration and size, and are located in opposite positions and the same distance relative to the incising proximal end **112**. Such configuration advantageously maximizes the areas of corresponding surfaces in the two or more samples obtained. Moreover, and particularly where the proximal end is configured as a chisel blade, it is preferred that the bases of the sample cavities are in a plane that is substantially parallel (deviation of no more than 20 degrees, and more typically no more than 10 degrees) to a plane drawn through the chisel blade (wherein that plane is also parallel to the longitudinal axis of the needle portion). Following the sample cavities in a direction away from the proximal end **112** is the remaining portion **118** of the needle portion that can extend to a length as required by the particular tissue to be sampled. It should be noted that the specific dimensions and configuration of that remaining portion **118** will predominantly be determined by the overall length of the needle portion and, if needed, type of biopsy gun employed. Therefore, the remaining end may further include one or more implements through which the biopsy device or needle portion may be attached to the biopsy gun (not shown).

[0028] In alternative aspects of the inventive subject matter, it is also contemplated that the incising proximal end **112** may be configured in various other geometries, and especially preferred geometries include point-shaped forms, and tips comprising triangular or tetragonal (and higher) pyramidal shapes to so lead to the formation of three or four (or more) corresponding surfaces. Moreover, while it is generally preferred that the needle portion has an angled intermediate portion **113** that allows for further separation of the tissue after incision or splitting, such intermediate portion may be modified to lack an angled portion to have a curved portion, or may be omitted altogether. Similarly, the distal portion may be omitted or shaped in numerous alternative forms (e.g., curved, flat, stepped, etc.) to provide a corresponding fit or resting place for the sharpened end of the sheath portion, or even include a recess into which at least a portion of the sharpened end of the sheath portion may fit.

[0029] Consequently, it should be appreciated that the needle portion may comprise a single, more typically two, and in some cases three or more sample receiving cavities in the portion following the distal end of the tip. Depending on the particular geometry of the incising tip, the position of the cavities relative to each other may vary considerably. However, it is generally preferred that the bases of the cavities are substantially parallel to the corresponding surfaces of the tissue samples formed by the tip. Thus, the cavities are preferably at opposite sides of the needle or radially arranged. Similarly, it is generally preferred that at least two of the cavities at least partially overlap in their distance from the incising proximal end to so generate samples with corresponding tissue surfaces.

[0030] It is still further contemplated that at least two cavities of the needle portion may form a single larger cavity as exemplarily depicted in FIG. 2. Here, needle portion **210** has a cavity **212** with lateral openings that receive the corresponding surfaces generated by the incising tip. Once the tissue samples are in the respective cavities, the sheath **220** is moved towards the tip and the sharpened front edge will sever the samples from the tissue. In such embodiments (and the embodiments described above), it should be recognized that at least a portion of the needle portion is hollow or comprises a channel through which a partial vacuum (suction) can be applied to at least one of the cavities.

[0031] Sheath portion **120** is preferably formed as a single tube or cylinder which slidably fits over the needle portion and has a length that is sufficient to cover the sample cavities when the sheath portion is moved against the tip **111**. Most typically, the sheath has a sharpened front edge **122** having a chamfered edge. It is generally preferred that the chamfer of the sharpened edge is on the inside of the sheath portion, however, an outside chamfer and a centrally beveled edge is also contemplated. In most preferred aspects, the chamfer is selected such that the sharpened edge matingly abuts the distal portion of the tip. Additionally, the sheath portion may be further configured to allow not only transverse motion along the longitudinal axis of the needle portion, but also rotational movement. To that end, the inner or outer surface of the sheath portion may comprise a rifling, or the sheath portion may be coupled to an implement that cooperates with a biopsy gun to provide a rotating motion to the sheath portion as the sheath portion slides along the needle portion.

[0032] Where desired, the sheath portion may also include one or more blades in the lumen of the sheath as exemplarily depicted in FIG. 3. Here, the sheath **320** has a sharpened front edge as discussed above, however, has an additional blade **322** that is configured to allow vertical section of a tissue sample that is collected in the sample receiving cavity **312** (or cavities). In such configurations, it should be noted that the needle portion will typically have a channel that accommodates movement of the blade for assembly of the biopsy device. Such channel is typically provided in the tip portion, however, other locations are also deemed suitable herein. Alternatively, the tip may be removed (or later formed) for assembly of the device.

[0033] It should be particularly appreciated that contemplated configurations and methods allow harvest of tissue samples with corresponding surfaces without generating tissue compression, drag, and shear, and therefore provide significantly improved samples that can be easily registered and analyzed. Moreover, contemplated devices and methods allow removal of the collected samples at the same time

(rather than serial removal). Still further, as contemplated devices are similar in structure to single sample biopsy devices, contemplated devices can be readily adapted for use in currently known biopsy guns.

[0034] Alternatively, a cutting tool may be removably coupled to the sheath portion (or provided as a separate tool that comprises a sheath portion), wherein the cutting tool includes a blade that sections the tissue after removal from the patient while the tissue is still in the sample cavity of the needle portion. In most preferred aspects, the sheath or tool will have a guiding element (e.g., groove) that assists straight movement of the blade through the tissue. For example, FIG. 4 schematically illustrates a cutting tool **430** with a sheath **432** that has a moveable (small arrow) or insertable blade **434** which sections the sample in a side-cut needle. Alternatively, the blade may also be in a fixed position relative to the sheath portion, and the sheath portion is then moved relative to the needle portion **410** (large arrow). To even further reduce friction forces on the biopsy sample that is still in the sample cavity **412** of the needle portion, a rolling blade may be used.

[0035] In still further alternative aspects, the blade may be located in a position other than the tip portion. For example, the blade may be located in the proximal portion of the needle (relative to a handle or gun), wherein cutting may be performed during the sampling as the needle advances, and/or during core removal through the proximal portion. In still further alternative aspects, and especially where the needle is driven by a spring-loaded mechanism, the blade may also be replaced by one or more thin wires.

[0036] Suitable needles with blades or other cutting implements are preferably formed using a standard needle production process in which the blade is inserted into corresponding preformed cuts or indentations in the lumen of the needle body. Alternatively, modification kits are also contemplated in which a user adds the blade to an existing biopsy needle. Such kits may advantageously comprise a generally cylindrical sheath that is inserted into the existing biopsy needle, wherein the sheath has a blade or wire arrangement at or proximal to the end of the sheath. Alternatively, or additionally, the core may also be removed from a conventional needle by inserting the needle into a sheath that has a blade arrangement as discussed above, wherein the core is typically suctioned out of the needle through the blade.

[0037] FIG. 5 depicts one exemplary embodiment for such device and methods. Here, device **500** is configured to have a portion **510** that sealingly receives an open tip biopsy needle **520** in which a biopsy core **522** is located. Needle stop **512** is further included in portion **510**. The device **500** further preferably includes an opening **530** that is sized and dimensioned to accommodate at least a portion of a blade (not shown) such that the blade can slice the core **522** as the core **522** is sucked through the device toward screen **540**. Opening **550** is preferably configured to allow removal of the split cores, wherein the opening is typically sealed by a sleeve **560** or plug (not shown). Where a sleeve is used, the sleeve may include a window **562** that corresponds to the opening **550** to so allow removal of the split cores. The sleeve is then rotated to close the opening **550** prior to next use. Alternatively, the blade may form part of the device **500**, and may be configured in numerous manners (e.g., linear blade, cutting wire, etc. In especially preferred devices, the blade or opening is disposed in a portion of the device that has a larger inner diameter than the diameter of the biopsy core to accommodate for the added cross sectional profile due to the blade width. Of course, it

should be appreciated that the width is not too wide to so prevent collapse of the partial vacuum. Air is evacuated from the device **500** via suction port **514**. Where desirable, the blade **540** may be coupled to a device that imparts vibrating or other motion to facilitate cutting (not shown).

[0038] It should be apparent to those skilled in the art that many more modifications besides those already described are possible without departing from the inventive concepts herein. The inventive subject matter, therefore, is not to be restricted except in the spirit of the appended claims. Moreover, in interpreting both the specification and the claims, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms “comprises” and “comprising” should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other elements, components, or steps that are not expressly referenced. Where the specification claims refers to at least one of something selected from the group consisting of A, B, C . . . and N, the text should be interpreted as requiring only one element from the group, not A plus N, or B plus N, etc.

What is claimed is:

1. A biopsy device comprising a needle portion and a sheath portion, wherein the needle portion has a closed incising tip and further has two cavities on opposite sides positioned such that at least part of each cavity has the same distance from the tip, and wherein the sheath portion has a sharpened front edge that allows sectioning of respective tissue that is at least partially disposed in the two cavities.
2. The biopsy device of claim 1 wherein the closed incising tip is configured as a chisel blade.
3. The biopsy device of claim 1 wherein the closed incising tip is configured to have an incising proximal end and a distal end, and wherein the distal end has a thickness that is less than a thickness of the tip in a position between the proximal end and the distal end.
4. The biopsy device of claim 1 wherein the tip comprises a slit in longitudinal direction that is configured to accommodate at least portion of a blade.
5. The biopsy device of claim 1 wherein at least 70% of the two cavities have the same distance from the tip.
6. The biopsy device of claim 1 wherein the two cavities form a contiguous opening through the needle portion.
7. The biopsy device of claim 1 wherein the needle portion has at least four cavities on opposite sides.
8. The biopsy device of claim 1 wherein the needle portion is further configured to allow application of a partial vacuum to the cavities.
9. The biopsy device of claim 1 wherein the sharpened edge of the sheath portion has an inside chamfer.
10. The biopsy device of claim 1 wherein the closed incising tip is configured to have an incising proximal end configured as a chisel blade and a distal end, wherein the distal end has a thickness that is less than a thickness of the tip in a position between the proximal end and the distal end, and wherein the sharpened edge of the sheath portion has an inside chamfer that is configured to matingly engage with the distal end.
11. A biopsy device comprising a needle portion and a sheath portion that are configured and positioned relative to each other to allow simultaneous sectioning of a tissue to

produce two tissue samples with corresponding surfaces using a motion of the needle portion relative to the sheath portion.

12. The biopsy device of claim **11** wherein the needle portion comprises a closed incising tip that is configured as a chisel blade.

13. The biopsy device of claim **11** wherein the needle portion comprises two cavities on opposite sides of the needle portion that are positioned such that at least part of each cavity has the same distance from the tip.

14. The biopsy device of claim **11** wherein the needle portion comprises a cavity and wherein the sheath portion comprises a blade, and wherein the sheath portion and the needle portion are configured such that the blade can move along a longitudinal axis of the cavity as the sheath portion is moved relative to the needle portion.

15. A method of facilitating or performing a biopsy, comprising:

providing a biopsy device that includes a needle portion and a sheath portion;

wherein the needle portion and the sheath portion are configured to allow simultaneous sectioning of a tissue to produce two tissue samples with corresponding surfaces using motion of the needle portion relative to the sheath portion; and

instructing a user to advance the biopsy device to a target area and to move the needle portion in the target area relative to the sheath portion to so produce the two tissue samples.

16. The method of claim **15** wherein the needle portion comprises a closed incising tip that is configured as a chisel blade.

17. The method of claim **15** wherein the needle portion comprises two cavities on opposite sides of the needle portion that are positioned such that at least part of each cavity has the same distance from the tip.

18. The method of claim **15** wherein the needle portion is configured to allow application of a partial vacuum to at least one cavity in the needle portion.

19. The method of claim **15** wherein moving the sheath portion comprises a rotational and a transverse movement of the sheath portion.

20. The method of claim **15** wherein moving the needle portion relative to the sheath portion is performed using an automated mechanism that is coupled to the needle portion and the sheath portion.

21. A post-biopsy splitting device comprising:

a sheath having a first opening in a side wall, wherein the opening is configured to allow insertion of a blade such that the blade can be positioned within a lumen in the sheath to allow splitting of a biopsy core in the lumen; wherein the sheath is configured to allow slidably moving the sheath over at least part of a needle.

22. The post-biopsy splitting device of claim **21** wherein the blade is coupled to an exterior surface of the side wall via a flexible element that is configured to allow moving the blade into and out of the lumen.

23. The post-biopsy splitting device of claim **21** wherein the sheath comprises a second opening in the side wall that is configured to allow removal of the split biopsy core from the lumen, and further comprising a third opening positioned such that suction applied to the third opening allows movement of the biopsy core across the blade in the lumen.

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