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Slupchynskyj

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(54) **NEEDLE KNIFE DEVICE AND SYSTEM**

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See application file for complete search history.

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(74) *Attorney, Agent, or Firm* — PK Patent Law

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A61B 17/00 (2006.01)

A61B 17/3211 (2006.01)

(52) **U.S. Cl.**

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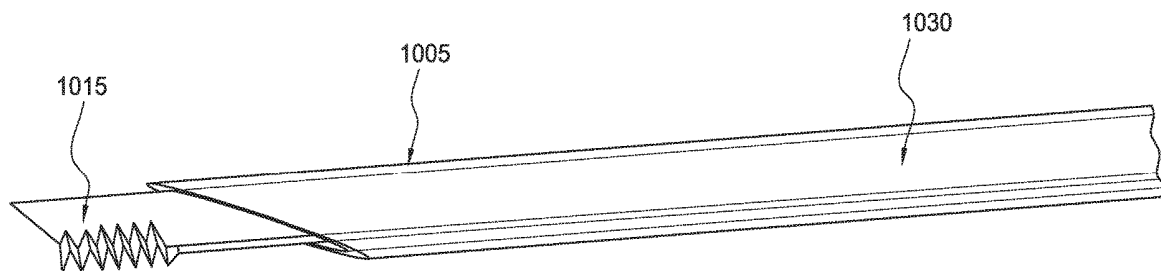
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CPC ... A61B 17/32002; A61B 17/32; A61B 17/34;
A61B 10/0233

(57) **ABSTRACT**

A needle knife device and system for cutting soft tissue under skin of a patient are provided. The needle knife can include an elongated needle including a lumen and a beveled point configured to allow the elongated needle to be inserted transcutaneously into the skin of the patient. The needle knife can also include a blade that is capable of being oscillated within the lumen of the elongated needle between a retracted position where the blade is disposed within the needle and a deployed position where the blade is disposed outside the needle beyond the beveled point. A motor unit can be operatively arranged with the blade and configured to oscillate the blade.

15 Claims, 25 Drawing Sheets



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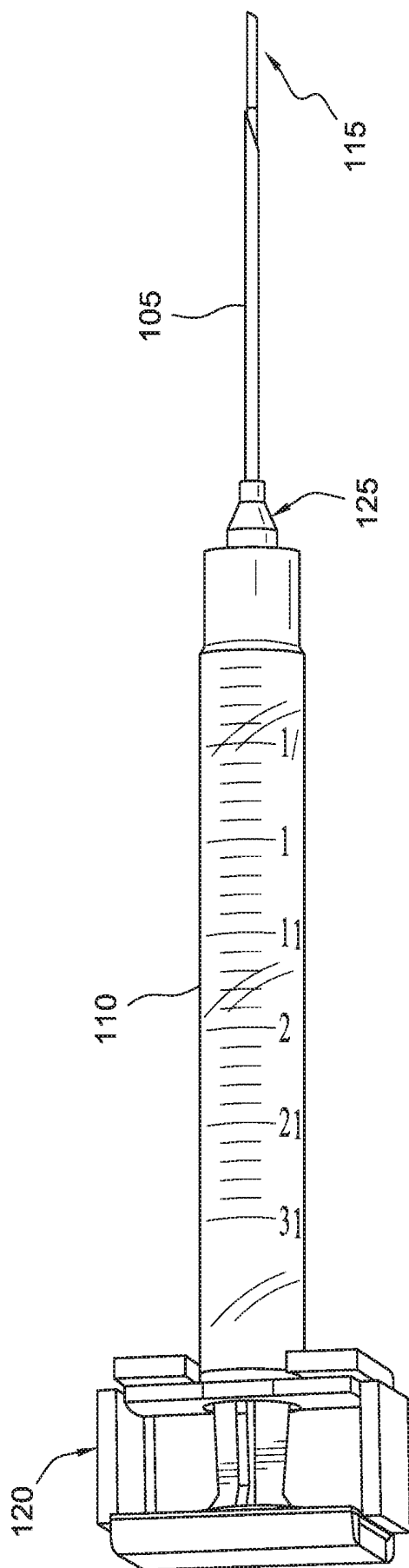


FIG. 1

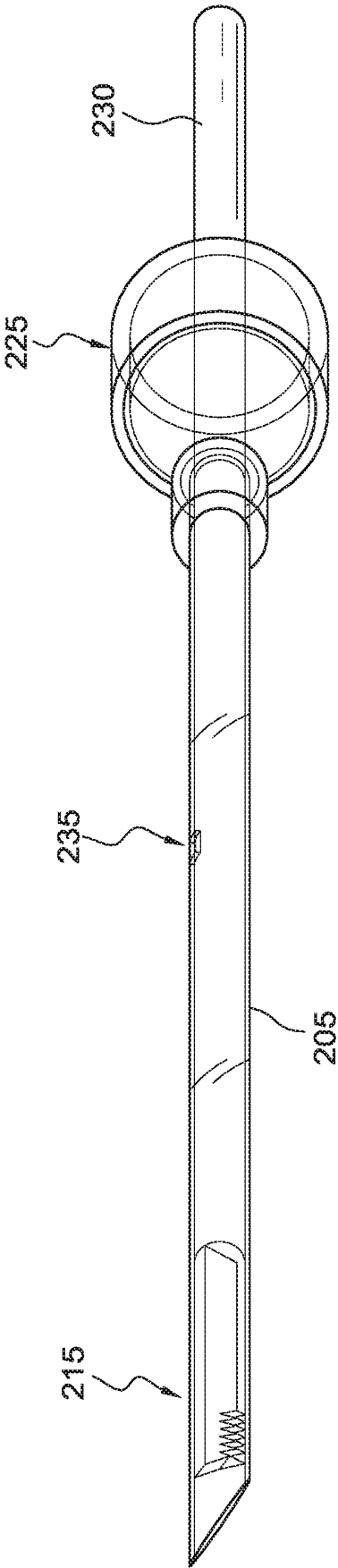


FIG. 2

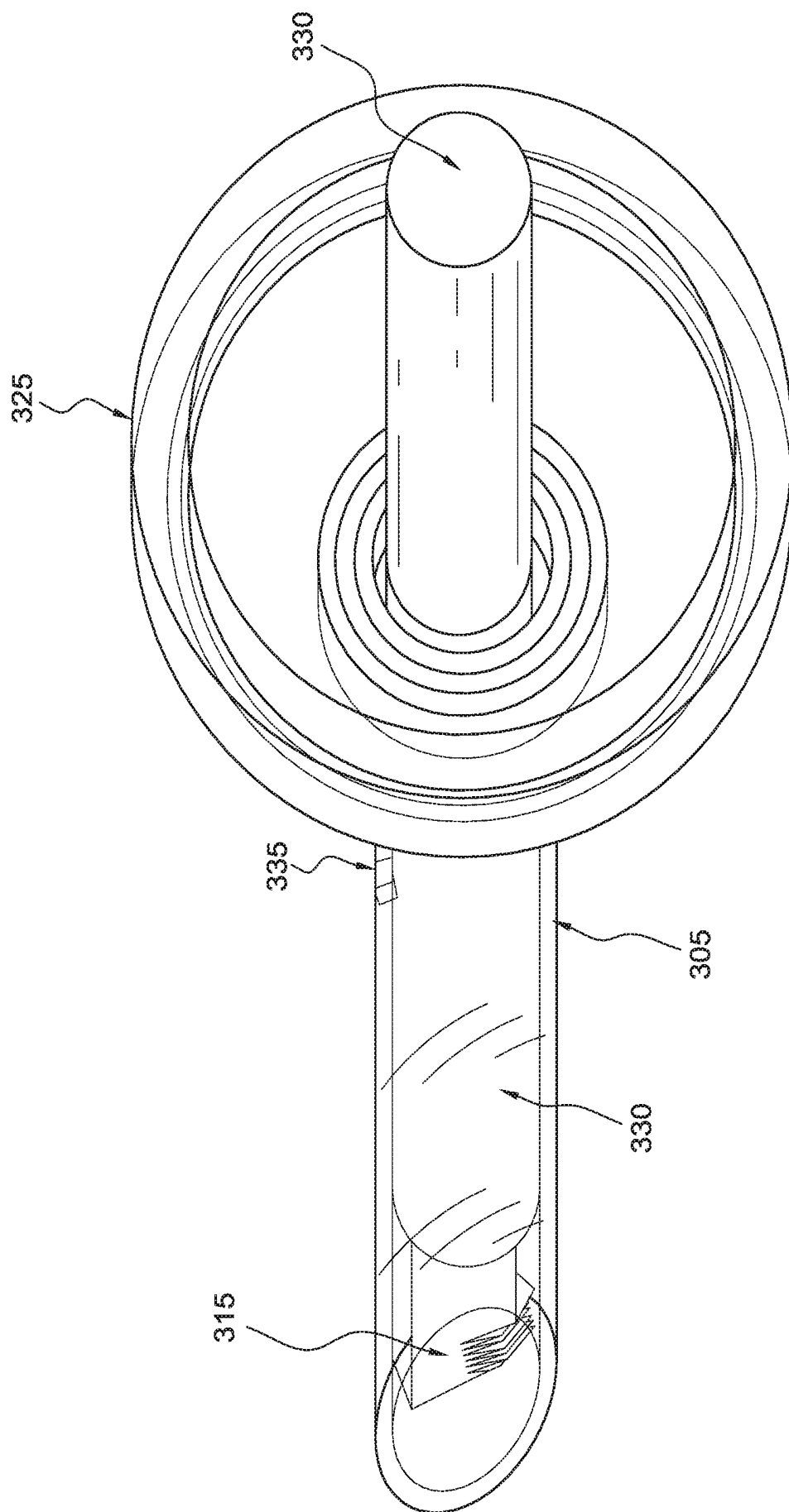
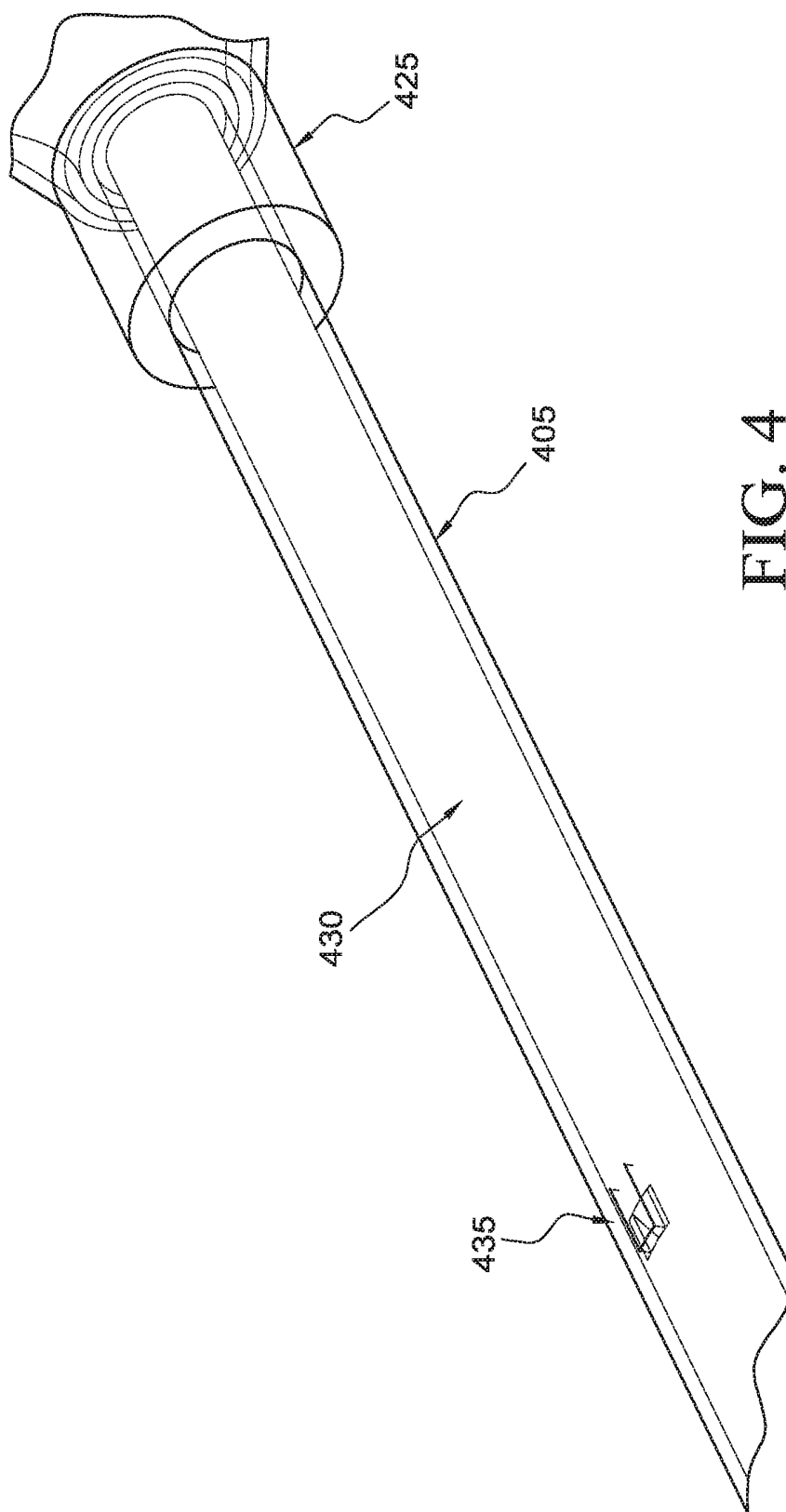
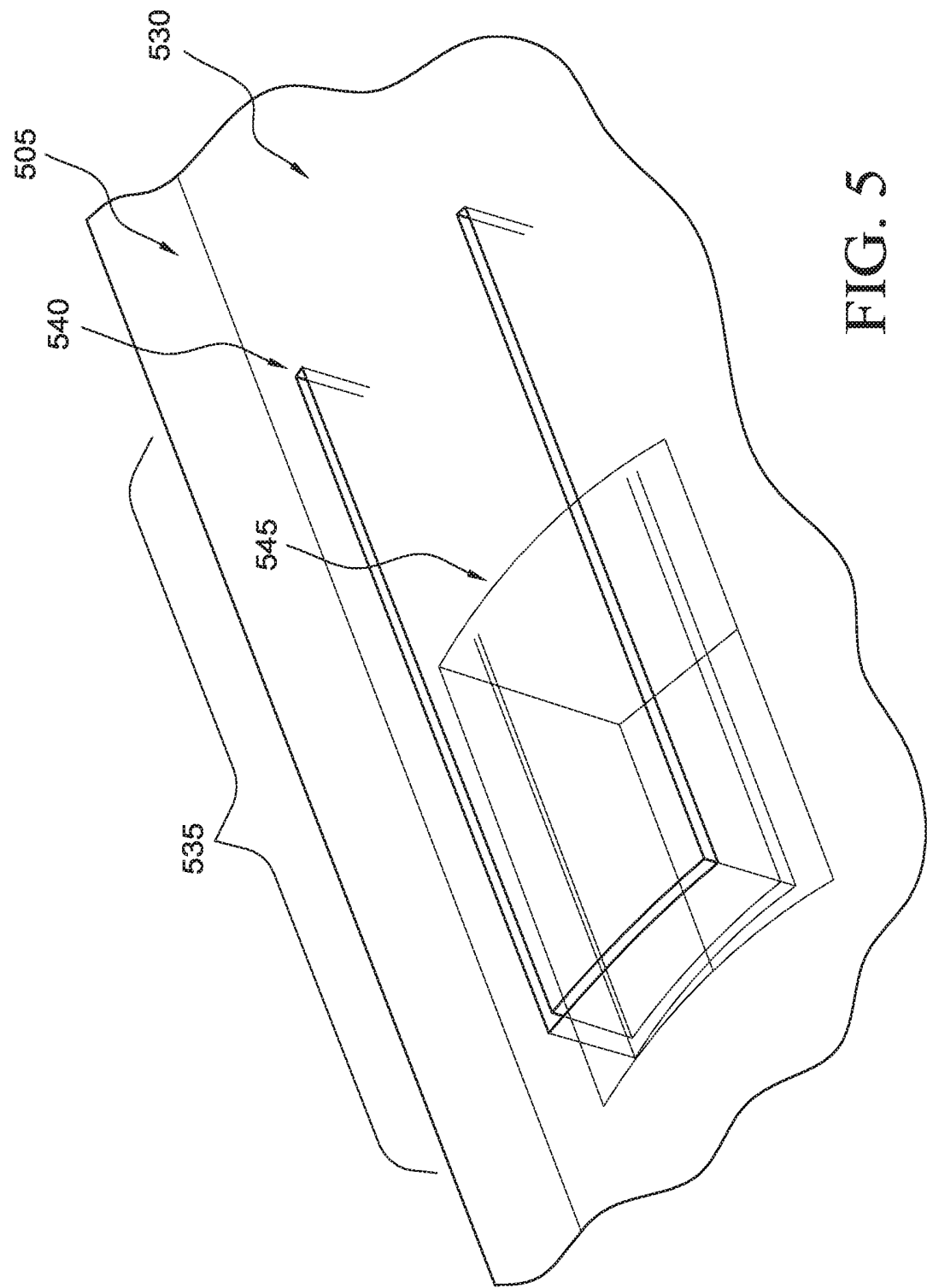


FIG. 3





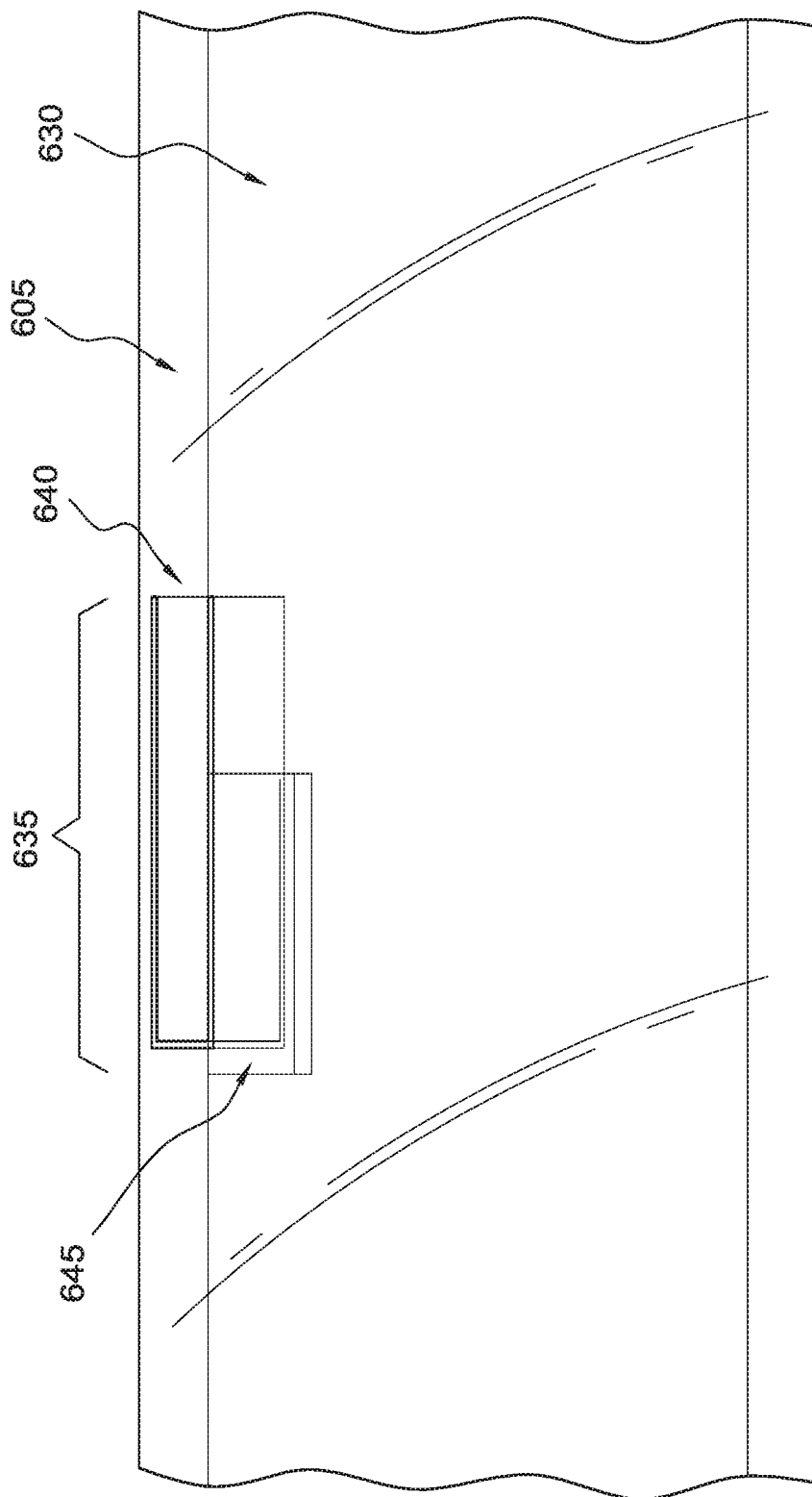


FIG. 6

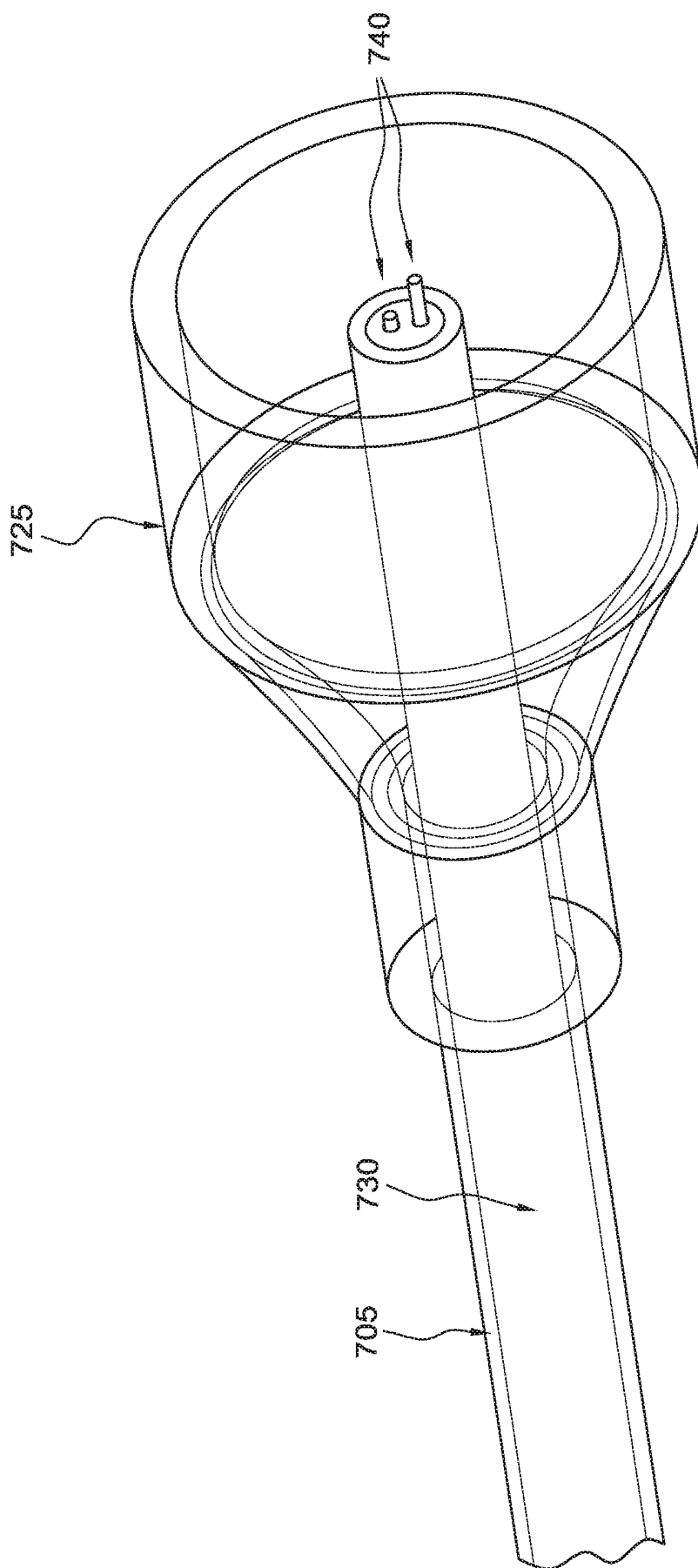


FIG. 7

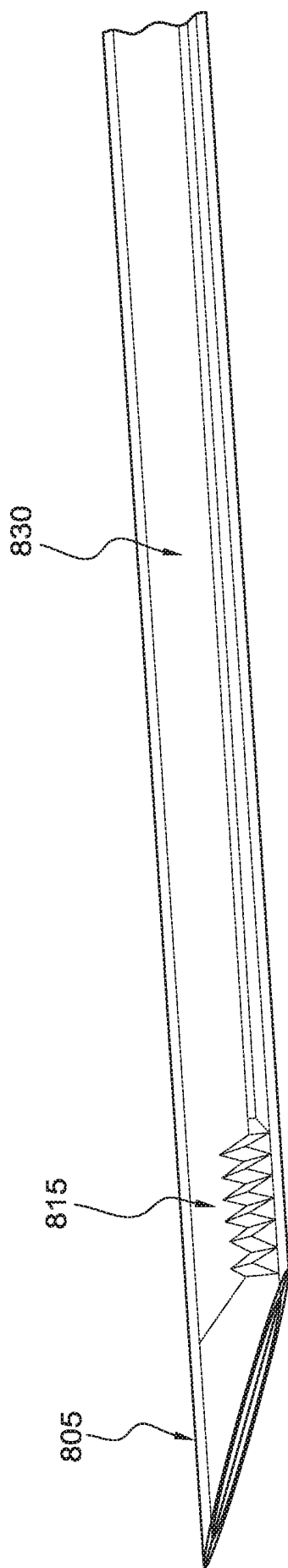


FIG. 8

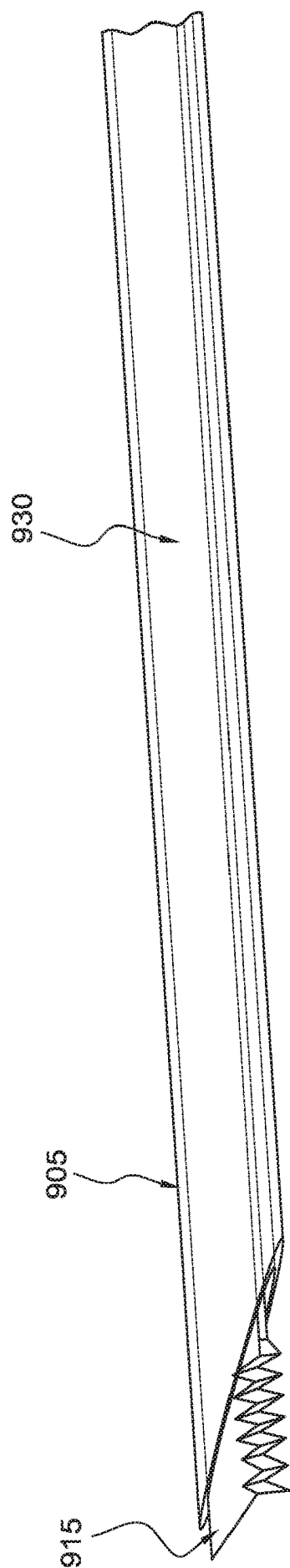


FIG. 9

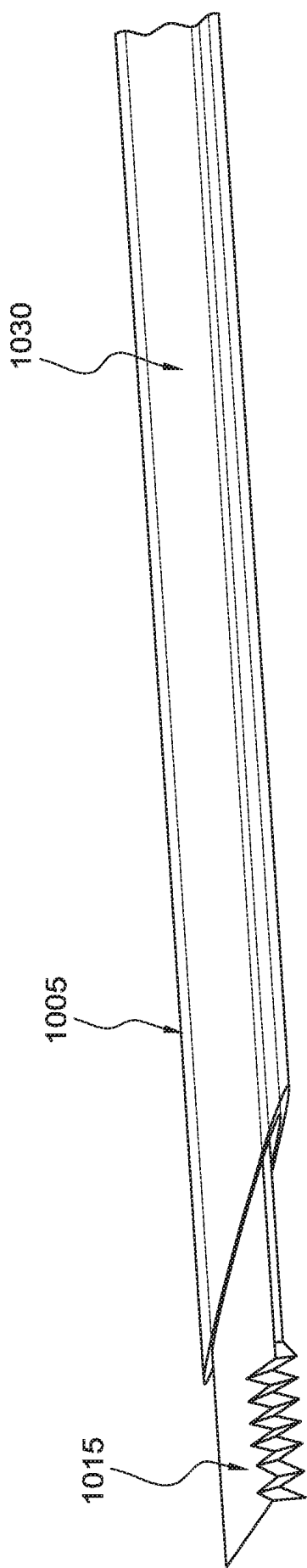


FIG. 10

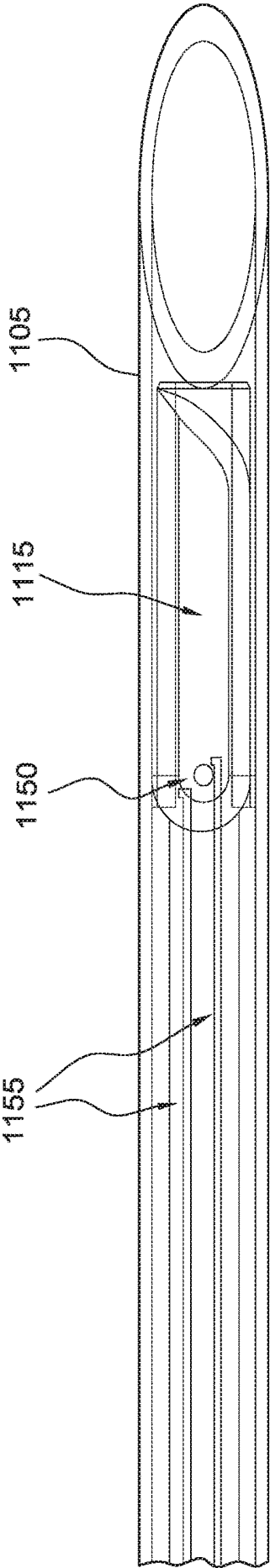


FIG. 11

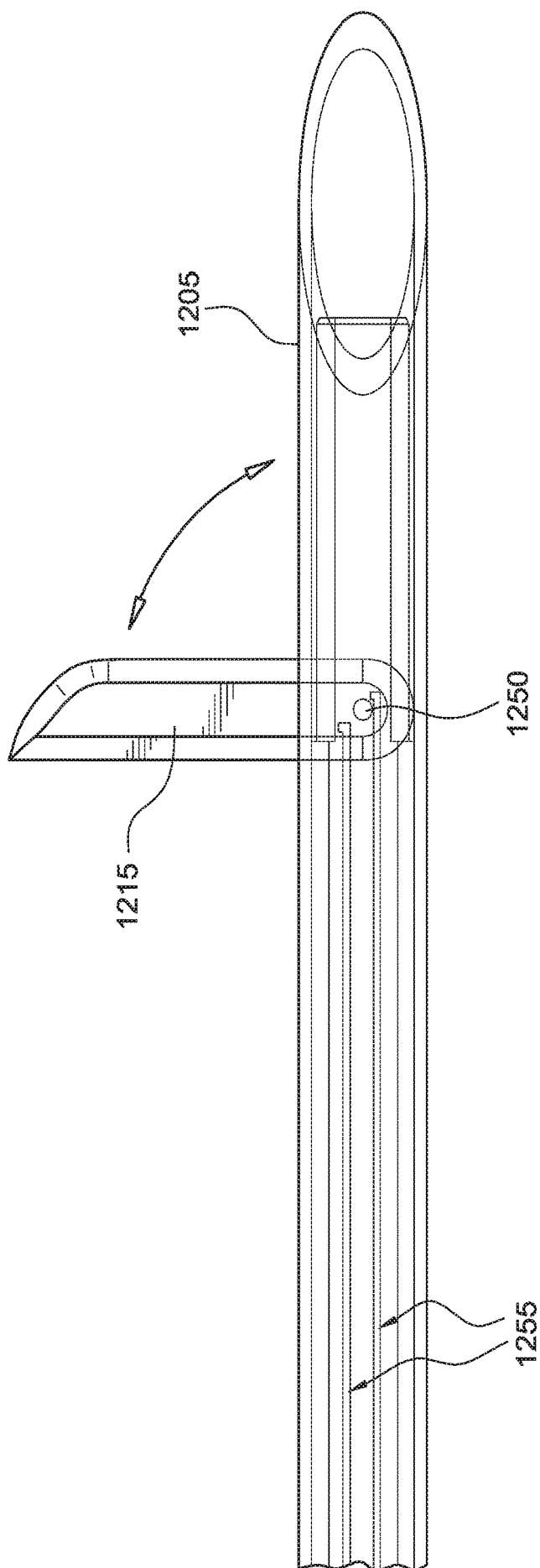


FIG. 12

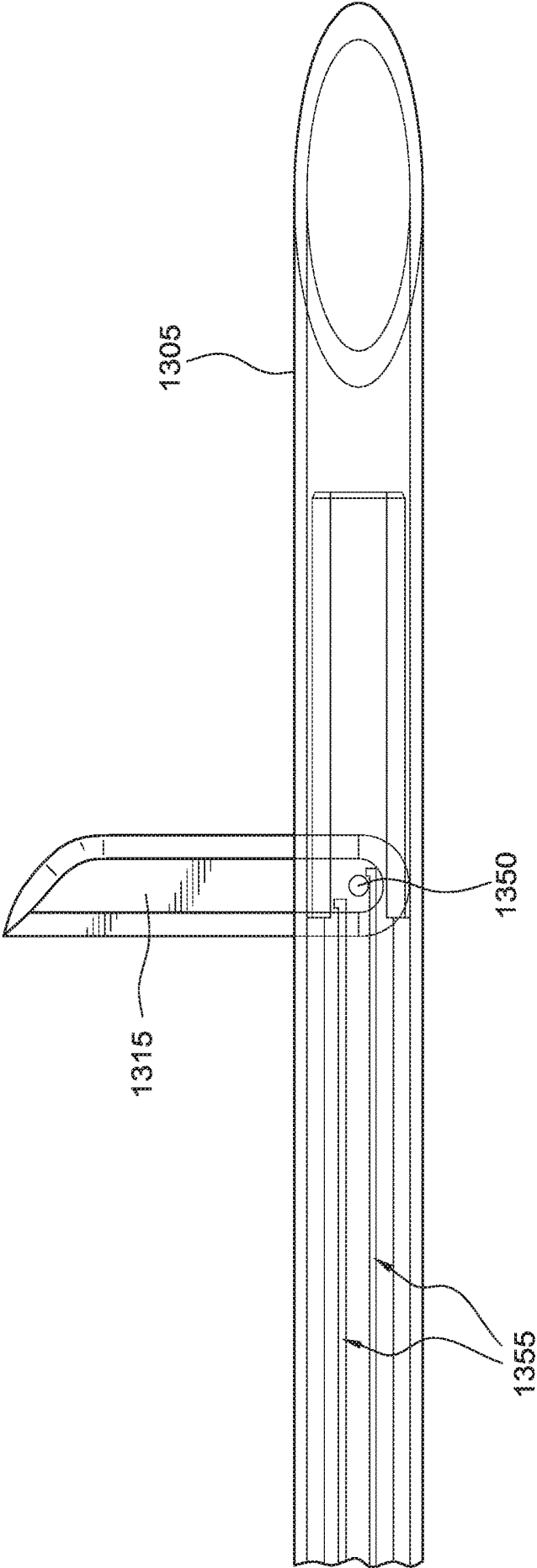


FIG. 13

Needle Knife Assembly 1400

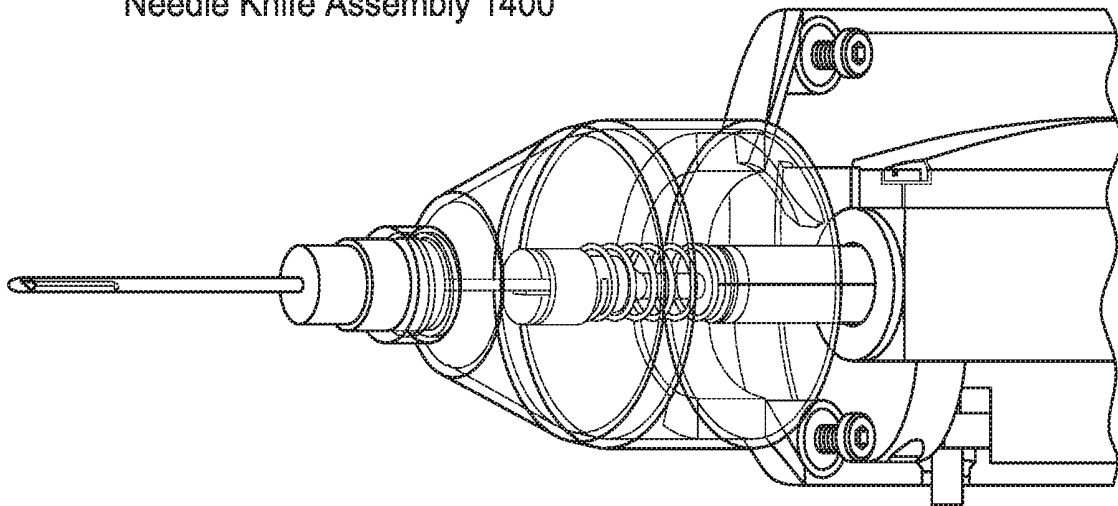


FIG. 14a

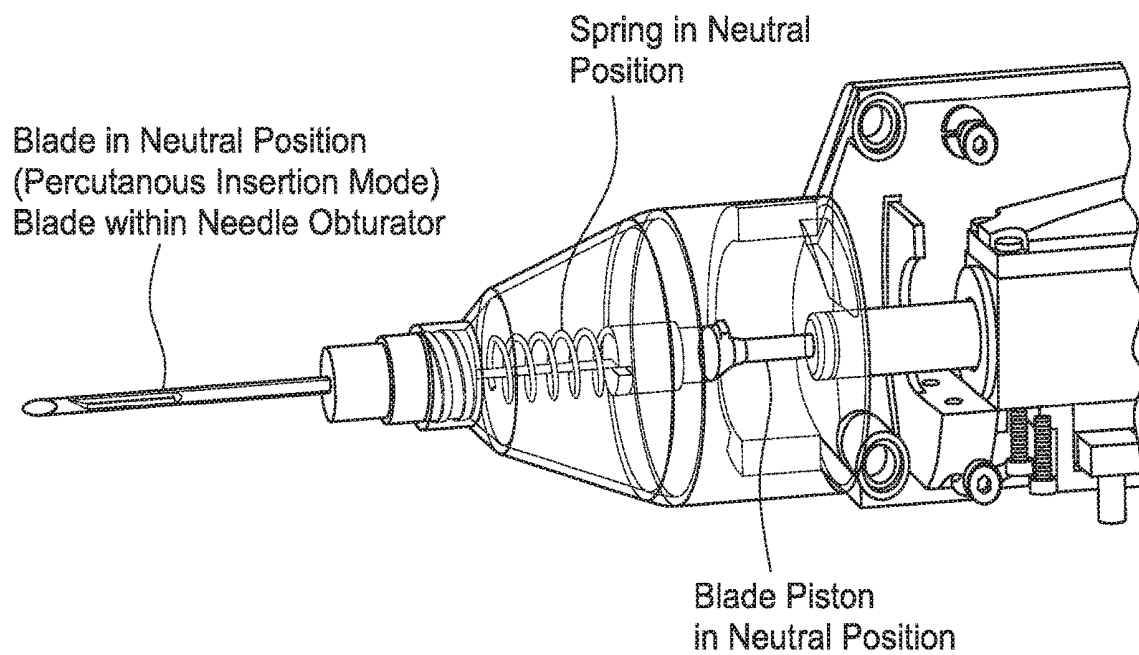


FIG. 14b

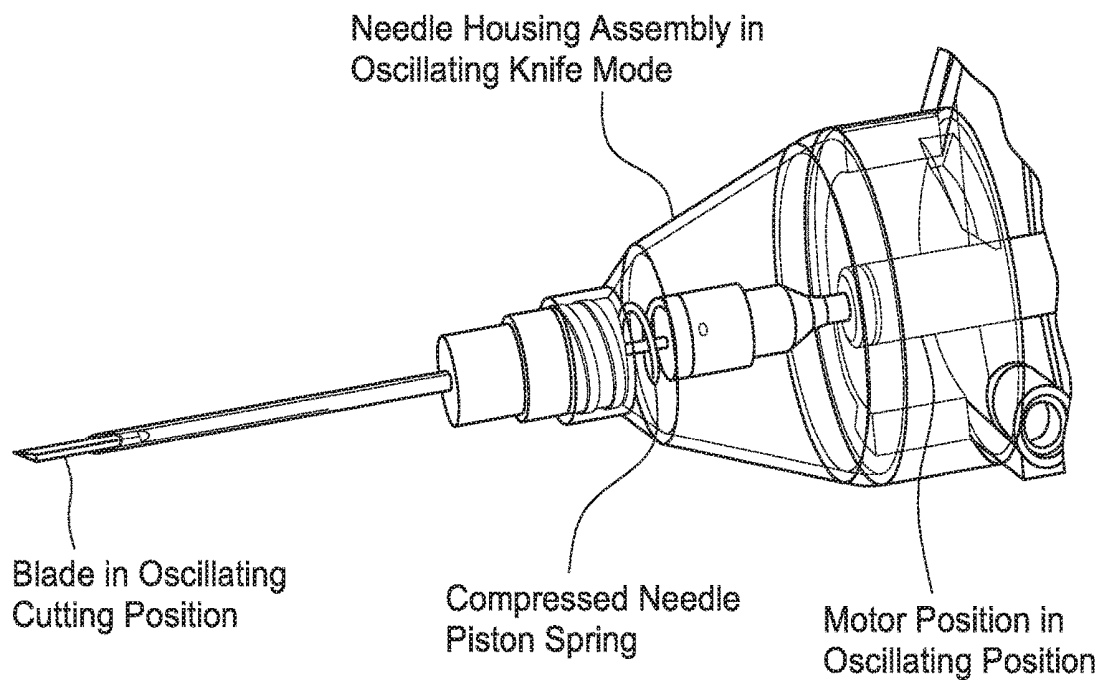


FIG. 14c

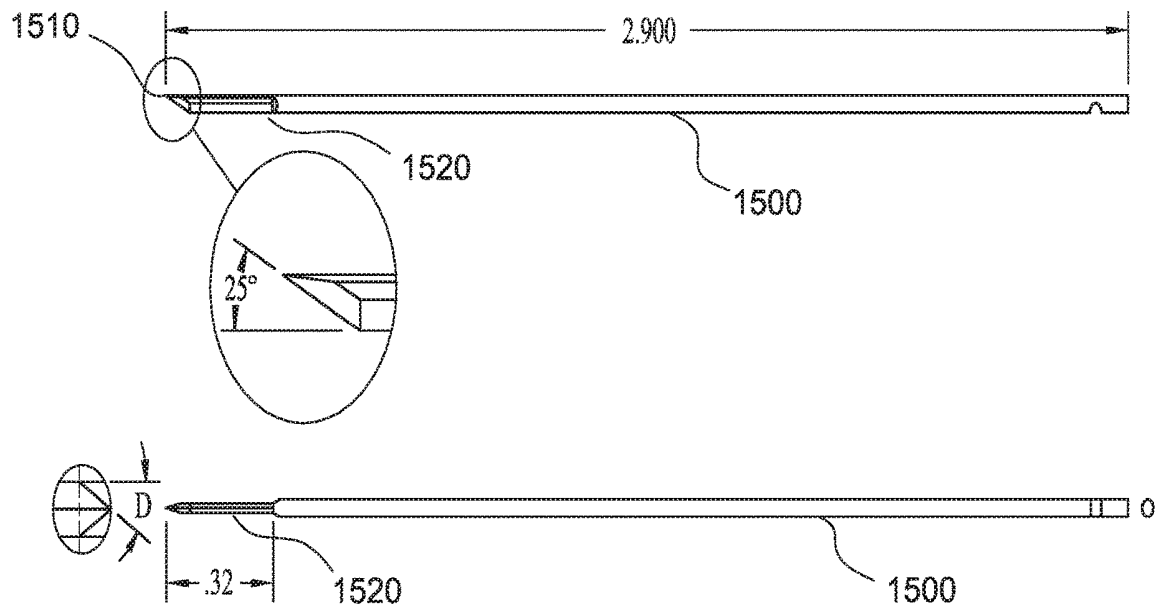


FIG. 15a

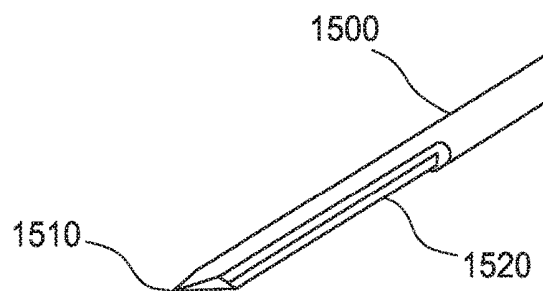


FIG. 15b

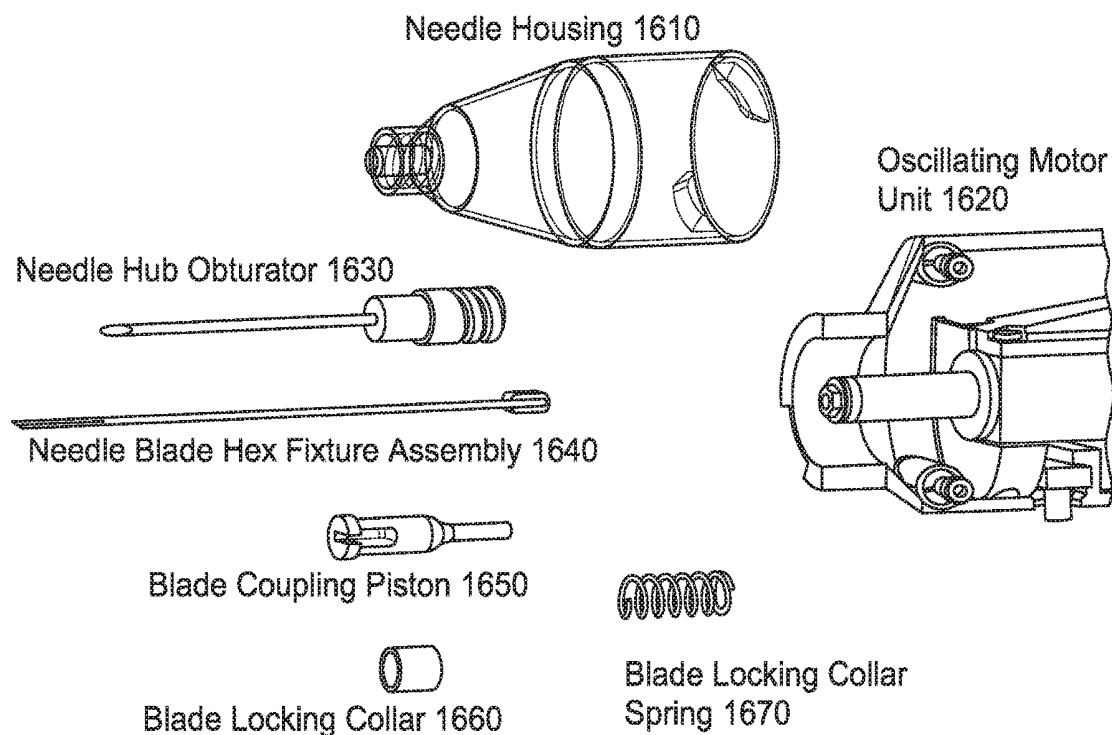


FIG. 16a

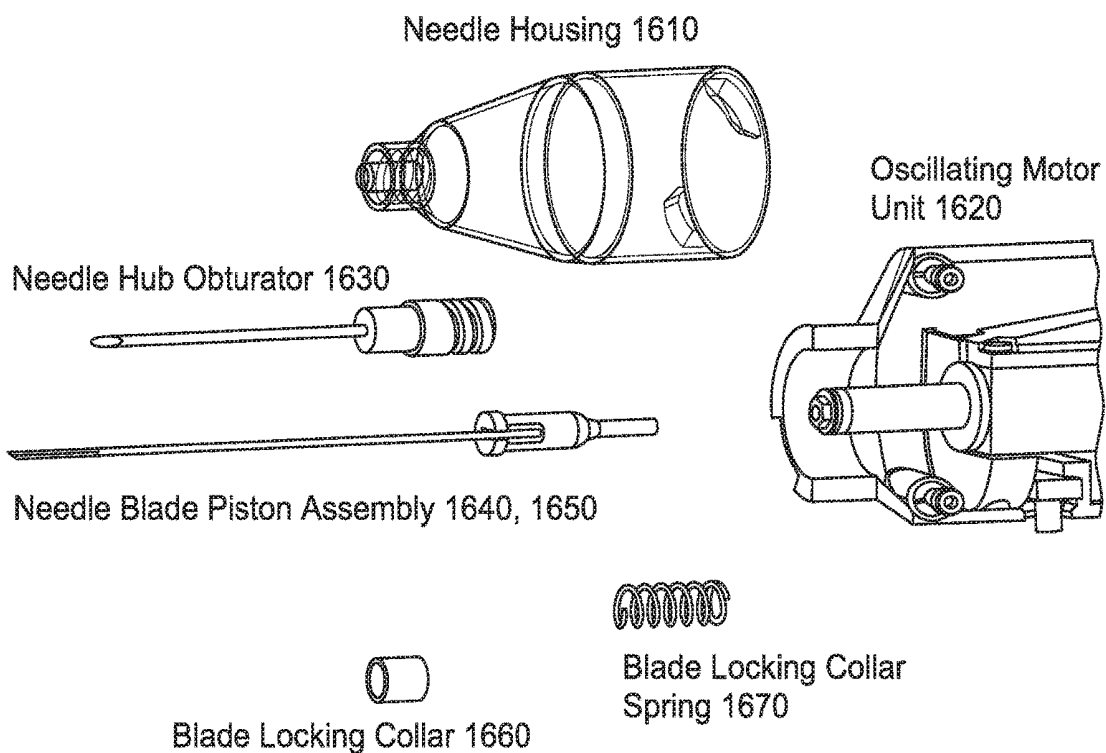


FIG. 16b

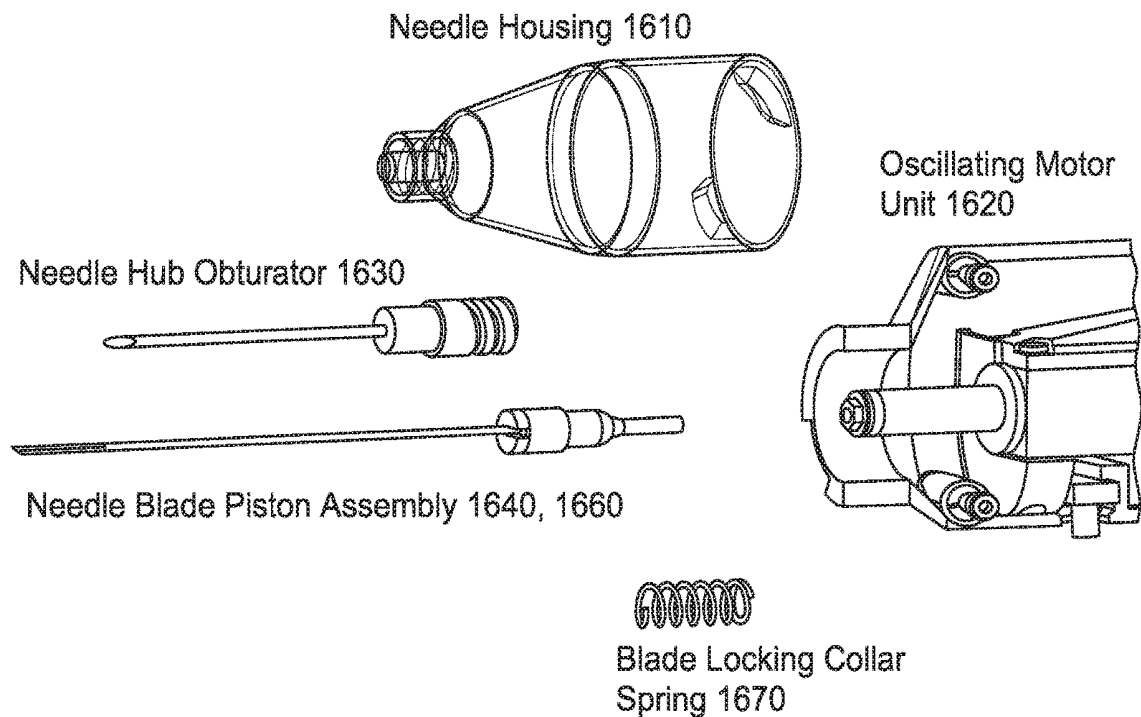


FIG. 16c

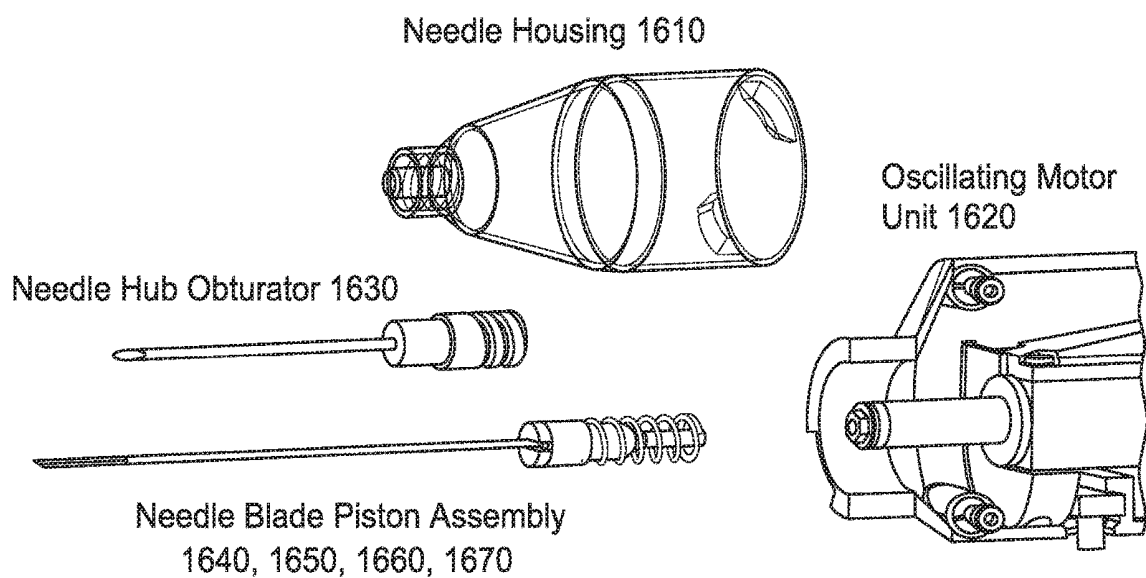


FIG. 16d

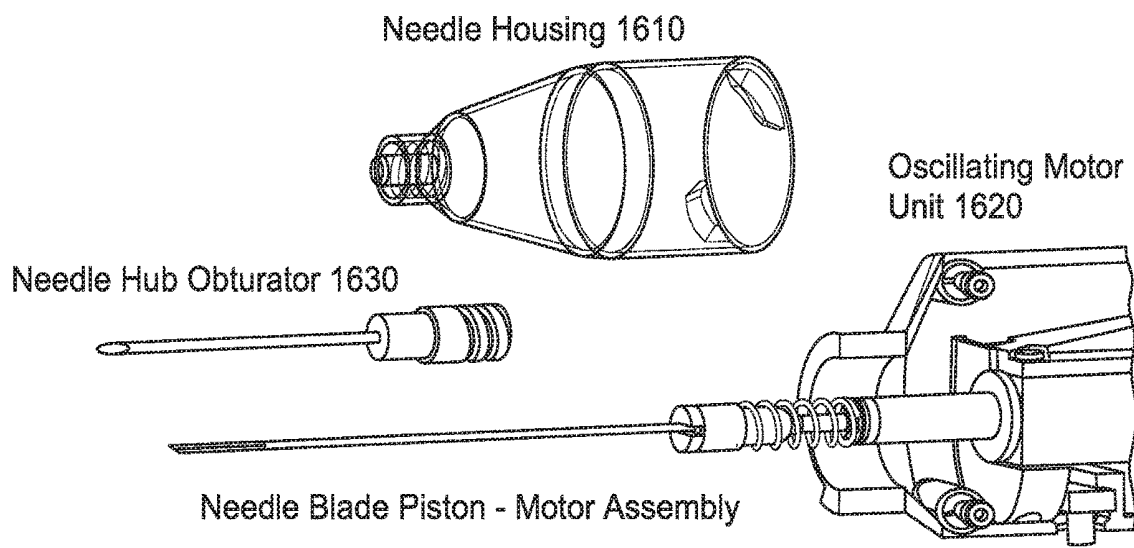


FIG. 16e

Needle Obtuator 1630 - Housing Assembly 1610

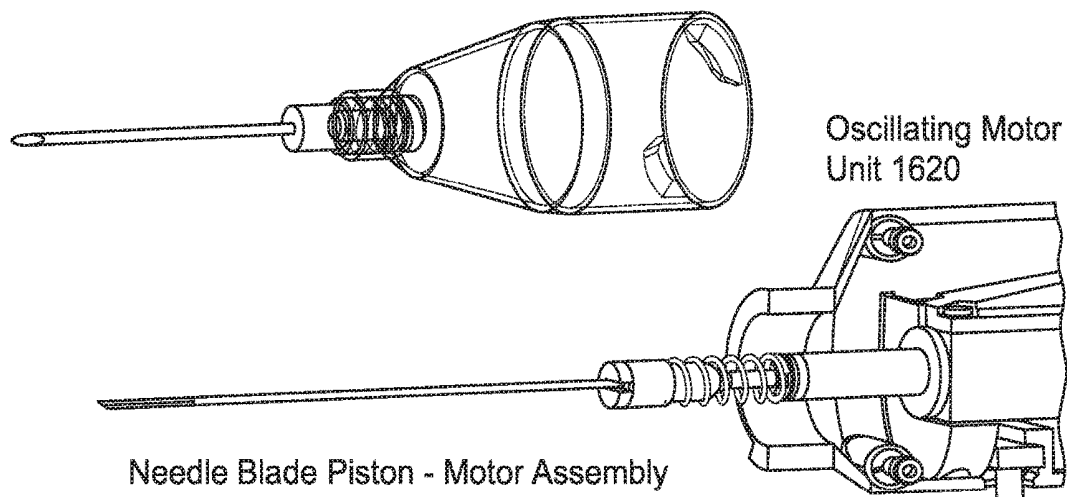


FIG. 16f

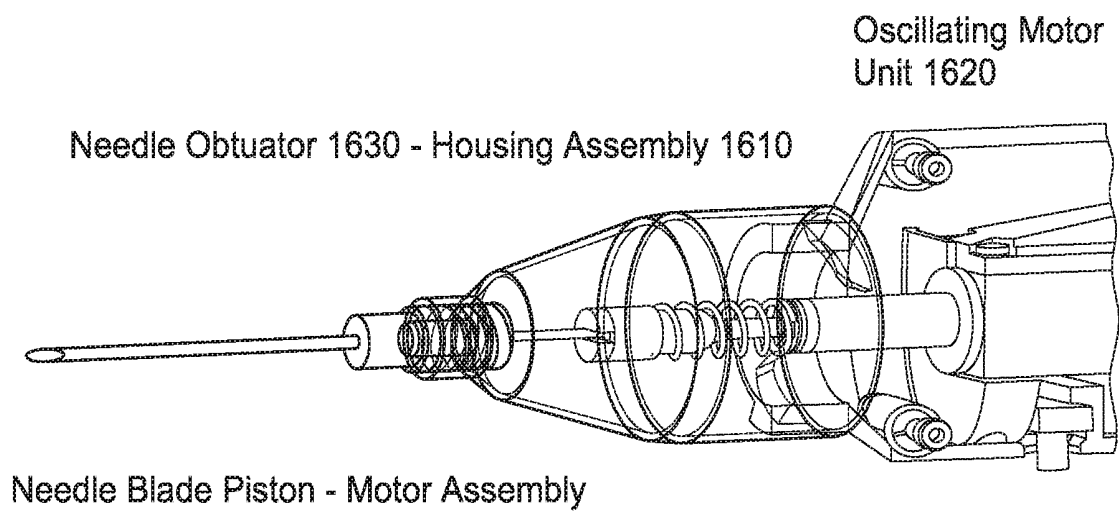


FIG. 16g

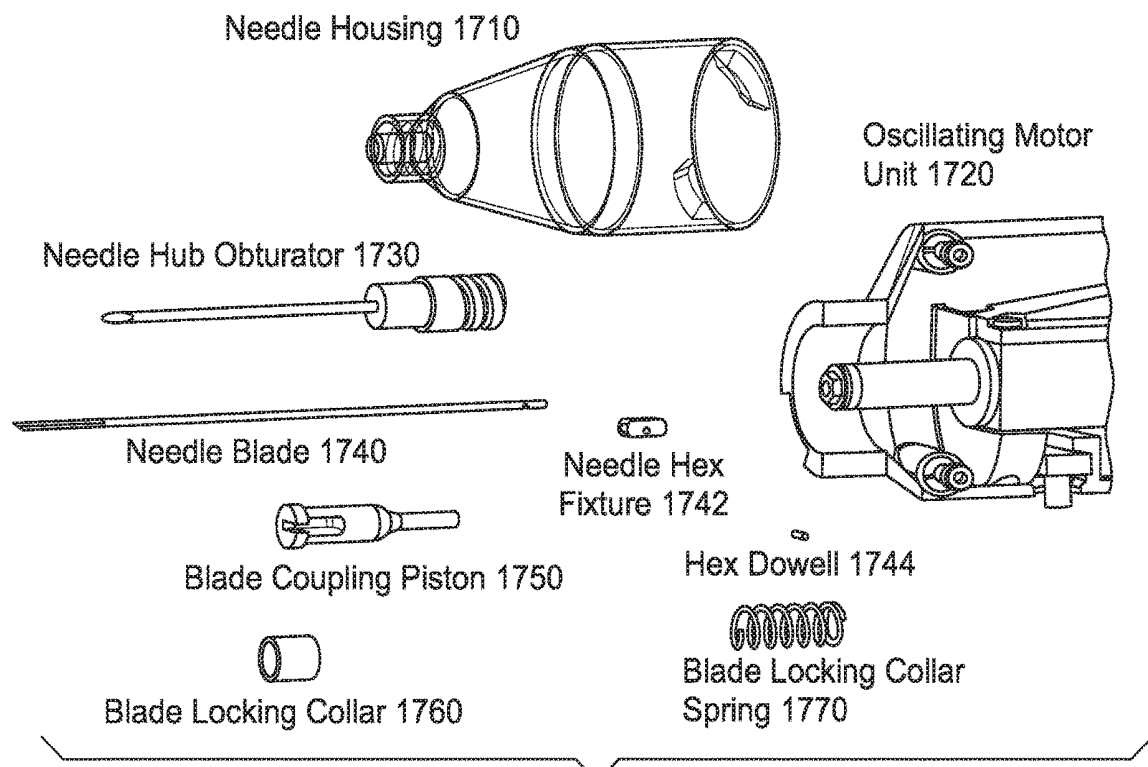


FIG. 17a

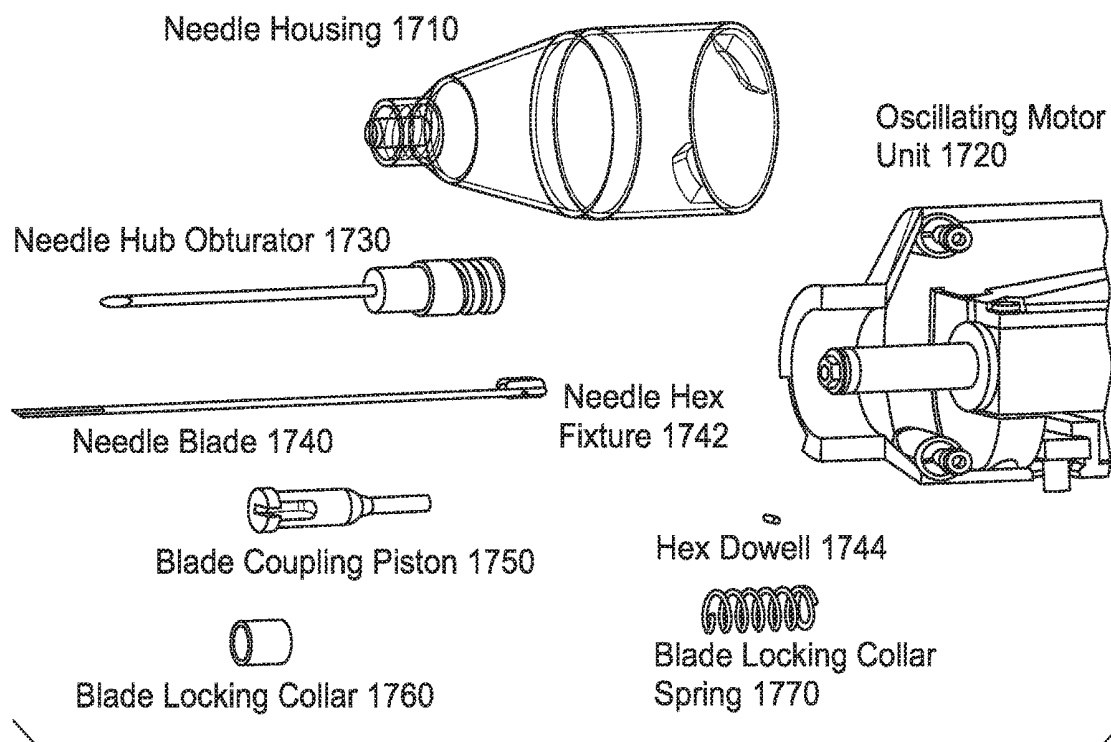


FIG. 17b

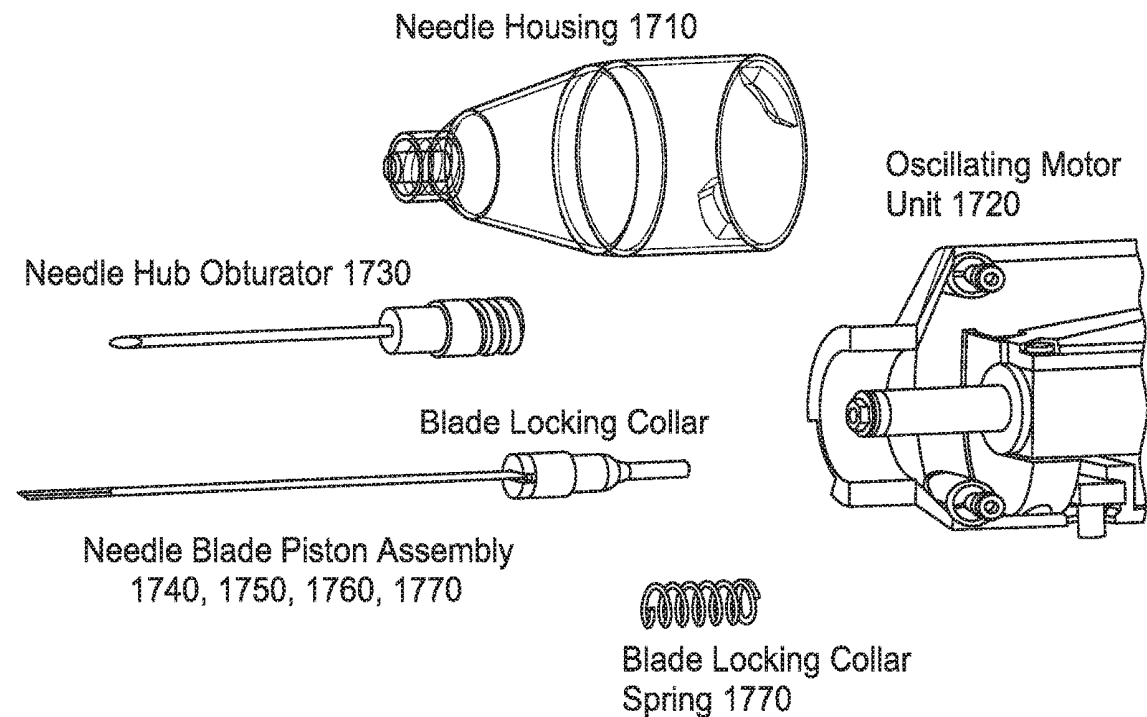


FIG. 17c

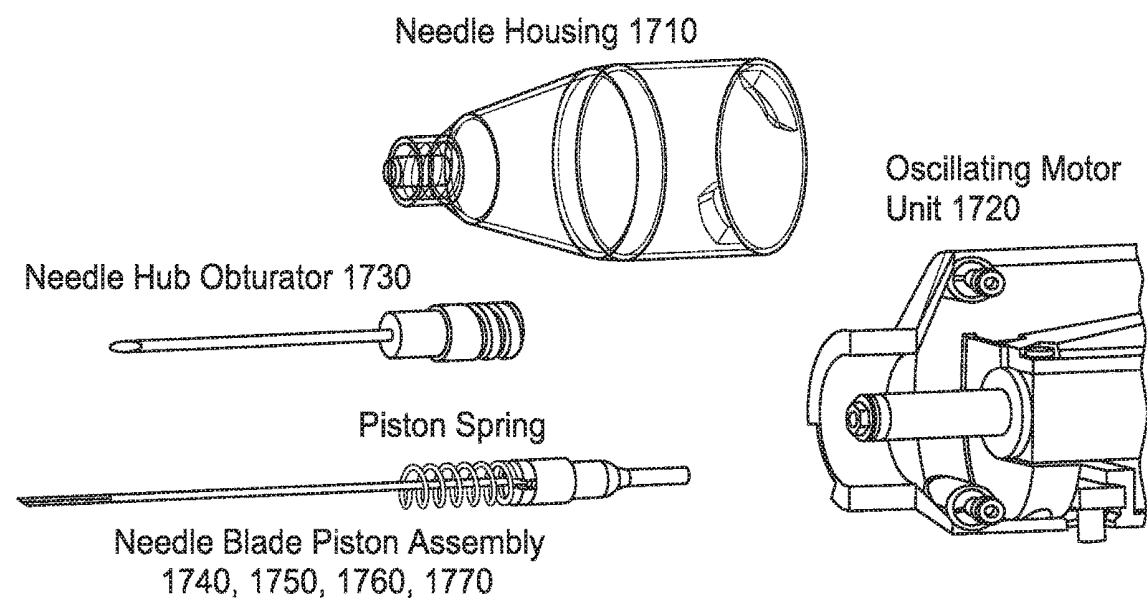


FIG. 17d

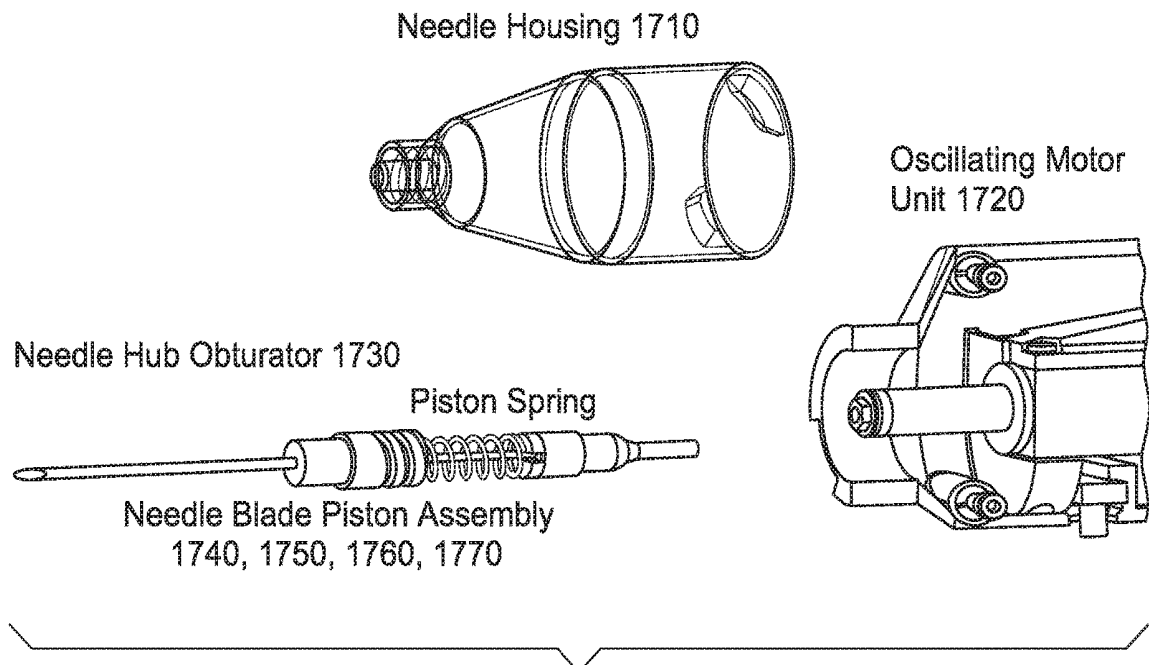


FIG. 17e

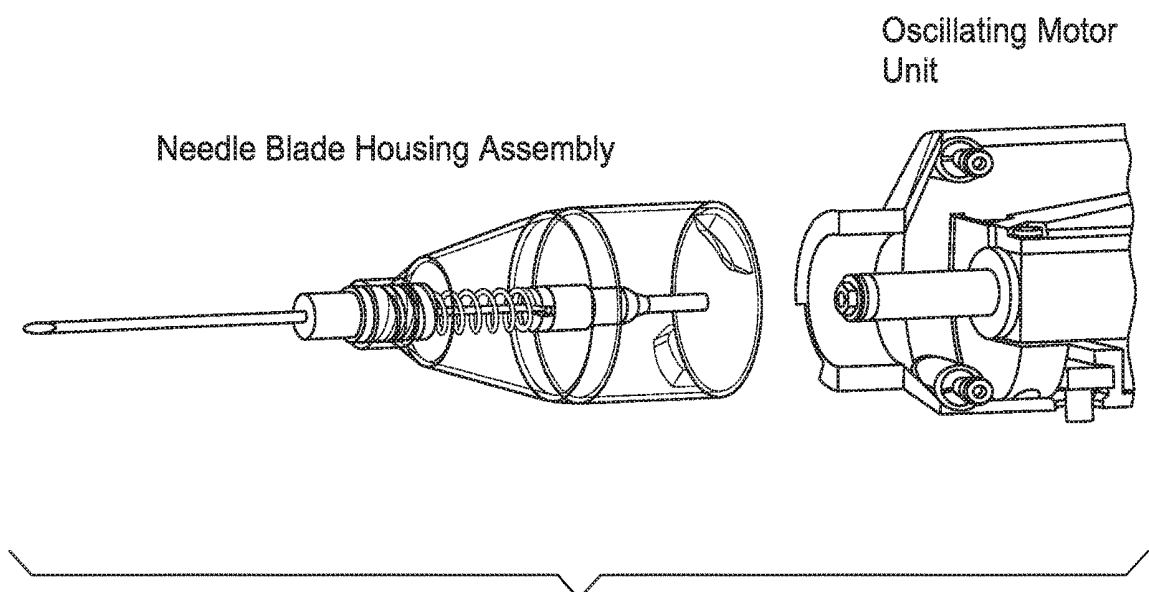


FIG. 17f

Needle Knife Motor Unit Assembly

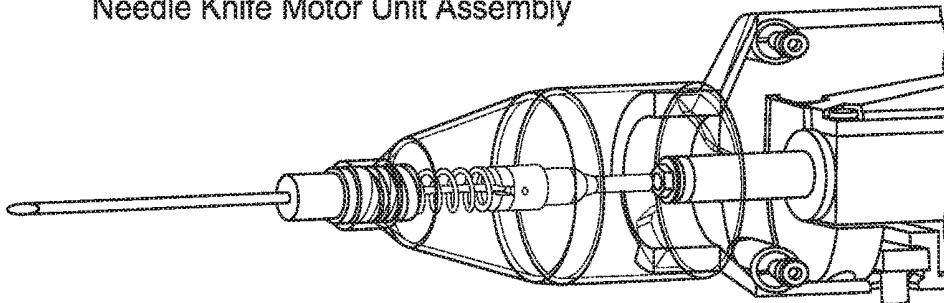
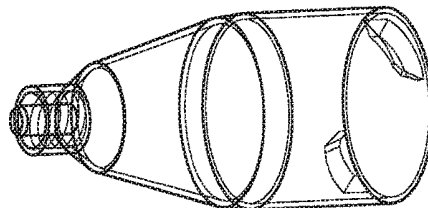


FIG. 17g

Needle Housing 1710

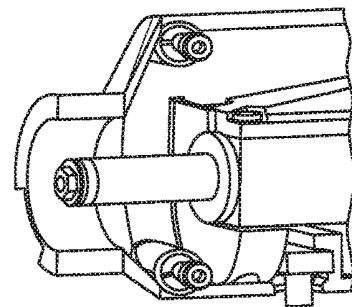


Needle Hub Obturator 1730



Needle Blade Piston Assembly 1740, 1750

Oscillating Motor Unit 1720



Blade Locking Collar 1760



Blade Locking Collar Spring 1770

FIG. 17h

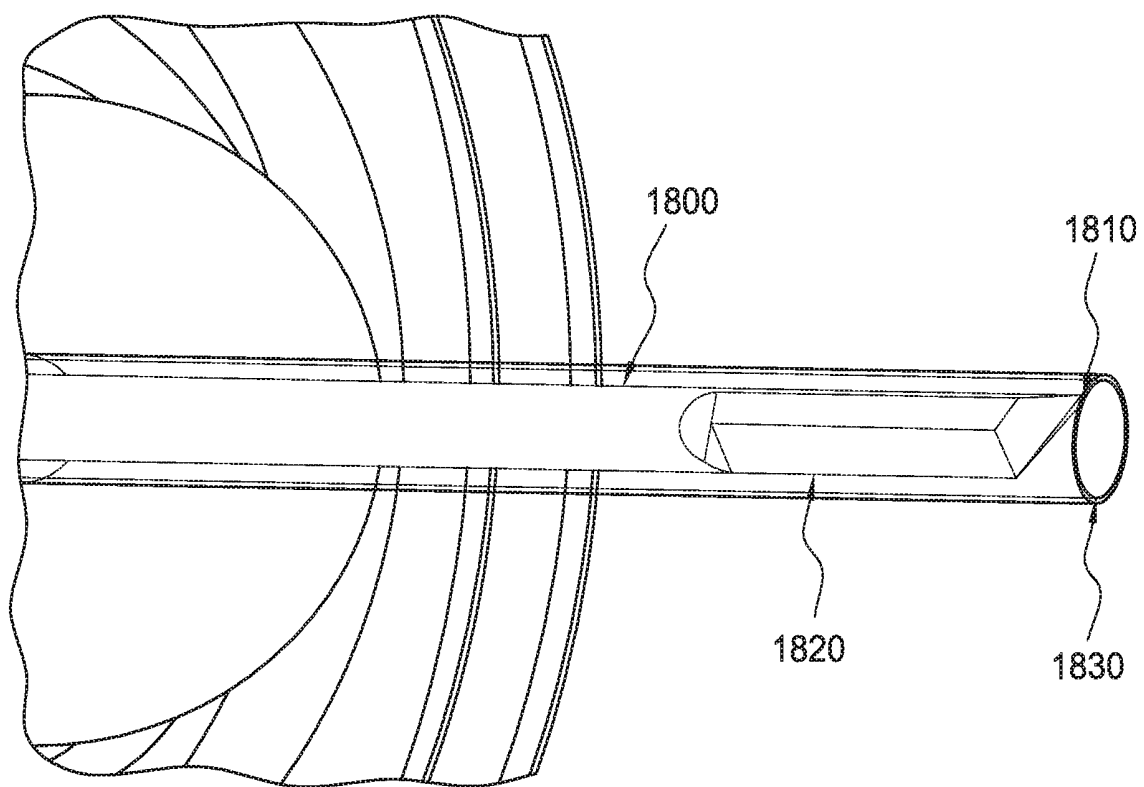


FIG. 18

NEEDLE KNIFE DEVICE AND SYSTEM

PRIORITY CLAIM

This application is a continuation of U.S. patent application Ser. No. 14/264,015, filed Apr. 28, 2014, which claims priority and benefit of U.S. Provisional Patent Application Ser. No. 61/890,640, filed Oct. 14, 2013, entitled "Needle Knife Apparatuses, Methods and Systems." The entire contents of the aforementioned applications are herein expressly incorporated by reference.

FIELD

The present innovations generally address medical devices, needles, and medical-grade blades and more particularly, include Needle Knife Apparatuses, Methods, and Systems.

However, in order to develop a reader's understanding of the innovations, disclosures have been compiled into a single description to illustrate and clarify how aspects of these innovations operate independently, interoperate as between individual innovations, and/or cooperate collectively. The application goes on to further describe the interrelations and synergies as between the various innovations; all of which is to further compliance with 35 U.S.C. § 112.

BACKGROUND

Small medical devices and small surgical blades may be used for various medical procedures. Various methods also exist for removing wrinkles from a person's body, and in particular, their face and forehead, such as face lifts and injecting Botox.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying appendices and/or drawings illustrate various non-limiting, example, innovative aspects in accordance with the present descriptions:

FIG. 1 shows a diagram illustrating an embodiment of the Needle Knife (hereinafter "NK");

FIG. 2 shows a diagram illustrating further embodiments of the NK;

FIG. 3 shows a diagram illustrating further embodiments of the NK;

FIG. 4 shows a diagram illustrating further embodiments of the NK;

FIG. 5 shows a diagram illustrating further embodiments of the NK;

FIG. 6 shows a diagram illustrating further embodiments of the NK;

FIG. 7 shows a diagram illustrating further embodiments of the NK;

FIG. 8 shows a diagram illustrating further embodiments of the NK;

FIG. 9 shows a diagram illustrating further embodiments of the NK;

FIG. 10 shows a diagram illustrating further embodiments of the NK;

FIG. 11 shows a diagram illustrating further embodiments of the NK;

FIG. 12 shows a diagram illustrating further embodiments of the NK; and

FIG. 13 shows a diagram illustrating further embodiments of the NK.

FIGS. 14a-c shows a diagram illustrating further embodiments of the NK, in FIG. 14b shows the blade in a neutral (sheathed) position and FIG. 14c shows the blade in an oscillating cutting position.

FIGS. 15a-b shows a diagram illustrating further embodiments of the NK having a non-serrated cutting blade.

FIGS. 16a-g shows various diagrams illustrating a series of exploded and assembled views of yet another embodiment of the NK.

FIGS. 17a-h shows various diagrams illustrating a series of exploded and assembled views of yet another embodiment of the NK.

FIG. 18 shows the NK with the blade in the neutral (sheathed) position.

The leading number of each reference number within the drawings indicates the figure in which that reference number is introduced and/or detailed. As such, a detailed discussion of reference number 101 would be found and/or introduced in FIG. 1. Reference number 201 is introduced in FIG. 2, etc.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Introduction

In one implementation, a minimally invasive needle knife is used for permanent glabellar and crow's feet wrinkle reduction. The device consists of a needle which is inserted into the areas of the forehead and facial skin that cause glabellar frown lines and crow's feet. Once the needle is inserted, a small knife within the needle lumen is activated and the muscles and nerves responsible for wrinkle creation are severed. This creates a permanent elimination in the wrinkle in that area.

In one implementation, a surgical-grade blade may be disposed along a needle disposed within a lumen or cannula assembly. The needle may be inserted into a patient, and the blade may then be deployed to perform various procedures. In some embodiments, an 18 gauge needle may be used. In other embodiments, a 16 gauge needle may be used.

In some embodiments, the needle may be inserted into the forehead of a patient to cut the patient's muscles in their forehead, thereby permanently removing wrinkles. This may avoid any potential dangers associated with the use of Botox and other similar such methods.

Needle Knife (NK)

FIG. 1 illustrates an embodiment of the NK. In one embodiment, the needle 105, shown here attached to a syringe 110, may contain a blade 115. The needle 105 may be inserted under the skin of a patient. The blade 115 may deploy after insertion, and may then be used to perform various medical functions. In one implementation, the blade 115 may be deployed to cut muscles in the forehead of a patient, thereby permanently eliminating forehead wrinkles.

The syringe 110 may be attached, via a connector mechanism 125, to a control mechanism 120. In some embodiments, the control mechanism may control deployment of the blade. The control mechanism may also control the speed at which the blade moves once it is inserted into the patient. In some embodiments, the doctor may control the deployment and/or motion of the blade by hand. In alternative embodiments, the deployment and/or motion of the blade may be controlled by a computerized and/or automated device.

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In one implementation, the control mechanism may also have a safety mechanism. The safety mechanism may, in some embodiments, detect if the blade hits bone or other unintended types of tissue. If the safety mechanism hits the other types of tissue, such as bone, the safety mechanism may engage and stop the motion of the blade. In some implementations, the safety mechanism may have an alert system to notify the doctor using the NK that (s)he has hit unintended matter; and, in a further embodiment, may be able to notify the doctor of what type of matter hit, for example, by detecting the density of the matter hit. In certain other embodiments, the NK is configured to shave bone and cut cartilage. As such, the device may be configured to notify the doctor that the NK has hit bone or cartilage to potentially adjust the speed at which the device operates, so as to facilitate the cutting of the bone or cartilage.

In another embodiment, ultrasound or other imaging techniques may be used to track the location of the needle and/or blade. In such embodiments, ultrasound or other markings may be incorporated into the needle.

FIG. 2 shows an embodiment of the NK. The blade 215 is shown inside the needle 205. A connector mechanism 225 may connect the blade and needle to a control mechanism, which, as discussed with reference to FIG. 1, may be automated or may be controlled by hand by the doctor. Although the blade 215 is shown as serrated, in other embodiments, the blade may be flat-edged.

In the embodiment shown in FIG. 2, the blade 215 may be deployed out the front of the needle 205. The blade 215 may be connected to a shaft 230. The shaft 230 may slide through the needle 205 to deploy the blade 215. Once the blade 215 is outside the needle 205, the shaft 230 may oscillate to control motion of the blade, as, in an example embodiment, the blade oscillates to cut through the muscle. Once the muscle has been cut or once the procedure has been completed, the shaft 230 may be used to retract the blade 215 into the needle 205, and the needle 205 may be removed from the patient's body. The blade 215 in the 18 gauge needle 205 until the needle 205 is inserted into the tissue transcutaneously. The surgeon can activate the blade 215 which advances from the lumen of the needle (trocar) 205 and oscillates at desired (variable) frequencies and engages tissue to be cut. As such, the system has a sheathed blade 215 that is deployed from the sheath in an oscillating parallel motion perpendicular to the tissue that is intended to be cut. Once the tissue is cut, the surgeon stops the oscillation of the blade and the blade automatically retracts into the trocar. The trocar can then be removed without cutting additional tissue or skin.

In some embodiments, the shaft 230 may have a negative recess, and the needle 205 may have a corresponding tab, creating a lock mechanism 235. The lock mechanism 235 may ensure that the orientation of the blade 215 within the needle 205 is consistent. In one implementation, the tab may be pressed into the recess in the shaft 230, which may secure the orientation such that the blade 215 and shaft 230 may not rotate within the needle 205. In one embodiment, the tab in the needle 205 may slide into an elongated recess along the shaft 230, such that the tab may slide within the elongated recess as the blade 215 oscillates. This may ensure that the blade 215 does not rotate during oscillation. This may also ensure that the blade 215 does not oscillate beyond specified limits of deployment, as the tab may stop extension of the blade once it reaches the end of the elongated recess in the shaft.

FIG. 3 shows an alternative view of one embodiment of the NK. The needle 305 may contain the blade 315 and shaft

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330. In some embodiments, the NK may also have a lock mechanism 335. The shaft 330 may move through the connector mechanism 325 and the needle 305 to deploy and/or oscillate the blade 315.

FIG. 4 illustrates an embodiment of the NK. The shaft 430 may be inside the needle 405, and the needle may be connected to the connector mechanism 425, while the shaft 430 may extend through the connector mechanism 425. The lock mechanism 435 may be provided with corresponding tabs and recesses in the needle 405 and shaft 430.

FIG. 5 illustrates a close-up embodiment of the NK. In the shown embodiment, the lock mechanism may comprise the tab 540 in the needle 505 and the recess 545 in the shaft 530. The tab 540 may be depressed into the recess 545. In depressing the tab, the shaft 530 may be locked into a particular orientation within the needle 505, such that the shaft cannot rotate within the needle. In some implementations, this may prevent the blade from rotating. In another embodiment, the depression 545 may be extended laterally along the shaft 530, such that the tab may slide within the elongated depression while the blade oscillates.

FIG. 6 illustrates another embodiment of the NK. A side view of the lock mechanism is shown, wherein the depression 645 in the shaft 630 and the tab 640 in the needle 605 may be engaged.

FIG. 7 shows another embodiment of the NK. The needle 705 may contain the shaft 730. The needle may connect to the connector mechanism 725, while the shaft 730 may extend through the connector mechanism. Pins 740 may be attached to the shaft 730. In some embodiments, the pins may be screws or other fasteners to connect the shaft 730 to a mechanism for moving the shaft to deploy and/or oscillate the blade.

In some embodiments, the mechanism for moving the shaft to deploy and/or oscillate the blade may be manual. In other embodiments, the mechanism for moving the shaft to deploy and/or oscillate may be motorized. In manual embodiments, the mechanism for moving the shaft may be connected to the shaft 730 by a tight fitting glue and/or glue-like substance. In motorized embodiments, the mechanism for moving the shaft may be connected to the shaft 730 via a collet system, whereby a series of fingers may crunch down on the shaft 730 with a tightening screw.

FIG. 8 shows an embodiment of the NK with a serrated blade. In one embodiment, the blade 815 may be serrated and the blade may begin within the needle 805. The blade 815 may be deployed to extend out the end of the needle 905, as shown in FIG. 9. FIG. 10 shows an embodiment of the NK where the blade may be fully deployed out the front of the needle.

FIG. 11 shows an alternative embodiment of the NK. In this embodiment, the blade 1115 may deploy out the side of the needle 1105. The blade 1115 may be connected to a hinge 1150 around which the blade may rotate to deploy. In some implementations, there may be a split in the side of the needle 1105 to allow for deployment of the blade 1115. In one embodiment, the needle may be inserted into a patient prior to deployment of the blade.

In a side-deployment embodiment of the NK, the shaft may be replaced by two cables that may control deployment and/or oscillation of the blade. Applying tension to one of the cables may cause the blade 1115 to deploy out the side of the needle 1105. Applying tension to the other of the cables 1155 may cause the blade 1115 to retract back into the needle 1105.

FIG. 12 shows an embodiment of the side-deployment implementation of the NK. The blade 1215 may rotate

around the hinge **1250** and through the split in the side of the needle **1205**, as shown by the arrow in FIG. **12**. In some implementations, the blade **1215** may rotate back into the needle **1205**. In some embodiments, the blade **1215** may oscillate between the deployed and retracted position. The oscillation may be caused by applying tension alternatively to each of the cables **1255**.

FIG. **13** shows an alternative embodiment of the NK. The blade **1215** may deploy to an open position after entry into a patient and retract into a closed position before exit from the patient, and may remain deployed to oscillate along a portion of the length of the needle **1205**. This oscillation is shown by the arrow in FIG. **13**. In some embodiments, the blade **1315** may oscillate within the same split in the side of the needle **1305** through which the blade **1315** deploys. In alternative embodiments, the oscillation may extend through only a portion of the split. In yet another embodiment, the split may extend beyond the length of the blade **1315** to allow the blade **1315** to oscillate along a distance longer than the length of the blade **1315**. In some embodiments, this oscillation may be provided by applying alternating tension and pressure on both of the cables **1355**. The alternating tension and pressure may be applied manually or by a motor. Prior to removal of the needle **1305** from the patient, tension may be placed on one of the cables **1355** to rotate the blade around the hinge **1350** to retract the blade **1315** through the split and back into the needle **1305**.

FIGS. **14a-c** shows an alternative embodiment of the NK. FIG. **14a** shows an assembled needle knife assembly **1400**. As will be described in greater detail below, FIGS. **14b-c** show the assembled needle knife assembly in various positions. FIG. **14b** shows the blade in a neutral position (percutaneous insertion mode) with a blade disposed within a needle obturator, and a blade piston is disposed in a neutral position. FIG. **14c** see shows the blade in an oscillating cutting position, such that a needle piston spring is compressed.

FIGS. **15a-b** show an elongated needle blade **1500** having a sharpened tip **1510** and a cutting blade **1520**. In this embodiment, the cutting blade **1520** is a non-serrated blade. In this embodiment, the cutting blade **1520** has a diameter which is less than or equal to the diameter of elongated needle blade **1500**. In other embodiments, the cutting blade **1520** is serrated. In additional embodiments, the cutting blade **1520** has a diameter which is greater than the diameter of elongated needle blade **1500**.

FIGS. **16a-g** shows various diagrams illustrating a series of exploded and assembled views of an embodiment of the NK. In this embodiment, the needle housing **1610** is configured for connection to oscillating motor unit **1620**. As shown, oscillating motor unit **1620** has had its cover removed to show components therewithin. Although various oscillating motor units may be used, one such oscillating motor unit can be which can be used in Faulhaber Minimotor model LM1247-020-01, although other units may be used. In certain embodiments, the motor oscillates at 10 hertz. A needle hub obturator **1630** is configured for connection to needle housing **1610**. The needle hub obturator **1630** has a trocar, cannula or lumen through which needle blade hex fixture assembly **1640** is disposed. The blade coupling piston **1650** is connected to needle blade text fixture assembly **1640** using a blade locking collar **1660**. A blade locking collar spring **1670** is disposed to normally bias the blade in a neutral position (percutaneous insertion mode) such that the blade is normally maintained (or sheathed) within the needle obturator **1630**, until oscillating motor unit **1620** is engaged. Upon engagement, the motor unit **1620** rapidly oscillates the

needle blade **1640** to expose the knife portion of the needle blade, thereby cutting soft tissue in front of the needle knife and alongside the blade **1640**.

FIGS. **17a-h** shows various diagrams illustrating a series of exploded and assembled views of an embodiment of the NK. In this embodiment, the needle housing **1710** is configured for connection to oscillating motor unit **1720**. As shown, oscillating motor unit **1720** has had its cover removed to show components therewithin. A needle hub obturator **1730** is configured for connection to needle housing **1710**. The needle hub operator **1730** has a trocar, cannula or lumen through which a needle blade hex fixture assembly (**1740**, **1750**, **1760**, **1770**) is disposed. Needle blade **1740** is connected to a needle hex fixture **1742** using a dowel **1744**. The hex fixture **1742** fits within a blade coupling piston **1750** and is locked in place with a blade locking collar **1760**. As such, the blade coupling piston **1750** is connected to needle blade text fixture assembly (**1740**, **1750**, **1760**, **1770**) using this blade locking collar **1760**. A blade locking collar spring **1770** is disposed to normally bias the blade in a neutral position (percutaneous insertion mode) such that the blade is normally maintained (or sheathed) within the needle obturator **1730**, until oscillating motor unit **1720** is engaged. Upon engagement, the motor unit **1720** rapidly oscillates the needle blade **1740** to expose the knife portion of the needle blade, thereby cutting soft tissue in front of the needle knife and alongside the blade **1740**.

As depicted in the figures, the embodiment of FIG. **16** differs from the embodiment of FIG. **17** in that the springs **1660**, **1760** are disposed on different sides of the blade piston assembly. In each of these embodiments, the spring is used to bias said blade piston assembly to sheath the needle blade.

With reference to FIG. **18**, elongated needle blade **1800** is shown as disposed within the trocar, obturator cannula or sheath **1830**. The elongated needle blade **1800** has a leading tip **1810** and a cutting blade **1820**. As shown, FIG. **18** depicts the needle knife assembly in which the elongated needle blade **1800** is fully disposed within the obturator **1830** during insertion into (and removal from) a patient. As such, this figure shows the NK in a neutral or fully sheathed position. In one embodiment, the leading tip **1810** is disposed within the obturator **1830** prior to engagement of the oscillating motor. In another embodiment, the leading tip **1810** is flush with the end of the obturator prior to engagement of the oscillating motor.

In another embodiment (not shown), the knife portion of the needle blade is replaced by a rotating cutting burr for use in cutting nasal cartilage and/or shaving bone. The needle knife may also be used to treat cellulite and dermal scarring. In such an embodiment, a 16 gauge needle may be used to provide for an effective cutting burr element. The cutting burr is powered by a motorized unit connected to the needle housing.

In alternate embodiments, the needle trocar may be configured to receive a retractable laser or heating element (in lieu of a knife or blade) to cut soft tissue, cartilage or bone after insertion into the body. In such alternate embodiments, the needle assembly is configured to have electrical connectivity to the retractable laser or heating element. In another embodiment, the knife or blade may be configured to have a heating element disposed at or near the blade tip to assist in the cutting of soft tissue, cartilage or bone.

In order to address various issues and advance the art, the entirety of this application for the needle knife (including the Cover Page, Title, Headings, Field, Background, Summary, Brief Description of the Drawings, Detailed Description,

Claims, Abstract, Figures, Appendices, and otherwise) shows, by way of illustration, various embodiments in which the claimed innovations may be practiced. The advantages and features of the application are of a representative sample of embodiments only, and are not exhaustive and/or exclusive. They are presented only to assist in understanding and teach the claimed principles. It should be understood that they are not representative of all claimed innovations. As such, certain aspects of the disclosure have not been discussed herein. That alternate embodiments may not have been presented for a specific portion of the innovations or that further undescribed alternate embodiments may be available for a portion is not to be considered a disclaimer of those alternate embodiments. It will be appreciated that many of those undescribed embodiments incorporate the same principles of the innovations and others are equivalent. Thus, it is to be understood that other embodiments may be utilized and functional, logical, operational, organizational, structural and/or topological modifications may be made without departing from the scope and/or spirit of the disclosure. As such, all examples and/or embodiments are deemed to be non-limiting throughout this disclosure. Also, no inference should be drawn regarding those embodiments discussed herein relative to those not discussed herein other than it is as such for purposes of reducing space and repetition. For instance, it is to be understood that the logical and/or topological structure of any combination of any program components (a component collection), other components and/or any present feature sets as described in the figures and/or throughout are not limited to a fixed operating order and/or arrangement, but rather, any disclosed order is exemplary and all equivalents, regardless of order, are contemplated by the disclosure. Similarly, descriptions of embodiments disclosed throughout this disclosure, any reference to direction or orientation is merely intended for convenience of description and is not intended in any way to limit the scope of described embodiments. Relative terms such as "lower," "upper," "horizontal," "vertical," "above," "below," "up," "down," "top" and "bottom" as well as derivative thereof (e.g., "horizontally," "downwardly," "upwardly," etc.) should not be construed to limit embodiments, and instead, again, are offered for convenience of description of orientation. These relative descriptors are for convenience of description only and do not require that any embodiments be constructed or operated in a particular orientation unless explicitly indicated as such. Terms such as "attached," "affixed," "connected," "coupled," "interconnected," and similar may refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise. Furthermore, it is to be understood that such features are not limited to serial execution, but rather, any number of threads, processes, services, servers, and/or the like that may execute asynchronously, concurrently, in parallel, simultaneously, synchronously, and/or the like are contemplated by the disclosure. As such, some of these features may be mutually contradictory, in that they cannot be simultaneously present in a single embodiment. Similarly, some features are applicable to one aspect of the innovations, and inapplicable to others. In addition, the disclosure includes other innovations not presently claimed. Applicant reserves all rights in those presently unclaimed innovations including the right to claim such innovations, file additional applications, continuations, continuations in part, divisions, and/or the like thereof. As such, it should be understood that advantages, embodiments,

examples, functional, features, logical, operational, organizational, structural, topological, and/or other aspects of the disclosure are not to be considered limitations on the disclosure as defined by the claims or limitations on equivalents to the claims. While various embodiments and discussions of the NK have included discussions of home applications, however, it is to be understood that the embodiments described herein may be readily configured and/or customized for a wide variety of other applications and/or implementations.

What is claimed is:

1. A needle knife device for cutting soft tissue under skin of a patient comprising:

an elongated needle including a lumen and a beveled point configured to allow the elongated needle to be inserted transcutaneously into the skin of the patient; a blade that is capable of being oscillated within the lumen of the elongated needle between a retracted position where the blade is disposed within the needle and a deployed position where the blade is disposed outside the needle beyond the beveled point; and a motor unit operatively arranged with the blade and configured to oscillate the blade; and

wherein the motor unit is configured to oscillate the blade at a frequency that is below an ultrasonic frequency; and

wherein the motor unit is configured to oscillate the blade at a frequency from about 5 hertz to about 15 hertz.

2. The needle knife device of claim 1, wherein the elongated needle is a maximum size of 16-gauge.

3. The needle knife device of claim 2, wherein the elongated needle is an 18-gauge needle.

4. The needle knife device of claim 1, wherein the blade is configured to be selectively coupled with the motor unit whereby the blade and elongated needle are capable of being decoupled from the motor unit.

5. The needle knife device of claim 1, further comprising a spring operatively arranged with the blade and configured to bias the blade into the retracted position.

6. A needle knife instrument for cutting soft tissue under skin of a patient comprising:

an elongated needle having a lumen and including a beveled point at a leading portion of the elongated needle, the leading portion of the needle capable of cutting through soft tissue after insertion of the leading portion into the patient;

a blade sheathed within the lumen of the elongated needle and capable of moving between a retracted position where the blade is disposed within the needle and a deployed position where the blade is disposed outside the needle beyond the beveled point, the blade being capable of cutting soft tissue adjacent the elongated needle while the blade is disposed outside the needle beyond the beveled point; and

a motor unit operatively arranged with the blade and configured to oscillate the blade to cut soft tissue; wherein the blade is configured to be sheathed within the elongated needle in the retracted position upon initial insertion of the elongated blade into the skin of the patient and during a subsequent withdrawal of the elongated needle from the patient; and

wherein the motor unit is configured to oscillate the blade at a frequency that is below an ultrasonic frequency; and

wherein the motor unit is configured to oscillate the blade at a frequency from about 5 hertz to about 15 hertz.

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7. The needle knife instrument of claim 6, further wherein the blade is configured to be disposed outside the needle beyond the beveled point in the deployed position thereby allowing soft tissue adjacent the elongated needle to be cut.

8. The needle knife instrument of claim 6, wherein the elongated needle is a maximum size of 16-gauge. 5

9. The needle knife instrument of claim 8, wherein the elongated needle is an 18-gauge needle.

10. The needle knife instrument of claim 6, wherein the blade is configured to be selectively coupled with the motor unit whereby the blade and elongated needle are capable of being decoupled from the motor unit. 10

11. The needle knife instrument of claim 6, further comprising a spring operatively arranged with the blade and configured to bias the blade into the retracted position. 15

12. A needle knife instrument for cutting muscle under skin of a patient comprising:

an elongated needle having a maximum size of 16-gauge, the elongated needle including a lumen and a beveled point capable of being inserted transcutaneously into the skin of the patient; 20

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a blade that is capable of being oscillated within the lumen of the elongated needle; and

a motor unit operatively arranged with the blade and configured to oscillate the blade to a deployed position where the blade is disposed outside the needle beyond the beveled point thereby allowing the muscle to be cut; wherein the motor unit is configured to oscillate the blade at non-ultrasonic frequencies; and wherein the motor unit is configured to oscillate the blade at a frequency from about 5 hertz to about 15 hertz.

13. The needle knife instrument of claim 12, wherein the blade is configured to be selectively coupled with the motor unit whereby the blade and elongated needle are capable of being decoupled from the motor unit.

14. The needle knife instrument of claim 12, further comprising a spring operatively arranged with the blade and configured to bias the blade into a retracted position where the blade is disposed within the needle.

15. The needle knife instrument of claim 12, wherein the elongated needle is an 18-gauge needle.

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摘要(译)

提供了一种用于在患者的皮肤下切割软组织的针刀装置和系统。针刀可包括细长针，该细长针包括管腔和被构造成允许细长针经皮插入患者皮肤的斜角。针刀还可以包括刀片，该刀片能够在细长的针的内腔中在刀片被布置在针内的缩回位置和刀片被布置在针的外部超过倾斜点的展开位置之间摆动。马达单元可以与叶片可操作地布置并且构造成使叶片振动。

