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(54) **ARTHROSCOPIC RESECTION DEVICES**

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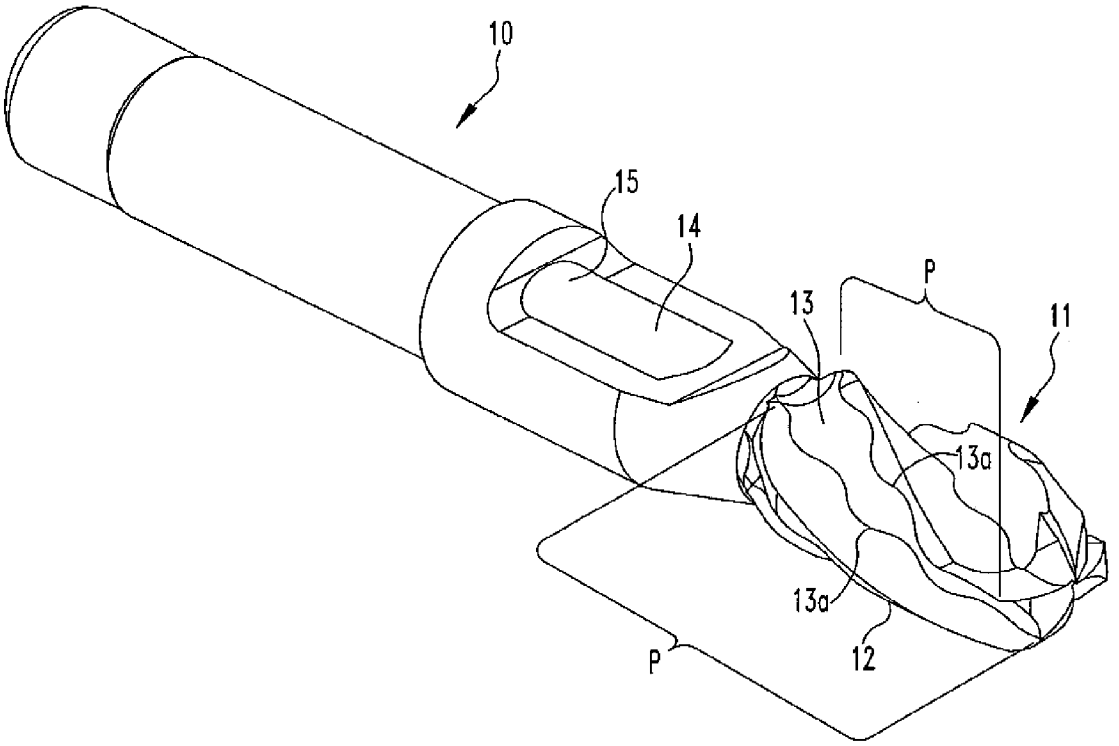
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(57) **ABSTRACT**

The present disclosure relates to a resection device. The resection device includes an outer tubular member; and an inner tubular member disposed within the outer tubular member, the inner tubular member including a burr having a body with flutes extending along a length of the body, the flutes including parabolic wave patterns located along surface edges of the flutes. In an embodiment, the parabolic wave patterns extend along entire lengths of the flutes. Other resection devices are also disclosed.



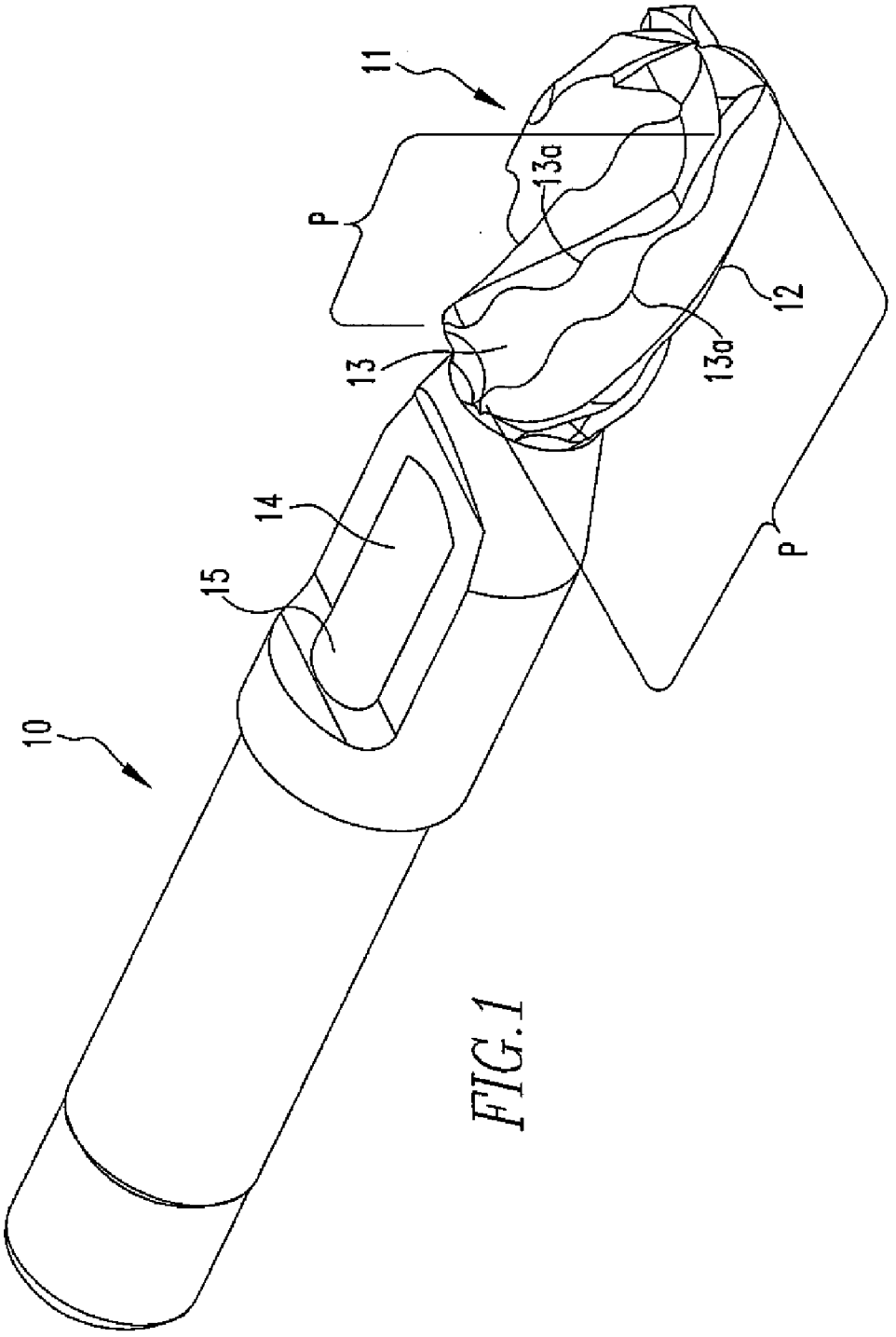


FIG. 1

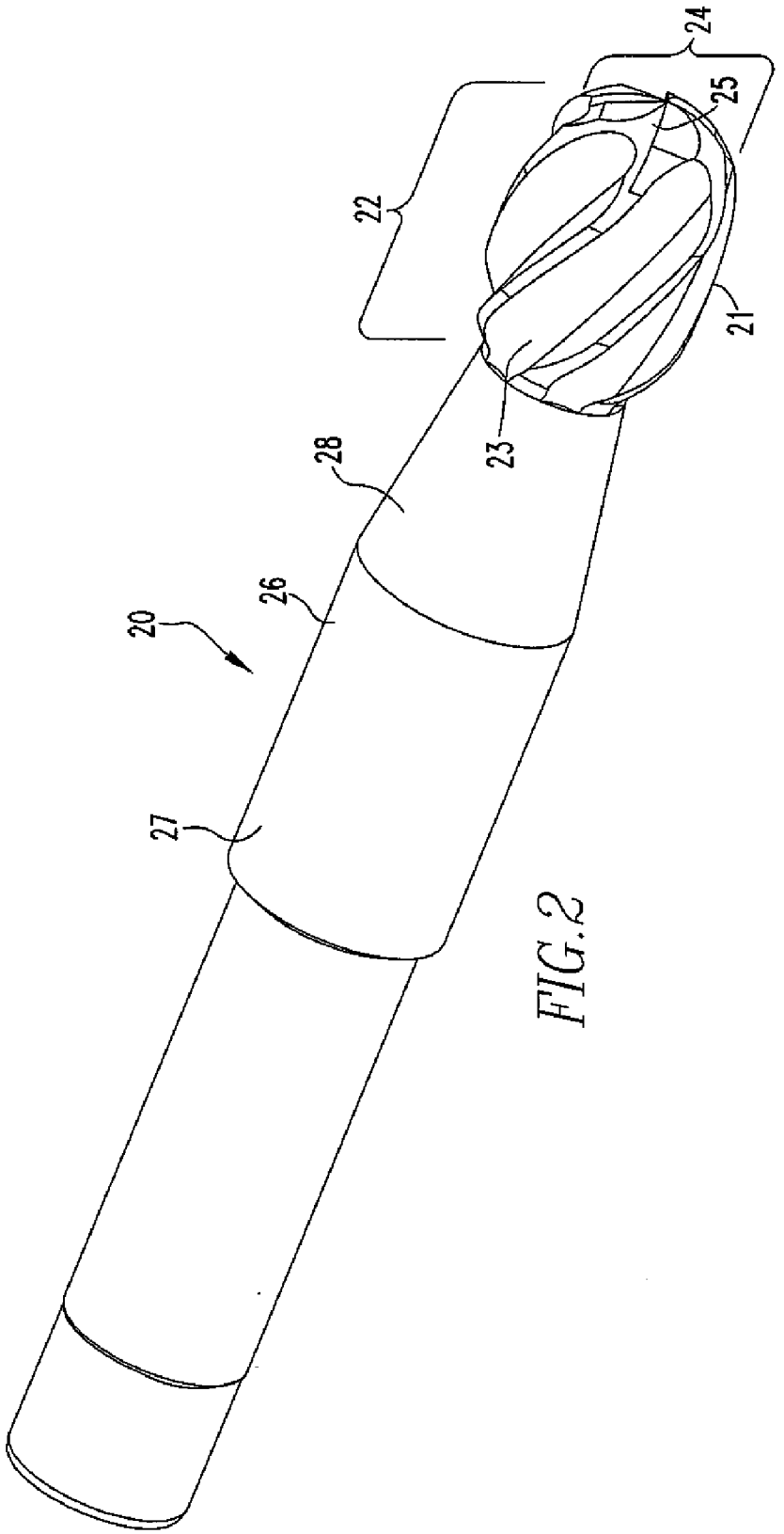


FIG.2

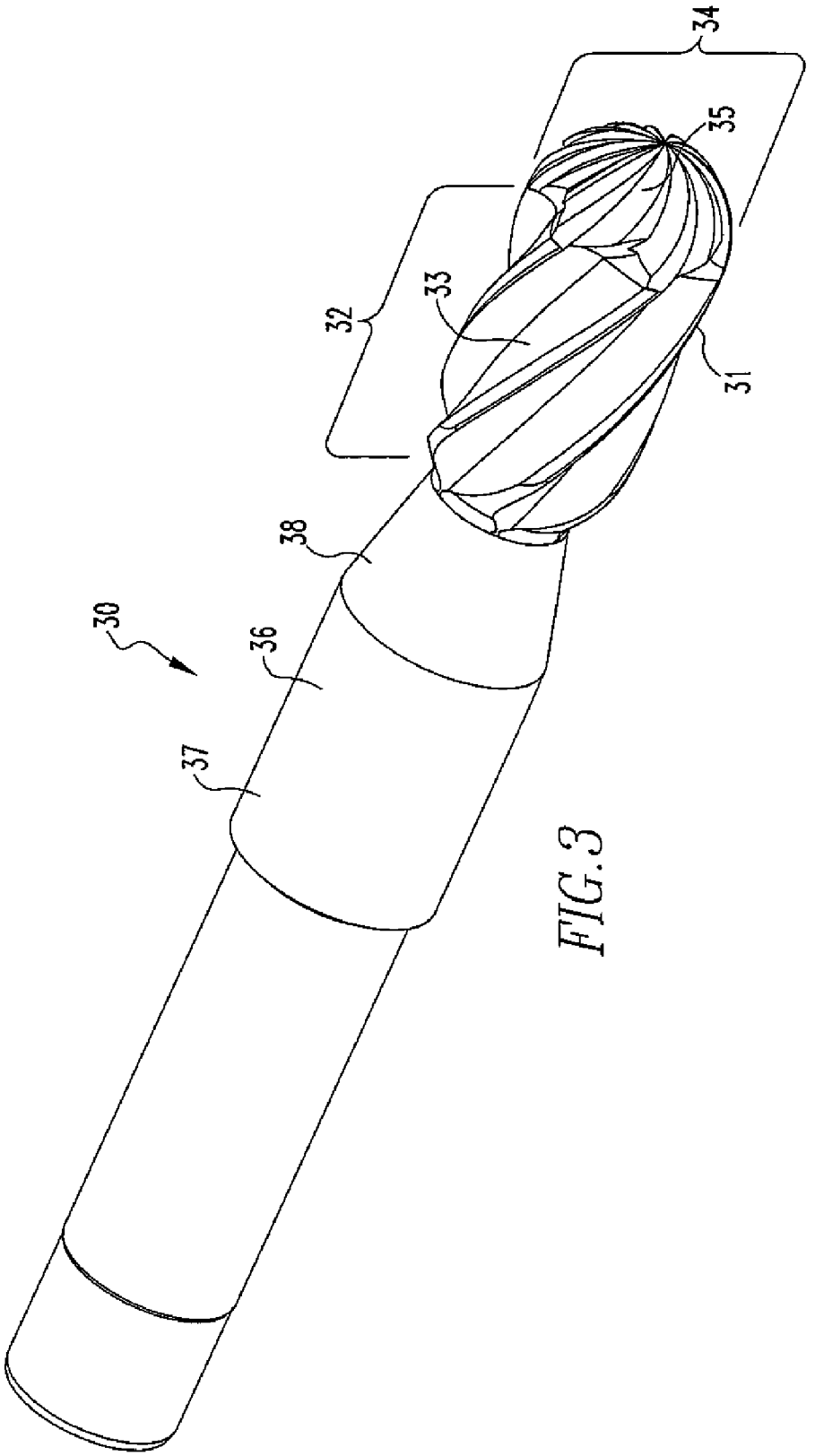


FIG. 3

ARTHROSCOPIC RESECTION DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Patent Application No. 61/316,860 and U.S. Patent Application No. 61/443,301, the disclosures of which are incorporated herein in their entireties.

BACKGROUND

[0002] 1. Field of Technology

[0003] The present disclosure relates to arthroscopic resection devices for resection of tissue.

[0004] 2. Related Art

[0005] Arthroscopic resection devices have been used in performing closed surgery, such as endoscopic surgery, i.e. arthroscopic surgery. Generally, these devices include, without limitation, blade devices and burr devices. Both the blade and burr devices include an elongate outer tubular member terminating at a distal end having an opening in the side wall and/or the end wall to form a cutting port or window. Both devices also include an elongate inner tubular member coaxially disposed in the outer tubular member and having a distal end disposed adjacent the port/window in the distal end of the outer tubular member. The distal end of the inner tubular member of the blade device has a surface or edge for engaging tissue via the port/window in the distal end of the outer tubular member and in many cases cooperates with the port/window to shear or cut tissue. Alternatively, the distal end of the inner tubular member of the of the burr device has a burr having helical grooved surfaces or flutes for drilling and grinding tissue via the port/window in the distal end of the outer tubular member and in many cases cooperates with the port/window to shear or cut tissue. The inner tubular members are rotatably driven at their proximal ends, normally via a hand piece having a small electric motor therein controlled by finger-actuated switches on the hand piece. A foot switch or switches on a console supply power to the hand piece.

[0006] The helical flutes of the burr tend to not have any additional distinguishing geometrical features designed to enhance performance. They typically have smooth, non-serrated cutting edges and follow the design of end mills or drills. Additionally, the burrs tend to have the same number of flutes along the entire body of the burr. The surfaces or edges of the blade device inner member typically have straight cutting edges.

[0007] The characteristics of these cutting features result in a less aggressive cutting action, thereby resecting the tissue or bone into larger fragments that increase the chances of the device becoming clogged, as well as cloud the image a surgeon has inside the surgical area. Additionally, these characteristics increase the possibility of the device displaying unpleasant harmonics or resonance during use. Furthermore, having the same number of flutes along the body of the burr allows for only one style of cutting, thereby providing the burr device with less versatility. Therefore, arthroscopic resection devices that alleviate these limitations are needed.

SUMMARY

[0008] In an aspect, the present disclosure relates to a resection device. The resection device includes an outer tubular member; and an inner tubular member disposed within the outer tubular member, the inner tubular member including a burr having a body with flutes extending along a length of the body, the flutes including parabolic wave patterns located along surface edges of the flutes. In an embodiment, the parabolic wave patterns extend along entire lengths of the flutes.

[0009] In another aspect, the present disclosure relates to a resection device. The resection device includes an outer tubular member; and an inner tubular member disposed within the outer tubular member, the inner tubular member including a burr having a body with flutes extending along a length of the body and a tip with flutes, wherein the tip and the body include a different number of flutes. In an embodiment, the body has a higher number of flutes than the tip. In another embodiment, the body has a lower number of flutes than the tip.

[0010] In yet another embodiment, the flutes on either the body or the tip include parabolic wave patterns located along surface edges of the flutes. In a further embodiment, the device further includes a transition piece located between the inner tubular member and the burr, the transition piece including a proximal portion and a tapered distal portion. In yet a further embodiment, the device further includes an opening located between the inner tubular member and the burr. In an embodiment, the opening leads to a passageway, the passageway extending along a length of the inner tubular member.

[0011] In yet another aspect, the present disclosure relates to a resection device. The resection device includes an outer tubular member; and an inner tubular member disposed within the outer tubular member, the inner tubular member including a burr having a body with flutes extending along a length of the body and a tip with flutes, wherein the tip and the body include a different number of flutes, the flutes on either the body or the tip including parabolic wave patterns located along surface edges of the flutes.

[0012] Further areas of applicability of the present disclosure will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the disclosure, are intended for purposes of illustration only and are not intended to limit the scope of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The accompanying drawings, which are incorporated in and form a part of the specification, illustrate the embodiments of the present disclosure and together with the written description serve to explain the principles, characteristics, and features of the disclosure. In the drawings:

[0014] FIG. **1** shows a first embodiment of an inner tubular member of the present disclosure.

[0015] FIG. **2** shows a second embodiment of an inner tubular member of the present disclosure.

[0016] FIG. **3** shows a third embodiment of an inner tubular member of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0017] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the disclosure, its application, or uses.

[0018] FIGS. **1-3** show inner tubular members for use with burr devices and, specifically, the distal ends of the members. FIG. **1** shows an inner tubular member **10** including a burr **11**

having a body **12** with helical flutes **13** extending along the length of the body **12**. The surface edges **13***a* of the flutes **13** incorporate parabolic wave patterns P along the entire lengths of the flutes **13**. The burr **11** may have any number of flutes **13** and the flutes **13** may be located at any angle relative to a longitudinal axis passing through the burr **11**. Additionally, the flutes **13** may incorporate a pattern having an alternate geometry that may not be truly parabolic, but has the cutting characteristics of the parabolic wave pattern.

[0019] Located proximal to the burr **11** and between the inner tubular member **10** and the burr **11** is an opening **14** to a passageway **15** extending the length of the inner tubular member **10**. The passageway **15** allows for the flow of fragmented tissue and bone during surgery. A vacuum (not shown) is attached to a proximal end (not shown) of the member **10** for vacuuming the tissue through the passageway **15**.

[0020] The parabolic wave patterns P on the flutes **13** provide the burr **11** with a more aggressive cutting action, especially when used in cutting bone, which causes the burr **11** to cut the bone into smaller fragments. Having smaller bone fragments allows the fragments to be removed more readily by the vacuum, thereby reducing the possibility of clogging and obscuring the visual image of the surgical area. Additionally, the parabolic wave pattern P deliberately creates inconsistencies in the burr geometry, thereby lessening any unpleasant harmonics or resonance of the burr device. This lessening, coupled with the fact the pattern P yields constant acceleration, provides the device with smoother cutting performance and controllability.

[0021] FIG. **2** shows another inner tubular member **20** including a burr **21** having a body **22** with helical flutes **23** extending along the length of the body **22** and a tip **24** also having helical flutes **25**. The tip **24** has a lower number of flutes **25** than the body **22**. Having a lower number of flutes **25** on the tip **24** makes the tip **24** cut more aggressively than the body **22** because the individual cutting area of each flute **25** is more. FIG. **3** shows yet another inner tubular member **30** including a burr **31** having a body **32** with helical flutes **33** extending along the length of the body **32** and a tip **34** with helical flutes **35**. Unlike member **20**, the tip **34** of burr **31** has a higher number of flutes **35** than the body **32**. Having a higher number of flutes **35** on the tip **34** makes the tip **34** cut less aggressively than the body **32** because the individual cutting area of each flute **35** is less.

[0022] Having a transitional fluted burr with a different number of flutes on the tip than on the body provides more versatility to the user. The ability to perform different cutting techniques with one burr is more efficient than using two different devices. Additionally, it is more cost effective to use this type of burr due to only one burr having to be inventoried and utilized.

[0023] Any different number combination of flutes may be used on the burrs **21**,**31** and the flutes **23**,**25**,**33**,**35** may be located at any angle relative to a longitudinal axis passing through the burr **21**,**31**. Additionally, it is within the scope of this disclosure to have parabolic wave patterns along the lengths of any of the flutes **23**,**25**,**33**.**35**, similar to the wave patterns P on flutes **13**. The patterns may be located on the surface edges of the flutes **23**,**25**,**33**,**35** and along the entire length or along a partial length of the flutes **23**,**25**,**33**,**35**. Furthermore, it is within the scope of this disclosure to have an alternating number of flutes having the wave patterns. Even further, the flutes **23**,**25**,**33**,**35** may incorporate a pattern having an alternate geometry that may not be truly parabolic, but has the cutting characteristics of the parabolic wave pattern.

[0024] Both burrs **21**,**31** are coupled to transition pieces **26**,**36** located between the inner tubular members **20**,**30** and the burrs **21**,**31**. The transition pieces **26**,**36** include proximal portions **27**,**37** and tapered distal portions **28**,**38**. In use, all of the members **10**,**20**,**30** would be disposed within an outer tubular member, as discussed above.

[0025] The inner tubular members **10**,**20**,**30** and their components are made from metal material. However, other material strong enough to withstand the forces of a tissue cutting action may be used. The flutes, parabolic wave patterns on the flutes, and opening are made via a machining process or other process known to those of skill in the art.

[0026] As various modifications could be made to the exemplary embodiments, as described above with reference to the corresponding illustrations, without departing from the scope of the disclosure, it is intended that all matter contained in the foregoing description and shown in the accompanying drawings shall be interpreted as illustrative rather than limiting. Thus, the breadth and scope of the present disclosure should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims appended hereto and their equivalents.

What is claimed is:

1. A resection device comprising:
an outer tubular member; and
an inner tubular member disposed within the outer tubular member, the inner tubular member including a burr having a body with flutes extending along a length of the body, the flutes including parabolic wave patterns located along surface edges of the flutes.

2. The resection device of claim **1** wherein the parabolic wave patterns extend along entire lengths of the flutes.

3. A resection device comprising:
an outer tubular member; and
an inner tubular member disposed within the outer tubular member, the inner tubular member including a burr having a body with flutes extending along a length of the body and a tip with flutes, wherein the tip and the body include a different number of flutes.

4. The resection device of claim **3** wherein the body has a higher number of flutes than the tip.

5. The resection device of claim **3** wherein the body has a lower number of flutes than the tip.

6. The resection device of claim **3** wherein flutes on either the body or the tip include parabolic wave patterns located along surface edges of the flutes.

7. The resection device of claim **3** wherein the device further includes a transition piece located between the inner tubular member and the burr, the transition piece including a proximal portion and a tapered distal portion.

8. The resection device of claim **1** wherein the device further includes an opening located between the inner tubular member and the burr.

9. The resection device of claim **8** wherein the opening leads to a passageway, the passageway extending along a length of the inner tubular member.

10. A resection device comprising:
an outer tubular member; and
an inner tubular member disposed within the outer tubular member, the inner tubular member including a burr having a body with flutes extending along a length of the body and a tip with flutes, wherein the tip and the body include a different number of flutes, the flutes on either the body or the tip including parabolic wave patterns located along surface edges of the flutes.

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