CLAIMS

1. An apparatus for sterilizing a surgical scoping device, the apparatus comprising:

a sterilization instrument insertable through a longitudinal channel that extends along an insertion tube of a surgical scoping device, the sterilization instrument comprising:

an elongate probe comprising a coaxial cable for conveying radiofrequency (RF) electromagnetic (EM) energy and/or microwave EM energy,

a probe tip connected at the distal end of the coaxial cable for receiving the RF and/or microwave energy, and

a gas conduit for conveying gas to the probe tip;

wherein the elongate probe comprises a protective sleeve that defines a lumen through which the coaxial cable extends, and wherein the gas conduit is an annular passageway formed between an outer surface of the coaxial cable and an inner surface of the protective sleeve,

wherein the coaxial cable comprises an inner conductor, an outer conductor and a dielectric material separating the inner conductor from the outer conductor,

wherein the probe tip comprises a first electrode connected to the inner conductor of the coaxial cable, and a second electrode connected to the outer conductor of the coaxial cable,

wherein the second electrode encloses an internal volume of the probe tip, wherein the first electrode extends longitudinally within the internal volume,

wherein the probe tip further comprises an insulating cap mounted at a distal end of the coaxial cable to isolate the coaxial cable from the internal volume,

wherein the gas conduit is in fluid communication with the internal volume via a flow path formed between the insulating cap and the second electrode,

wherein the first electrode and second electrode are configured to receive the RF and/or microwave energy from the coaxial cable to set up an electric field in the internal volume for striking a plasma therein, ~~and~~

wherein the probe tip includes an outlet for releasing plasma from the internal volume~~.~~

~~2. The apparatus of claim 1~~,

wherein the insulating cap is mounted within the second electrode,

wherein the second electrode is a cylinder that sits within the annular passageway of the gas conduit at its distal end, and

wherein the second electrode is castellated to provide ~~flow path comprises~~ a plurality of longitudinal notches in the cylinder ~~openings in the second electrode~~ that provide the flow path to permit gas flow around the insulating cap.

~~3~~2. ~~The apparatus of claim 2~~1~~, wherein the second electrode is a cylinder, and the plurality of openings each comprise a longitudinal notch in the cylinder.~~

~~4~~3. ~~The apparatus of claim 3~~2~~, wherein a proximal end of the second electrode is castellated to provide the plurality of openings.~~

~~5~~2. The apparatus of ~~any of~~ claim~~s~~ 1~~ to 4~~ including a liquid conduit for delivering water to the internal volume.

~~6~~3. The apparatus of claim ~~5~~2, wherein the liquid conduit is a hollow passage through the inner conductor of the coaxial cable.

~~7~~4. The apparatus of claim ~~5~~ 2 or 3~~6~~, wherein the liquid conduit is configured to deliver water mist into the internal volume.

~~8. The apparatus of any preceding claim, wherein the elongate probe comprises a protective sleeve that defines a lumen through which the coaxial cable extends, and wherein the gas conduit is a passageway formed between an outer surface of the coaxial cable and an inner surface of the protective sleeve.~~

~~9~~5. The apparatus of any preceding claim, wherein the probe tip comprises a conductive cap mounted on the first electrode at a distal end of the internal volume, the conductive cap being spaced from a distal end of the second electrode to define the outlet.

~~10~~6. The apparatus of any preceding claim, wherein the first electrode is helical.

~~11~~7. The apparatus of any preceding claim, wherein the first electrode is formed from a portion of the inner conductor of the coaxial cable that extends beyond a distal end of the outer conductor.

~~12~~8. The apparatus of any preceding claim, wherein the insulating cap has a chamfered distal edge.

~~13~~9. The apparatus of any preceding claim further comprising a withdrawal device mounted on the elongate probe and configured to retract the elongate probe therethrough.

~~14~~10. The apparatus of claim ~~13~~9, wherein the withdrawal device comprises a motor drivable to retract the elongate probe at a speed less than 10 mm per second.

~~15~~11. The apparatus of any preceding claim, wherein the probe tip further comprises a cleaning brush mounted at a distal end thereof.

~~16~~12. The apparatus of any preceding claim further comprising a vibration excitation device configured to impart ultrasonic vibrations to the elongate probe and/or the probe tip.

~~17~~13. The apparatus of claim ~~16~~12, wherein the vibration excitation device is mounted on the elongate probe.

~~18. An apparatus for sterilizing a surgical scoping device, the apparatus comprising:~~

~~a housing that defines an enclosure for receiving a surgical scoping device;~~

~~a plasma applicator mounted in the housing, the plasma applicator comprising a plasma generating region and an outlet for directing generated plasma out of the plasma generating region into the enclosure;~~

~~a power generator connected to deliver RF and/or microwave EM energy to the plasma applicator;~~

~~a gas supply connected to deliver gas to the plasma applicator.~~

~~19. The apparatus of claim 18, wherein the housing includes a turnable for rotating the surgical scoping device within the enclosure.~~

~~20. The apparatus of claim 18 or 19 including a liquid supply for delivering water into the enclosure.~~

~~21. The apparatus of claim 20, wherein the liquid conduit is configured to deliver water mist into the enclosure.~~

~~22. The apparatus of claim 20 or 21, wherein the liquid conduit is arranged to deliver water into the plasma generating region of the plasma applicator.~~

~~23. The apparatus of any one of claims 18 to 22, wherein the housing comprises a panel that defines a surface of the enclosure, wherein the panel has an array of plasma applicators mounted therein.~~

~~24. The apparatus of any one of claims 18 to 23, wherein the enclosure comprises a body portion for receiving a body of the surgical scoping device, and an annular region for receiving an insertion tube of the surgical scoping device.~~

~~25. The apparatus of claim 24, wherein the annular region comprises an annular plasma generator configured to move relative to the insertion tube of the surgical scoping device.~~

~~26. The apparatus of claim 25, wherein the annular plasma generator is mounted on a treatment bed that is movable~~

relative to the body portion along the length of the insertion tube of the surgical scoping device.

27. The apparatus of claim 26, wherein the treatment bed comprises a conveyor belt.

28. The apparatus of any one of claims 18 to 26 further comprising an apparatus according to any one of claims 1 to 17 for sterilizing inside a channel extending through the insertion tube of the surgical scoping device.

29. An apparatus for sterilizing a surgical scoping device, the apparatus comprising:

a housing that defines a recess for receiving a distal end of an insertion tube of a surgical scoping device;

a brush mounted in the recess to contact the distal end of the insertion tube;

a drive element operably connected to the brush to cause relative motion of the brush within the housing.

30. The apparatus of claim 29 further comprising:

a plasma applicator mounted in the housing, the plasma applicator comprising a plasma generating region and an outlet for directing generated plasma out of the plasma generating region into the recess.

31. The apparatus of claim 30 further comprising:

a power generator connected to deliver RF and/or microwave EM energy to the plasma applicator;

a gas supply connected to deliver gas to the plasma applicator.

32. The apparatus of claim 30 or 31 including a liquid supply for delivering water into the enclosure.