CLAIMS

1. An electrosurgical cutting tool having:

a first blade and a second blade, joined at a pivot point, with the first blade being a planar body made of a first dielectric material separating a first conductive element on a first surface thereof from a second conductive element on a second surface thereof, the second surface facing in the opposite direction to the first surface;

actuation means for causing relative rotation between the first and second blades about the pivot point to cause a gap between the first blade and second blade to change between an open position and a closed position, the relative rotation being substantially in the plane of the blades;

a coaxial transmission line for delivering RF energy and microwave energy to the first blade, the coaxial transmission line having an inner conductor and an outer conductor separated by a second dielectric material,

wherein:

the inner conductor and the outer conductor are each connected to one of the first conductive element and the second conductive element of the first blade;

the first conductive element and the second conductive element of the first blade are able to act as active and return electrodes for sustaining an RF electric field therebetween, the RF electric field corresponding to RF energy delivered to the first blade by the coaxial transmission line; and

the first conductive element and the second conductive element of the first blade are able also to act as an antenna structure for radiating a microwave electromagnetic (EM) field corresponding to microwave energy delivered to the first blade by the coaxial transmission line.

2. An electrosurgical cutting tool according to claim 1, wherein the second blade comprising a planar body made of a first dielectric material separating a first conductive element on a first surface thereof from a second conductive element on a second surface thereof, the second surface facing in the opposite direction to the first surface,

wherein:

the coaxial transmission line is arranged to deliver RF energy and microwave energy to the second blade;

the inner conductor and the outer conductor are each connected to one of the first conductive element and the second conductive element of the second blade;

the first conductive element and the second conductive element of the second blade are able to act as active and return electrodes for sustaining an RF electric field therebetween, the RF electric field corresponding to RF energy delivered to the second blade by the coaxial transmission line; and

the first conductive element and the second conductive element of the second blade are able also to act as an antenna structure for radiating a microwave electromagnetic (EM) field corresponding to microwave energy delivered to the second blade by the coaxial transmission line.

3. An electrosurgical cutting tool according to claim 2, wherein the first conductive element and second conductive element are exposed on faces of the first blade and second blade that oppose each other across the gap.

4. An electrosurgical cutting tool according to claim 3, wherein faces of the first blade and second blade that are opposed across the gap are curved.

5. An electrosurgical cutting tool according to claim 3 or 4, wherein faces of the first blade and second blade that are opposed across the gap are oriented perpendicularly to the plane of the blade.

6. An electrosurgical cutting tool according to any one of claims 2 to 5, wherein:

the inner conductor of the coaxial transmission line is electrically connected to the first conductive element of the first blade and to the second conductive element of the second blade, and

the outer conductive of the coaxial transmission line is electrically connected to the second conductive element of the first blade and the first conductive element of the second blade.

7. An electrosurgical cutting tool according to any one of claims 2 to 5, wherein:

the inner conductor of the coaxial transmission line is electrically connected to the first conductive element of the first blade and to the first conductive element of the second blade, and

the outer conductive of the coaxial transmission line is electrically connected to the second conductive element of the first blade and the second conductive element of the second blade.

8. An electrosurgical cutting tool according to any one of claims 2 to 7, wherein during movement from the open position to the closed position, the first surfaces of each blade slide past each other.

9. An electrosurgical cutting tool according to any one of claims 2 to 7, wherein, in the closed position, the faces of the first blade and second blade that oppose each other across the gap are parallel.

10. An electrosurgical cutting tool according to any preceding claim, wherein the first and second conductive elements are formed from one or more layers of metallization on the first surface and second surface.

11. An electrosurgical cutting tool according to any preceding claim, wherein the thickness of the first dielectric material is equal to or less than 1 mm.

12. An electrosurgical cutting tool according to any preceding claim, wherein, when in the closed position, the tool has an maximum outer diameter equal to or less than 5 mm.

13. An electrosurgical cutting tool according to any preceding claim wherein the inner conductor of the coaxial transmission line is hollow, and defines a channel running therethrough.

14. An electrosurgical cutting tool according to any preceding claim, wherein the actuation means comprises an actuation element that is movable relative to the pivot point.

15. An electrosurgical cutting tool according to claim 14, wherein the actuation element includes a push rod that is operably connected to the first blade and/or the second blade.

16. An electrosurgical cutting tool according to any preceding claim, wherein the actuation means includes a cam arrangement.

17. An electrosurgical cutting tool according to claim 16, wherein the cam arrangement comprises:

a push rod mounted to slide longitudinally with respect to the pivot point, and

a guide path formed on the first blade,

wherein the push rod is operably engaged with the guide path, and

wherein the guide path is offset from the longitudinal direction, whereby longitudinal movement of the push rod relative to the pivot point causes the first blade to pivot with respect to the pivot point.

18. An electrosurgical cutting tool according to claim 17, wherein the guide path is a linear track extending in a direction that is offset from the pivot point.

19. An electrosurgical cutting tool according to claim 18, wherein the push rod comprises a follower mounted in an constrained to lie on the linear track.

20. An electrosurgical cutting tool according to any one of claims 17 to 19, wherein the push rod is slidably mounted on the coaxial transmission line.

21. An electrosurgical cutting tool according to claim 15, wherein the actuation means comprises a linkage having a proximal end pivotably connected to the push rod and a distal end pivotably connected to the first blade at a location

offset from the pivot point.

22. An electrosurgical cutting tool according to claim 15, wherein the push rod comprises a wire having a preformed curved distal portion that is rigidly secured to the first blade.

23. An electrosurgical cutting tool according to any preceding claim including a biasing means arranged to urge the first blade and the second blade towards the open position.

24. An electrosurgical cutting tool according to any preceding claim, wherein the actuation means includes a collar that is slidably mounted with respect to the first blade and second blade, the collar being movable between a first position in which it encloses the blades to hold them in the closed position, and a second position in which the blade are exposed to permit them to be opened.

25. An electrosurgical cutting tool according to any preceding claim, wherein the blades are mounted in a clevis structure which is located at the distal end of the cutting tool, the clevis structure comprising a base for attaching to the coaxial transmission line, and a housing that defines a longitudinal recess for receiving the first blade and second blade.

26. An electrosurgical cutting tool according to claim 25, wherein the clevis structure comprises an axle that traverses the recess, and wherein the first blade and the second blade are rotatably mounted on the axle.

27. An electrosurgical cutting tool according to claim 26, wherein the electrical connections between the inner conductor and outer conductor of the coaxial transmission line and the first conductive element and second conductive element on each of the first blade and the second blade are made via the axle.

28. An electrosurgical cutting tool having:
a first blade and a second blade joined at a pivot point,

each blade being a planar body made of a first dielectric material separating a first conductive element on a first surface from a second conductive element on a second surface, the second surface facing in the opposite direction to the first surface;

actuation means for causing relative rotation between the first and second blades about the pivot point, between and open position and a closed position, the relative rotation being substantially in the plane of the blades;

a first coaxial transmission line having a first inner conductor and a first outer conductor separated by a second dielectric material, the first coaxial transmission line arranged to deliver RF and microwave frequency signals for the first blade, wherein the first inner conductor and the first outer conductor are respectively connected to the first conductive element and the second conductive element of the first blade,

a second coaxial transmission line having a second inner conductor and a second outer conductor separated by a third dielectric material, the second coaxial transmission line arranged to deliver RF and microwave frequency signals to the second blade, wherein the second inner conductor and the second outer conductor are respectively connected to the first conductive element and the second conductive element of the second blade, and

wherein:

the first conductive element and the second conductive element of each blade are able to act as active and return electrodes for sustaining an RF electric field therebetween, the RF electric field corresponding to the RF signal delivered to the first and second blades by the first and second coaxial transmission lines respectively, and

the first conductive element and the second conductive element are able also to act as an antenna structure for radiating a microwave frequency EM field corresponding to the microwave signal delivered to the first blade and the second blade by the first and second coaxial transmission lines respectively.

29. An electrosurgical apparatus including:

an electrosurgical generator arranged to output RF energy and microwave energy;

an electrosurgical cutting tool according to any one of the previous claims connected to receive RF energy and microwave energy from the electrosurgical generator.

30. An electrosurgical apparatus according to claim 29 including a signal alternator arranged to alternately switch RF energy or microwave energy from the electrosurgical generator between the first blade and the second blade.

31. An electrosurgical apparatus according to claim 30, wherein a signal alternator comprises any one of a co-axial switch, PIN diode, and varactor diode power switch.