CLAIMS

1. A microwave antenna apparatus for use in radiating microwave energy into surface tissue of a uterine cervix, the microwave antenna apparatus comprising:

an electrically conductive ground element defining an aperture;

an electrically conductive elongated element extending through the aperture and terminating at a distal end; and

one or more dielectric elements,

wherein one or more of the dielectric elements electrically insulate the elongated element and the ground element from one another; and

wherein the one or more dielectric elements:

define a central distal feature for centring the microwave antenna apparatus with respect to an axis of a cervical os of the uterine cervix; and

define a cupping feature for cupping a proximal ectocervix region of the uterine cervix and preventing excessive insertion of the central distal feature into the cervical os of the uterine cervix.

2. The microwave antenna apparatus as claimed in claim 1, wherein the ground element and the elongated element ~~may be~~are co-axial.

3. The microwave antenna apparatus as claimed in claim 1 or 2, wherein one or more of the dielectric elements define an outer surface for engagement with a surface of the uterine cervix.

4. The microwave antenna apparatus as claimed in any preceding claim, wherein one or more of the dielectric elements cover the distal end of the elongated element and/or wherein one or more of the dielectric elements cover a distal portion of the elongated element.

5. The microwave antenna apparatus as claimed in any preceding claim, wherein the elongated element extends axially beyond the ground element by a predetermined length.

6. The microwave antenna apparatus as claimed in claim ~~5~~4, wherein one or more of the dielectric elements cover a proportion of the predetermined length of the

elongated element or one or more of the dielectric elements cover the whole of the predetermined length of the elongated element.

7. The microwave antenna apparatus as claimed in any preceding claim, wherein one or more of the dielectric elements are configured so as to prevent the elongated element from coming into contact with the surface of the uterine cervix when the microwave antenna apparatus is in use.

8. The microwave antenna apparatus as claimed in any preceding claim, wherein one or more of the dielectric elements are configured to separate the ground element and/or the elongated element from the tissue of the surface of the uterine cervix by a desired predetermined distance, for example wherein one or more of the dielectric elements have a desired predetermined thickness.

9. The microwave antenna apparatus as claimed in any preceding claim, wherein the one or more dielectric elements fill the aperture defined by the ground element.

~~10. The microwave antenna apparatus as claimed in any preceding claim, wherein the one or more dielectric elements define a central distal feature for centring the antenna with respect to an axis of a cervical os of the uterine cervix.~~

~~11~~10. The microwave antenna apparatus as claimed in any preceding claim ~~10~~, wherein the central distal feature is configured for radiating microwave energy into a proximal section of the cervical os.

~~12. The microwave antenna apparatus as claimed in claim 10 or 11, wherein the one or more dielectric elements define a cupping feature for cupping a proximal ectocervix region of the uterine cervix and preventing excessive insertion of the central distal feature into the cervical os of the uterine cervix.~~

~~13~~11. The microwave antenna apparatus as claimed in any preceding claim, wherein one or more of the dielectric elements cover at least part of the ground element.

~~14~~12. The microwave antenna apparatus as claimed in any preceding claim, wherein one or more of the dielectric elements cover at least part of a distal surface of the ground element.

~~15~~13. The microwave antenna apparatus as claimed in any preceding claim, wherein the microwave antenna apparatus defines an axis and the microwave antenna apparatus is cylindrically symmetrical about the axis.

~~16~~14. The microwave antenna apparatus as claimed in claim ~~15~~13, wherein the elongated element is rod-like, cylindrical and/or conical.

~~17~~15. The microwave antenna apparatus as claimed in claim ~~15~~ 13 or ~~16~~14, wherein a radial extent of the ground element may be more than or less than a radial extent of the one or more dielectric elements by a predetermined radial offset.

~~18~~16. The microwave antenna apparatus as claimed in any one of claims ~~15~~ 13 to ~~17~~15, wherein at least one of:

the ground element is annular or generally annular;

the ground element is planar or generally planar;

the ground element is curved;

the ground element is shaped in the form of a cup or a bowl with an opening of the cup or the bowl directed towards the distal end of the elongated element; and

the ground element is shaped in the form of an inverted cup or an inverted bowl with an opening of the inverted cup or the inverted bowl directed away from the distal end of the elongated element.

~~19~~17. The microwave antenna apparatus as claimed in any preceding claim, comprising an electrically conductive cap element at or adjacent the distal end of the elongated conductor.

~~20~~18. The microwave antenna apparatus as claimed in claim ~~19~~17, wherein a distal end of an outer surface of the microwave antenna apparatus is defined by one or more of the dielectric elements and the electrically conductive cap element is located between the distal end of the elongated conductor and the distal end of the outer surface of the microwave antenna apparatus.

~~21. The microwave antenna apparatus as claimed in claim 19, wherein the electrically conductive cap element defines a distal end of the outer surface of the microwave antenna apparatus.~~

~~22~~19. The microwave antenna apparatus as claimed in any preceding claim, wherein the microwave antenna apparatus is disposable or re-useable.

~~23~~20. The microwave antenna apparatus as claimed in any preceding claim, wherein the microwave antenna apparatus is configured for use in radiating microwave energy into the surface tissue of the uterine cervix for at least one of:

so as to provide a therapeutic effect in one or more regions, such as one or more regions of the cervix infected with human papillomavirus (HPV) and/or diagnosed with cervical intraepithelial neoplasia (CIN);

so as to create the correct biological response in one or more regions, such as one or more regions of the cervix infected with human papillomavirus (HPV) and/or diagnosed with cervical intraepithelial neoplasia (CIN);

localized non-ablative hyperthermia of the surface tissue of the uterine cervix;

localized ablation of the surface tissue of the uterine cervix; and

cauterisation of the surface tissue of the uterine cervix.

~~24~~21. A plurality of microwave antenna apparatus as claimed in any preceding claim, wherein each microwave antenna apparatus has a different configuration selected to provide a corresponding different radiation pattern.

~~25~~22. A microwave assembly for use in radiating microwave energy into surface tissue of a uterine cervix, the microwave assembly comprising the microwave antenna apparatus as claimed in any preceding claim and a shaft connected to the microwave antenna apparatus.

~~26~~23. The microwave assembly as claimed in claim ~~25~~22, comprising a connection arrangement connecting the shaft and the microwave antenna apparatus, wherein the connection arrangement is configured to vary an angle between an axis of the microwave antenna apparatus and an axis of the shaft.

~~27~~24. The microwave assembly as claimed in claim ~~26~~23, wherein the connection arrangement comprises at least one of a pivot arrangement, a hinge, a flexible joint, and a ball and socket joint.

~~28~~25. The microwave assembly as claimed in claim ~~26~~ 23 or ~~27~~24, wherein the connection arrangement is configured to detachably attach the microwave antenna apparatus to the shaft thereby allowing the fitting of a different microwave antenna apparatus to the shaft, wherein the different microwave antenna apparatus features an alternative configuration, for example an alternative shape and/or size, to the microwave antenna apparatus.

~~29~~26. The microwave assembly as claimed in any one of claims ~~25~~ 22 to ~~28~~25, wherein the shaft is disposable or the shaft is re-useable.

~~30~~27. The microwave assembly as claimed in any one of claims ~~25~~ 22 to ~~29~~26, comprising a hand grip or hand piece at or adjacent a proximal end thereof, for example, at or adjacent a proximal end of the shaft.

~~31~~28. The microwave assembly as claimed in claim ~~30~~27, wherein the hand grip or hand piece is detachably attached to the shaft.

~~32~~29. The microwave assembly as claimed in claim ~~30~~ 27 or ~~31~~28, wherein the hand grip or hand piece is disposable or reusable.

~~33~~30. The microwave assembly as claimed in any one of claims ~~25~~ 22 to ~~32~~29, comprising an electrical switch which is configurable between an on state in which the switch allows the transmission of microwave energy from a microwave generator to the microwave antenna apparatus and an off state in which the switch prevents the transmission of microwave energy from the microwave generator to the microwave antenna apparatus.

~~34~~31. The microwave assembly as claimed in claim ~~33~~ 30 when dependent on any one of claims 30 to 32, wherein the hand grip or hand piece comprises a manual control element such as a button or the like for reconfiguring the electrical switch between the on and off states.

~~35~~32. A microwave system for use in radiating microwave energy into surface tissue of a uterine cervix, the system comprising:

a microwave assembly as claimed in any one of claims ~~25~~ 22 to ~~34~~31;

a microwave generator; and

a microwave waveguide,

wherein the microwave waveguide electrically connects the microwave generator and the microwave assembly.

~~36~~33. The microwave system as claimed in claim ~~35~~32, wherein the microwave waveguide comprises a microwave cable such as a flexible and/or a co-axial microwave cable.

~~37~~34. The microwave system as claimed in claim ~~36~~33, wherein the microwave waveguide is housed in the shaft.