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Fitzmayer

[11] **3,843,863**

[45] **Oct. 22, 1974**

[54] **IMPEDANCE VARYING DEVICE FOR MICROWAVE OVEN**

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[73] Assignee: **General Electric Company,** Louisville, Ky.

[22] Filed: **Jan. 24, 1974**

[21] Appl. No.: **436,027**

[52] **U.S. Cl.** **219/10.55,** 333/33
[51] **Int. Cl.** **H05b 9/06**
[58] **Field of Search** .... 219/10.55; 333/33, 35, 333/97 R

[56] **References Cited**

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Primary Examiner—J. V. Truhe
Assistant Examiner—Hugh D. Jaeger
Attorney, Agent, or Firm—Prangley, Dithmar, Vogel, Sandler & Stotland

[57] **ABSTRACT**

Impedance varying apparatus for use with a microwave oven operating at a predetermined microwave frequency includes metal wall structure defining a cooking cavity, inner and outer coaxial conductor sections coupled to the heating cavity, and a shorting conductor interconnecting the inner and outer sections and movable axially thereof between first and second positions for respectively producing an effective open circuit and an effective short circuit across the inner and outer conductor sections at the heating cavity. An alternative embodiment includes inner, outer and intermediate coaxial cylindrical conductor sections overlapping one another, the inner and outer conductor sections being coupled to the heating cavity, the intermediate conductor being insulated from the inner conductor section and electrically connected to the outer conductor section at the outer end thereof, and a conductive member disposed within the intermediate conductor section and insulated therefrom and movable axially with respect thereto. Three different forms of cooperation between the inner conductor section and the conductive member are disclosed.

15 Claims, 4 Drawing Figures

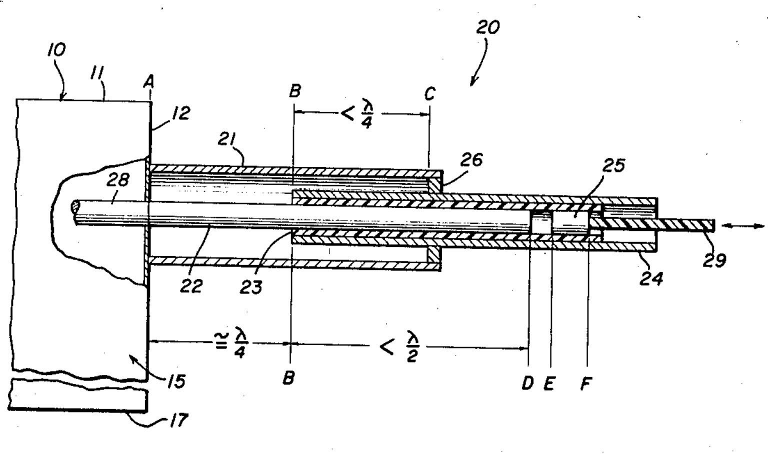


FIG. 4

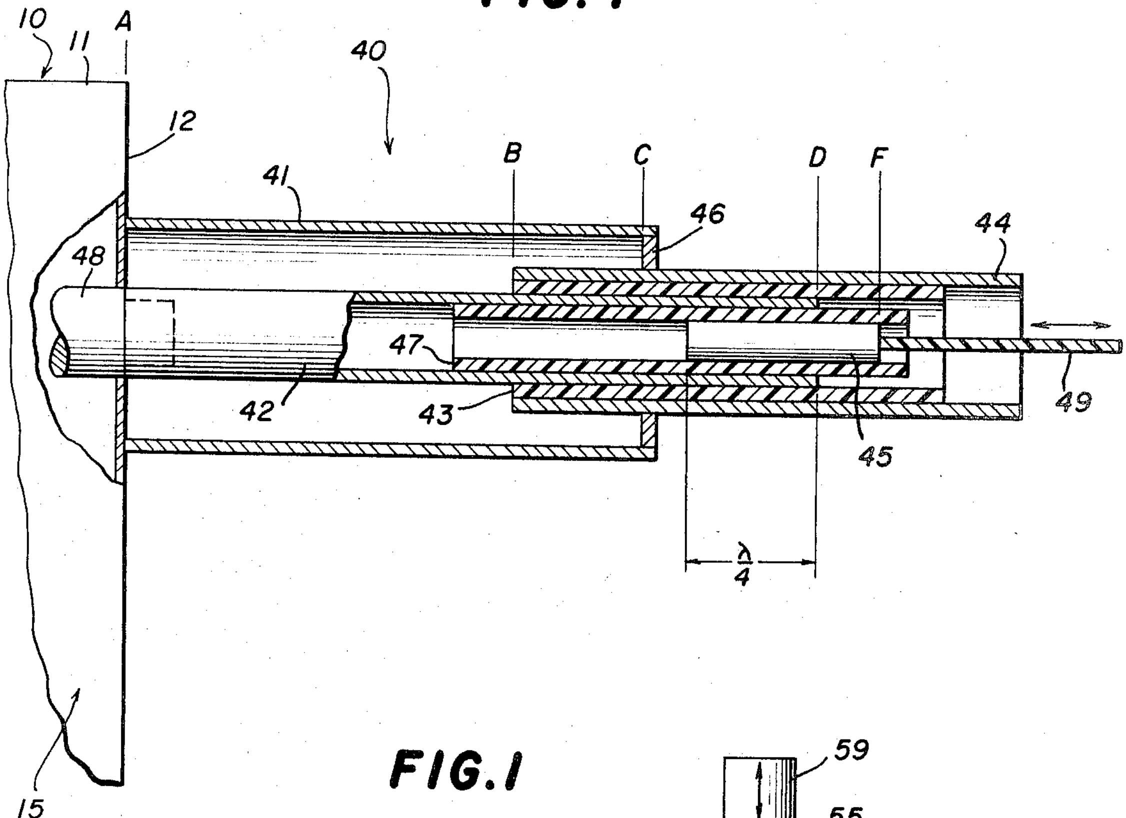

10
11
A
40
12
41
B
C
D
F
46
44
48
47
42
43
45
49
λ/4
15

FIG. 1

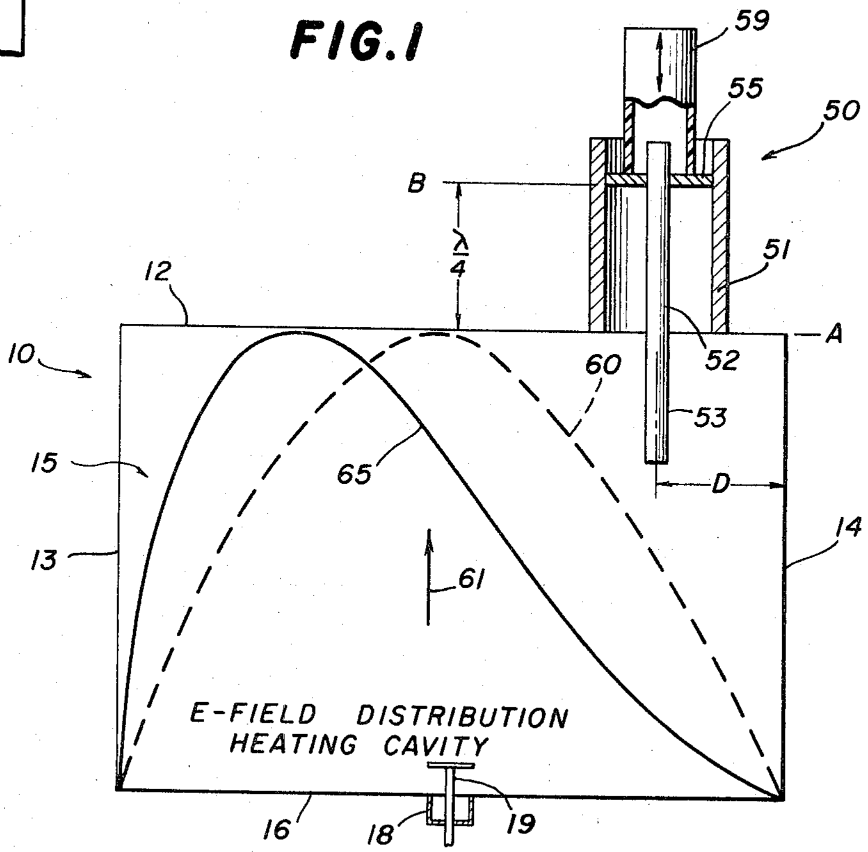

59
55
50
B
λ/4
51
12
A
52
10
60
53
15
65
D
13
14
61
E-FIELD DISTRIBUTION
HEATING CAVITY
16
18
19

FIG.2

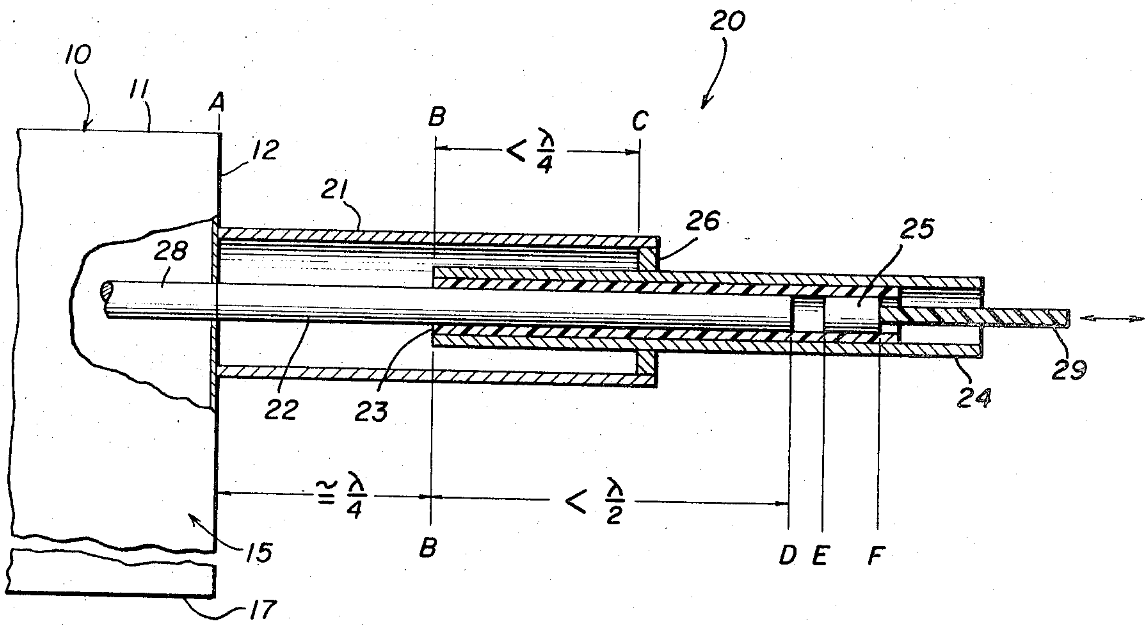
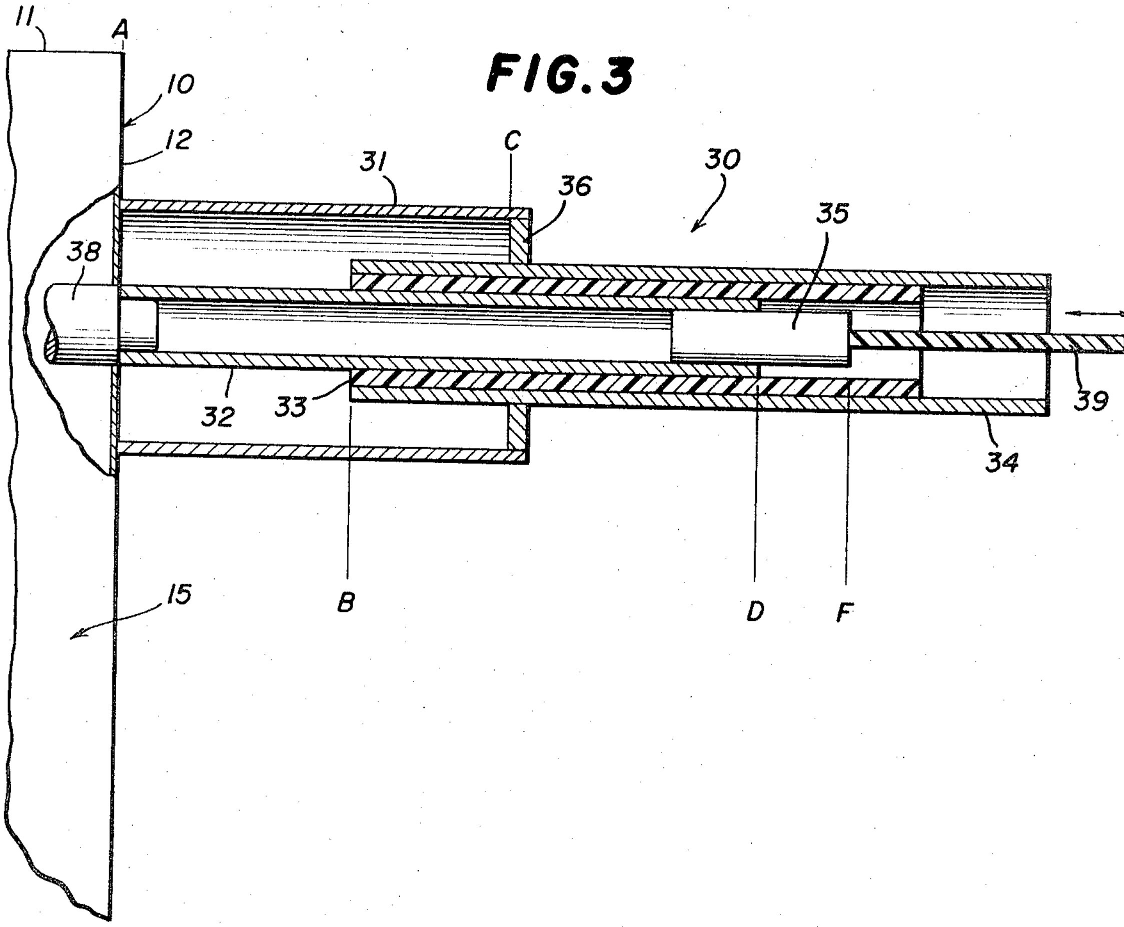

10
11
A
12
20
B
C
< λ/4
21
26
25
28
22
23
24
29
≅ λ/4
< λ/2
15
17
B
D
E
F

FIG.3


11
A
10
12
31
C
36
30
35
38
32
33
39
34
15
B
D
F

IMPEDANCE VARYING DEVICE FOR MICROWAVE OVEN

BACKGROUND OF THE INVENTION

This invention relates to microwave ovens and to transmission means for varying the distribution of microwave energy in the heating cavity of the microwave oven. More particularly, the present invention relates to variable impedance means coupled to the oven cavity for varying the electric field distribution in the heating cavity.

In cooking food with a microwave oven, microwave energy is radiated into the heating cavity for establishing therein a predetermined electromagnetic field pattern. Typically, this field pattern will have regions of high impedance and regions of low impedance therein. Similarly, different types of foods to be cooked in the heating cavity have different impedances. Accordingly, a recurrent problem of microwave cooking is effective matching of the impedance of the food load to the impedance of the electromagnetic field pattern in the heating cavity.

Previously attempted solutions to this problem have included rotating food supports for moving the food load through a number of different regions of the electromagnetic wave pattern, mode stirrers for periodically changing the electromagnetic wave pattern, and the like.

SUMMARY OF THE INVENTION

The present invention relates to means for varying the electric field distribution in the heating cavity by movement of a mechanism outside the heating cavity rather than inside the heating cavity.

It is the general object of the present invention to provide apparatus for varying the electric field distribution in the heating cavity by varying the impedance at the heating cavity of a coaxial transmission line. More particularly, it is an object of this invention to provide adjustable means for varying the impedance of the transmission line at the heating cavity between an effective short circuit and an effective open circuit.

It is an important object of this invention to provide in a microwave oven for heating a body with microwave energy of a predetermined wavelength, the combination comprising metal wall structure defining a heating cavity for receiving therein the associated body to be heated, source means for transmitting microwave energy of the predetermined wavelength into the heating cavity, a coaxial transmission line section coupled to the heating cavity, and a conductive member disposed in the coaxial transmission line section and movable with respect thereto between first and second positions, the conductive member in the first position thereof producing across the coaxial transmission line section at the heating cavity an effective electrical open circuit, the conductive member in the second position thereof producing across the coaxial transmission line section at the heating cavity an effective electrical short circuit, whereby the impedance of the coaxial transmission line section and thereby the field distribution in the heating cavity may selectively be varied.

Another object of this invention is to provide in an electronic oven a combination of the type set forth, wherein the coaxial transmission line section includes a hollow outer conductor section having one end thereof connected to the wall structure, an inner conductor section disposed within the outer conductor section coaxially therewith and spaced therefrom, and a conductive member connected to each of the inner and outer conductor sections for forming a short circuit therebetween and movable axially thereof between the first and second position.

Another object of this invention is to provide in a microwave oven a combination of the type set forth, which includes impedance means disposed in the coaxial transmission line section for providing a series resonant circuit between the inner and outer conductors thereof, and a conductive member disposed in the coaxial transmission line section and movable with respect thereto between first and second positions for varying the resonant frequency of the series resonant circuit.

Still another object of this invention is to provide in a microwave oven a combination of the type set forth wherein the coaxial transmission line section includes a hollow outer conductor section having one end thereof connected to the wall structure, an inner conductor section disposed within the outer conductor section coaxially therewith and insulated therefrom and extending from the one end thereof to a point outwardly beyond the other end thereof, a hollow intermediate conductor section disposed between the inner and outer conductor sections coaxially therewith and insulated from said inner conductor section and extending from a point intermediate the ends of the outer conductor section to a point outwardly beyond the outer end of the inner conductor section, conductive means electrically interconnecting the intermediate and outer conductor sections and closing the space therebetween adjacent to the other end of the outer conductor section, and a cylindrical conductive member disposed within the intermediate conductor section coaxially therewith and insulated therefrom and movable between the first and second positions with respect to the inner conductor section.

Further features of the invention pertain to the particular parts of the impedance varying apparatus whereby the above-outlined and additional operating features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of an oven cavity diagrammatically illustrating the electric field distribution therein and illustrating in partial section an impedance varying apparatus constructed in accordance with and embodying the features of a first embodiment of the present invention.

FIG. 2 is a fragmentary view in vertical section of a portion of an oven heating cavity and a coaxial transmission line coupled thereto including impedance varying apparatus constructed in accordance with and embodying the features of a second embodiment of the present invention;

FIG. 3 is an enlarged view similar to FIG. 2, showing an impedance varying apparatus constructed in accordance with and embodying the features of a third embodiment of the present invention; and

FIG. 4 is a view similar to FIG. 3 and illustrating an impedance varying apparatus constructed in accordance with and embodying the features of a fourth embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now in particular to FIG. 1 of the drawings, there is illustrated a portion of an oven liner, generally designated by the numeral **10**, of a microwave oven, the oven liner **10** being substantially in the shape of a rectangular parallelepiped and including a top wall **11** (FIG. 2) a rear wall **12**, a bottom wall **17** (FIG. 2) and a pair of opposed side walls **13** and **14** cooperating to define a heating cavity, generally designated by the numeral **15**, the front of the heating cavity **15** typically being closed by an oven door which in the closed position thereof forms a front wall **16** in a well known manner. Microvewave energy of a predetermined wavelength is generated in a microwave generator which is preferably in the form of a magnetron tube (not shown) and is transmitted by a suitable transmission line **18** to the heating cavity **15** and is radiated thereinto by means of an antenna **19** for establishing therein a predetermined electromagnetic wave pattern. All or a portion of such a transmission line may typically be in the form of a coaxial transmission line as is well known in the art.

It is an important feature of the present invention to provide an impedance varying apparatus, generally designated by the numeral **50**, which utilizes a movable shorting plug. The impedance varying apparatus **50** includes a hollow cylindrical outer conductor **51** circular in transverse cross-section, connected at one end thereof to the rear wall **12** of the oven liner **10** at a plane A and extending outwardly therefrom, and a cylindrical inner conductor **52** disposed within the outer conductor **51** coaxially therewith. The inner conductor **52** is preferably connected at the inner end thereof to a parasitic antenna **53** which projects into the heating cavity **15**. Electrically interconnecting the inner and outer conductors **52** and **51** and closing the space therebetween is an annular conductive shorting plug **55** slidably engageable with the inner and outer conductor sections **52** and **51** for axial movement with respect thereto. Fixedly secured to the shorting plug **55** and extending outwardly therefrom is a cylindrical push tube **59** preferably formed of dielectric material for effecting movement of the shorting plug **55** axially of the conductors **51** and **52**.

The probe antenna **53** preferably has a length approximately equal to $\lambda/4$ and is spaced a predetermined distance D from the oven liner side wall **14**, which distance is determined by the desired effect on the electric field in the heating cavity. In FIG. **1**, the electric field distribution of the electromagnetic wave pattern in the heating cavity **15** is illustrated in broken line designated by the numeral **60**, the direction of the electric field **60** being in the direction of the arrow **61**. When the shorting plug **55** is disposed at a plane B spaced from the rear wall **12** of the oven liner a distance substantially equal to $\lambda/4$, the probe antenna **53** is open circuited and, therefore, has little effect on the electric field distribution in the heating cavity **15**. However, when the shorting plug **55** is moved to the plane A, the probe antenna **53** resonates and acts like a short circuit across the heating cavity **15**, thereby greatly distorting the electric field distribution, this distorted electric field distribution being indicated in solid line in FIG. **1** and designated by the numeral **65**. While variation of the electric field distribution is shown in FIG. **1** for purposes of illustration, it should be noted that the magnetic field distribution may similarly be distorted by use of a loop antenna instead of a probe antenna.

By use of the impedance varying apparatus **50**, any parasitic elements within the heating cavity **15** can be resonated by external motion of the shorting plug **55** to produce the correct impedance across the coaxial conductors **51** and **52** at the plane A. The specific distortion or enhancement of an existing electromagnetic field mode or the generation of a new mode which can be achieved by use of the apparatus **50** is determined by the specific type and location of the parasitic element in the heating cavity **15**.

Referring now to FIG. **2** of the drawings, there is illustrated another embodiment of the present invention, generally designated by the numeral **20**, which comprises an arrangement of coaxial conductor sections. The impedance varying apparatus **20** includes a hollow cylindrical outer conductor **21** circular in transverse cross-section, having one end thereof connected to the rear wall **12** of the oven liner **10** at a plane A and having the other end thereof disposed a predetermined distance rearwardly of the rear wall **12** at a plane C. Disposed within the outer conductor section **21** coaxially therewith and insulated therefrom is a solid cylindrical inner conductor section **22** having an inner end substantially coplanar with the inner end of the outer conductor section **21** and adapted for coupling to an appropriate antenna or other parasitic radiating means, the outer end of the inner conductor **22** extending outwardly a predetermined distance beyond the outer end of the outer conductor section **21** to a plane D.

Disposed within the outer conductor section **21** and in surrounding relationship with the inner conductor section **22** coaxially therewith and separated from the latter by a cylindrical insulating sleeve **23** is a hollow cylindrical intermediate conductor section **24** having the inner end thereof disposed intermediate the ends of the outer conductor section **21** at a plane B spaced from the rear wall **12** of the heating cavity **15** by a distance approximately equal to one-quarter of the operating frequency of the microwave oven, which in the preferred embodiment of the invention is approximately 915 MHz. The outer end of the intermediate conductor section **24** extends a predetermined distance outwardly beyond the outer end of the inner conductor section **22**. Disposed between and electrically interconnecting the outer and intermediate conductor sections **21** and **24** and accurately positioning these members with respect to each other while closing the space therebetween is a conductive annular spacer member **26**.

Disposed within the insulating sleeve **23** and axially outwardly of the inner conductor section **22** is a short conductive slug **25** preferably having an outer diameter substantially equal to the outer diameter of the inner conductor section **22**. Fixedly secured to the conductive slug **25** and extending axially outwardly therefrom is a pushrod **29** of insulating material for effecting movement of the conductive slug **25** axially with respect to the inner conductor section **22**.

It will be appreciated that the impedance varying apparatus **20** forms three coaxial transmission line sections, viz., a first section A–B having a first impedance Z_1 and comprising the portions of the inner and outer conductor sections 21 and 22 extending from the plane A to the plane B; a second coaxial transmission line section B–C having a second impedance Z_2 and comprising the portions of the outer and intermediate conductor sections 21 and 24 extending from the plane B to the plane C; and a third coaxial transmission line section B–D having an impedance Z_3 and comprising the portions of the inner and intermediate conductor sections 22 and 24 extending from the plane B to the plane D. Preferably, the coaxial transmission line section A–B has a length approximately equal to $\lambda/4$, the coaxial transmission line section B–C has a length less than $\lambda/4$, and the coaxial transmission line section B–D has a length greater than $\lambda/4$ but less than $\lambda/2$, where λ is the wavelength of the microwave energy at the operating frequency of the electronic oven, preferably 915 MHz.

The impedance varying apparatus **20** utilizes the principle of a series resonant circuit tuned to a resonant frequency at the high end of the permitted microwave band in which λ falls, the resonant frequency in the preferred embodiment being 940 MHz. at the plane B when the parts are in the configuration illustrated in FIG. 1. The coaxial transmission line section B–C is inductive at the plane B and at the resonant frequency and the coaxial transmission line section B–D is capacitive, the inductance and capacitance of the coaxial transmission line sections B–C and B–D series resonating to produce a short circuit between the inner and outer conductor sections 21 and 22 at the plane B when the conductive slug 25 is in the position illustrated in FIG. 1, with its inner end at a plane designated by the reference E and its outer end at a plane designated by the reference F. Thus, in this configuration, there is an effective open circuit between the inner and outer conductor sections 21 and 22 at the plane A of the heating cavity.

As the conductive slug 25 is moved between the planes E and D the resonant frequency of the impedance varying apparatus 20 is changed considerably, producing an impedance variation at the plane A between open and short circuit conditions. More particularly, as the conductive slug 25 moves from the plane E to the plane D the resonant frequency of the impedance varying apparatus 20 becomes lower, passing through and becoming much lower than when the conductive slug 25 reaches the plane D. Thus, the impedance at the plane B becomes highly inductive and approaches an open circuit at λ when the conductive slug 25 is at the plane D. Thus, in this latter configuration, there will be an effective electrical short circuit between the inner and outer conductor sections 21 and 22 at the plane A.

In a constructional example of the embodiment of the invention illustrated in FIG. 2, the outer conductor section 21 has an inner diameter of three-quarters, inch, the intermediate conductor section 24 has an outer diameter of approximately one-half inch and an inner diameter of seven-sixteenths inch, while the inner conductor section 22 has an outer diameter of five-sixteenths inch. The length A–B is 3¼ inches, the length B–C is 2½ inches, the length B–D is 6¼ inches, the length D–E is a minimum of one-eighth inch and the length E-F is five-eighths inch. With these dimensions, the impedances of the three coaxial transmission line sections are $Z_1 = 50$ ohms, $Z_2 = 24$ ohms and $Z_3 = 14$ ohms where $\lambda = 915$ MHz.

Referring now to FIG. 3 of the drawings, there is illustrated an alternative form of the present invention, generally designated by the numeral **30**, and substantially similar in construction and operation to the impedance varying apparatus **20** of FIG. **2**, but utilizing a different form of inner conductor section. The impedance varying apparatus **30** includes a hollow cylindrical outer conductor section **31** connected to the rear wall **12** of the oven liner **10** at a plane A and extending rearwardly therefrom, and a hollow cylindrical inner conductor section **32** disposed within the outer conductor section **31** coaxially therewith and insulated therefrom and extending from the heating cavity **15** outwardly to a plane D beyond the outer end of the outer conductor section **31**. Disposed between the inner and outer conductor sections **31** and **32** coaxially therewith and extending from a plane B intermediate the planes A and C outwardly to a point beyond the outer end of the inner conductor section **32** is a hollow cylindrical intermediate conductor section **34**, which is insulated from the inner conductor section **32** by a tubular sleeve of insulating material **33** disposed therebetween.

Electrically interconnectng the outer and intermediate conductor sections **31** and **34** at the plane C and accurately positioning these parts with respect to each other while closing the space therebetween is an annular conductive spacer member **36**. Extending axially into the inner conductor section **32** in telescoping relationship therewith is a cylindrical conductive member **35** having an outer diameter very slightly less than the inner diameter of the inner conductor section **32** for axially sliding engagement therewith. Fixedly secured to the outer end of the cylindrical conductive member **35** and extending outwardly therefom axially thereof is a dielectric pushrod **39** for effecting movement of the cylindrical conductive member **35** axially of the inner conductor section **32**.

The operation of the impedance varying apparatus **30** is substantially the same as was described above with respect to the apparatus **20**, axial movement of the cylindrical conductive member **35** serving to vary the effective electrical length of the coaxial transmission line section B–D, thereby varying the resonant frequency of the series resonant circuit formed by the apparatus **30** for varying the impedance at the plane A between open and short circuit conditions.

Another form of the invention, generally designated by the numeral **40**, is illustrated in FIG. **4** and is substantially similar in construction and operation to the apparatus **30**. The impedance varying apparatus **40** includes a hollow cylindrical outer conductor section **41** connected to the rear wall **12** of the oven liner **10** at a plane A and extending therefrom outwardly to a plane C, and a hollow cylindrical inner conductor section **42** disposed within the outer conductor section **41** coaxially therewith and insulated therefrom and extending from the plane A outwardly beyond the plane C to a plane D. Disposed between the outer and inner conductor sections **41** and **42** coaxially therewith and insulated from the latter by a tubular dielectric sleeve **43** is an intermediate hollow conductive section **44** extending from a plane B intermediate the planes A and C to a point outwardly beyond the plane D. Extending axially into the inner conductor sections **42** from the outer end thereof and insulated therefrom by a tubular dielectric sleeve **47** is a cylindrical conductive member **45.** Electrically interconnecting the outer and intermediate conductor sections **41** and **44** at the plane C and accurately positioning these parts with respect to each other while closing the space therebetween is an annular conductive spacer member **46.** Fixedly secured to the cylindrical conductive member **45** at the outer end thereof and extending axially outwardly therefrom is a dielectric pushrod **49** for effecting movement of the cylindrical conductive member **45** axially of the inner conductor section **42.**

The operation of the impedance varying apparatus **40** is substantially the same as was described above with respect to FIGS. **2** and **3,** axial movement of the cylindrical conductive member **45** serving to vary the resonant frequency of the series resonant circuit formed by the apparatus **40** and thereby varying the impedance at the plane A between open circuit and short circuit conditions. Preferably, when the apparatus **40** is in the configuration illustrated in FIG. **4,** for producing an effective open circuit condition at the plane A, the cylindrical conductive member **45** extends into the inner conductor section **42** a distance substantially equal to $\lambda/4$.

From the foregoing, it can be seen that there has been provided a novel apparatus for varying the impedance of a coaxial transmission line section coupling the microwave energy in a microwave oven heating cavity, and thereby varying the field distribution in the heating cavity.

More particularly, there has been provided an impedance varying apparatus which includes a coaxial transmission line section coupled to the heating cavity and a conductive member disposed in the coaxial transmission line section and movable with respect thereto between first and second positions for respectively producing at the heating cavity end of the coaxial transmission line section an open circuit or a short circuit condition.

There has also been provided an impedance varying apparatus which includes coaxially arranged inner and outer conductors and a conductive shorting plug interconnecting the inner and outer conductors and movable axially thereof for varying the position of a physical short circuit between the inner and outer conductors thereby varying the impedance of the coaxial transmission line at the heating cavity.

There has also been provided an impedance varying apparatus of the character described, which includes impedance means disposed in the coaxial transmission line section for providing a series resonant circuit between the inner and outer conductors thereof, movement of the conductive member between the first and second positions thereof varying the resonant frequency of the series resonant circuit.

There has also been provided three different forms of an impedance varying apparatus, each of which forms includes three coaxially arranged conductor sections which cooperate to form three coaxial transmission line sections of different impedance, and a movable conductive member for varying the effective electrical length of one of the transmission line sections.

While there have been described what are at present considered to be the preferred embodiments of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a microwave oven for heating a body with microwave energy of a predetermined wavelength, the combination comprising metal wall structure defining a heating cavity for receiving therein the associated body to be heated, source means for transmitting microwave energy of the predetermined wavelength into said heating cavity, of coaxial transmission line section coupled to said heating cavity, and a conductive member disposed in said coaxial transmission line section and movable with respect thereto between first and second positions, said conductive member in the first position thereof producing across said coaxial transmission line section at said heating cavity an effective electrical open circuit, said conductive member in the second position thereof producing across said coaxial transmission line section at said heating cavity an effective electrical short circuit, whereby the impedance of said coaxial transmission line section and thereby the field distribution in said heating cavity may selectively be varied.

2. The combination set forth in claim **1,** wherein said conductive member is movable axially of said coaxial transmission line section.

3. The combination set forth in claim **1,** and further including dielectric means connected to said conductive member for effecting movement thereof between the first and second positions thereof.

4. In a microwave oven for heating a body with microwave energy of a predetermined wavelength, the combination comprising metal wall structure defining a heating cavity for receiving therein the associated body to be heated; source means for transmitting microwave energy of the predetermined wavelength into said heating cavity; and a variable impedance coaxial transmission line section coupled to said heating cavity; said coaxial transmission line section including a hollow outer conductor section having one end thereof connected to said wall structure, an inner conductor section disposed within said outer conductor section coaxially therewith and spaced therefrom, and an annular conductive member connected to each of said inner and outer conductor sections coaxially therewith for forming a short circuit therebetween and movable axially thereof between first and second position, said conductive member in the first position thereof providing at said heating cavity an effective electrical open circuit between said inner and outer conductor sections, said conductive member in the second position thereof providing at said heating cavity an effective electrical short circuit between said inner and outer conductor sections, whereby the impedance of said coaxial transmission line section and thereby the field distribution in said heating cavity may selectively be varied.

5. The combination set forth in claim **4,** wherein said conductive member in the first position thereof is spaced from said heating cavity a distance substantially equal to one-quarter of the predetermined wavelength as measured axially of said conductor sections, said conductive member in the second position thereof being disposed at said heating cavity.

6. In a microwave oven for heating a body with microwave energy of a predetermined wavelength, the combination comprising metal wall structure defining a heating cavity for receiving therein the associated body to be heated, source means for transmitting microwave energy of the predetermined wavelength into said heating cavity, a coaxial transmission line section having inner and outer conductors coupled to said heating cavity, impedance means disposed in said coaxial transmission line section for providing a series resonant circuit between the inner and outer conductors thereof, and a conductive member disposed in said coaxial transmission line section and movable with respect thereto between first and second positions for varying the resonant frequency of said series resonant circuit, said conductive member in the first position thereof producing across said coaxial transmission line section at said heating cavity an effective electrical open circuit, said conductive member in the second position thereof producing across said coaxial transmission line section at said heating cavity an effective electrical short circuit, whereby the impedance of said coaxial transmission line section and thereby the field distribution in said heating cavity may selectively be varied.

7. The combination set forth in claim **6,** wherein said impedance means includes an inductive reactance and a capacitive reactance, movement of said conductive member between the first and second positions thereof effecting a change in the value of said capacitive reactance.

8. The combination set forth in claim **6,** wherein movement of said conductive member between the first and second positions thereof effects change of the resonant frequency of said series resonant circuit between frequencies greater than and less than said predetermined frequency.

9. The combination set forth in claim **6,** wherein said coaxial transmission line section includes three coaxial and overlapping cylindrical conductor sections.

10. In a microwave oven for heating a body with microwave energy of a predetermined wavelength, the combination comprising metal wall structure defining a heating cavity for receiving therein the associated body to be heated; source means for transmitting microwave energy of the predetermiend wavelength into said heating cavity; and a variable impedance coaxial transmission line section coupled to said heating cavity; said coaxial transmission line section including a hollow outer conductor section having one end thereof connected to said wall structure, an inner conductor section disposed within said outer conductor section coaxially therewith and insulated therefrom and extending from said one end thereof to a point outwardly beyond the other end thereof, a hollow intermediate conductor section disposed between said inner and outer conductor sections coaxially therewith and insulated from said inner conductor section and extending from a point intermediate the ends of said outer conductor section to a point outwardly beyond the outer end of said inner conductor section, conductive means electrically interconnecting said intermediate and outer conductor sections and closing the space therebetween adjacent to said other end of said outer conductor section, and a cylindrical conductive member disposed within said intermediate conductor section coaxially therewith and insulated therefrom and movable between first and second positions with respect to said inner conductor section, said conductive member in the first position thereof providing at said heating cavity an effective electrical open circuit between said inner and outer conductor sections, said conductive member in the second position thereof providing at said heating cavity an effective electrical short circuit between said inner and outer conductor sections, whereby the impedance of said coaxial transmission line section and thereby the field distribution in said heating cavity may selectively be varied.

11. The combination set forth in claim **10,** wherein said cylindrical conductive member in the first position thereof is spaced a predetermined distance axially from said outer end of said inner conductor section, said cylindrical conductive member in the second position thereof being disposed in engagement with said outer end of said inner conductor section.

12. The combination set forth in claim **10,** wherein said inner conductor section is hollow, said cylindrical conductive member extending axially into said hollow inner conductor section in sliding engagement therewith.

13. The combination set forth in claim **10,** wherein said inner conductor section is hollow, said cylindrical conductive member extending axially into said hollow inner conductor section and being insulated therefrom.

14. The combination set forth in claim **10,** wherein the distance from the inner end of said intermediate hollow conductor section to said heating cavity is approximately equal to an odd integral multiple of one-quarter of the predetermined wavelength.

15. The combination set forth in claim **10,** wherein the distance from the inner end of said intermediate hollow conductor section to said heating cavity is approximately equal to an odd integral multiple of one-quarter of the predetermined wavelength, the distance from the inner end of said intermediate hollow conductor section to the outer end of said outer conductor section is less than one-quarter of the predetermined wavelength, and the distance from the inner end of said intermediate conductor section to the outer end of said inter conductor section is less than one-half of the predetermined wavelength.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,843,863 Dated October 22, 1974

Inventor(s) Louis H. Fitzmayer

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 40, after "parasitic" insert --probe--; and
Column 10, line 53, "inter" should be --inner--

Signed and sealed this 7th day of January 1975.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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