

United States Patent

Ikeda

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[54] MICROWAVE OVEN

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[51] Int. Cl.....H05b 9/06

[58] Field of Search.....219/10.55

[56]

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[57]

ABSTRACT

In an electronic cooking device including a stirrer, a stirring compartment above a heating compartment is provided on its top with a truncated cone-shaped protrusion for reflecting a microwave to the heating compartment. The stirrer is disposed adjacent the end of the protrusion to direct the microwave toward the heating compartment.

6 Claims, 5 Drawing Figures

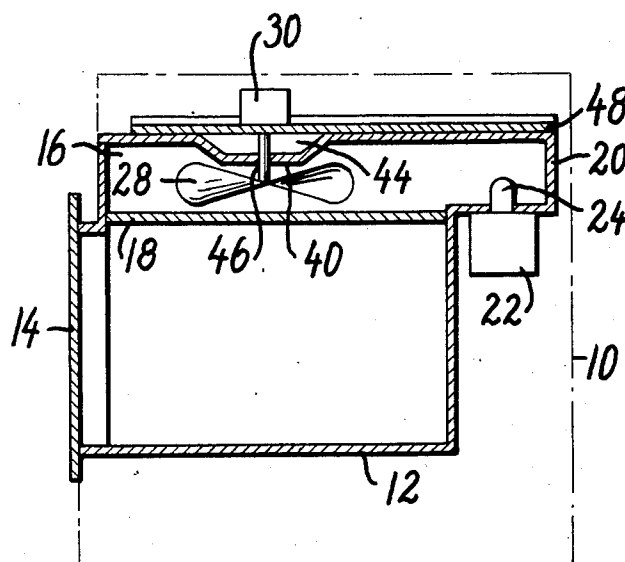


FIG. 1
PRIOR ART

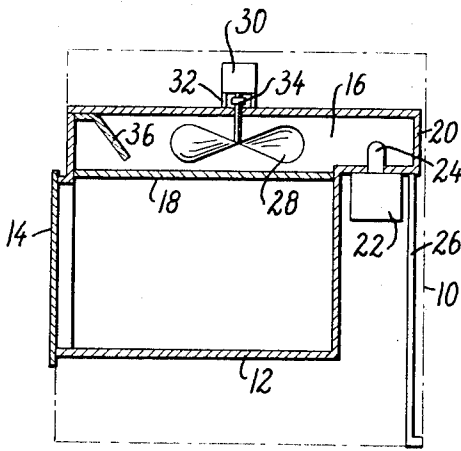


FIG. 2

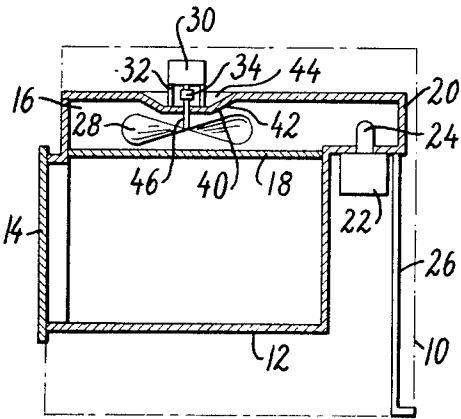


FIG. 3

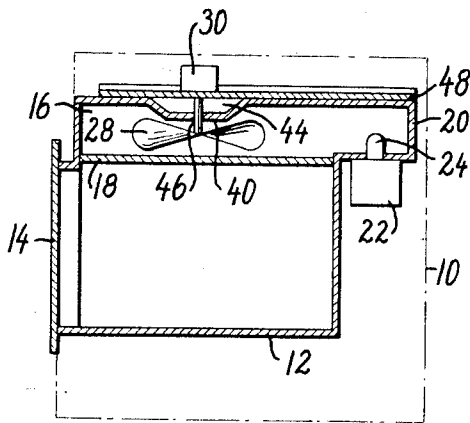


FIG. 4

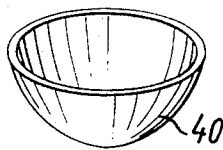
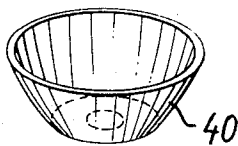


FIG. 5



MICROWAVE OVEN

BACKGROUND OF THE INVENTION

This invention relates to an electronic cooking device, and more particularly to improvements in a stirring mechanism for stirring a microwave to uniformly heat the contents such as food in such a device.

In the conventional type of electronic cooking devices including a stirrer for stirring a microwave, that portion of the microwave traveling past the stirrer is reflected back toward the latter from a flat reflective plate. Due to its flatness the reflective plate has reflected the microwave only in a single direction leading to uneven dispersion of the microwave. Also in order to prevent the microwave from leaking through that portion of the device on which the stirrer is mounted, an electric motor for driving the stirrer has been required to be operatively connected to the stirrer through a metallic coupling. Therefore the device has been made higher by the height of the coupling. Further, a magnetron for generating the microwave is so heavy that that portion of the associated wave guide having mounted thereto the same should be supported on a special support member or the like.

SUMMARY OF THE INVENTION

The invention provides an electronic cooking device comprising, in combination, a housing, a heating compartment disposed within the housing, a stirring compartment within the housing disposed just above the heating compartment to stir a microwave energy, a partition plate formed of a material transmissive to microwave to partition the stirring compartment off from the heating compartment, a protrusion disposed on that wall of the stirring compartment remote from the heating compartment and provided on at least one portion with a curved surface for reflecting the microwave energy, an electric motor, a shaft driven by the electric motor and extending substantially centrally through the extremity of the protrusion into the stirring compartment, for rotation, and a stirrer fixedly secured on the shaft at the end to uniformly radiate the microwave energy reflected from the protrusion into the heating compartment.

Accordingly it is an object of the invention to provide an electronic cooking device including improved means for uniformly radiating a microwave energy into a heating compartment involved.

It is another object of the invention to provide a new and improved electronic cooking device decreased in dimension.

It is still another object of the invention to provide an electronic cooking device including improved means for preventing a microwave energy from leaking through a clearance around a shaft for driving a stirrer.

It is a further object of the invention to provide an electrically cooking including improved means for supporting a heavy magnetron for generating a microwave.

BRIEF DESCRIPTION OF THE DRAWING

The invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawing in which:

FIG. 1 is a schematic, longitudinal sectional view, partly in elevation, of an electronic cooking device constructed in accordance with the principles of the prior art;

FIG. 2 is a schematic, longitudinal sectional view, partly in elevation, of an electronic cooking device constructed in accordance with the principles of the invention;

FIG. 3 is a view similar to FIG. 2 but illustrating a modification of the invention; and

FIGS. 4 and 5 are perspective views of different forms of the reflecting element shown in FIG. 2 or 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawing and FIG. 1 in particular, it is seen that an electronic cooking device disclosed herein com-

prises a housing shown at dotted-and-dashed line 10 and a heating compartment 12 disposed within the housing 10 to include an opening on the front face of the device. The heating compartment 12 has a metallic wall and its opening is openable closed by a door 14 suitably hinged to the housing 10. Disposed within the housing 10 and just above the heating compartment 12 is disposed a microwave stirring compartment 16 partitioned off from the heating compartment 12 by a partition plate 18 formed of any suitable material permeable or transmissive to microwave energy. The stirring compartment 16 is connected on one sidewall to one end of a section of a wave guide 20 including the other end connected to a microwave-generating source 22, for example, a magnetron. Then the source 22 is operatively coupled to a microwave antenna 24 projecting into the waveguide 20. That end of the waveguide 20 to which the source 22 is supported on a supporting leg 26 suitably connected to the housing 10.

A stirrer 28 is pendent from that wall of the stirring compartment 16 remote from the heating compartment 12 or the top thereof and within the housing 10 an electric motor 30 is disposed on the outer surface of that top through a supporting member 32 to rotate the stirrer 28 through a metallic coupling 34.

In operation the source or magnetron 22 generates a microwave energy which is, in turn, radiated in the waveguide 20 through the antenna 24. The microwave energy is fed into the stirring compartment 16 where it is partly stirred and directed to the heating compartment 12 by the rotating stirrer 28. The microwave energy partly travels past the stirrer 28 to reach a flat reflective plate 36 disposed adjacent the other sidewall of the stirring compartment. Then the microwave energy is reflected back toward the stirrer 28 by the reflective plate 36 and directed to the heating compartment 12 by the stirrer 28. After having entered the heating compartment 12, the microwave energy heats the contents such as food (not shown) disposed therein in the manner well known in the art.

In the arrangement illustrated, the reflective plate 36 has a plane surface so that the microwave energy is reflected only in a single direction, resulting in the uneven dispersion of the microwave energy. Also in order to prevent the microwave energy from leaking through a clearance around that portion of the stirrer's shaft extending through the top of the stirring compartment, that shaft has been required to be operatively connected to the electric motor 30 through the metallic coupling 34. The use of the coupling 34 inevitably causes the overall height of the device to increase by the height of the coupling. Further since a magnetron serving as the source for generating the microwave energy is heavy that portion of a section of waveguide to which the magnetron is mounted has been necessarily supported by the supporting leg or the like.

The invention contemplates to eliminate the disadvantages of the prior art practice as above described. FIG. 2 wherein like reference numerals designate the compartments identical to those shown in FIG. 1 illustrates one embodiment of the invention. The arrangement is different from that shown in FIG. 1 only in that in FIG. 2, that portion adjacent the stirrer 28 of the top of the stirring compartment 16 is depressed into the interior of the compartment 16 to form a truncated cone-shaped protrusion 40 including a tapered, curved surface 42 facing the stirring compartment to reflect the microwave energy toward the heating compartment 12. The surfaces defining the protrusion is arcuate in cross section. Then the electric motor 30 is fixedly secured to the outer surface of the top of the stirring compartment 16 through the supporting member 32 disposed in a motor-shaped recess 44 defined by the external surface of the protrusion 40. The motor 30 is operatively connected through the metallic coupling 34 to a shaft 46 for the stirrer 28. Then the shaft 46 extends through substantially the center of the small end face of the protrusion 40 so that it is coaxial therewith.

In operation the microwave energy generated by the magnetron 22 travels via the section of waveguide 20 to the stirring compartment 16 where it is reflected to the heating com-

partment 12 by that half of the tapered curved protrusion surface 42 nearer to the magnetron 20. At the same time, the stirrer 28 is rotating to reflect the microwave energy to the heating compartment by the other half of the curved surface 42. As compared with the conventional flat reflective plate such as shown in FIG. 1 serving to reflect the microwave energy only in that direction pointing the associated stirrer, the entire curved surface 42 formed of the protrusion 40 serves as a reflective surface which, in turn, cooperates with the rotating stirrer 28 to uniformly dispose the microwave energy into the heating compartment 12 thereby to uniformly heat stuffs to be heat in the compartment.

In the arrangement of FIG. 2 it will be also seen that the overall height of the device has decreased by the depth of the recess 44.

FIG. 3 shows a modification of the invention. The arrangement illustrated is substantially identical to that shown in FIG. 2 except for a shield plate 48 of U-shaped cross section closing the motor-shaped recess 46 to form a microwave cavity therebetween. This cavity serves to attenuate that portion of the microwave energy leaked through an opening on the stirring top through which the stirrer's shaft extends. Thus the motor's shaft itself can be extended to provide the shaft of the stirrer resulting in the omission of the coupling required for interconnecting both shafts. This leads to the elimination of the necessity of disposing a space in which the coupling is provided and therefore to a further decrease in overall height of the device.

The shield plate 48 is shown in FIG. 3 as extending to that end portion of the section of waveguide 20 on which the magnetron 22 is secured. This type of the shield plate is also operative as a reinforcing element for the waveguide resulting in the omission of the supporting leg such as shown at 12 in FIGS. 1 and 2.

While the invention has been illustrated and described in conjunction with a few preferred embodiments thereof it is to be understood that various changes and modifications may be resorted to without departing from the spirit and scope of the invention. For example, the protrusion may be substantially in the form of a hemisphere such as shown in FIG. 4 or of a trun-

cated cone of elliptic cross section. It is to be noted that the protrusion is subject to no limitation as to its shape as long as the lateral surface thereof includes at least partly a curved surface functioning to reflect the microwave energy.

What is claimed is:

1. In a microwave oven, means defining a heating compartment for receiving foodstuffs therein for cooking and baking and the like, means defining a waveguide immediately above said heating compartment, means for transmitting microwave energy through said waveguide to apply it to said heating compartment, a tapered protrusion extending inwardly into said waveguide converging in a direction toward said heating compartment and having a reflective surface arcuate in cross section circumferentially defining said protrusion for reflecting microwave energy into said heating compartment, a stirrer in said waveguide, a driven shaft extending into said waveguide coaxial with said protrusion for rotatably mounting and driving said stirrer to uniformly radiate the microwave energy reflected from said reflective surfaces into said heating compartment.
2. In a microwave oven, according to claim 1, in which said protrusion defines a recess exteriorly of said waveguide, and including an electric motor in said recess for driving said shaft rotationally.
3. In a microwave oven, according to claim 2, in which said waveguide comprises a wall defining a partition permeable to microwave energy between the heating compartment and the waveguide.
4. In a microwave oven according to claim 2, in which said protrusion is disposed over said heating compartment centrally disposed with respect thereto.
5. In a microwave oven according to claim 2, including a source of said microwave energy and an antenna in said waveguide for transmitting said microwave energy through said waveguide.
6. In a microwave oven according to claim 2, including shield means across said recess to reduce leakage of microwave energy from said recess leaked thereinto around said shaft.

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