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MICROWAVE OVEN

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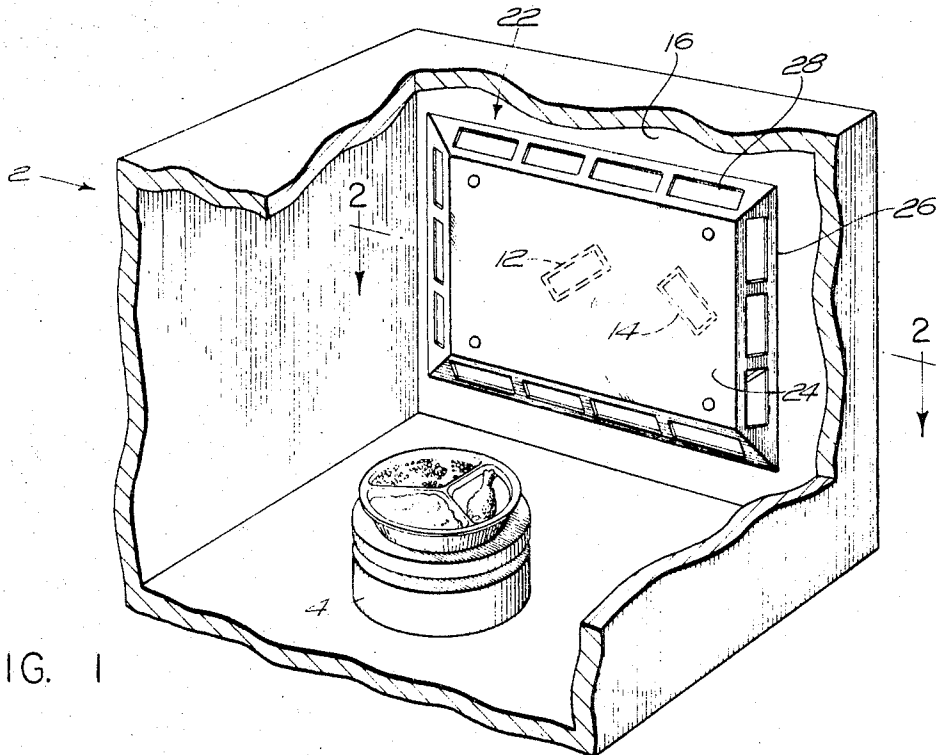


FIG. 1

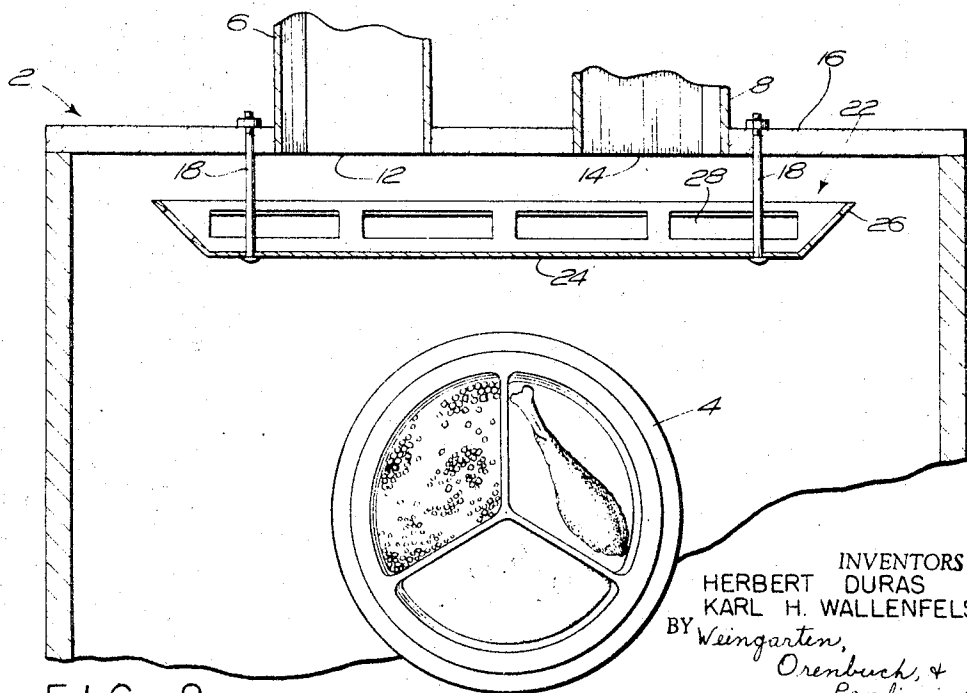


FIG. 2

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MICROWAVE OVEN

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1 Claim. (Cl. 219—10.55)

This invention relates in general to microwave ovens and more particularly to apparatus for impedance matching a source of microwave energy to an oven enclosure.

A major problem inherent in the use of microwave ovens is that the mismatching of the source of microwave power, which is usually a magnetron tube, and the load can result in damage or destruction to the microwave generator, that is, could damage the magnetron tube generating the microwave energy. For example, should the microwave power be turned on when no food is present in the oven, large amounts of energy would be reflected back towards the source. Moreover, as foods change state during heating, i.e., from frozen to liquid, a change in electrical impedance of the food occurs. Thus, when a microwave oven is turned on, a frozen object presents a very low impedance to the source of energy, and as the food absorbs microwave energy and thaws, its impedance increases.

Another problem inherent in the use of microwave ovens is the fact that when a microwave oven is energized, certain modes of oscillation are set up in the oven which vary with the type of load being heated and further will set up different field patterns depending upon whether the enclosure is empty or loaded. Thus, objects placed in the oven may or may not be heated, depending upon whether or not they are positioned in a region where there is sufficient field intensity to heat the object.

The principal object of the present invention is to provide apparatus for matching the impedance of a microwave oven enclosure to a source of microwave energy. An advantage of the present invention is that should the source of microwave energy be turned on when no load is present in the oven enclosure, any mismatching which may occur between the source and the enclosure will not be sufficient to destroy the tube generating the microwave energy.

The invention resides in a microwave oven, having a source of microwave energy, the oven having a resonant element coupled to the oven enclosure. The resonant element is either made of or covered with energy absorbing material. When the microwave power is turned on and no load or a very small load is present in the oven enclosure, the absorbing resonant element will absorb substantially more energy than when a load is present. Further, when the microwave power is turned on and a load is present in the oven enclosure, the element acts as a simple coupling element without exhibiting resonant properties, coupling energy from the source to the enclosure.

Other objects and many of the attendant advantages of the invention will be readily appreciated as the invention becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 depicts a microwave oven in accordance with the invention; and

FIG. 2 depicts a top sectional view of the microwave oven shown in FIG. 1.

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Referring now to FIGS. 1 and 2, there is shown a microwave oven 2 having a working enclosure portion 3 into which objects 4, such as foods, are placed. A source of microwave energy feeds energy into a Y-shaped waveguide (not shown) which in turn couples microwave energy to a pair of waveguides 6, 8. Energy in the waveguides 6 and 8 is transferred to the oven 2 through the coupling slots 12 and 14, respectively, which are common to both the waveguides 6, 8 and the rear wall 16 of the oven.

Spaced from the rear wall 16 of the oven by means of a plurality of screws 18 is a resonant element 22. The element 22 may be either made of or covered with energy absorbing material. The element is formed of a center portion 24 and a recessed peripheral portion 26. The edge 26 has a plurality of output coupling slots 28 formed therein.

Microwave energy is radiated into the oven through the coupling slots 12 and 14. When the enclosure is loaded, that is, contains food or other objects which absorb microwave energy, the impedances transformed at the output coupling slots 28 of the resonant element 22 are such that the slots 28 work as a simple coupling element without resonant properties and transfer microwave energy from the input coupling slots 12 and 14 to the enclosure 3. However, at no load conditions when there is no energy absorbing material present in the enclosure 3, the coupling slots 28, owing to the different field distribution of microwave energy, see a different impedance. The impedance seen by the coupling slots at no load allows the element 22 to appear as a resonant element to incoming microwave energy and part of the microwave power presented to it is absorbed by it, thereby reducing the magnitude of reflections back to the source and thereby preventing its destruction.

The element 22 shown in FIG. 2 is resonant at the TE₃₄₀ mode. Of course, the resonant element could take other forms such as a cavity resonator, capacitively loaded dipoles, more commonly referred to as mushroom antennas, or a metallic plate, each of which would be coupled to the oven enclosure. Each of these embodiments should be covered with a suitable energy absorbing material to ensure appropriate absorption of microwave power.

Obviously, many modifications and variations of the present invention are possible in the light of the foregoing teachings. It is to be understood, therefore, that the invention is not limited in its application to the details of construction and arrangement of parts specifically described or illustrated, and that within the scope of the appended claims, it may be practiced otherwise than as specifically described or illustrated.

We claim:

In an oven of the type having
a heating enclosure for confining microwave energy,
the enclosure supporting a predetermined wave energy mode pattern when no load is present in the enclosure,
a source of microwave energy,
means for guiding microwave energy from the source to the enclosure, the enclosure having an aperture in one wall for admitting the microwave energy,
the improvement comprising:
an energy absorbing element disposed in the heating enclosure adjacent to the admitting aperture,
the energy absorbing element being spaced from the

admitting aperture and being configured to resonate
when the oven is operating at the no-load condition.

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RICHARD M. WOOD, *Primary Examiner.*