July 12, 1966 S. C. JOHNSON 3,260,832

OVEN

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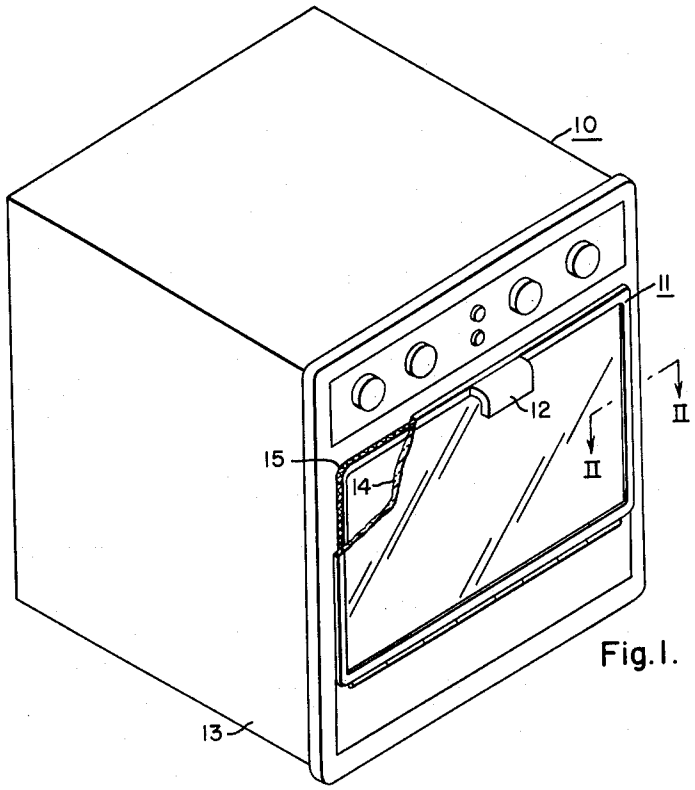

Fig. 1.

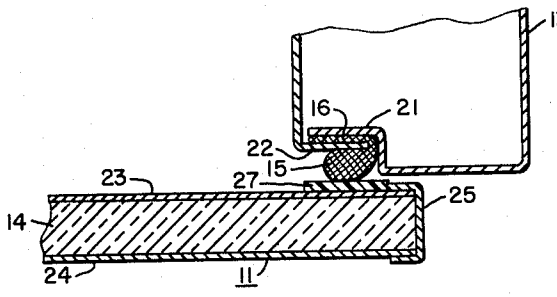

Fig. 2.

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This invention relates to heating of materials in a housing supplied with microwave energy and concerns particularly containment of such energy about the edge of a door or the like.

Foodstuffs and other materials of so-called "lossy" dielectric may be heated by exposure to electromagnetic radiation in the microwave portion of the spectrum (from about one thousand to three hundred thousand megacycles per second, corresponding to wavelengths of from about thirty centimeters to one millimeter). Microwave generators operating in the midportion of this range are used to provide energy to cooking ovens or the like. The housing of such an oven is provided with a doorway or similar opening for the insertion and removal of the food and containers, and a door, which may contain a window for permitting visual observation of the interior. Not only must the window, if any, be designed to be opaque to the microwave radiation (though relatively transparent to visible light) but the leakage of such radiation about the edge of the door must be eliminated or limited to a very small amount without unduly complicating the construction of the door or adversely affecting its operation.

A primary object of the present invention is provision of an effective microwave energy seal for a door or similar closure member of a microwave oven or the like.

Another object is reduction in the amount of adjustment, maintenance, and repair or replacement required in the sealing of a door for a microwave oven or the like.

A further object is sealing of a microwave oven door containing a window by locating the seal directly between the window and the oven housing.

Other objects of the present invention together with means and methods of attaining the various objects will be apparent from the following description and the accompanying diagrams of a preferred embodiment thereof.

FIG. 1 is a perspective view, partly cut away, of a microwave oven embodying this invention; and

FIG. 2 is a sectional plan of a portion of the same apparatus, on a much larger scale, taken at II—II of FIG. 1.

In general, the objects of the present invention are accomplished, in apparatus for heating materials in a housing supplied with microwave energy and having an opening therein and a covering closure member for the opening, by means of a seal therefor comprising a resilient gasket having at least its surface electrically conductive and a relatively thin gasket adjacent thereto having at least its surface electrically nonconductive, the seal being interposed between adjacent surfaces of the closure member and the housing.

More particularly, where such a door includes an optically transparent pane, this invention contemplates an electrically conductive coating on the interior surface of the pane, a separate conductive member at the exterior surface of the housing about the doorway, and therebetween a door seal comprising a resilient conductive gasket carried on the separate conductive member and a thin non-conductive gasket carried on the pane, the gaskets being contiguous with one another when the door is in the closed position.

FIG. 1 shows in perspective a microwave oven **10** having a door **11** hinged at the bottom edge and provided with a handle **12** at the top. The door covers an opening or doorway in the front portion of the oven housing **13**.

A window pane **14** occupies a major portion of the door area. The upper left corner of the door and window is cut away to show an electrically conductive gasket **15**, which forms part of a seal for the door. A row of controls appears in a panel above the door; however, as they and the elements controlled by them are wholly conventional and do not enter into the present invention, neither the controls nor the elements controlled thereby are described or illustrated further herein.

FIG. 2 shows sectioned and on an enlarged scale a portion of the oven housing, door, and the intervening seal, as indicated on FIG. 1. It will be understood that the location at which this sectional view is taken is actually immaterial, the construction of the seal being essentially unchanged along the entire edge of the door or so much thereof as is of the construction indicated. The gasket **15** is generally Q-shaped in transverse cross-section, having a preferably resilient body portion generally oval in shape and having a flat tail portion **16** extending therefrom. The tail portion is sandwiched in a recess provided between a terminal flange **21** of the housing **13** and an overlying flange **22** of the oven interior wall, thereby supporting the gasket. This gasket preferably is composed of braided or woven metal, such as copper, or metal-covered rubber or other elastomer.

The visible portions of the door include the window pane **14**, which has an electrically conductive coating **23** on the inside and a similar coating **24** on the outside. The peripheral edge of the pane is covered by channel member **25**, which does not come into contact with the oven housing even in the illustrated closed position of the door. Between the gasket **15** and the adjacent portion of the conductive coating **23** on the inside of the pane lies a nonconductive gasket or insulating strip **27**, which is secured thereto by adhesive or other suitable means.

The insulating strip **27** preferably extends for somewhat more than the full body width of the electrically conductive resilient gasket **15** but not so far as to overlie (and thereby obscure) any part of the oven interior. The channel member **25** may extend over a correspondingly wide portion of the exterior surface of the window pane as the insulating strip does over the interior. If electrically nonconductive the channel member may be combined with or itself constitute the insulating strip. Normally, however, the channel member will be made of metal as are the oven interior wall and usually the exterior surface of the housing as well. The insulating strip **27** may be made of electrically nonconductive paper, film, or resin-impregnated fabric tape for example, or may comprise electrically conductive material coated with such nonconductive material. The strip thickness preferably does not exceed several hundredths of an inch.

As is well known, the purpose of the electrically conductive coating of the window pane is to render it opaque to microwave radiation while leaving it substantially transparent to visible light. Similarly it has been customary to rely upon a metal-to-metal seal where the door of a microwave oven abuts the oven housing. However, metal-to-metal seals are subject to arcing and resultant pitting, giving rise to problems of maintenance, repair, or replacements. The conductive coating on a window pane, as described, would soon be damaged if employed as one half of a metal-to-metal seal.

The present invention dispenses with the conventional metal-to-metal seal while retaining the advantages thereof and also extending the same to a window seal. The durability of the seal provided by this invention is a desirable safety feature. Radiation measurements of the microwave energy at locations outside the oven but in the vicinity of the door indicate a radiation level at least 20 decibels below the accepted safe level of 10 milliwatts per square centimeter.

Modifications may be made in the number, size, shape, or means of support of the apparatus components disclosed herein without departing from the structural features or losing the benefits of the present invention as defined in the following claims.

I claim as my invention:

1. In apparatus for heating material in a housing supplied with microwave energy, having a doorway to the exterior and a door covering the doorway, a first conductive member at the exterior surface of the housing about the doorway, a second conductive member at the adjacent interior surface of the door, and therebetween a door seal comprising a resilient conductive gasket and a thin nonconductive gasket contiguous therewith, the conductive gasket being generally Q-shaped in transverse cross-section, with the tail of the Q secured in a complementarily recessed portion of the housing about the doorway, and the nonconductive gasket being secured adhesively to the adjacent surface of the door.

2. In apparatus for heating material in a housing supplied with microwave energy, having a doorway to the exterior and a door covering the doorway, a window pane

in the door, an electrically conductive coating on the inside surface of the window, a separate conductive member at the exterior surface of the housing about the doorway, and therebetween a door seal comprising a conductive gasket and a thin nonconductive gasket contiguous therewith, the conductive gasket being generally Q-shaped in transverse cross-section, with the tail of the Q secured in a complementarily recessed portion of the housing about the doorway, and the nonconductive gasket being secured adhesively to the adjacent surface of the door.

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