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Miller et al.

[11] **3,818,171**

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[54] **MICROWAVE COOKING APPARATUS**

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[52] **U.S. Cl.**..... **219/10.55,** 126/21 A, 312/236

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

[58] **Field of Search**..... 219/10.55, 399, 400; 126/21 A; 312/214, 236

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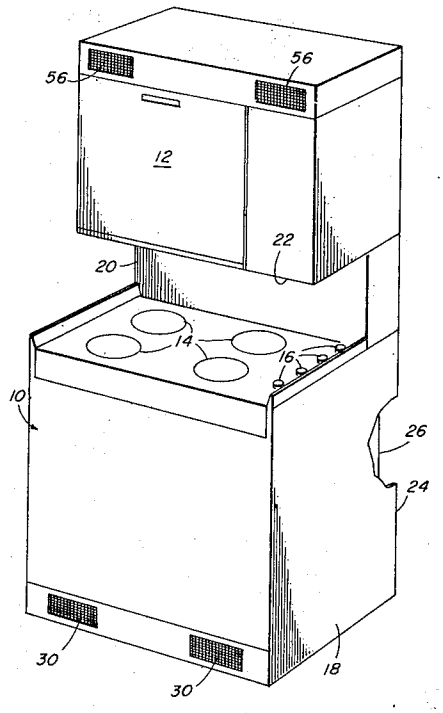
Primary Examiner—J. V. Truhe

Assistant Examiner—Hugh D. Jaeger

[57] **ABSTRACT**

An eye-level microwave oven having a set of cooking burners disposed therebelow includes a ventilation duct extending vertically from a bottom chamber of the apparatus to the microwave oven. The duct may terminate at either the bottom or the back of the microwave oven.

7 Claims, 5 Drawing Figures



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SHEET 1 OF 2

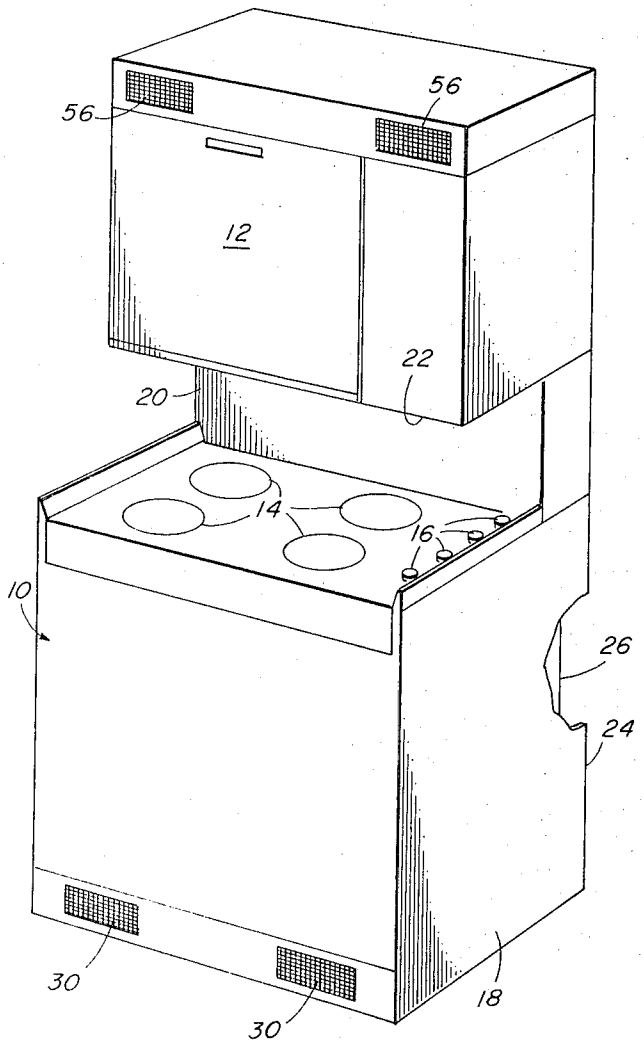


FIG. 1

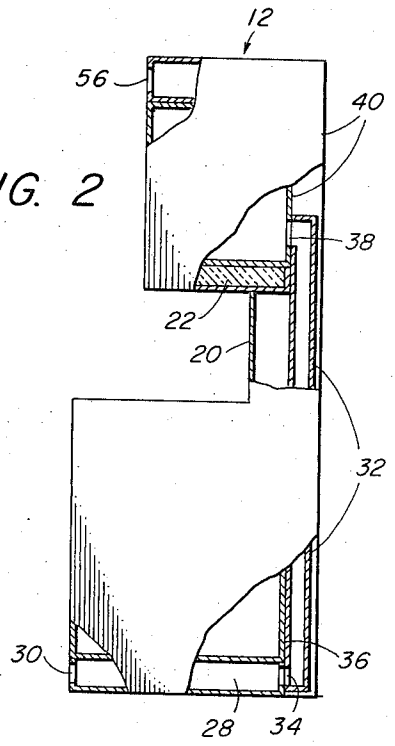


FIG. 2

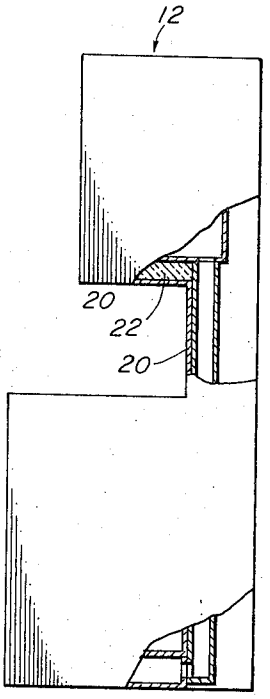


FIG. 5

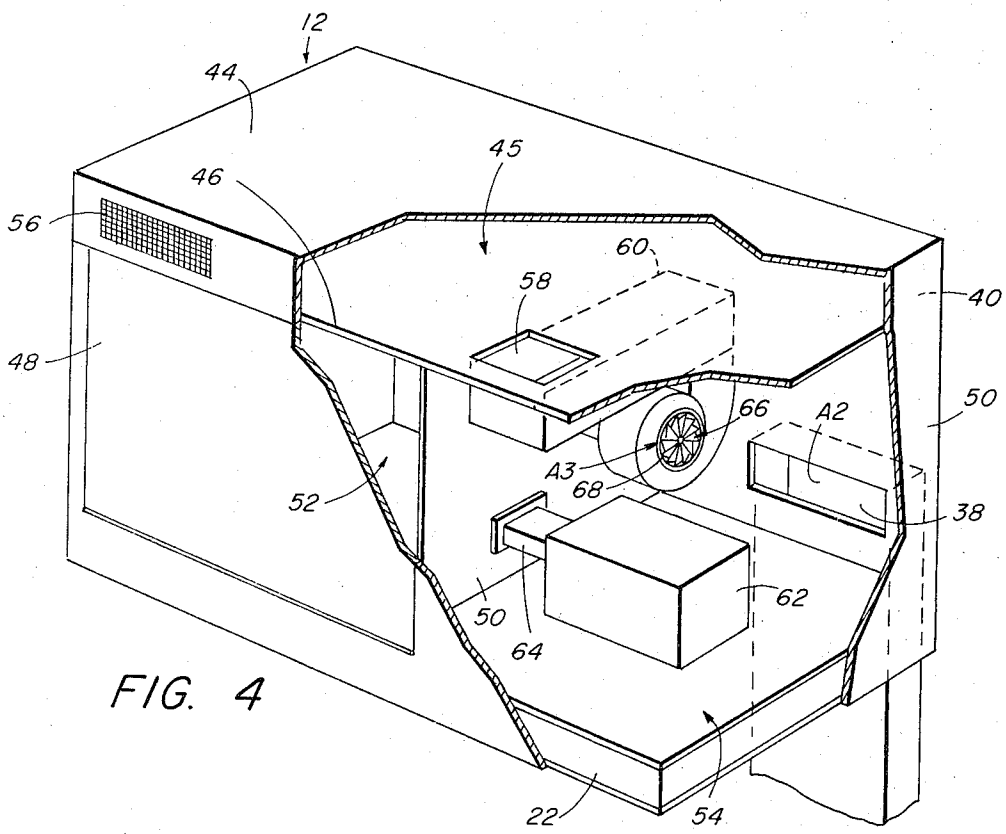

12
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60
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40
48
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66
A2
A3
68
52
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62
50
64
22
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FIG. 4

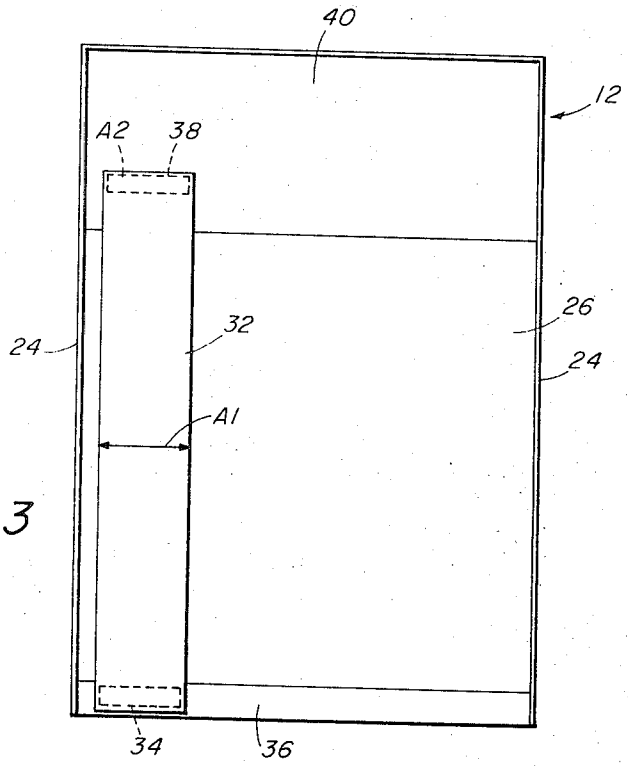

40
12
A2
38
26
24
32
24
A1
34
36

FIG. 3

MICROWAVE COOKING APPARATUS

BACKGROUND OF THE INVENTION

Some commercially available cooking apparatus includes a set of cooking burners which may be gas or electric burners, and an eye-level oven disposed thereabove. The eye-level oven is also operated typically by either gas or electricity.

In accordance with the present invention, the conventional eye level oven is replaced by a microwave oven of approximately the same size, and disposed above the cooking burners of the apparatus. The microwave oven is powered by a magnetron, or the like. The magnetron may have a maximum allowable operating temperature on the order of 235° F, and thus if the magnetron of the microwave oven is not properly ventilated continuous operation of the oven is not possible when heat is being generated therebelow from the conventional cooking burners.

In a commercial microwave oven, there is generally no heat generated below the oven, and the oven is not normally confined in a small space. However, the eye-level microwave oven, which is primarily meant for use in a dwelling place, has heat generated therebelow and is also usually disposed against a wall. Thus, the usual ventilation techniques used in commercial microwave ovens do not provide adequate magnetron cooling in the eye-level microwave oven application.

Accordingly, one important object of the present invention is to provide an improved microwave cooking apparatus including an eye-level microwave oven.

Another object of the present invention is to provide a microwave cooling apparatus in accordance with the preceding object and including ventilation means coupled to the microwave oven for cooling the energy source of the oven even when excessive heat is being generated below the oven. The energy source or magnetron must be suitably cooled so that its temperature is maintained below a predetermined shut-off temperature thereby providing continuous operation of the microwave oven under virtually all operating conditions.

A further object of the present invention is to provide a microwave cooling apparatus in accordance with the preceding objects wherein a conventional eye-level oven can be used and easily adapted for microwave cooking.

SUMMARY OF THE INVENTION

To accomplish the foregoing and other objects of the present invention, there is provided a cooking apparatus having a typical set of cooking burners which may be either gas or electric operated, and a microwave oven disposed above and spaced from the cooking burners. In accordance with one aspect of the present invention, the cooking apparatus has an enclosed chamber at the bottom thereof, and there is provided a ventilation duct preferably vertically arranged, and extending from the bottom chamber of the apparatus to the microwave oven. In one embodiment of the invention the ventilating duct terminates at the bottom of the microwave oven and in an alternate embodiment the duct terminates into the back of the microwave oven.

In a preferred embodiment, the duct has a rectangular cross section of a first area and the opening into the microwave oven is dimensioned having a second area,

wherein the first area is preferably larger than the second area for providing adequate air flow. The blower that is provided in the microwave oven for circulating the air adjacent the magnetron, or the like, has an intake aperture that is preferably circular and should have a cross section no larger than the said second area.

BRIEF DESCRIPTION OF THE DRAWINGS

Numerous other objects, features and advantages of the invention will now become apparent upon a reading of the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a microwave cooking apparatus constructed in accordance with the principles of the present invention;

FIG. 2 is a side view of the apparatus of FIG. 1 partially in cross section showing one embodiment for the ventilation duct;

FIG. 3 is a back view of the cooking apparatus of FIG. 1;

FIG. 4 is a perspective view of the microwave oven section of the cooking apparatus of FIG. 1 partially cut away to show the compartment containing the energy source for the oven; and

FIG. 5 is a side view similar to the one shown in FIG. 2 partially in cross section of another embodiment of the ventilation duct of the present invention.

DETAILED DESCRIPTION

Referring now to the drawings, and in particular to FIG. 1, there is shown a perspective view of a cooking range **10** that is basically of conventional design but includes a microwave oven **12** in place of the conventional eye-level oven. The range includes cooking burners **14** which may be either electric, gas or the like, burners and their associated controls **16.** The range is basically constructed of sheet metal, may have a baked enamel finish and may include a storage area in the bottom portion **18** of the range.

An upwardly extending intermediate portion **20** interconnects the bottom portion **18** with the rear of the microwave oven **12.** The microwave oven preferably has an insulating sheet **22** disposed therebelow to provide a limited amount of insulation between the heat generated from the burners **14** and the microwave oven itself.

The range **10** is typically constructed as depicted in the cutaway section in FIG. **1,** with the side walls **24** extending rearwardly to form a back cavity **26** (see also FIG. **3**). As indicated in FIG. **2,** the bottom portion **18** is also constructed so that there is an open bottom chamber **28** that forms an enclosed chamber when the range is supported on a floor or the like. This bottom chamber **28** is vented at the front vent **30.** Referring now to FIGS. **2** and **3,** there is shown respective side and back views of the cooking range indicating the position for the vertical ventilating duct **32.** Duct **32** connects from the bottom chamber **28** through an opening **34** in the back wall **36** defining the chamber **28.** The duct **32** may be constructed of sheet metal and its upper end terminates in an opening **38** in the back wall **40** of the microwave oven. Thus, the bottom chamber **28** is a source of relatively cool input air coupled from input vent **30** and the vertical duct **32** carries this relatively cool air to the microwave oven **12.**

Referring now to FIG. 4 there is shown a perspective view of the microwave oven **12** partially cutaway to diagrammatically show some of the internal components comprising the oven. The oven comprises a bottom insulating plate **22**, a top plate **44** and an intermediate plate **46**. The oven also comprises a front door **48** and a number of vertically extending walls **50** which define an oven cooking area **52** and a component storage area **54**.

The space provided between top wall **44** and intermediate wall **46** defines an output plenum chamber **45** having an output vented opening **56** and an input opening **58** which communicates with the blower **60** in the area **54**. Area **54** also contains a magnetron **62** or the like and means **64** which may be a wave guide for coupling the energy from the magnetron to the cooking cavity **52**.

The blower **60** may be of conventional design and includes a circulating fan **66** having an input port **68**. FIG. **4** also shows the opening **38** in the back wall **40** which terminates the top end of the vertical duct **32**.

When the oven was operated without the use of a vertical duct and with the use of a rear input port, there was not sufficient cooling provided for the magnetron, and thus the temperature limit switch associated therewith caused intermittent operation of the magnetron. Typically, the magnetron should not be operated at its cooling fins in excess of approximately 235° F. With the use of a vertical duct interconnecting to the bottom chamber **28** sufficient cooling was provided to enable continuous operation of a magnetron. Also, this operation was tried with all of the burners **14** on which would be the worst case condition.

In accordance with one aspect of the present invention, it was discovered that the cross sectional area A1 of the duct **32** should be larger than the cross section of the opening **38**. In one embodiment the ventilation duct **32** has an 8 × 1 1/2 inch cross section and the opening **38** has a 7 × 1 1/2 inch opening. Alternatively, the area A1 should not be made too much larger than the area A2 as this would decrease the velocity of the air moving up the vertical duct **32**. The air should be drawn up the duct at approximately 80 cu. ft. per minute. It is also preferred that the opening **34** in the bottom be slightly larger in area than the area A1. The dimensions of this opening may be 8 inches by 2 inches for example.

In accordance with a further aspect of the present invention, it was found that the opening **38** in the rear wall **40** of the microwave oven should not be any smaller than the cross sectional area A3 of the input port **68** of the blower **60**. In one embodiment the diameter of the input port **68** is 2 3/4 inches and the area A3 is approximately 9 sq. in. The area of opening **38** is approximately 10 1/2 sq. in. The air passes from the output port **58** of the blower **60** and is vented through vents **56** preferably in the front, top portion of the microwave oven.

FIG. **5** shows an alternate arrangement for the vertical duct **32**. The duct **32** couples from the bottom chamber **28** to the bottom of the microwave oven and the opening terminating the top of the vertical duct **32** may be the same size as opening **38** shown in FIG. **4**. Alternatively, the top end of duct **32** may extend through bottom insulated wall **22** and terminate slightly above this wall internal of the oven. With the duct in this position, the cooling is approximately the same as discussed hereinbefore with reference to FIGS. **1–4**.

Having described a limited number of embodiments of the present invention, it should now be obvious that numerous other embodiments will fall within the spirit and scope of the present invention which is defined by the appended claims.

What is claimed is:

1. A cooking apparatus comprising;

a bottom section having a plurality of upright walls, a back wall and a bottom plate defining a chamber having at least one port for carrying air from outside the apparatus to the chamber, said chamber being a source of relatively cool air,

a top section including a microwave oven having electrical components including a magnetron, and a circulating blower with an air intake port,

means intermediate the top and bottom sections for structurally interconnecting the top and bottom sections with the top section disposed at normal eye level,

and a ventilation duct that continuously extends from said bottom chamber to said microwave oven,

said microwave oven having an opening for receiving the top end of the ventilation duct and said bottom section having a rear wall defining in part the chamber, said rear wall having an opening for receiving the bottom end of the ventilation duct,

said ventilation duct having a cross-sectional area smaller than the cross-sectional area of the opening from the rear wall defining the bottom chamber.

2. The apparatus of claim **1** wherein the cross-sectional area of the duct is larger than the cross-sectional area of the opening in the microwave oven.

3. The apparatus of claim **2** wherein the blower and duct are constructed to pass air at a rate of approximately **80** cubic feet per minute.

4. The apparatus of claim **3** wherein the cross-sectional area of the intake port of the blower is smaller than the cross-sectional area of the opening in the microwave oven to which the duct is coupled.

5. The apparatus of claim **4** wherein said duct has a rectangular cross-section.

6. The apparatus of claim **5** wherein said microwave oven has an output air vent and means defining an output plenum chamber for receiving area from the blower and exiting air via the output air vent.

7. The apparatus of claim **6** wherein said bottom chamber, duct and blower are for conveying air to the microwave oven for the purpose of cooling the components therein, said air flow being continuous from said bottom chamber to said microwave oven.

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