US007107983B1

(12) **United States Patent**
West

(10) **Patent No.: US 7,107,983 B1**
(45) **Date of Patent: Sep. 19, 2006**

(54) **PORTABLE STOVE**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/059,904**

(22) Filed: **Feb. 17, 2005**

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/783,050, filed on Feb. 20, 2004, now abandoned.

(51) **Int. Cl.**
A47J 37/00 (2006.01)
A47J 37/07 (2006.01)

(52) **U.S. Cl.** ..... **126/25 R**; 126/9 R; 126/9 B

(58) **Field of Classification Search** ..... 126/25 R, 126/29, 30, 9 R, 9 B, 65
See application file for complete search history.

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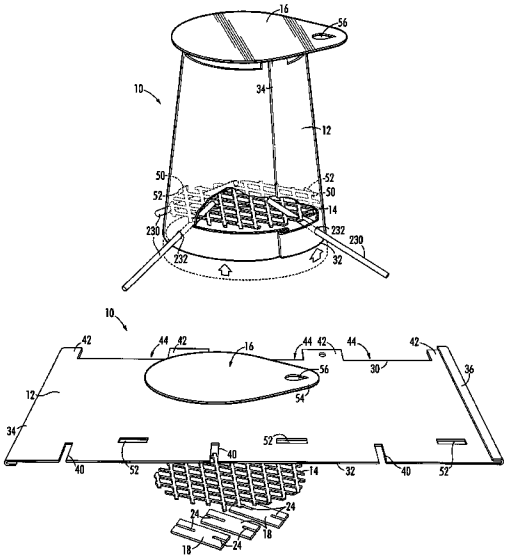
(57) **ABSTRACT**

A portable stove includes a frusto-conical body and a grid carried within the body together with an optional cooking surface for the smaller end of the body and stands to elevate the larger end of the body to facilitate establishing an air flow into the body. By rolling a flat piece of metal that has folds on both ends until the folded ends are interlocked, the stove's body is formed. Squeezing the formed body releases it to return to a flattened configuration for storage. The components of the stove can thus be stored in a compact configuration such as in a backpack. An optional oven includes a cooking chamber within a housing. The oven rests on the body and redistributes heat from the burning fuel inside the body to the cooking chamber base, body and lid so that it bakes evenly. The housing confines the heat to the chamber for improved cooking efficiency.

19 Claims, 7 Drawing Sheets



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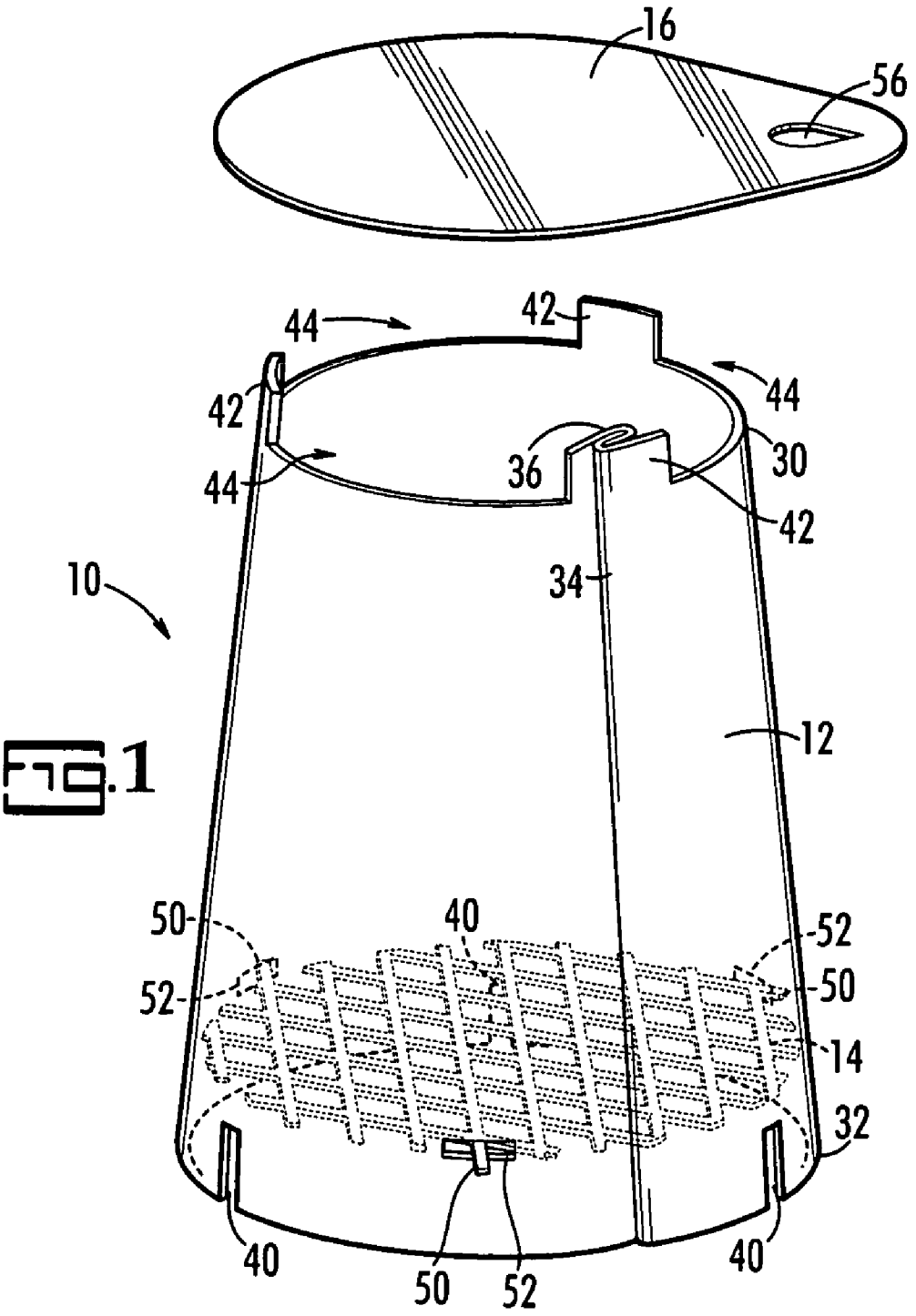

FIG. 1

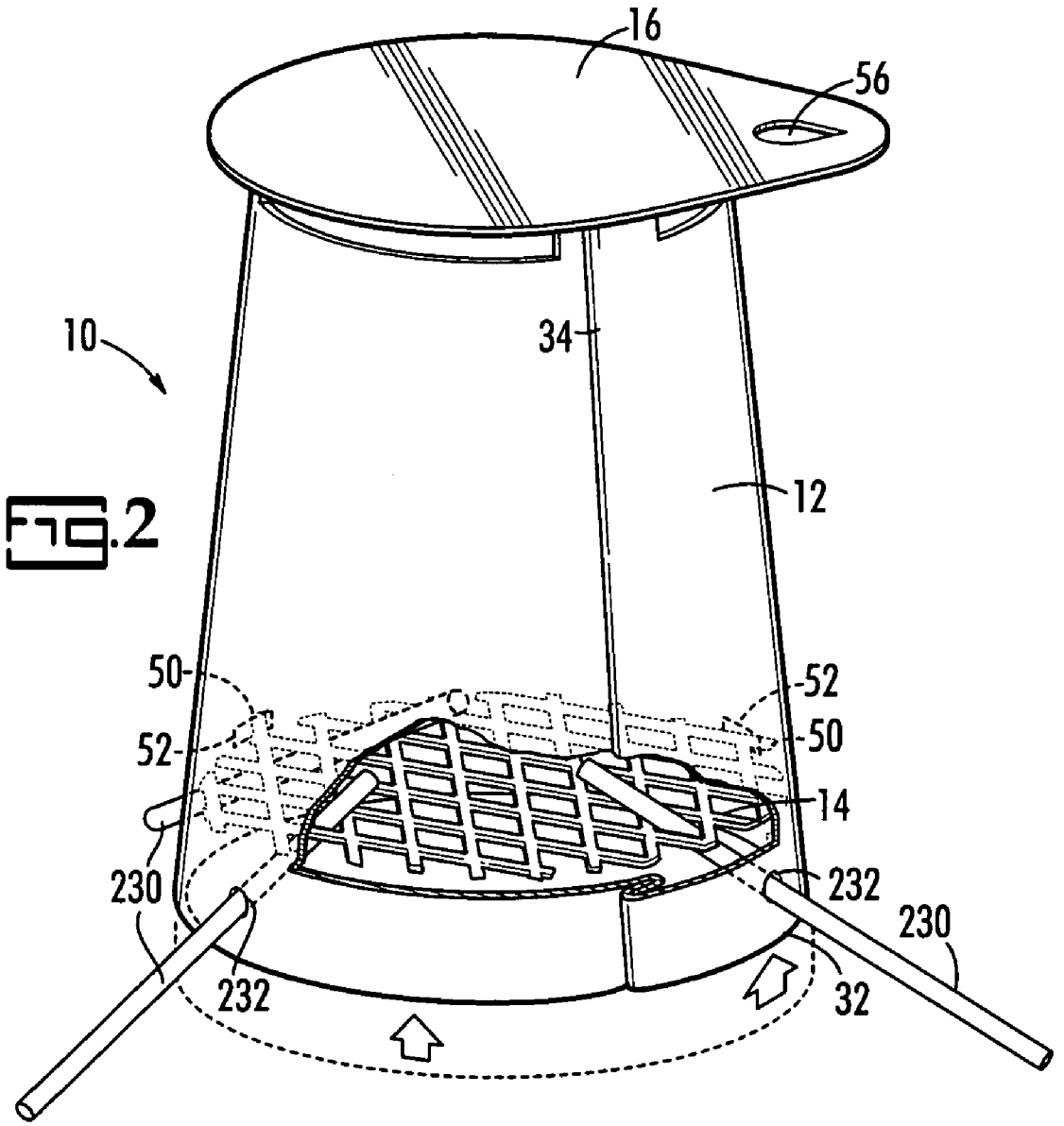

FIG.2

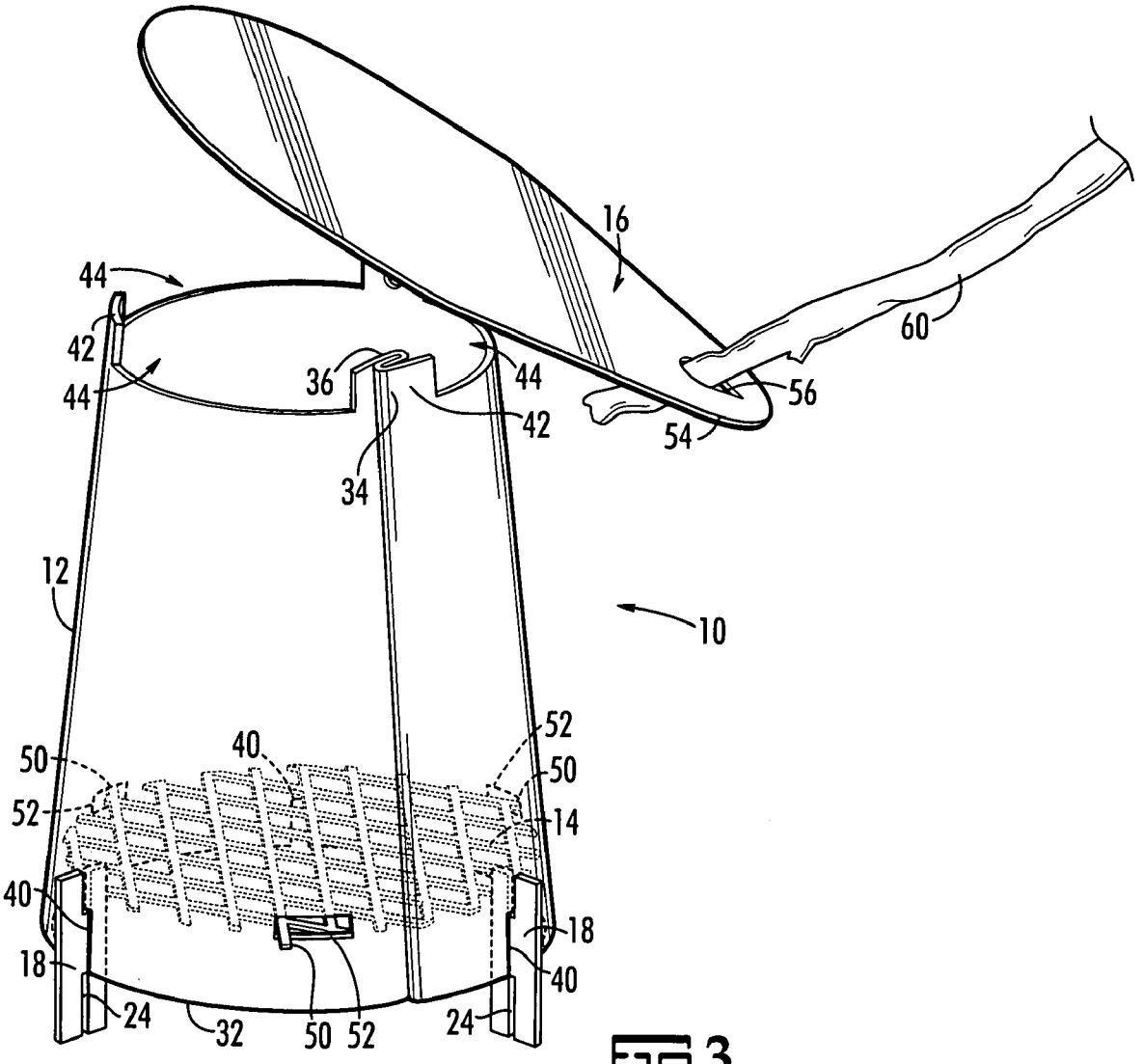
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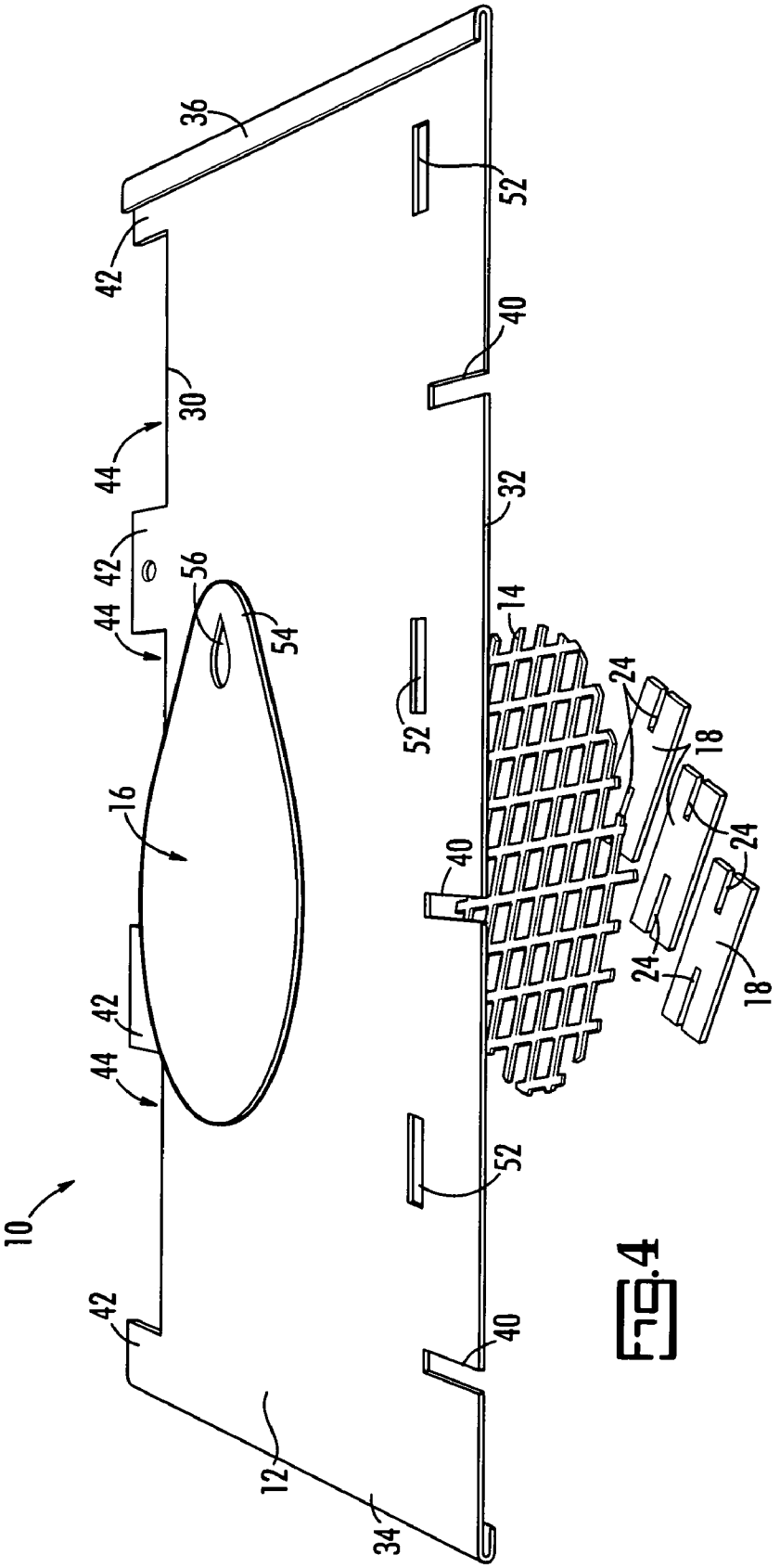
FIG.3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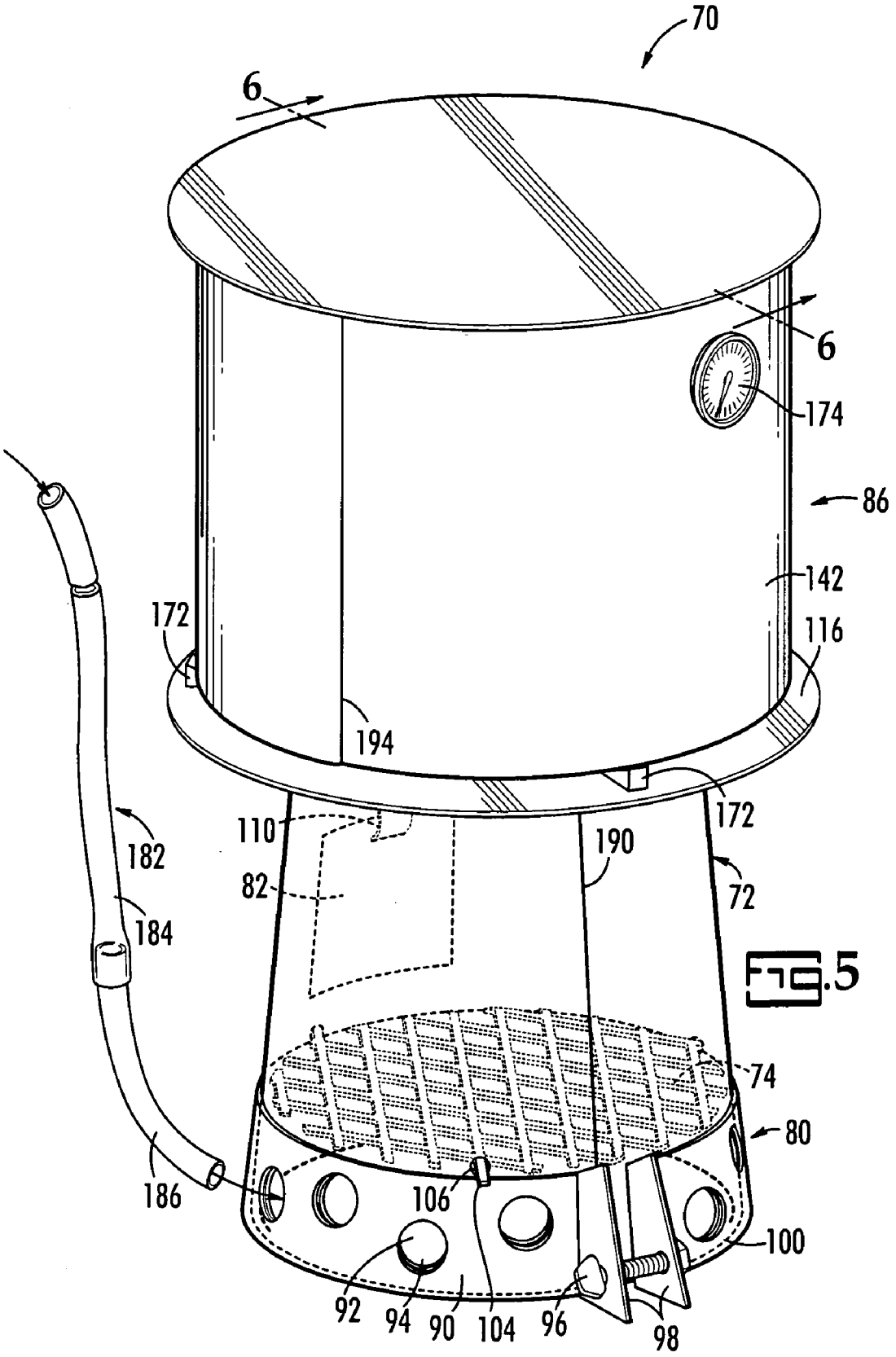
34

FIG. 4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174
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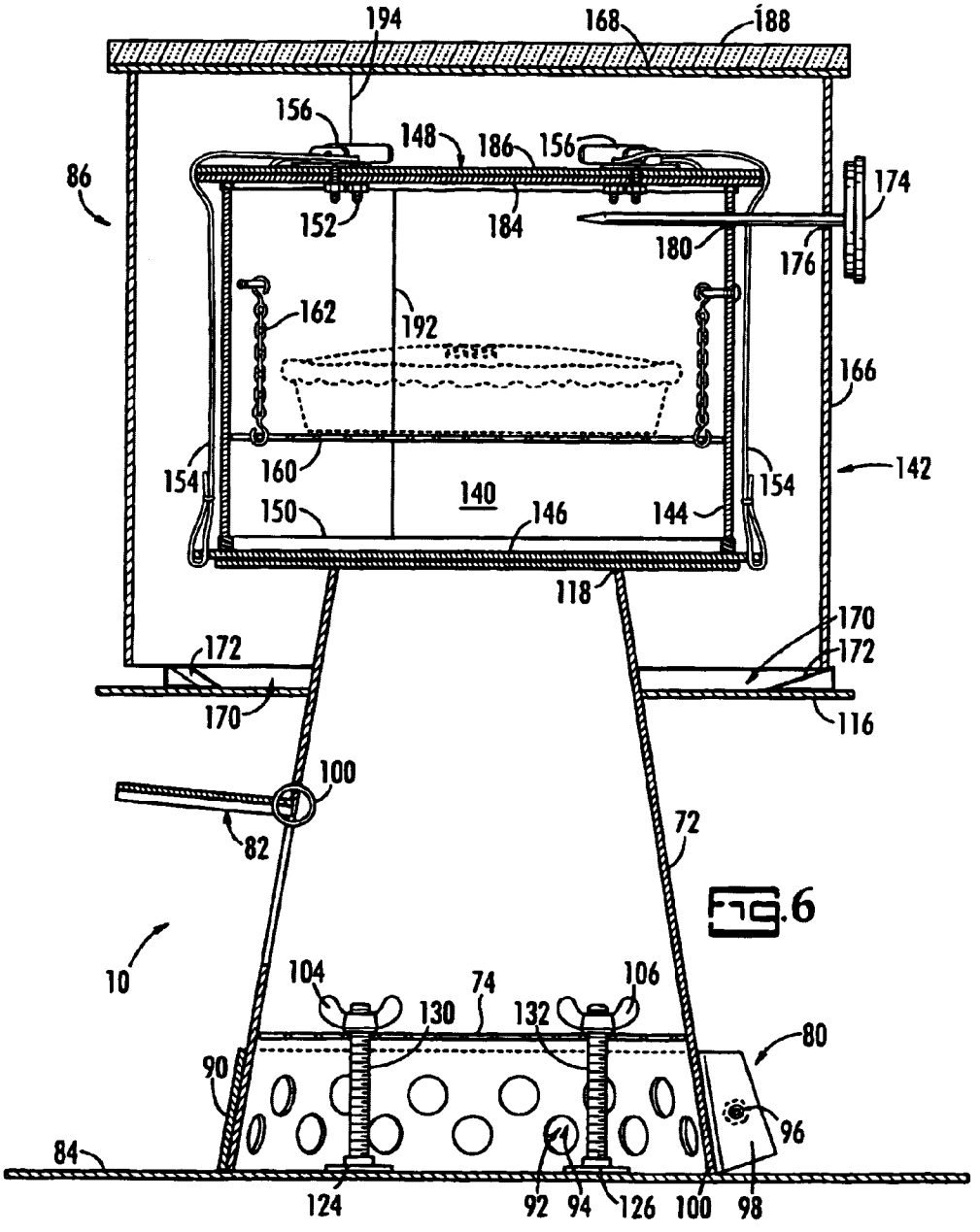
98

FIG.5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150
146
144
118
170
172
172
170
116
100
82
72
10
104
74
106
130
132
80
90
96
84
124
92
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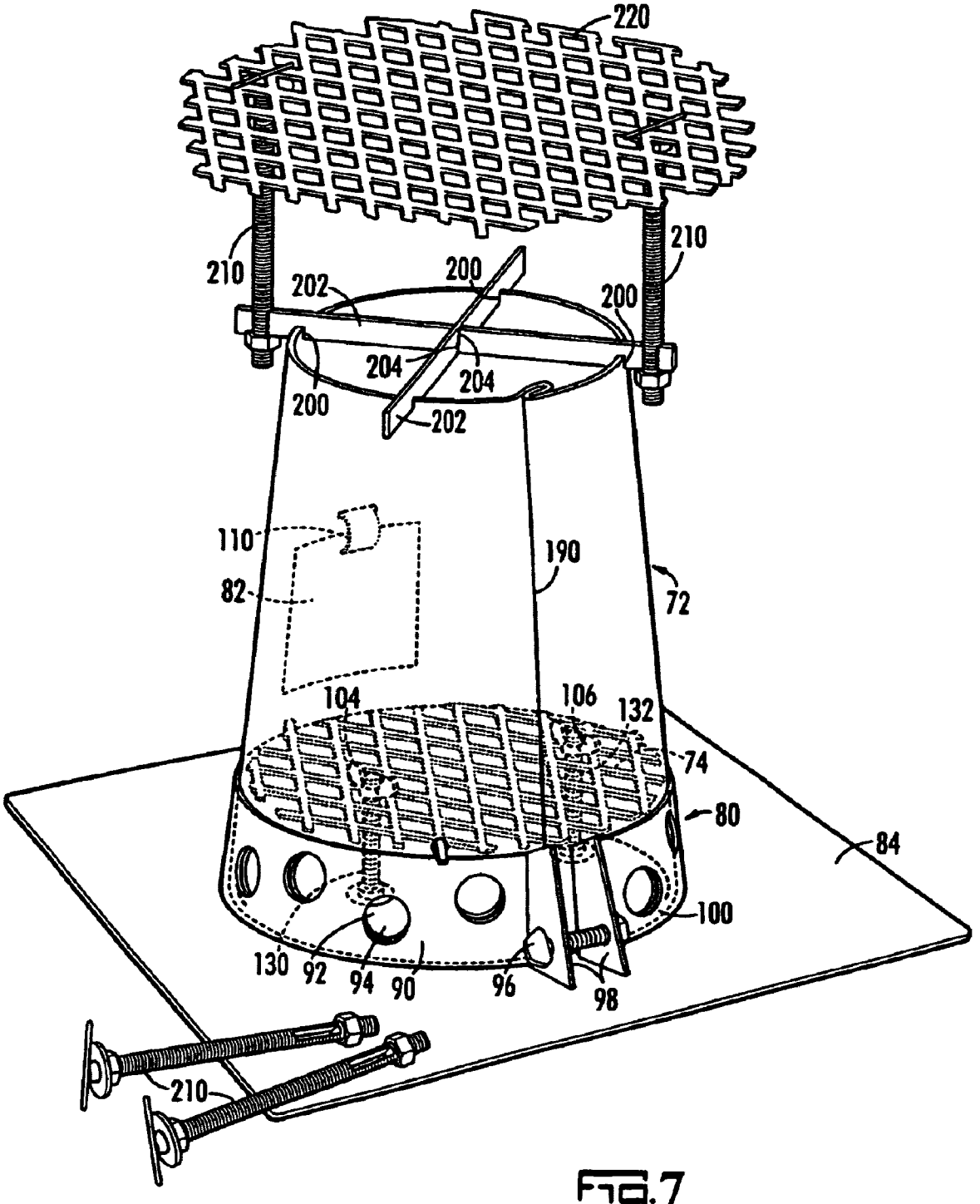
126
100
98

FIG. 6


220
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202
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204
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130
92
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96
98
210

FIG. 7

PORTABLE STOVE

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is a contination in part of application Ser. No. 10/783,050, filed Feb. 20, 2004 now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates generally to portable stoves and ovens for cooking using available combustible solid fuels.

Many people throughout the world use electric or gas ovens, microwave ovens and stovetops for cooking. However, many more do not. Stoves and ovens that use wood, propane, charcoal, peat, dung, or chemical combustibles are often used out of convenience or necessity. For example, those hiking long distances may build campfires for cooking and for warmth. Campers may include small portable propane stoves specifically for camping among their camping gear.

Not everyone has a choice in the way to cook. Many people in underdeveloped countries cook in primitive ways, perhaps using campfires or simple structures in which to burn whatever solid fuels are available. Many times these primitive heat sources are inefficient, consuming a lot of fuel for the amount of cooking actually being done.

However, even when the most modern cooking appliances are available, the results are not always optimal. The taste of food is often better when the right combinations of browning and residual moisture content are obtained. Those combinations do not always result from the use of the most modern cooking appliances.

Thus their remains a need for a better way to cook, particularly for those who do not have access to conventional stoves, ovens, microwave ovens and the like, whether by choice or not, and preferably a way to cook that is more energy efficient and also, ideally, more easily portable.

SUMMARY OF THE INVENTION

According to its major aspects and briefly recited, the present invention is a portable stove. The present stove in all embodiments is a small stove for simple outdoor cooking and, in one embodiment, baking.

An important feature of the present invention is that the stove disassembles without tools into a series of flat components that can be stored or carried easily with minimal space requirements.

Another important feature of the present invention is that it is preferably made to have a frusto-conical shape that has two advantages. This shape is very stable and is more energy efficient. The present stove also has a cooking surface that takes the heat, concentrated by the frusto-conical shape, and delivers it to the food-holding container placed on the surface, thereby avoiding wasted heat thrown to the sides of the container.

Still another important feature of the present invention is the use of copper to transmit heat in a controlled manner. The heat follows copper readily, more so than many other metals, delivering it to where it is desired and thus wasting less heat.

Another feature of the present invention is an oven that surrounds a baking chamber with heat from the stove below it and thus bakes with surprisingly good results.

Other features and their advantages will be apparent to those skilled in the art of lamp design from a careful reading of a Detailed Description Of The Invention accompanied by the following drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is a perspective, partially exploded view of a stove according to a first preferred embodiment of the present invention;

FIG. **2** is a perspective, partially cut-away view of a stove according to an alternative preferred embodiment of the present invention;

FIG. **3** is a perspective view of a stove according to a first preferred embodiment with alternative stands;

FIG. **4** is a perspective view of the stove of FIG. **3** shown disassembled, according to the first alternative embodiment of the present invention;

FIG. **5** is a perspective view of an alternative stove according to a second preferred embodiment of the present invention;

FIG. **6** is a cross sectional side view of the alternative stove shown in FIG. **5**; and

FIG. **7** is a perspective, partially exploded view of a stove having an alternative cooking surface configuration.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is a device for cooking, that is, for serving as a heat source for food and beverages, which device will be referred to simply as a stove. The present stove can heat the bottom of a container of food in the same fashion as a stovetop does or, in an alternative embodiment, it can surround a food item, in a container or otherwise, with heat in order to bake the item, as in an oven. It has a secondary function as serving as a heat source for individuals.

Referring now to FIGS. **1**–**4**, the present stove, generally referred to with reference number **10**, includes a body **12** and a fuel support grid **14**. It may also include a cook surface **16** and stands **18**. Stands **18** may have slits **24** formed in them to receive body **12**.

Body **12** is generally cylindrical in shape but is preferably slightly frusto-conical in shape so that the diameter of its top **30** is smaller than the diameter of its bottom **32** in order to concentrate heat and be more stable. Body **12** is made of a single piece of sheet metal with complementary folds **34**, **36** at opposing edges that can be interleaved for body **12** to define and hold the cylindrical or frusto-conical shape but also to allow it to be unfolded flat when it is to be stored, perhaps slightly curved inside a backpack. The term cylindrical will be used herein to include frusto-conical unless the latter term is specifically used.

It is important to allow air to flow into body **12** and out of body **12**. Air flowing in brings oxygen for combustion; air flowing out takes exhaust gases with it. Accordingly, body **12** can have small cutout portions **40** at bottom **32** (FIG. **1**) for mating with stands **18** to elevate stove **10** above a surface on which it is placed. Correspondingly, upstanding tabs **42** at top **30** define openings **44** through which exhaust gases may exit body **12** at top **30**.

FIG. **2** shows an alternative method, to that shown in FIG. **1**, for elevating body **12** in order to admit air for combustion. Base support rods **230** may be inserted through holes **232** formed in body **12** just below fuel support grid **14**. One end

of rods **230** extends into body **12** and through holes in grid **14**; the other remains outside body **12** and acts as a leg for standing body **12** above the ground. All of the rods **230** may be moved inward as desired to adjust the height of the stove and thus adjust the draft and rate of combustion. Additionally, if used on a slope, some of the rods may be moved inward to keep the stove and cooking utensil level.

Fuel support grid **14** is a disk with plural holes formed therein, preferably a circular disk of expanded metal. Grid **14** has extensions **50** at several locations around its periphery that extend through holes **52** in body **12**, when extensions **50** are brought into registration with holes **52**, for supporting grid **14** at a distance above bottom **32** of body **12**. Grid **14** is adapted to hold fuel while permitting air to flow up into the bottom opening of body **12**, through grid **14** and the fuel, and out the top opening of body **12**, thereby admitting air and creating a draft within body **12** to facilitate combustion. The frusto-conical shape of body **12** also facilitates the establishment of a draft by forcing the acceleration of the heated air upwards from cutout portions **40** or the spaces between stands **18** at bottom **32** upwards within body **12** to exit at openings **44** a top **30**. Holes **52** may be round or rectangular and should be sized to make it easy to put extensions **50** through them as body **12** is curled around grid **14** during assembly and squeezed to release interlocking folds **34**, **36**. Also, extensions **50** and holes **52** are preferably deployed about body **12** to provide stable support for grid **14**, most preferably three extensions **50** and three holes **52** at approximately 120 degree intervals are sufficient.

Cook surface **16** is preferably made of copper or other metal or metal alloy that quickly and readily conducts heat, and has an extended portion **54** along its periphery to facilitate lifting. Preferably extended portion **54** has a hole **56** formed near an edge that can be used in combination with a tool or stick **60** to lift cook surface **16** when it is hot.

Note from the illustration in FIG. **4** that the components of the present stove **10** can be disassembled without tools and laid flat. Grid **14**, cook surface **16**, and stands **18** are already flat. Body **12** cools quickly because it is made of metal and can be easily squeezed to release interleaved folds **34**, **36**. Once folds **34**, **36** are released, body **12** can be unrolled from its cylindrical or frusto-conical shape and placed flat. Alternatively, body **12** can be inserted in a backpack so that it follows the curve of the backpack's sides. Grid **14**, cooking surface **16**, and stands **18** can be placed in a plastic bag and carried easily in a backpack or one of its pockets. Note that cook surface **16** prevents soot deposits on cooking utensils and it and the other components of the present stove **10** can easily be wiped clean with a damp cloth.

FIG. **5** and FIG. **6** illustrate another embodiment of the present invention. In this embodiment, there is a stove **70** having a body **72** and a grid **74** that function in the same manner as stove **10** with its body **12** and grid **14**. Other than being dimensioned to be somewhat larger, the primary differences are a lower air-controller **80**, a fuel hatch **82**, a base **84**, and an optional oven **86**.

Lower air-controller **80** is a collar **90** with a series of holes **92** formed therein. A series of holes **94** are also formed in body **72**. Holes **92** can be brought into and out of registration with holes **94** to increase or decrease the flow of air into the interior of body **72**. Collar **90** is made to be easily rotatable coaxially with body **72** but can be secured by tightening a bolt **96** running through flanges **98** at the end of collar **90**, thereby pulling flanges **98** together and tightening collar **90** to body **72**. Collar **90** is preferably dimensioned to be below grid **74** and near bottom **100** of body **72**.

Fuel hatch **82** is intended to allow the user to add fuel after setup. Hatch **82** is preferably hinged to body **72** in such a way that it can be lifted to an open position or lowered to a closed position easily. Most preferably, when lifted, the top edge of hatch **82** pivots about a ring hinge **110** and can be inserted partially into the hatch opening where it will remain in the lifted position against body **72** until lowered. Fuel hatch **82** is of course preferably located above grid **74** in the side of body **72**.

Above fuel hatch **82** is a support surface **116** that is a flat, disk-shaped piece of sheet metal having a hole formed therein large enough so that it slips over a top **118** of body **72** and comes to rest on the exterior of body **72** several inches from top **118**. Support surface **116** acts to support oven **86**, as will be described below.

Base **84** has two threaded fittings **124**, **126** that receive centering bolts **130**, **132**. Bolts **130**, **132** are threaded to threaded fittings **124**, **126**. Then grid **74** is secured to centering bolts **130**, **132** using nuts **104**, **106**. Body **72** can be fitted over grid **74** and the remaining components placed thereon.

Oven **86** includes a baking chamber **140** and a baking housing **142**. Baking chamber **140** fits within housing **142**, which creates a heated environment surrounding baking chamber **140**. Baking chamber **140** includes a cylindrical body **144**, base **146** and lid **148**. Helping to seal base **146** to body **144** and body **144** to lid **148** are gaskets **150** and **152**, respectively. These are preferably made of copper channel metal but may be made of any other heat conducting, flexible material. Once body **144** is placed on base **146**, base **146** is secured to lid **148** using thin cables **154** and latches **156** that pivot to pull cables **154** tight and hold baking chamber **140** together. Inside baking chamber is a cooking rack **160** held in place preferably by chains **162** secured to body **144** using bolts **164**. Chains **162** allow cooking rack to be adjusted vertically to the proper position within baking chamber **140**. Food items such as breads, pies, cakes, casseroles, chickens and potatoes can be baked on rack **160** within baking chamber **140**. The height of rack **160** is preferably set so that the top of the food item is an inch or so below lid **148**.

Except for lid **148**, baking chamber **140** is preferably made entirely of copper or other metal or metal alloy that conducts heat readily so that heat received from the combustion of fuels on grid **74** is transmitted to base **146** and thence to body **144** and to top **148** quickly so that body **144**, base **146** and top **148** radiate heat evenly into the interior of baking chamber **140**. Lid **148** has preferably two layers: a copper lower layer **184** and a stainless steel upper layer **186**. This combination helps to prevent warping of lid **148** as a result of prolonged exposure to heat.

Housing **142**, preferably made of stainless steel or other alloy that conducts heat less readily than copper or other metal baking chamber **140** is made of will tend to hold heat in and surround baking chamber **140** with heat. Housing **142** rests on support surface **116** and includes only a body **166** and a lid **168**. Support surface **116** has a hole dimensioned to receive a portion of body **166** so that body **166** extends into housing **142**. Preferably lid **168** has a layer for heat insulation **188** on top of it. Smoke and other exhaust gases can circulate within housing **142** (but not enter baking chamber **140**) and exit from a gap **170** between support surface **116** and body **166**. Preferably wedges **172** can be used to enlarge gap **170**.

A thermometer **174** is important to use, as baking requires a reasonable degree of control over the temperature inside baking chamber **140**. Thermometer **174** extends from out-

side housing **142** through a first hole **176** formed therein into baking chamber **140** through a second hole **180** formed therein.

Without wishing to be bound by theory, it is believed that the present baking chamber **140** promotes browning without excessive moisture loss. Browning, while nominally improving the appearance of food, also contributes to the flavor of food, particularly baked products. The Maillard reaction, in which amino groups of amino acids, peptides and proteins react with the glycosidic hydroxyl groups of sugars to form brown pigments, is known to enhance flavor and aroma. The present chamber **140** has been observed in testing to produce superior browning of pies, for example, when compared to that achieved using standard ovens. Not only is browning more even, but flavor and aroma is enhanced. It is believed that the smaller confines and relatively sealed conditions of chamber **140** produce this effect. Liquids in the food are not lost or dispersed but are retained to be absorbed by the sugars in the food item and slow the gelatinization process to become lighter and more tender.

To use stove **70** for baking, a food item such as a pie **182** is placed on rack **160** and lid **148** placed on body **144**. Lid **148** is secured to base **146** using cables **154** and latches **156** are pivoted closed to pull lid **148** on tightly. A fire is started in body **72** using available fuel such as wood or dried dung by inserting the fuel through open fuel hatch **82** and adjusting lower air controller **80** and upper air controller **84**. An optional hose **182** that preferably has flexible plastic portion **184** and a metal portion **186** can be used to increase airflow while the fuel is catching fire by blowing in plastic portion **186** while holding metal portion in holes **92**, **94**. Once the fire is burning evenly, support surface **116** can be put into position and baking chamber placed on top **118**. Housing **142** is lowered over baking chamber **140** and first and second holes **176**, **180**, respectively, are brought into registration by rotating housing **142**. Once holes **176** and **180** are aligned, thermometer **174** can be inserted. If the temperature reading on thermometer **174** is too low, fuel can be added and lower air controller **80** adjusted to produce a hotter flame. If the temperature is too high, lid **168** can be lifted for a few moments, water can be squirted on the fuel or lower air controller **80** adjusted to reduce the amount of air flowing into body **72**. Combinations of these can be used to maintain the temperature inside baking chamber within a pre-selected range of temperatures.

Stove **70** can be disassembled into its components and bodies **72**, **144**, and **166** flattened in the same manner as body **12**. Bodies **72**, **144**, **166**, all have seams **190**, **192** and **194** that are formed by interlocking folds formed in their respective edges. By squeezing bodies **72**, **144**, **166**, these interlocking folds can be unlocked and separated. Once unlocked, bodies **72**, **144**, **166** may be pressed flat. Collars **90** and **120** can be unbolted and opened nearly flat. Thus, stove **70** can be stored in a relatively compact configuration for later use, easily re-assembled without tools and used again.

FIG. **7** illustrates another embodiment of the present invention whereby body **72** may be used to convey heat to the surface of a grilling surface **220**. To achieve this configuration, slots **200** on support bridges **202** are first positioned to allow support bridges **202** to rest on the top edge of body **72**. Support bridges **202** may be joined by their interlocking slots **204** to provide stability to the support structure for grilling surface **220**. Bridges **202** may extend outside the perimeter of the top surface of body **72**. On the ends of support bridges **202**, slotted elevating bolts **210** can be positioned, with the ends of bridges **202** being received into the slots of slotted elevating bolts **210**, to provide elevated support for grilling surface **220** above body **72**.

It is intended that the scope of the present invention include all modifications that incorporate its principal design features, and that the scope and limitations of the present invention are to be determined by the scope of the appended claims and their equivalents. It also should be understood, therefore, that the inventive concepts herein described are interchangeable and/or they can be used together in still other permutations of the present invention, and that other modifications and substitutions will be apparent to those skilled in the art of lamp manufacture from the foregoing description of the preferred embodiments without departing from the spirit or scope of the present invention.

What is claimed is:

1. A stove, comprising:

a frusto-conical body having a smaller top opening and a larger bottom opening;

a fuel support grid carried within said frusto-conical body;

a cook surface carried on said top opening, said top opening being formed to define tabs between which exhaust gases exit, said cook surface being carried on said tabs of said top opening; and

means for elevating said frusto-conical body so as to admit a draft of air into said frusto-conical body through said bottom opening, pass through said fuel support grid and exit said top opening.

2. The stove of claim **1**, wherein said frusto-conical body has an opening formed therein between said fuel support grid and said top opening, and wherein said stove further comprises a hatch covering said opening, said hatch being adapted to be lifted to insert fuel through said opening for placement onto said fuel support grid, wherein said elevating means further comprises at least three rods, and wherein said frusto-conical body has at least three holes formed therein between said fuel support grid and said bottom opening, said at least three holes being dimensions for receiving said at least three rods so that said at least three rods can be inserted partially into said at least three holes toward and into said fuel support grid whereby said at least rods extend laterally and rigidly from said frusto-conical body in order to elevate said frusto-conical body and admit said draft of air, said rods being movable inward as desired to adjust the height of the stove and thus adjust the draft and rate of combustion.

3. The stove of claim **1**, wherein said cook surface has an edge and wherein a hole is formed therein near said edge for use in lifting said cook surface **16** when said cook surface is hot.

4. The stove of claim **1**, further comprising a baking chamber carried by said cook surface.

5. A stove, comprising:

a frusto-conical body having a smaller top opening and a larger bottom opening;

a fuel support grid carried within said frusto-conical body;

a cook surface carried on said top opening, said top opening being formed to define tabs between which exhaust gases exit, said cook surface being carried on said tabs of said top opening; and

means for admitting a draft of air into said frusto-conical body, through said fuel support grid and out said top opening, wherein said elevating means further comprises at least three rods, and wherein said frusto-conical body has at least three holes formed therein between said fuel support grid and said bottom opening, said at least three holes being dimensions for receiving said at least three rods so that said at least

three rods can be inserted partially into said at least three holes toward and into said fuel support grid whereby said at least rods extend laterally and rigidly from said frusto-conical body in order to elevate said frusto-conical body and admit said draft of air, said rods being movable inward as desired to adjust the height of the stove and thus adjust the draft and rate of combustion.

6. The stove of claim **5**, wherein said frusto-conical body includes a first series of holes near said bottom opening and below said fuel support grid, and wherein said admitting means further comprises a collar encircling said frusto-conical body near said bottom opening below said fuel support grid, said collar having a second series of holes formed therein and being rotatable so that said first and said second series of holes can be placed more or less in registration to define an air passage into said frusto-conical body below said fuel support grid.

7. The stove of claim **5**, wherein said cook surface further comprises:

a grilling surface; and

means for elevating said grilling surface above said top opening.

8. The stove of claim **7**, wherein said elevating means further comprises:

support bridges crossing said top opening of said frusto-conical body; and

bolts carried by and extending upwards from said support bridges to which said grilling surface can be secured.

9. The stove of claim **5**, further comprising a baking chamber carried on said cook surface.

10. The stove of claim **9**, further comprising:

a baking housing dimensioned to hold said baking chamber therein; and

a support surface having a hole formed therein dimensioned for receiving a portion of said frusto-conical body, said baking housing resting on said support surface so that said portion of said frusto-conical body extends into said baking housing.

11. The stove as recited in claim **9**, wherein said baking chamber is made of copper.

12. The stove as recited in claim **9**, further comprising a thermometer insertable into said baking chamber and readable outside said baking chamber.

13. The stove of claim **9**, wherein said baking chamber further comprises:

means for sealing said chamber; and

means for adjustably positioning food vertically within said chamber.

14. The stove of claim **13**, wherein said means for sealing said baking chamber includes plural latches.

15. The stove of claim **13**, wherein said means for sealing said baking chamber includes a gasket.

16. The stove of claim **5**, wherein said frusto-conical body has an opening formed therein between said fuel support grid and said top opening, and wherein said stove further comprises a hatch covering said opening, said hatch being adapted to be lifted to insert fuel through said opening for placement onto said fuel support grid.

17. The stove of claim **5**, wherein said frusto-conical body is formed of a sheet of metal having a first edge and an opposing second edge, said first and said second edges being folded complementarily so that said folds interleave to define said frusto-conical shape but also to release said folds to open said housing when said housing is squeezed.

18. The stove of claim **5**, wherein said hatch has a top edge and is secured by said top edge to said frusto-conical body by a hinge and wherein said hinge is dimensioned to allow said top edge of said hatch to hold said hatch in an opened position to allow fuel to be placed on said fuel support grid.

19. The stove as recited in claim **5**, further comprising a tube for augmenting air flow admitted into said frusto-conical body.

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