

Title: LARGE-BURNER STOVE WITH RECESSED BURNER WELL
AND EXHAUST DUCTING

This invention generally relates to a stove for cooking and particularly to one having a large burner which
5 generates a high heat exhaust and which is adapted for multiple styles of cooking with a high heat flame.

Industrial stoves, e.g. as used in restaurants and institutional kitchens, often have one or more large burner units that generate a high amount of heat and
10 smoke which must be exhausted from the cooking area. Equipment typically used to handle large volumes of exhaust include large fans which pull heated and smoke-filled air from around the stove cooking area into a duct system that directs the high heat exhaust out
15 through an exit vent or a chimney. In such conventional large-burner stoves, the burners provide their gas-fired flames at the stove surface under pots, frying pans, and other cooking vessels. In the cooking of Oriental foods, a large-diameter wok is typically seated on a
20 support or collar while a large burner provides an exposed flame often at full gas volume.

The exposed flames of large-burner stoves generate high amounts of heat that must be ducted forcefully away from the cook. Measures must be taken to handle the high
25 heat of the exhaust. For example, the high heat exhaust must be ducted into a chimney lined with refractory material, or must be forcefully mixed with cool air to reduce its temperature to manageable levels. The required high-capacity fan and duct system is a large

equipment that has a high cost and takes up a large volume of space. This requirement makes large-burner stoves costly, unsuitable and/or unsafe for common use in the home.

- 5 It is therefore a principal aim of the invention to provide a large-burner stove which has a simple and inexpensive structure for handling high heat exhaust. In particular, it is desired to have a large-burner stove which is suitable for use in the home, and which
10 does not require a high-capacity fan and duct system to handle the exhaust. It is a further aim to provide means for moderating high heat exhaust from a large-burner stove using a natural convection draught without the necessity of using a duct fan.
- 15 It is another aim of the invention to provide a large-burner stove which has a simple and inexpensive structure for handling multiple styles of cooking with a high heat flame. It is also desired to have a large-burner stove which is suitable for use in the home, and
20 which does not require a high-capacity fan and duct system to handle the exhaust.

In accordance with the present invention, there is provided a stove comprising: a casing having walls defining a horizontal upper surface adapted for use as a
25 cooking surface and a hollow interior; a burner well extending into the interior of said casing and having an upper annular rim at the said horizontal upper surface which defines a support on which a cooking vessel can be placed for cooking, the annular rim being so
30 dimensioned that the cooking vessel substantially

closes off the well from exposure at said horizontal upper surface; a burner located at an interior position in said well in the interior of the casing for providing a flame to a bottom portion of the cooking vessel; and
5 ducting including a first duct member positioned at a rear portion of said casing remote from said burner well and a second duct member communicating with the interior of the well via a first opening located adjacent said interior position in said well and via another opening
10 communicating with said first duct member for conveying combustion products from said burner into said first duct member at the rear portion of the casing; wherein the burner well has a vertically orientated cylindrical wall which is lined with a refractory material to
15 insulate the stove from the heat from said burner in said well and wherein the first opening is formed through the cylindrical wall and liner material.

Preferably, the annular rim of the burner well is dimensioned to support a wok or other rounded-bottom
20 cooking vessel.

According to a preferred embodiment of the invention, the first duct member comprises an enclosed duct casing orientated vertically and having walls defining a hollow interior, an inlet communicating with said second duct

member for receiving high heat exhaust at a lower portion of said duct casing, an outlet for reduced-temperature exhaust at an upper portion thereof, a plurality of generally horizontal baffles forming a labyrinthine channel through the interior of said first duct member between said inlet and said outlet, and means for generating a draught of ambient air into said labyrinthine channel for mixing with said high heat exhaust and reducing its temperature such that a reduced-temperature exhaust exits from the outlet of said first duct member.

The duct casing is preferably a quadrangularly shaped member supported upright in the vertical direction on the rear portion of the stove casing. The baffles in the duct casing are preferably spaced vertically from each other and have offset horizontal lengths which are alternated in opposite directions to form the labyrinthine channel. The duct casing desirably has a double wall construction lined with insulative material to insulate the stove from the heat of the exhaust in the duct casing. The ambient air draught is preferably generated by a second inlet in the bottom portion of the stove casing which is supplied with ambient air through openings formed in the stove casing.

The duct casing and stove may be formed as separate modules which are assembled together for installation. They may also be installed as a stove top unit over a lower oven or storage unit.

In accordance with another feature of the present invention, the recessed burner of the stove includes a catch basin member positionable in the interior of the burner well having annular walls defining a central opening for fitting around the burner and a surrounding retention area for catching any spillage or debris falling from a cooking vessel used thereon.

The catch basin member may have an opening formed through a front portion of its walls, and the stove casing may have a window formed in its front panel aligned with the opening, for allowing the burner flame to be visually checked by viewing through the window.

The stove according to the invention may further include a recessed burner plate which is positionable in the well over the burner for allowing cooking with other types of cooking vessels, and a grill which is positionable over the upper annular rim and a deflector unit positionable below the grill and over the burner for open-flame cooking when the wok is not used.

The invention will now be further described, by way of example, with reference to the drawings, in which:-

Fig. 1 is a perspective view of one embodiment of a stove according to the invention suitable for large-burner cooking generating high heat exhaust having one large burner recessed in a well and two conventional small stove-top burners;

Fig. 2 is a side sectional view of the stove shown in Fig. 1 showing a section through the large burner, burner well, and rear duct casing;

Fig. 3 is a front sectional view of the stove shown in
5 Fig. 1 showing a section through the large burner and one of the small burners;

Fig. 4 is an exploded diagram illustrating the double wall construction of the duct casing of the stove shown in Fig. 1;

10 Fig. 5 is a plan view of a large burner stove according to the invention showing a catch basin feature in its recessed burner well;

Fig. 6 is a front view of the stove showing the feature of a window for visually monitoring the burner flame;

15 Fig. 7 is a side sectional view of the stove showing the catch basin structure and a recessed burner plate feature; and

Fig. 8 is a side sectional view of the stove showing the catch basin structure and the further feature of a grill
20 and deflector plate structure.

In the following description, the general principles of the invention are illustrated by reference to a particular embodiment of a stove suitable for large-burner cooking generating a high heat exhaust. A first
25 principle encompasses the arrangement of recessing a

- large burner in a well in the interior of a stove casing, so that the flame of the burner is substantially confined in the well, and directing the high heat exhaust from around the recessed burner through one duct member in the interior of the stove casing to another duct member located at a rear portion of the stove casing. A second principle encompasses the arrangement of a duct casing at the rear portion of the stove having a lower inlet for high heat exhaust from the large burner received from the duct member through the interior of the stove casing, an upper outlet, a labyrinthine channel between the inlet and outlet formed by a plurality of baffles in the duct casing, and a cool air draught for mixing with and cooling down the high heat exhaust in the channel. A third principle is the use of a catch basin, viewing window, recessed burner plate, grill, and deflector in and over the recessed burner well in order to allow multiple styles of cooking with a high heat flame.
- 20 The preferred embodiment of the stove is a unit sized for home cooking and has one large burner which is used for wok cooking and two smaller conventional burners. However, it is to be understood that the principles of the invention are equally applicable to multiple large- burner arrangements, as well as to industrial stoves for use in restaurants and institutional cooking.

Referring to Fig. 1, a stove in accordance with the invention comprises a stove casing 10 having sheet metal walls and a horizontal upper surface 11 used as a cooking surface, a hollow interior 12 and a well 13 for

a large burner 14 extending into the interior of the casing. The well 13 has an upper annular rim 13a which is used to support a cooking vessel placed thereon. As illustrated in Fig. 2, the cooking vessel is preferably a wok 5 which has a rounded-bottom that rests upon the annular rim 13a so as to substantially close off the well 13 and prevent the flame 14a of the burner 14 from being exposed at the cooking surface 11. Confining the flame 14a in the well 13 greatly reduces the amount of heat lost to the outside, so that the heat is instead applied to the bottom of the cooking vessel. The cooking vessel may also be one having a flat bottom which is supported on the annular rim 13a. The stove also includes two small burners 15, 16 which may be of the conventional type positioned at the cooking surface 11 under a rigid grate 15a, 16a and above a shallow catch plate 15b, 16b.

The well 13 is lined with a refractory material, preferably fire brick. For example, KS-4 firebrick, rated for 2500 degrees, supplied by A. P. Green, Industries, Missouri, may be used. A duct member 37, which may be formed from sheet metal, has an inlet 37a which leads from the well 13 and may also be lined with refractory material.

The stove casing 10 includes a front panel 17, on which gas controls 18 for the burners are arranged, and a rear portion 19 which houses a gas feed pipe 20 having individual feeds 20a, 20b, 20c to the burners and a connector extending through a rear opening 21 in the stove casing 10 to allow connection to a gas utility

source external to the stove. The gas controls 18 on the front panel 17 are connected to control valves to the burners 14, 15, 16 by mechanical linkages which are well known and therefore not shown in the drawings or
5 described further herein.

A quadrangularly shaped duct casing 30 is arranged vertically upright above the rear portion 19 of the stove casing 10 and has a hot exhaust inlet 31 and a cool air inlet 32 formed in a lower panel 33, a warm air
10 outlet 34 formed in an upper panel 35, and a plurality of baffles 36a, 36b, 36c, 36d forming a labyrinthine channel 36 from the inlets 31, 32 to the outlet 34. The cool air inlet 32 communicates with the interior 12 of the stove casing 10 and is supplied with cool air
15 through the rear opening 21 and front openings 22 formed at a lower side of the front panel 17. The hot air inlet 31 communicates with an outlet from the duct member 37.

The operation of the stove is illustrated in Figs. 1-3.
20 The hot exhaust air heated by the flame 14a of the large burner 14 is trapped in the well 13 and becomes entrained by a convection draught of cold air entering the stove casing through openings 20, 22, and passes along the duct member 37 to the hot air inlet 31 of the
25 duct casing 30. Cold air also enters the duct casing 30 through the cold air inlet 32. The hot and cold air are combined in the streams moving by convection along the labyrinthine channel 36 formed by the baffles 36a, 36b, 36c, 36d which have lengths shorter than the horizontal
30 width of the duct casing 30, and are arranged alternately offset in opposite directions in ascending

vertical order. The cold air is indicated by white arrows, hot air by arrows that are densely cross-hatched, and warm air by arrows that are more sparsely cross-hatched.

5 As the hot and cold air streams move along the channel 36, they become mixed together, and the resulting temperature of the combined air streams is substantially reduced. For example, hot exhaust air of 500 to 600 degrees Fahrenheit (260-315° Celsius) in the vicinity of
10 the burner becomes cooled down to about 80 to 100 degrees Fahrenheit (26-37° Celsius) at the outlet 34 in ambient air of about 70 degrees Fahrenheit (21° Celsius). The exiting air at the outlet 34 is thus cooled down enough so that it can be exhausted into the
15 ambient air or handled by a small kitchen fan and vent. The stove thus provides the advantages of large-burner cooking suitable for use in the home. The positioning of the recessed burner 14 in the well 13, so that the flame 14a is not exposed to the outside, also ensures
20 that the ambient air around the cooking surface will remain cool and comfortable without the necessity for forced-draught air handling equipment. The design of the stove also allows the air entrainment and mixing to be accomplished by natural convection, thereby
25 eliminating any need for movement of air by forced draught. However, a small fan may be used to increase the volume of air movement if desired.

In Fig. 4, the duct casing 30 is shown formed with a double wall construction of outer panels 33, 35, 38a,
30 38b, (front and back panels not shown for simplicity) and an inner casing 39. The panels and casing may all

- be formed of sheet metal, preferably stainless steel. The hollow space between the outer panels and inner casing is filled with an insulative material to insulate the outer panels from the heat of the air streams moving through the inner casing. For example, INSWOOL (Registered Trade Mark) - HP ceramic fibre blanket, made by A. P. Green Industries, Missouri, may be used. As a result the outer panels remain cool to the touch, thus enhancing its safety.
- 10 The stove casing and duct casing may be formed as an integral unit, or as separate modules that can be mounted together for installation. The assembled unit is a stove-top range unit that can be mounted on a conventional oven to form a combined oven/range unit.
- 15 Alternatively, it may be sold as a range unit which can be installed over a storage cabinet.

- In Figs. 5 and 6, the wok is removed in order to show another feature of the large-burner stove in accordance with the invention consisting of a recessed catch basin member 40. The recessed catch basin member 40 has annular walls defining a central opening 41 for fitting around the burner 14 and a surrounding retention area 42 for catching any spillage or debris falling from the cooking vessel used over the burner. A window 43 is provided in the front panel 17 of the stove casing 10 to allow the flame of the burner 14 to be visually monitored through the front of the stove. A hooded opening 44 is formed through the walls of the catch basin member 40 in alignment with the window in order to leave open the line-of-sight (indicated by the dashed line and arrow in Fig. 5) from the window 43 to the

burner 14. A raised ridge 45 is also formed at one side in order to allow passage of a pilot ignition unit to the burner 14. The catch basin member 40 can be readily removed for cleaning by lifting it up from the burner
5 well 13.

As shown in Fig. 7, further features of the invention include a recessed burner plate 46 which is positionable in the burner well 13 over the burner 14 by suspension from a cradle which hangs from the annular rim 13a. The
10 recessed burner plate allows large pots (as shown in Fig. 7) and other cooking vessels to be seated on the burner plate 46 when the wok 5 is removed from the stove. The high heat exhaust from the recessed burner 14 is also at least partially drawn into the interior
15 duct 37 to be draughted and cooled down through the moderator chimney 35.

Fig. 8 shows another feature of a stove according to the invention which includes a grill attachment 50 which is positionable over the upper annular rim 13a at the
20 horizontal upper surface 11 of the stove casing 10 for grilling, barbequeing, and other types of open-flame cooking. The grill 50 has a round shape with crossbars for holding the food to be grilled thereon. A deflector unit 51 is positionable below the grill 50 and over the
25 burner 14 in order to deflect dripping grease, debris, or liquids away from the burner 14 into the retention area 42 of the catch basin member 40. The deflector unit has an upper deflector plate 51a vertically spaced from a lower deflector plate 51b. This tiered deflector
30 plate structure allows the flame from the burner 14 to

be spread out substantially evenly across the width of the grill 50. Instead of the open grill and deflector unit, a solid plate may be supported on the annular rim for pan frying or grilling or omelette and crepe cooking.

Although the invention has been described with reference to certain preferred embodiments, it will be appreciated that many variations and modifications may be made consistent with the broad principles of the invention.

10 It is intended that the preferred embodiments and all of such variations and modifications be included within the scope of the invention as defined in the following claims.



- 14 -

CLAIMS

1. A stove comprising: a casing having walls defining a horizontal upper surface adapted for use as a cooking surface and a hollow interior; a burner well extending into the interior of said casing and having an upper annular rim at the said horizontal upper surface which defines a support on which a cooking vessel can be placed for cooking, the annular rim being so dimensioned that the cooking vessel substantially closes off the well from exposure at said horizontal upper surface; a burner located at an interior position in said well in the interior of the casing for providing a flame to a bottom portion of the cooking vessel; and ducting including a first duct member positioned at a rear portion of said casing remote from said burner well and a second duct member communicating with the interior of the well via a first opening located adjacent said interior position in said well and via another opening communicating with said first duct member for conveying combustion products from said burner into said first duct member at the rear portion of the casing; wherein the burner well has a vertically orientated cylindrical wall which is lined with a refractory material to insulate the stove from the heat from said burner in said well and wherein the first opening is formed through the cylindrical wall and liner material.

2. A stove according to claim 1, wherein said annular rim of said burner well is dimensioned to support a wok or other rounded-bottom cooking vessel.



3. A stove according to claim 1 or claim 2, wherein the stove further comprises a grill positionable over the upper annular rim for open-flame cooking.

4. A stove according to claim 3, wherein the stove further comprises a deflector unit positionable in the interior of the burner well below the grill and over the burner for open-flame cooking.

5. A stove according to any preceding claim, wherein said first duct member comprises an enclosed duct casing orientated vertically and having walls defining a hollow interior, an inlet communicating with said second duct member for receiving high heat exhaust at a lower portion of said duct casing, an outlet for reduced-temperature exhaust at an upper portion thereof, a plurality of generally horizontal baffles forming a labyrinthine channel through the interior of said first duct member between said inlet and said outlet, and means for generating a draught of ambient air into said labyrinthine channel for mixing with said high heat exhaust and reducing its temperature such that a reduced-temperature exhaust exits from the outlet of said first duct member.

6. A stove according to claim 5, wherein said duct casing is a quadrangularly shaped member supported upright on the rear portion of said stove casing.

7. A stove according to claim 5 or claim 6, wherein said baffles in the duct casing are spaced vertically from each other and have offset horizontal lengths which are alternated in opposite directions to form said labyrinthine channel.



- 16 -

8. A stove according to any one of claims 5 to 7, wherein said duct casing has a double wall construction lined with insulative material to insulate the stove from the heat of the exhaust in the duct casing.

9. A stove according to any one of claims 5 to 8, wherein said ambient air draught is generated by a second inlet in the bottom portion of the stove casing which is supplied with ambient air through openings formed in said stove casing.

10. A stove according to any one of claims 5 to 9, wherein said duct casing and said stove casing are formed as separate modules which are assembled together for installation.

11. A stove according to any one of claims 5 to 10, wherein said duct casing and the stove casing are installed as a stove top unit over a lower oven or storage unit.

12. A stove according to any preceding claim, wherein a catch basin member is positionable in the interior of said burner well having annular walls defining a central opening for fitting around said burner and a surrounding retention area for catching any spillage or debris falling from a cooking vessel used thereon.

13. A stove according to any preceding claim, wherein the stove casing has a window formed in a front panel thereof at a position in alignment with said burner in the interior of said burner well for allowing the burner flame to be visually checked by viewing through said window.



- 17 -

14. A stove according to any preceding claim, wherein the stove further comprises a recessed burner plate which is positionable in the interior of said burner well over said burner for allowing cooking with a cooking vessel seated thereon.

15. A stove substantially as described herein with reference to the drawings.
