March 16, 1943. R. M. SHERMAN 2,314,249

COOKING STOVE

Filed Dec. 13, 1939 2 Sheets-Sheet 1

*Fig. 1.*

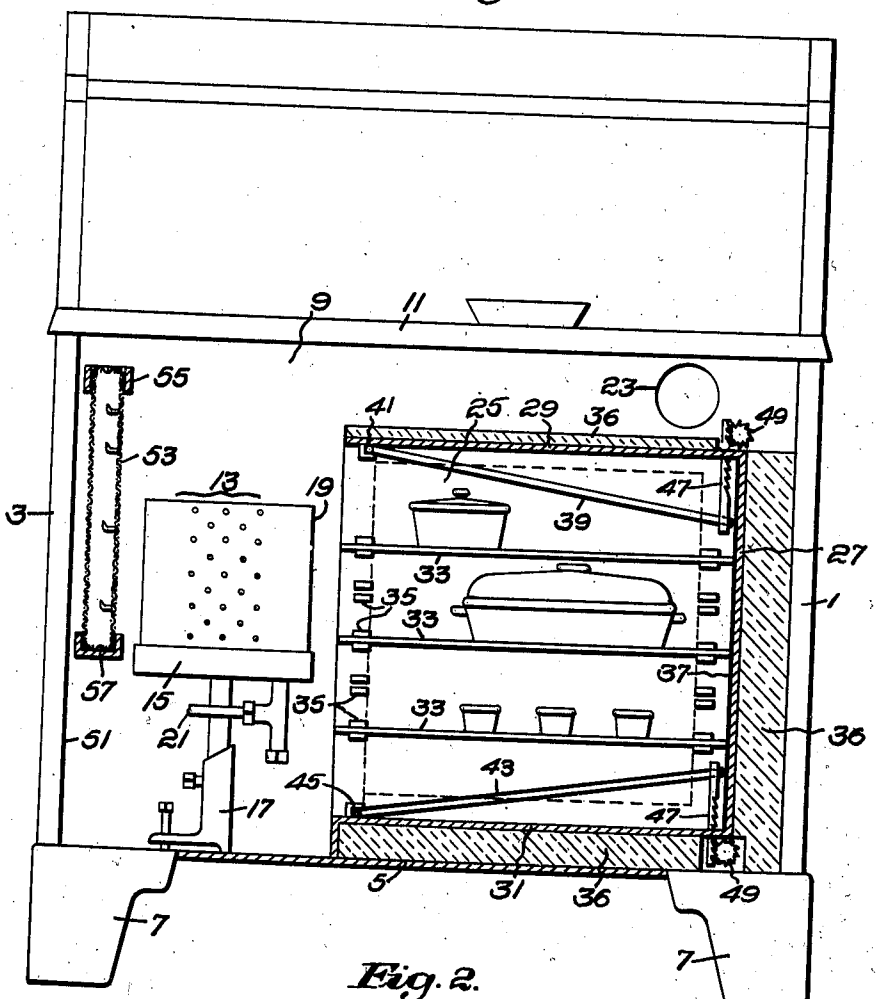
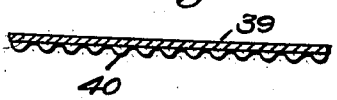



*Fig. 2.*

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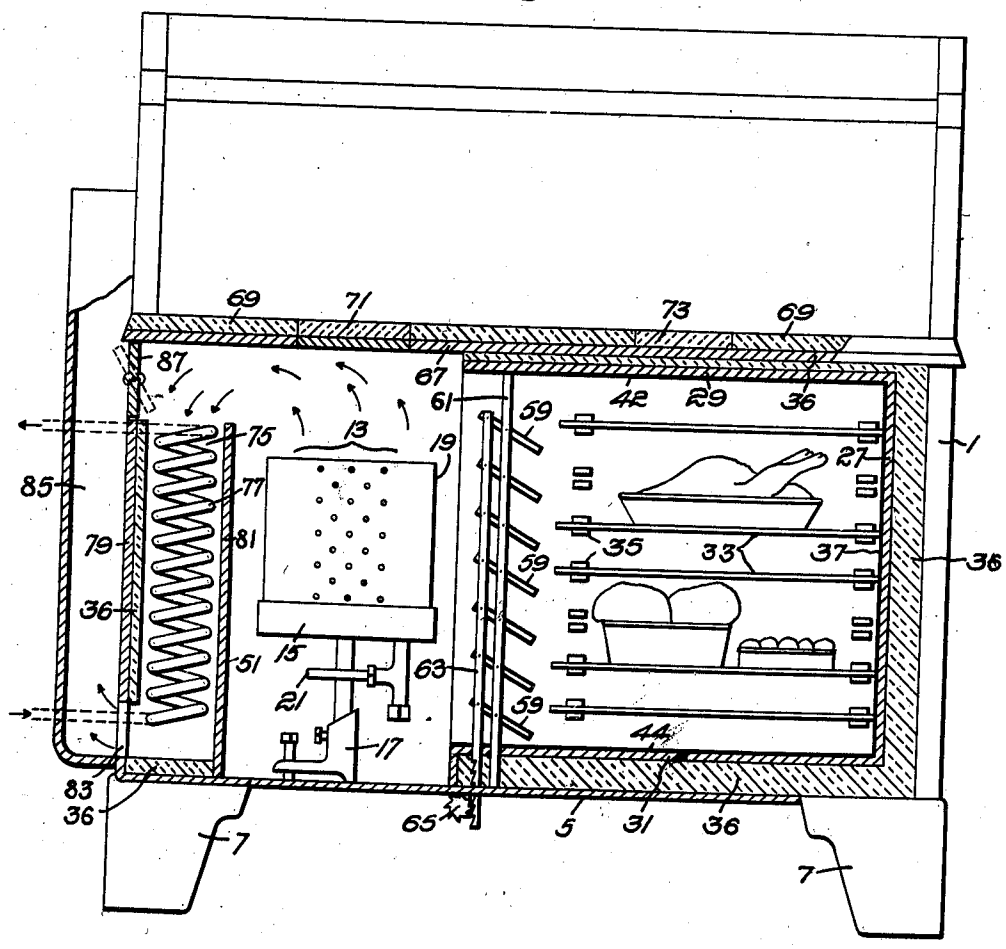
Filed Dec. 13, 1939 2 Sheets-Sheet 2

Fig. 3.

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## COOKING STOVE

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8 Claims. (Cl. 126—44)

This invention relates to cooking stoves or ranges, one object being to provide a self-contained unitary range having one or more oven chambers for baking, broiling or other cooking, entirely enclosed within the compartment of the stove but open directly to the radiation from a source of radiant heat such that the radiant heat therefrom may be utilized to the fullest and best advantage.

Another object of the invention is to provide an oven entirely enclosed within a stove chamber, heated by the unscreened radiant heat emitted from the heat source, the stove chamber having an exit flue and so arranged that heat other than that radiated into the oven may be usefully availed of, the combined oven and stove constituting a compact, self-contained, portable, unitary structure capable of being set up and utilized in any place where a domestic range may be used and of serving all the functions of the latter.

Another object is to take advantage, in such a self-contained range, of the peculiarities inherent in a combustion tube burner, whereby the radiant heat of the burner may be most effectively utilized for baking, broiling or roasting in the open ended oven, and the heat from the products of combustion of the burner may be fully utilized in the range for cooking, hot water or hot air heating, or other useful purposes.

Another object is to provide a domestic range which may be manufactured at relatively low cost and operated under conditions of unusually high efficiency and economy.

These and other objects of the invention will be best understood by the following description when taken in connection with the accompanying illustration showing one specific embodiment thereof.

In the drawings:

Fig. 1 is a cross-sectional elevation of a cooking range embodying one form of the invention;

Fig. 2 is a detail in section of one of the reflecting plates; and

Fig. 3 is a view similar to Fig. 1 illustrating a modified form of the cooking stove.

Referring first to the embodiment of the invention shown in Fig. 1 and where its application has been made to a range of more or less conventional type, the latter comprises a box-like casing having end or side walls 1 and 3 and back and front walls. These walls may be of cast-iron, for example, and may, if desired, be provided with heat insulating lining. The stove chamber has the bottom 5, which may be of sheet metal, resting on the four legs or standards 7. This provides a box-like stove compartment or chamber 9 which is covered by the usual stove top 11, and the latter may be provided with one or more removable lids or covers to facilitate cooking or the heating of dishes on the top of the stove, as is usual.

Within the stove chamber there is provided a source of heat 13 of relatively great heat radiating capacity. Various means may be employed for this purpose, but herein there is shown a burner of the combustion tube type adapted to use either oil or gas as its fuel, the burner having the base 15 supported on the pedestal 17 which is mounted on the bottom of the stove. The burner is provided with one or more perforated combustion tubes, the outer one of which is indicated at 19, the burner being supplied with oil (or gas) from an outside source through the inlet pipe 21 and with air through one or more draft controlled air inlet openings (not shown) below the burner in the stove casing. The burner is positioned at one end of the stove compartment (herein the left end as viewed in Fig. 1) and approximately midway between the bottom and the top thereof. A group of two or more such burner units may be employed placed side by side and each directly facing the open end of the hereinafter described oven.

When the burner is in operation the combustion of the commingled air and fuel within the combustion chamber of the burner raises the temperature of the combustion tube to a very high value, bringing the tube 19 to a state of more or less incandescence with a high capacity for radiation of infra-red and other calorific rays. The products of combustion emerge from the top of the burner, pass upward to the upper part of the stove chamber, and circulate along the bottom of the stove top where their heat is available for warming dishes or cooking the contents thereof on the stove top or for heating water coils or the like before passing out through the flue 23, which may be under damper control if desired.

A combustion tube burner of this class is particularly effective for the purposes herein described since its heated combustion tube or tubes present to the adjacent open end of the oven a wide expanse of highly heated metal, providing at the mouth of the oven a steady source of radiant calorific rays, including a profusion of infra-red rays which are highly desirable for purposes of cooking and particularly for broiling and roasting.

Enclosed within the stove chamber there is provided an inner oven or heating chamber 25,

herein of a generally box-like form presenting an open end adjacent to and facing the source of radiant heat. The oven chamber is formed by an end wall 27, remote from but facing the open end of the oven and the source of radiant heat, by top and bottom walls 29 and 31 respectively, a back wall and a front wall (the latter not appearing in the sectional elevation shown in the drawings). The front wall, which is parallel with and adjacent to the front wall of the stove casing, may be provided jointly with the stove front with a unitary or single heat insulated door (not shown, but its outline indicated by dotted lines), so that when the door is open the interior of the oven chamber becomes accessible from without for the insertion in or removal from the oven of the articles or materials to be cooked.

The oven chamber may be provided, as usual, with one or more grid-like shelves or supports 33, the edges of which rest upon guides 35 and are adjustable to different positions in the oven chamber to adapt them for the support of the materials or articles to be baked, roasted or otherwise cooked, or the dishes containing the same.

In the usual cooking stove the heating of the closed oven compartment is effected by causing the hot gases comprising the products of combustion to circulate through passages about the exterior walls of the oven compartment before being permitted to escape through the flue. This oven heating operation being effected solely by conduction renders the oven unfitted for such operations as broiling. The heating also is relatively slow, and, during the time it is taking place, the heat from such gases is not available, or is available only in part, for heating the stove top or for purposes other than the heating of the oven. In the described form of stove such circulation of the hot gases about the oven is neither necessary nor desirable. It is unnecessary since the heat radiated from the combustion tube burner directly into the open end of the oven is relied on to heat the latter, and the required temperature in the oven may be reached in much shorter time and to a higher degree than by the circulation of the gases about a closed oven compartment. It is undesirable since it diverts the hot gases from utilization in heating the stove top or in otherwise functioning, as, for example, in heating water coils and the like. Furthermore it tends to disturb the uniformity of temperature conditions in the oven, which should be maintained and regulated by the control of the radiant heat alone. In fact, the temperature in the oven can be brought to such a high degree that enforced circulation of the gases about the outsides of the walls of the oven, if the latter are uninsulated, may result in lowering the temperature of the oven below what is desired, particularly in the lower part of the oven.

Accordingly, the top, bottom, back and end walls of the oven chamber are preferably spaced from the walls of the stove chamber, as indicated, and may, and preferably do, have their outer surfaces backed by heat insulating material 36. Such heat insulating material may be so applied as to leave spaces between the oven casing and the end, back and bottom walls of the oven chamber, but since the heat directly radiated from the burner into the open end of the oven is relied upon as the effective heating agent for the oven interior, the heat insulating material is preferably applied to fill the spaces between the end, back and bottom walls.

To best avail of the radiant heat from the burner, the stove is provided with surfaces which serve to direct the radiated heat into and concentrate the heat rays on the interior of the oven, on and about the materials to be cooked and to raise the temperature of the oven to a high degree.

In the stove shown in Fig. 1, the end wall 27 of the oven on which the calorific rays impinge at approximately right angles is provided with a non-reflecting surface 37 of high heat absorbing and high heat emissive capacity and which, through the high temperature to which it is raised by the radiant heat, becomes effective to radiate its heat into and through the oven interior. Such surface may be produced by forming such end wall of or covering it with a plate consisting of sheet metal having a dull or dark surface or of roughened unfinished cast-iron.

The top and bottom walls 29 and 31 of the oven chamber on which the heat rays impinge at more or less oblique angles may present reflecting surfaces, as by forming such walls of or facing them with a plate presenting a surface of high reflective capacity, such as a plate of chromium steel having a highly polished surface. Herein, however, the top reflecting surface consists of a plate 39 having a highly reflective surface on its under side, the plate being positioned near but separate from the oven top and hinged at 41 so as to be adjustable about its hinge. The heat rays radiated from the burner and entering the open end of the oven chamber may thereby be reflected downwardly from the surface of the plate with angles of reflection which may be adjusted to suit the requirements of temperature therein.

The bottom reflecting surface may consist of a plate 43, similar to the plate 39, hinged at 45 and presenting a reflecting surface on its upper side and serving to reflect the radiating heat upwardly into the oven chamber at adjustable angles of reflection.

While the top and bottom reflecting surfaces are indicated in Fig. 1 as flat reflectors, giving a generally uniform reflection dependent on the angle of incidence of the heat rays, one or both of such surfaces are preferably so formed as to give a diffused or irregular reflection. This may be had, as indicated in Fig. 2, by forming the reflecting surface of small spherical or bulbular projections 49 which give a diffused reflection of the heat rays throughout the oven interior and avoid excessive concentration of the heat in any one part thereof. If desired the surface 37 on the end wall 27 of the oven, instead of being a heat absorbing surface, may consist of a diffusion reflecting surface, such as that illustrated at 40 in Fig. 2.

For adjusting the upper and lower reflecting plates 39 and 43, the free end of each plate near the inner end of the oven chamber is connected to and supported by a vertically movable rack bar 47 guided in suitable guideways, the teeth of the two racks outside of the oven casing being engaged by pinions 49, each of which may be turned by exteriorly arranged means, such as a handle, so that the reflecting angle of the plates may be varied either independently or together.

The back and front walls of the oven chamber may, if desired, be provided with reflecting sur-

faces similar to the reflecting surfaces on the plates 39 and 43. The end wall 3 of the stove chamber, between which and the open end of the oven the burner is positioned, is also preferably lined with a flat reflecting surface 51 facing the burner and serving to reflect the heat rays emitted from that side of the burner toward the open end of the oven.

Additional cooking means may be provided in the oven chamber, if desired, to avail of the radiant heat from the opposite side of the burner, as, for example, between the burner and the reflecting surface 51 on the end wall 3 of the stove chamber. This is illustrated in Fig. 1 by the broiling grill 53, which may be inserted from above through covers in the stove top between guides 55 and supported in the underlying channel 57.

In the use of the stove, the heat rays from the combustion tubes of the burner entering the open end of the oven become concentrated on the interior thereof, raising the temperature in the oven chamber to the maximum point required for normal cooking operations, including that of broiling as well as roasting and baking, this being attained under conditions of moderate burner combustion, and a temperature in the oven greatly in excess of that in the stove chamber above and about the outside of the oven walls. The temperature within the oven and different parts of its interior is subject to a wide range of control by varying the intensity of burner combustion and to a measure of control by the adjustment of the reflecting plates 39 and 43, the temperature, especially near the mid portion of the oven chamber, being increased when the angle of inclination of the plates is increased and diminished when such angle is reduced or flattened.

One objection in cooking stoves employing closed oven chambers is the fact that there is a wide discrepancy between the temperature which can be maintained near the bottom of the oven compartment and that near the upper part. That is to say, if the temperature near the bottom is that required for a given cooking operation, the temperature near the top is excessively high, or if the temperature near the top is the required temperature that in the lower part is much too low. While exact correspondence between the temperature in the upper part and that in the lower part of the oven can scarcely be attained, nevertheless, in a stove of the described construction a comparatively uniform diffusion of the heat is possible and the discrepancy between the temperature maintained in different parts of the oven may be reduced to a comparatively small amount.

The odors, steam and other gases emitted from the food being cooked in the oven emerge from the open mouth thereof and are carried upward by the current of hot gases from the burner into the heating space above the oven and beneath the stove top, escaping with the products of combustion through the flue 23. The burner is thus utilized so that its radiant heat is applied to heat the oven, while its products of combustion are conducted through the space above the oven and under the stove top where their heat is usefully applied and, finally, with any gases emitted from the oven, pass out through the flue.

The conditions of moderate or low burner combustion which are adequate in the heating effect on the oven may result in a disproportionately low temperature at the point where heat from the products of combustion is being usefully employed. At the top of the stove chamber, for example in the range shown in Fig. 1, and in the heating space between the oven top and the under side of the stove top, such heating effect at conditions of low burner combustion may be inadequate for the heat required for cooking on the stove top or for other useful purposes. If the burner combustion is increased to bring the stove top to the required temperature, the oven temperature tends to rise to a disproportionately high degree which it may not be possible to reduce to required limits by the mere adjustment of the reflecting plates 39 and 43. To provide a closer limiting control on the temperature of the oven so that the burner may be operated at such higher combustion rates as are required to provide adequate heating elsewhere from the products of combustion, without an inordinately high heating of the oven compartment, additional or other control means may be provided, such as are illustrated in Fig. 3.

In the stove shown in Fig. 3, the oven itself is substantially the same as in the stove shown in Fig. 1, save that the upper and lower hinged adjustable reflecting plates 39 and 43 (which may or may not be employed) are here replaced by upper and lower reflecting surfaces 42 and 44 presented, respectively, by the upper and lower oven walls 29 and 31, and a vertical series of relatively narrow shutter-like members 59 are provided at or adjacent the open end of the oven. These comprise a series of plates, preferably presenting each a heat reflecting surface on each of its opposite sides, and these are individually hinged on the frame 61, one above another. One end of each plate is pivotally connected to the vertically movable rod 63, the latter having a lower end projecting through the bottom of the stove with a toothed rack engaged by a pinion 65 outside of and below the stove bottom, by the turning of which pinion the rack and the rod may be raised or lowered. By raising the rod the angle of the reflector shutters may be varied over a wide range, being movable from a horizontal position and through intermediate positions to one approximating the vertical, where a large part of the radiant heat of the burner is cut off from the interior of the oven.

The oven shown in Fig. 3 illustrates pointedly the advantages which can accrue from the enclosure in the same unitary stove of an open ended oven positioned in the chamber to receive the unscreened heat rays from a radiating source of heat, such as a combustion tube burner, while the products of combustion of the burner are utilized at the same time not only to remove the gases from the cooking food in the oven, but to apply in the fullest extent to other useful functions the heat of the gases which is unnecessary for heating the oven, since the latter makes use of radiated heat.

Under these conditions the heat from the products of combustion may be utilized for heating water or cooking, or for both or other purposes. In this case, to avoid unnecessary radiation or wastage of heat from the stove, not only is insulation material 36 utilized, as in the stove of Fig. 1, to insulate the walls of the oven, but the metal or castiron stove top 67 rests directly against the insulated top of the oven and is itself covered with insulating material 69 which prevents any radiation from the stove top. Such insulating covering preferably consists of a sheet of firm, rigid but comparatively light weight ma-

terial, such as so-called sponge or insulating brick, which can be molded into sheet form. To avail of the stove top, however, for cooking when desired, the insulating covering 69 is provided with one or more removable disk-shaped sections 71 to which a similar section of the stove top is attached and the removal of which permits a dish or cooking utensil being inserted to receive heat directly from the rising products of combustion of the burner. Other disk-shaped sections, such as 73, may be provided in the insulating covering 69 above the oven where the stove top is insulated from the direct heating effect of the burner but is heated by conduction, so that, by the removal of the section 73, a dish may be placed on the stove top for slow heating.

To apply the heat of the burner for heating water, the products of combustion pass upward from the burner and thence downward through a vertically disposed heating chamber 75 at the end of the stove in which is contained a series of water coils 77, cool water being admitted to the bottom coils and heated water withdrawn from the top. Such a heating chamber may extend either partially or entirely across the stove chamber, being formed in the latter case between its front and rear walls, the end wall 79 and a partition wall 81. One or more series of such coils may be positioned in the heating chamber and its walls may be lined where necessary with insulation 36. The heated gases emerging from the burner, after sweeping through the space beneath the insulated stove top, are caused to pass downward through the heating chamber 75, imparting their heat to the water coils 77, thence through the exit opening 83 at the bottom of the chamber, and thence upward through the flue passage 85, which latter may itself be covered with insulating material if desired. The heated water may be employed for domestic purposes or for house heating, as desired.

It will be observed that the products of combustion in their hottest state encounter those coils discharging the hot water, and in their relatively cooler state encounter those coils connected to the incoming cooler water, thereby providing the condition most efficient for heat transfer from the gases to the water. Since the gases from the burner before entering the heating chamber impinge only on the insulated walls of the stove chamber, the entire heat is therefore available for heating the water, except as it may be desired from time to time to utilize a part of it for cooking by removal of one or more of the sections 71.

Since it may at times be desirable to divert a part of the heat from the heating chamber 75, means may be employed for that purpose, such as the pivoted damper 87, by which a more or less restricted passage may be opened from the top of the stove chamber directly into the flue 85.

The described form of range has particular utility for domestic purposes under conditions where heat radiation from the range is undesirable, particularly in warm weather. It has particular utility in small apartments or houses since the heat from the products of combustion of the burner, being unnecessary for heating the radiantly heated oven, may be utilized for heating such apartments or houses when effectively utilized as herein. Such a range is compact, relatively simple and inexpensive in construction, and highly efficient both in respect to baking, broiling and roasting foods in the radiantly heated oven itself, as well as in the utilization of the products of combustion from the burner.

While I have herein shown and described for the purposes of illustration one specific embodiment of the invention, it is to be understood that the form and relative arrangement of parts and the details of construction may be varied within wide limits, all without departing from the spirit of the invention.

I claim:

1. A cooking range having, in combination, a stove casing having an interior chamber and an upper wall forming a stove top, a fluid fuel combustion tube type heater in said chamber below said stove top adapted to discharge heated gaseous products of combustion vertically toward it, said heater having an upwardly extending combustion tube beneath said top exposed to the interior of said chamber and adapted to constitute a source of heat ray emission, an oven chamber in said casing, which oven chamber has an open side facing said tube of said heater whereby heat rays emitted by said tube may enter said oven chamber to heat it and vapor from said oven chamber may escape therefrom and mix with said products of combustion, said casing having an opening for discharge from said interior chamber thereof of the mixed gaseous products of combustion and oven vapors, which opening communicates with said interior chamber at the exterior of said oven chamber whereby such mixture will travel through paths wholly outside said oven chamber and said products of combustion will be prevented from entering said oven chamber and contaminating food therein.

2. A cooking range having, in combination, a stove casing having an interior chamber and an upper wall forming a stove top, a fluid fuel combustion tube type heater in said chamber below said stove top adapted to discharge heated gaseous products of combustion vertically toward it, said heater having an upwardly extending combustion tube beneath said top exposed to the interior of said chamber and adapted to constitute a source of heat ray emission, an oven chamber in said casing, which oven chamber has an open side facing said tube of said heater whereby heat rays emitted by said tube may enter said oven chamber to heat it and vapor from said oven chamber may escape therefrom and mix with said products of combustion, a chamber containing a heat exchange device, which chamber has an opening in communication with the interior chamber of said casing exteriorly of said oven chamber, and an exit flue for said mixture communicating with the chamber having said heat exchange device.

3. A cooking range according to claim 1 in which adjustable shutter-like members are positioned near the open side of the oven chamber for controlling the admission of the rays thereto.

4. A cooking range according to claim 1 in which horizontal adjustable shutter-like members having reflecting surfaces are positioned near the open side of the oven chamber for controlling the admission of the rays thereto and the direction of the rays admitted.

5. A cooking range according to claim 1 in which the oven chamber has interior reflecting surfaces, and adjustable shutter-like members having reflecting surfaces are positioned near the open side of the oven chamber for controlling the admission of the rays thereto and the direction of the rays admitted.

6. A cooking range comprising a casing form-

ing an enclosed stove chamber, heating means in said chamber comprising a part adapted to constitute a source of heat ray emission, means in said casing forming an oven chamber having an open side facing and adjacent said part for receiving heat rays from the latter whereby to cause the oven to be heated, and means for controlling the temperature of said oven chamber comprising adjustable shutter-like members near said open side of the oven chamber for controlling the admission of the rays thereto.

7. A cooking range comprising a casing forming an enclosed stove chamber, heating means in said chamber comprising a part adapted to constitute a source of heat ray emission, means in said casing forming an oven chamber having an open side facing and adjacent said part for receiving heat rays from the latter whereby to cause the oven to be heated, and means for controlling the temperature of said oven chamber comprising adjustable shutter-like members having reflecting surfaces near said open side of the oven chamber for controlling the admission of the rays thereto and the direction of the rays admitted.

8. A cooking range comprising a casing forming an enclosed stove chamber, heating means in said chamber comprising a part adapted to constitute a source of heat ray emission, means in said casing forming an oven chamber having an open side facing and adjacent said part for receiving heat rays from the latter whereby to cause the oven to be heated, and means for controlling the temperature of said oven chamber comprising adjustable horizontal shutter-like members having reflecting surfaces near said open side of the oven chamber for controlling the admission of the rays thereto and the direction of the rays admitted.

RALLSTON M. SHERMAN.