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2,921,176

GAS ELECTRIC HEATING DEVICE

Filed March 1, 1955

2 Sheets-Sheet 1

FIG. 1.

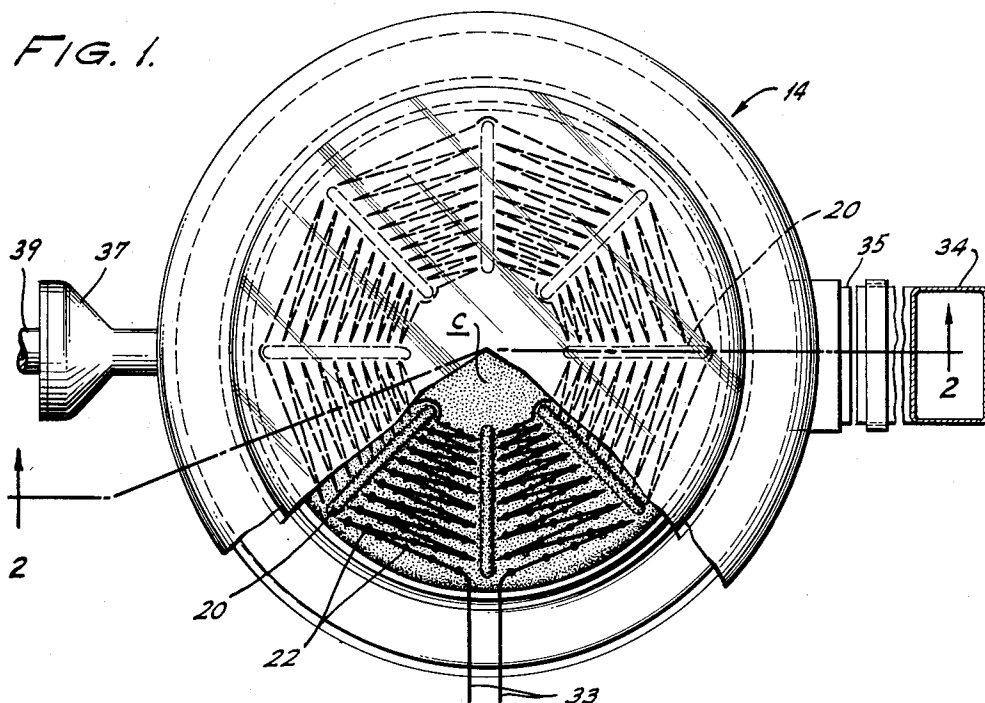


FIG. 3.

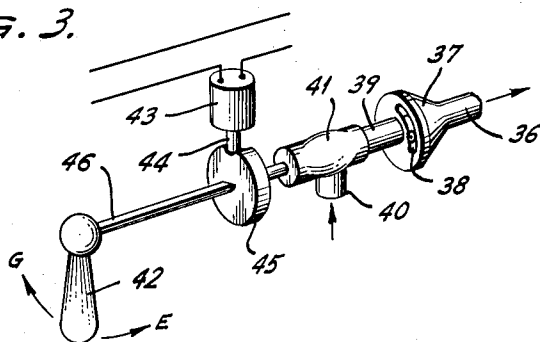


FIG. 4.

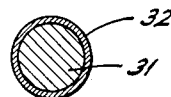
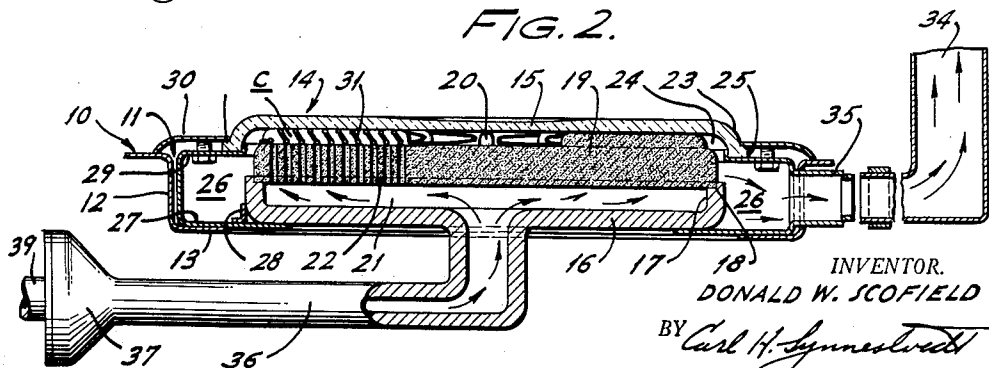


FIG. 2.



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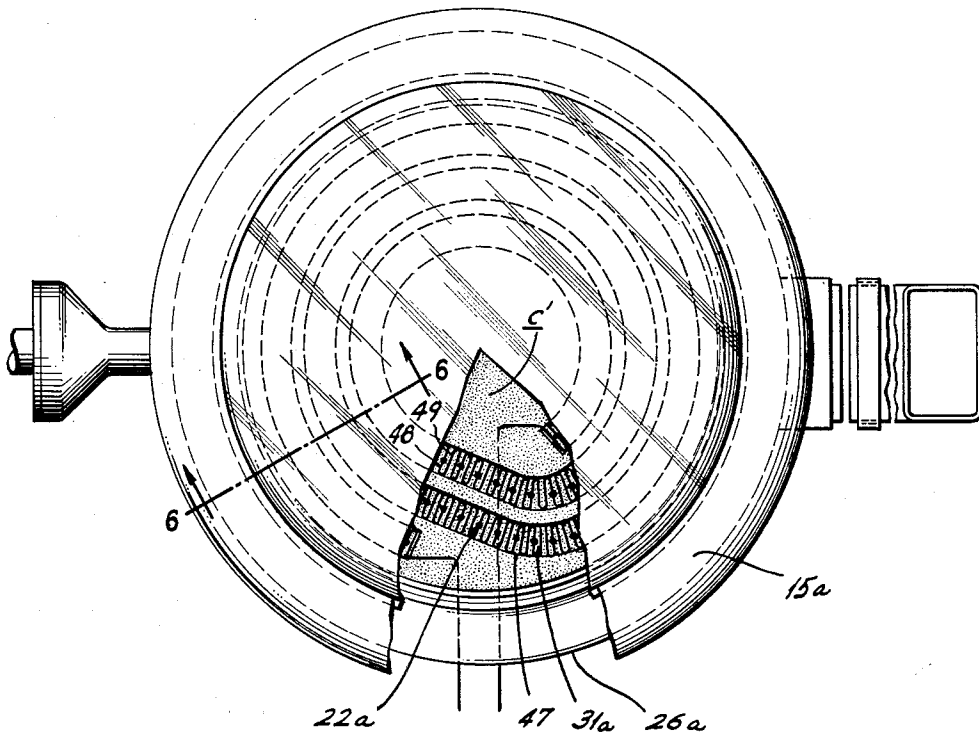


FIG. 5.

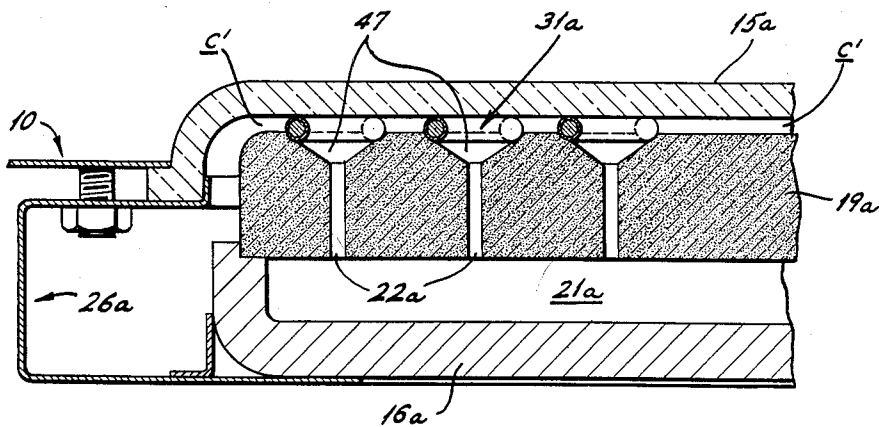


FIG. 6.

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## GAS ELECTRIC HEATING DEVICE

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3 Claims. (Cl. 219—37)

The invention hereinafter described and claimed relates to heating equipment and, more particularly, to gas burner units having especial adaptability as surface cooking elements in household ranges.

Gas burners now in use on ranges are commonly of the so-called "open" type, that is, a type in which jets of combustible gas project flame through an open grate upon which the cooking utensil is placed. Burners of this kind are relatively inefficient, are disadvantageous in that they are difficult to clean, and tend to deposit carbon upon the cooking vessels and upon range surface portions adjacent to the burner units. The advent of the modern electric range, with its efficient and easy-to-clean metal sheathed heating elements, has emphasized the deficiencies of the gas apparatus, with the result that considerable time and effort has been devoted to attempts to increase the efficiency of gas burning equipment, and to render it cleaner and more convenient in use. Thus far, however, these efforts have not met with substantial success, and even very recent gas ranges leave much to be desired from the standpoint of cleanliness and efficiency.

Accordingly, and with the foregoing in mind, it is the general objective of my invention to provide a flameless gas burner which is not only of high thermal efficiency, but which is also exceedingly easy to maintain in a clean and attractive condition.

In achievement of the foregoing general objectives, and first briefly described, I have provided gas burning equipment including wall structure defining a gas supply zone; a porous or foraminous sheet overlying said zone and adapted to provide for flow of gas from said zone to a region of combustion overlying the porous sheet; a substantially imperforate heat-shock resistant plate of glass or the like overlying said porous sheet, to define the upper limit of the region of combustion and to support a cooking vessel; and means for effecting complete catalytic incineration of gas flowing through said porous sheet and into said region of combustion.

As will be appreciated, foods or other materials spilled upon the glass plate do not gain access to the underlying region of combustion, and no carbon is formed. Accordingly, there is no need to remove the burner unit from the range to clean the dished receptacle which underlies the assembly, and which conveniently provides the mentioned gas supply zone or chamber. Presence of the porous sheet, which is preferably of a material of low heat conductivity for example foam silica, minimizes loss of heat downwardly through the burner unit, and this fact, as well as the complete combustion which results from the use of catalytic incinerating means of the kind described hereinafter, results in thermal efficiency which has not hitherto been approached in gas equipment. While the glass plate which overlies the porous sheet—and together with the latter defines the region of combustion—promotes efficiency by reason of its good conductive contact with the cooking vessel, it is also to be recognized that said glass plate may be, and preferably

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is, fabricated of known glass compositions which are substantially transparent to radiated energy, thereby further enhancing the thermal efficiency of the unit. It is therefore to be appreciated that by this invention there is provided a flameless, highly efficient gas burner characterized by cleanliness and simplicity in use.

In one aspect of the invention it is an important feature that the catalytic incinerating means may be used independently of the gas supply, thereby providing the low heat "simmer" adjustment which has been difficult to achieve in gas ranges.

Preferred embodiments of my invention, and the best modes of achieving the foregoing and other objects and advantages inherent therein, will be understood from a consideration of the following detailed description taken together with the accompanying drawings, in which:

Figure 1 is a plan view of gas burner equipment embodying the invention, parts being broken away to facilitate illustration of features of construction;

Figure 2 is a sectional view taken substantially along the line 2—2 of Figure 1;

Figure 3 is a perspective illustration of control equipment which may to advantage be utilized with the apparatus of my invention;

Figure 4 is a sectional view, on a greatly enlarged scale, illustrating catalytically coated heating wire employed in the illustrated apparatus;

Figure 5 is a plan view similar to Figure 1, but illustrating a modified form of the invention; and,

Figure 6 is a fragmentary sectional view taken substantially along the line 6—6 of Figure 5, and on a considerably enlarged scale.

Now with more particular reference to the drawings, and initially to Figures 1 and 2 thereof, the numeral 10 designates, generally, a fragmentary portion of the metallic upper surface of a household range of known type. This surface is provided with a number of apertures, one of which is illustrated at 11 and is shown as being formed by downwardly turned flanging 12 having an inwardly directed annular flange portion providing a recessed seat 13 within the work surface of the range. This flange structure provides a rigid seat within which may be received a heating unit or burner 14 of the type illustrated in the drawings and constructed in accordance with the principles of my invention. It will be understood that, in certain aspects of the invention, illustration of the apparatus as embodied in range structure is purely exemplary, the burner per se being capable of wider applicability.

Burner 14 comprises a simple and relatively inexpensive assembly including an upper, imperforate plate 15 of glass or similar material which is highly resistant to mechanical impact and to thermal shock. In practice such a plate may be constructed largely of silica (a preferred composition comprises upwardly of 96% silica) glass of this general type having recently been developed and merchandised under the trade name "Vycor."

Beneath the plate 15 is a metallic dished or pan-like member 16 having an upturned annular flange 17 provided with a recessed seat 18 about the inner edge of its periphery. Disposed in the recessed seat 18 is a foraminous or porous disk 19 fabricated of material of low thermal conductivity, for example foam silica, and having upon its upper surface a plurality of radially extending ridges 20 disposed closely adjacent to or in contact with the lower surface of plate 15. It will be observed that the lower surface of disk 19 is spaced from the bottom of pan-like member 16, thereby forming a gas supply chamber or zone employed in the distribution of the combustible gas-air mixture. This chamber is indicated in the drawing at 21 and is in communication with the areas lying between the radially extending ridges 20,

through the agency of a large number of apertures 22 provided in disk 19.

The combustion region or chamber C lies directly beneath the lower surface of plate 15 and is defined by said plate and by the underlying porous sheet 19. As will be appreciated, gas is distributed substantially uniformly throughout the combustion chamber through the agency of the perforations 22 which lead from supply chamber 21. While it is preferred to provide a sheet of the kind illustrated at 19, that is a sheet which is provided with a multiplicity of distinct and separately formed passages or apertures, it will be recognized that passage of gas to the combustion chamber, and proper distribution of the gas through said chamber, may be achieved by the porosity of the material of which the sheet is made, rather than by the provision of formed apertures therein.

Glass plate 15 is provided with a downturned peripheral flange portion 23 which is of slightly larger diameter than the diameter of disk 19, whereby to provide a peripheral passageway 24 between the said flange 23 and the outer edge of disk 19, said passageway forming a part of the combustion chamber C. Flange 23 includes an outwardly turned portion 25 which is seated upon the upper surface of an annular channel member 26, the latter completely surrounding the described burner elements and forming with said elements an annular exhaust port through which may be carried away the products of combustion. It will be noted that the lower flange 27 of said channel member 26 extends beneath the dished member 16 thus supporting the latter and positioning it centrally with respect to the assembly. To this end the lower flange 27 carries a plurality of upstanding angle elements 28 (only one of which is illustrated) which are secured to said flange 27 and bear against the dished member 16.

The plate 15 may be secured to the upper flange 29 of channel member 26 as by means of a trim ring 30, the latter being fastened to said upper flange 29 as by the studs shown in Figure 2. The inner periphery of the trim ring overlies the outwardly extending marginal portion 25 of plate 15, thus clamping the plate securely to the channel member 26. The assembled unit rests upon intumed flange 13 of the range top 10, as aforesaid with ring member 30 extending across a portion of the top of the range, thus to prevent accumulation of spilled food in the recessed seat within which is received the burner unit.

In accordance with a particular feature of my invention there is disposed within the spaces between radially extending ridges 20 a plurality of wire elements having the shape of flattened coils (see particularly Figure 1), the wire of these coils being illustrated in cross section in Figure 4 and being provided with a coating 32, which latter is of suitable catalytically active material. The individual coil sections are connected in series across a suitable source of electrical potential, as by leads shown at 33. Experience shows that a 115 volt supply is suitable for this purpose.

Catalytically coated wire of the kind preferably employed in the apparatus of my invention is, per se, not new, having been provided in a number of known ways and utilized heretofore. While, as indicated, there are a number of ways in which a suitable treating coil or conductor may be fabricated, I prefer to utilize, as the base of this coil, electrical resistance heating wire of a nickel-chromium alloy, for example, the alloy known as Nichrome. In preparation of a catalytic treating coil of the kind contemplated, the base-wire conductor is coated—in accordance with known technique—with a finely divided metallic coating which may for example be of the kind known as "platinum black."

It is to be recognized that the coil elements are so shaped and disposed as to maintain good contact between the catalyst 32 and the gas under combustion, and I have found that when such coils are utilized with the other elements of my burner assembly, it is possible to

achieve virtually complete, flameless, and highly efficient combustion.

Gas flows to the supply zone or chamber 21 through a conduit 36, which latter preferably has its outer end flared, as indicated at 37, said outer end being provided with an adjustable air intake shutter 38, as clearly appears in Figure 3. As respects this portion of the apparatus the construction is more or less conventional, gas being introduced into the conduit as by a nozzle 39 (Figure 3) connected to a gas supply line 40, a valve 41 having an adjustable handle 42 serving to control the flow of gas through the nozzle. As also appears in Figure 3 the service line connecting the catalytically coated coil 31 to the mentioned source of electrical potential takes the form of a switch 43 provided with an actuating plunger 44, disposed to be operated by a cam element 45 carried by the actuating shaft 46 of valve 41. In operation, rotation of the valve handle in a clockwise direction moves the switch plunger upwardly to close the electrical circuit, thus energizing the catalytic coils and simultaneously releasing gas through the valve and gas nozzle for flow into the supply chamber 21, through conduit 36. As the gas flows through the conduit 36 air is drawn inwardly through the shutter 38 and the resultant gas-air mixture passes into the chamber 21. From the chamber it is distributed through apertures 22 and flows upwardly into the region of combustion and between the radially extending ridges 20, where it passes into intimate contact with the heated catalytically treated coils. Contact of the combustible gaseous mixture with the coils (which have been electrically heated to active temperature) causes said coils to become heated to incandescence, by reason of a reaction between the gas and the catalyst, thereby completely oxidizing the gas. The products of combustion flow outwardly beneath the surface of plate 15, and into the annular exhaust port, from which they are exhausted through a suitable flue and duct assembly shown at 34, 35. It is to be noted that the catalytic coils, being of flattened spiral form (see Figure 2), are in direct contact with the underside of plate 15, with the result that the heat of said coils, and also the heat rising from the combustion process, is conducted directly through the plate and into a vessel supported thereon.

After completion of a cooking operation, and in the event that it is desired to reduce the heat to a "simmer" value, the valve handle 42 is turned in a counter-clockwise direction, thereby terminating flow of gas while leaving the coils energized. This has the effect of reducing the amount of heat passing through the plate to the amount available in said coils.

Figures 5 and 6 illustrate modified apparatus incorporating the principles of this invention. Primarily, this apparatus differs from the device shown and described in Figures 1 to 3 in that the electrically heated catalytic treating coil is constructed, and arranged cooperatively with respect to the other elements of the apparatus, in such a way as to result in a higher degree of contact between the coil and the overlying glass plate. To this end, and as shown in Figures 5 and 6, the catalytically coated wire 31a of which the coil is made comprises a large number of short convolutions all lying generally in the same plane, every convolution or "pass" of wire being maintained in contact with the under surface of the glass plate 15a. This construction, which results in a thermal efficiency even greater than that achieved by the embodiment first described, involves certain modifications of the foam silica sheet 19a, which modifications will be described hereinafter.

As was the case with reference to the first embodiment, the gas burner of Figures 5 and 6 includes a dished member 16a defining a supply zone or chamber 21a, the foam silica sheet 19a being disposed between the member 16a and the plate 15a and being provided with a plurality of apertures 22a through which the combustible mixture is fed from the supply chamber to the region of combustion

C'. The apparatus of the second embodiment is assembled, mounted, and provided with exhaust passages and duct work, in accordance with the corresponding apparatus already described with reference to the first embodiment.

As clearly appears in Figure 5 the convoluted catalytic wire 31a is disposed in a generally spiral path, being supported upon the upper surface of the foam silica sheet and with the complete length of wire which comprises the coil in contact with the under surface of the glass plate 15a.

In the form of Figures 5 and 6, due to the spiral configuration of the catalytic treating coil, special provision is made to insure free passage of the products of combustion from the region of combustion C' to the annular exhaust duct defined by the channel member 26a. In this connection, and considering by way of example products of combustion which are generated in the central area of the combustion region (the area which is completely surrounded by the treating coil) contact of the flat coil with both the glass plate and the foam silica sheet would at first appear to prevent free outward passage of products of combustion formed in said central region. In this connection, however, it is to be noted that the upper surface of the foam silica sheet 19a has been provided with a grooved or recessed portion 47, this portion being of spiral configuration and underlying the entire length of the coiled spiral conductor 31a. This grooved portion is clearly shown in Figure 6, and its marginal boundaries also appear in Figure 5. By virtue of the presence of this spiral groove, located beneath and throughout the length of the catalytic treating coil, it is possible to insure free passage of products of combustion—regardless of where said products are generated—to the annular exhaust duct. Products of combustion formed in any area bounded by the catalytic treating coil flow downwardly into the groove 47, obtaining access to said groove between the spaced ends of adjacent coil passes, for example between the passes shown at 48 and 49 in Figure 5, said products then passing beneath the coil and flowing outwardly of the groove toward the exhaust duct between oppositely disposed spaced ends of the individual convolutions or passes of the coil. The modified apparatus illustrated in Figures 5 and 6 is capable of extremely high thermal efficiency, and this without any interference with free discharge of combustion products.

From the foregoing description it will be understood that the present invention provides novel and improved gas burning equipment which achieves completely flameless combustion, and, which is characterized by unusually high thermal efficiency and complete cleanliness.

While two preferred embodiments of the invention have been illustrated and described, and whereas these embodiments emphasize the utility of the invention as applied to gas cooking ranges, it will be understood that, in the broader aspect, principles of the invention may be employed in a wide variety of gas heating devices, and that changes and modifications may be made in the specific structure disclosed, without departing from the principles of my invention. However it will be recognized that the invention contemplates such changes and modifications as may come within the terms of the appended claims.

I claim:

1. In gas burning equipment, a gas impervious heat transmissive plate shaped and disposed to support a cooking vessel, a gas pervious heat insulative wall underlying said plate, said wall and said plate forming boundaries of a combustion chamber, an electrical resistance heater element adapted to serve as a catalyst in the combustion of gas and having an area distributed over the area of said gas pervious wall, passage means for passing combustible gas to the region of said pervious wall for delivery therethrough to said chamber, additional passage means providing for passing products of combustion from said chamber, and control means including an element selectively actuatable between a plurality of positions, said element being operative in one position to energize said resistance heater element alone, said control element being operative in another position to control the feed of combustible gas to the first passage means while maintaining energization of said heater element, and said element being operative in a third position simultaneously to terminate energization of said electric heater element and flow of said combustible gas.

2. In gas burning equipment, a gas impervious heat transmissive plate shaped and disposed to support a cooking vessel, a gas pervious heat insulative wall underlying said plate, said wall and said plate forming boundaries of a combustion chamber, a plurality of individual ridges disposed on said heat insulative wall and each having its length extending outwardly from the center of said combustion chamber toward the periphery thereof, said ridges further being presented toward said plate, an electrical resistance heater element adapted to serve as a catalyst in the combustion of gas and comprising coil means disposed intermediate adjacent ridges and having one side bearing against said gas pervious wall and the other side bearing against said gas impervious plate, passage means for supplying combustible gas to the region of said pervious wall for passage therethrough to said chamber, additional passage means providing for passing products of combustion from said chamber, and electrical circuit means for passing electrical current through said element.

3. Equipment in accordance with claim 2, and further characterized in that said ridges are disposed in abutting engagement with said heat transmissive plate.

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