ABSTRACT: An apparatus and method for heating a work load by oxidation of hydrogen wherein the heat input is continuously controllable from zero to maximum and the area of heating surface is independently continuously controllable. The apparatus is made of a base for supporting and heating a load, the underside of the base being coated with an oxidation catalyst which is capable of initiating the oxidation of hydrogen in a proper hydrogen-air mixture, a conduit formed beneath said base for conducting said hydrogen-air mixture into contacting relationship with said catalyst-coated surface, means for admitting said hydrogen-air mixture into said conduit and means for removing exhaust gases from said conduit, and adjusting means for the continuous adjustment of the clearance within said conduit to thereby control the size of the area of the base which is being heated.
GAS-FUELED HEATING ELEMENT AND CONTROL

BACKGROUND OF THE INVENTION

The present invention relates to a novel apparatus and method for heating a load by a gas-fueled heating element. Heretofore, home appliances such as the kitchen ranges are of two types: the electric resistance type and the gas-burning type. These heating appliances possess certain disadvantages. In the first place, the conventional prior art gas burner usually burns natural gas which is largely methane. Such gas burners require some source of energy to initiate combustion, and this is usually provided by way of a pilot flame. Such pilot burner may be a source of trouble. Moreover, the prior art gas burners usually cannot be adjusted to reduce the heat input to an extremely low point because the resultant small flame would be very unstable. Although it is possible to continuously control the heat input to an electric resistance type of heating element by means of a rheostat, such continuous control would be expensive and inefficient due to the power loss in the control rheostat. Therefore, it is conventional practice with respect to an electric resistance heating element to vary the input thereto by selectively applying different, fixed levels of voltage available from the power supply source. Two or more resistance elements are also used to selectively obtain different heat input levels. However, in most of the electric resistance heating ranges, only stepwise control of heat input is provided.

Thus, there is a need for a kitchen range which is capable of burning gaseous fuel, which is self-igniting without the use of a pilot flame or matches, whose heat input can be continuously adjusted from nearly zero to the maximum capacity of the burner, and whose heating surface area can be independently continuously adjusted. It is, accordingly, an object of the present invention to provide a novel gas range which is self-igniting, whose heat input can be continuously adjusted over a wide range from nearly zero to the maximum capacity of the range, and whose heating surface area can be independently continuously adjusted to suit particular needs.

It is another object of the present invention to provide a gas-burning range which is safe, efficient and inexpensive to operate.

Further objects of the invention can be gathered from the following description.

SUMMARY OF THE INVENTION

In accordance with the present invention, we provide a gas-burning device, for use in a range, which is made of a base for supporting a load to be heated, the underside of the base being coated with an oxidation catalyst which is capable of initiating the oxidation of hydrogen in a proper mixture of hydrogen and oxygen, a conduit formed beneath the base for conducting the hydrogen-oxygen mixture into contacting relationship with the catalyst coated surface, means for admitting the hydrogen-oxygen mixture into the conduit and means for removing exhaust gases from the conduit, and adjusting means for the adjustment of the clearance within said conduit to thereby control the size of the area of the base which is being heated by the oxidation of hydrogen therein.

The device of the invention is capable of automatically igniting a proper mixture of hydrogen and oxygen without the use of a pilot flame or other ignition means, such as matches. The gas-fueled device of the invention is capable of handling heat inputs in a wide range from a level which is substantially zero to a level which represents the maximum capacity of the device. In addition, the size of the area on the base of the device which is being heated can be continuously controlled, e.g., to suit the physical size of the load to be heated.

BRIEF DESCRIPTION OF THE DRAWING AND THE PREFERRED EMBODIMENTS 774—780

The invention will now be further described with reference to the drawing, in which:

FIG. 1 shows a vertical sectional view of the gas-burning device of the invention;

FIG. 2 shows a plan view of a kitchen range having mounted on top thereof four of the gas-burning devices of the present invention; and

FIG. 3 is a partial elevation view, in section, showing the range of FIG. 2.

Referring to FIG. 1, a gas-burning device of the invention is generally shown at 10. The device 10 has a fixed top heating surface 11 which may be of any suitable geometry. Preferably, heating surface 11 is rounded for easy accommodation of conventional pots and pans. At the outer periphery of top heating surface 11, and connected thereto, is a ringlike channel 13, which serves the dual function of supporting the device 10 on a range top and to collect exhaust gases therefrom. An exhaust passageway 13 is connected to and in communication with channel 12 for passing exhaust gases out of the device 10. A flexible member 14 is attached to channel 12 and located below the heating surface 11. Flexible member 14, channel 12 and heating surface 11, together with a gas inlet passageway 15 form an enclosed space or conduit 16. Gas inlet passageway 15 is connected to a pinion mechanism 17 which has a pivot 18 and a handle 19. By raising or lowering handle 19, the gas inlet passageway 15 and flexible member 14 can be lowered or raised, respectively. In the same manner, the space or clearance between heating surface 11 and flexible member 14 can be increased or decreased.

Gas inlet passageway 15 is connected to and in communication with a flexible gas line 20 and a flow control valve 21. The hydrogen-oxygen mixture may be supplied, for example, from a source of hydrogen and the hydrogen is mixed with air or other oxygen-containing gases after it has been withdrawn from the source. The source of hydrogen and means for mixing hydrogen with an oxygen-containing gas are not shown.

The underside 22 of heating surface 11 is coated with a layer of a suitable oxidation catalyst for the hydrogen-oxygen mixture. Such catalysts are known to those skilled in the art and they include, for example, high specific surface area platinum. The method for applying the catalyst to the surface 22 is also well known. When the hydrogen-oxygen mixture comes into contact with the catalyst-coated surface 22, the hydrogen becomes oxidized by the oxygen without the need for a flame. In this manner, the heat of reaction for the oxidation of the hydrogen is released for heating the heating surface 11 and the load placed on top thereof.

As indicated above, the conduit 16 or the clearance between flexible member 14 and heating surface 11 may be adjusted by operation of the pinion mechanism 17. In practice, we have found that the maximum suitable spacing distance between the fixed heating surface 11 and the flexible member 14 is about ½ of an inch. Therefore, the device of the present invention makes it possible to provide for the continuous control of the useful heating area on the heating surface 11 with no more than ¼ inch vertical adjustment of the gas inlet passageway 15 by operation of the pinion mechanism 17.

Flexible member 14 may be made of any material which possesses the requisite ability to withstand heat and the proper structural and resilient characteristics. For example, a sheet of springlike steel would be suitable. If flexible member 14 is made of a metal, it is preferable that the outside surface area of member 14 be insulated to reduce heat losses.

Referring to FIG. 2, there is shown in a plan view, the top of a kitchen range equipped with four devices of the present invention. The gas-burning device 10 may be so accommodated on the kitchen range top 23 so that the heating surface 11 is substantially in the same plane as the range top 23. This is more clearly shown in FIG. 3.

FIG. 3 is a partial section view of the kitchen range of FIG. 2 along a line 3—3. In FIG. 3, a kitchen range is generally shown at 24. Range 24 has a top surface 23 for accommodating the gas-burning devices 10. Range top 23 has openings 25 thereon for receiving the gas-burning devices 10. Openings 25 are so sized that a portion of the gas-burning devices 10 may be received in the openings 25. A portion of the gas-burning devices 10 is held in openings 25 by a lock 26 which is engaged with a member 27 on the back of device 10. Openings 25 may also be so sized as to receive the gas-burning devices 10. At the outer periphery of opening 25, a portion of range top 23 is
bent downwardly to form an annular recess 26 for receiving and retaining channel 12 on the gas-burning devices. A slot may be provided on the annular recess 26 for passing gas exhaust 13 therethrough. It may be noted that in both FIGS. 2 and 3, the controls for the gas flow controlling valve 21 and the lever or handle 19 for the pinion mechanism 17 are not shown. molten

From the above, it can be gathered that the gas-burning device of the present invention is capable of utilizing the latent heat in a gaseous fuel such a hydrogen without the need for a pilot flame or other ignition means. In addition, the heat input to the device can be varied within the maximum possible range since the oxidation of the fuel gas, e.g. hydrogen, by oxygen in the presence of the catalyst can take place nearly without regard to the amount of fuel gas mixture fed into the device. In this manner, the heat input and output of the device can be continuously varied between the levels of nearly zero to the maximum capacity of the device. Furthermore, the size of the portion of the heating surface area which will be heated by the oxidation of the fuel gas can be controlled by varying the configuration of space between the heating surface and the flexible member. For example, a decrease in the clearance between the heating surface and the flexible member will cause an increase in the velocity of gases therethrough which will result in the oxidation of a part of the fuel gas further away from the center of the heating surface.

The invention has been described in detail with reference to particular and preferred seven-sixteenths inch it will be understood that variations and modifications can be made within the spirit and scope of the invention as described hereinabove and as defined in the appended claims. According to the demand upon

We claim:

1. A device for heating a load by the oxidation of a fuel gas comprising: a base for supporting and heating said load, the underside of said base being coated with an oxidation catalyst which is capable of initiating the oxidation of said fuel gas in the presence of oxygen; a flexible member disposed below said base and is substantially parallel thereto; means for collecting and removing exhaust gases located at the periphery of said base and said flexible member and joined therewith to form a conduit therebetween; means for admitting and controlling the fuel gas and oxygen into said device; and means for controlling the clearance between said base and said flexible member.

2. A device according to claim 1 wherein said fuel gas is hydrogen and said catalyst is a high specific surface area platinum.

3. A device according to claim 2 wherein said means for controlling said clearance is a pinion means connected to said flexible member.

4. A device according to claim 2 wherein said means for collecting and removing exhaust gases is a ringlike channel member adapted to support said device within a recessed opening on a kitchen range.

5. A device according to claim 5 wherein said base is substantially in the same plane as the top of said kitchen range.