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M. A. POWERS

2,039,607

LIQUID FUEL BURNING APPARATUS

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Fig. 1.

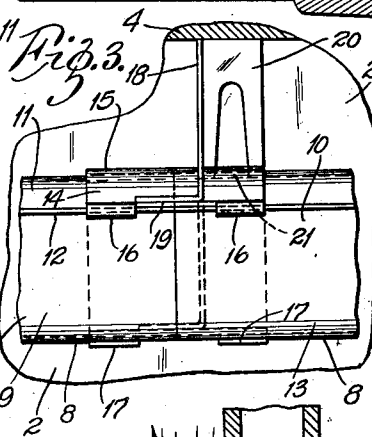
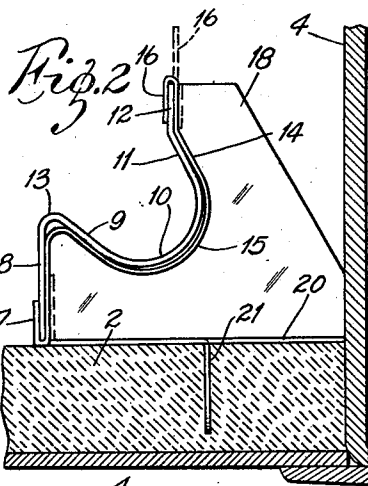
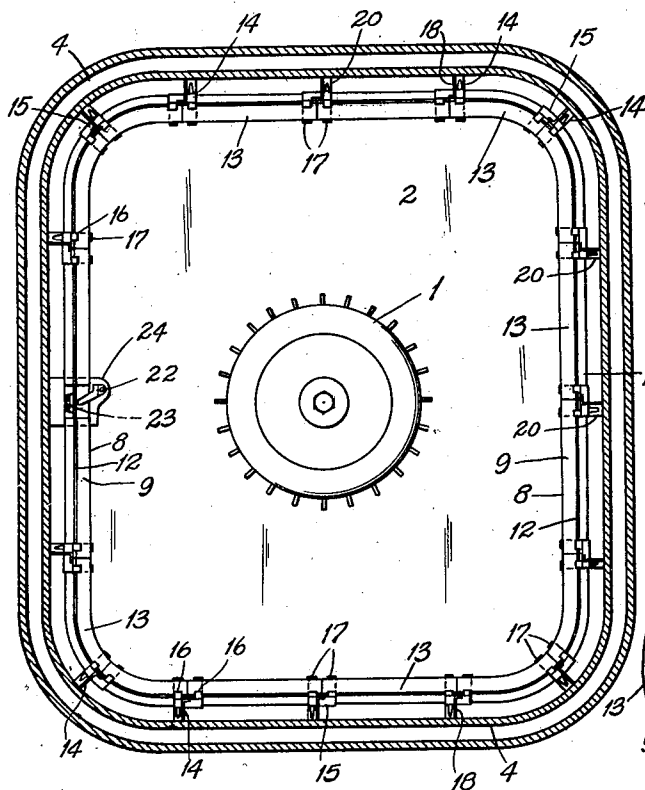


Fig. 4.

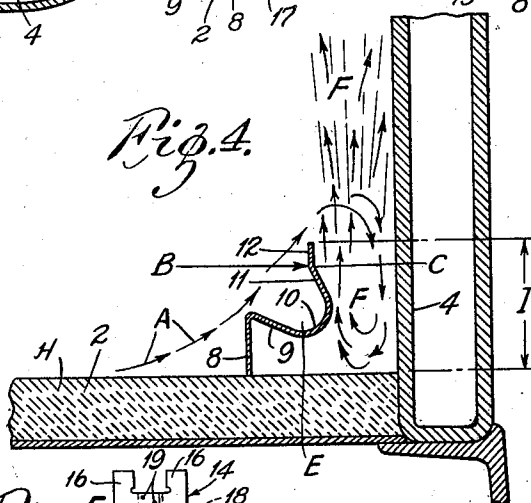
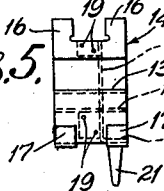


Fig. 5.



INVENTOR:
Milton A. Powers,
by Carl E. Hyman,
HIS ATTORNEYS.

UNITED STATES PATENT OFFICE

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LIQUID FUEL BURNING APPARATUS

Milton A. Powers, Detroit, Mich., assignor to The
Timken Silent Automatic Company, Detroit,
Mich., a corporation of Michigan

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18 Claims. (Cl. 158—4)

My invention relates to liquid fuel burners of the so-called rotary wall flame type wherein ignition and combustion take place around the outer periphery of a hearth adjacent to the wall of the combustion chamber of the furnace. It has for its principal objects to reduce to a minimum the time elapsing between initial ignition and the obtaining of normal combustion conditions, to enable the burner to properly consume a heavier and less costly fuel than has heretofore been practicable, to expose a larger area of heat absorbing surface to the heated gases, to minimize the deleterious effects of the highly heated combustion member of the present conventional type after shut down of the burner, to simplify the method of burner installation and to reduce its cost, and to lengthen the life span of the hearth. Other objects and advantages will appear hereinafter.

The invention consists principally in providing the hearth of such a burner with a peripheral ignition and combustion ring spaced away from the furnace wall and made of metal or other heat conducting material. The invention further consists in the ignition and combustion ring for liquid fuel burners and in the parts and combinations and arrangements of parts herein-after described and claimed.

In the accompanying drawing which forms part of this specification and wherein like numerals refer to like parts wherever they occur,

Fig. 1 is a plan view of a portion of a furnace having an ignition and combustion ring embodying my invention;

Fig. 2 is an elevation at the joint between two hearth ring members;

Fig. 3 is a top plan view of said joint;

Fig. 4 shows a similar view of my ring; and

Fig. 5 is a front elevation, on a reduced scale, of one of the clips for supporting the ends of adjacent hearth segments.

Oil burners of the rotary wall flame type include a rotary distributor head at the center of the combustion chamber, a hearth of refractory material and an ignition and combustion ring around the periphery of said hearth. Oil and air are discharged from said distributor head, the outwardly moving particles of oil being for the most part above the level of the air current.

The hearth periphery construction prior to my invention has consisted usually of a ring built up of a plurality of segments of refractory clay material placed against the water leg or combustion chamber wall and extending around the periphery of the hearth.

As illustrated in Fig. 4 my ignition and combustion ring comprises an upstanding supporting wall portion 8 near the outer periphery of the hearth and spaced a short distance, say three or four inches, away from the wall 4 of the combustion chamber, an outwardly extending ledge 9 at the top of said supporting wall having a groove or gutter 10 therein, and an upwardly extending impact wall portion 11 disposed at the outer edge of said gutter and terminating in a substantially vertical upper edge flange 12. Said ring is preferably made of heat resisting metal and is of comparatively thin section.

Preferably the combustion ring is made in segments 13 which may be partly assembled outside the combustion chamber, with final assembly in place to form a substantially continuous hearth ring.

Figures 2 and 3 illustrate a suitable clip member 14 for supporting the abutting ends of adjacent segments 13 and at the same time spacing the segments the desired distance from the combustion chamber wall 4. The clip 14 illustrated includes a supporting body member 15 of contour similar to that of the segments 13. Said body or chair member has spaced lugs 16 at the top and similar lugs 17 at the bottom, which may be bent to clasp the top and bottom portions respectively of the metal segments 13. A vertical backing brace 18 attached to the chair 15 as by welding at spots 19 has a base 20 that rests on the hearth and may be provided with a downwardly projecting anchor portion 21 for embedding in the hearth 2 while it is still plastic. The outer end of the backing brace 18 abuts against the furnace wall and suitably spaces the segments from the wall.

In assembling two segments 13, the procedure is to slip the lower edges of the segments behind the lower lugs 17 with the abutting ends of the segments near the center of the face of the chair 15 and in close contact with it. It is then readily possible to bend over the upper lugs 16 to hold the segments 13 tightly in place. In a round hearth a continuity of round segments 13 is used while in a rectangular combustion chamber combinations of straight and curved segments are necessary.

Any suitable ignition means may be used. In the drawing has been illustrated an electric spark ignition of the type shown in my Patents Nos. 1,888,692, 1,888,694 and 1,888,695. Spaced electrodes 22, 23 are mounted in a combustion ring segment 24 composed of refractory clay or other suitable material. As the face of this igni-

tion segment 24 conforms in shape to that of the combustion ring segments 13, the ignition segment may be placed at any desired point around the periphery of the hearth, with said combustion ring segments overlapping it.

Fig. 4 illustrates the normal functioning of my ignition and combustion wall. The oil spray is thrown along the trajectory B and strikes the impact wall portion 11 of the combustion ring at the point C, where the temperature is sufficiently high to instantly vaporize the oil. Air from the distributor head 1 flows along the hearth surface as shown at A and is deflected upward by the lower or supporting wall portion 8 of the combustion ring and flows over the edge flange 12, where it entrains vapor arising from C and mixes with it above the level of the top surface of the combustion ring, where combustion is initiated, the shape of the flame being illustrated and being indicated by the letter F. Instead of burning entirely above the top of the combustion ring (as in the case of the normal flame of previous burners having a refractory clay ring abutting against the furnace wall), the flame extends down into the space between the impact wall 11 and the furnace wall 4 and highly heated gases and flame make wiping contact with the outer face of the thin metal impact wall 11. Thus the impact wall is quickly heated to its maximum temperature, said maximum being considerably higher than that of a refractory clay member. It follows that there is almost no delay in transmitting a large amount of heat to the oil as it strikes the impact wall; so that complete vaporization takes place within a very short time from the instant of starting the burner.

When starting the burner in a cold boiler, oil strikes the impact surface C, wetting it and draining down into the gutter E where it collects. The oil in said gutter is ignited and the flame is at once propagated around the gutter E and continues to burn in said gutter until the rate of vapor formation is sufficiently high to produce an over-rich mixture in the gutter, at which time the flame moves upwardly to the top of the impact wall and burns thereafter at this upper level.

With my construction, all impinging oil is being vaporized and burned in less than twenty seconds from the starting of the burner in a cold furnace and in less than forty-five seconds the entire surface of the metal combustion ring is dry. The rapid heating of the combustion ring prevents the accumulation of oil in the gutter.

The almost instantaneous heating of the impact wall and its continuous heating thereafter by reason of the flame contact with the outer surface thereof makes it possible to use oils that are quite heavy and have a high end point. The very rapid heating of the impact wall and of the entire combustion ring, the high final operating temperature and the concentration of a large amount of heat at the vaporizing zone make possible the burning of a heavy oil, such as oil of the No. 3 grade or even somewhat heavier oil. In using the lowest grades of oil, a small amount of carbon may collect at the point of impingement, but as soon as this reaches any appreciable thickness, flakes drop off into the gutter where combustion conditions are such that these flakes of carbon are entirely consumed.

The spacing of the combustion ring a slight distance away from the boiler wall allows the flame and highly heated gases to wipe the boiler wall to the level of the top of the hearth H, thus making available as a heat absorbing surface

the additional area indicated by the letter I. This distance is approximately two inches, or over ten percent of the effective height of the usual combustion chamber of not to exceed twenty inches in height. The ignition and burning of part of the normal flame in the protected channel between the combustion ring and the boiler wall causes the flame to hold down to the desired location instead of lifting upwardly into the boiler.

The metal segments are of light weight and may be nested together, thereby greatly increasing the economy and convenience of handling and shipping. Being made of metal, the segments can be held within very close tolerance limits as to all dimensions, whereas segments made of other materials necessarily vary considerably in dimensions. Making the segments of metal minimizes the loss and waste of material and parts throughout the processes of manufacturing, handling, shipping and installation and in the final use of the finished product. Metal parts may be quickly manufactured, whereas other materials frequently require three weeks or more to complete their manufacturing process; so that the use of metal makes possible lower inventories and minimizes the danger of inability to promptly furnish replacement parts. Installation of the metal segments is quite easy, as a number of them may be assembled outside the furnace, slipped through the fire door onto the hearth and the clamp members then locked in place if required. The segments may be made of any desired heat resisting metal, such as chrome-nickel steel or chrome steel having at least twelve percent chromium content.

The present combustion ring is especially suited for the increasingly popular and desired installation in hot water and steam boilers provided with an indirect water heater, such installations having heretofore made considerable trouble due to the fact that in warm weather the periods of operation required to heat water for domestic use are too short to enable prior constructions to reach normal operating conditions, thus causing accumulation of oil and tarry matter, smoky flame and other important disadvantages; whereas my combustion ring provides the quick heating of the combustion ring and the high final operating temperature essential to the truly satisfactory and efficient operation of such devices.

The present construction is also rapid in its cooling after the burner has shut down, thus avoiding the possibility that restarting may take place while the hearth is still heated, with the result that the immediate and complete vaporization of the fuel would blanket the ignition device and cause a highly undesirable and dangerous delay in ignition.

Obviously, numerous changes may be made without departing from the invention and I do not wish to be limited to the precise construction shown.

What I claim is:

1. Liquid fuel burning apparatus of the rotary wall flame type comprising a combustion chamber having a peripheral wall, a vaporizing and carbureting structure comprising a troughed step member of imperforate sheet material of high heat conductivity having an upwardly extending impact wall portion along its outer margin spaced away from said wall, centrifugal means for spraying oil against said impact wall portion and means for directing a current of air towards said

troughed step member, said air current being deflected upwardly by said step member.

2. A hearth construction for liquid fuel burners of the wall flame type wherein oil and air for combustion are discharged from a centrally located rotary head, consisting of a substantially flat bed of refractory hearth material extending to the periphery of the combustion chamber and a continuous segmented sheet metallic peripheral ring resting upon said hearth bed near the periphery thereof.

3. A hearth construction for liquid fuel burners of the wall flame type wherein oil and air for combustion are discharged from a centrally located rotary head, consisting of a substantially flat bed of refractory hearth material extending to the periphery of the combustion chamber and a substantially continuous sheet metallic ring located near but slightly spaced from the sides of the combustion chamber and resting upon said hearth bed.

4. A hearth construction for liquid fuel burners of the wall flame type wherein oil and air for combustion are discharged from a centrally located rotary head, consisting of a substantially flat bed of refractory hearth material extending to the periphery of the combustion chamber, a substantially continuous sheet metallic ring located near but slightly spaced from the sides of the combustion chamber and resting upon said hearth bed, and means for holding said ring in place on said hearth bed.

5. A liquid fuel burner of the rotary wall flame type comprising a combustion chamber, a hearth extending to the periphery of said combustion chamber, means disposed centrally of said hearth for discharging oil and air toward the periphery thereof and a peripheral combustion ring of sheet material of high heat conductivity spaced slightly from the periphery of said hearth.

6. A liquid fuel burner of the rotary wall flame type comprising a combustion chamber, a hearth extending to the periphery of said combustion chamber, means disposed centrally of said hearth for discharging oil and air toward the periphery thereof and a peripheral combustion ring of sheet material of high heat conductivity spaced slightly inward from the periphery of said hearth, said combustion ring having an air deflecting face projecting upwardly from the surface of the hearth, a gutter in the lee of said deflecting face and an upwardly extending impact wall at the outer edge of said gutter.

7. In a liquid fuel burner of the wall flame type, a combustion chamber having a hearth and a peripheral wall adjacent to which wall combustion takes place in an annular zone, said hearth serving to close said chamber adjacent said wall, and a sheet metal combustion ring spaced inwardly from said wall and in the path of liquid fuel.

8. In a liquid fuel burner of the rotary wall flame type, a hearth, a peripheral wall therefor, a plurality of metal segments extending around said hearth spaced inwardly from said peripheral wall and arranged in abutting relation to each other, and clips for supporting and positioning the abutting ends of adjacent segments and spacing them away from said peripheral wall, said clips having surfaces conforming to the contour of said segments, portions for clamping the ends of adjacent segments in abutting relation and portions for anchoring said clips to said hearth.

9. In a liquid fuel burner of the rotary wall flame type, a hearth, a peripheral wall therefor,

a plurality of metal segments extending around said hearth spaced inwardly from said peripheral wall and arranged in abutting relation to each other, and clips for supporting and positioning the abutting ends of adjacent segments and spacing them away from said peripheral wall, said clips having surfaces conforming to the contour of said segments, portions abutting against said peripheral wall, means for clamping the ends of adjacent segments in abutting relation and means for anchoring said clips to said hearth.

10. In a liquid fuel burning apparatus, in combination with a combustion chamber having a hearth and an upright wall, fuel distributing means designed to project a fuel stream above said hearth and toward said wall, a fuel vaporizing wall spaced materially from said chamber wall in the direction of said fuel distributing means and spaced substantially above said hearth to intersect the path of said fuel stream, thereby to form a relatively large chamber between said vaporizing wall and said upright wall of the combustion chamber, and means for supplying and causing air to intersect the fuel stream in the region of said vaporizing wall.

11. In the combination defined in claim 10, said fuel vaporizing wall being thin and formed of refractory material that is a good heat conductor.

12. In a liquid fuel burning apparatus, in combination with a combustion chamber having a hearth and an upright wall, and fuel distributing means positioned to project a fuel stream toward said wall, a refractory carbureting structure disposed between said wall and said distributing means and comprising a thin fuel vaporizing wall of high heat conductivity mounted above the hearth in the path of the fuel stream, means for directing air toward said upright wall in the vicinity of said vaporizing wall, and a member for causing the air to mix with the fuel vaporized by said thin wall, said member being spaced horizontally with respect to said thin wall to provide therebetween a somewhat sheltered ignition zone.

13. In a liquid fuel burning apparatus, in combination with a combustion chamber having a hearth and an upright wall with the hearth closing the bottom of said chamber in the vicinity of the wall, fuel distributing means for projecting a stream of liquid fuel above the hearth and toward said wall, means for projecting an air blast over the hearth toward said wall, and an upright thin sheet metal member disposed in the general path of fuel and air projection and spaced materially from said combustion chamber wall in the direction of the projecting means.

14. In the combination defined in claim 13, said fuel and air projecting means being designed to substantially prevent admixture or carburetion prior to impingement upon said metal wall, and there being a substantially upright wall, of lesser height than said metal wall, disposed between the latter and the projecting means to deflect the air blast into intersection with the fuel stream adjacent the top of said metal wall.

15. In a liquid fuel burning apparatus of the wall flame type, comprising a hearth and associated means forming a combustion chamber surrounding a centrally located fuel projector: a substantially continuous carbureting structure spaced inwardly from the wall of the combustion chamber and provided with an upright fuel impact wall; and metal supporting and positioning means for said structure, said metal means com-

prising portions secured to the structure and integral offset portions secured to the hearth.

16. In a liquid fuel burning apparatus, in combination with a combustion chamber having a hearth and an upright wall with the hearth closing the bottom of said chamber in the vicinity of the wall, fuel distributing means for projecting a stream of liquid fuel above the hearth and toward said wall; means for projecting an air blast toward said wall; and a refractory impingement device of good heat conductivity disposed in the general path of fuel and air projection and spaced materially from said chamber wall in the direction of said fuel projecting means to form a relatively large vertical space adjacent said chamber wall; said device comprising a fuel impingement wall positioned materially above the hearth, and a trough portion depending from said wall to catch any downwardly flowing unvaporized oil, said trough portion having its bottom elevated with respect to the hearth to thus form therebetween a horizontal space in communication with said vertical space.

17. In a liquid fuel burner of the wall flame type, a combustion chamber having a hearth closing the bottom of the chamber and a wall

extending around the periphery of said hearth, means for projecting liquid fuel toward the hearth periphery, a heat resistant sheet metal combustion ring of substantially uniform height spaced inwardly from said wall and in the path of the projected fuel, and means for supplying air for admixture with the fuel adjacent the top of said ring.

18. In a liquid fuel burner of the wall flame type, a combustion chamber having a hearth and a wall extending around the periphery of said hearth, means for spraying oil toward the hearth periphery, a relatively thin combustion ring of material of high heat conductivity spaced inwardly from said wall and presenting a vaporizing face in the path of the sprayed fuel, and means for passing a current of air toward the top of the ring to produce a mixture of fuel and air for combustion in an annular zone extending from a locus above the top of the ring downwardly between said combustion ring and the peripheral wall, whereby the temperature of the vaporizing face will rapidly vary in accordance with any changes of temperature in the combustion zone.

MILTON A. POWERS.