

June 6, 1939.

R. W. BECKETT
OIL BURNING APPARATUS

2,161,222

Filed March 14, 1938

3 Sheets-Sheet 1

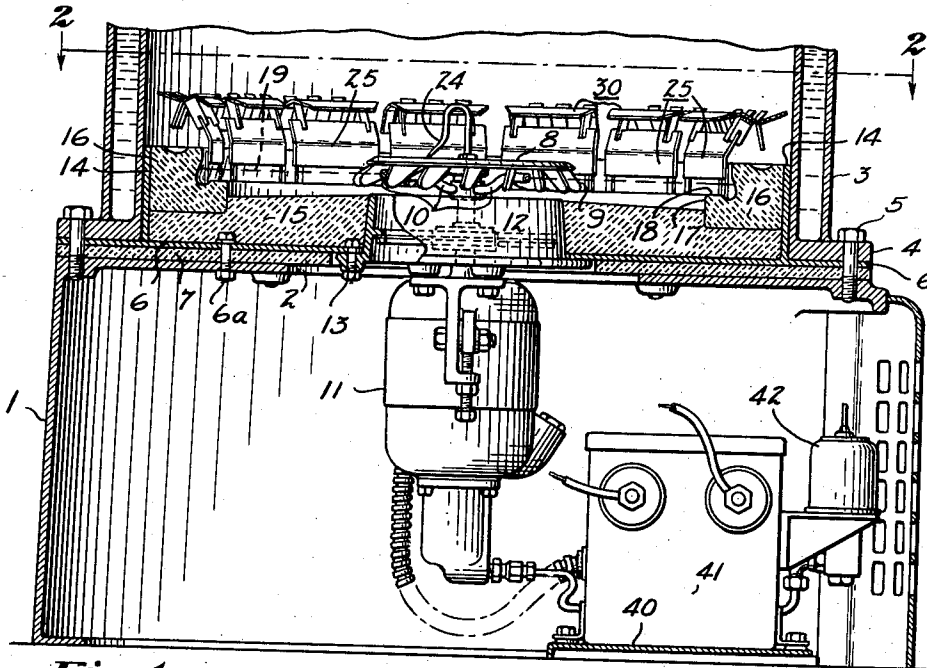


Fig. 1

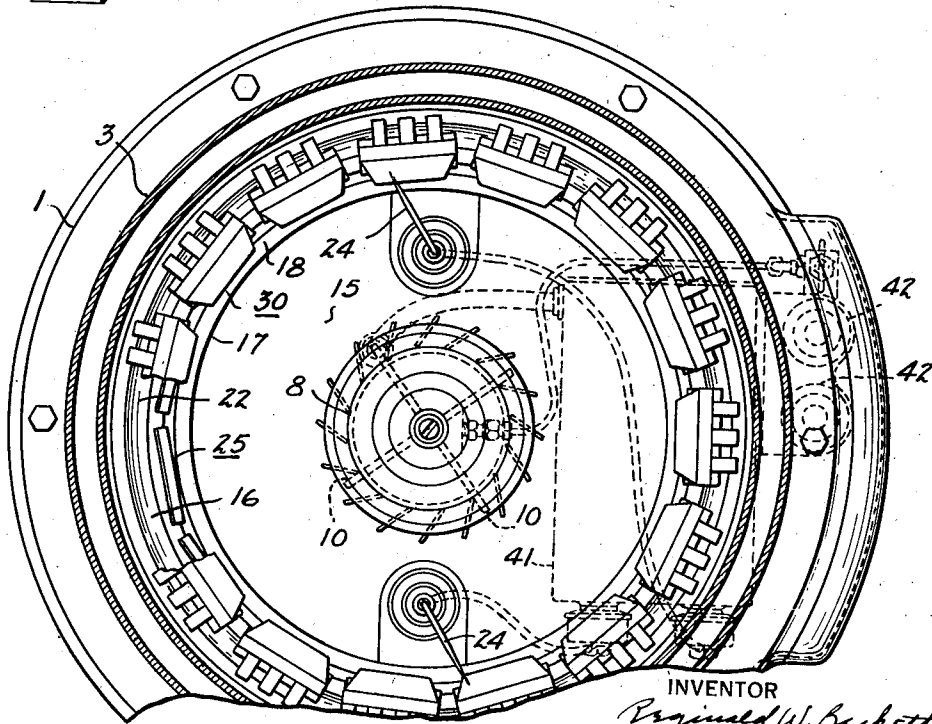


Fig. 2

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3 Sheets-Sheet 2

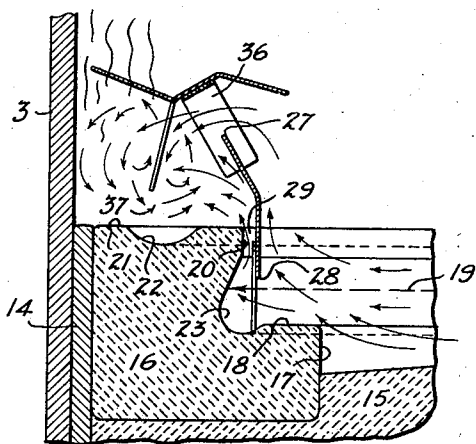


Fig. 4

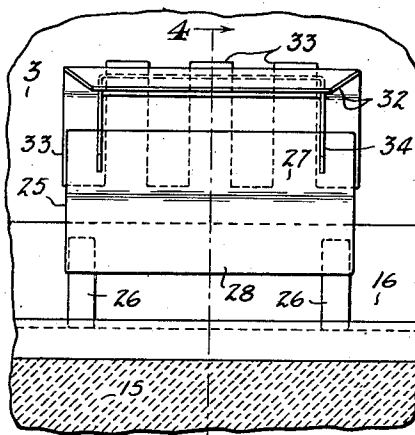


Fig. 3

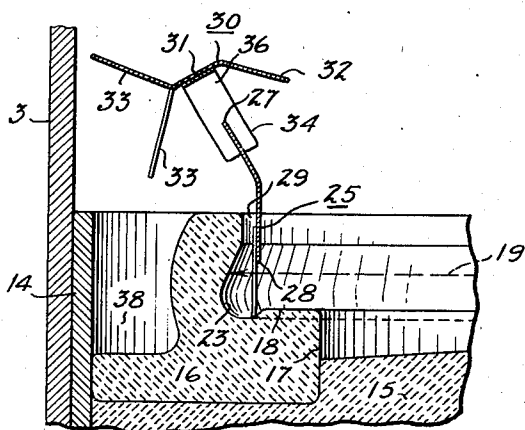


Fig. 7

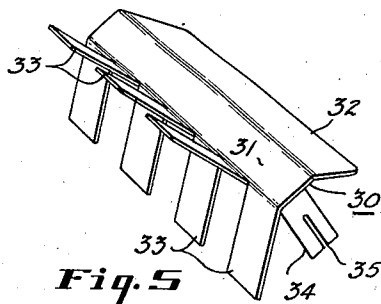


Fig. 5

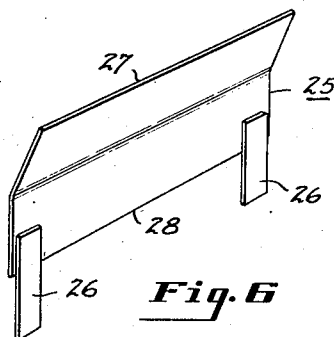


Fig. 6

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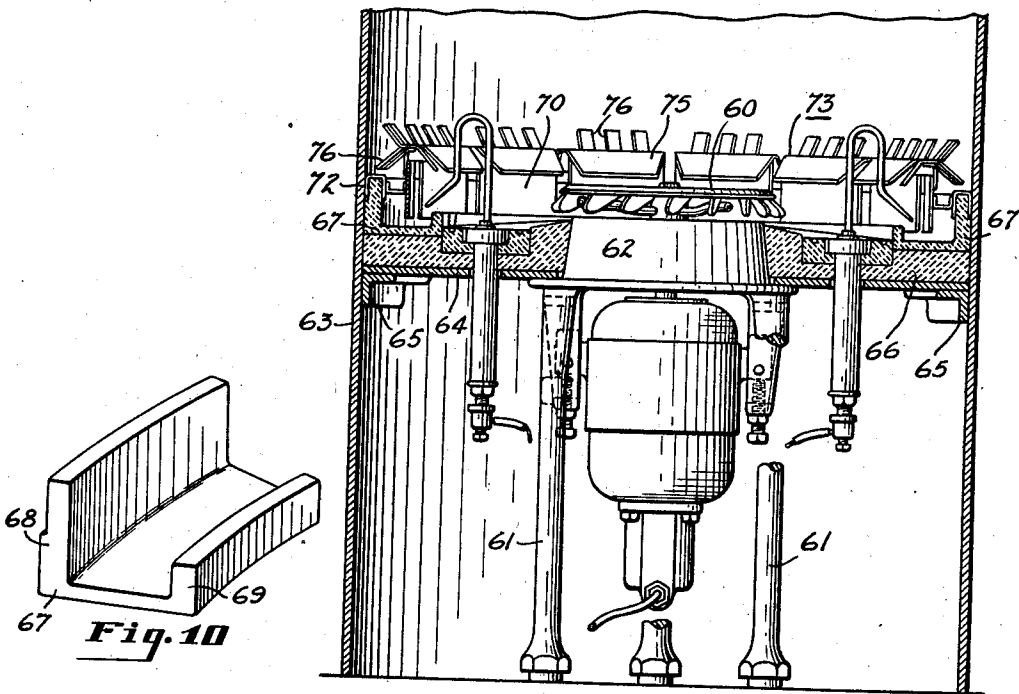
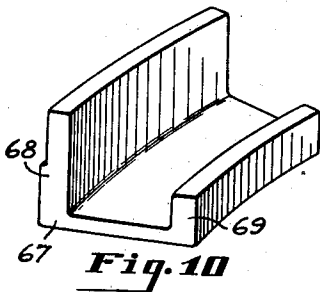
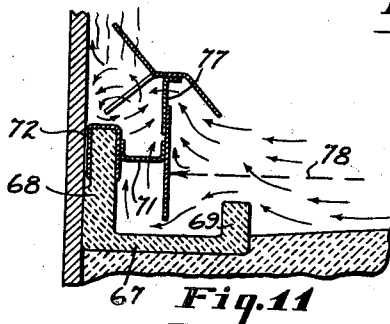
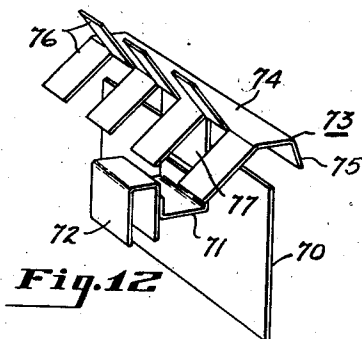
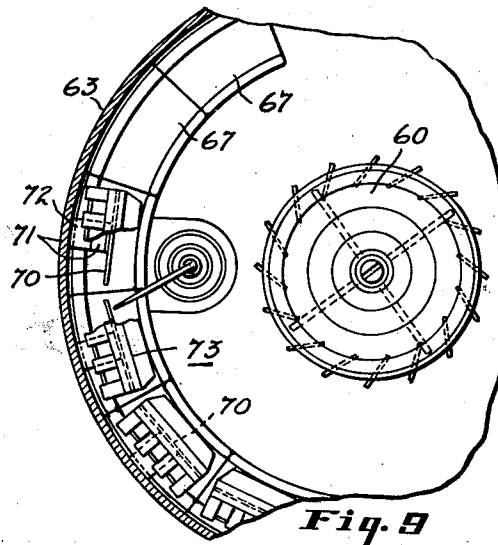
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,161,222

OIL BURNING APPARATUS

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Application March 14, 1938, Serial No. 195,908

8 Claims. (Cl. 158-4)

This invention relates to oil burning apparatus and more particularly to oil burning apparatus of the rotary wall flame type wherein combustion is initiated adjacent the combustion chamber wall of a furnace unit.

One of the objects of the present invention is to provide a rotary wall flame type oil burning apparatus with new and improved means for improving the efficiency and operating characteristics of the same, which means is simple in construction, easy to install and economical to manufacture.

Another object is to provide a wall flame type oil burning apparatus having a combustion promoting element of heat resistant material with an air deflecting arrangement of new and novel construction in association with the combustion promoting element which will tend to assist in properly placing the flame of combustion and in increasing combustion efficiency.

Another object is to provide oil burning apparatus with an improved means for preventing the snuffing out of the flame of combustion.

Another object is to provide the combustion ring of a wall flame type oil burning apparatus with new and improved means for obtaining a thorough mixture of vaporized oil and the combustion supporting air.

Another object is to provide a wall flame type burning apparatus having an oil vaporizing wall with a novel arrangement for deflecting the combustion supporting air away from the vaporizing wall whereby to prevent the cooling effect of such air on the vaporizing wall.

With the above and other objects in view the present invention consists in certain features of construction and combination of parts to be hereinafter described with reference to the accompanying drawings and then claimed.

In the drawings which illustrate suitable embodiments of the present invention,

Figure 1 is a fragmentary vertical section of a furnace unit having the oil burning apparatus associated therewith;

Fig. 2 is a transverse section taken approximately on line 2-2 of Fig. 1 showing the oil burning apparatus in plan view;

Fig. 3 is an enlarged fragmentary front elevation showing the air deflecting structure of the present invention;

Fig. 4 is a section taken approximately on the line 4-4 of Fig. 3, the flow of the air and vaporized oil being indicated by arrows;

Fig. 5 is a perspective view of one of the flame placing elements;

Fig. 6 is a perspective view of one of the air deflecting elements;

Fig. 7 is a transverse section similar to Fig. 4, showing a combustion promoting element of modified construction;

Fig. 8 is a vertical section through a furnace unit having an oil burning apparatus associated therewith in which the combustion promoting element is of modified construction;

Fig. 9 is a fragmentary plan view of the oil burning apparatus illustrated in Fig. 8;

Fig. 10 is an enlarged perspective view of one of the refractory elements illustrated in Fig. 8;

Fig. 11 is an enlarged section through the combustion promoting element, the flow of air and oil being indicated by arrows; and

Fig. 12 is a perspective view of one of the combustion promoting elements illustrated in Fig. 8.

In oil burning apparatus of the rotary wall flame type, a centrally located rotary head discharges oil and air outwardly over a hearth into contact with a substantially continuous face or vaporizing wall located adjacent the furnace or combustion chamber wall. During normal operation, the oil vaporized by the heat of this face mixes with the air, and combustion occurs outwardly of the vaporizing face adjacent the furnace or combustion chamber wall in the form of a whirling, annular, wall-wiping flame. A construction of this character is shown in Patent No. 1,881,260, issued October 2, 1932 to H. F. Braun et al. Certain phases of the invention have to do with a means associated with a combustion promoting element of the general character disclosed in this patent for improving the character of the flame produced, for deflecting the combustion supporting air in a manner to increase the efficiency of the combustion producing element, for providing means for better combustion efficiency and for minimizing the tendency of the flame to snuff out. Other phases of the invention have to do with modifications of the combustion promoting structure and with an arrangement of parts for facilitating the assembly of the furnace and burner units.

Referring to the accompanying drawings, in which like numerals refer to like parts throughout the several views, I have shown in Figs. 1 and 2 a hollow casting or base 1 having a central opening 2 in its upper side which supports the oil and air projecting devices, the hearth structure and the furnace or boiler 3, the boiler having a peripheral flange 4 through which bolts 5 extend to secure it to the base 1. Interposed between the base 1 and boiler flange 4 and held

in place by the bolts 5 are an annular burner supporting plate 6 and an annular body 7 of insulating material, the body 7 being disposed between the plate 6 and base 1, and the plate 6 being secured to the base 1 by bolts 5a.

The oil and air distributing device may be of any suitable construction, and as shown in Figs. 1 and 2 for the purpose of illustration, may comprise a rotatable head 8 having a plurality of air propelling blades 9 and oil distributing tubes 10 located at the under side of head 8, the head being rotated by an electric motor 11 supported from an annular member 12. The annular member 12 projects upwardly through the plate 6 and is secured to the under side thereof by suitable bolts 13.

The plate 6 is formed with an upwardly extending annular flange 14 which fits within the lower end of the combustion chamber wall in engagement therewith. Extending between the flange 14 and member 12 is a layer 15 of refractory, such as, for example, a refractory cement.

The combustion promoting element or ring 16, shown in Figs. 1, 4 and 7 for illustration, is of the character shown in said Patent 1,881,260, and is of stepped construction, having an inner vertical face 17 terminating above the hearth 15 in a low horizontal face 18, but below the path of projected oil indicated by line 19, and an outer vertical face 20 terminating in an upper horizontal face 21 above the path of projected oil. The upper horizontal face 21 is preferably formed with an annular groove 22, and a groove 23 is preferably formed in the faces 18 and 20, as shown in Fig. 4. The combustion ring 16 may be made of metal or a suitable ceramic refractory in the form of preformed segments seating in the hearth 15 and abutting the annular flange 14 of the plate 6. During the operation of the oil burning apparatus, the tubes 10 of the rotating head 8 project oil outwardly toward the furnace wall and this oil is intercepted by the outer face or vaporizing wall 20 of the combustion promoting element 16. The fan blades 9 draw air upwardly through the annular member 12 and propel it outwardly in layers above and below the oil stream.

Initial ignition of the oil is produced by any well known means such as sparks produced by electrodes 24. Upon the heating of the vaporizing wall 20 due to the ignited oil which burns adjacent thereto, the oil impinged against the face 20 is vaporized and mixed with the air, and combustion occurs above the combustion element 16 and adjacent the furnace wall, the inner vertical face 17 directing the outwardly flowing lower layer of air upwardly along the outer vertical face or vaporizing wall 20.

In order to prevent the combustion supporting air from causing a cooling effect on the vaporizing wall 20 I have provided, as shown in Figs. 1 to 6 inclusive, a plurality of rectangular air deflecting elements 25, preferably of heat resistant sheet metal bent to an obtuse angle, each of which is provided with a pair of spaced legs 26 which may be attached thereto or may form an integral part thereof. These elements are arranged in spaced relation with the legs 26 thereof seating in the lower groove 23 and with their vertical edges abutting the upper portion of the vaporizing wall 20, the upper horizontal edge 27 thereof being disposed above the upper horizontal face 21 and the plane of the lower horizontal edges 28 thereof being above the path of projected oil as shown in Fig. 4. It is to be noted

that due to the curvature of the vaporizing face 20, spaces or passages 29 are provided between the wall 20 and elements 25. In the event the combustion producing elements embody straight rather than curved sections, any suitable means may be employed to hold the elements 25 slightly away from the vaporizing wall to provide the passages just described.

Associated with the elements 25 are deflecting members 30, preferably of heat resistant sheet metal. These members are of the general character shown in a co-pending application Serial No. 95,396, filed August 11, 1936, and each comprises an intermediate imperforate portion 31, and imperforate portion 32 at one side extending, as viewed in Fig. 4, downwardly at an obtuse angle, and a plurality of narrow fingers 33 at the other side thereof, the fingers alternately extending upwardly and downwardly at obtuse angles with respect to the intermediate portion. Secured to the under side of each member 30 are spaced depending strips 34, the lower edges of which are formed with slots 35 which seat around the upper edges 27 of the elements 25 to support the members 30 above the elements 25 with the intermediate imperforate portions 31 in spaced relation with respect to the upper edges 27 to provide passageways 36 therebetween.

During operation of the oil burning apparatus described, the oil projected by the distributing head is impinged against the vaporizing wall 20 and is initially ignited by sparks produced by the electrodes or other ignition means that may be employed.

The lower layer of air projected by the distributing head is deflected upwardly by the inner face 17 of the combustion promoting element 16 beyond the lower edges of and toward the elements 25, passing through the oil stream, and the upper layer of air projected by the distributing head is deflected upwardly toward the members 30 by the elements 25. A small portion of the lower layer of air, however, may pass below the lower edges 38 of the elements 25 and impinge against the vaporizing wall 20. Also, some of the air from the upper and lower layers will pass between the elements 25 and impinge against the vaporizing wall 20.

In the construction described, the greater portion of the air, however, is deflected upwardly by the elements 25 and then is deflected outwardly by the members 30 through the passageways 36 and above the combustion element 16. Due to the annular chamber 37 provided above the combustion element 16 between the furnace wall and upper portions of the elements 25 and due to the oppositely inclined fingers 33 of the members 30, a rolling motion is imparted to the air entering through the passageways 36, creating a suction effect adjacent the passages 29 which, after the vaporizing wall 20 becomes heated from the burning oil, draws the vaporized oil through the passages 29 between the vaporizing wall 20 and elements 25 and into the rolling air in the chamber 37.

Due to the turbulence and rolling action within the annular chamber 37, the air and vaporized oil particles are thoroughly mixed and combustion takes place within the chamber 37 in the form of an annular ring of flame. Thorough mixing of the air and oil particles is also assisted by the downwardly inclined fingers 33 which also become highly heated and assist in vaporization. The turbulence and rolling action of the combustible mixture and the low pres-

sure zone created by the annular upper groove 22 tend to hold the flame near the combustion ring and minimizes the tendency toward snuffing out of the flame.

By employing the elements 25 and members 30 in association with the combustion element 16 for preventing the greater portion of combustion supporting air from impinging against the vaporizing wall 20 and directing the air into the vaporized oil, not only efficient and complete but more rapid combustion is obtained.

The modified construction shown in Fig. 7 is identical with the construction described with the exception that the upper outer portion of the combustion ring 16 is removed to provide a large annular recess 38 adjacent the furnace wall which provides for a low pressure zone of greater volume that increases the tendency to hold the flame of combustion lower down the furnace wall whereby additional area is provided to absorb heat. It will be noted that in this construction the portion of the combustion promoting element outwardly of the vaporizing wall is of materially less thickness than the construction previously described. By decreasing this thickness, the vaporizing wall 20 will heat more rapidly and increase the rapidity of combustion upon initial ignition.

One distinct advantage of the constructions described is that the vaporizing wall 20 will become heated much more rapidly and thereby provide for quicker vaporization of the oil impinging against the same than can be obtained in constructions using the conventional refractory combustion ring, due to the fact that the elements 25 prevent the greater portion of the cool currents of air from impinging against the vaporizing wall 20, which currents in conventional constructions tend to cool the same.

The invention described lends itself particularly to converting coal and gas burning furnaces into oil burning furnaces. However, it is also adaptable to furnace-burner units to be sold and installed as a complete unit.

Referring again to Fig. 1, the base 1 is provided with a support 40 extending across the lower portion of the same which supports the ignition transformer 41 and oil valves 42. The electrical controls, or any other adjuncts that may be desired, may also be positioned within the base 1.

The base 1, fuel and air distributing unit, hearth, combustion structure, transformer 41 and oil valves 42 may be assembled and shipped as a unitary structure. The boiler or furnace unit and the unitary structure are assembled by merely positioning the furnace unit over the base 1 and lowering the same in a manner to fit the flange 14 within the furnace unit. All that remains to be done is to secure the bolts 5 in place and connect the leads from the transformer with the electric power lines.

In Figs. 8 to 12, I have shown a further modified construction which is especially suitable for conversion units. In this construction, the distributing head 60, which may be of the character previously described, is supported by legs 61 connected with the annular motor supporting member 62 and extending to the floor within the furnace 63. A hearth supporting plate 64 is supported by the member 62 and elements 65 secured to the furnace wall 63. A suitable refractory 66, such as refractory cement, extends between the member 62 and furnace wall and supported upon the refractory 66 are a plurality of generally U-shaped refractory elements 67 abut-

ting each other and forming a continuous ring adjacent the furnace wall. The outermost leg 68 of the ring is materially higher than the innermost leg 69 and forms a support for the oil intercepting elements 70 which are in the form of rectangular plates of heat resistant sheet metal. Suitably secured to the outer side of each plate 70 is a straplike element 71 to which is secured an inverted U-shaped element 72 which fits over the outer leg 68 of the ring as shown in Fig. 11 to support the plate 70 in a vertical position intermediate the legs 68 and 69. As shown in Figs. 8 and 9, the plates 70 are supported in spaced endwise relation. Also, secured to the upper portions of the plates 70 are deflectors 73 of the same construction as the members 30 previously described, having an imperforate intermediate portion 74, an imperforate downwardly inclined inner side portion 75 and oppositely inclined alternate fingers 76 at the opposite side. The deflectors 73 are of the same construction as the members 30 previously described with the exception of the means for supporting the same. In this construction, each deflector 73 is supported by means of a straplike element 77 secured to the intermediate portion and secured to the outerface of the plate 70 in a manner to space the intermediate portion above the upper edge to provide a space therebetween.

It will be noted in this construction that the lower edges of the plates 70 extend below the line 78 of projection of fuel. The plates 70 therefore act as the vaporizing elements and the flame of combustion will be produced in a manner similar to that produced by the construction shown in Fig. 8.

If desired, however, the lower edges of the plate 70 may be disposed above the line 78 of fuel projection, in which case the structure will function similar to that of Fig. 4, the inner faces of the legs 68 serving as the vaporizing wall.

Although several embodiments of the invention have been shown and described it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined in the following claims.

What I claim is:

1. Oil burning apparatus comprising a combustion chamber having an upright wall, a hearth extending to the periphery of said chamber, oil and air projecting means above said hearth for discharging oil and air toward said upright wall, means adjacent said wall having an oil vaporizing wall inwardly of said upright wall and facing said projecting means for intercepting and vaporizing the oil discharged from said projecting means, and baffle means immediately in front of said vaporizing wall and having the lower edges thereof slightly above the path of oil discharged from said projecting means for protecting said vaporizing wall from direct impact of a large portion of the air discharged from said projecting means and for directing the said portion of the air upwardly over said vaporizing wall and outwardly into the oil vapor passing from said vaporizing wall.

2. Oil burning apparatus comprising a combustion chamber having an upright wall, a hearth extending to the periphery of said chamber, oil and air projecting means above said hearth for discharging oil and air toward said upright wall, means adjacent said wall having an oil vaporizing wall inwardly of said upright wall and facing said projecting means for intercepting and va-

porizing the oil discharged from said projecting means, and baffle means disposed directly in front of said vaporizing wall and having the lower edges thereof slightly above the path of oil discharged from said projecting means for protecting said vaporizing wall from direct impact of a large portion of the air discharged from said projecting means and for directing the said portion of the air upwardly over said vaporizing wall and outwardly into the oil vapor passing from said vaporizing wall, said baffle means being disposed inwardly of said vaporizing wall a sufficient distance to provide space for the passage of oil vapor therebetween.

3. Oil burning apparatus comprising a combustion chamber having an upright wall, a hearth extending to the periphery of said chamber, oil and air projecting means above said hearth for discharging oil and air toward said upright wall, means adjacent said wall having an oil vaporizing wall inwardly of said upright wall and facing said projecting means for intercepting and vaporizing the oil discharged from said projecting means, and a plurality of vertically disposed plate-like members having their lower edges slightly above the path of oil discharged from said projecting means and being disposed immediately in front of said vaporizing wall in slightly spaced relation with respect thereto for protecting said vaporizing wall from direct impact of a large portion of the air discharged from said projecting means and for directing the said portion of the air upwardly over said vaporizing wall and outwardly into the oil vapor passing from said vaporizing wall.

4. Oil burning apparatus comprising a combustion chamber having an upright wall, a hearth extending to the periphery of said chamber, oil and air projecting means above said hearth for discharging oil and air toward said upright wall, means adjacent said wall having an oil vaporizing wall inwardly of said upright wall and facing said projecting means for intercepting and vaporizing the oil discharged from said projecting means, and a plurality of sheet metal plates disposed in endwise spaced relation immediately in front of said vaporizing wall and slightly above the path of oil discharged from said projecting means for protecting said vaporizing wall from direct impact of a large portion of the air discharged from said projecting means and for directing the said portion of the air upwardly over said vaporizing wall and outwardly into the oil vapor passing from said vaporizing wall.

5. Oil burning apparatus comprising a combustion chamber having an upright wall, a hearth extending to the periphery of said chamber, oil and air projecting means above said hearth for discharging oil and air toward said upright wall, means adjacent said wall having an oil vaporizing wall inwardly of said upright wall and facing said projecting means for intercepting and vaporizing the oil discharged from said projecting means, a vertically arranged air baffle structure disposed slightly above the path of the oil discharged from said projecting means and immediately in front of said vaporizing wall in slightly spaced relation for protecting said vaporizing wall from direct impact of a large portion of the air discharged from said projecting means

and for directing the said portion of the air upwardly over said vaporizing wall and outwardly into the oil vapor passing from said vaporizing wall, and a second wall extending upwardly from said hearth and terminating slightly below the path of the oil discharged from said projecting means and being located slightly inwardly of said baffle structure.

6. Oil burning apparatus comprising a combustion chamber having an upright wall, a hearth extending to the periphery of said chamber, oil and air projecting means above and centrally of said hearth for discharging oil and air toward said upright wall, and a combustion promoting element adjacent said upright wall comprising a substantially endless refractory element adjacent said wall having an upright oil vaporizing surface and an oil groove at the base of said surface, and a plurality of sheet metal plate-like members, each having leg portions seating in the bottom of said oil groove and said members engaging the upper edge of said surface, the lower edge and said leg portions of each of said members defining an elongated opening for the direct passage therethrough to said vaporizing wall of the oil discharged from said projecting means, said members being in the path of a portion of the air discharged by said projecting means.

7. Oil burning apparatus comprising a combustion chamber having an upright wall, a hearth extending to the periphery of said chamber, oil and air projecting means above said hearth for discharging oil and air toward said upright wall, means adjacent said wall having an oil vaporizing wall inwardly of said upright wall and facing said projecting means for intercepting and vaporizing the oil discharged from said projecting means, a vertically arranged air baffle structure disposed slightly above the path of the oil discharged from said projecting means and immediately in front of said vaporizing wall in slightly spaced relation for protecting said vaporizing wall from direct impact of a large portion of the air discharged from said projecting means and for directing the said portion of the air upwardly and over said vaporizing wall, and a deflecting structure spaced above said baffle structure and vaporizing wall and extending inwardly beyond said baffle structure for positively deflecting the said portion of the air into mixing relation with the oil vapor passing from said vaporizing wall.

8. Oil burning apparatus comprising a combustion chamber having an upright wall, a hearth extending to the periphery of said chamber, oil and air projecting means above and centrally of said hearth for discharging oil and air toward said upright wall and a combustion promoting means comprising a substantially endless refractory element adjacent said wall and having an upright surface, a plurality of upright sheet metal plate-like members immediately in front of said upright surface and supported by said element, said plate-like members having the greater portion of their lower edges slightly above the path of the oil discharged from said projecting means for the passage of the oil therebelow into direct contact with said upright surface of said refractory element.

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