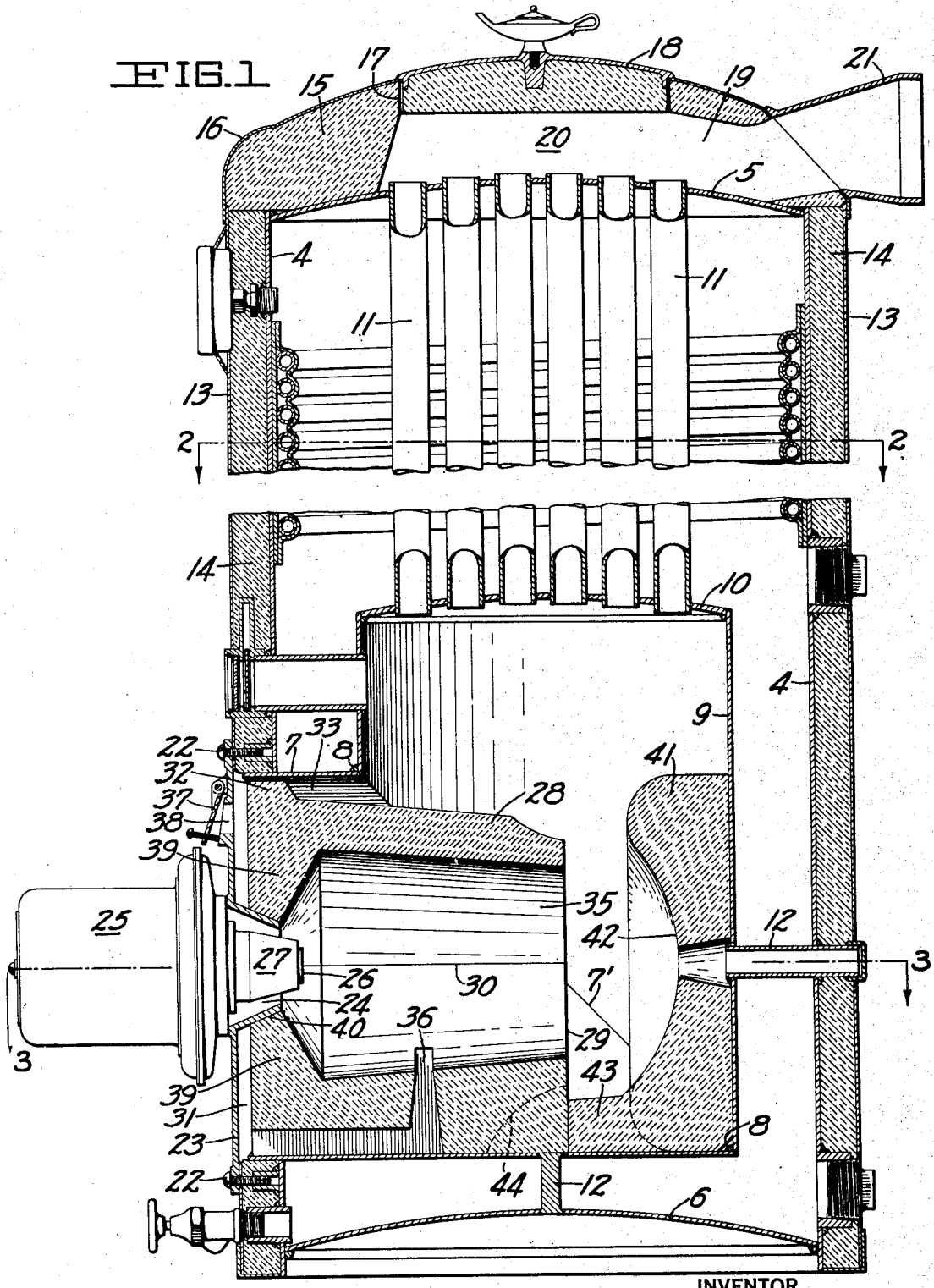
Oct. 19, 1937. J. C. JOHNSON 2,096,586

COMBUSTION CHAMBER FOR STEAM BOILERS

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FIG. 1



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FIG. 2

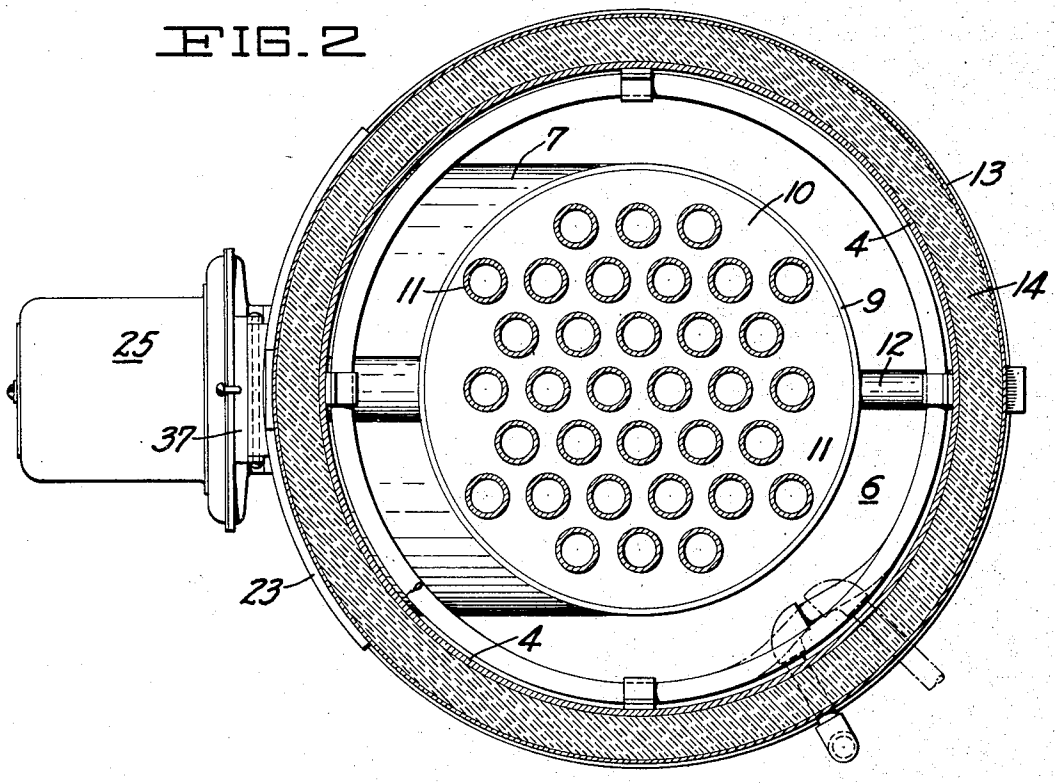
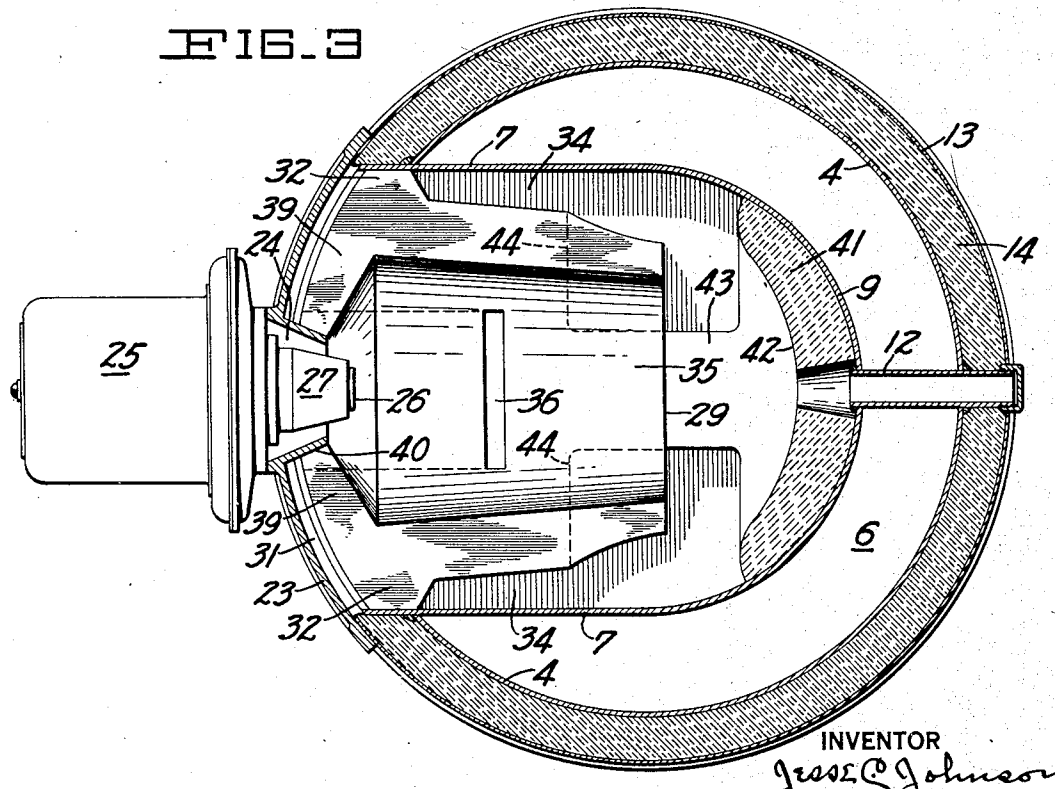


FIG. 3



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COMBUSTION CHAMBER FOR STEAM BOILERS

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Application July 8, 1935, Serial No. 30,263

3 Claims. (Cl. 110—86)

This invention relates to steam boilers and particularly to the construction of the fuel combustion chambers thereof.

It is an object of the invention to provide for concentration of the hot gases in the combustion chamber of a boiler so as to insure that combustion of the fuel is substantially complete before the gases contact the surfaces through which the heat is conveyed to the water in the boiler.

Another object of the invention is to provide for reflecting heat in the firebox of a boiler and focusing it at a point adjacent the burner so that unatomized particles of fuel discharged from the burner will be completely disintegrated and ignited.

A further object of the invention is to provide an improved firebox for boilers by means of which material economies in fuel consumption may be effected.

Still another object of the invention is to provide an improved firebox construction for boilers which, by means of heat reflection, assists the burner to operate on low gravity fuel.

The invention possesses other objects and features of advantage some of which together with the foregoing, will be pointed out in the detailed description of the invention following, however it is to be understood that the invention is not to be limited to the specific embodiment shown and described as various embodiments thereof may be employed within the scope of the appended claims.

Referring to the drawings:

Figure 1 is a vertical sectional view of a boiler incorporating the principles of the invention.

Figure 2 is a horizontal sectional view of the boiler. The plane of section, in which this view is taken is indicated by the line 2—2 of Figure 1.

Figure 3 is a horizontal sectional view of the boiler taken through the combustion chamber as indicated by the line 3—3 of Figure 1.

In detail, my invention is particularly adapted to the smaller boilers, of the type shown in Figure 1, which are employed in homes for the generation of steam, or hot water, for heating purposes, in which a cylindrical shell 4 is provided with an upper head 5 and a lower head 6 welded into the ends thereof.

A combustion chamber is provided, comprising a horizontally disposed tube 7 which is welded at one end into a large aperture formed adjacent the lower end of the shell 4, and which is mitered at its inner end and joined along the line 7' by welding 8, with a vertically disposed tube 9 positioned concentrically with, and within, the shell 4. A head 10 is welded into the upper end of the shell 9 in the same manner as the heads 5 and 6 are mounted, and both the heads 5 and 10 are provided with a plurality of spaced apertures in which are secured, by rolling or welding in the manner well-known in the boiler-making art, tubes 11. To provide for stabilization of the combustion chamber, studs 12 are provided securing the former to the shell 4.

Concentric with, and disposed about the shell 4, is a sheet metal jacket 13 which serves to maintain a layer of suitable heat insulation 14 against the shell, and a dome 15, of refractory material, which is covered by a sheet metal cap 16, is disposed on the upper head 5. The dome is provided with a central aperture 17, closed by a cover 18, through which inspection or cleaning of the tubes 11 may be accomplished, and a passage 19 connects the open space 20 above the upper ends of the tubes with a flue connector 21 through which the products of combustion may be led out of the building.

Secured to the shell 4, over the open end of the combustion chamber tube 7, by means of the screws 22, is a plate 23 having a central aperture 24 therein in which is mounted a burner 25. This burner is preferably of the rotary type, using crude oil as fuel, and having a suitable fuel atomizer 26 disposed within a tubular air nozzle 27, through which a continuous blast of air, from an impeller contained within the burner housing, is discharged so as to create a combustible mixture, with the particles of fuel discharged by the atomizer, and to convey the fuel particles into the combustion chamber.

Within the tube 7 of the combustion chamber is a fire-box, constructed of refractory material, and comprising an upper section 28 and a lower section 29 joined in a plane indicated by the line 30. Both of the fire-box sections terminate, at their outer ends, a short distance from the inner surface of the plate 23, so as to provide an air space 31, and, at their inner ends, substantially at the centerline of the vertical tubular portion 9 of the combustion chamber.

The upper section 28 is provided with a collar 32, substantially in contact with the bore of the tube 7, the rest of the section being of lesser radius and convergent axially so as to provide a space 33 between the surface of the section and the inner surface of the tube and the lower section is also narrowed, at its sides, so as to provide spaces 34 between it and the combustion chamber walls. This construction provides for the exposure of a large portion of the surfaces of the tubes

7 and 9 to the hot gases in the combustion chamber.

Both sections are provided with recessed centers which, together, provide a cylindrical fire-box 35 whose bore tapers slightly as it recedes from the burner nozzle; and the lower section is provided with an air passage 36 which joins the fire-box and the air space 31. An adjustable shutter 37 is provided, over an aperture 38 in the plate 23, so that air may be permitted to enter the fire-box, through the passages described, in regulated amounts. The outer end of each fire-box section is provided with abutments 39 which contact the rim 40 about the plate aperture 24 and isolate the fire-box from the air space 31.

Spaced from the open end of the fire-box is a reflector, also constructed of refractory material and comprising a body 41 provided with a concave surface 42 facing the burner and a foot 43 extending, for the purpose of stabilizing the body 41, along the bottom of the tube 7, and also in contact with the end of the lower fire-box section so as to maintain the body 41 firmly against the rear wall of the vertical tube 9. Portions of the lower section 29, as is indicated by the dotted lines 44 are cut away so, as was explained above, the hot gases are permitted to contact the lower inner surface of the tube 7.

Let us now consider the operation of the boiler particularly action which occurs in the combustion chamber thereof. In most boilers of this type it is necessary that the burner run for a considerable period of time before satisfactory combustion occurs, this being due, particularly if the fuel oil used is of low gravity, to the inability of the burner to thoroughly atomize the fuel, thereby resulting in a flame having considerably less than the maximum possible temperature, and to the fact that the flame is being projected into a cold combustion chamber in which there are no hot surfaces which will disintegrate the heavier fuel particles. The result therefore is that considerable incompletely consumed fuel will be exhausted through the flue during the time that it takes the combustion chamber to attain the temperature necessary to thoroughly vaporize the fuel and effect efficient combustion thereof. The amount of loss in fuel, under such conditions, is obvious.

In the boiler of my invention these objections have, to a great extent, been overcome. As soon as the burner 25 is lighted the flame cone projected thereby into the fire-box 35 will, due to the diminishing bore of the fire-box, be prevented from expanding and cooling and will be discharged from the end of the fire-box against the concave face 42 of the reflector.

While some of the gases will escape radially through the gap between the end of the fire-box and the face of the reflector and be carried through the flue, most of the heat will be reflected back into the fire-box where it will act to raise the flame temperature and cause vaporization of any heavy fuel particles which may be discharged by the burner. The result therefore is that the flame temperature in the fire-box is continually being supplemented by the heat reflected from the surface 42, thereby providing for more rapid and complete combustion of the fuel being discharged from the burner.

It is therefore obvious that by the use of the reflector action described above in the combustion chamber of a boiler, or other device requiring the use of a burner, the maximum B. t. u. output of such a device may be maintained using a minimum of fuel, and the fuel wastage incident to heating a cold boiler is reduced to an absolute minimum.

Another valuable feature of the construction lies in its simplicity and ease of replacement, the entire structure consisting of but three parts which are sturdily constructed and which, if they become fractured or partially consumed, may be replaced by removing the plate 23, inserting the new sections, and replacing the plate, no cementing in, or other means of attachment being necessary to hold the parts in place.

In conclusion, the combustion chamber construction described above has proven a distinct advance in the art, it being proven by comparative tests that the operating efficiency of a boiler so equipped far exceeds that of others of its type.

I claim:

1. In a boiler having a combustion chamber, a fire-box within said combustion chamber comprising a refractory member having a central tapered bore therein open at its smaller end, an end wall closing the large end of said bore and provided with an aperture therein through which a burner nozzle may project into said bore, and a block of refractory material spaced from said refractory member and overlying the open end of the bore thereof, said block having a concave surface facing the open end of said bore, and said concave surface having its center of curvature lying on the central axis of said bore.

2. In a boiler having a combustion chamber, a fire-box within said combustion chamber comprising a refractory member having a central tapered bore therein open at its smaller end, an end wall closing the large end of said bore and provided with an aperture therein through which a burner nozzle may project into said bore, and a block of refractory material spaced from said refractory member and overlying the open end of the bore thereof, said block having a concave surface facing the open end of said bore, and said concave surface having its center of curvature lying within said bore and on the central axis thereof.

3. In a boiler having a combustion chamber, a fire-box within said combustion chamber comprising a refractory member having a central tapered bore therein open at its smaller end and an opening intermediate the ends thereof through which a current of air may be admitted to said bore, an end wall closing the large end of said bore having an aperture therein through which a burner nozzle may project into said bore, and a block of refractory material overlying and spaced from, the open end of said refractory member, said block having a spherically concave surface thereon facing said open end of said member, said surface having its center of curvature lying within, and on the axis of, said bore adjacent said burner nozzle.

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