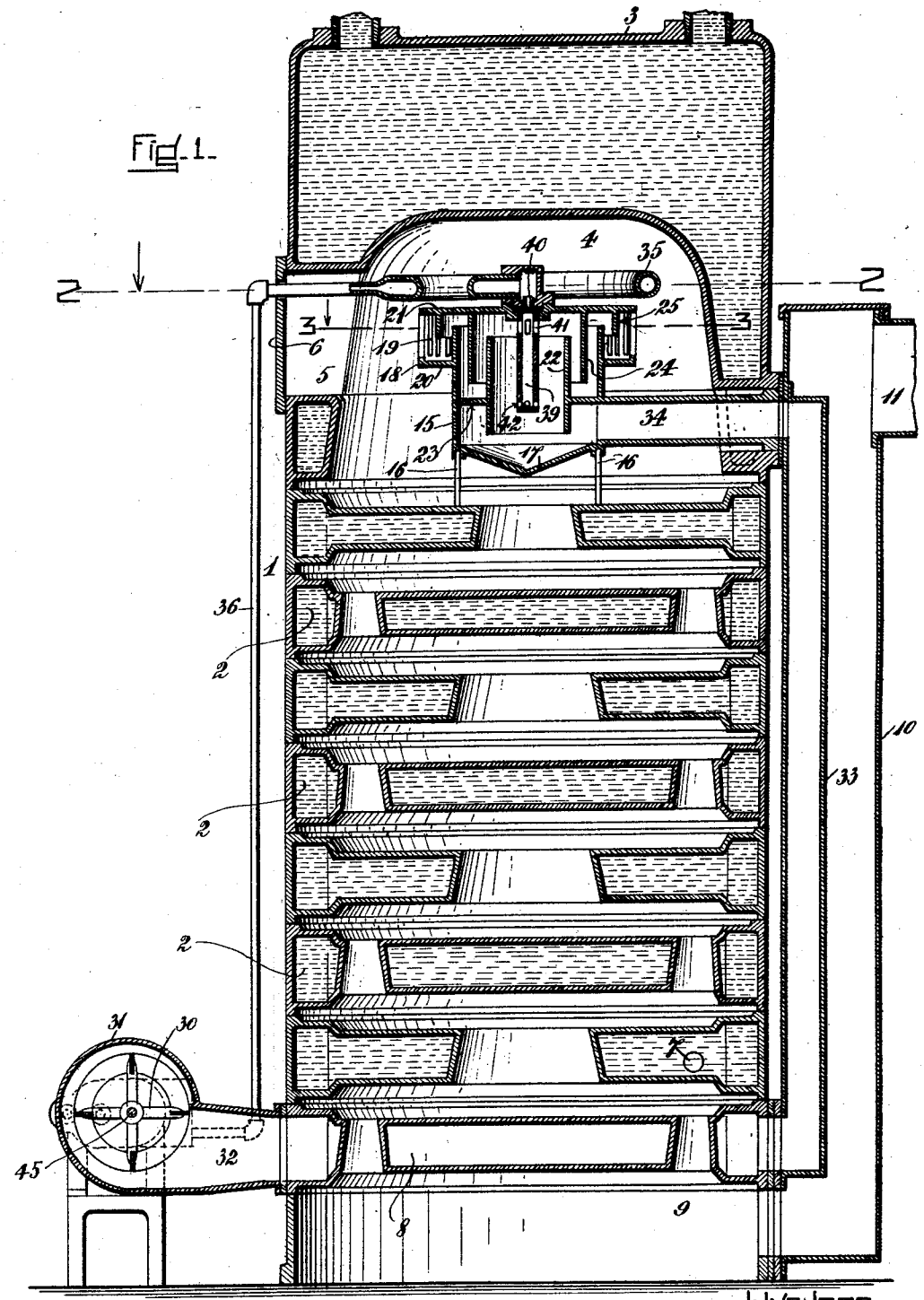
June 16, 1931. D. C. WOODWARD 1,809,920

OIL BURNER BOILER

Filed July 23, 1928 4 Sheets-Sheet 1

Fig. 1.



INVENTOR
Daniel C. Woodward
By John E. R. Mayo
ATTORNEY

June 16, 1931. D. C. WOODWARD 1,809,920

OIL BURNER BOILER

Filed July 23, 1928 4 Sheets-Sheet 2

Fig. 2.

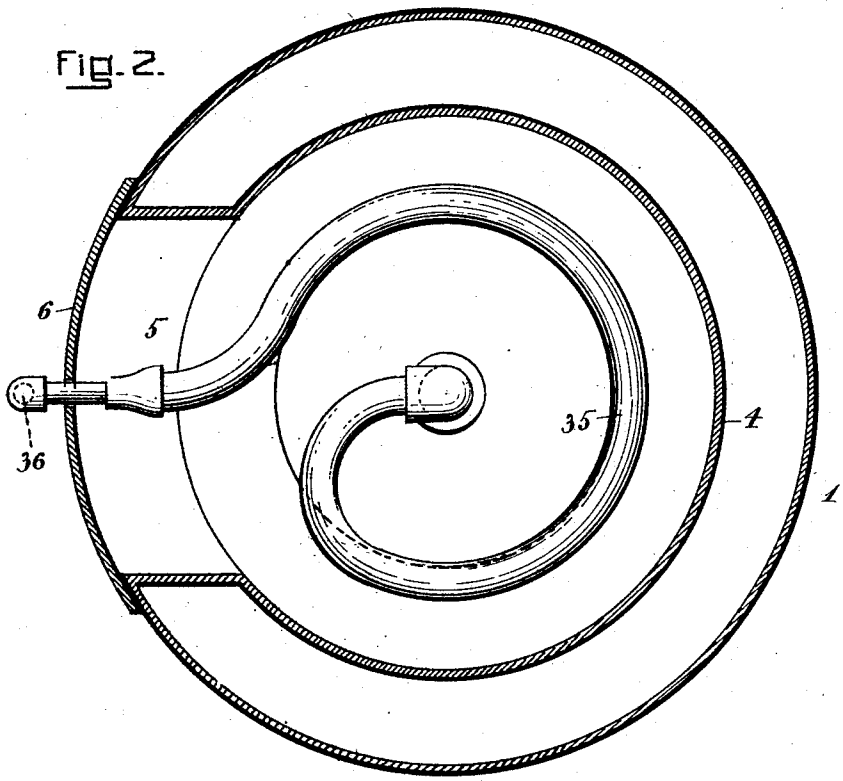
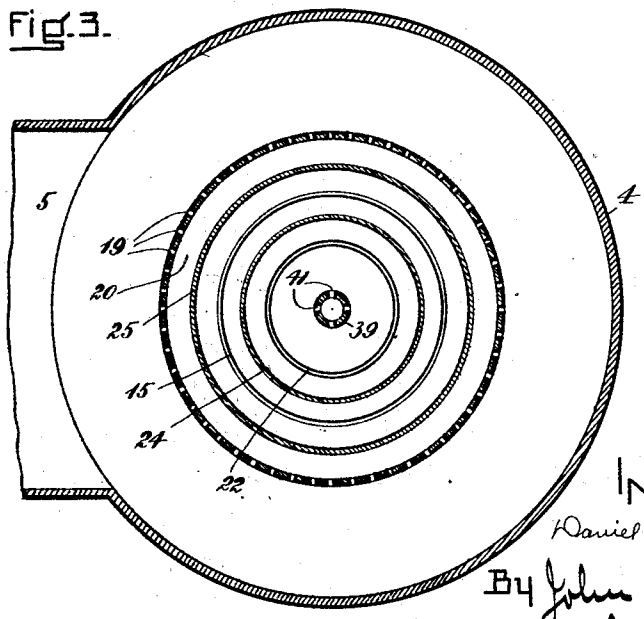


Fig. 3.



INVENTOR
Daniel C. Woodward
BY John E. R. Hayes
ATTORNEY

June 16, 1931. D. C. WOODWARD 1,809,920

OIL BURNER BOILER

Filed July 23, 1928 4 Sheets-Sheet 3

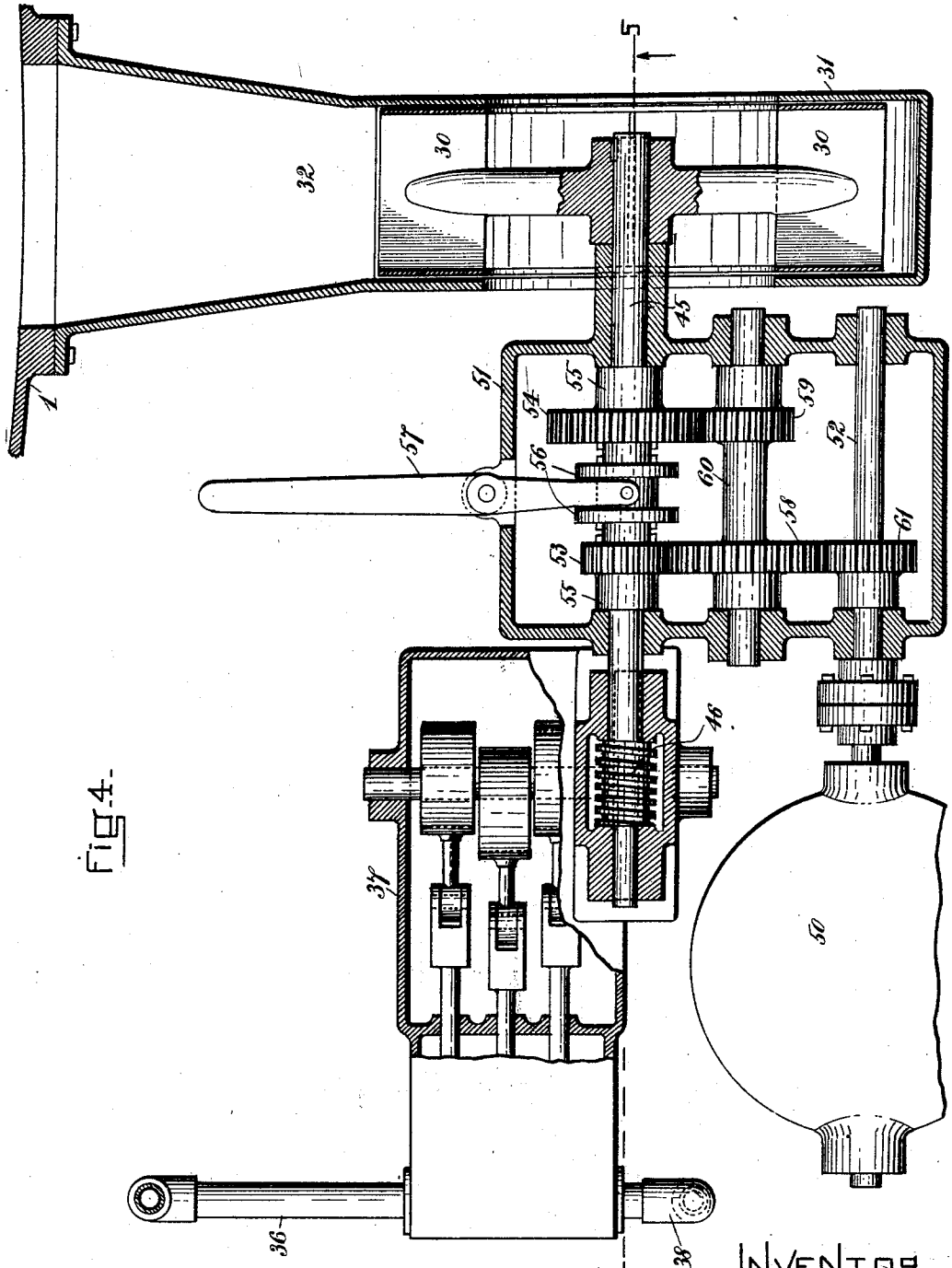


Fig. 4.

INVENTOR
Daniel C. Woodward
By John E. R. Hayes
ATTORNEY

June 16, 1931. D. C. WOODWARD 1,809,920

OIL BURNER BOILER

Filed July 23, 1928 4 Sheets-Sheet 4

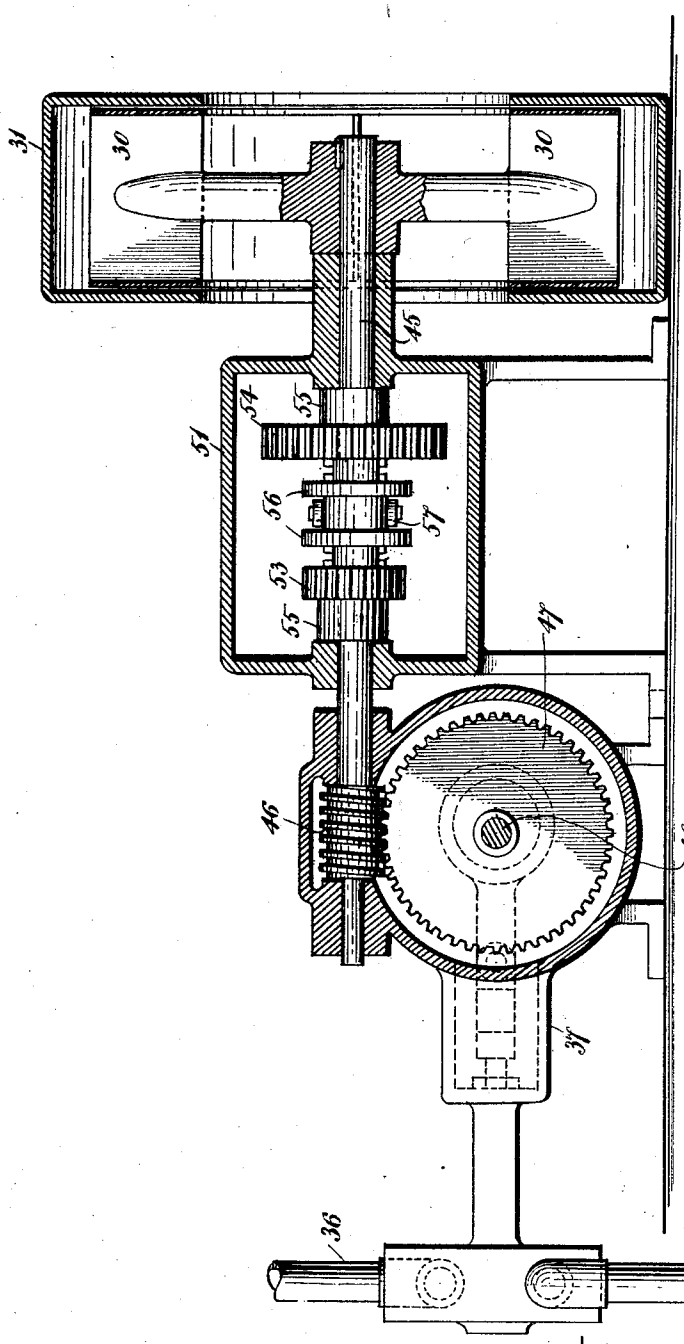


Fig. 5.

INVENTOR
Daniel C. Woodward
BY John E. R. Hayes
ATTORNEY

Patented June 16, 1931 1,809,920

UNITED STATES PATENT OFFICE

DANIEL C. WOODWARD, OF LOWELL, MASSACHUSETTS

OIL BURNER BOILER

Application filed July 23, 1928. Serial No. 294,679.

The invention relates to an improvement in oil burner boilers, and the object of the invention is to obtain as near a complete combustion of the fuel as possible and to utilize the heat resulting from the combustion to the best possible advantage.

The invention can best be seen and understood by reference to the drawings in which—

Figure 1 is a cross vertical section of the boiler.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is a plan of the combination oil and air discharge mechanism including an oil pump and a fan or blower, and

Fig. 5 is a section on the line 5—5 of Fig. 4.

Referring to the drawings:—

1 represents the boiler which is of the upright sectional type, 2 representing the respective water-containing sections having openings through them for the passage of the hot gases. The body of the boiler is surmounted with a water-containing head or dome 3. 4 is the combustion chamber which is located between the head or dome and the top section of the boiler, these parts forming practically a water jacket around the entire combustion chamber except for an opening 5 into the combustion chamber in the side of the boiler and which opening is normally closed by a door 6. The water-containing interiors of the dome and water sections are connected in any suitable manner. Water is introduced by way of an opening 7 into the bottom water section. Below its bottom water section the boiler is provided with an air section 8 with an opening through it for the passage of hot gases as through the water sections. Air is introduced to pass through this section to be heated by the hot gases and afterward passed to the burner as will presently be explained. Below its air section 8 the boiler is provided at its extreme bottom with a flue chamber 9. Having outlet connection with this chamber is a flue 10. This flue extends upward by the side of the boiler to a point substantially even with the combustion chamber and communicates with a smoke pipe 11 leading to the chimney.

The burner is preferably located in the combustion chamber resting on the topmost one of the water sections. 15 represents the upright tubular body of the burner provided with legs 16 by which it is supported to rest on the topmost one of the water sections as aforesaid. The body 15 is provided with a closed bottom plate 17 which forms the bottom of the burner. 18 represents the head of the burner made larger than the body and provided with a plurality of slits or openings 19 in the side thereof. The head is secured to the body by a bottom connecting plate 20. The head is provided also with a top plate 21 which forms the top of the burner. This plate 21 is spaced from the top edge of the body of the burner so as to leave a clearance over the top edge of the body leading to the slits 19 in the side of the head. Located within the body of the burner is a tubular fixture 22. The opposite ends of this fixture are both open and are spaced respectively from the top and bottom of the burner. The tubular fixture is carried by an annular rib-forming plate 23 interposed between it and the side of the burner body. This plate 23 closes the passage between the burner body and the side of the tubular fixture 22 so that all air introduced into the bottom of the burner below the tubular fixture will be directed to pass through this fixture. Carried by the top plate 21 of the burner are baffle plates of which 24 is one extending down into the space between the body of the burner and the tubular fixture within it above the connecting plate 23. Another baffle plate 25 extends down from the top plate 21 of the burner within the head thereof to lie between the top exterior side of the burner body and the side of the head well above the plate 20 which connects the head to the body. With the tubular fixture and baffle plates thus arranged inside the chamber of the burner body and head, which chamber forms a mixing chamber leading to the slits in the side of the head, all air introduced into the burner and passing through the tubular fixture will pass down beneath the baffle plate 24, thence upward over the top of

the burner body, forming a baffle plate, thence down around the baffle plate 25 and thence outward to and through the slits 19 in the side of the head. The arrangement is such that only highly heated air will be introduced into the burner to pass through the tubular fixture and by the baffles as aforesaid. The air is initially introduced by means of a fan blower 30 arranged in a fan case 31 which connects with the bottom air section 8 of the boiler through a connecting pipe or conduit 32. Air thus introduced will become heated by the hot gases passing around the air section 8 through which the air is directed to pass. After passing through the air section 8 the air is directed to pass through a pipe 33 connecting with the air section 8 of the boiler and extending up through the flue 10 so that air passing through the pipe 33 will be subjected to the heat from the hot flue gases in the flue 10. From the upper end of the flue the pipe 33 is continued by a pipe 34 which connects with the burner body in such place and manner as to direct the entering air into the bottom of the burner beneath its inside tubular fixture 22.

Reference will now be made to the manner in which gaseous fuel highly heated will be introduced to mix with the heated air passing through the burner and combining therewith to form a combustible mixture: Arranged above the burner and connected to the top plate thereof is a gasifier tube 35. Oil is introduced into this tube by a pipe 36 passing through the door of the combustion chamber. Flow of oil is induced by a pump 37 later to be referred to, and to which oil is led by way of a pipe 38. Connecting with the gasifier tube through the top plate 21 of the burner is a tube 39. The oil as a gas passes from the gasifier tube into the tube 39, entrance being had through a nozzle plug 40 arranged in the top end of the tube 39. The tube 39 has openings 41 in it at its top and also openings 42 at its bottom. As the gas is passing down through the tube 39 at high velocity some of the heated air passing through the burner will be drawn through the openings 41 into the tube to mingle with the gas. The mingled gas and air will escape from the tube 39 by way of the openings 42 at the bottom into the mixing chamber of the burner to there mingle with the air passing through it as previously explained, the baffle plates then operating to form a very intimate mixture between the air and gas before passage of the mixture through the slits in the burner head. The flame is formed by the ignition of the combustible mixture after passing through the slits in the burner head and the slits should be so small that the velocity of the mixture passing through them will prevent ignition thereof before the passage of the mixture out of the burner head. The gasifier tube 35 is preferably slightly larger diametrically than the burner head so that it will fit over and around the head and be in close proximity to the flame issuing from it.

As previously explained, air is supplied to the burner by a fan or blower 30 and oil by a pump 37. Both are of common form, the pump being preferably one of the three-piston plunger type. Both the fan and pump are so connected that when any increase or decrease in the speed of the driving mechanism occurs the amount of air and oil discharged to the burner will remain in correct proportion, maintaining the proper condition for complete combustion without excess air. To this end the fan and pump are operated by a driving shaft 45 common to both. The fan is mounted directly upon this shaft while the pump is driven by the shaft 45 through a worm and gear connection 46 and 47, respectively, the worm being fixed to the shaft 45 and the gear being fixed to a shaft 48 which operates the pump. The shaft 45 is driven by means of a motor 50. This motor may be a constant-speed motor or one of the variable or adjustable-speed type. In any event I prefer as shown that the motor drive the shaft 45 through a chain of gears capable of imparting different speeds to the shaft. The gears are arranged within a common gear box or casing 51 through which the shaft 45 extends and on the sides of which it is journaled to turn. 52 is the shaft driven by the motor which also extends through the gear box and is journaled to turn on the sides thereof. Upon the shaft 45 inside the gear box are gears 53 and 54, respectively. Each of these gears is borne by a sleeve 55 loose on the shaft 45. The gear 53 is a relatively small gear diametrically while the gear 54 is one of much larger diameter. Interposed between the gears 53 and 54 is a clutch-forming member 56 splined to the shaft 45 and making clutch forming engagement with either one or the other of the gears 53 or 54 as the clutch member is moved to the right or left along the shaft 45. The clutch member is thus moved by means of a hand lever 57 pivotally mounted on the casing. In engagement with the gears 53 and 54, respectively, are gears 58 and 59 both fixed to a common shaft 60 journaled to turn on the sides of the casing. The gear 58 is a gear of relatively large diameter and the gear 59 one of relatively small diameter. In engagement with the gear 58 is a relatively small gear 61 fixed to the motor shaft 52. With the differential gearing thus provided the motor operating at constant speed will impart a relatively rapid rotation to the shaft 45 when the movement of the clutch causes the gear 53 to be locked to this shaft. In such case both the fan and pump will be driven at a relatively high speed. Conversely the shaft 45 will be driven at a much slower speed and accordingly the fan and pump more slowly operated when

the clutch is moved to lock the gear 54 to the shaft 45. The arrangement is one of simple differential gearing and, as said before, it may be entirely eliminated and dependence placed only upon a variable-speed motor for operating the shaft 45 which drives the fan and pump.

In connection with the operation of the boiler it will be observed that both the oil and air are highly heated before they are brought together within the burner to form a combustible mixture. The oil is heated and gas formed by the passage of the oil through the gasifier tube 35 arranged within the combustion chamber in close proximity to the burner, while the air is heated by the passage thereof through the air section 8 of the boiler through which the flue gases are passed and also by passage through the pipe 33 arranged within the flue 10 through which the gases are directed to escape to the chimney. The arrangement is also such that proper proportions of air and gas will be directed to the burner at all times to form a proper combustible mixture, and the combined air and gas are intimately mixed within the burner before ignition. The combustion chamber containing the burner, located as it is between the top of the water jacket of the boiler and the air-containing drum or head, occupies an advantageous position in that the flame from the burner will be in practically intimate contact with a relatively large water-containing surface, the combustion chamber being, as said before, practically water-jacketed except at the point of its door or entrance. The flow of hot gases out of the combustion chamber will be downward through the water sections of the boiler and accordingly will be opposite the direction of flow of the water which is from the bottom of the boiler upward to the top. As the hot gases pass downward through the boiler the first contact will be with the top water jacket where the water is hottest, the gases then passing downward through the cooler sections gradually giving up its heat until it passes into the flue. In this manner the temperature of the flue gases can be reduced to a minimum and the efficiency of the unit carried to a maximum.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States:—

1. An oil burner boiler comprising a number of superposed water sections having openings through them for the passage of hot gases, a water-containing dome surmounting the upper one of the water sections and co-operating therewith to form a combustion chamber between them, a burner for heating the dome from within the combustion chamber, means for supplying fuel to the burner, means for supplying heated air to the burner to mingle with the fuel including an air section associated with the water sections with opening through it for the passage of hot gases and through which air section air supplied to the burner is passed, and a flue passage for the escape of the gases after passage downward through the water sections and air section from out of the combustion chamber.

2. An oil burner comprising a number of superposed water sections having openings through them for the passage of hot gases, a water-containing dome surmounting the upper one of the water sections and co-operating therewith to form a combustion chamber between them, a burner for heating the dome from within the combustion chamber, means for supplying fuel to the burner, means for supplying heated air to the burner to mingle with the fuel including an air section associated with the water sections with opening through it for the passage of hot gases, and including also a pipe leading from the air section and connecting with the burner and through which air section and pipe air supplied to the burner is passed, and a flue passage for the escape of gases after passage downward and through the water sections and air section from out of the combustion chamber, said passage extending in part upward by the side of the boiler and containing the pipe delivering air to the burner as aforesaid.

3. An oil burner boiler comprising a number of superposed water sections having openings through them for the passage of hot gases, a water-containing dome surmounting the upper one of the water sections and co-operating therewith to form a combustion chamber between them, an air section associated with the water sections with opening through it for the passage of hot gases, a flue passage for the escape of the gases after passage downward through the water sections and air section from out of the combustion chamber, a burner for heating the dome from within the combustion chamber, a gasifier associated with the burner inside the combustion chamber for supplying a hot gaseous fuel to the burner, means for supplying oil to the gasifier, and means for passing air through said air section to be heated thereby and thence passed to the burner to mingle with the hot gaseous fuel supplied by the gasifier.

4. An oil burner boiler comprising a number of superposed water sections having openings through them for the passage of hot gases, a water-containing dome surmounting the upper one of the water sections and co-operating therewith to form a combustion chamber between them, a flue passage for the escape of gases after passage downward through the water sections from out of the combustion chamber, a burner for heating the dome from within the combustion chamber comprising a burner body having a bottom closure, a burner head surmounting

the body having a top closure spaced from the top edge of said body and a bottom making closure with the sides of said body, said head having, also, openings in its sides, a central fixture inside the body of the burner open at its opposite ends and which ends are spaced respectively from the bottom closure of said body and top closure of said head, means interposed between said body and central fixture for closing the space between them whereby air introduced into the chamber of said body below said central fixture will pass through said fixture, means whereby heated air may be supplied to the chamber of the burner to pass through said central fixture as aforesaid, a gasifier associated with the burner and heated thereby, a tube extending from the gasifier into said central fixture and provided with openings at its opposite ends, a nozzle plug separating the interior of the gasifier from that of said tube, and means whereby oil may be supplied to the gasifier.

5. An oil burner boiler comprising a number of water sections having openings through which hot gases of combustion may be directed to pass downward through said sections, a water containing dome surmounting the upper one of said water sections and cooperating therewith to form a combustion chamber within the dome opening onto said top one of the water sections whereby hot gases within said chamber will contact with the interior wall of the dome and pass out of said chamber downward through the water sections, said water sections and dome being interconnected whereby water admitted at the bottom of said water sections will pass upward therethrough and into the dome, a burner arranged whereby heat from the burner will be directed against the wall of said dome from within the combustion chamber and the hot gases escape from the combustion chamber to pass downward through the water sections as aforesaid, a flue for the escape of gases after passage through the water sections, and means for supplying a combustible mixture to the burner.

6. An oil burner boiler comprising a number of water sections provided with openings through which hot gases of combustion may be directed to pass downward through said sections, a water containing dome surmounting said water sections and formed to provide a combustion chamber within it opening onto the top one of said water sections whereby hot gases within said chamber will contact with the interior wall of the dome and pass out of said chamber downward through the water sections, said water sections and dome being interconnected whereby water admitted at the bottom of said water sections will pass upward through and into the dome, a burner arranged whereby heat from the burner will be directed against the wall of said dome from within the combustion chamber and the hot gases escape from the combustion chamber to pass downward through the water sections as aforesaid, a flue passage for the escape of gases after a passage through the water sections, and means for supplying a combustible mixture to the burner.

DANIEL C. WOODWARD.