

June 5, 1951

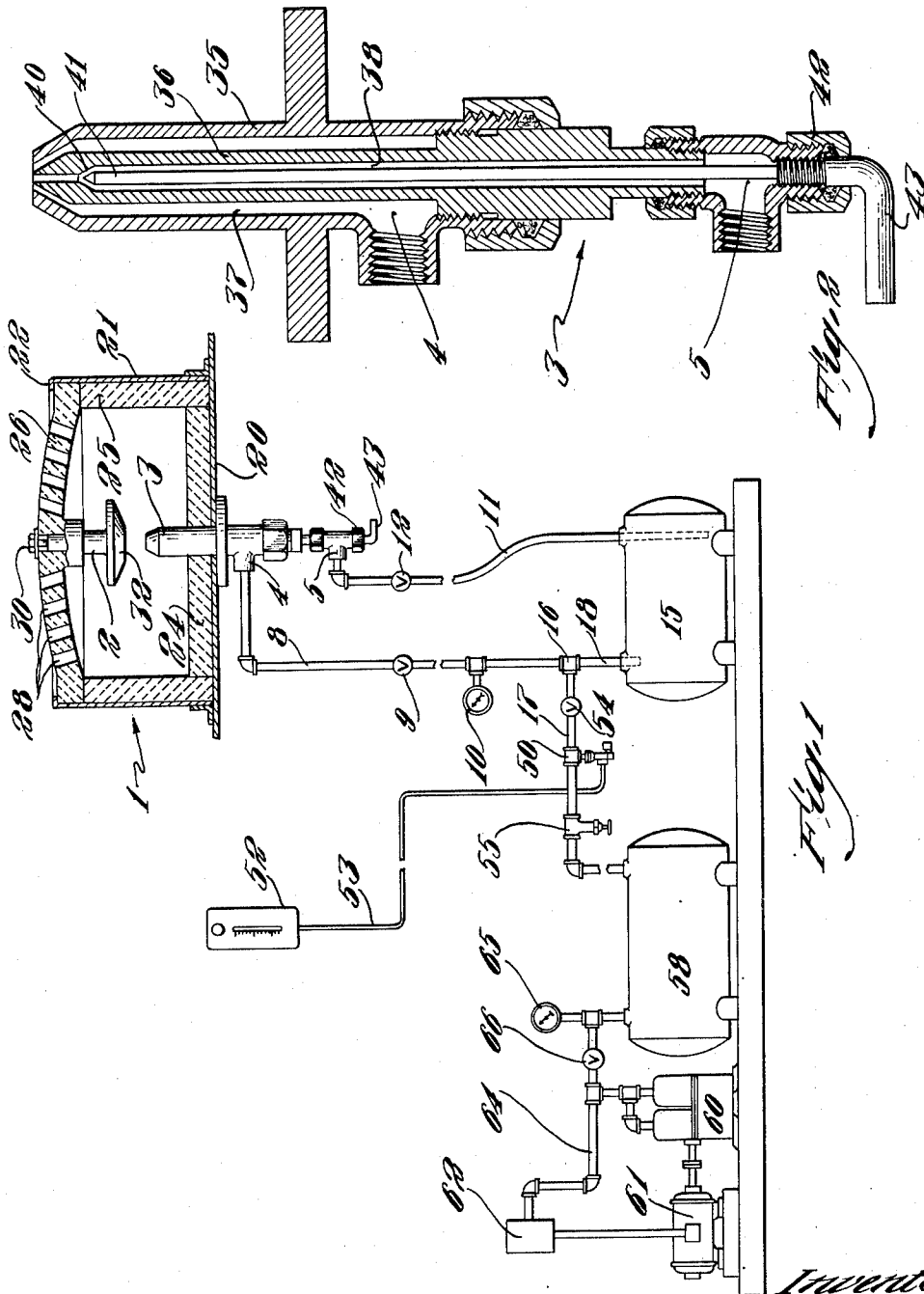
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CONTINUOUSLY FIRED OIL BURNING SYSTEM

Filed Oct. 3, 1946

2 Sheets-Sheet 1



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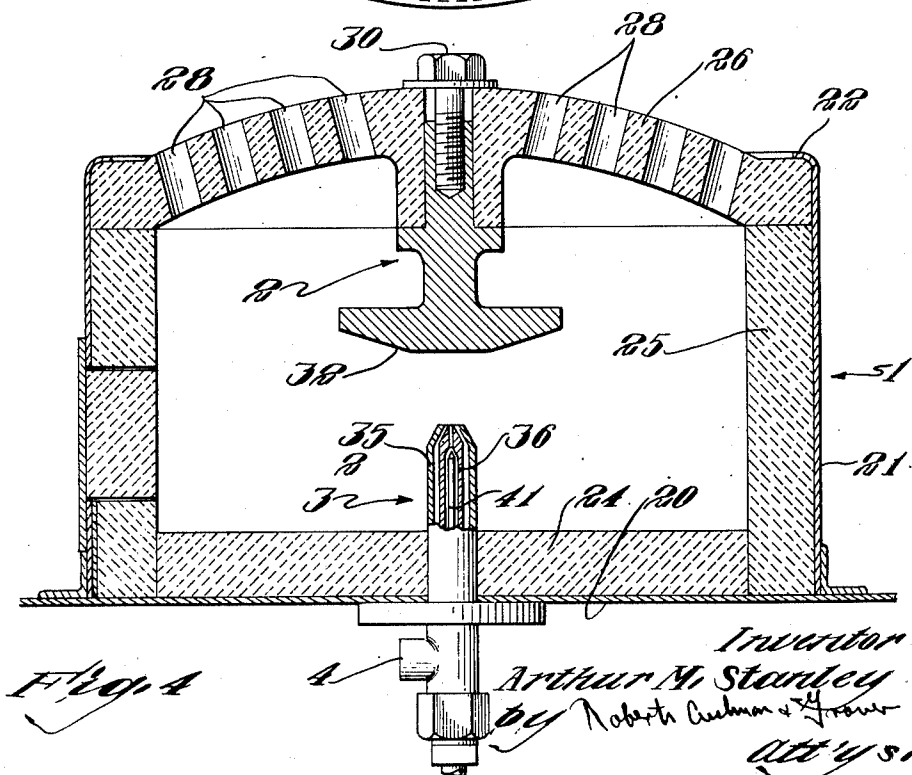
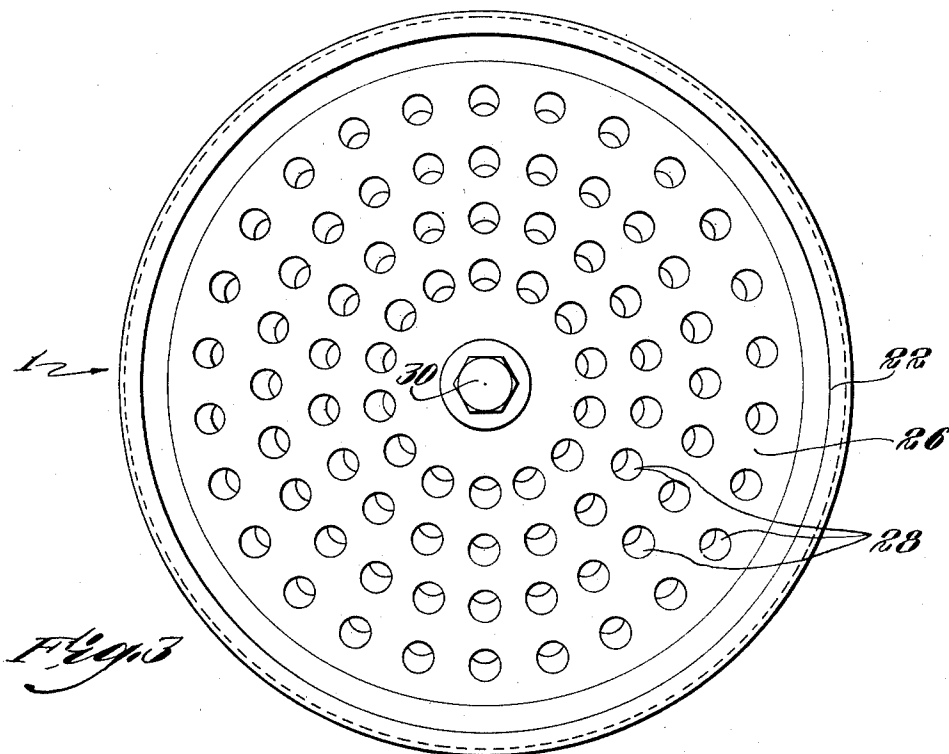
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UNITED STATES PATENT OFFICE

2,556,047

CONTINUOUSLY FIRED OIL-BURNING
SYSTEM

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Application October 3, 1946, Serial No. 700,905

6 Claims. (Cl. 158—4)

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This invention relates to an oil-burning system and its principal objects are to provide a simple, efficient and reliable burner which is capable, not only of operating on various types of fuel oil, but also of effecting substantially complete combustion of the fuel oil; to provide an apparatus which is subject either to thermostatic or to manual control so as to vary the rate of combustion of the fuel oil in accordance with the demand, thereby providing a balanced combustion functioning in accordance with the requirements, as distinguished from the "off and on" operation of conventional apparatus such as the gun-type burner; and to provide an apparatus which may be economically constructed and readily installed in conventional boilers or furnaces without necessitating an expensive modification or reconstruction.

Further objects relate to various features of construction and will be apparent from a consideration of the following description and the accompanying drawings, where:

Fig. 1 is an elevation of an oil-burning apparatus constructed in accordance with the present invention;

Fig. 2 is an enlarged longitudinal section of the burner nozzle;

Fig. 3 is a top plan view of the combustion chamber; and

Fig. 4 is an enlarged section through the combustion chamber.

The apparatus herein shown for the purpose of illustration comprises a combustion chamber 1 having a depending baffle 2 and a nozzle 3 having fuel-oil and air-supply passages 4 and 5, respectively. The air-supply passage is connected with a line 8 which includes a shut-off valve 9 and a pressure gauge 10, and the oil-supply passage is connected with a line 11 which includes a shut-off valve 12. The line 11 is connected with an oil tank 15 which is installed at a level below that of the nozzle 3, so that the oil cannot flow by gravity, thus eliminating a syphon action and the danger of picking up sediment. The air-supply 8 is connected with a T 16, one branch 17 of which is connected to a suitable source of air supply, hereinafter more fully described, and the other branch 18 being connected to the oil tank 15 so that the oil and air supply are always under the same pressure. If desired, the tank 15 may be connected with an oil reservoir and a float valve or other suitable means (not shown) may be provided for maintaining a predetermined oil level within the tank.

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The combustion chamber 1 is of generally cylindrical shape designed to be installed at the grate level of a boiler or furnace and comprises a base plate 20 on which is mounted a cylindrical metal casing 21, the upper end of which is turned inwardly to provide a retaining flange 22. The base plate 20 supports the bottom and side walls or liner members 24 and 25 which are of porous ceramic material, such as fire clay. The said wall 25 is provided with a circular access door (Fig. 4) which may be used for the initial ignition of the fuel mixture in installations which do not embody an automatic ignition system. The top wall 26 of the combustion chamber is also of porous ceramic material and is supported on the top of the liner 25, being held in place by the flange 22. The top wall 26 is formed with a moderate convexity and is provided with a plurality of circumferentially and radially spaced openings 28 which may be of the order of $\frac{1}{2}$ inch in diameter and through which the hot combustion gases escape from the chamber.

The baffle member 2 is of non-porous fire-resisting material, such as a 3% nickel-alloy, and is formed with a stem which projects through a central opening in the top wall 26, being held in place by a bolt 30, as shown in Fig. 4. The lower end of the baffle is formed with a downwardly facing, generally convex surface 32, as shown in Fig. 4, and is spaced above the upper end of the nozzle 3 a distance of the order of 1 inch, i. e., from about $\frac{3}{4}$ inch to $1\frac{1}{4}$ inch, a $\frac{1}{16}$ inch setting for the particular burner herein shown having been determined to be the optimum for the burner herein shown. This spacing has been found to be critical in that a spacing greater or less than the above specific range does not permit as efficient or satisfactory combustion.

The nozzle 3 extends through an opening in the bottom wall 24 and, as shown in Fig. 2, the nozzle comprises two coaxial tubes 35 and 36 which define an outer air duct 37 and an inner oil duct 38, respectively connected with the air and oil passages 4 and 5. The inner end of the tube 36 is formed with a valve seat 40 against which a needle valve member 41 operates so as to control the flow of oil. The lower end of the valve member 41 extends through a packing gland 42 and is connected with an operating handle 43 by means of which a fine adjustment of the valve member may be made. The inner ends of the tubes 35 and 36 are of frusto-conical shape so as to provide discharge openings capable of creating relatively high velocity jets which are directed against the surface 32 of the baffle.

Due to the convexity of the surface 32, the oil jet is deflected outwardly so that the heavier hydrocarbon constituents of the fuel oil strike and are absorbed by the porous walls of the combustion chamber and are thus broken up into fine particles, which are forced back into the chamber by expansion in which condition they readily undergo complete combustion. The lighter hydrocarbon constituents of the fuel oil are vaporized either before striking the baffle or after they are deflected therefrom and hence undergo complete combustion, it being understood that the flow of air through line 8 is so adjusted as to be capable of insuring an air supply sufficient to support complete combustion of the fuel oil.

The needle valve 41 is set to effect the most efficient combustion for the particular fuel oil being used and for a given setting of the valve 41 the amount of fuel oil consumed or fed to the combustion chamber is governed by the air pressure in line 17 which, in turn, is subject to a thermostatically-operated control valve 50, such as a Regatherm pressure regulating valve, connected in line 17 and operated by a thermostat connected thereto by a small tube 53. The thermostat 52 is installed at a suitable location remote from the control valve 50, as indicated in Fig. 1, and a hand-operated valve 54 is also connected in the line 17 between the pressure control valve 50 and the T 16 so that both the air and oil-supply system may be cut off when desired.

The line 17 is connected to one port of a manually operated pressure reducing valve 55 and the other port is connected with the pressure tank 53 capable of holding an air supply under a pressure of 60 to 75 pounds gauge. The tank 58 is connected with a compressor unit comprising an air compressor 60 driven by a motor 61, the operation of which is controlled by a pressure actuated switch mechanism 62 associated with a line 64 connecting the compressor and tank. A pressure gauge 65 and hand-operated valve 66 are also connected in the system, as shown, and all parts may be of standard equipment.

Under normal operating conditions the pressure-actuated switch 62 is operative to maintain an air pressure of from 30 to 60 pounds gauge within the tank 58 and the pressure reducing valve 55 is set to step down the pressure to about 8 to 10 pounds gauge. The thermostatically operated pressure reducing valve 50 is effective to vary the pressure in the line 17 from a minimum of about one half pound gauge to a maximum of about 8 pounds gauge, and thus not only controls the pressure exerted on the oil in the tank 15 which, in turn, controls the amount of oil fed to the burner, but also controls the amount of air supplied to the burner. Hence, by properly setting the needle valve 41 and adjusting the valve 9 in air line 8, for any pressure in the line 17 the correct proportion of air and oil discharged through the nozzle 3 may be obtained.

Assuming that the burner is installed in a boiler of a heating system, when there is little or no demand on the heating system the thermostat 52 acts on valve 50 so as to effect a reduction in air pressure in the line 17 to the lowest point necessary to maintain the burner in operation; when the demand on the heating system is greatest, the thermostat operates to raise pressure in line 17 so as to effect maximum delivery of oil and air to the burner; and demands

on the heating system intermediate these extremes are similarly satisfied. Thus, the burner gives a balanced fire, constantly functioning according to the demands or requirements of the system, rather than the "off and on" operation of the conventional gun-type burners. In shutting off the burner, the valve 12 is first closed and the valve 9 is permitted to remain open for a minute or two so as to insure complete combustion of the heavier hydrocarbons absorbed by the chamber walls, after which valve 9 may be closed.

A further feature of the invention involves safety of operation and it will be noted that with the design herein shown no oil can flow without pressure and, as the only oil under pressure is contained within the tank 15 and as the pressure of the oil in the tank 15 is the same as that in the air-supply line, there can be no flow of oil into the burner without the corresponding amount of air to support complete combustion. Moreover, since the oil forced from the tank 15 is delivered to the burner, together with the proper amount of air, when once ignited the combustion chamber is always hot enough to insure ignition of the oil. In case of a failure of the electric current, there is sufficient storage capacity of both air and oil to keep the burner in operation for several hours, thus preventing a complete shut-down during the period in which repairs are being made.

While I have shown and described one desirable embodiment of the invention, it is to be understood that this disclosure is for the purpose of illustration and that various changes and modifications may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. A continuously fired oil-burning system comprising a combustion chamber having interior walls of porous ceramic material, at least one of the walls being formed with a plurality of perforations through which combustion gases pass, a generally convex baffle member of relatively non-porous, heat-resisting material, an oil and air-supply nozzle projecting into said chamber, in the direction of said baffle, with its delivery end terminating a distance of the order of one inch from said baffle so as to discharge a jet of mixed air and fuel directly against said baffle which deflects it outwardly against the interior walls of the combustion chamber, means for supplying oil and air under pressure to said nozzle, and means for varying said pressure in accordance with the demand on the system.

2. A continuously fired oil-burning system comprising a combustion chamber having interior side and top walls of porous ceramic material, the top wall being formed with a plurality of perforations through which combustion gases pass, a downwardly facing generally convex baffle member of relatively non-porous, heat-resisting material depending from the top wall of said chamber, an oil and air-supply nozzle projecting upwardly into said chamber with its delivery end terminating a distance of the order of one inch immediately below said baffle so as to discharge a jet of mixed air and fuel directly against said baffle which deflects it outwardly against the side wall of the combustion chamber, means for supplying oil and air under pressure to said nozzle, and means for vary-

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ing said pressure in accordance with the demand on the system.

3. A continuously fired oil-burning system comprising a combustion chamber having interior walls of porous ceramic material, at least one of the walls being formed with a plurality of perforations through which combustion gases pass, a generally convex baffle member of relatively non-porous, heat-resisting material, a nozzle having an oil passage and an air-supply passage, said nozzle extending into said chamber with its delivery end terminating a distance of the order of one inch from said baffle and arranged so as to discharge a jet of mixed air and fuel directly against said baffle which deflects it outwardly against the interior walls of said combustion chamber, an oil-supply tank disposed below the level of said nozzle, a fuel line leading from said tank to said oil passage, an air-supply line having one branch connected with said tank and another branch connected with said air-supply passage, and means connected in said air-supply line for varying the pressure of air in said tank in accordance with the demand on said system.

4. A continuously fired oil-burning system comprising a combustion chamber having interior walls of porous ceramic material, at least one of the walls being formed with a plurality of perforations through which combustion gases pass, a generally convex baffle member of relatively non-porous, heat-resisting material, a nozzle having an oil passage and an air-supply passage, said nozzle extending into said chamber with its delivery end terminating a distance of the order of one inch from said baffle and arranged so as to discharge a jet of mixed air and fuel directly against said baffle which deflects it outwardly against the interior walls of said combustion chamber, an oil-supply tank disposed below the level of said nozzle, a fuel line leading from said tank to said oil passage, an air-supply line having one branch connected with said tank and another branch connected with said air-supply passage, valve means in said nozzle for controlling the delivery of fuel therethrough, and valve means in said air-supply line for varying the pressure of air in said tank in accordance with the demand on said system.

5. A continuously fired oil-burning system comprising a combustion chamber having interior walls of porous ceramic material, at least one of the walls being formed with a plurality of perforations through which combustion gases pass, a generally convex baffle member of relatively non-porous heat-resisting material, a nozzle having an oil passage and an air-supply passage, said nozzle extending into said chamber with its delivery end terminating a distance of the order of one inch from said baffle and arranged so as to

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discharge a jet of mixed air and fuel directly against said baffle which deflects it outwardly against the interior walls of said combustion chamber, an oil-supply tank disposed below the level of said nozzle, a fuel line leading from said tank to said oil passage, an air-supply line having one branch connected with said tank and another branch connected with said air-supply passage, and thermostatically operated valve means for governing the air pressure in said air-supply line.

6. A continuously fired oil-burning system comprising a combustion chamber having interior walls of porous ceramic material, at least one of the walls being formed with a plurality of perforations through which combustion gases pass, a generally convex baffle member of relatively non-porous, heat-resisting material, a nozzle having an oil passage and an air-supply passage, said nozzle extending into said chamber with its delivery end terminating a distance of the order of one inch from said baffle and arranged so as to discharge a jet of mixed air and fuel directly against said baffle which deflects it outwardly against the interior walls of said combustion chamber, an oil-supply tank disposed below the level of said nozzle, a fuel line leading from said tank to said oil passage, an air-supply line having one branch connected with said tank and another branch connected with said air-supply passage, valve means in said nozzle for controlling the delivery of fuel therethrough, valve means in said air-supply line for governing the discharge of air through said air-supply passage, and thermostatically operated means for governing the air pressure in said air-supply line and tank.

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