

Nov. 28, 1933.

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1,936,623

APPARATUS FOR HEATING

Filed June 29, 1932

Fig. 2.

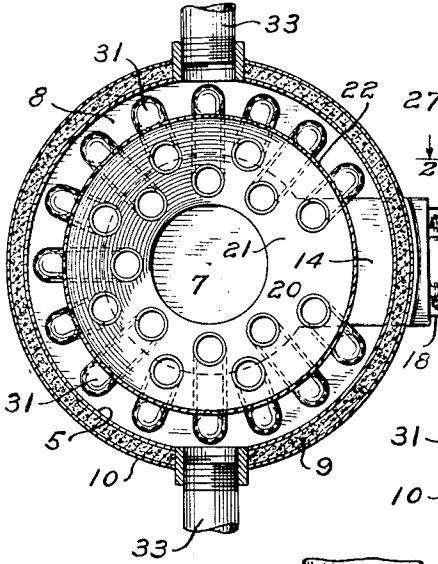


Fig. 1.

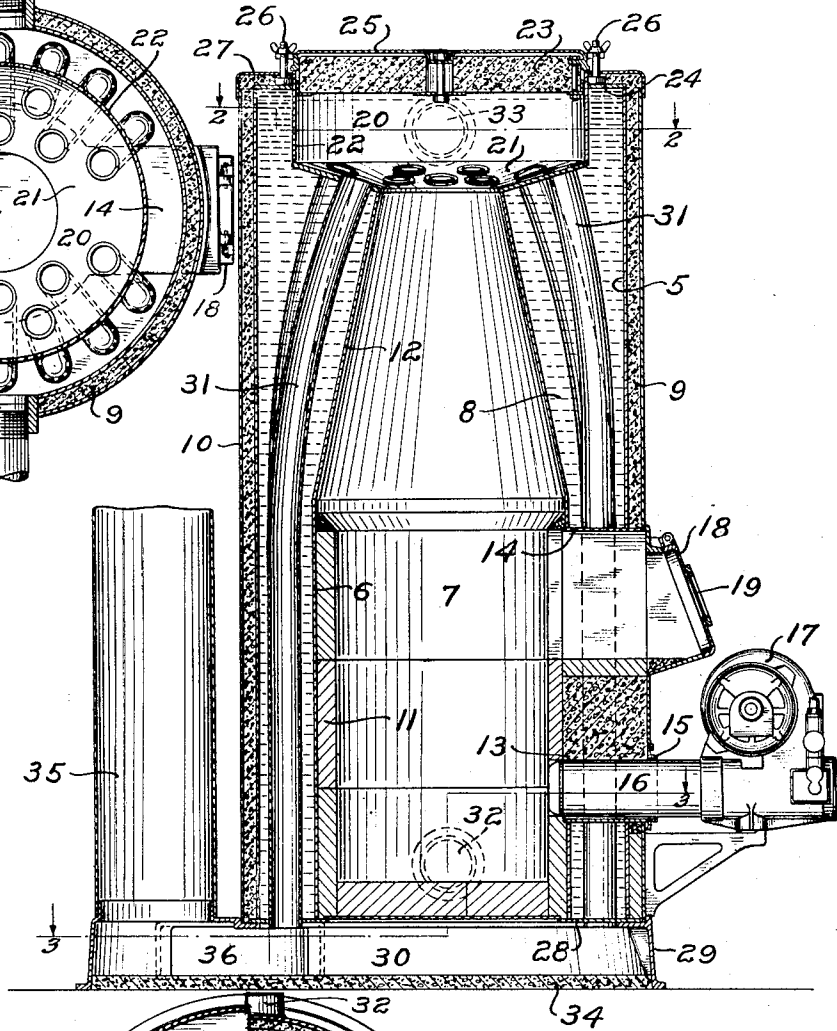
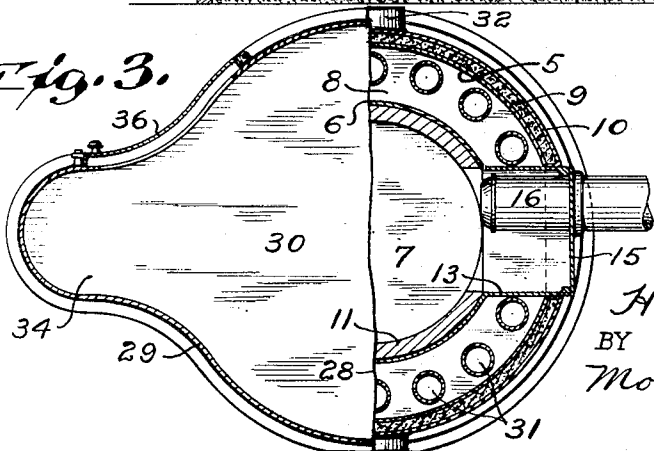


Fig. 3.



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UNITED STATES PATENT OFFICE

1,936,623

APPARATUS FOR HEATING

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Application June 29, 1932. Serial No. 619,885

7 Claims. (Cl. 122—182)

The present invention relates in general to improvements in the art of transferring heat, and relates more specifically to an improved apparatus for heating one fluid with the aid of another.

Generally stated, an object of the invention is to provide an improved apparatus for transferring heat from one fluid to another.

Some of the more specific objects of the present invention are as follows:

To provide an improved structure for transferring heat from hot gases to a heat absorbing medium such as water or air, with minimum loss of available heat.

To provide a simple, compact and highly efficient heater for transferring heat from hot gases to a flowing heat absorbing medium such as water or air.

To provide a new and useful heating device for household or other service, which may be utilized either for space heating with the aid of steam, hot water or hot air, or for the purpose of merely producing hot fluid for divers uses such as washing, bathing, and so forth.

To provide a compact heating unit which may be readily constructed and operated, and all portions of which are conveniently accessible for inspection, cleaning and repairs.

To provide heating apparatus which is durable in structure, and which operates upon theoretical principles assuring maximum efficiency and economy.

To provide a flexible heating unit especially operable in conjunction with an oil or gas burner, and which presents an attractive appearance making it an asset to any building or home.

To provide a simple hot water heater especially adapted for industrial and domestic uses, which may be manufactured and operated at minimum cost.

To provide an improved boiler wherein the heat transfer surfaces are positioned so as to insure most efficient transfer of heat units while retaining maximum durability of the structure, and in which the heating gases are utilized to the utmost extent without interfering with the draft.

To provide a self-cleaning boiler structure wherein the heat transfer surfaces are constantly scoured by the action of the hot gases, and in which removed sediment drops free of the heat transfer surfaces.

To provide a relatively small and compact furnace or boiler having relatively large capacity as compared to similar devices now on the market.

These and other objects and advantages will be apparent from the following detailed description.

A clear conception of one embodiment of the invention and of the mode of constructing and of operating a hot water heater built in accordance with the improvement, may be had by referring to the drawing accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the various views:

Fig. 1 is a central vertical section through a hot water heater or boiler which is fired with the aid of an oil burner;

Fig. 2 is a transverse horizontal section through the heater of Fig. 1, taken on the line 2—2 of Fig. 1 and looking down; and

Fig. 3 is a transverse horizontal section through the same heater, taken on the irregular line 3—3 of Fig. 1 and looking down.

The improved heating unit shown in the drawing by way of illustration, comprises in general an outer cylindrical casing 5 and an inner circular casing 6 cooperating with the outer casing to form a central combustion chamber 7 surrounded by an annular fluid confining jacket or chamber 8. The outer casing 5 may be formed of heavy steel plate, and is completely surrounded by a layer 9 of heat insulating material which is in turn surrounded by an outer covering 10 formed of relatively thin plate painted or enameled any desired color. The lower cylindrical portion of the inner casing 6 may also be formed of heavy plate metal and is lined at the sides and bottom with refractory material 11 such as fire brick. The upper dome portion 12 of the inner casing 6 is likewise formed of heavy material and is frustro-conical in shape, converging toward the top and being directly exposed to the chamber 8.

The casings 5, 6 are connected by a conduit 13 located near the lower ends thereof, and by an inspection duct 14 located above the conduit. The conduit 13 is provided with a closure 15 having an offset opening adapted for the reception of the nozzle 16 of an oil burner 17 or the like, so that the fuel and air delivered by the nozzle into the combustion chamber 8 enters tangentially and thereby produces a whirling vortex of the burning mixture and of the resultant gases of combustion as they rise upwardly through the tapered casing portion 12. The conduit 13 is of sufficient width to permit disposition of the nozzle 16 therein tangentially of the combustion chamber 7, and the portion of the conduit interior which is not occupied by the nozzle is normally

filled with refractory material. The inspection and clean-out duct 14 may be provided with a door 18 having a peep-hole 19 covered with heat resistant transparent material which will permit observation of the chamber 7 at all times.

The upper constricted delivery opening of the dome portion 12 communicates with a flow reversing chamber 20 formed by a downwardly tapered upper tube sheet 21, an auxiliary cylindrical inner casing 22, and a removable top cover 23, the two former of which are likewise exposed directly to the chamber 8. The lower inner edge of the tube sheet 21 is secured as by welding, directly to the upper edge of the dome portion 12 at the constricted central opening, and the upper outer edge of the tube sheet 21 is attached directly to the lower end of the casing 22. The upper end of the auxiliary casing 22 is connected to the upper end of the outer casing 5 by an annular plate 24, and the sheet 21, casing 22 and plate 24 are again preferably formed of relatively heavy sheet material. The removable top cover 23 may be formed of a slab of heat resistant insulating material confined within an outer metal retainer 25, and the cover 23 is detachably secured to the upper end of the heater by means of bolts 26 coating with an annular inspection cover 27 which is secured to the heater covering 10. Upon removal of the top cover 23, free access is had to all portions of the chamber 20, without necessity of removing the cover 27.

The lower ends of the casings 5, 6 are connected by a lower tube sheet 28 formed of heavy steel plate, which rests directly upon a base 29 having a gas collecting chamber 30 therein. The upper and lower tube sheets 21, 29 are interconnected by a series of curved tubes 31 and afford open passages connecting the upper chamber 20 with the lower chamber 30, of sufficient total cross-sectional area to prevent undesirable retardation to the flow of gases therethrough. The tubes 31 extend through the length of the jacket chamber 8, and this chamber is provided with lower cold fluid inlets 32 and with upper hot fluid outlets 33. The heater base 29 may be formed as a casting which may be mounted upon a suitable foundation 34, and the rear of the chamber 30 located within the base 29, communicates directly with a stack 35 or other draft producing device. A clean-out door 36 is provided on the base 29 near the stack 35, and permits free access to all portions of the lower chamber 30.

The major portion of the improved heater may be formed of sheet metal plates welded together, and the exterior of the heater may be painted, enameled or otherwise decorated in any desired manner. The entire exterior of the chamber 8 should be insulated against heat losses, and the combustion chamber 7 may obviously be fired either with gas, oil, or solid fuels.

During normal operation of the improved heater, heat transferring medium such as water may be admitted to one of the inlets 32, and heating fluid may be delivered from one or both of the outlets 33, depending upon the specific use to which the apparatus is being put. The fuel and air are admitted to the combustion chamber 7 through the conduit 13 and are ignited therein. The gases of combustion are caused to whirl by virtue of the tangential disposition of the nozzle 16 and rise upwardly through the interior of the dome portion 12 as a whirling vortex of highly heated gas. By virtue of the tapered formation of the dome portion 12,

considerable heat is transferred to the medium within the chamber 8 during the ascent of the vortex. As the heated gases enter the chamber 20 they strike the top cover 23 and the flow thereof is reversed. The heated gases then pass downwardly through the tubes 31 and further heat the medium within the chamber 8, being eventually discharged into the lower chamber 30 in the base 29 where the individual streams of gas commingle. By the time the gases reach the chamber 30, by far the greater proportion of their heat has been transferred to the heating medium within the chamber 8, and the spent gases are subsequently delivered from the chamber 30 through the stack 35.

It will be apparent that the construction of the dome portion 12 and of the tubes 31 is not only such that the heat is transferred to the heating medium within the chamber 30 with maximum efficiency, but that the surfaces which are exposed directly to the gases are automatically scoured and maintained free from accumulation of coatings which would tend to retard effective heat transference. The heating medium within the chamber 8 constantly circulates upwardly through this chamber and the hottest portion of this medium is obviously exposed to the gases of combustion while these gases are in their most highly heated condition. While two inlets 32 and outlets 33 have been shown, the number of these inlets and outlets may obviously be varied, and some of them may be blanked off during normal use of the heater. The inspection opening 19 furthermore permits observation of the combustion conditions within the chamber 7 so that the burner 17 may be readily adjusted to produce most effective combustion. Instead of a stack 35, any other form of suction producing apparatus may be utilized, and the oil burner 17, as previously indicated, may also be replaced by other forms of fuel injection apparatus.

It should also be noted that all portions of the improved heater are readily accessible for inspection and cleaning. The doors 15, 18 permit lateral entry into the chamber 7, while the top cover 23 permits free entry to the chamber 20 for the purpose of cleaning the tube sheet 21, casing portion 12 and tubes 31. The door 36 associated with the base 29 permits access to the chamber 30 for the removal of sediment deposited therein from the tubes 31 and otherwise, thus permitting the apparatus to be maintained in most effective condition at all times.

From the foregoing description it will be apparent that the present invention provides a simple, compact and highly efficient heating unit which may be caused to present an extremely neat appearance. The unit may be manufactured at moderate cost and due to its high efficiency may be operated with minimum fuel consumption, and this assertion has been proven by the successful commercial operation of units built in accordance with this invention. The number of tubes 31 and the size thereof may obviously be varied to suit different heating conditions, and the invention is applicable to heaters utilizing either water or air as well as other fluids, such as a heating medium. In this improved heating unit, the heat distribution is effectively balanced, by virtue of the fact that the hot gases are admitted to the extreme upper ends of the tubes 31 whereas the spent gases are delivered from the extreme lower ends thereof. This method of circulation produces uniform velocity of flow through all of

the tubes 31, and insures maximum efficiency. The lining 11 of the combustion chamber 7 functions as a heat insulator and accumulator, and permits the combustion chamber temperature to be maintained sufficiently high to insure complete combustion of the fuel. Any heat conducted through this lining is delivered directly to the heating medium within the chamber 8, thereby avoiding heat losses.

10 It should be understood that it is not desired to limit the invention to the exact details of construction of the apparatus herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

15 It is claimed and desired to secure by Letters Patent:

1. In a heater, a main cylindrical casing, a central cylindrical casing disposed within and spaced from said main casing, a tapered casing attached to the upper end of said central cylindrical casing, an upper reversely tapered tube sheet attached to the upper end of said tapered casing, a lower tube sheet connecting said cylindrical casings, and a series of tubes connecting said tube sheets and extending through the space between said cylindrical casings.

2. In a heater, a main cylindrical casing, a central cylindrical casing disposed within and spaced from said main casing, a tapered casing attached to the upper end of said central cylindrical casing, an upper reversely tapered tube sheet attached to the upper end of said tapered casing, a lower tube sheet connecting said cylindrical casings, a series of tubes connecting said tube sheets and extending outwardly and downwardly through the space between said cylindrical casings, and means for constantly removing gas from the lower ends of said tubes.

3. In a heater, a cylindrical outer casing, a lower cylindrical inner casing disposed within and spaced from said outer casing, said lower casing having a refractory lining, a tapered dome portion secured to the upper end of said lower cylindrical casing, a tapered tube sheet connected to the upper end of said dome portion and extending outwardly therefrom, an upper inner cylindrical casing connecting the outer edge of said upper tube sheet with said outer casing, a lower tube sheet connecting said outer casing with said lower cylindrical casing, a series of tubes connecting said tube sheets and extending through the space between said outer and lower cylindrical casings, means for injecting hot gases into

said lower cylindrical casing, and means for removing gases from the lower ends of said tubes.

4. In a heater, a main casing, a central circular casing disposed within and spaced from said main casing, a tapered circular casing extending upwardly from said central casing, an upper reversely tapered tube sheet extending upwardly from the upper constricted end of said tapered casing, a lower tube sheet between said main and central casings below said upper sheet, and a series of tubes connecting said tube sheets and extending through the space between said main and central casings.

5. In a heater, an outer casing, an inner annular casing disposed within and spaced from said outer casing, means for effecting injection of fuel tangentially into the lower portion of said annular casing, an annular tapered casing extending upwardly from the upper end of said annular casing, a reversely tapered tube sheet extending upwardly from the upper constricted end of said tapered casing, a lower tube sheet between said outer and inner casings below said upper sheet, and a series of tubes connecting said tube sheets and extending through the space between said outer and inner casings.

6. In a heater, an outer casing, an inner casing disposed within and spaced from the lower portion of said outer casing, means for effecting injection of fuel tangentially into the lower portion of said inner casing, a tapered casing converging upwardly from the top of said inner casing and spaced inwardly from the upper portion of said outer casing, a reversely tapered upper tube sheet extending upwardly and outwardly away from the constricted top of said tapered casing, and a series of tubes extending downwardly and outwardly from said tube sheet through the space between said outer casing and said tapered and inner casings.

7. In a heater, an outer casing, an inner casing disposed within and spaced from the lower portion of said outer casing, a tapered casing converging upwardly from the top of said inner casing and spaced inwardly from the upper portion of said outer casing, a reversely tapered upper tube sheet extending upwardly and outwardly away from the constricted top of said tapered casing, and a series of tubes extending downwardly and outwardly from said tube sheet through the space between said outer casing and said tapered and inner casings.

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