May 9, 1933. C. E. LUCKE 1,908,375

OIL STILL

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Fig. 1.

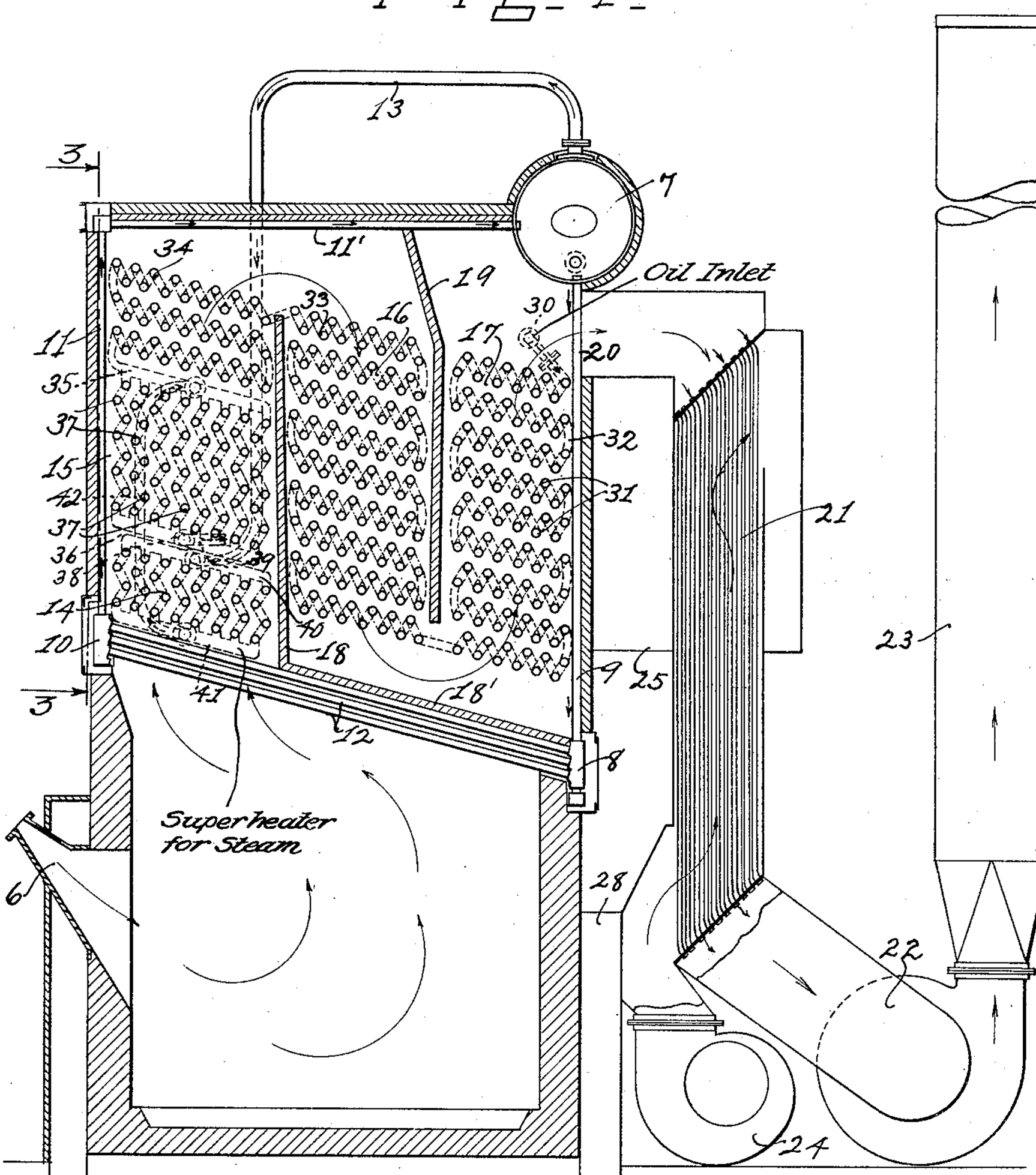

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Fig. 2.

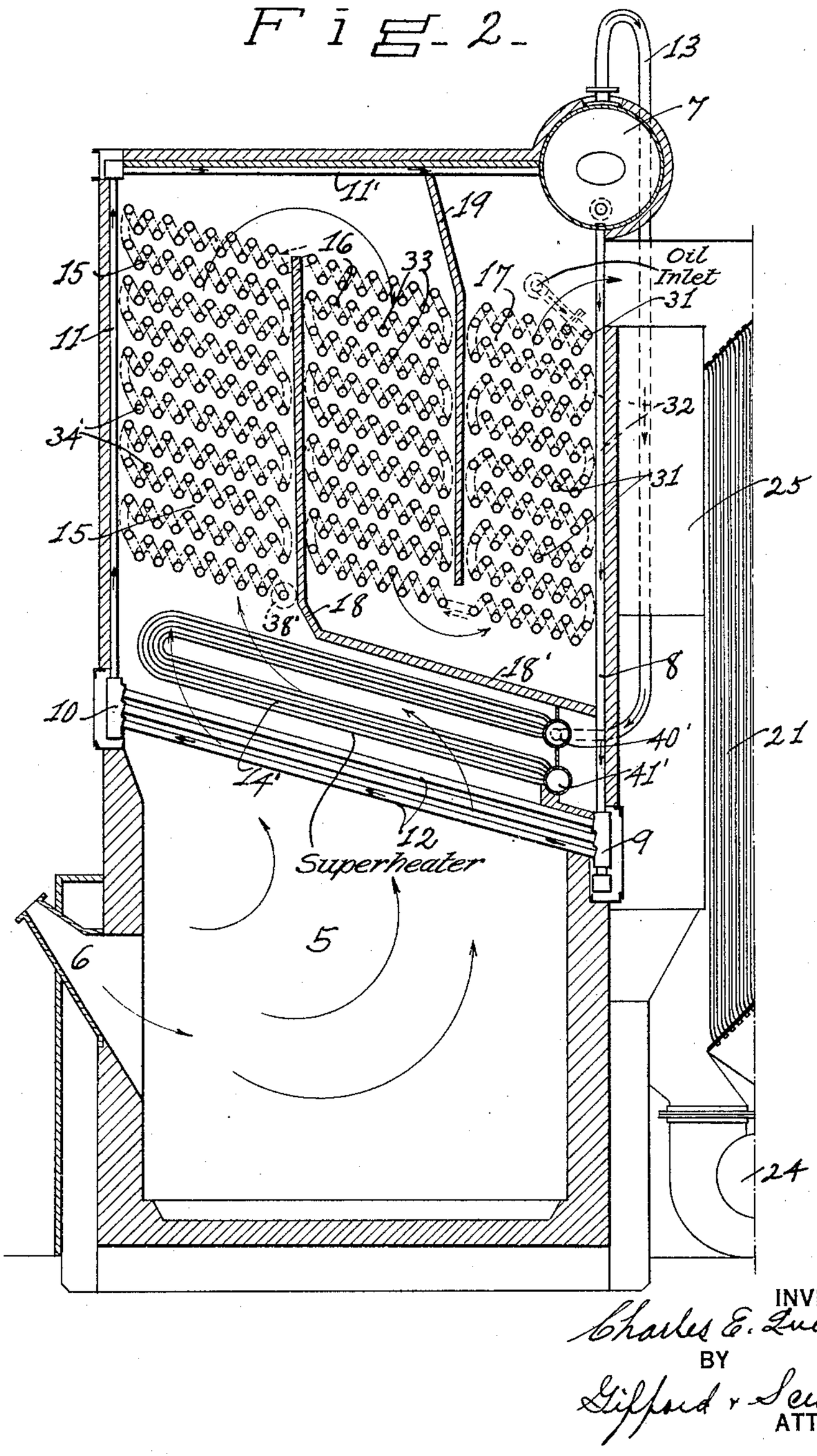

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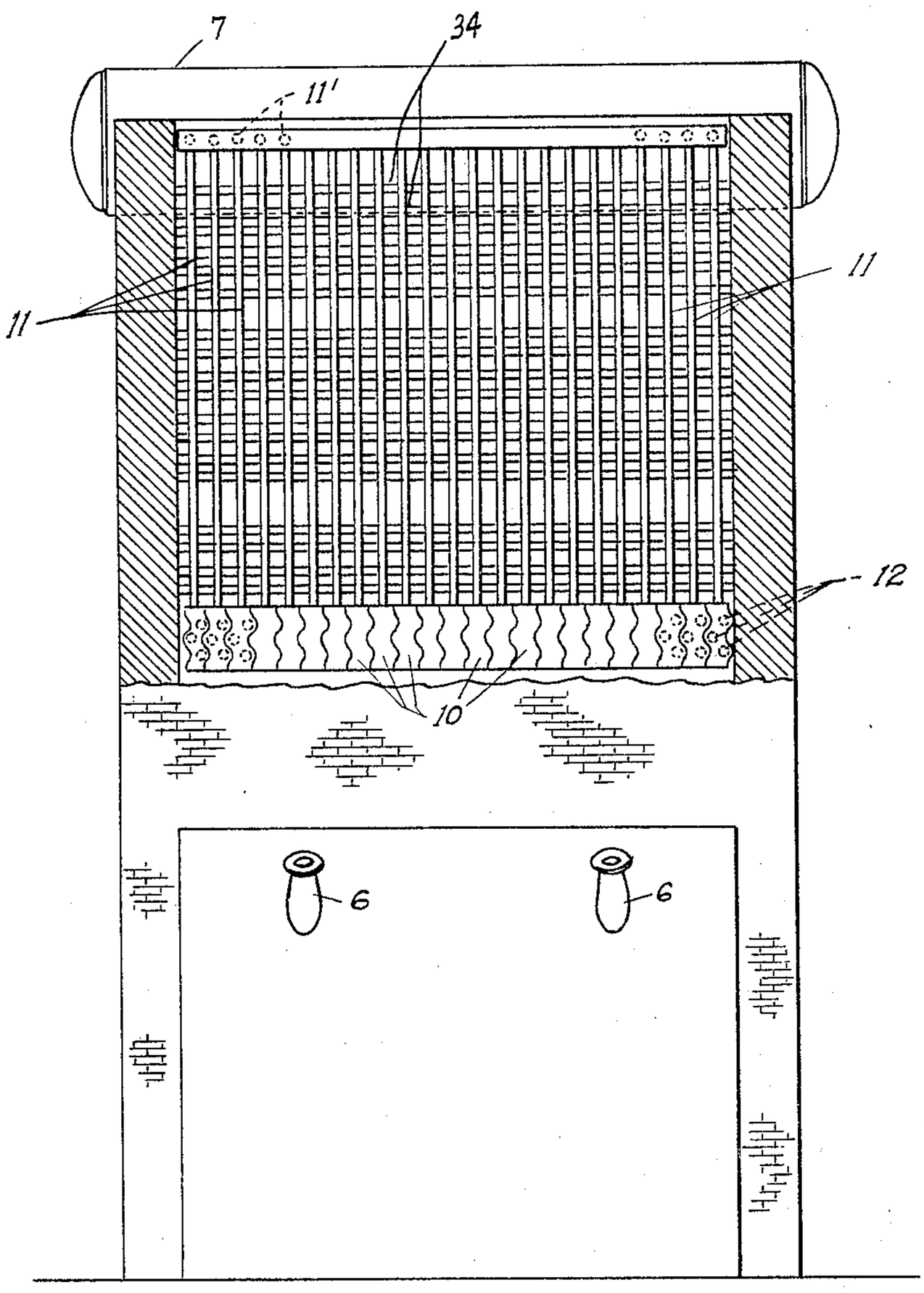
Fig. 3



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UNITED STATES PATENT OFFICE

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OIL STILL

Application filed March 28, 1928. Serial No. 265,247.

This invention relates to an oil still that is located above a furnace and is shielded from the radiant heat of the furnace by means of water tubes that may be connected, for example, to the circulation system of a water tube boiler. The invention will be understood from the description in connection with the accompanying drawings in which Fig. 1 is a vertical section through an illustrative embodiment of the invention and Fig. 2 is a similar section showing a modification. Fig. 3 is a sectional view on line 3—3 of Fig. 1.

In the drawings, reference character 5 indicates a furnace that is provided with burners 6 for powdered fuel or other combustible material. A water tube boiler is located above the furnace and is shown as comprising a cross steam and water drum 7, the water space of which is connected to downtake headers 8 by means of tubes 9. Uptake headers 10 are connected to the steam and water drum 7 by means of side wall tubes 11 and roof tubes 11′. The headers 8 and 10 are connected by rows of inclined or drop leg tubes 12, constituting a bank of tubes. A pipe 13 leads from the steam space of the steam and water drum 7 to a superheater 14 located above the bank of tubes 12. The number and disposition of the tubes 12 is such that very little, if any, radiant heat can pass between the same and become absorbed by the oil tubes located above the bank 12. The number of tubes is preferably limited to the smallest number of tubes that will sufficiently screen the oil tubes from the radiant heat of the furnace so that the furnace gases will not be appreciably cooled before they reach the tubes above the screen.

The space above the tubes 12 is divided into conduits or gas passages 15, 16 and 17 by means of baffles 18 and 19, so that the successive gas passages decrease in cross sectional area. The upper end of the baffle 18 terminates short of the upper end of the passages 15 and 16, and its lower end is connected by means of a baffle 18′ lying along the upper row of the bank of tubes 12 and extending to the headers 8. The baffle 19 extends downwardly from the roof tubes 11′ and terminates short of the baffle 18′. A conduit leads from the outlet 20 for the waste gases to an air heater 21, to which a suction fan 22 is connected. The outlet of the suction fan leads to the stack 23. A fresh air fan 24 forces air through the air heater, thence through the conduit 25 into passages outside of the conduits 15, 16 and 17, from which it passes to the space in front of the furnace 5, and thence into the furnace for combustion purposes. A branch 28 may lead from the fan 24 to spaces along the outside of the furnace 5, and thence into the space 27 and thence into the furnace.

An oil inlet pipe 30 leads to the upper portion of the conduit 17 and is connected to the end of a straight tube 31 that extends horizontally across the passage 17.

The tube 31 is connected by a return bend connection 32 to a similar parallel tube that is connected in series with the next tube, and so on, through the group of tubes that are located in the passage 17. The last one of the tubes 31 is connected to the end of a similar tube in the gas passage 16. The tubes in the gas pasage 16 are connected and located similar to the tubes 31 so that the oil passes in series through these tubes into similar tubes 34 in the upper portion of the gas passage 15. The outlet end of the tube group 34 is connected to a header 35 which is common to the upper row of tubes of the group 37. The tubes in the upper row have their ends connected by return bends to a lower row and so on, through a plurality of tubes the last row of which have their ends connected to the header 38 on the outside of the wall and an outlet 39 leads away from the outlet header 38.

The pipe 13 from the steam space of the steam and water drum 7 leads to the superheater inlet header 40 that is connected by the superheater tubes 14 to the outlet header 41 from which a pipe 42 leads to the header 35 so that the superheated steam is mixed with the oil vapors as they enter the tubes 37.

The operation is as follows: Hot products of combustion from the furnace 5 pass over water tubes 12, which act as a radiant heat screen, and thence over the oil tubes in the

gas passages 15, 16 and 17. The waste products of combustion then pass through the air heater 21 where air that may be utilized for combustion purposes in the furnace 5 is heated.

Water from the steam and water drum 7 passes downwardly through the tubes 20 into the headers 8 and as it flows upwardly through the tubes 12, steam is generated and passes back into the steam and water drum 7 through the pipes 11 and 11′. The steam then passes through the pipe 13 into the superheater 14, and thence into the header 35.

Oil entering through the pipe 30 passes through the tubes 31, 33 and 34 in a countercurrent direction with respect to the hot gases and the vapors therefrom enter with the steam into the tubes 37 where they are further heated and finally pass out through the outlet 39. The size of oil tubes in the passages 15, 16 and 17 is such and the rate of feed of the oil therethrough is of sufficient velocity to cause turbulent flow of the oil through the tubes, so that danger of overheating films of oil on the inside surfaces of the tubes is eliminated. Oil flowing in turbulent condition is well mixed in the tubes so that when the oil and vapors pass into the tubes 37 they are at uniform temperature throughout and portions thereof are not cracked in an objectionable manner because of local overheating or excess heat in spots.

The superheater for the steam may be entirely dispensed with and no steam mixed with the oil while the oil is being distilled. In this case the steam generated in the steam boiler may be used for other purposes. When the steam from the steam boiler portion of the device is mixed with the oil vapors, less steam or no steam is required from an outside source for this purpose.

In the modification shown in Fig. 2, the same parts that have been described above are referred to by the same reference characters and it is not thought necessary to repeat the description. In this modification, the superheater 14′ is made up of U-tubes connected to the inlet headers 40′ and 41′, the legs of these U-tubes being parallel to the inclined tubes 12. The steam generating portion of this arrangement may generate steam that is used for any desired purpose. Or, the superheated steam from the superheater 14′ may be caused to mix with the oil vapors as above described in connection with Fig. 1 if desired. In this modification, the tubes 34′ through which the oil passes are shown as occupying substantially the entire space of the gas conduit 15 and no mixture of the steam from the superheater with the oil vapors is indicated. The oil vapors after being heated in the tubes pass out through the outlet 38′. The steam superheater may be entirely omitted and the device will operate whether steam is mixed with the oil vapor near the end of the distillation operation or not.

In both illustrations of the invention the gas passes above the radiant heat screen decrease in cross sectional area so that the velocity of the gases is kept up even while the gases are being cooled by passing over the oil tubes. Decreasing the gas path adds to the efficiency and decreases the amount of surface that would otherwise be required. Very little of the heat of the gases from the furnace is abstracted by contact with the tubes 12 so that a sufficient amount of heat is left in the gases to distill and crack the oil that passes through the tubes in the gas passages 15, 16 and 17.

With this invention it is not necessary to temper or cool the furnace gases before allowing them to contact with the oil tubes. Very high efficiency can also be obtained because hot air can be introduced into the furnace for combustion purposes and it is not necessary to use a large amount of excess air. Products of combustion at considerably high temperatures can be permitted to escape and the air heater used to recover heat therefrom.

I claim:

1. In an oil still, a combustion chamber, a gas passage of gradually decreasing area leading from said combustion chamber, straight oil tubes connected in series and located in said gas passage, and radiantly heated tubes comprising drop leg water tubes of a water tube boiler located between said straight tubes and said combustion chamber, the number and disposition of said radiantly heated tubes being such that the temperature of the hot products of combustion passing across them is not appreciably lowered.

2. In an oil still, a combustion chamber, a gas passage of gradually decreasing area leading from said combustion chamber, straight oil tubes connected in series and located in said gas passage, and radiantly heated tubes comprising drop leg water tubes of a water tube boiler located between said straight tubes and said combustion chamber, and means to cause steam from said boiler to commingle with oil vapors in the tubes located in the hottest portion of said gas passage.

3. In combination, a furnace including a combustion chamber and a winding gas passage therefor of gradually decreasing area from entrance to outlet, a thermosiphonic circulation water tube boiler having its tubes disposed in radiant heat relation with respect to said combustion chamber and shielding the gas passage, and oil heating tubes disposed in said gas passage and providing a continuous flow from the cooler portion thereof to the hotter portion, and a superheater in the hotter portion receiving steam generated in the boiler and delivering superheated steam to the oil passage at a location near the hotter end thereof.

4. In combination, a furnace including a combustion chamber and a winding gas passage therefor of gradually decreasing area from entrance to outlet, a thermosiphonic circulation water tube boiler having its tubes disposed in radiant heat relation with respect to said combustion chamber and shielding the gas passage, and oil heating tubes disposed in said gas passage and extending straight across same and providing a continuous flow from the cooler portion thereof to the hotter portion, and a superheater in the hotter portion receiving steam generated in the boiler and delivering superheated steam to the oil passage at a location near the hotter end thereof.

5. In combination, a furnace including a combustion chamber and a winding gas passage therefor of gradually decreasing area from entrance to outlet, a thermosiphonic circulation water tube boiler having its tubes disposed in radiant heat relation with respect to said combustion chamber and shielding the gas passage, and oil heating tubes disposed in said gas passage and extending straight across at right angles to the boiler tubes and providing a continuous flow from the cooler portion thereof to the hotter portion, and a superheater in the hotter portion receiving steam generated in the boiler and delivering superheated steam to the oil passage at a location near the hotter end thereof.

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