Aug. 22, 1933. H. L. ALLEN 1,923,135

METHOD OF CLEANING AND COOLING GAS SCRUBBING WATER AND APPARATUS THEREFOR

Filed May 26, 1930 2 Sheets-Sheet 1

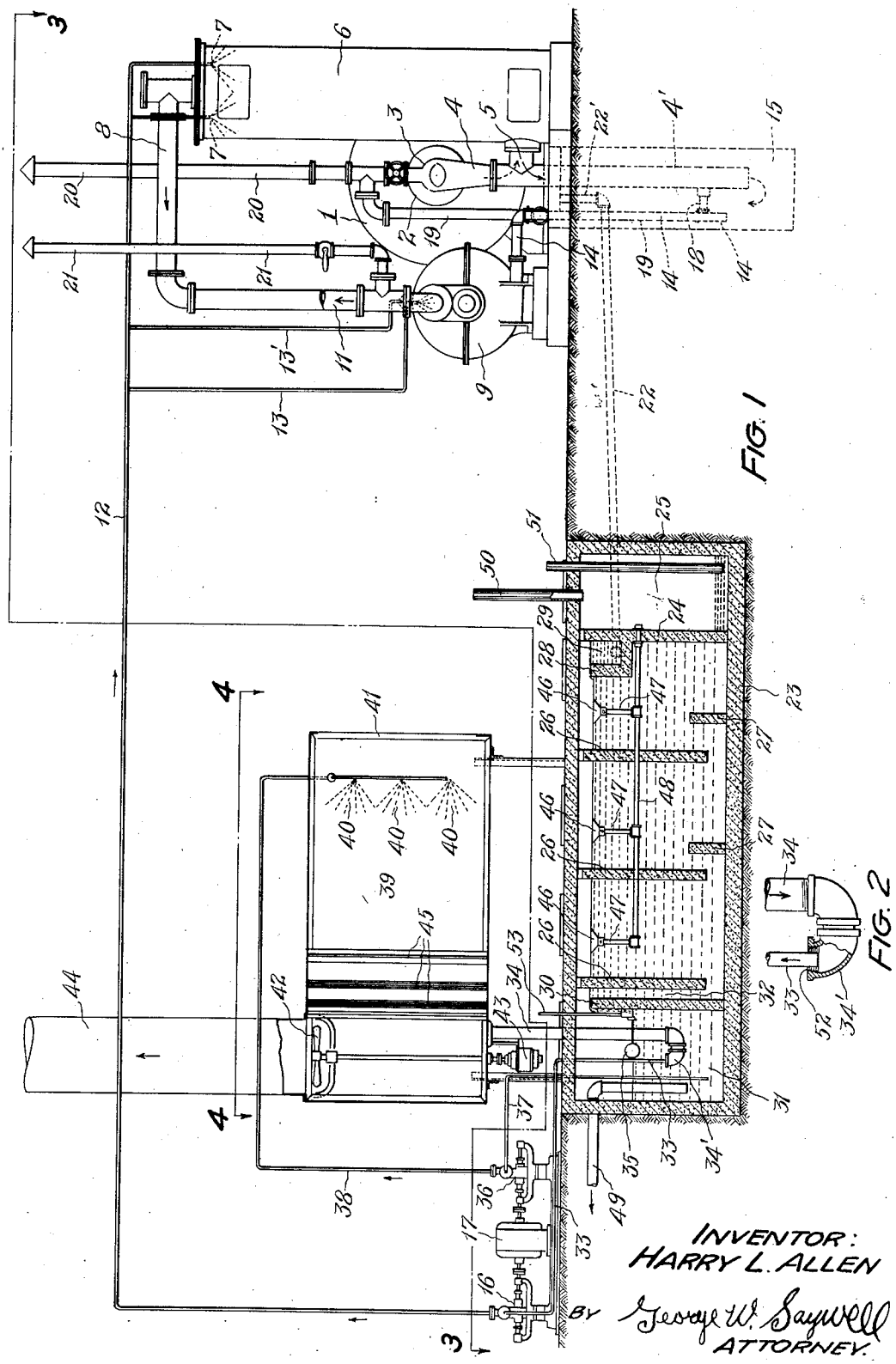

FIG. 1

FIG. 2

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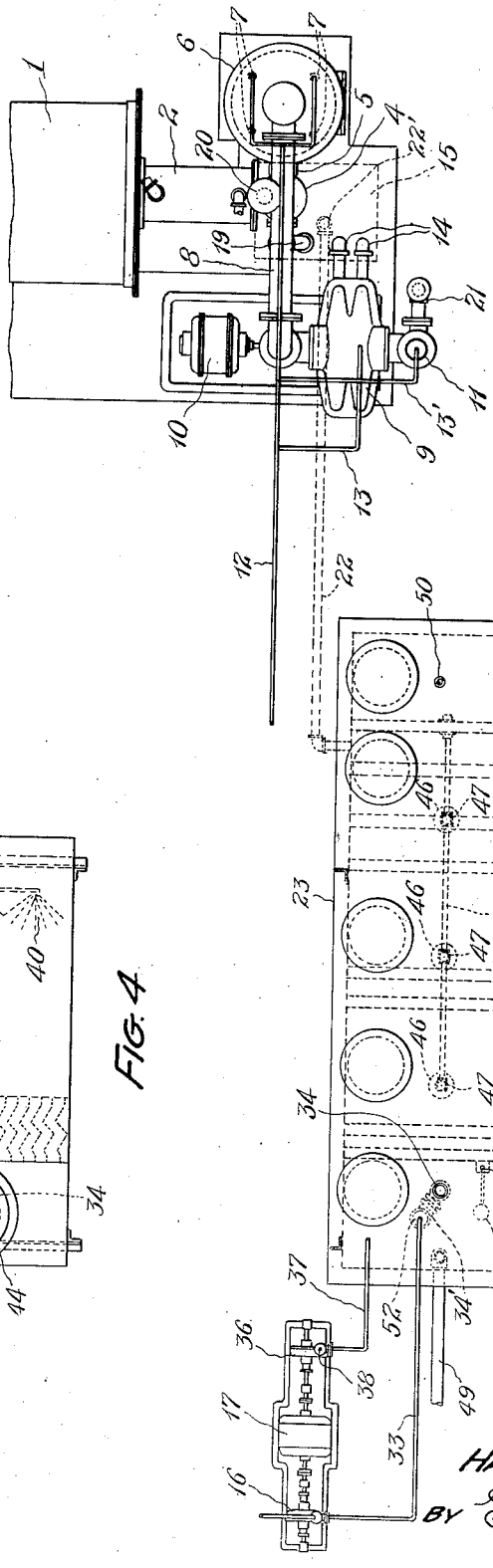

FIG. 3

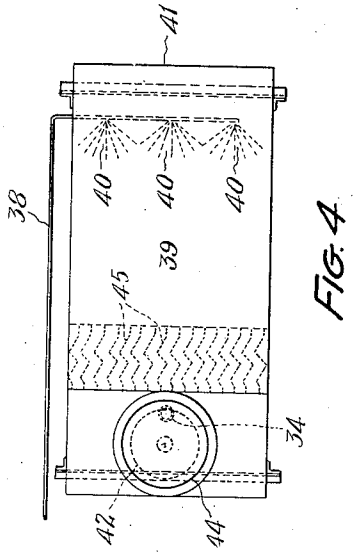

FIG. 4

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1,923,135

METHOD OF CLEANING AND COOLING GAS SCRUBBING WATER AND APPARATUS THEREFOR

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Application May 26, 1930. Serial No. 455,562

4 Claims. (Cl. 210—52)

My improvements particularly relate to the separation of oil from water which has been utilized for the scrubbing of hot gas, and for the cooling of such water and the re-use of the same in a continuous scrubbing operation. The apparatus is operated without any sewer connection so that no obnoxious odors are discharged to sewer, nor is any oil or other material which might possibly be discarded thus discharged. A considerable saving in cooling water is effected, and oil and certain by-products hitherto wasted are subject to recovery.

The annexed drawings and the following description set forth in detail certain steps illustrating the method of carrying out my new and improved process and certain apparatus by which the process can be carried out, such disclosed steps and apparatus constituting, however, but one of the various series of steps by which the process may be worked and but one of the various forms of apparatus embodying the principle of the apparatus portion of the invention.

In said annexed drawings:

Figure 1 is a partial elevation and partial vertical longitudinal section of an arrangement of apparatus for effecting the oil-separation and the water-cooling, including certain associated elements of a gas-making machine;

Figure 2 is an enlarged showing, partially in vertical section, of certain features shown in Figure 1, this view particularly showing the apparatus for the return to the system of the cooled water and the commencement of the recirculation of the latter, together with a construction which provides for the smooth furnishing of any additional water necessary over and above that obtainable from the supply of cooled water;

Figure 3 is a plan section, taken in the planes indicated by the line 3—3, Figure 1; and

Figure 4 is a plan section, taken in the plane indicated by the line 4—4, Figure 1.

Referring to the annexed drawings in which the same elements are indicated by the same several numbers in the different views, a gas generator 1 discharges through a heater 2 into a horizontal conduit 3 which leads into a downwardly-extended pipe 4 discharging into an inlet 5 adjacent the bottom of the scrubber 6. Scrubbing water is furnished to the latter through jet sprays 7 which are fed by a water line 12 leading from a water pump 16 operated by a motor 17. The gas after being subjected to the action of the scrubbing water in the chamber 6 passes outwardly adjacently the top of the scrubbing chamber through the offtake pipe 8 to the blower 9 operated by the motor 10 and thence is discharged through the offtake pipe 11 leading to the gas main. In the blower chamber 9 and in the offtake pipe 11 adjacent to the blower outlet, the gas is subjected to a final water cleaning, the water being obtained from the line 12 and discharging into the blower 9 and offtake pipe 11 through the auxiliary water lines 13 and 13'. This water is discharged from the blower chamber 9 through the drains 14 into the sump 15, the latter also receiving the water from the scrubbing chamber 6 through an extension 4' of the pipe 4, which extension 4' communicates with the gas inlet 5 to the scrubber 6, the element 5 serving both as gas inlet to the scrubber 6 and as a hot foul water outlet therefrom.

If the gas is under sufficient pressure to force any of it downwardly through the pipe extension 4', it is vented through a relief pipe 18 which communicates with a safety vent pipe 19, the latter discharging into a vent pipe 20 which at its lower end is adapted to communicate with the offtake 3 from the heater 2 and discharges to atmosphere at its upper end. Furthermore, a bleeder 21 also discharging to atmosphere communicates with the gas offtake 11 leading to the main from the blower chamber 9.

The purposes of the invention are to separate the oil from the hot scrubbing water which is discharged from the bottom of the scrubbing chamber 6 into the sump 15, to cool this water when thus cleaned, and then recirculate it through the scrubber. To this end there is provided a water offtake pipe 22 from the sump 15, which pipe has an upwardly-extended intake portion 22' fixed at that height at which it is desired to maintain the water level in the sump 15, the main portion of the pipe 22 being downwardly-inclined toward a water reservoir 29 provided in a separating tank 23. This tank 23 is provided with a partition wall 24 which creates an end chamber 25 into which the separated oil is collected, as hereinafter explained, the tank 23 being further provided with an upwardly-extended series of baffles 27 and a downwardly-extended series of baffles 26 which form a circuitous path for the passage of water from one end to the other of the tank 23. This water enters this baffling chamber very smoothly inasmuch as it is floated from the reservoir 29 over the top of a weir 28 formed integrally with the partition 24 and serving with the upper part of this partition 24 to form the water reservoir 29.

Within the water-baffling chamber of the tank 23 is contained a series of skimmer heads 46

mounted upon the top of tubular stems 47 which in turn are mounted upon a pipe 48 secured in the partition wall 24. The oil which is separated by gravity from the hot water and which rises to the top of the liquid quietly passing through the water-baffling chamber is skimmed off the top of this liquid by the successive skimming heads 46, the level of these heads being slightly higher than a weir 30 hereinafter described, so as to permit the oil, which is comparatively light and foamy, to float into these skimmers and to be conducted off through the stems 47 and the pipe 48 whence it is discharged into the oil reservoir 25. This recovery of the oil is accomplished without a material amount of water accompanying the oil. The reservoir 25 is provided with a vent 50 and the oil collected therein can be pumped therefrom through the pipe 51 or bailed and shoveled out as is desired. Thus this oil which has hitherto been discharged to the sewer and lost can be recovered and refined to obtain various valuable oil products, or can be used as recovered for road oiling or suitable industrial purposes. After the hot foul water has passed through the said baffling chamber 23, substantially all of the oil has been separated out. Any slight amount of oil which may escape separation in the tank 23 is recirculated with the water through the subsequent scrubbing operation.

The hot water from which the oil has been separated is discharged from the separating chamber through a vertical conduit 32 formed between the end baffle wall 26 and an adjacent wall 30, this latter wall also forming a weir over which the water is quietly discharged into a chamber 31 formed in the end of the tank 23 opposite that end in which the oil reservoir 25 is formed. This chamber 31 is the main water chamber of the apparatus. It is a water-equalizing chamber and its several functions and the several operations therein taking place will presently appear. From this chamber 31 the water is passed through cooling devices and returned to the chamber and then recirculated through the scrubber, as will now be explained.

The water cooling chamber is provided in a tower 39 to which water from the chamber 31 is conducted through water lines 37 and 38, the former leading to a water pump 36 which also is operated by the motor 17 and the latter water line leading from the pump 36 into the chamber 39 where it is provided with jet spray devices 40. One end 41 of the tower 39 is open whereby cooling air can be rapidly drawn through the tower and discharged through the stack 44 by means of an exhaust fan 42 operated by a motor 43, the air thus discharged through the stack 44 carrying with it so much of the obnoxious vapors gathered by the wash water in the scrubber 6 as may be removed from the water by the cooling action of the air in the tower 39. The air in thus being drawn through the tower 39 is effectively baffled by a device 45, provided adjacent the air-offtake end of the tower 39 and plainly shown in Figure 4. Thus the cooling action of the air upon the hot water from the sprays 40 is rendered more effective. The baffling device 45 consists of a series of spaced vertical corrugated partitions which provide a series of tortuous channels for the passage of the heated air therethrough. The comparatively hot water in the equalizing chamber 31 is thus conducted through the air-cooler 39 where it loses considerable of its heat, this cooled water falling in a spray to the floor of the tower 39 and then being conducted by gravity through the pipe 34 back to the chamber 31. This cooled water which is recirculated, as hereinafter described, carries with it all of the obnoxious vapors except those which were taken out by the cooling action in the tower 39 and vented with the air discharged through the stack 44.

The cooled water which is returned to the equalizing chamber 31 is again placed in circulation for gas-scrubbing through the medium of a water line 33 which communicates at one end with the pump 16 and opens at its other end into the mouth of an elbow 34' secured to the bottom of the cooled water-return line 34, the mouth of this elbow 34' being open to the equalizing chamber 31, and being of a diameter considerably larger than that of the pipe 33, as plainly shown in Figure 2. The result is that the water recirculating line 33 thus obtains all of the cooled water returning to the chamber 31, through the pipe 34, if so much is needed for recirculation and, furthermore, if additional water is required for recirculation, over and above that which is furnished by the pipe 34, it can be obtained from the chamber 31 through the space 52, Figure 2, between the pipe 33 and the wall of the mouth of the elbow 34'. This construction results in the placing into recirculation in a smooth manner of cooled water substantially of the amount requisitioned by the pump 16. The pumps 16 and 36, being operated by the same motor 17 are synchronized so as to pump water to the cooling tower 39 at substantially the rate that water is required for scrubbing in the chamber 6.

In order to maintain the desired liquid level in the equalizing chamber 31, it is necessary occasionally to add fresh water thereto. This is done automatically through the medium of a float device 35 which operates a valve controlling a fresh water line 53 fed from any suitable water main. It is evident, therefore, that the chamber 31 is the main water chamber of the apparatus and that therein the water conditions are equalized. Into this chamber 31 discharges the hot waters separated from the oil in the baffling chamber of the tank 23, and also the cooled water from the tower 39. From this chamber 31 is taken the water which is cooled in the tower 39; as also, the water which passes through the pump 16 for recirculation. An emergency off-take to the sewer is from the chamber 31; as is also the intake to said chamber 31 from the fresh water supply. Furthermore, within the chamber 31 is the arrangement of pipe elements 34, 34', and 33, which permits the recirculation of cooled water to the extent that the supply from the tower 39 permits and the requisitioning of the pump 16 requires, any differential in supply and demand being smoothly cared for by the arrangement of the lower end of the pipe 33 in the comparatively large mouth of the elbow 34', within the liquid of the chamber 31, as plainly shown in Figures 1 and 2.

The emergency sewer connection is provided by the pipe 49.

By means of the improved apparatus shown and described, and the improved methods of operating the same, the gas-scrubbing water is repeatedly used, resulting in considerable economy in water bills. The oil is separated from this water efficiently and economically during each recirculation, and the water is cooled between the successive circulations to a very appreciable extent.

In addition to the recovery of all the oil and by-products which have hitherto been wasted,

when the hot scrubbing water has been discharged to the sewer, I avoid the nuisance of discharging obnoxious odors to the sewer. For ordinary operation, I utilize no sewer connection, and the odors for the most part accompany the recirculating water.

What I claim is:

1. In gas manufacture, a method of separating oil from scrubbing water and cooling and recirculating the water consisting in, conducting the hot foul water from the scrubber to an oil-separating chamber; effecting therein a separation of oil and water; floating the separated water from the separating chamber to a fresh water chamber; furnishing fresh water in controlled amounts to said fresh water chamber; pumping water from said fresh water chamber to a cooling tower; conducting the cooled water back to the fresh water chamber while subjecting it in transit to the action of a pump adapted to force it into the scrubber for recirculation, any cooled water not thus pumped being permitted to flow into said fresh water chamber; and exposing said fresh water chamber to the action of said recirculating pump to the degree that the requirements of the latter are not satisfied by the water retrieved from the cooling tower.

2. In gas manufacture, a water-equalizing chamber provided with an inlet for fresh water, an inlet for hot water, an inlet for cooled water, and two outlets, one of said outlets communicating directly with said inlet for cooled water and indirectly but freely with the main chamber portion, the other outlet and said inlet for cooled water communicating with each other exteriorly of said chamber; and means automatically controlling said inlet for fresh water to maintain the liquid level in the chamber at a desired height.

3. In gas manufacture, apparatus for separating oil from scrubbing water and cooling and recirculating the water comprising, inlet means and a pump for conducting cooled water to the scrubber and outlet means for conducting hot foul water therefrom; an oil-separating chamber with which said outlet means communicate; means for separating the oil from the hot water in said chamber; means for conducting away the separated oil; a water-equalizing chamber; means forming a weir over which the separated hot water is floated into the equalizing chamber; a cooling tower and means for cooling water therein; a water-line and a pump for conveying water from said equalizing chamber to said cooling tower; a cooled water discharge pipe communicating with said cooling tower and said equalizing chamber; a water line communicating directly with said discharge pipe and indirectly but freely with said equalizing chamber and subject to the action of said first-mentioned pump; and means for furnishing fresh water to said equalizing chamber.

4. In gas manufacture, apparatus for separating oil from scrubbing water and cooling and recirculating the water comprising, a cooled-water inlet pipe for the scrubber; two water pumps; a cooling tower; a water-equalizing chamber; a water and oil separating chamber and means for effecting separation of water and oil therein; a hot foul-water line leading from the scrubber to said separating chamber; means for conducting water from said separating chamber to said equalizing chamber; pipes communicating through one of said pumps with said equalizing chamber and said cooling tower; a pipe connected to said equalizing chamber and communicating through the other of said pumps with said cooled-water inlet pipe; means for conveying cooled water from said cooling tower to said equalizing chamber; and means furnishing fresh water to said equalizing chamber and arranged automatically to keep the liquid level therein at the desired height.

HARRY L. ALLEN.