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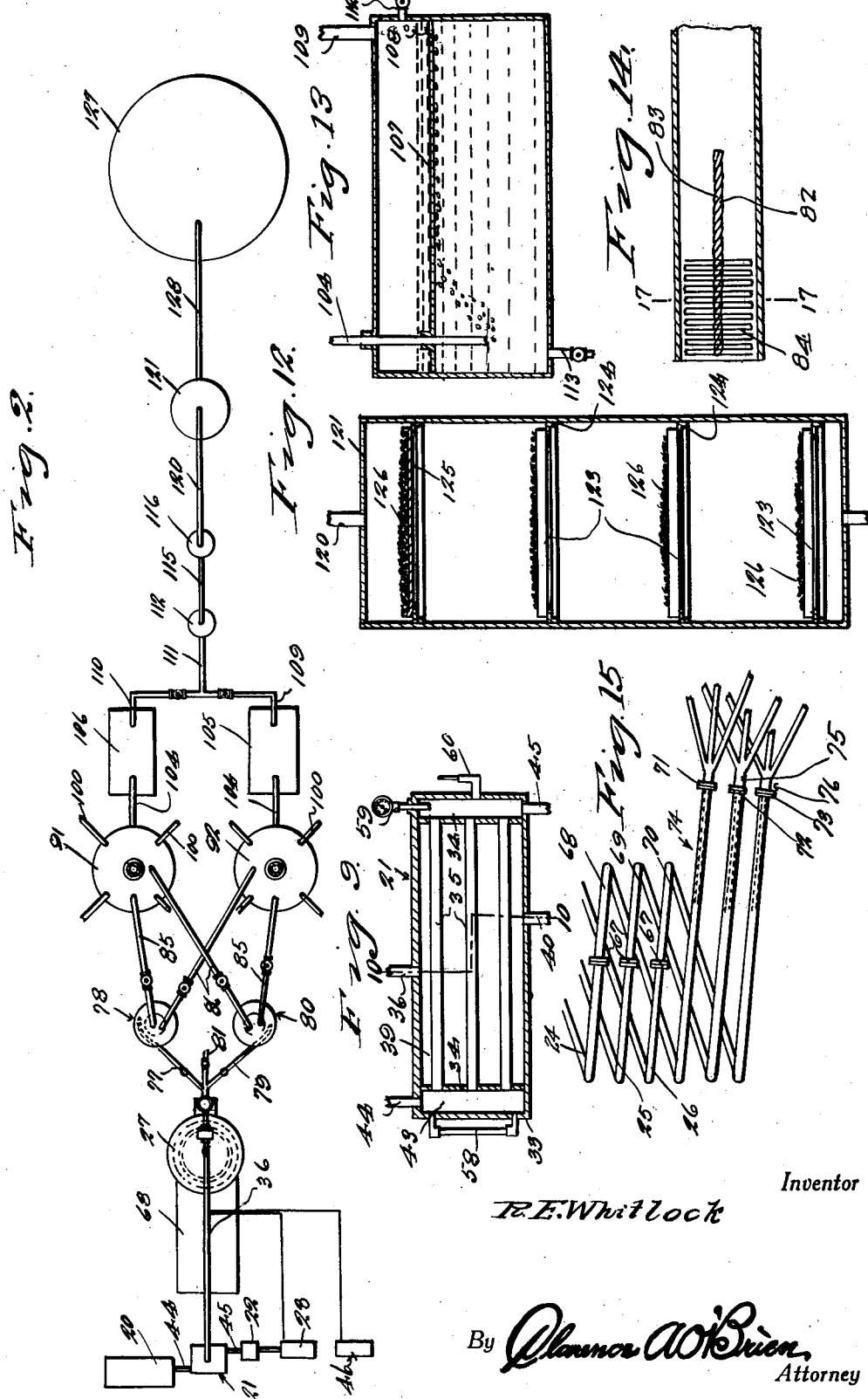
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PROCESS OF MAKING OIL GAS

Filed July 3, 1929

3 Sheets-Sheet 2



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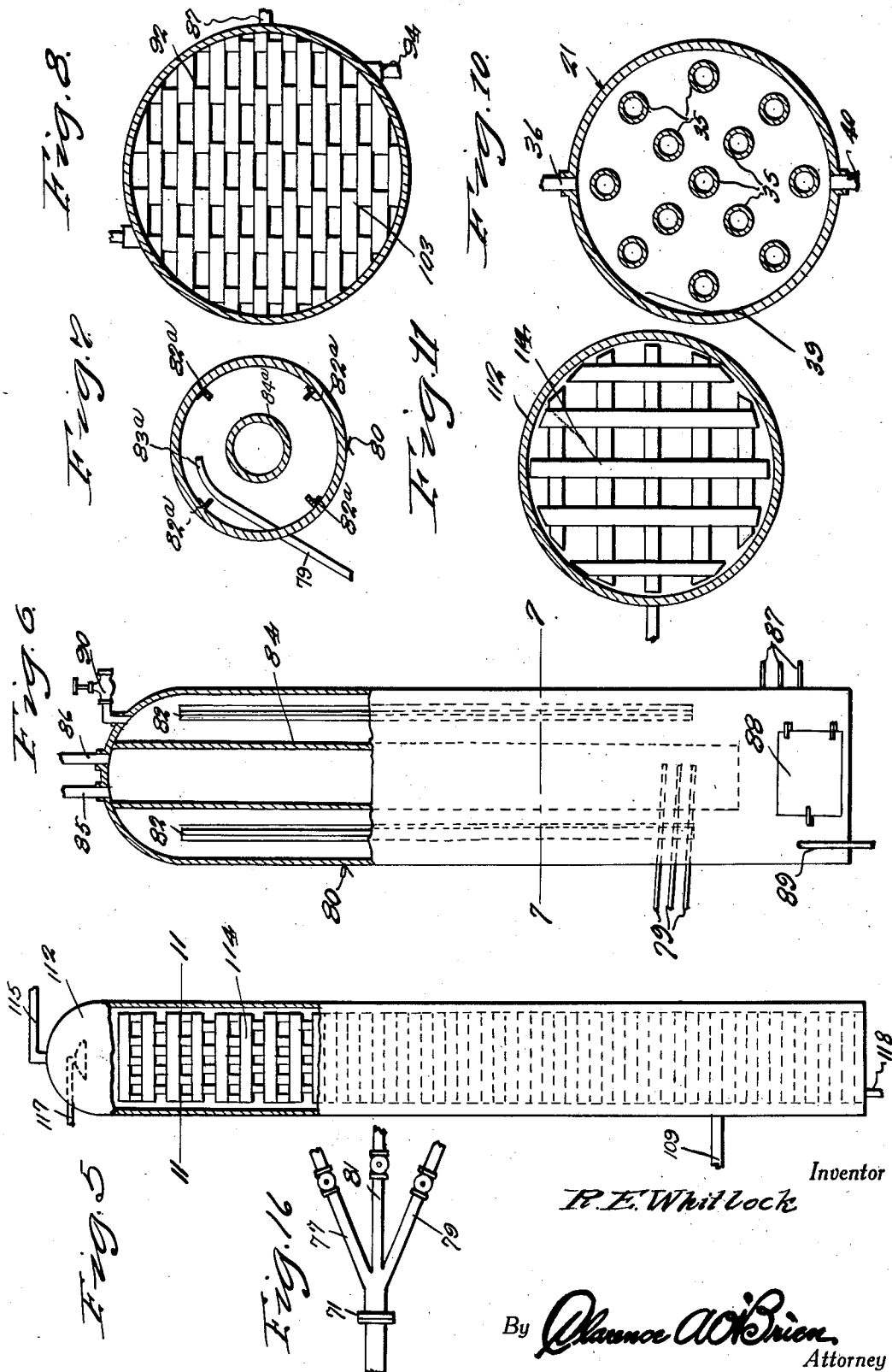
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

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PROCESS OF MAKING OIL GAS

Application filed July 3, 1929. Serial No. 375,323.

This invention relates to a process for making gas and is particularly adaptable to making gas for heating and illuminating purposes in homes, factories or other buildings.

5 An object of the invention is to provide for making oil gas from petroleum and water vapors, whereby a clean burning odorless gas is produced, having an average B. t. u. value in the storage tank, adaptable for commercial and domestic use.

10 Another object is to provide for an agitating catalytic action in the vapor stage of the water and oil that materially decreases the carbon dioxide and nitrogen in the finished gas and increases the hydrogen content thereof, which action also permits the use of light petroleum residuums of a very low specific gravity, and further, to provide a catalytic action that forms free carbon in large flakes that separate from the fixed gases with great rapidity.

15 A further object of the invention is to provide an arrangement of apparatus that permits the production of the gas within four hours starting with a cold or inoperative state of the apparatus and materials, and further to provide for making gases that range in value from 1050 to 550 B. t. u. per cubic foot.

20 Further objects of the invention are to provide, in a manner as hereinafter set forth, a process of the character referred to, which is very simple in its operation, thoroughly reliable in its results, and which requires minimum of technical control, and is very economical in its manufacture and operation.

25 With the foregoing and other objects in view, the invention consists in the novel construction, combination, and arrangement of parts and ingredients, as will be hereinafter more specifically described and illustrated in the accompanying drawings, wherein is disclosed an embodiment of the invention, but it is to be understood that changes, variations, and modifications may be resorted to, without departing from the spirit of the claims hereunto appended.

30 In the drawings, wherein like reference characters denote corresponding parts throughout the several views:—

Figure 1 is a side elevational view of an apparatus as a whole as utilized for carrying out the process in accordance with the present invention.

Figure 2 is a top plan view thereof.

Figure 3 is a fragmentary sectional view in detail of one of the headers for the coils of the heating furnace at the upper end thereof, showing the water vapor and oil vapor lead lines arranged therein.

Figure 4 is a detailed vertical longitudinal sectional view through the heater for the water.

Figure 5 is a side elevational view partly broken away of the water scrubber.

Figure 6 is a side elevational view partly broken away of one of the reaction chambers.

Figure 7 is a horizontal sectional view taken substantially on the line 7—7 of Figure 6.

Figure 8 is a horizontal sectional view of the interior of one of the expanders taken on the line 8—8 in Figure 1.

Figure 9 is a vertical longitudinal sectional view through the heat exchanger for the petroleum.

Figure 10 is a vertical transverse sectional view through Figure 9 taken approximately on the line 10—10.

Figure 11 is an enlarged horizontal sectional view of the interior of one of the reaction chambers, taken approximately on the line 11—11 of Figure 5.

Figure 12 is a vertical transverse sectional view in detail of the purifier for removing impurities from the generated oil gas.

Figure 13 is an enlarged vertical longitudinal sectional view of one of the water coolers.

Figure 14 is an enlarged fragmentary vertical sectional view through the lower end of one of the removable sections of the heating furnace coils, showing the location of the catalyzer element therein.

Figure 15 is a fragmentary elevation of the lower portion of the heating furnace coils.

Figure 16 is a fragmentary top plan view of the lower termination of one of the heat-

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ing furnace coils showing the three way casting attached thereto.

Figure 17 is a detailed transverse sectional view, taken substantially on the line 17—17 of Figure 14.

The present invention produces an oil gas of a very low carbon monoxide, nitrogen and carbon dioxide content. The methane gas generated from the oil gas is washed by oil and furthermore treated by catalytic action, whereby the heat value of the methane gas is retained, but the undesirable characteristics thereof which would militate against its commercial use appear to be eliminated. The process promotes saving and cleaning of all gases generated in the process incidentally which possess a high B. t. u. value, while eliminating by absorption and other means the gases and elements of low B. t. u. value.

Crude petroleum residuum, of either asphalt or paraffin base, ranging from 16 to 42 degrees Baumé is pumped from a storage tank 20 through the heat exchanger indicated generally at 21, and then through the filter 22, provided with a suitable screen where it is taken up by the pump 23.

The pump 23 forces the petroleum under an approximate pressure of ninety pounds per square inch into three separate leads 23a, 23b and 23c, which communicate with three helically coiled pipes 24, 25, and 26 extended through the side and near the top of the heating furnace indicated generally at 27. Each of the three petroleum leads 23a, 23b and 23c enters a header 28 on each of the separate helically coiled pipes 24, 25, and 26. The headers 28 extend from outside the heating furnace into the hot zone of each coil internally of the heating furnace. In the enlarged view of one of the heating coils 24, shown in Figure 3, the numeral 28 indicates the associated removable header, 23a is one of the petroleum lead lines. It is provided with a valve 30 and an atomizer or nozzle 31 at its end, within the header whereby the petroleum is atomized. Each of the three petroleum lines 23a, 23b, and 23c, has a conventional type of pressure and flow meter 32, adapted by suitably incorporated needle valve means to control the volume of flow within predetermined limits. One of the water lead lines 55 also enters the header 28 in a manner to be described.

The heat exchanger 21 consists of a hollow drum 33 having a partition wall 34 spaced from each opposite end wall and secured to the side walls of the drum whereby a closed compartment 39 is provided. Extending longitudinally of the drum and secured to communicate through the partition walls 34 at their opposite ends is a plurality of spaced oil heating tubes 35. Exhaust gases from the stack 38 on the heating furnace 27 are introduced into the compartment 39 by

means of the conduit 36 to heat the tubes 35. The blower 37 in the conduit 36 forces the gases into the compartment 39 which has the outlet conduit 40 which discharges the gases into the bottom of heating furnace 27, as will be seen in Figure 1 of the drawings. The stack 38 is provided with a rotatable damper 41. A valved by-pass conduit 42 is connected with the conduit 36, so that the exhaust gases may be shunted directly into the heating furnace whenever undesirable temperatures are reached in the heat exchanger. The compartment 43 formed between one of the partitions 34 and the end of the drum 33 receives the petroleum from the pump 23 through conduit 44, whereupon the petroleum passes through the tubes 35 and is heated by exhaust gases in the compartment 39, and then discharged through outlet 45 into the filter 22.

The water under pressure is conducted from a suitable source into the water heater indicated generally 46, by the conduit 47, and the heater may be of any suitable size and configuration.

The heater illustrated is formed of a pair of hollow casings 48, 49 the hollow casing 49 being placed inside of the casing 48 in spaced relation thereto on three sides to form a jacketed compartment and secured in this relationship by welding or riveting at the fourth side, as indicated at 51.

The exterior compartment 50 receives superheated steam through conduit 52, for the purpose of heating the water in the interior compartment 53 to a temperature between 210 to 212 degrees Fahrenheit. The compartment 53 has the outlet 54 in connection therewith. Leading from the exposed end of the interior compartment 53 are three valve controlled pipes 55, 55a and 55b, each of which is lead into a header 28 on the three heating coils 24, 25, and 26, in the heating furnace. Again referring to Figure 3 of the drawings, it will be seen that one of the three valved pipes 55, 55a and 55b from compartment 53 indicated at 55, is extended through the header 28 into the hot zone of one of the three coil pipes 24, 25 and 26 and where it is provided with a nozzle or atomizer 56 on its end contiguous the oil nozzle 31. The pipes 55, 55a and 55b, are each provided with a conventional flow meter 57 to control the time volume of flow of water which operates in connection with a needle valve arrangement to control the spraying of the oil from the orifice of the atomizer.

The heat exchanger 21 and the water heater 46 have gauge glasses 58 and 58a respectively, pressure gauges 59 and 59a and pyrometers 60 and 60a in connection therewith for facilitating perfect control of the petroleum and water vapors therein.

It has been found that successful results are obtained when water at approximately 210–212 degrees Fahrenheit and under

pounds per square inch pressure is discharged in a finely divided state into the path of finely divided petroleum vapors in the hot zone of the heating furnace coils, the petroleum vapors being at a temperature of three hundred and fifty degrees to four hundred degrees Fahrenheit, and under ninety pounds per square inch pressure. A proportion of sixty percent petroleum and forty percent water has been found desirable but the invention is not necessarily limited to any of the temperatures, pressures, and volumes stated herein.

The heating furnace 27 is of hollow vertical cylindrical shape having the stack 38 leading from the hollow interior 61 at the top thereof. The walls of the furnace are preferably formed of heat resistant fabric. Made as an integral part of the inner wall 62 at the lower end of the furnace is the Dutch oven or heating chamber 63. The oil burners 64 are arranged in the upper part of the Dutch oven so that the flame thereof will strike the lower end 65 of the kiln wall 62, which acts as a baffle so that the flame takes a circuitous path through the flue opening 66 into the bottom of the furnace. Air is supplied in a conventional manner to the oil burners 64 and by baffling the flame, oxidation and corrosion of the coils in the furnace is prevented.

There are three distinct coil units 24, 25 and 26, as heretofore described, supported in the interior 61 of the furnace in spaced relation to the walls thereof. The coils are formed of spaced helical pipes in the shape of a cylinder and the cylinder is vertically disposed.

The piping of the coils is of sufficient diameter to permit the expansion of the gases therein and sufficiently strong to withstand high temperatures. The lower end of the coil cylinder terminates at a considerable distance above the flue opening 66. Each of the coils 24, 25, 26 is formed at its lower end with a flange 67, so that detachable lower sections 68, 69, and 70 of these coils may be easily replaced when they are burned out. The upper end of each coil 24, 25, 26 extends out through the side of the furnace thru one of the headers 28, while the lower end of each coil 24, 25, 26 or rather the detachable sections 68, 69, 70 thereof extend outwardly of the kiln and are provided with a flange 71, 72, and 73. To each of these flanges is secured a three-way pipe casting indicated generally at 74, 75, and 76 in Figure 15. Referring particularly to Figure 16 of the drawings wherein one of the three way castings 74 preferably of high temperature steel is shown attached to the flange 71, it will be seen that one valved pipe leg 77 of this casting leads to the reaction chamber in the drawing indicated at 78, and that another valved pipe leg 79 of the casting leads to the other reaction chamber indicated

generally at 80, while the middle or third valved pipe leg 81 of the casting is arranged to be opened to the atmosphere for the purpose of closing down that particular coil with which the casting is associated, in the event of trouble or back pressure developing in the unit. The valves 77', 79', and 81' in the legs 77, 79 and 81, respectively, are of the quick acting type making it possible to quickly transfer the vapors and gases to either reaction chamber or to the atmosphere whenever it is desirable or necessary. The catalyzer unit comprises the lower end portion of each of the separable coil sections 68, 69 and 70, adjacent the couplings 71 to the three way valve. In the lower ends of these sections are carried the combined catalyzer and agitator elements indicated in dotted lines in Figure 15 and in side elevation and in cross section in Figures 14 and 17 respectively.

Each of the combined catalyzer and agitator elements is about four feet long and extends a considerable distance into the lower end of its associated coil section. Each of the catalyzer elements is formed of two longitudinally extending high temperature resisting metal rods 82 and 83 supported in spaced relation to each other by twisting chrome nickel wire 84 about the two rods in the manner shown in Figure 17. The wire net work 84 agitates the gas as it flows through whereby an ideal condition for the catalytic action of the chrome nickel upon the hot gases and vapors is promoted at this point in the flow of the vapors and gases.

The petroleum vapor passing through nozzle 31 in conjunction with the water vapor emitted from the nozzle 56 in each of the headers 28 flows downwardly in the furnace coils 24, 25, 26 at a rate not exceeding two gallons of oil and water per minute. The point in the furnace coils where oil and water enters ranges in temperature from six hundred to seven hundred degrees Fahrenheit, and the temperature at the half-way point ranges from eight hundred to nine hundred degrees Fahrenheit, while at the lower ends of the coils the temperature of the gases will range in the neighborhood of from nine hundred to twelve hundred degrees Fahrenheit. The pressure in the coils is kept as near atmosphere as is possible and will never exceed two pounds per square inch. The gentle curving helical coils reduce to a minimum the possibility of coating and by reason of their gently curving configuration in a downward direction there will be no possibility of carbon collecting in the helical coils.

At the mentioned temperatures and pressures it will be found that the vapors flow into the reaction chambers at a temperature of about nine hundred degrees Fahrenheit, and that 25 to 40 percent of the volume of the petroleum vapor and water vapor will have been converted into a fixed gas, and that from

ninety to ninety five percent of free carbon will be deposited in the reaction chamber.

Thus the amount of fixed gas leaving the catalyzer ranges from 25 to 40 percent with the remainder liquid oil and condensible vapors and other aromatics, coke, and the like depending upon the density of the petroleum and the temperatures in the heating furnace. The ideal temperature for the gases and vapors leaving the furnace is thought to be nine hundred degrees Fahrenheit, and when this temperature is maintained constant, the amount of fixed gas will run as high as about 40% on average petroleum residuums used in the process.

It has been found that the catalyzer and agitator elements eliminate the formation of high percentages of carbon dioxide and nitrogen, analysis showing that the catalytic and agitating action provided herein increases the hydrogen content and materially reduces the sulphur content; and furthermore the said catalyzer and agitation action permits the use of petroleum residuum ranging from sixteen to forty-two degrees Baumé whereas, without it is has been found impossible to successfully utilize petroleum residuum under 30 degrees Baumé. By providing that the water used be expanded in the coils at 210 to 212 degrees Fahrenheit while in the liquid stage and converted into steam at the hot zones of the heating coils all expansion of the water is accomplished in the coils whereby the velocity of the gases therein is increased, so that the depositing of carbon and coating of the coils is reduced to a minimum.

The reaction chambers 78 and 80 are vertically disposed, hollow drums having a plurality of angle bars 82a, secured to the inner walls thereof and extending longitudinally of the drum. The angle bars 82a are spaced at quadrants about the circumferential walls of the drum and have one leg thereof extending radially inwardly so as to baffle the flow of vapors and gases in the drum and thereby cause the uncombined carbon and other heavier particles contained in the vapor to be deposited. The legs 77 and 79 of the three way casting extend through the wall of the chamber at an inclination to the diameters of the drums and the ends thereof are curved as at 83a to cause the vapors introduced and gases to have a whirling circular path and give them opportunity to expand. The legs 77 and 79 enter the reaction chambers at a point adjacent the bottom thereof. A tube 84a of less diameter than the drum is secured at its upper end to the upper end of the drum and communicates with a pair of valved conductors 85, 86, whereby each of the drums may be selectively placed in connection with the expanders to be presently described.

The tube 84a extends on the axis of the drum in spaced relation to the side walls and the baffles 82a and has an open lower end ter-

minating above the bottom of the drum but below the point at which the gases and vapors are injected. By this arrangement the gases will be required to flow upwardly and downwardly in the drums before finding exit through the lower end of the tube 84a so as to insure that the maximum deposit of solid particles entrained therein will be made.

At their lower portions each of the drums 78, 80 is connected by means of three pipes 87 to a pump for pumping away any sludge that may form, and has adjacent to these pipes a clean out door 88, hingedly connected therewith. The pipes 85 and 86 are arranged so that one may be operated while the other is cut out to be cleaned. A steam pipe 89 is provided at the bottom of the drum and a large safety valve 90 leading to the atmosphere is connected at the top thereof to cool the chamber and blow out the deposits therefrom.

The oil gases and vapors entering the reaction chambers 78, 80 range in temperature from nine hundred to eleven hundred degrees Fahrenheit and leave the chambers at a temperature of about eight hundred and fifty to about ten hundred and fifty degrees Fahrenheit, so that very little reduction in temperature is suffered, and, therefore, little condensation of the vapors occurs. The chambers permit the vapors and gases to expand and decrease the velocity of flow of the vapors and gases through the action of the baffles and the circuitous path required to be taken by the vapors and gases. Most of the mechanically entrained matter is caused to be dropped in the reaction chambers.

Expander chambers provided here two in number are formed of hollow vertical drums 91, 92. Connection between the reaction chambers and the expanders is established by means of the valved pipes 85, 86, in such manner that each expander may be selectively communicated with either or both of the reaction chambers 78 and 80. The expanders are of larger diameter than the reaction chambers. The expanders 91, 92 have arched baffle walls at the bottom above the fuel burners 93, and 94 disposed on the opposite sides of the drum at the bottom of each expander. Below the oil burners, the air blast pipes 95 and 96 extend into the drum. A pair of clean-out doors 97, 98 are hingedly connected to the drum adjacent the burners. Intermediate the top and bottom, the drums are provided with explosion doors 99 which are resiliently connected to the walls of the drums to permit the escape of excess pressures above a predetermined point. Adjacent the top, each of the drums has a plurality of steam pipes 100 connected therewith adapted for blowing out gases prior to shutting it down for cleaning or rejuvenating after cutting out an expander. Leading from the top of each expander is a large pipe 101

having a quick acting-valve 102 to permit the escape of gases into the air when the expander is to be cleaned as pointed out. The interior of the drums 91 and 92 is provided with staggered fire brick checker work 103 which holds heat and requires gases and vapors to take a circuitous path therethrough to the outlet conductor 104, adjacent the bottom of the drum.

The expanders 91, 92 are built with brick throughout and with checker work hold heat a considerable time. The vapors and gases come into the reaction chambers at a temperature of from 850 to 1050 degrees Fahrenheit and are materially increased in temperature therein, while at the same time the volume of fixed gases is materially increased due to the resultant further expansion of gases at the increased temperature. The B. t. u. value of the gas is decreased in the expanders depending upon the retrograde temperature therein. The fixed gas leaving the reaction chambers has value of about 1050 B. t. u. which is too high for commercial purposes. In the expanders the remaining volume of the oil vapors and water vapors except that deposited as carbon, is formed into a fixed gas and at the same time the B. t. u. value is decreased from 1050 to approximately 550 B. t. u.

The expanders are arranged so that one can be operated while the other is being cleaned and reheated. The working temperature runs from 1800 degrees to 1200 degrees Fahrenheit, the higher temperature obtaining when the expander is cut into operation fresh after cleaning, and the lower temperature obtaining when the expander has accumulated deposit to a point where rejuvenation or cleaning is necessary. When an expander has cooled to twelve hundred degrees Fahrenheit the B. t. u. value of the gases flowing from the same is about 1050. The expander is then blown out with steam, through the pipe 101 and when thoroughly clean the oil burners and air blasts are lighted and with all outlets closed, the temperature is run up to about 1800 degrees Fahrenheit. This expander is then cut into service after extinguishing the burners and the other expander is closed down for like treatment. The first gases coming out of the expander at a temperature of 1800 degrees will run about 350 B. t. u., and during the natural retrogression of the temperature, all fires having been removed, the gases will increase in B. t. u. value until the temperature has reached about 1200 degrees, whereupon the other expander is ready to be cut out of service. It has been found that the mixture of gases in the storage tank will run an average of 550 to 600 B. t. u. per cubic foot, by this process.

There are two coolers 105, 106, of closed hollow rectangular configuration for each expander, each one of which has a sealed gas

tight plate 107 secured to its side walls intermediate its upper and lower walls. The conduits 104 extend from the expanders through the upper wall and terminate below the plate 107 in the coolers 105, 106 as will be seen in Figure 13, so that the gases from the expanders will be caused to flow through the water in the coolers in a horizontal plane below the level of the water from one end of the plate 107 to an opening 108 in the plate at the far side thereof and escape through the outlets 108 and 110 into the main conduit 111, which leads to the water scrubbing tank 112, to be presently described. It is to be understood that the level of the water in the coolers is at all times kept above the level of the dividing plate 107. The gases are cooled in the coolers from the expander temperature to approximately 70 degrees Fahrenheit. Some of the mechanically entrained particles in the gases are removed in the cooler as well as the freely soluble constituents of the gases. The unfixed portions of the oil and water vapors are also removed from the gases in the cooler. The level of the water in the coolers may be kept at a constant plane of flow by regulation of a valved inlet and the valved outlet 113.

The water scrubber 112 consists of a vertically disposed cylindrical tank, having 3 x 4 redwood planks disposed in checker work fashion as indicated at 114, in tiers, extending the entire height of the tank. The gas from the coolers flows into the tank at the bottom from lead line 111, rises through the checker work and passes out of the conduit 115 leading from the top of the tank into the oil scrubber 116. A constant stream of water flows through pipe 117 connected to the top of the tank so as to trickle downwardly over the redwood checkerwork, as the gas is flowing upwardly therethrough. The water drains from the tank through pipe 118.

The water scrubber is for the purpose of condensing any oil and water vapors that are not fixed by the previous steps of the process, and to wash the gases thoroughly of any carbon and asphaltic particles that are carried over mechanically.

Through the outlet conduit 115 leading from the top of the water scrubber 112, the gas enters the oil scrubber 116 adjacent the bottom thereof. The oil scrubber is formed substantially in the same manner as the water scrubber 116, except that oil instead of water is trickled down through the redwood checker work, from conductor 119, while the gas is flowing upwardly through the checker work. The gas rises through the checker work and is discharged through the conduit 120 into the top of the purifier 121. The oil from the bottom of the oil scrubber flows through the conduit 122 into the oil storage tank and may be used over and over again until its absorbing qualities are spent.

The oil scrubber eliminates a percentage of carbon monoxide and nitrogen and some other undesirable elements in the gas.

The purifier 121 consists of a hollow closed vertically disposed cylinder provided with a plurality of vertically spaced trays 123. The trays are supported upon annular angle brackets 124, which are secured to the side walls of the cylinder. The trays 123 are removably supported on the brackets and have foraminous bottoms 125 to permit the gas to flow freely therethrough. In each of the trays is supported layers 126, of iron oxide, of such mesh as to permit percolation of the gas therethrough. The sulphur content of the gas freely unites with the iron oxide as the gases pass therethrough, whereby this harmful ingredient is removed from the gas. If the sulphur content of the oil begun with is such as does not require to be extracted, it is within the contemplation of this invention to provide a suitable by-pass connection (not shown) directly from the oil scrubber 116 to the storage tank 127. When the sulphur content is to be removed, the gas from the oil scrubber 116 is entered into the top of the purifier 121 through conductor 120 so that it passes downwardly through the trays 123, and out of the purifier 121, by way of the conduit 128, into the gas storage tank 127.

The flow of the vapors of oil and water has been traced through each step in the process as the apparatus was described and a more detailed description thereof is believed to be unnecessary. From a point where the vapors leave the heating furnace, the following steps of the process are carried out at as nearly atmospheric pressure as possible.

It is to be understood that by describing in detail, any particular form, structure or operation, it is not intended to limit the invention beyond the terms of the several claims or the requirements of the prior art.

What is claimed is:

1. A process of making oil gas comprising injecting oil and water simultaneously in an atomized condition into and downwardly through heated coils having catalytic members within the lower portion of the coils, and thereby generating oil vapors and gases, then removing entrained solid carbon particles by passing the mixture of vapors upwardly and downwardly through a heated separating chamber having baffles for baffling the mixture, then expanding the mixture of oil vapors and gases and fixing the vapors by passing through a heated checker work chamber at a temperature of about 1200° F., then cooling and scrubbing the gas with water by passing through a scrubber and removing sulphur from the oil gas by passing through a gas purified containing iron oxide.

2. A process of making oil gas comprising injecting oil and water simultaneously in an atomized condition into and downwardly

through heated coils having catalytic members within the lower portion of the coils, and thereby generating oil vapors and gases, then removing entrained solid carbon particles by passing the mixture of vapors and gases upwardly and downwardly through a heated separating chamber having baffles for baffling the mixture, then expanding the mixture of oil vapors and gases and fixing the vapors by passing through a heated checker work chamber at a temperature of above 1200° F., then cooling and scrubbing the mixture with water by passing it through a scrubber, then further cooling and scrubbing the mixture with oil by passing it through a scrubber, and removing sulphur from the mixture by passing it through a gas purifier containing iron oxide.

3. A process of making oil gas comprising injecting oil and water simultaneously in an atomized condition into and downwardly through heated coils having catalytic members within the lower portion of the coils, and thereby generating oil vapors and gases, then removing entrained solid carbon particles by passing the mixture of vapors and gases upwardly and downwardly through a heated separating chamber having baffles for baffling the mixture, then expanding the mixture of oil vapors and gases and fixing the vapors by passing through a heated checker work chamber at a temperature of above 1200° F., then removing the readily soluble materials from the mixture by bubbling the mixture through water, then cooling and scrubbing the mixture with water by passing it through a scrubber, and removing sulphur from the mixture by passing it through a gas purifier containing iron oxide.

4. A process of making oil gas comprising injecting oil and water simultaneously in an atomized condition into and downwardly through heated coils having catalytic members within the lower portion of the coils, and thereby generating oil vapors and gases, then removing entrained solid carbon particles by passing the mixture of vapors and gases upwardly and downwardly through a heated separating chamber having baffles for baffling the mixture, then expanding the mixture of oil vapors and gases and fixing the vapors by passing through a heated checker work chamber at a temperature of above 1200° F., then cooling and scrubbing the mixture with water by passing it through a scrubber, and removing sulphur from the mixture by passing it through a gas purifier containing iron oxide, said oil and said water being atomized by means of a pressure approximating ninety pounds per square inch acting through nozzles passing not exceeding two (2) gallons of oil and water per minute into said heated coils.

5. A process of making oil gas comprising injecting oil of from (16) sixteen to (42)

forty-two degrees Baumé, and water simultaneously in an atomized condition into and downwardly through heated coils having catalytic members within the lower portion
 5 of the coils, and thereby generating oil vapors and gases, then removing entrained solid carbon particles by passing the mixture of vapors and gases upwardly and downwardly through a heated separating chamber having
 10 baffles for baffling the mixture, then expanding the mixture of oil vapors and gases and fixing the vapors by passing through a heated checker work chamber at a temperature of above 1200° F., then cooling and scrubbing
 15 the mixture with water by passing it through a scrubber, and removing sulphur from the mixture by passing it through a gas purifier containing iron oxide.

6. A process of making oil gas comprising
 20 injecting oil of from (16) sixteen to (42) forty-two degrees Baumé, and water simultaneously in an atomized condition into and downwardly through heated coils having catalytic members within the lower portion
 25 of the coils, and thereby generating oil vapors and gases, then removing entrained solid carbon particles by passing the mixture of vapors and gases upwardly and downwardly through a heated separating chamber having
 30 baffles for baffling the mixture, then expanding the mixture of oil vapors and gases and fixing the vapors by passing through a heated checker work chamber at a temperature of above 1200° F., then cooling and scrubbing
 35 the mixture with water by passing it through a scrubber, and removing sulphur from the mixture by passing it through a gas purifier containing iron oxide, said oil and said water being atomized by means of a pressure approximating (90) ninety pounds per square
 40 inch acting through nozzles passing not exceeding two (2) gallons of oil and water per minute into said heated coils.

7. A process of making oil gas comprising
 45 injecting oil of from (16) sixteen to (42) forty-two degrees Baumé, and water preheated to approximately the boiling point simultaneously in an atomized condition into and downwardly through heated coils having
 50 catalytic members within the lower portion of the coils, and thereby generating oil vapors and gases, then removing entrained solid carbon particles by passing the mixture of vapors and gases upwardly and downwardly through
 55 a heated separating chamber having baffles for baffling the mixture, then expanding the mixture of oil vapors and gases and fixing the vapors by passing through a heated checker work chamber at a temperature of above
 60 1200° F., then cooling and scrubbing the mixture with water by passing it through a scrubber, and removing sulphur from the mixture by passing it through a gas purifier containing iron oxide.

65 8. A process of making oil gas comprising

injecting oil of from (16) sixteen to (42) forty-two degrees Baumé, and water preheated to approximately the boiling point simultaneously in an atomized condition into and downwardly through heated coils having
 70 catalytic members within the lower portion of the coils, and thereby generating oil vapors and gases, then removing entrained solid carbon particles by passing the mixture of vapors and gases upwardly and downwardly through a heated separating chamber
 75 having baffles for baffling the mixture, then expanding the mixture of oil vapors and gases and fixing the vapors by passing through a heated checker work chamber at a temperature of above 1200° F., then cooling and scrubbing the mixture with water by
 80 passing it through a scrubber, and removing sulphur from the mixture by passing it through a gas purifier containing iron oxide, said oil and said water being atomized by means of a pressure approximating (90) ninety pounds per square inch acting through
 85 nozzles passing not exceeding two (2) gallons of oil and water per minute into said heated coils.

9. A process of making oil gas comprising
 injecting oil of from (16) sixteen to (42) forty-two degrees Baumé, and water preheated to approximately the boiling point simultaneously in an atomized condition into and downwardly through heated coils having
 95 catalytic members within the lower portion of the coils, and thereby generating oil vapors and gases, then removing entrained solid carbon particles by passing the mixture of vapors and gases upwardly and downwardly through a heated separating chamber
 100 having baffles for baffling the mixture, then expanding the mixture of oil vapors and gases and fixing the vapors by passing through a heated checker work chamber at a temperature of above 1200° F., then cooling and scrubbing the mixture with water by passing
 105 it through a scrubber, and removing sulphur from the mixture by passing it through a gas purifier containing iron oxide, said oil before injection being preheated to a temperature of from 350 to 400 degrees Fahrenheit.

10. A process of making oil gas comprising
 injecting oil of from (16) sixteen to (42) forty-two degrees Baumé, and water preheated to approximately the boiling point simultaneously in an atomized condition into and downwardly through heated coils having
 120 catalytic members within the lower portion of the coils, and thereby generating oil vapors and gases, then removing entrained solid carbon particles by passing the mixture of vapors and gases upwardly and downwardly through
 125 a heated separating chamber having baffles for baffling the mixture, then expanding the mixture of oil vapors and gases and fixing the vapors by passing through a heated check-
 130

er work chamber at a temperature of above 1200° F., then cooling and scrubbing the mixture with water by passing it through a scrubber, and removing sulphur from the
5 mixture by passing it through a gas purifier containing iron oxide, said oil and said water being atomized by means of a pressure approximating (90) ninety pounds per square
10 inch acting through nozzles passing not exceeding two (2) gallons of oil and water per minute into said heated coils, said oil before injection being preheated to a temperature of from 350 to 400 degrees Fahrenheit.

In testimony whereof I affix my signature.

15 RICHARD EUGENE WHITLOCK.