J. H. PARKER.

PROCESS FOR THE TREATMENT OF OILS.

APPLICATION FILED JUNE 1, 1909.

958,820. **Patented May 24, 1910.**

5 SHEETS—SHEET 1.

Fig. 1.

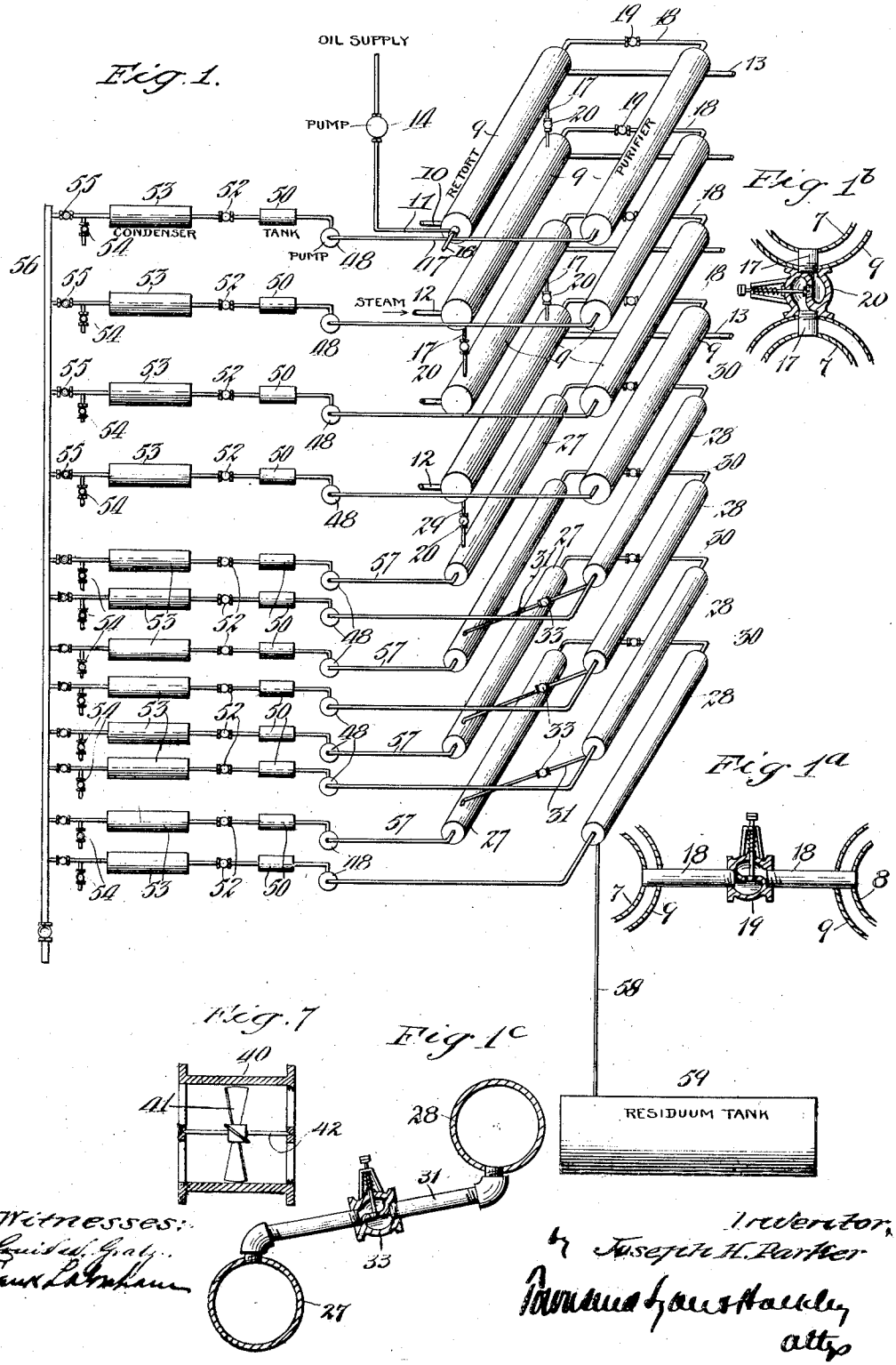

Fig. 1b

Fig. 1a

Fig. 7

Fig. 1c

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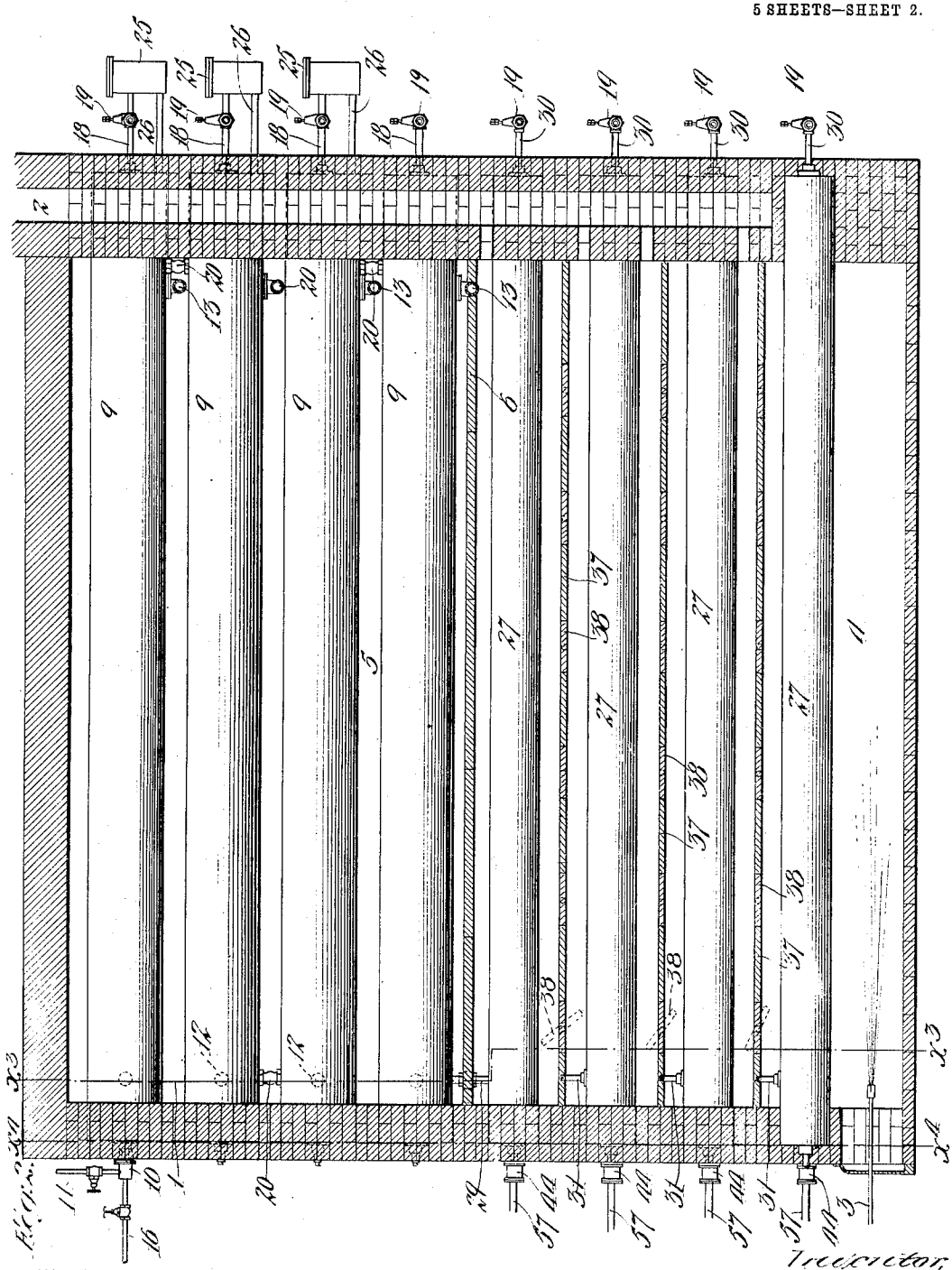
5 SHEETS—SHEET 2.



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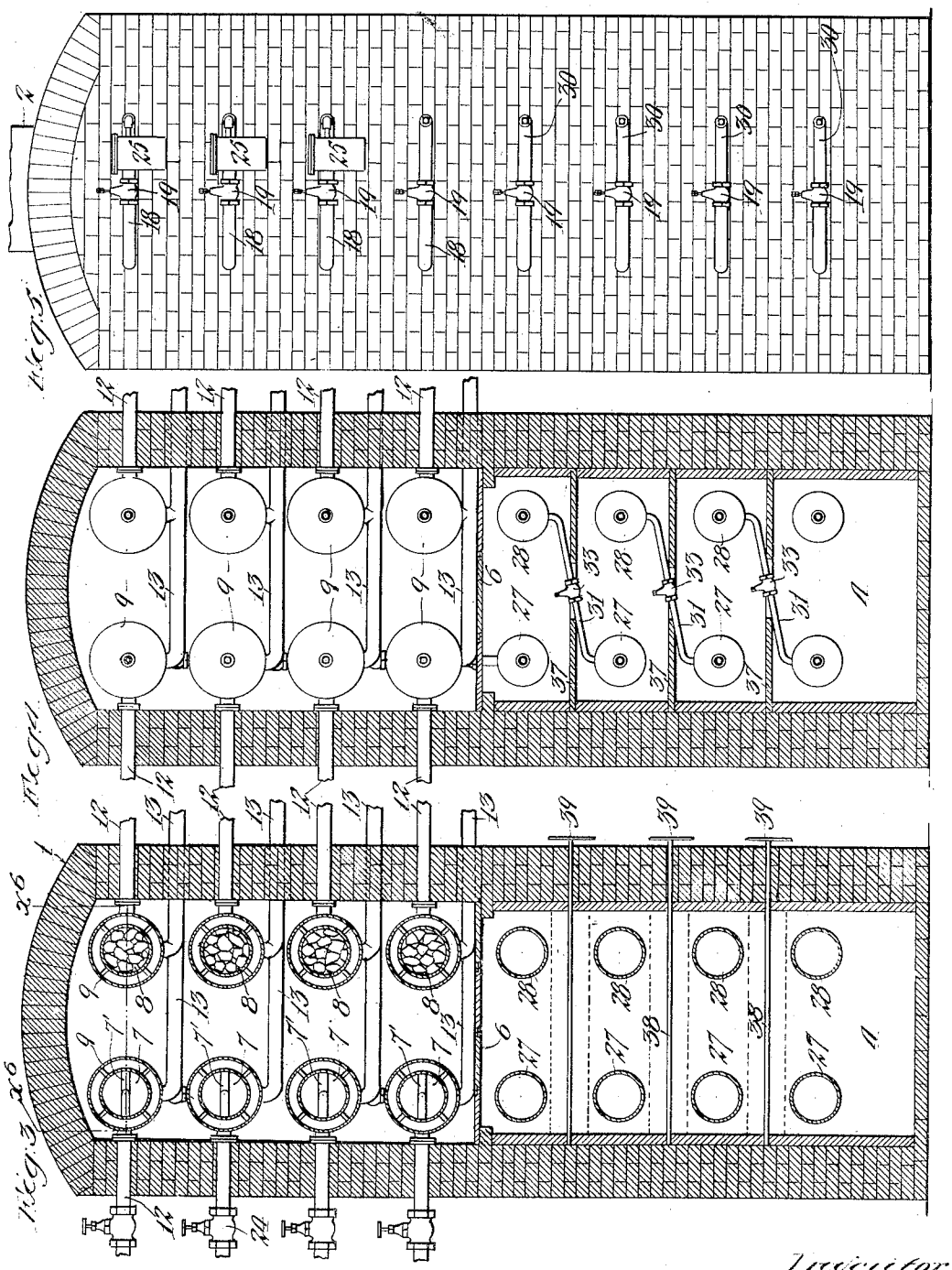
5 SHEETS—SHEET 3.



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5 SHEETS—SHEET 4.

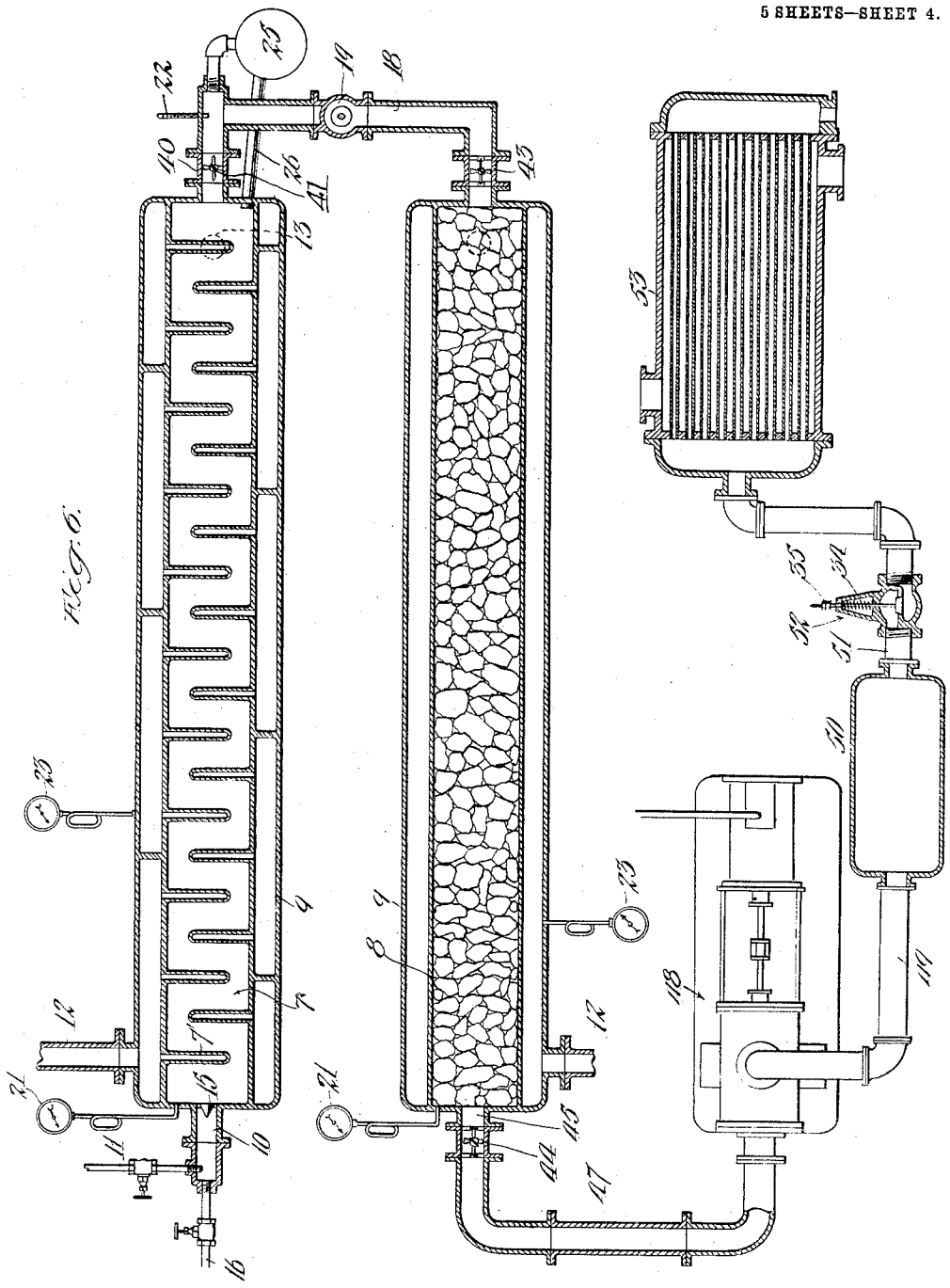

Fig. 6.

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5 SHEETS—SHEET 5.

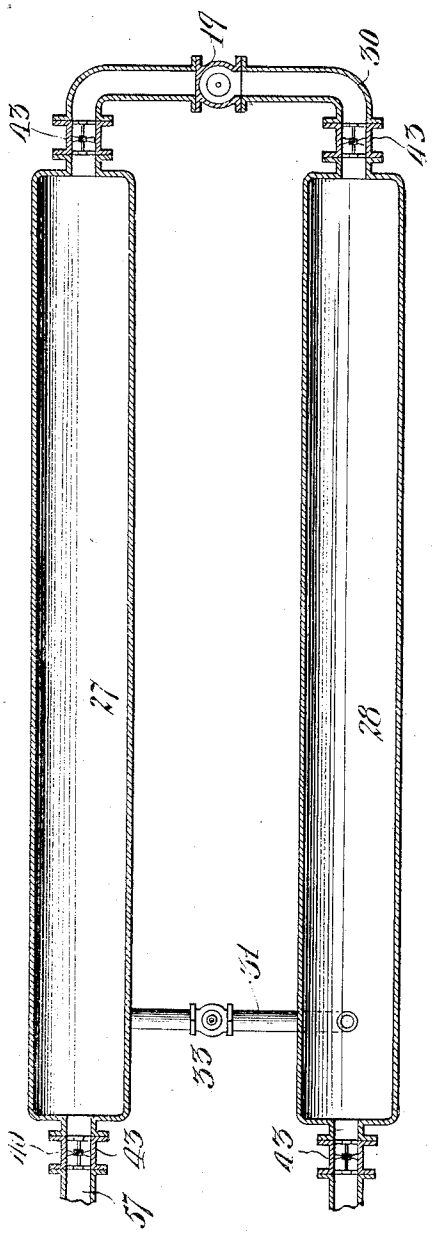

Fig. 8.

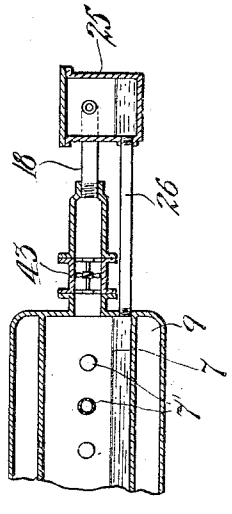

Fig. 9.

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UNITED STATES PATENT OFFICE.

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PROCESS FOR THE TREATMENT OF OILS.

958,820. Specification of Letters Patent. Patented May 24, 1910.

Application filed June 1, 1909. Serial No. 499,586.

To all whom it may concern:

Be it known that I, JOSEPH H. PARKER, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Process for the Treatment of Oils, of which the following is a specification.

This invention relates to the treatment of hydrocarbon oils for the production of one or more oil products therefrom, said oil products being, in general, of less density and viscosity than the original oil.

The main object of the present invention is to provide for effecting the transformation or separation of the oil in the most rapid and economical manner.

I have discovered that in the distillation of oils, the maximum quantity of liquid hydrocarbons, is obtained by distillation under high pressure and low temperature, with subsequent rapid condensation, and an important object of the present invention is to utilize the advantages of such a mode of operation.

A further object of the invention is to provide for producing a plurality of products of different density, each product being of definite character.

The accompanying drawings illustrate the invention, and referring thereto: Figure 1 is a diagrammatic perspective of an apparatus suitable for carrying out the process, this figure omitting certain parts of the apparatus, viz., the foam traps which are shown in other figures. Figs. 1^a, 1^b and 1^c are detail sections of automatically operating valves controlling the passage of oil between successive members of the apparatus. Fig. 2 is a longitudinal section of the retort means. Fig. 3 is a vertical section on the line x^3—x^3 in Fig. 2. Fig. 4 is a vertical section on the line x^4—x^4 in Fig. 2. Fig. 5 is a rear elevation of the retort apparatus. Fig. 6 is a horizontal section on the line x^6—x^6 in Fig. 3. Fig. 7 is a sectional view of one of the atomizing devices. Fig. 8 is a horizontal section through the lower series of retorts. Fig. 9 is a vertical, longitudinal section of the outer end portion of one of the retorts with the adjacent devices.

The process consists essentially in forcing oil, together with steam, at high velocity into a chamber which is maintained under pressure, causing the oil while in said chamber to be broken up and to be distributed over an extended surface to generate a vapor, withdrawing from time to time a portion of the vapor so generated from said chamber, withdrawing the unvaporized portion of the oil from said chamber, and passing it into a second chamber, repeating such operation in said second chamber, and continuing this operation in a series of steps, the oil being divided at each step into a vaporized portion and an unvaporized portion, and the vaporized portion being withdrawn suddenly and in successive intermittent discharges from the respective chambers.

The process further comprises the treatment of the vapor portions liberated intermittently from the successive chambers by compression thereof and subsequent condensation to form a plurality of oil products of definite character.

The process further comprises the pulverization or atomization of the oil or the mixture of oil, steam and vapor as it is being withdrawn from the chambers and in subsequent stages in order to subdivide and mechanically break up the oil and increase the amount of vaporization.

An important feature of the process is the dependence on mechanical action of division and extension of the oil over surfaces for the formation of vapor therefrom for dividing the oil into its component parts, rather than on the chemical effect of heat in breaking up the oil or changing its chemical combinations.

In the present process heat is used at progressively higher temperatures in forming the vapors at progressive stages of the process, but the operation of such heat is in facilitating and determining the vaporization of a definite hydrocarbon or oil product having a certain boiling point.

The apparatus for carrying out the process comprises retort means for subdividing the oil and exposing it over an extended surface at progressively higher temperatures, to generate successive portions of vapor therefrom, pulverizing or atomizing means for mechanically breaking up and mixing the vaporous products, means for drawing off vaporized product from the retort means and compressing the same, automatically operating means for causing such withdrawal of the vaporized product to be intermittent and at determinate pressures, means for compressing the vapors, means

for condensing the compressed product, and means for delivering the condensed liquids, separately or blended, as may be required.

The retort apparatus comprises a hollow structure or chamber 1 formed, for example, of masonry and provided at one end with a stack 2 and at the other end, at the lower portion thereof, with means for application of direct heat, for example, a burner 3. The interior space of the retort is divided into a lower chamber 4 heated by direct heat, and an upper chamber 5 which is divided from the lower chamber by a horizontal partition 6. A plurality or series of retorts 7 are provided in the upper chamber 5, said retorts being preferably in vertical series, say at one side of the chamber 5, and a corresponding set or plurality of series of purifier cylinders or shells 8 being arranged in a vertical series at the other side of the chamber 5. Retorts 7 have inwardly extending porcupine tubes 7′ to give a greater heating surface.

Means are provided for heating the retorts 7 and the purifier shells 8, preferably by indirect heat, for example, steam or hot water, said means consisting, for example, of a jacket or outer shell 9 around each retort 7, and around each of the shells 8 and steam inlet and outlet connections 12, 13 for said jackets.

The first retort 7 is provided with means for injecting or forcing oil thereinto, said means comprising an inlet chamber 10, an oil supply pipe 11 leading thereinto and connected to an oil pump 14, and a steam supply 16 connected to any suitable source of steam pressure. The outlet from chamber 10 to retort 7 is provided with a deflecting cone 15 which causes the oil and steam to issue into the retort 7 in a sheet or spray, at high velocity.

The retorts 7 are connected in series, a pipe 17 leading from the bottom of each retort 7 near one end thereof, to the top of the corresponding end of the next lower retort, these pipes being placed alternately at opposite ends of the successive retorts, so that the oil in passing through the series has to pass the full length of each retort. A pipe 18 leads from the delivery end of each retort 7 to the corresponding purifier shell 8, said pipe having a spring operated automatic relief valve 19 operating automatically under a definite difference of pressure within the retort and the corresponding purifier shell of the chamber 8. A similar relief valve 20 is included in each pipe 17 so that the passage of oil from each retort to the next is governed by said automatic valve according to the difference of condition of pressure existing in said retorts.

Pressure gages 21 are connected to the retort 7 and purifier shell 10 and steam pressure gages 23 are connected to the jackets 9, whereby definite condition of pressure may be maintained in the retort and purifier shell and a definite condition of temperature may be maintained in said parts by reading a thermometer 22 connected to the retorts and controlling the steam pressure by means of manual valves 24 in the steam supply connections.

A foam trap 25 may be connected to the outlet connection 18 of each retort 7, said foam trap consisting of a chamber having a lateral opening to said outlet connection and having a discharge connection or pipe 26 at its lower portion leading back into the retort 7.

In the lower chamber 4 are provided two vertical series of retorts 27, 28, at the respective sides of the chamber, connected to receive the oil from the series of retorts in the upper chamber, a pipe 29 conducting the oil from the discharge end of the lowermost retort 7 to one end of the uppermost retort of the series 27, a discharge pipe 30 leading from the farther end of said retort 27 to the corresponding end of the opposite retort 28, and a pipe 31 leading obliquely downward from the forward end of the last named retort to the next retort in the series 27 at the forward end thereof and so on, each retort 27 being connected at its rear end to a corresponding end of the opposite retort 28, and said retort 28 being connected at its forward end to the corresponding end of the next lower retort 27. Relief valves 33 are provided in each of the pipes 31 opening under a definite difference of pressure. The relief valves 19, 20 and 33 may be of the construction shown in Fig. 6 comprising a spring 34 holding the valve to its seat but opening under a definite pressure, adjusting means 35 being provided to adjust the pressure of the spring.

Horizontal partitions 37 are provided in the lower chamber 4 between each pair of retorts 27, 28, and the next lower pair, so that the said chamber 4 is divided into a series of heating chambers, each containing a pair of retorts. These horizontal partitions 37 are provided with movable dampers 38 having handles 39 whereby one or more of the valves may be opened as shown in dotted lines in Fig. 2, so that more or less communication may be established between the several chambers aforesaid and the heat may be progressively graduated from the higher temperature in the lowermost chamber to successively lower temperatures in the overlying chambers.

In the outlet connection from each retort 7 to the connecting pipe 18 is provided a pulverizer or atomizing device consisting of a fan 43 mounted to rotate on a horizontal shaft 42 in a casing 40 and extending in the outlet connection in such manner as to be rotated by the current of vapor passing

through said connection and by its mechanical action to agitate and mechanically mix the vapor. A similar pulverizer or atomizing device 43 may be provided in the inlet connection from the said pipe 18 to the purifying shell, and another similar pulverizer 43 in the outlet connection 45 from the purifier shell 8 and each inlet and outlet connection of the retorts 26, 28 in the lower series (see Fig. 8).

From the delivery end of each purifier shell 8 a pipe 47 leads to a pump 48 whose outlet is connected by a pipe 49 to a pressure tank 50. The outlet pipe 51 of said pressure tank is connected through a relief valve 52 similar to relief valve 19, to a condenser 53, which may be, for example, a tubular condenser as shown in Fig. 6. Separate valved outlet connections 54 are provided for each condenser 53 and these outlet connections may also be connected through valves 55 to a pipe 56 whereby the product of any one of the retorts may be blended with the product of any one or more of the other retorts.

The delivery end of each of the retorts 27, 28, in the lower chamber 4 is connected through a pipe 57 to a corresponding pump 48. The pumping and condensing set consists of pump 48, pressure tank 50, automatic relief valve 52, condenser 53, an outlet valve 54 being provided for each vapor delivery pipe 47, 57, so that the product of each retort 7 and of each retort 27, 28 is separately compressed, condensed and delivered. From the final tank 28 a pipe 58 leads to a residuum tank 59.

The process is carried out as follows:— The oil is forced under pressure into the inlet chamber 10 together with steam supplied through pipe 16 and passing the device 15 it is atomized or pulverized so that it enters the first retort chamber 7 in a state of extreme fine division. In this chamber the oil is subjected to the heat passing through the walls of the chamber from the surrounding steam jacket, the walls of the chamber and of the porcupine tubes 7′ thereof providing an extended surface which is covered with a film of oil. This atomization of the oil and its distribution over the heated surface produces a continual development of oil vapor. Simultaneously with this operation the pumps 48 operate to produce a condition of suction in each purifier and the retort connected therewith, the pump drawing the vapor from the purifier and the vapor flowing from the retort through the pipe 18 to the purifier. This operation is intermittent, the relief valve 19 opening when a certain condition of pressure in the retort 7, accompanied by a certain condition of suction in the purifier 8, is attained and the vapor then flowing through the pipe 18 from the retort 7 to the purifier 8 until the difference of pressures becomes sufficiently equalized to allow the relief valve 19 to close. The relief valve is adjusted or set according to the pressure at which the oil is to be vaporized. The greater the pressure of the spring in the relief valve, the higher will be the pressure at which the vapor passes over, and the heavier will be the quantity of the product. The range of pressures will depend on the number and grade of products into which the oil is to be separated. The vapor passing in this manner from the retort 7 is agitated or mechanically acted upon by the rotary devices or fans 43, so as to further atomize or break up into particles all liquids carried by the vapors. Any foam passing over with the vapor is caught by the foam trap 25, the chamber of which is of sufficient size to allow the foam to settle into liquid which is drawn through pipe 26 to the lower portion of retort 7. The vapor which has passed through the connection 18 aforesaid to the purifier shell 8 is acted on by suitable material indicated at 60 in said shell, to remove deleterious substances therefrom and is then drawn from the other end of the purifier shell past the atomizing device 45 to the pump 48 by which it is compressed into the pressure tank 50, whence it escapes through the relief valve 52 to the condenser 53. The purifying material may consist, for example, of fifty per cent. lime coke, ten per cent. sodium chlorid, thirty per cent. oxid of iron and ten per cent. colemanite. The relief valve 19 is preferably so adjusted that the above described operation is intermittent, the pressure accumulating in the retort 7 until it is sufficient to open the relief valve 19 in the outlet thereof and allow a certain amount of vapor to be drawn quickly past the atomizers 40, 43, and pumped into the pressure tank. By this sudden expansion from a high pressure I have found it possible to secure maximum atomization of the oil and consequent vaporization at a definite temperature, and also to obtain the maximum amount of resulting liquid of the desired grade.

As stated, efficient atomization and subsequent liquefaction requires expansion from a condition of high pressure, and the supply of heat to the expanding oil by conduction through the walls of the retort requires a retort surface of great extension, and even with such a construction there is required considerable time for accumulation of the heat in the oil and vapor before it reaches the condition for expansion. By intermittent release of the oil and vapor from the retort time is allowed for this accumulation of heat, the process consisting in this respect of alternate accumulation of heat in the oil in the retort until the requisite pressure is attained, followed by sudden release of the oil and vapor from this condition of pressure. The intermittent action is, there-

fore, a necessary feature of the process in that it is only possible by such intermittent release of the oil to provide for the necessary accumulation of heat in the oil. The oil passing into the first retort 7 under pressure generates a certain amount of vapor under pressure as that above described, and the unvaporized portion of the oil accumulates in the bottom of the first retort 7, and eventually under the suction of the system and the pressure at the inlet a condition is attained where the pressure of the oil in the first retort is sufficient to open the relief valve 20 connecting with the second retort 7, so that the oil in the first retort, or a definite portion thereof, is discharged into the second retort. The relief valves 19, 20, in the vapor and oil connections for the first retort are preferably so adjusted that the discharge of vapor and the discharge of oil from the first retort take place at substantially the same pressure. Under these conditions it is found in practice that the relief valves operate successively so that they do not interfere with one another's action. The oil enters the second retort 7 from the atomizer 43 in a finely divided condition and in said second retort is subjected to the same operation as above described, the heat in the second retort being preferably somewhat higher than in the first retort, this being effected by the proper adjustment of the steam supply, so that there is produced in the second retort a vapor representing a product of lower boiling point than that generated in the first retort, and this product is drawn off intermittently through the automatic relief valve and the corresponding purifier, pump, presure tank and condenser and so on for each succeeding retort 7. When the oil has thus become exhausted of the constituents which are capable of distillation with steam pressure, it passes to the first of the retorts 27 where it is subjected to direct heat in the lower chamber 4, and from this retort it passes successively to the first retort of the series 28 and then back and down to the second retort of the series and so on, the heat increasing progressively in the sets or pairs of retorts 27, 28, as the oil descends, so that at each retort or pairs of retorts a product of definite boiling point is drawn off through pipes 57, pumps 58, etc., this operation being controlled by relief valves 33 as with the retorts above described, so that the withdrawal of vapor takes place intermittently and suddenly, and a maximum amount of liquid product is thereby obtained.

What I claim is:—

1. The process of producing from crude petroleum one or more products of lighter gravity, which consists in forcing the petroleum in finely divided condition into a chamber under pressure, continuously supplying heat by conduction to said chamber to cause the heat to accumulate in the oil and thereby causing the petroleum oil in said chamber to generate vapor under pressure, intermittently withdrawing successive portions of such vapor from the chamber, when the vapor in the chamber attains a definite condition of pressure and condensing the portions of vapor so produced.

2. The process of producing from crude petroleum one or more products of lighter gravity, which consists in forcing the petroleum in finely divided condition into a chamber under pressure, continuously supplying heat by conduction to said chamber to cause the heat to accumulate in the oil and thereby causing the petroleum oil in said chamber to generate vapor under pressure, intermittently withdrawing successive portions of such vapor from the chamber when the vapor in the chamber attains a definite condition of pressure, compressing the portions so withdrawn, and condensing the compressed product.

3. The process of treating petroleum which consists in causing the petroleum to pass successively through a series of chambers, the petroleum being forced into each chamber in a finely divided condition and maintained under pressure in each chamber, imparting heat to the petroleum in each chamber to generate vapor under pressure therein, allowing the petroleum to escape from each chamber to the succeeding chamber under definite difference of pressure between said chambers, intermittently withdrawing from each chamber a portion of the vapor generated therein under a definite condition of pressure in said chamber, and condensing the portions so withdrawn, the successive chambers being of successively higher temperature so that the products obtained therefrom are of different boiling point.

4. The process of treating petroleum which consists in causing the petroleum to pass successively through a series of chambers, the petroleum being forced into each chamber in a finely divided condition and maintained under pressure in each chamber, imparting heat to the petroleum in each chamber to generate vapor under pressure therein, allowing the petroleum to escape from each chamber to the succeeding chamber under definite difference of pressure between said chambers, withdrawing from each chamber a portion of the vapor generated therein under a definite condition of pressure in said chamber, and compressing and subsequently condensing the portions so withdrawn, the successive chambers being of successively higher temperature so that the products obtained therefrom are of different boiling point.

5. The process of producing from crude

petroleum one or more products of lighter gravity, which consists in forcing the petroleum in finely divided condition into a chamber under pressure, continuously imparting heat to the petroleum while in said chamber by conduction through the walls of said chamber and thereby causing the petroleum oil in said chamber to generate vapor under pressure, intermittently withdrawing successive portions of such vapor from the chamber when sufficient heat has been accumulated in the oil to produce a definite pressure, subjecting the vapor in its withdrawal to mechanical mixing action, and condensing the portions of vapor so produced.

6. The process of producing from crude petroleum one or more products of lighter gravity, which consists in forcing the petroleum in finely divided condition into a chamber under pressure, continuously imparting heat to the petroleum while in said chamber by conduction through the walls of said chamber and thereby causing the petroleum oil in said chamber to generate vapor under pressure, intermittently withdrawing successive portions of such vapor from the chamber when sufficient heat has been accumulated in the oil to produce a definite pressure, subjecting the vapor in its withdrawal to action of purifying material, and condensing the portions of vapor so produced.

7. The process of producing from crude petroleum one or more products of lighter gravity, which consists in forcing the petroleum in finely divided condition into a chamber under pressure, continuously imparting heat to the petroleum while in said chamber by conduction through the walls of said chamber and thereby causing the petroleum oil in said chamber to generate vapor under pressure, intermittently withdrawing successive portions of such vapor from the chamber when sufficient heat has been accumulated in the oil to produce a definite pressure, subjecting the vapor in its withdrawal to mechanical mixing action and to the action of purifying material and condensing the portions of vapor so produced.

8. The process of producing from crude petroleum one or more products of lighter gravity, which consists in forcing the petroleum in finely divided condition into a chamber under pressure, continuously imparting heat to the petroleum while in said chamber by conduction through the walls of said chamber and thereby causing the petroleum oil in said chamber to generate vapor under pressure, intermittently withdrawing successive portions of such vapor from the chamber when sufficient heat has been accumulated in the oil to produce a definite pressure, subjecting the vapor in its withdrawal to mechanical mixing action, compressing the portions so withdrawn, and condensing the compressed product.

9. The process of producing from crude petroleum one or more products of lighter gravity, which consists in forcing the petroleum in finely divided condition into a chamber under pressure, continuously imparting heat to the petroleum while in said chamber by conduction through the walls of said chamber and thereby causing the petroleum oil in said chamber to generate vapor under pressure, intermittently withdrawing successive portions of such vapor from the chamber when sufficient heat has been accumulated in the oil to produce a definite pressure, subjecting the vapor in its withdrawal to action of purifying material, compressing the portions so withdrawn, and condensing the compressed product.

10. The process of producing from crude petroleum one or more products of lighter gravity, which consists in forcing the petroleum in finely divided condition into a chamber under pressure, continuously imparting heat to the petroleum while in said chamber by conduction through the walls of said chamber and thereby causing the petroleum oil in said chamber to generate vapor under pressure, intermittently withdrawing successive portions of such vapor from the chamber when sufficient heat has been accumulated in the oil to produce a definite pressure, subjecting the vapor in its withdrawal to mechanical mixing action and to the action of purifying material, compressing the portions so withdrawn, and condensing the compressed product.

11. The process of producing from crude petroleum one or more products of lighter gravity, which consists in forcing the petroleum in finely divided condition into a chamber under pressure, continuously supplying heat to the petroleum by conduction through the walls of said chamber, causing the heat to accumulate in the petroleum to generate vapor under pressure, allowing the vapor to escape from the chamber under such condition of pressure, pumping the escaping vapor to maintain a condition of suction at the point of escape from the chamber and to compress the vapor, and subsequently condensing the escaping vapor.

12. The process of producing from crude petroleum one or more products of lighter gravity, which consists in forcing the petroleum in finely divided condition into a chamber under pressure, continuously imparting heat to the petroleum in the chamber by conduction through the walls of the chamber to cause the petroleum to generate vapor under a definite condition of pressure, allowing the vapor to escape from the chamber under such definite condition of

pressure, intermittently pumping the produced vapor by intermittent action to maintain a condition of suction at the point of escape from the chamber, and to subsequently compress the vapor, subjecting the vapor as it is escaping from the chamber to the action of the purifying material, and condensing the vapor subsequent to the purifying and compression operations.

13. The process of treating petroleum, which consists in causing petroleum to pass successively through a series of chambers, the petroleum being forced into each chamber in a finely divided condition and maintained under pressure in each chamber, continously imparting heat to the petroleum in each chamber to generate vapor under pressure therein, allowing the petroleum to escape from each chamber to the succeeding chamber under definite difference of pressure between each chamber, allowing the vapor generated in each chamber to escape therefrom under definite condition of pressure in said chamber, pumping the escaping vapor to maintain a condition of suction at the point of escape and to compress the vapor, subjecting the vapor subsequent to its escape to mechanical mixing action and to the action of purifying material, and condensing the portions of vapor subsequent to the mixing, purifying and compressing operations, successive chambers being maintained at successively higher temperatures so that the products obtained therefrom are of different boiling point.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 25th day of May 1909.

JOSEPH H. PARKER.

In presence of—

ARTHUR P. KNIGHT,

FRANK L. A. GRAHAM.