

Dec. 18, 1923.

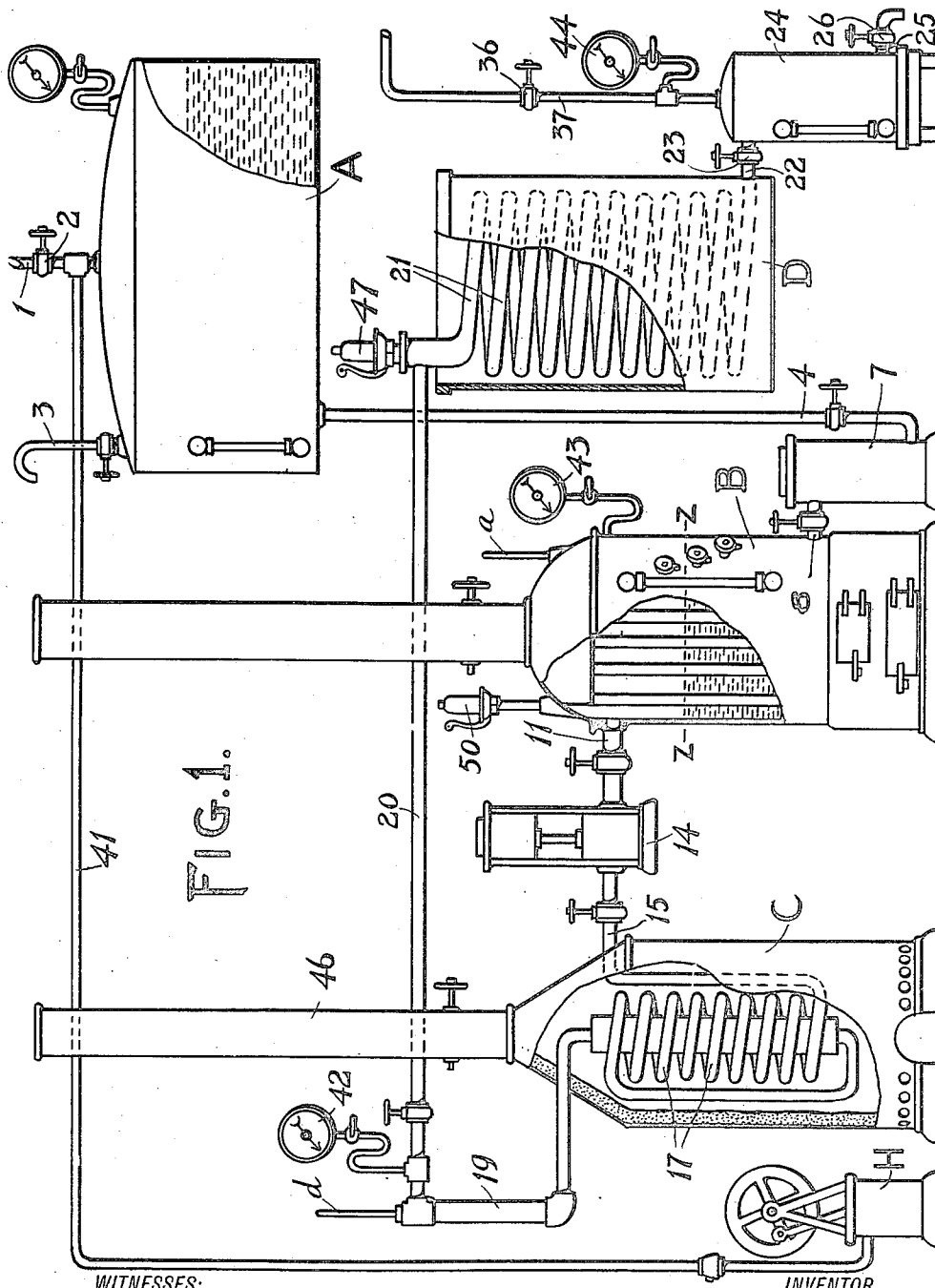
J. H. ADAMS

1,477,860

OIL CONVERTING APPARATUS FOR THE CONVERSION AND TRANSFORMATION OF OILS

Filed April 6, 1916

4 Sheets-Sheet 1



WITNESSES:

INVENTOR

A. Capstick
Joseph H. Adams

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Dec. 18, 1923.

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4 Sheets-Sheet 2

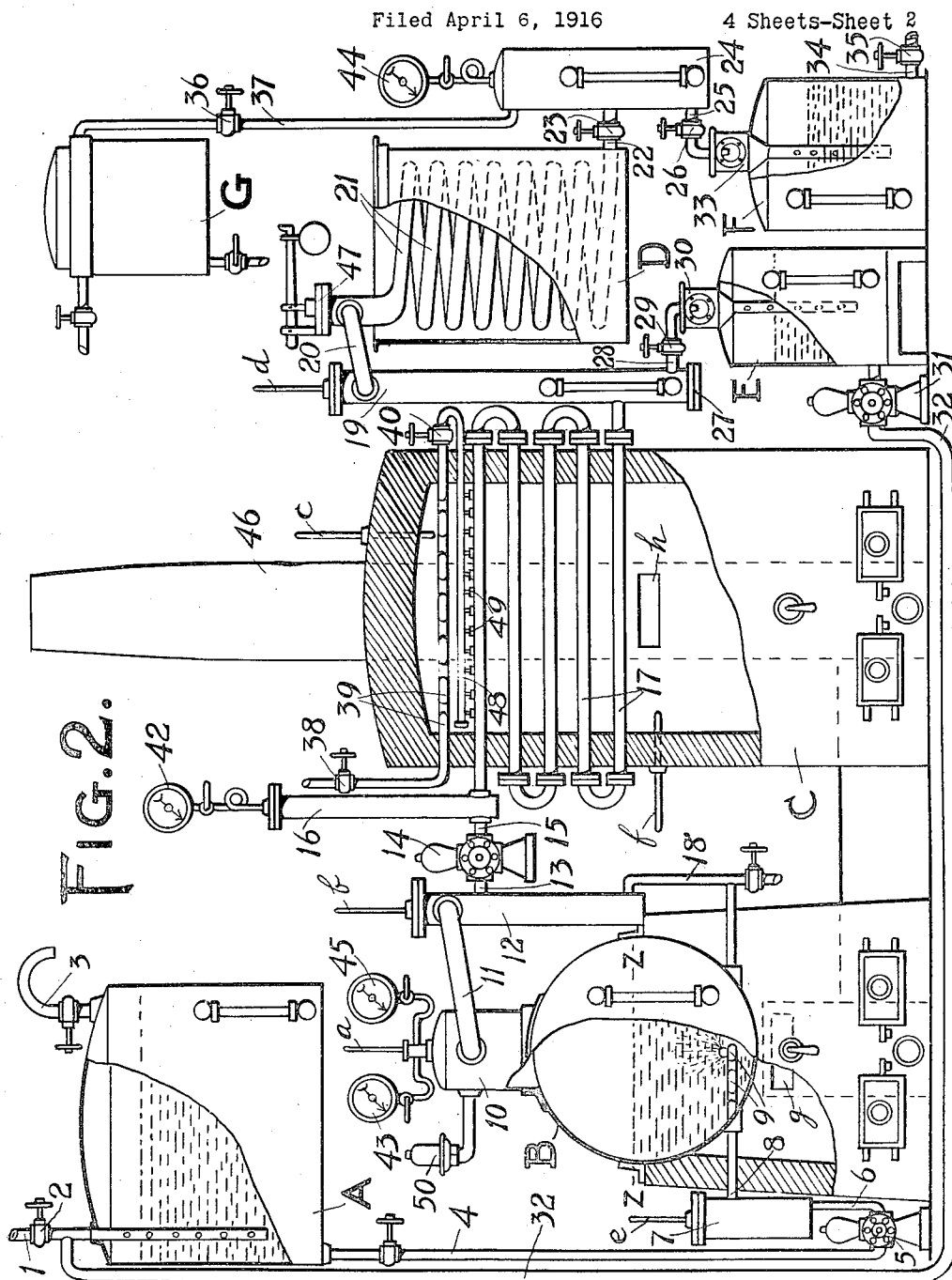


FIG. 2.

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Dec. 18, 1923.

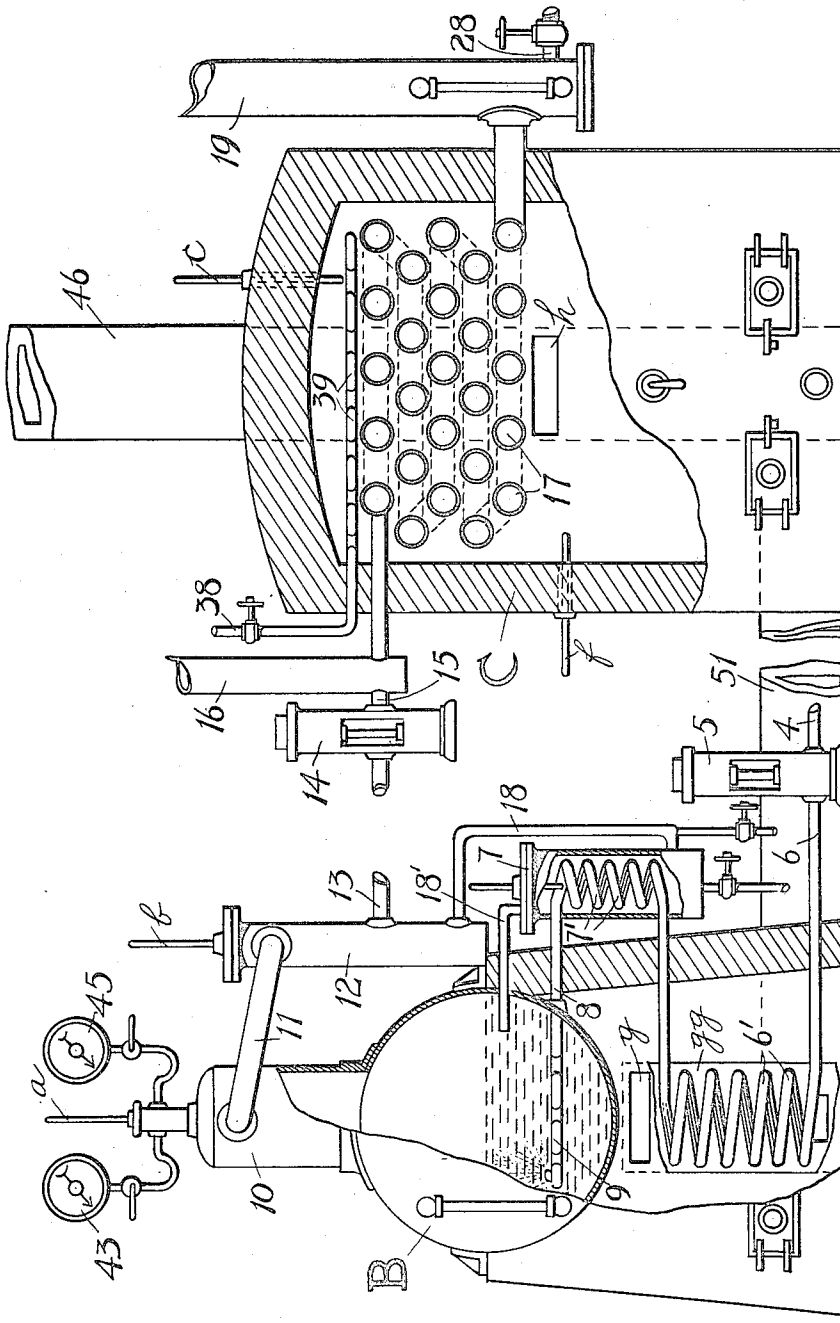
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WITNESSES:

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INVENTOR

Joseph Adams.

UNITED STATES PATENT OFFICE.

JOSEPH H. ADAMS, OF FLATBUSH, NEW YORK, ASSIGNOR TO THE TEXAS COMPANY,
OF HOUSTON, TEXAS, A CORPORATION OF TEXAS.

OIL-CONVERTING APPARATUS FOR THE CONVERSION AND TRANSFORMATION OF OILS.

Application filed April 6, 1916. Serial No. 89,335.

To all whom it may concern:

Be it known that I, JOSEPH H. ADAMS, a citizen of the United States, residing at Flatbush, in the county of Kings and State of New York, have invented a new and useful Oil-Converting Apparatus for the Conversion and Transformation of Oils, and of which the following is a specification.

This invention relates to an improved apparatus for converting oils and liquids, more especially those of the hydro-carbon group into products of lower specific gravity, for the purpose of obtaining from high boiling oils lower boiling products such as naphthas, gasolenes, benzines, benzol, toluol and other light oils and oily spirits of low specific gravities and boiling points of both the plain and aromatic series.

While the apparatus which is the subject of this application is adapted to carry out in practical use a novel process of oil conversion invented by me, I do not herein claim that process since it is made the subject of another application of even date herewith Serial No. 89,334.

The object of my invention is to produce comparatively simple and inexpensive means for accomplishing the results above indicated and to that end it embodies means for vaporizing the original oil, means for removing the vapors from the oil which is being vaporized, means for maintaining said vapors after removal under pressure, means for heating said vapors under pressure to a cracking or converting temperature and means for condensing the product of the cracking operation.

The pressure on the vapors in the converter is preferably higher than the pressure in the vaporizer and the condenser is preferably in open communication with the converter with means for controlling the discharge from the condenser so as to regulate the pressure.

The apparatus is so constructed as to permit continuous operation since oil may be continuously supplied to the vaporizer and the vapors may be continuously forced into the converter and they may continuously pass to the condenser.

The novel features of the invention will be apparent from the following description taken in connection with the accompanying drawings, of apparatus in which the same reference characters, whether in letters of

the alphabet or numerals, will denote corresponding parts throughout the several elevation and sectional drawings of which:

Figure 1, is an elevation and partly sectional view on an apparatus embodying the main features of my invention.

Figure 2, is a similar view of a modified construction showing additional details.

Figure 3, is an elevation of a battery of converters freely connected with each other.

Figure 4, is a detail sectional view showing means for admitting steam to the converter.

Figure 5, is a similar view showing a slightly different means for admitting the steam.

Figure 6 is an elevation and partly sectional view of the vaporizer showing the heat exchanger for preheating in-going oil; and Figure 7 shows the "staggered" method of arranging the cracking chambers to obtain the best heating advantages.

Apparatus.

In Fig. 1 of the drawings I have shown a simple form of apparatus which embodies the main elements of my invention and in Fig. 2, I have shown the same broad features with changes and additions in the nature of improvements or additional details.

In these two figures I have designated the main elements of the apparatus with letters of the alphabet whereas the specific parts are marked with reference numerals, the same reference characters being used to indicate corresponding parts in the two figures.

Referring particularly to the simple form of apparatus shown in Fig. 1, the reference character A, represents an oil supply tank from which the oil is to be drawn in using my apparatus for carrying out the oil conversion process. The oil passes from the oil supply tank A, through the pipe 4, pre-heater 7 and pipe 8, to the vaporizer B. The vaporizer B, is of any preferred construction and may be heated by any suitable means so as to raise the oil supplied to it to the boiling or vaporizing point.

In order to economize in heat, the oil is preferably heated before it enters the vaporizer in the pre-heater 7.

The oil in the vaporizer B, is preferably maintained at a substantially constant level indicated at Z—Z, leaving a vapor space above the oil. The vapors generated in this

vaporizer B, pass over to the converter C, leaving the vaporizer B, by means of the pipe 11, and passing through the force pump 14 and the pipe 15. The converter C, embodies an outer casing of heat enduring and insulating material for confining the heat and any suitable means may be provided for causing the heat in this chamber, such as oil or gas burners or other means.

I preferably make the converter itself in tubular form so that there will be a large heating surface presented compared to the volume of vapor to be heated passing through the converter.

In the form shown in Fig. 1, the converter is made in the shape of a pipe coil 17. The vapors, after being subjected to the high temperature in the coil 17, to crack and convert them, pass out through the pipe 19 and vapor line 20, to the condenser D, where they pass down the condensing coils 21 and are condensed.

The liquid resulting from this condensation is drawn off through the pipe 22, into the running trap tank 24, which is provided with a draw off pipe 25 and valve 26.

It will be understood that the supply tank A, can be refilled from time to time through the inlet pipe 1, and that the supply of oil from that tank to the converter B, may be by gravity, if the tank is properly elevated, or, if necessary, pressure may be applied to the oil in the tank in order to force it into the vaporizer B.

For this purpose there is shown a pump H, which may supply compressed air to the surface of the oil in the tank A through pipe 41.

The vaporizer B, is intended only to heat the oil sufficiently to cause its vaporization and is not intended to perform any cracking operation. In normal operation, therefore, it is not intended that there shall be any particular pressure on the oil in this vaporizer, the vaporization taking place ordinarily at approximately atmospheric pressure. The pump 14, is, of course, of that type which will act on hot vapors and which will in its operation serve to draw the vapors from the vaporizer B, through pipe 11, and force them through pipe 15, into the converter C.

The temperature of the converter C, is raised to such a point as will crack and convert the vapors into lower boiling point products or convert them into products having essentially different natures. It will be seen that the condenser D, is in open communication with the converter C, and therefore any pressure in the converter will extend to and through the condenser.

This continuous action of the pump 14, in forcing vapors into the converter and the tendency of the vapors to expand when cracked or converted will raise the pressure

in the converter and consequently throughout the condenser so that the vapors undergoing the cracking operation will be at considerable higher pressure than those in the vaporizer. The particular pressure maintained in the converter and throughout the condenser may be regulated by controlling the discharge of the fixed gases which are always generated to some extent in the converter.

The condensation of the vapors also tends to reduce the pressure and thus control of the escape of fixed gases is sufficient to enable the operator to maintain the pressure desired.

The fixed gases pass out with the condensed vapors through the pipe 22, into the trap tank 24, and their escape through the pipe 37, is controlled by valve 36.

When the apparatus is in operation pressures in the converting system will be registered on gauges 42 and 44, which, under normal operative conditions, should both indicate the same uniform pressure while for safety purposes on both vaporizer B and converting system, comprising converter C and condenser D, the release pop valves 50 and 47, are provided.

Referring now to the drawing Fig. 2, the source of supply or oil tank A, may be located at any reasonable distance away from the vaporizer B, and by means of pump 5, the oil is delivered continuously into the vaporizer under uniform pressure to replace that which is continually withdrawn in vapor form and forced into the converter C.

Original oil may be admitted to tank A, through pipe 1, regulated by valve 2, and displaced air will escape through pipe 3.

The pump 5, withdraws oil through pipe 4, and forces it through pipe 6, pre-heater 7 and pipe 8, into the final heating coils 9, located within and at the bottom of the vaporizer B, then the oil, having been brought to a safe and sufficiently high temperature within the pre-heater and coil, is delivered into the body of oil undergoing vaporization at normal atmospheric pressure, super-atmospheric pressures or vacuum, through openings, jets or spray nozzles located along the last ingoing section of pipe comprising the heater 9.

In this manner, by means of the pre-heater, feed oil is continuously brought to the same temperature before delivery into the vaporizer as that undergoing vaporization within the vessel B.

It is best to pre-heat original oil before admitting it to the vaporizing system so that the heat from the vaporizer furnace may be conserved for the purpose of volatilizing oil and not for pre-heating it, and to this end both overflow unconverted hot oil and waste furnace heat can be economically applied in an exchanger to the purpose of

heating original inflowing oils. This method of utilizing waste heat from overflow hot oil and furnace flues in exchangers to preheat inflowing oil to the vaporizer B, is more clearly shown in Figure 6, where a slight rearrangement of the pre-heater (Fig. 2) is made so that the oil forced in by means of pump 5, may flow through pipe coil 7', enclosed in tank 7, where the heat from the overflow hot oil through trap 12 and pipe 18, will raise the temperature of oil within the coils and the heating oil will return to the vaporizer B, through pipe 18'.

As a further means of raising the temperature of inflowing oil, a pipe coil 6', may be arranged in a flue stack *gg*, (Fig. 6), so that waste heat flowing from the furnace through the flue *g*, may pass down through this stack and circulate about the pipe coil 6' before it is exhausted from the high stack 46, of the converter C; to which it is conducted through flue 51.

In this manner, oil passing first through the pipe coil 6', in flue *gg*, then through coil 7', of pre-heater 7, becomes heated before being subjected to the final pre-heating in the pipes 9, contained within the vaporizer B.

The vaporizer B, may assume any convenient shape as a still or boiler in which oils may be economically and rapidly volatilized, the lighter parts rising into dome 10, and flowing out through vapor line 11, to the settling trap 12, which is a column provided with a drain pipe 18, at its lower end taking into the vaporizer B, and in this vaporizer the oil is preferably maintained at a constant level as indicated at Z—Z.

A pump 14, interposed between the vaporizer B and converter C, is provided to draw vapors from trap 12, through pipe 13, and force them into converter C, through pipe 15 and expansion column 16, against a back and partly generated vapor pressure maintained in the tubes 17, and throughout the several following parts of the system comprising the carbon and vapor trap 19, condenser D, running trap tank 24 and the intervening vapor and liquid pipes 20, 22, and 25, valves 23 and 26, and both sight and pressure gauges located on the apparatus.

In Fig. 2, of the drawings, one of the many forms of tubular converters which may be employed in my oil converting process is shown, and in this type of apparatus a multiple of heat enduring tubes 17, constructed of material capable of withstanding intense temperatures and high pressures, are located in the upper part of the furnace enclosure within walls of fire brick designed to withstand protracted high heats.

The tubular chambers 17, are preferably connected in series with terminal fittings assembled so that each layer of tubes will overlay the spaces between those of the layer

below, in order that the entire group may receive the greatest efficiency from the underlying furnace heat. This feature of tube arrangement is not claimed by me as new but is shown in Figure 7, slightly modified from the drawing in Figure 2, the tubes running lengthwise instead of across the furnace, to illustrate the manner of placing tubes, each layer alternating in spaces with those located above and below, in order to present the greatest area to heats generated in the underlying fire box and flue channels, and which arrangement, to all purposes and intent, is similar to the efficiency construction of the well known water tube rapid steam generating boilers.

At the outgoing end of the series of tubes 17, vapors are led into a carbon and oil vapor trap 19, where any free carbon accumulated in the process is swept by the circulation of oil and oily vapors in the tubes.

This trap is provided with a detachable plate 27, at its lower end for cleaning out purposes and leading from the top a vapor line 20, conducts vapors to coils or pipes 21, of condensing apparatus D.

Any free carbon which may be held in suspense in vapors issuing from the converting tubes 17, may have a chance to precipitate to the bottom of trap 19, while vapors are rising therein and through pipe 20, so that vapors led into the condenser D, may be in part or wholly freed from mineral carbon.

Overflow oils or condensed vapors caught in the lower part of trap 19, may be intermittently or continually withdrawn through pipe 28 and valve 29, into sight box 30 and hot oil collecting tank E, from which they may be drawn by pump 31, and returned to oil supply tank A, through pipe 32.

A vapor line 20, rising from the top of trap 19, conducts vapors into the coils or pipes 21, of condenser D, which latter may assume any of the forms employed in the oil refining industry.

The coil pipes of condenser D, ordinarily are immersed in cold water and the rapidity of condensation as well as the quality of product can be partially controlled by the temperature of the water surrounding these condensing coils or pipes.

Condensate accumulated in the condenser runs freely into an enclosed collecting or running trap tank 24, through pipe 22 and valve 23, from which it is withdrawn into running tank F, through pipe 25 and valve 26, after passing sight box 33.

Any accumulation of distillate in tank F, may be drawn off through pipe 34 and valve 35, to make room for newly and continuously admitted distillates from trap tank 24.

Vapor pressures generated above a predetermined degree can be intermittently or continually lowered and held at a deter-

mined degree of pressure by permitting the escape of gases through valve 36 in pipe 37.

In the conversion of oily vapors under the application of intense cracking temperatures a percentage of oil is always converted into fixed gases; the amount of gas so formed depending upon a wide range of conditions and the oils undergoing treatment.

These non-condensable gases, the discharge of which can be regulated to maintain vapor pressures in the apparatus, usually carry with them a small portion of very light gravity condensable vapors which more or less saturate the gases and which, by further treatment as compression and expansion or scrubbing methods, may be extracted and the light oily spirits redeemed, and while this recovery feature is not a part of this invention the holder or scrubber G, is shown in the drawing as a possible gas accumulator or treater.

Vapor pressures throughout the apparatus can be registered on gauges 42 and 44, which, under normal operative conditions, should both indicate the same uniform pressure, throughout the system, that is, the generated and maintained vapor pressures under which the oily vapors are held while undergoing treatment in this apparatus by the conversion process.

The feature of volatilizing oil at normal atmospheric pressure, pressures in excess of atmospheric or vacuum and forcing it under pressure into a converting apparatus presents many advantages in the rapid yield of light gravity products without having to subject the resultant distillates to extensive fractional distillation or separation methods, as the product, under proper working conditions in the apparatus, carry very high percentages of clear oily spirits as naphthas, gasolenes, benzol and toluol.

Pressure and vacuum gauges 43 and 45, are provided for registry purposes on the dome 10, of vaporizer B, for information as to the condition under which it is working, due to the applied heat, the suction of force pump 14 or the slight pressure due to overproduction of vapors faster than it is possible or advisable to admit them to converter C; and thermometers and pyrometers *a*, *b*, *c*, *d*, *e* and *f*, are located at principal parts of the system so as to register the temperatures of oil, steam, vapors, heat, etc.

In general practice the vapors should be produced in vaporizer B, in quantities equal to that supplied and forced into converter C, but it is not always possible to so balance the heat and vaporizing conditions as to carry on the volatilization under atmospheric pressure so in consequence there may be at times, pressure in the vaporizer while at others a vacuum may be created due to the suction of vapors by pump 14, more rapidly than they are produced.

Either slight pressure or vacuum can be maintained constantly or alternately in the vaporizer B, for as it is not designed as a converter nor employed for the purpose of oil transformation the conditions of super-atmospheric pressure at any or all times in the vaporizer are immaterial.

Simplicity in the operation of this apparatus is one of its principal features as well as the rapid, continuous and safe method of oily vapor transformation to produce large yields of low boiling hydro-carbon and other oily products.

The multiplicity of tubular converters presents large surfaces to the furnace heats in proportion to the amount of oil in vapor form contained in the tubes, and thus the yield of distillates will be rapid, the quality satisfactory and high in the production of desired oils and oily spirits.

A considerable number of tubes having a comparatively small diameter of from two to six inches may be so arranged as to present from four to six times greater surfaces to the intense furnace heat than the parts of tubes extending through and beyond the furnace walls for terminal and return fittings.

The continual circulation of oily vapors through the tubes permits the intense heat to act rapidly and convert high percentages of subjected vapors into desirable products and the small quantity of vapors contained within such tubes, overflow pipes and traps, cooling coils and vapor lines, lends safety to this form of apparatus, for if a break or large leak occurred in any part of the converting apparatus under high pressure, the fire which might result from such a condition would be principally confined to a very few barrels or gallons of oil rather than to a still full of the material undergoing treatment. The furnace of converter C, may be operated in any convenient manner with coal, fuel oil, gas, electricity or other economical and easily obtainable heat producing medium, but for uniformity in temperature, economy and ease in handling, a fuel oil burning equipment is, at the present time, the most generally satisfactory method of generating the intense temperatures required in the operation of this form of apparatus.

Almost any of the various efficient fuel oil burning installations are adapted to this work, but as that part of the apparatus is not a feature of this oil converting system, any specific description is avoided beyond the indication of burner holes in the fire doors of vaporizer B and converter C, the flues *g* and *h*, and in the location of stack 46, rising from the rear of the converter for vent or draught purposes.

As a feature of safety on this high pressure system the release pop or blow off

valve 47, is preferably located at a distance away from the converter, usually at the end of the vapor line 20, just above the condenser D.

5 In commercial practice where it is desired to convert oil on a large scale it will be desirable and advisable to use a number of converters in the same plant and in that case they should be arranged in battery form and should be so connected that the vapor pressure from each will be transmitted to the others thus operating all under the same pressure.

15 Any tendency towards a drop in pressure in one converter will be compensated for by the pressure from the others and thus easier and more perfect regulation may be secured.

20 This arrangement is shown in Fig. 3, where a battery of converters C,—C,—C, are spaced apart for mechanical operation and the proper arrangement of connecting pipes and fittings.

25 The hot oily vapors being drawn from the vaporizer by pump 14, through pipe 13, are delivered through pipe 15, to the tubular converting chambers 17, in each of the converters.

30 The converted and transformed vapors pass out through traps 19, and from the top of each trap into vapor line 20, leading to the condensing apparatus.

35 As each one of the tubular converting systems comprising the chambers 17, are freely connected with the vapor line 20, by means of the pipes leading out from the top of the traps 19, and this vapor line leads freely to and is in open communication with the condenser in which vapors are condensed under vapor pressures maintained throughout the converting system from the source of supply or vapor pump 14, through to the end of the condenser and running trap tank located beyond the foot of the condenser, it will be seen that two or more converters comprising the battery will be equalized in operative vapor pressure through the vapor line 20, or other vapor lines which may be employed to connect and compensate the several converters for the purpose of equalizing and maintaining uniform pressures in the vapors undergoing transformation in such battery of converters.

50 This unit battery feature and the freely connected converters one with another was adopted by me and employed as described in my co-pending application 530,852, filed Dec. 1, 1909.

55 As an added feature of importance in this method of oily vapor transformation I may also use super-heated steam and inject it while at elevated temperatures into the body of oily vapors through one or more of the tubular converters 17, as indicated by the pipe 48 and jets 49, of Fig. 2, the steam being generated outside the apparatus but

may be super-heated to any desired degree in the super-heating coils 39, as shown in Figs. 2 and 3, by the heats generated within the furnace of converter C, to which it may be admitted through valve 38, and controlled 70 in its entry into the oily vapors by valve 40. The jets 49, employed for such admission of steam may be more clearly seen in the drawing Fig. 4, where they are projected into the top of a tube 17, the steam flowing 75 through pipe 48, and being under control by means of valve 40.

As a matter of convenience and mechanical practicability, I may also introduce the steam into tubes 17, by projecting the steam 80 pipe or pipes 48', into the end of one or more tubes, as shown in Fig. 5, carrying it in a part or all of the length of each tube and providing the pipe with suitable openings or small jets 49', for the proper admission 85 of steam, which same is controlled by valve 40'.

I ordinarily super-heat the steam above 800 to 1000° F. and when admitted and mixed with oil and oily vapors it possesses 90 advantages both in hydrogenating oils and reducing mineral carbon deposit while at the same time the resultant distillates are superior in odor and color; and I therefore intend that this feature may be employed in 95 this apparatus as a matter of practical and mechanical convenience during the process at such time or at any time the operator may find it advisable to introduce the same.

Mode of operation.

100 Having filled the reservoir tank or source of supply A, with original oil to be converted and the vaporizer about half full of oil, as indicated at Z—Z, the fires are started 105 under the vaporizer and brought to the required degree of temperature in order to raise the contained oil to a volatilizing point necessary to drive off sufficient quantities of vapors. 110

When the temperature of the oil undergoing volatilization approaches the boiling point, fires are started in the furnace of converter C, and the tubes 17, are gradually heated so that when pump 14, is operated to 115 force vapors therein and therethrough, the temperature should be elevated sufficiently to prevent condensation of the vapors while in the tubes.

120 As soon as the tubes 17, are full of vapor the temperature is gradually increased until it reaches the cracking temperature and it is then maintained at that temperature so that the vapors under pressure will be converted.

125 In this operation some of the vapors will necessarily be changed to fixed gases and some of the vapors will not be converted but a large proportion will be converted into lower boiling point products essentially different in nature from the original materials. 130

When the products pass from the converter into the trap 19, some of the unconverted oils of high boiling point will condense and may be drawn off through pipe 28 and valve 29, while the converted vapors and fixed gas pass into the coils 21, of the condenser D.

The converted vapors are here condensed and pass with the fixed gases into the trap tank 24, from which they are drawn off in liquid form into tank F, through pipe 25 and valve 26.

The fixed gases are carried off by pipe 37 and the valve 36, and that valve may be so adjusted as to allow the escape of so much gas as will maintain the desired pressure in the converter and condenser.

Preferably the apparatus is operated continuously, the oil being continuously supplied from tank A, through the pre-heater to the vaporizer B, and the vapors generated being continuously forced under pressure into the converter C.

The continuous operation of forcing the vapors into the converter and the generated self-imposed pressure of the vapors due to the cracking operation tend, of course, to raise the pressure in the converter but this is compensated for by the condensation of the vapors in the condenser and the regulation of the valve for the escape of fixed gases and thus, even in the continuous operation, the pressure may be maintained at the number of pounds desired throughout the continued use of the process.

In operation the valves 26 and 29, in discharge pipes 25 and 28, having been closed the tubular converters 17, and freely connected condenser D, with coils or tubes 21 and tank 24, are sealed; and, as the cracking heat is increased in the furnace of converter C, the vapors in the tubes create their own pressures in addition to the pressures produced by pumping in more vapors.

These pressures together with heats in excess of those required merely to hold vapors in suspense or gaseous form bring about the required transformation of the oils undergoing treatment while held in vapor form.

As the oil in vaporizer B, changed to the form of vapors and conducted out through dome 10, into the converter C, by means of pump 14, becomes lowered, pump 5, is employed to force new oil in through pre-heater 7 and coils 9, to take its place to maintain the desired level Z—Z, and any condensed vapors falling to the bottom of trap 12, are returned to the vaporizer through drain and return pipe 18. In like manner any partially or wholly unconverted vapors leaving tubes 17, and entering trap 19, may fall to the bottom of that trap and from which, they can be collected and removed in the form of hot oil through pipe

28 and valve 29, into hot oil collecting tank E.

The lighter partially and wholly converted vapors and gases rise from the top of trap 19, and enter coils 21, of condenser D, where they are reduced to distillates and more or less fixed gases and run freely into trap 24; the distillates being withdrawn into tank F, through pipe 25 and valve 26, while the gases are released through pipe 37 and valve 36, to and through a scrubber or gas holder G.

Preferably the process of oil conversion as carried on in this apparatus is a continuous one, the oil being withdrawn constantly from tank A, through pipe 4, by means of pump 5, and forced through pipe 6, into pre-heater 7, for its first heating; then through pipe 8, into final heating coils 9, before admittance through nozzles or sprayers on the last line of the heating pipes 9, into the body of oil contained in the vaporizer B.

Vapors rising into dome 10 are conducted through vapor line 11, into trap 12, and pump 14, draws through pipe 13, and forces them through the tubular train of pipes 17, in converter C, from which they escape into trap 19, the lighter desirable parts passing through condenser D, are reduced to distillates and run into tank F, from which the oils and oily spirits may be withdrawn through pipe 34 and valve 35.

Thus it will be seen that vapors generated in the vaporizer are forcefully driven through the converter, condenser and running trap tank while maintained under built up vapor pressures throughout the system from the pump 14, to the valves 29 in pipe 28, and 26 in pipe 25, and the high temperatures in the converter brings about transformation of oils while the same are held in vapor form under high pressure for the purpose of breaking up and converting the heavier molecules into lighter ones or for reducing high boiling oils to lower boiling products.

Since various minor changes could be made in constructional parts and method of operating them and as many different combinations of parts could be made without departing from the fundamental principle and the principal features thereof, it is my intention that all matter contained in the above description or shown in the drawings is to be taken as illustrative and not in a limited sense.

The apparatus is believed to be broadly new, operating in a new way to secure new results and therefore the terms used in the following claims are not to be read in a limited sense but are to be construed broadly.

What I claim as new and desire to secure by Letters Patent is:

1. An apparatus of the nature disclosed

comprising in combination an oil supply tank, pump and pre-heater, a boiler for vaporizing oils, a high pressure hot vapor pump connecting said boiler with said converter, a condenser in which vapors may be condensed under high vapor pressures, a converter composed of a furnace and multiple of tubular converting chambers in which vapors may be brought to elevated temperatures and vapor pressures, a vapor and carbon trap freely connecting said converting chambers with said condenser and an enclosed liquid and gas trap at the foot of or beyond said condenser in which liquids and gases may be collected under vapor pressure; a tank for the collection of overflow hot oils and for the accumulation of converted oil distillates and fixed gases and a pump for returning unconverted oils to the supply tank for re-treatment as before.

2. An apparatus of the nature disclosed comprising in combination a bulk oil supply tank, pump and pre-heater, a boiler for vaporizing oils, a multiple tubular converter for transforming oily vapors under the influence of intense cracking temperatures and super-atmospheric vapor pressures, a hot vapor pump for connecting the boiler with the converter, a condenser in free communication with said converter, an enclosed liquid and gas trap tank at the foot of or beyond said condenser, a tank for the accumulation of overflow hot oils connected at the end of or beyond the series of tubular converters, a tank for the accumulation of distillates located beyond said liquid and gas trap tank; means for raising temperatures to volatilize oils in said boiler, means for generating intense cracking heats above those required to volatilize oils in tubular converters, means for maintaining vapor pressures in excess of atmospheric in vapors undergoing transformation, means for forcing vapors into said converting chambers against a vapor back pressure and means for continually supplying new oils for vaporization and vapors for conversion as required when said apparatus is under continuous operation.

3. An apparatus of the nature disclosed for the conversion of high boiling hydrocarbon oils to products of lower boiling points and specific gravities comprising in combination a bulk oil supply tank, a boiler for vaporizing oils, a pump and connections for supplying oil from said tank to said boiler, a pre-heater in said connections, a converter composed of a series of tubular cracking chambers contained within a furnace, a carbon and vapor trap freely connected to said converter, a condenser freely connected to said trap, an enclosed running trap tank located beyond the foot of said condenser in free communication therewith,

means for raising temperatures to volatilizing points of oil contained within said boiler, means for generating intense cracking temperatures in said tubular converter, means for forcibly supplying hot oily vapors from said boiler to said tubular cracking chamber while the vapors therein are under high pressures, and means for the withdrawal of partly or wholly unconverted oil from said carbon and vapor trap and returning it to said bulk oil supply for re-treatment.

4. An apparatus of the nature disclosed comprising in combination a bulk oil supply tank, a boiler for vaporizing oils, pipe connections between said tank and boiler, a pump in said connections for supplying oil to said boiler, a pre-heater between said pump and boiler, a converter comprising a series of tubular chambers within a furnace chamber adapted to withstand high heat, a hot vapor pump for taking vapors from said boiler and forcing them into said converter, a carbon and liquid trap connected to the discharge end of said converter, a condenser connected to the vapor space of said carbon and liquid trap, means for collecting and controlling the discharge of liquid and gases from said condenser, means for subjecting the vapors in said converter to a converting or cracking temperature, and means for maintaining vapor pressures in said converter through the condenser.

5. An apparatus of the nature disclosed comprising in combination a bulk oil supply tank, a boiler for vaporizing oils, pipe connections between said tank and boiler, a pump in said connections for supplying oil to said boiler, a pre-heater between said pump and boiler, a converter comprising a series of tubular chambers within a furnace chamber adapted to withstand high heat, a hot vapor pump for taking vapors from said boiler and forcing them into said converter, a carbon and liquid trap connected to the discharge end of said converter, a condenser connected to the vapor space of said carbon and liquid trap, means for collecting and controlling the discharge of liquid and gases from said condenser, means for subjecting the vapors in said converter to a converting or cracking temperature, means for maintaining vapor pressure in said converter through the condenser, and means for withdrawing from said carbon and vapor trap the partly or wholly unconverted oil and returning it to the bulk supply tank for re-treatment.

In testimony whereof I affix my signature in the presence of two witnesses.

JOSEPH H. ADAMS.

Witnesses:

A. CAPSTICK,
JOEL S. DE SELDING.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,477,860, granted December 18, 1923, upon the application of Joseph H. Adams, of Flatbush, New York, for an improvement in "Oil-Converting Apparatus for the Conversion and Transformation of Oils," errors appear in the printed specification requiring correction as follows: Page 7, line 3, claim 1, commencing with the words "a high," strike out all to and including the word and comma "pressures," line 6; same page and claim, line 10, after the word "pressures" insert *a high pressure hot vapor pump connecting said boiler with said converter, a condenser in which vapors may be condensed under high vapor pressures;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 15th day of July, A. D. 1924.

[SEAL.]

THOMAS E. ROBERTSON,
Commissioner of Patents.