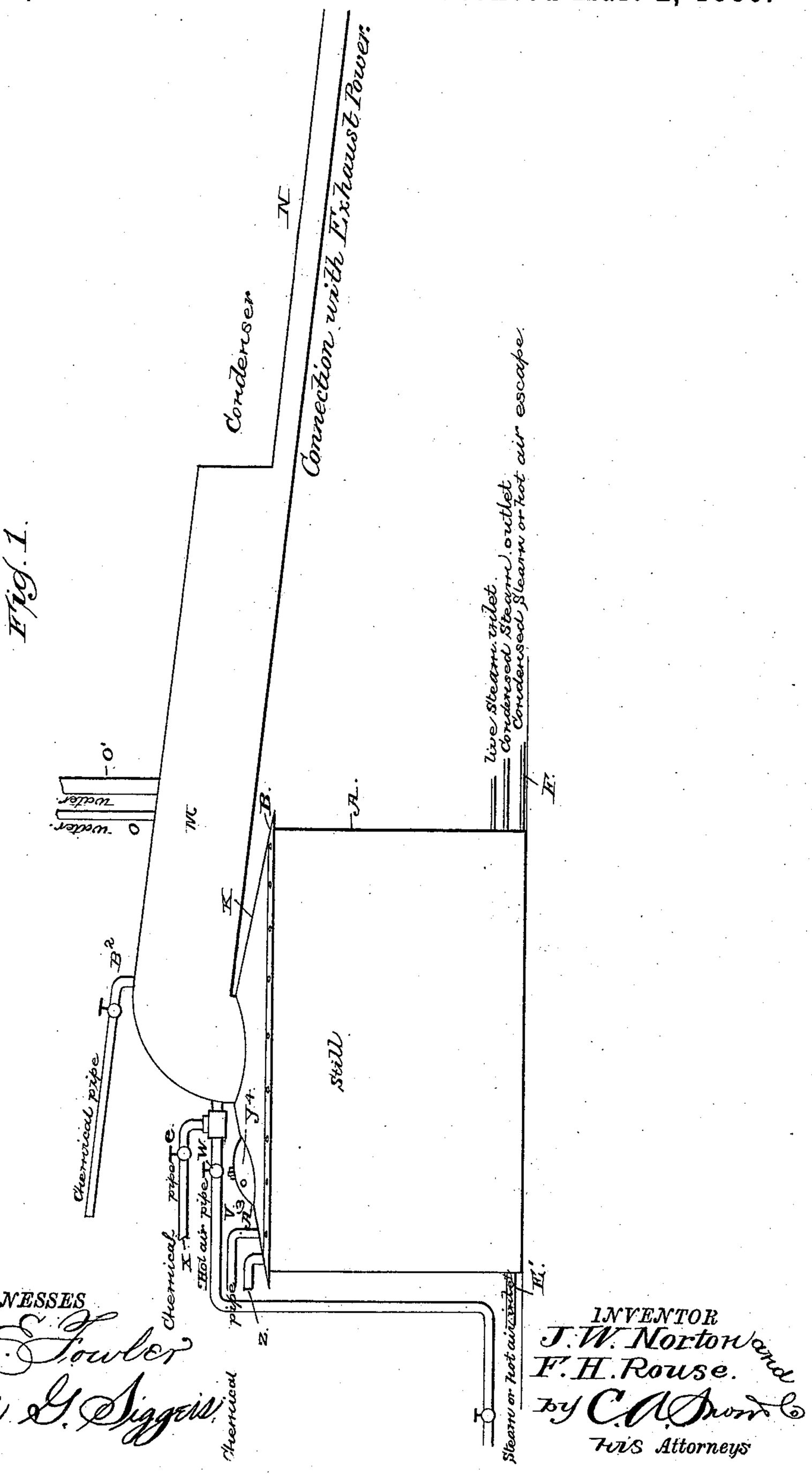
(No Model.) 2 Sheets—Sheet 1.

J. W. NORTON & F. H. ROUSE.

PROCESS OF AND APPARATUS FOR DISTILLING OIL.

No. 336,941. Patented Mar. 2, 1886.

Fig. 1.



WITNESSES

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His Attorneys

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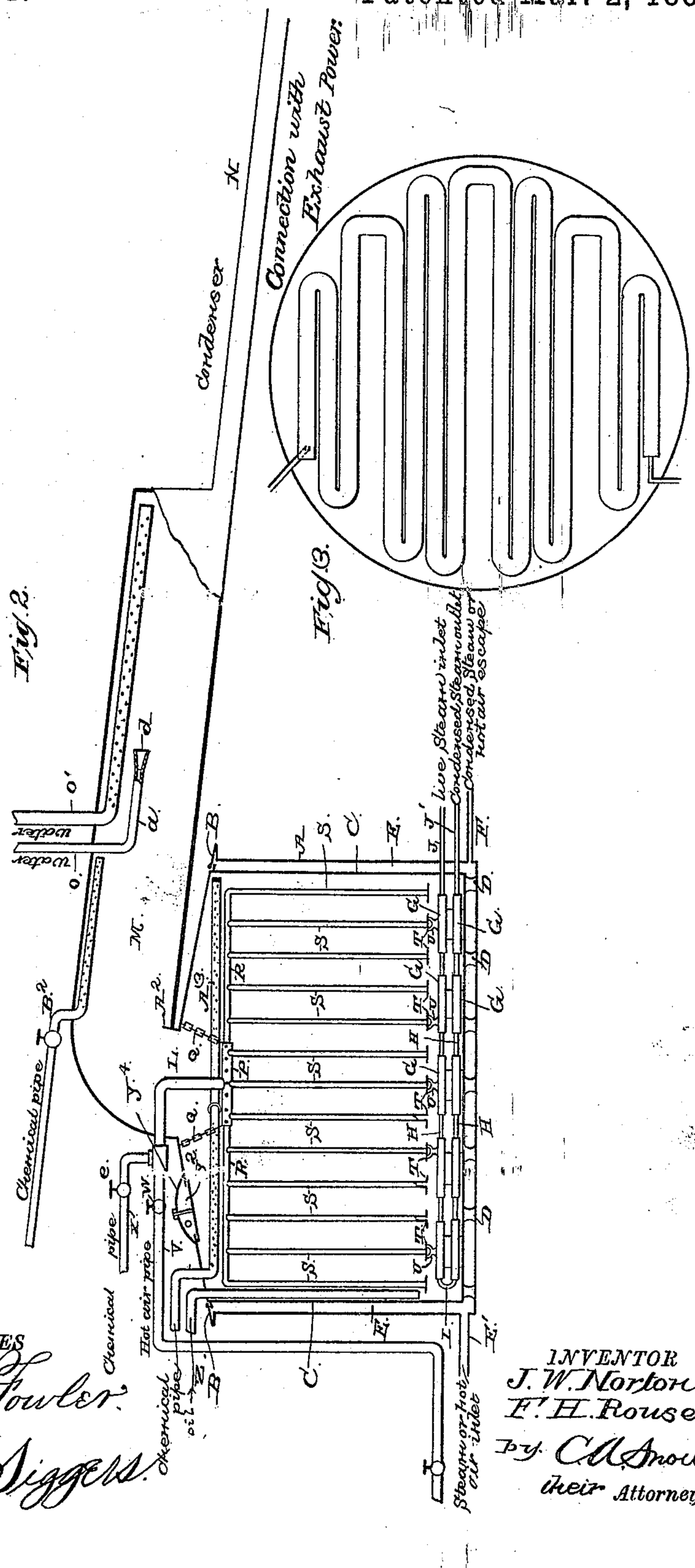

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their Attorneys

UNITED STATES PATENT OFFICE.

JAMES W. NORTON AND FRANKLIN H. ROUSE, OF KINZUA, PENNSYLVANIA, ASSIGNORS OF ONE-THIRD TO JACOB C. FULLER, OF SAME PLACE.

PROCESS OF AND APPARATUS FOR DISTILLING OIL.

SPECIFICATION forming part of Letters Patent No. 336,941, dated March 2, 1886.

Application filed April 4, 1885. Serial No. 161,230. (No model.)

To all whom it may concern:

Be it known that we, JAMES W. NORTON and FRANKLIN H. ROUSE, citizens of the United States, residing at Kinzua, in the county of Warren and State of Pennsylvania, have invented a new and useful Improvement in Process of and Apparatus for Distilling Oil, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to an improved apparatus for distilling petroleum-oil; and it has for its object to provide simple and efficient means, which will effect the purposes stated, thoroughly eliminating the gas, gasoline, benzine, and illuminating-oil from the poorer quality or residuum, which is retained in the still and removed as desired.

By the method in common use petroleum-oil has been distilled by the employment of a powerful heat derived from a fuel-flame generally made from coal or gas and applied directly to the bottom and upon the sides of the still. This method involves great expense of fuel and repairs to the stills. In the employment of our invention we avoid these serious objections and substitute a more economical plan, which will distill the oil by the use of hot air, steam, and chemicals. Furthermore, our invention produces a more rapid distillation of oil, and obviates the production of tar occasioned by the use of the means above referred to. Again, by the use of our invention a purer and better paraffine or residuum is left in the bottom of the still after distillation.

With these objects in view the said invention consists in distilling petroleum-oil by the use of heat derived from drums or large pipes arranged in the bottom of a still, and heated by steam in connection with hot air forced into a large drum situated at the top thereof, a series of radiating-pipes connecting with this drum and having vertical branches extending downward near the aforesaid drums or large pipes at the bottom of the still, disks being attached to the ends of the vertical branches for the purpose of distributing the hot air through the body of oil, to cause the said hot air to infuse with, heat, gasify, and eliminate the best quality of the oil.

The invention further consists in the employment of a condensing-chamber at the top of the still, to gather the gas and subject it to the action of a water-spray, and there condensed back again to oil, whence the hot air loses its expansive force and passes along with the oil and water, a rotary exhaust power being connected with the condenser to withdraw the oil, water, and air therefrom into a receiving-tank, where the said air returns to its original element, and the water drawn off through a pipe at the bottom of the receiving-tank, the oil remaining in the latter ready to pass onto the agitator.

The invention further consists in the use, in connection with the hot air and steam above referred to, of chemicals or chemical gases forced by pressure-power into the space above the oil in the still, where it unites and mingles with the air and gases arising from the oil, and purifies the said gas, a portion of the chemicals passing upward into the condensing-chamber and the balance gravitating downward and mingling with the oil kept in constant motion within the still, purifying, eliminating, and precipitating the impurities and paraffine to the bottom thereof, where it can be drawn off through pipes arranged for that purpose.

The invention further consists in certain details of construction and combination of parts, as hereinafter set forth, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a front elevation of our improved apparatus. Fig. 2 is a longitudinal central section of the same. Fig. 3 is a horizontal section of the still, illustrating a modified arrangement of the pipes or drums at the bottom of the still.

Like letters are used to indicate corresponding parts in the several figures.

Referring to the drawings, A designates an outer shell, made of light boiler-iron (or wood) and resting upon a level foundation, the upper edge of the shell having an inwardly-extending flange, B, for the purpose hereinafter explained. The still C is several inches smaller than the shell, and is received within the latter, the flange B being riveted to the upper edge of the still. Supporting-bearings D D project upward several inches from the bottom of the shell, and upon these bearings rest the still, thereby forming a chamber, E, be-

tween the latter and the shell, for the circulation of steam or hot air, which is fed by a pipe, E′, at one side of the shell, and discharged through a pipe, F, at the opposite side. This steam or hot air may be supplied by a boiler or hot-air furnace, (not shown,) so as to keep up a continuous circulation around the sides and bottom of the still, and thus assist in heating the body of oil contained therein. In this form we discard the usual fire-arch, although our arrangement may be applied to the ordinary still. The latter may be in the form of a parallelogram, and both forms may be incased in wood, instead of iron, when steam alone is used. Upon the bottom of the still is arranged a double series of cylindrical steam chests or drums, G G, each of which is connected by pipes H H, thus making the communication continuous throughout.

The series of drums or steam-chests form two parallel rows extending across and around the bottom of the still, one row being connected to the other by a curved elbow-pipe, I, and each row having its terminal pipe J J′ extending through the side of the still and shell and connecting with a suitable boiler. (Not shown.) The pipe J receives the supply of steam from the boiler and passes it to the first drum G, which being connected by the pipe H to the second drum the steam is allowed communication therewith, and so on to the drums of the first row, whence by the elbow-connection I the steam passes to the second row and through the several drums of the latter, the steam partially condensed issuing from the pipe J′, through which it is returned back to the boiler, to be reheated and again delivered to the drums in the manner explained.

We do not wish to be confined to the special construction of the drums or steam-chests shown and described, as we may employ such an arrangement as is illustrated in Fig. 3. As seen, we use a series of parallel rows of pipes extending across the bottom of the still and communicating with each other, the pipe at one side of the still receiving the supply of steam and delivering it to the adjoining pipe, and so on through the series, the partially-condensed steam issuing from the pipe at the opposite side of the still and returning back to the source from whence it came. This arrangement of pipes effects the same purpose of heating the oil as the steam chests or drums, and either may be used as deemed expedient and desirable. The top of the still is inclined upward, as at K, Fig. 1, and is provided with a large central opening, L, from which extends a condensing-chamber, M. the latter being cylindrical in form and arranged above and on one side of the still. Projecting from the inclined top K at the central opening is an upwardly-extending flange, A^2, which serves to prevent the oil from passing or returning back to the still after being acted upon within the condensing-chamber. The outer end of the latter terminates in a pipe, N, leading to a rotary pump or other rotary exhaust-power, (not shown,) serving to give an accelerated motion to the contents of the chamber, and to produce as much of a vacuum in the still as is possible to create under the action of the combined elements hereinafter explained, thereby causing a more rapid and free elimination of the gas or vapor arising from the oil, and to aid and assist in elevating it to the condensing-chamber above. A pipe, O, enters the upper portion of the condensing-chamber, and is provided with a branch, *a*, having a flaring mouth, *d*. said pipe connecting with a source of water-supply, so as to deliver into the condensing-chamber what is termed the "fish-tail" spray. A larger pipe, O′, enters the chamber forward of the pipe O, and connects with the same water-source, the inner end of the said pipe O′ being perforated to allow the water to issue therefrom in the form of a very fine spray, serving to condense the gas, which then escapes with the water through the rotary pump. The latter is connected with the usual receiving-tank, (not shown,) to pass the water, gas, and air thereto. When the pump discharges into the tank, the air escapes to its original element, the water is drawn off at the bottom of the tank, while the oil remains within the same, ready to pass on to the agitator.

P designates a circular-shaped drum held in place at the upper end of the still by any suitable fastening means—such as a chain, Q, connecting with the inclined top K of the still. The drum has horizontal radiating pipes R R, to which are connected the vertical series of pipes S, at the lower ends of which are attached disks T T, or any suitable equivalent, several of the latter resting on bearings U U, projecting from the steam chests or drums G, which bearings serve to support the entire pipe structure. To the top of the drum P is connected a supply-pipe, V, which extends upward and outward through the side in the chamber M and over the top of the still, and connects with a suitable hot-air furnace. (Not shown.) An air-pump or other suitable means is employed to force the hot air into the drum P, and there distributed through the pipes R and S to the oil under the disks or equivalents T. A valve, W, is arranged in the large pipe V, to regulate the pressure of air in the still. A pipe, X, provided with a cock or valve, *e*, connects with the hot-air-supply pipe V, and is arranged to receive a supply of chemicals—such as sulphuric acid or muriatic acid—for the introduction of the latter to the still for the purpose well known. In the top K of the still is provided a man-hole, Y^2, closed by a cover, Y^4, to allow free entrance to the interior of the still.

Z designates a pipe communicating with the still and connecting with the source of oil-supply, for filling the still with crude oil.

A^3 designates a perforated pipe extending across the still at the top and supported on the drum P, said perforated pipe extending over the still and communicating with a vessel for supplying chemicals such as described,

the passage of the latter being controlled by a stop-cock. The chemicals discharged by this pipe mingle with the gases before they reach the condenser, so as to make a change in the gas that is rising upward, and make a purer oil, which will be superior in every respect for burning purposes. The perforated pipe B^2 that enters the condensing-chamber at the top and extends along the same for a short distance is supplied with chemicals for the same purpose; but the chemicals pass along and mingle with the rest and settle at the bottom of the tank which receives the oil, benzine, and other matter distilled from the crude oil. When the chemicals are introduced through the pipe A^3, a part will escape into the condensing-chamber, and a part will fall into the body of oil contained in the still.

The chemicals herein referred to should be of that class which have a definite effect upon the oil. For this purpose we may use either sulphuric acid, muriatic acid, or ammoniacal salts.

The operation of our invention will be readily understood from the foregoing description, taken in connection with the annexed drawings. Oil is supplied to the still through the pipe Z to any desired amount. As the still is surrounded by a chamber supplied with either hot air or steam, the oil in said still will be consequently heated. Steam is supplied to the chests or drums G along the bottom of the still, passes through the same and back to the boiler, and is there reheated and returned to the drum, thus keeping up a continuous circulation of steam in the latter. Hot air, with or without chemicals, is delivered to the drum P by the pipes V W, thence entering the pipes R, and down through the pipes S and out below the disks T into the oil, and acting upon the latter. The action upon the oil by the chemicals is well known, while the hot air, which gathers the chemicals, serves to heat the oil and cause vapor and gases to rise in the condensing-chamber, the impurities settling to the bottom of the still, where they may be drawn off, as desired. The chemicals introduced by the perforated pipe A^3 at the top of the still will escape partly into the condensing-chamber, and the remaining portion will fall into the body of oil contained in the still. The chemicals introduced by the perforated pipe B^2 pass along and mingle with the matter which rises in the condensing-chamber. The spray from the water-pipes O O′ serves to condense the gas within the condensing-chamber, and the rotary pump, with which said chamber connects, is operated to produce a vacuum in the still, so as to relieve the pressure that would otherwise be upon the oil, and to cause a more rapid elimination of the vapor and oil arising from the action of the heat and air. By the operation of the aforesaid rotary pump or other exhaust power the oil, water, and air is withdrawn from the condensing-chamber into a series of tanks—one tank for each of the different liquids obtained by distillation from the body of crude oil—the connection between the pump and each of the tanks being severed at will. When the several agencies are in full operation, the first that escapes from the condensing-chamber through the pump is gas, next is the very lightest that can be condensed, which is gasoline, and then continues to grow heavier from this on. Benzine comes next, and finally the illuminating-oil, and that which remains in the still is tar and paraffine. Of course in these successive operations, or rather steps, the heat is gradually increased, as is well known, from the lowest heat necessary to eliminate the light gases to the highest for illuminating-oil, and when the full amount of each distillate has been eliminated or withdrawn from the crude oil the connection between the pump and the receiving-tank is broken, and a new connection made with a fresh receiving-tank, and thus the benzine, gasoline, and oil will be stored in separate tanks, to be treated again in the manner well known. The steam within the chests or drums G acts to heat the oil at the bottom of the still, where the impurities settle, and thus assist in the elimination of the lighter oil therefrom.

We claim that by the combined use of hot air, chemicals, and steam the oil is distilled in such a manner as to produce a purer article for illuminating purposes. The steam chests or drums are connected with the pipes H by any suitable joint, so as to be detachable, as desired. The drum P is also detachable, so as to be withdrawn from the still at will, and the several pipes R S are fitted together and to this drum in such a manner as to be capable of detachment therefrom. The disks T are likewise detachably fitted to the pipes S, so that the entire pipe structure can be separated and put together, and are not intended as a permanent fixture of the still. It will be understood that the chemicals being introduced into the still through the gas and vapor above the oil, that part of the chemicals which do not rise into the condensing-chamber will be precipitated into the top part of the oil in the still, and the oil being in a state of ebullition from the air that is constantly being forced into it will cause the oil and chemicals to be mixed more perfectly, so that before the chemicals have reached the bottom of the still the mixture will be complete. As the chemicals are kept constantly in motion, they will have a perfect effect upon the oil, and at the same time the heat from the steam chests or drums will keep the chemicals in a gaseous form, and by so doing produce a more perfect distillation. It will be apparent that the pressure of the hot air is the same in all of the pipes at one and the same time, and that the action under and the upward movement of the air is the same from all of the disks. The effect of the hot air upon the body of oil is to heat, gasify, and carry the lighter particles upward into the space above the oil.

Our improved apparatus furnishes the great-

est amount of heat that can be furnished by steam or hot air, so as to insure a rapid distillation of the oil.

We do not wish to be confined to mere details of construction, as such may be modified at will without departing from the spirit or scope of the present invention. It will be seen that the hot air and chemicals which are forced down through the pipes S and out from the disks T will give a lateral motion to the oil in the still, and yet not create any considerable agitation. The tar-paraffine which forms the residuum at the bottom of the still may be removed by forcing steam or hot air through the pipes S and out below the disks T, to liquefy the mass, which can then be withdrawn through the said pipes in the manner described in our application for Letters Patent filed September 1, 1884, No. 141,956, to which reference is hereby made.

The quantity of sulphuric acid or other chemical employed cannot be definitely stated. Ordinarily it is about one per cent.; but if the distillate is clear, then the proportion would be less. This is left entirely to the judgment of the operator of the still. There are no two quantities of oil alike in distillation, and hence the quantity of chemicals employed must be varied to suit the circumstances.

Heretofore it has been proposed to provide a still with a hollow shaft or tube which carries a series of agitators, said shaft or tube being revolved by suitable gearing, to cause the rotation of the agitators, and inclosing a smaller tube, which is supplied with hot air, and has at its lower end a perforated pipe. In operation the interior tube is supplied with hot air, which passes downward, enters the perforated pipe, and percolates into the oil through the perforations of the pipes. The outer tube is rotated and the agitators worked, to keep the body of the oil in motion, so as to allow the commingling of the air with the oil; but in this arrangement it is necessary to violently agitate the body of oil before the air will have any effect, this severe agitation retarding, in a measure, perfect distillation, as is well known to those skilled in the art of distilling petroleum-oil. The air which issues from the perforated pipe in the form of a spray will not have sufficient power to force itself through the oil, and hence it is that additional agitating means were found necessary to be employed.

In our improvement we provide a series of pipes, each of which occupies a different portion of the still, and which are supplied with hot air, the latter issuing from the pipes simultaneously with sufficient force and in such volume as to press downward at various points. This downward pressure of the air will cause the oil displaced to move to one side, thereby imparting a lateral motion to the entire body of oil without any violent agitation. We are thus enabled by our improvement to dispense with any supplemental agitating means, the hot air alone sufficiently stirring the body of oil to insure the thorough mixture of the hot air therewith, and by this means effecting a rapid and efficient distillation, the distillate being purer for all purposes than could be obtained by a violent process of distillation. It does not require any great heat to gasify or evaporate oil. For instance, when it is left exposed to the heat of the sun and influence of the air in open tanks the lighter properties of the oil will entirely disappear, leaving nothing but a thick heavy residuum in the bottom of the tank. On this principle we have devised a process of distilling oil without employing the violent process embodying excessive heating and agitation of the oil now in common use.

The process is simple and inexpensive and effective. There will be no more burning out of stills, and the article produced will be a superior grade, all the impurities being eliminated from the distillate.

We are aware heretofore in the distillation of oil sulphurous-acid gas has been employed to be mixed with the oil in the still, the vapor and oil arising therefrom being carried off to a chamber, where the vapor is condensed and separated from the oil, and hence we lay no broad claim to the use of chemical gases to aid in the process of distillation.

Having described our invention, we claim—

1. The oil-still provided with a closed top having an opening, in combination with the condensing-chamber arranged longitudinally above the still and connecting directly with the opening, in which the hot air, gases, and vapors are received, and a reduced portion combined and communicating with the outlet end of the body portion and connecting with an exhaust-power to withdraw the water, gas, and air, and pipes arranged in the enlarged portion, and adapted, respectively, to spray water and liquid chemicals on the hot air and gases, with receptacles for supplying water and liquid chemicals thereto, all substantially as described.

2. The still, in combination with the pipe situated within the same at the upper portion thereof, means for supplying sulphuric acid, muriatic acid, or the like to the said pipe, from whence it is delivered to the interior of the still, above the body of oil, pipes for delivering hot air to the bottom of the still and imparting a lateral motion to the body of oil, and means for supplying hot air to the pipes, part of the chemicals being precipitated downward into the oil, which, being in a state of ebullition or constant motion, will allow the thorough mixing of the oil and chemicals, as and for the purpose set forth.

3. The oil-still, in combination with the drum arranged within the same and communicating with a source of supply for hot air or liquid chemicals, a series of pipes radiating from the drum and extending down within the body of oil, and a pipe arranged across the top of the still adjacent to the drum and supplying liquid chemicals to the still above

the oil, whereby part of the chemicals will be precipitated downward into the oil, which, being in a state of ebullition by the air forced therein, will cause the oil and chemicals to be mixed thoroughly, as set forth.

4. The oil-still, in combination with the condenser communicating with the top of the still, a series of pipes for delivering hot air through the body of oil and imparting a lateral motion thereto, a series of heating-pipes arranged across the bottom of the still, below the hot-air-supply pipes, and a pipe for introducing chemicals, part of the latter escaping into the condensing-chamber and the remainder being precipitated downward into the body of oil, as set forth.

5. The oil-still, in combination with the condensing-chamber communicating with the top, so as to receive the hot air and gases arising from the body of oil, horizontal heating-pipes extending within the still across the bottom, and a series of vertical radiating pipes extending down through the body of oil and supplied with hot air alone, or both hot air and liquid chemicals, the said horizontal pipes heating the oil so as to liquefy it, while the air from the vertical pipes gives a lateral motion to the oil and further heating it, these combined actions causing a rapid distillation, as set forth.

6. The herein-described method of distilling petroleum-oil, consisting of heating the oil at the bottom of the still, forcing hot air downward through the body of oil to give thereto a lateral motion, causing chemicals to be precipitated or mixed thoroughly with the oil by this action of the hot air, subjecting the gases, &c., arising from the body of oil to the combined action of chemicals and water spray in a condensing-chamber, the water and chemicals thus mingling with the gases, and conveying the same into a receiving-tank, as set forth.

7. The herein-described method of distilling oil, consisting of heating the oil at the bottom of the still, forcing hot air down through the body of oil at different points simultaneously, so as to give a lateral motion to the oil, simultaneously subjecting the oil to the action of sulphuric acid or other suitable chemicals, and finally spraying the hot air, gases, &c., in a condensing chamber, as set forth.

8. The herein-described method of distilling oil, consisting in heating the oil at the bottom of the still, forcing hot air downward through the oil at different points thereof, so as to give a lateral motion to the oil, passing chemicals—such as sulphuric acid—into the still above the oil, and causing a thorough mixture of the oil and chemicals, and finally treating the gases and hot air arising from the body of oil, to cause the hot air and gases to be condensed, as set forth.

9. The herein-described method of distilling oil, consisting of forcing hot air downward through the body of oil, passing liquid chemicals—such as sulphuric acid—into the still above the oil, and causing a thorough mixture of the oil and chemicals, and finally treating the hot air and gases and hot air arising from the body of oil within the cooling-chamber, to cause the hot air and gases to be condensed, as set forth.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in presence of two witnesses.

JAMES W. NORTON.
FRANKLIN H. ROUSE.

Witnesses:
JOHN P. PETERSON,
J. L. SMITH.