

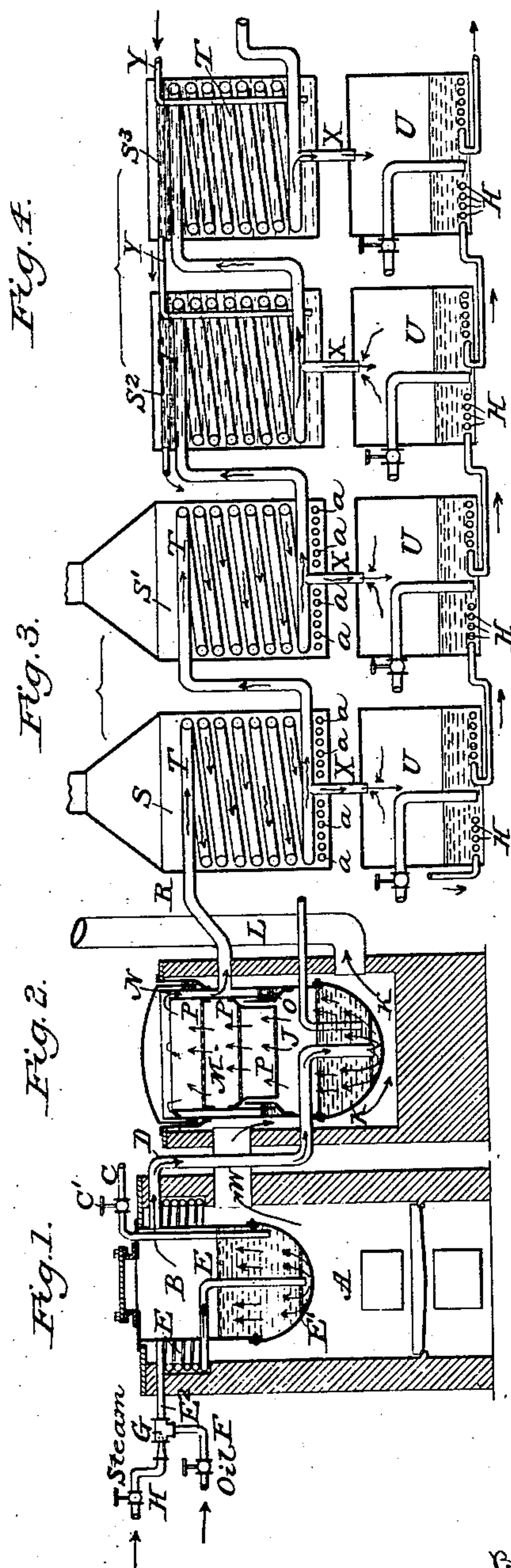
(No Model.)

L. STEVENS.

PROCESS OF DISTILLING OILS AND OLEAGINOUS SUBSTANCES.

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Attest:
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UNITED STATES PATENT OFFICE.

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PROCESS OF DISTILLING OILS AND OLEAGINOUS SUBSTANCES.

SPECIFICATION forming part of Letters Patent No. 414,601, dated November 5, 1889.

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To all whom it may concern:

Be it known that I, LEVI STEVENS, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Processes of Distilling and Purifying Oils and Oleaginous Substances; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention consists, first, in forcing under pressure a compound of steam and petroleum or other oil through a body of molten asphalt or lead or other equivalent material capable of liquefaction without volatilization at a temperature sufficient to decompose or break up and volatilize all the products to be derived from the oil, and, secondly, after passing the purified vapor through a series of condensers each cooler than that preceding it, whereby the several products of distillation contained in the vapor are severally and automatically separated by simple gravity, each by means of the change of temperature to which it is subjected in its appropriate condenser; collecting the products of condensation from each condenser into a separate receiving still or tank heated to a temperature at which the lighter products which may pass into the still will be expelled and returned to the condensing apparatus, so as to insure the purity and exact commercial standard of the product in said receiving-still.

My invention is especially adapted for the distillation of heavy sulphurous oil. By mixing the oil (a hydrocarbon) with the steam (hydro-oxygen) under pressure, so that the oil shall be heated to its boiling-point in the compound, and then forcing the compound at this temperature through a body of molten asphalt heated to a temperature of from 600° to 1,000° Fahrenheit, the oil will be so broken up in the presence of the steam that the sulphur, which may be present in the oil, will be enabled to seize the oxygen of the steam, (as SO or SO^2), and by liberating the hydrogen, which, in its nascent condition, will readily combine with the carbon of the oil, thereby increase the volume of hydrocarbon in the compound, and consequently the percentage

of light oil to be derived therefrom. In brief, the sulphur in the oil is utilized in decomposing the steam and in increasing the percentage of the lighter and more valuable products obtained from the distillation of the oil, the carbonization of the asphalt being meantime prevented by the constant admission of steam thereto. An important advantage is moreover gained in the use of my process from the fact that all the constituent elements of the oil are vaporized together at a temperature much lower than that which is required in methods of fractional distillation commonly pursued to vaporize the heavier products alone after separation from the lighter, while by my method of fractional condensation the commercial products, after being volatilized all together and separated in accordance with their specific gravities, are redistilled in the one continuous process, whereby their purity according to their grade is insured.

If molten lead be substituted as an equivalent for the asphalt in breaking up the oil and steam forced through it in manner as described, the decomposition of the steam will be promoted by its oxidation of the lead, and a measure of hydrogen be thereby liberated to combine with the carbon of the oil, so as to produce the desired increase in the volume of hydrocarbon in the compound.

In the accompanying drawings, which illustrate in vertical section the apparatus employed in carrying out my process, Figure 1 represents the distilling-retort, Fig. 2 the purifying-chamber, Fig. 3 the air-condensers, and Fig. 4 the water-condensers.

A represents a furnace, which may be of any approved form of construction, and B a retort fitted therein to be heated thereby.

C is a large blow-out or discharge pipe fitted to extend outwardly from near the bottom of the retort, and through which its liquid contents may be blown out as occasion may require, said pipe being closed by a cock C'. D is a similar discharge-pipe fitted in the top of the retort to connect it with the condenser, as hereinafter described.

A perforated plate E' is fitted to the bottom of the retort to serve as a horizontal partition therein.

The upper end of the retort is encircled by

a coil E of pipe fitted within the furnace, and whose lower end is carried under the perforated plate E' to open within the space beneath said plate.

5 The discharge-flue W for the furnace is led out laterally at a point just below coil E.

An oil-supply pipe F is connected by means of an injector G to the outward extension E² of the coil E, and a steam-supply pipe H, leading from a suitable steam-generator, (of any approved description and which need not herein be described or illustrated,) is connected to the injector G in such manner as to produce, when steam is admitted thereto, an admixture of the steam with the oil supplied from the pipe F. The pipe F is connected with an oil-reservoir (not shown in the drawings) either directly to be supplied therefrom by gravity or mediately by means of an oil-pump, so as to give a proper head to the oil to insure its free delivery to the injector. By means of the apparatus thus constructed a current of mingled steam and oil at a high temperature, determined by that of the steam supplied through the pipe H, is forced through the coil E into the pipe C, and, being discharged under the perforated plate E' in the retort B, passes up through the perforations in said plate into the retort and through its fluid contents. The column of mingled steam and oil becomes more or less superheated in passing through the coil E before it enters the retort.

The retort B is filled more or less with asphalt, lead, or other equivalent material which will melt and become liquid without vaporizing at a temperature of not less than 600° Fahrenheit, and the compound of steam and oil entering the bottom of the retort being forced to pass through this molten material is thereby broken up or decomposed and wholly vaporized, and in this condition passes out from the retort through the pipe D.

In the distillation of petroleum a supply of asphalt is obtained in the first retort B by condensation from the oil, the excess being drawn off from time to time through the pipe C. The vapor-discharge pipe D is connected with the lower end of a purifying-vessel J, which is mounted in an encircling chamber K, connected with the flue W of the furnace A, so that the heat and products of combustion escaping from the furnace A shall pass through said chamber K, before being delivered into the chimney L. The heat of the furnace is thus utilized to maintain a high temperature within the purifying-vessel J sufficient to prevent a condensation of the vapors admitted thereto. A cylindrical vessel M, smaller in diameter than the vessel J, and open at both ends, is inserted therein, leaving an annular space N between the two, and the joint between the two vessels at the bottom thereof is sealed, as at O, with molten asphalt or its equivalent. Shelves P P, of perforated metal or of wire-netting, are fitted within the inner vessel M to support iron

sponge, ordinary quicklime, chloride of lime, or such other well-known chemical reagents as the character of the oil may require for its purification and deodorization. The hot vapor entering the bottom of the purifying-chamber is carried upward through it and the heat of the purifying-chamber prevents any condensation of the vapor therein. The vapor passing out of the top of the vessel M is carried through the encircling passage N to a discharge-pipe R, by which it is conveyed to the first of a series of condensers constructed in the customary manner of a coil of pipe T, inclosed within a suitable chamber S. The first one or more of these condensers S S' are cooled by means of currents of air which are admitted through apertures a a a in the bottom thereof, and being made to pass upward over the coils T, as indicated by the arrows, are discharged at the top. (See Fig. 3.) By this means the heavier products of the vapor are condensed in the coil, and being condensed are discharged through a branch pipe X into a suitable tank U, fitted beneath the condenser. The condensed vapor is carried from the lower end of the coil in each condenser to the upper end of the coil in the next through a suitable connecting-pipe R. From the condenser S', constructed substantially as described and cooled by currents of air having the effect of precipitating from the heated vapor its heavier constituents, the vapor is thus passed through a series of condensers S² S³. The coils in these condensers S² S³ are cooled by being immersed in tanks of water supplied through suitable pipes Y by a running stream, which, entering the bottom of the farthest condenser S³ in the series, is discharged in order from the top thereof into the bottom of the condenser next preceding it, so that the last condenser S³ is the coolest, and the vapor, first entering said condenser S², is gradually cooled more and more in each condenser, depositing in each the product of its progressive condensation, until in the last condenser S³ of the series the vapor is completely liquefied. The products of distillation will be deposited at each condenser in the order of their specific gravities, and by regulating the temperature of the successive condensers each to the condensing-point of one of the different commercial products derived from the oil each particular product may be separated and collected.

To insure the purity and exact specific gravity or fire-test grade of the several products as they are deposited successively into the tanks U U, beneath the several condensers in the series, I heat each of said receiving-tanks U, preferably by means of a steam-coil H, placed in the bottom thereof, to a temperature approaching that at which the product collected therein will be volatilized, and I thereby separate and distill therefrom the lighter products, which may have been carried thereinto from the condenser above. The vapor

thus expelled from each tank will pass up and out through the pipes X and R into the worm of the next condenser to find its appropriate place in the series.

My improved process of constructive (as contradistinguished from destructive) distillation is applicable to the refining of cottonseed and other vegetable oils, as well as hydrocarbons, and I contemplate its use in the treatment of oils and fats of all descriptions.

While my improved process is highly useful in the distillation and fractional condensation of hydrocarbon oil in manner as described, it is also serviceable in the manufacture therefrom of gas for heating or illuminating purposes, the gas being taken as it is discharged from the first distilling-retort and before it is carried to the purifier, and carried either directly to a suitable gas-furnace for consumption or to a fixing-retort for conversion into illuminating-gas by any of the well-known processes.

I claim as my invention—

1. The process of distilling oils, which consists in admixing the same with steam, passing the compound through a molten mass of

material, substantially as described, which will liquefy but not volatilize at a temperature sufficient to break up and volatilize the heavier products of the oil, and finally condensing the resultant vapor. 30

2. The process of distilling oils and oleaginous compounds, which consists in admixing the same with steam, vaporizing the compound, conducting the resulting vapor through a series of condensers, in each of which in succession it is subjected to a lower temperature, and drawing off the product of condensation from each condenser into a still or vessel heated to a temperature at which said product shall be redistilled to expel therefrom the lighter products, which may have been carried with it from the condenser, all substantially in the manner and for the purpose herein set forth. 40

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses. 45

LEVI STEVENS.

Witnesses:

A. N. JESBERA,
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