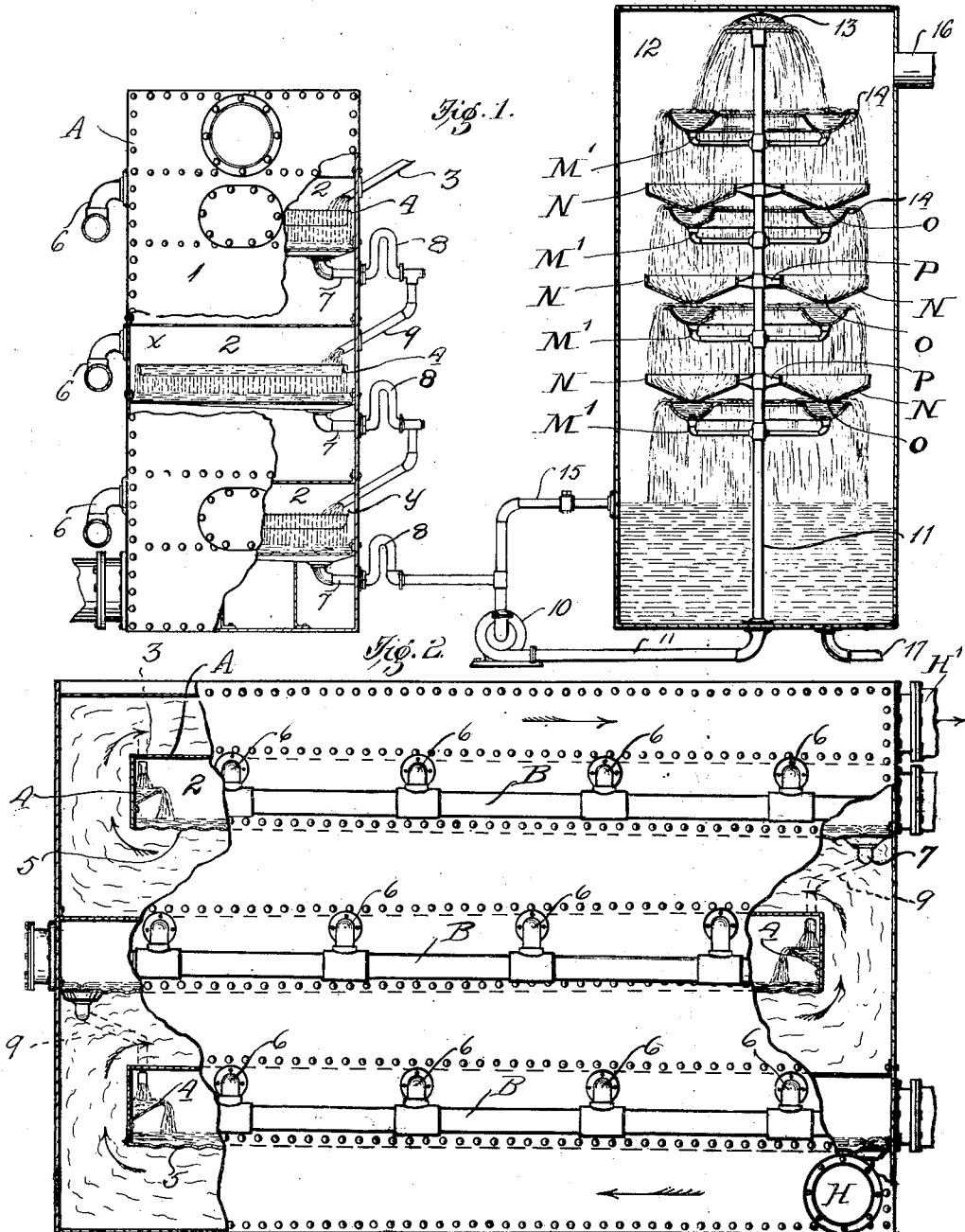


R. C. DUNDAS.
PROCESS OF MAKING ASPHALT.
APPLICATION FILED JAN. 26, 1910.

1,056,980.

Patented Mar. 25, 1913.

2 SHEETS—SHEET 1.



WITNESSES—

Fritz Rosenstein.
H. M. Barton

INVENTOR—

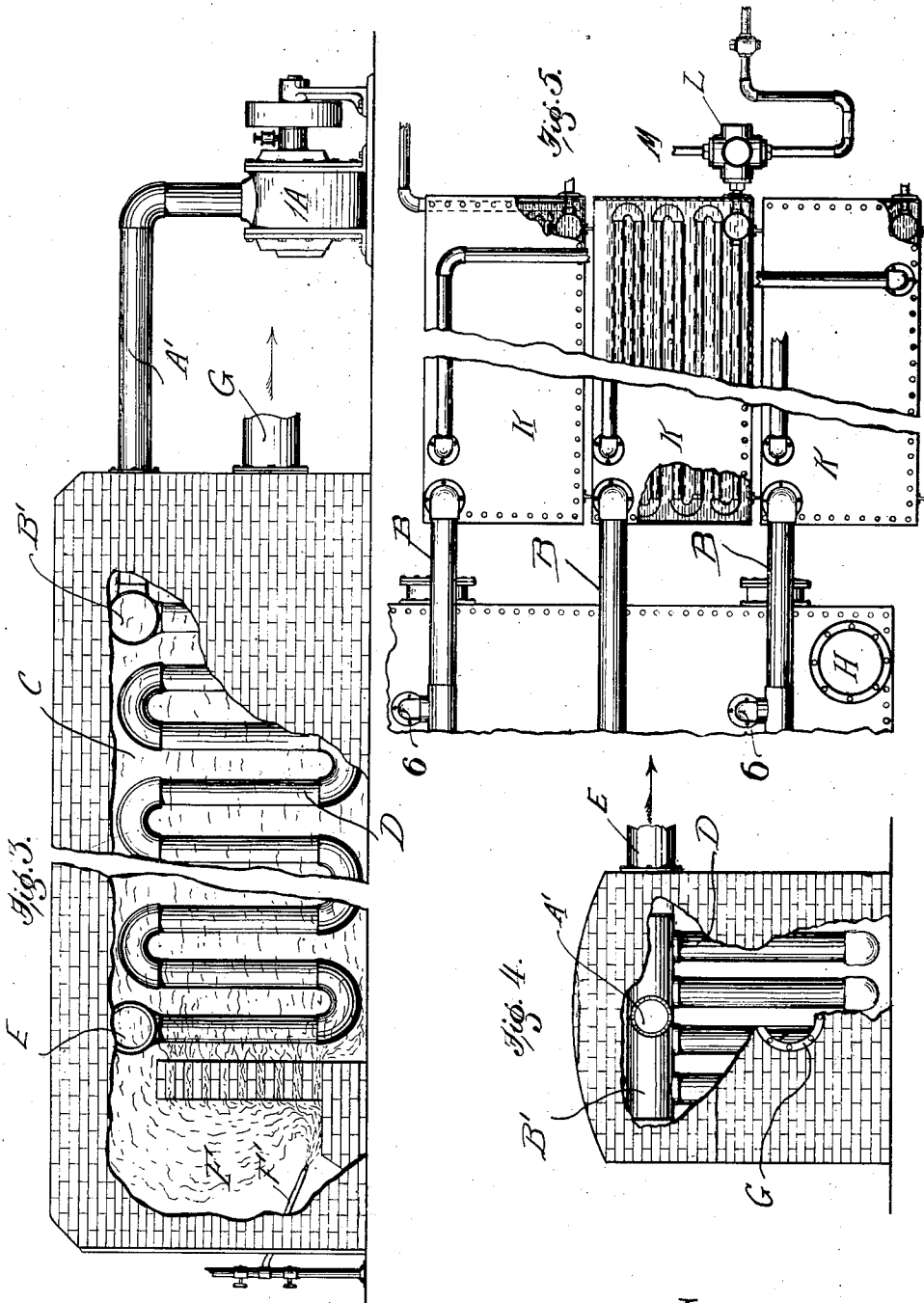
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UNITED STATES PATENT OFFICE.

ROY C. DUNDAS, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO DUNDAS ENGINEERING COMPANY, A CORPORATION OF CALIFORNIA.

PROCESS OF MAKING ASPHALT.

1,056,980.

Specification of Letters Patent.

Patented Mar. 25, 1913.

Application filed January 26, 1910. Serial No. 540,183.

To all whom it may concern:

Be it known that I, ROY C. DUNDAS, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles, in the State of California, have invented a certain new and useful Process of Making Asphalt, of which the following is a specification.

This invention relates to a process of making asphalt from crude petroleum, such as is found in California and elsewhere and has for its object primarily to preserve the original asphalt base of the crude petroleum by so distilling the natural oil that no new compounds of the hydrocarbon group are formed.

Briefly stated, the methods heretofore employed for the treatment of hydrocarbon oils having an asphalt base have had in view principally the obtainment of the by-products contained therein, the preservation of the base or the basic element in the oil being merely incidental to the refining process.

The crude oil is let into cylindrical stills and there subjected to high heat which is convectively diffused throughout the body. On account of the density and viscosity of the crude petroleum, the convection of heat is slow, and on account of the low conductivity of the heavy hydrocarbon, the heat distribution is by no means uniform, the lower strata becoming heated to an excessive degree, while the upper strata are comparatively unaffected. The result of the high heat employed and the uneven distribution of heat is eventually a cracking of the basic product, causing some of the vital hydrocarbon globules contained in the pure asphaltic base to be entrained or carried over with the distillates, and some to be separated from the mass; these globules, uniting with the products of distillation in suspension fall back into the distilling petroleum and recombine with the molecules. The meta-morphism thus resulting vitiates the balance of the crude petroleum in the still, and deteriorates by such chemical reaction the resultant base.

The principal objects of the invention therefore, are to expedite the fractionation of the crude oil without destructively distilling the mother product, to rid the viscous mass of oil of the nascent gases liberated during the process of heating, to preserve intact the basic product, and finally to produce an as-

phalt having great ductility and fibrous tenacity.

The accompanying drawings illustrate one form of apparatus employed for carrying out the process.

Figure 1, is an end elevation, partly in section showing the interior of the still, the circulating pump and a sectional elevation of the distilling vat in which the final distillation occurs without further heat. Fig. 2, is a side elevation of the same partly broken showing the condensing pipes, the baffle boxes and the direction of travel of the radiated heat. Fig. 3, is a side elevation of the furnace showing the manifolds, heating chamber, and blower for forcing air through the manifolds. Fig. 4, is an end elevation partly broken, and Fig. 5, is a fragmentary view of the still, and condenser showing the vapor pipes connected with the still.

The still shown in the drawings, consists of a casing, 1, provided with a series of baffle boxes 2, superposed and arranged in zig-zag fashion, for the purpose of causing the heat to circulate about all portions of the same. The crude petroleum is let into the said baffle boxes through the pipes 3, connected with the supply, which pipes are arranged to feed the oil at that point of the baffle boxes which is hottest. The oil from the pipes 3, flows into troughs 4, located in the ends of the boxes 2, and overflowing, travels by gravity over the inclined bottoms of the baffle boxes 2. During its travel the oil is agitated or more accurately speaking "turned over," by means of the riffles 5, disposed transversely in said boxes, whereby the greater percentage of the lighter products are freed, the heat in the upper box A being sufficient only to initially distil or drive off the lighter vapors, which escape through the pipes 6, into the manifold B and from there to the condenser. From the baffle box A, the oil discharges through the outlet 7, which is connected with a goose-neck joint 8, swiveled thereto, by means of which the depth of the oil in the bottom of the baffle boxes is gaged. This arrangement is desirable for increasing or reducing the speed of fractionation of the oil, the amount of the distillates given off being visible in the tail boxes L. From the baffle box A, the oil flows through the pipe 9, into the trough 4, of the baffle box α , and is dis-

tributed in a thin layer or in thin sheets over the surface thereof, being constantly agitated by the raffles afore described. The same process occurs in the next baffle box y , or in as many as may have been deemed advisable to employ. From the last baffle box, which is in the belt of the greatest heat, the resultant product or residue is withdrawn by means of a pump 10, and forced upwardly through a pipe 11, located centrally of the tank 12, striking eventually against a concave plate 13, which deflects the oil-base downwardly into the circular troughs or trays 14, from which it falls in turn to the bottom of the tank. These troughs or trays 14 are mounted on brackets m' which in turn are fastened to the stand pipe 11. Disposed above said troughs or trays are a plurality of circular funnels n of considerably larger diameter than the troughs or trays 14, the bottoms of said funnels being perforated, as seen at o . Such funnels n are connected with said stand pipe by a bracket p . In the drawing, the approximate depth of the residual product is shown on a level with the pipe 15, which is connected with the pump, and which continuously circulates the asphalt until the vapors otherwise impossible of liberation are extracted by the vacuum pipe 16 connected with the tank. The final product is drawn from the tank 12, by the draw-off pipe 17, connected with the bottom thereof.

Crude petroleum having an asphalt base should be distilled with a uniform heat, that is to say, fluctuations should be avoided, and in order to furnish a large volume of heat at determined temperature, I have devised an apparatus for furnishing radiated heat. This apparatus is shown in Figs. 3, 4 and 5, and consists of a blower A, which furnishes air through pipe A' to an inlet manifold B', within the furnace C, and having a number of branch pipes D, which connect with an outlet manifold E. The air is heated by the combustion of fuel at F, in the furnace, the quantity of air being controlled by the blower, and the temperature by the oil burner F'. G designates the outlet for the gases from the combustion chamber F, and furnace C. Said manifold E connects with the still at H, the heat traveling through the still exhausting at H'. Vapor flows from pipes 6 into the manifold B connects with the condenser K, provided with a tail box L, through which the condensed vapors flow. A vacuum pipe M, is provided on the tail box L, and this vacuum pipe communicates with a vacuum receiver, not shown, for the purpose of carrying a low pressure on the still.

During the treatment of the oil in the still, the inspissation of the crude oil is gradual, the viscosity being increased as the volatilization proceeds. At the bottom

of the still the heat is greatest, but at no time must the heat exceed a temperature which will destructively distil the crude petroleum or crack the basic product. While not specifically stating what such temperature is, it is believed that between 575% and 600% F. depolymerization begins, and to prevent such destructive action, radiated heat alone is used, which is easily regulated, and more evenly distributed over the area than direct flame, at the same time causing a more speedy and certain liberation of the lighter products.

The total abstraction of all of the vapors from the crude petroleum is by no means final in the still. The homogenous inspissated body still contains very volatile vapors when discharged from the last baffle box of the still. What may be called "atomic vapors" I have found to be prevalent in a refined body of petroleum, from which supposedly all of the condensable gases have been driven. My experiments have led to the assumption, that molecular gaseous impregnation exists and that ordinary refining though coupled with accelerating means, cannot avail to produce heterogeneity of the mass sufficient to expose each molecule to the heat. A disintegration, without destructive distillation, permits of a thorough convection, consequently dissipating converted gases. I have therefore devised a means, shown in Fig. 1, and complementary to the still, for ridding the asphaltic product of those vapors which, though generated during treatment in the still, cannot escape on account of the viscous nature of the residuum. This means consists, as above explained, of a plurality of superposed trays, over the edges of which, the asphalt flows in attenuated streams, causing thereby the excessively light vapors to be drawn off by the vacuum created in the vat.

At present, in cylinder distilling, air and steam in jets, are used to force the vapors through the mass. During this process of forcing, the purity of the vapors is vitiated by the entrainment of hydrocarbon solids, which are forcibly segregated from the base, hence requiring subsequent acidular treatment for purification. Artificial penetrative agitation, while more speedily liberating the distilled products, disrupts, without homogeneous disintegration of the globular constituents, the base of the natural petroleum, and in this manner allows a large percentage of the petroleum particles to be carried over with the subtilized products. But some of these, in suspension with the vaporized products, combine with them, and attaining by such combination, a higher atomic weight, return to the bulk, recombining with the base, produce under excessive heat metamorphism, both chemically and mechanically. When the heat under

the still vacillates, some of the vapors which are carried off, with the assistance of air or steam, condense before leaving the still and return to the bulk. This is commonly known as cracking of the oils. The result of this process is a vapid asphalt a large percentage of the petroleum having been extracted, leaving the base in a frangible condition.

It is obvious that by this process of distilling, the disillates produced are of greater purity than obtainable under the present system of cylinder distilling. The natural oil flowing in thin layers or sheets absorbs heat in a uniform degree liberating the gases, as they are generated, and permitting of their unimpeded escape without having to pass through a bulky quantity, which necessarily restrains their escape. Since, however, the object of this invention is the production of a perfect asphalt, which embodies the essentials of ductility, tenacity and resistance to heat, the preservation of the purity of the lighter products is a primal requisite, and these must not be contaminated by hydrocarbon solids. Where, therefore, under this system, the distillation has progressed systematically and the products respond to the test of chemical purity, it is obvious that the base of the natural oil also remains in a condition of purity, being free from the chemical reformations resulting from forced fractionation. In order therefore to produce an asphalt of strong ductility and not susceptible to changes in temperature within determined limits, the oil is caused to flow gradually by gravity to meet in its progression a higher degree of heat, a temperature varying from a determined minimum to a determined maximum being at all times maintained in order to cause a gradual conversion of the basic constituents in the petroleum into an asphalt of proper tenacity and consistency. If the heating of the crude petroleum exceeds a determined limit, the petroleum is changed to asphaltene, and an asphalt in which the petroleum has undergone such a change, is lacking necessarily in the qualities which give to it ductility and proper fibrous elasticity. Under existing processes no asphalt can be produced under 600° F. nor would it be possible because of the bulk inhibiting thermal penetration. A

continuous production of asphalt from which the chemical constituents have been freed is likewise impossible, because the chemical composition of natural petroleum is changed by present methods, petroleum, the essential ingredient having suffered molecular disruption or at least a chemical metamorphosis of its component elements; gases *in statu nascendi*, but incapable of escape, inhere in all of the present asphalts when discharged from the still, and these gases recondense upon cooling and re-unite by atomic affinity with the base. The result is a product perhaps properly incrasated, but lacking in tenacious ductility and malleability, and a loss of those already generated gases.

In the specification I have employed the term "destructive distillation", and desire to have it understood that by such term I mean such distillation of the petroleum that will cause carbonization or coking of the base.

What I claim, is:—

1. The method of making asphalt from crude petroleum which consists in causing the natural oil to flow continuously in undulatory strata, heating the strata so that the temperature on the same varies from a determined minimum to a determined maximum, whereby to drive off the lighter products and gradually inspissate the base, and finally causing the inspissated product to fall in attenuated streams *in vacuo* to liberate the nascent vapors therefrom.

2. The method of making asphalt from crude petroleum which consists in causing the natural oil to flow by gravity in continuous undulatory strata *in vacuo*, then varyingly heating the strata from a determined minimum to a determined maximum whereby to gradually and evenly drive off the by-products and inspissate the base, and finally causing the resultant product to continuously fall in attenuated streams whereby to liberate all or nearly all of the nascent vapors until the desired grade is obtained.

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

ROY C. DUNDAS.

Witnesses:

H. M. BARSTOW,
EDGAR LEAVITT.