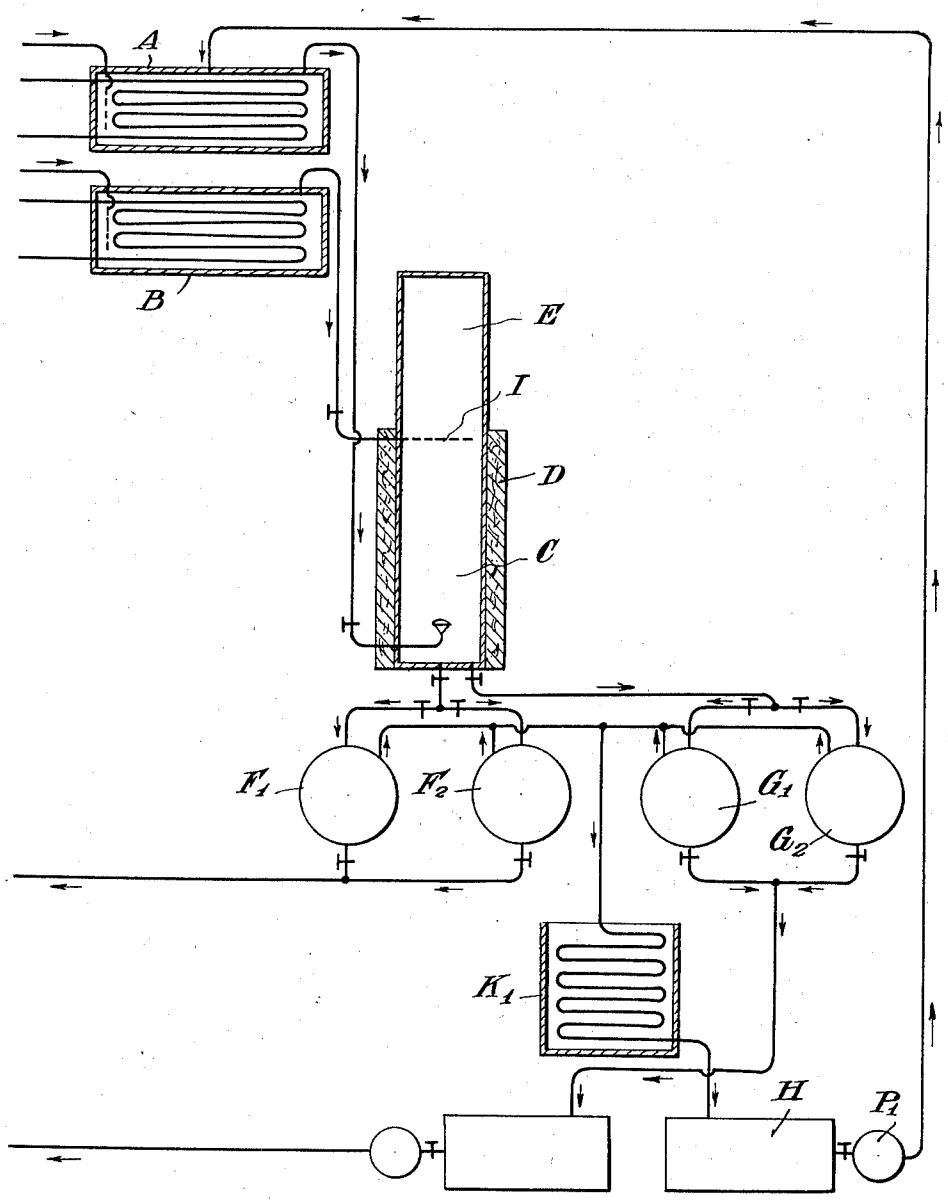
April 23, 1940. M. LANDAU 2,198,388

PROCESS FOR PRODUCING OILS FREE OF ASPHALT

Filed April 29, 1938



Inventor

Max Landau,

By Bailey & Carson

Attorneys

Patented Apr. 23, 1940

2,198,388

UNITED STATES PATENT OFFICE

2,198,388

PROCESS FOR PRODUCING OILS FREE OF ASPHALT

Max Landau, Berlin-Wilmersdorf, Germany

Application April 29, 1938, Serial No. 205,107

3 Claims. (Cl. 196—13)

The present invention relates to a new process for removing the asphaltic constituents from heavy crude oils and oil residues for obtaining oils which are free of asphalt and are suitable for future use as lubricants, and for obtaining an asphalt which is free of coke and particularly suitable for road construction.

This application is a continuation-in-part of an application Serial Number 741,478, filed by the present applicant on August 25, 1934.

It is well-known that various difficulties arise in the distillation of heavy crude mineral oils or residues thereof for obtaining lubricating oils and asphalt or coke, and particularly it has been found that the viscosity and the flash point of the mineral oil distillates obtained in such a manner are too low, while the asphalts are contaminated by coke so that their usefulness is greatly impaired. If such heavy crude mineral oils or oil residues are subjected to separation, a considerable amount of coke will be formed which causes clogging of the heater tubes, too rapid filling up of the reaction chamber with coke or a deposition of coke in the connected apparatus. This formation of coke considerably restricts the practical usefulness of such oils for separation.

It has been found that these disadvantages which are caused by the fact that the crude mineral oil or residues thereof have a high content of asphalt or asphalt-like products can be avoided by removing the asphalt from the crude material prior to the distillation of the latter.

Various processes have already been proposed by the prior art for effecting a separation of asphalt from crude oil, and also the use of light gasoline or similar extraction agents has been disclosed for separating crude oil into an oil which is relatively free from asphalt and an asphalt which is relatively free from oil. However, a complete separation of the asphalt from the oil could be effected according to these known processes only if the amount of extraction agent, for example, gasoline, considerably exceeded the amount of crude oil or the like subjected to extraction, and for obtaining an oil which is free from asphalt, an amount of gasoline was required which exceeded that of the crude oil approximately thirty times.

These processes according to the prior art generally consisted of intimately mixing the oil with the gasoline or similar solvent for example by means of stirring or agitating means or by filling the extraction column with insoluble substances designed to obstruct the flow of the materials through the column, to increase the contact of the materials with the solvent and to produce thereby eddying currents and a result equivalent to that of mechanical agitating means. After thoroughly intermixing the crude material with the solvent, the mixture was then usually allowed to settle so that the asphalt could sink to the bottom of the column while the liquid above the asphalt was withdrawn and the solvent removed therefrom by distillation. The residue obtained by such distillation consists of an oil which is relatively free of asphalt, while by heating the asphalt which was collected at the bottom of the column a product was obtained which is substantially free of oil. However, the separation according to these processes is never entirely complete, and they require exceedingly large amounts of gasoline or the like which render them uneconomical and expensive. Furthermore, in these processes in which the materials and the solvent are mechanically intermixed the mixture forms an emulsion which requires considerable time for its separation.

The principal object of the present invention, therefore, resides in a new process according to which the disadvantages of the known processes are overcome and whereby a complete separation of the crude oil or similar material into oil and asphalt can be performed, whereby such complete separation can take place by using only very small amounts of light gasoline and thereby such complete separation is performed in considerably less time than according to the processes of the prior art.

Other objects and advantages will be revealed by the following detailed description and the drawing showing a diagrammatic view of an apparatus for carrying out the new process.

It has now been found according to the invention that only a very small amount of light gasoline or the like, that is, an amount approximately equal to the amount of crude oil or similar material which is subject to separation, will be sufficient to effect a complete separation of oil and asphalt if not only the action of the gasoline of separating the asphalt is taken into account but also the fact that the extractions consisting of oil and gasoline possess different specific gravity than the precipitating asphalt and that the extractions consisting of oil and gasoline are always specifically lighter than the precipitating asphalt. This observation constitutes the basic idea of the present invention.

It has also been found that contrary to the process of the prior art, any artificial mixing of

the oil and the extraction agent and any movement or agitation of the liquid must be entirely avoided if a separation of the extractions consisting of oil and gasoline from the precipitating asphalt shall take place by means of the difference in specific gravity of these materials. Consequently, a sufficient separation of asphalt by means of such small amounts of gasoline as applied according to the invention is possible only if the crude oil or similar material is inserted at a constant low pressure and as finely dispersed as possible into a column of gasoline which is maintained in a substantially quiescent state in which no agitation thereof is caused either by stirring means or by eddying currents such as are caused by the flow of fluids against and around baffles or filling materials.

This constant pressure is obtained according to the invention by allowing the crude oil to flow by gravity from an elevated container into the gasoline through a perforated pipe of suitable shape which is arranged a short distance above the surface of the column of gasoline. Upon entering the column, those ingredients of the crude oil, which are the most soluble, are dissolved in the uppermost strata of gasoline and these parts do not continue to sink but form with the gasoline a solution of a specific gravity which is lower than that of the crude oil as such.

Those portions of the oil which are not as easily dissolved, however, sink to a lower level in the gasoline column and then dissolve likewise with the formation of a solution of a certain specific gravity.

Finally, those ingredients which are hardest to dissolve or are insoluble pass down through the column and settle as the heaviest parts in the lowest strata of the column and gradually displace the gasoline upwardly because of their higher specific gravity. As soon as the column of gasoline has been saturated with oil, the upper parts thereof will be found to contain oil which is entirely free from asphalt, the lower parts an oil with very small asphaltic content, while the asphalt as such will settle below the column of liquid. The asphalt which is thus obtained is of excellent quality, entirely free from coke and particularly suitable for road construction and surfacing of streets, while the oil obtained by this process is entirely free from any asphalt and forms an excellent raw material for the production of lubricating oils.

After treating a certain amount of crude oil which depends on the saturation of the gasoline used, the asphalt is withdrawn from the lower part of the column first, and thereafter the solution of oil and gasoline. The asphalt is then passed through distillation apparatus for expelling the remaining gasoline while the solution of de-asphalted oil and gasoline is passed through other distilling apparatus for separating the gasoline from the oil. The gasoline which is recovered is then again used for filling the column and for treating further amounts of crude oil or the like.

Describing the new process more in detail with reference to the drawing, the gasoline used for the extraction is mildly heated for example by heating coils in a container A and then passed into the lower part C of an extraction column until the latter is filled with gasoline to approximately half its height whereupon the supply of gasoline is discontinued. The lower part C of the column is preferably heat-insulated or provided with a steam jacket D.

The asphaltic oil to be treated is stored in a second container B which is of construction similar to the container A and also contains steam coils for preheating the crude material to such an extent that it flows easily, that is, for example, to 50° C. to 70° C. The material then flows downwardly and enters the extraction column a short distance above the surface of the extraction agent under constant pressure produced by the gravity flow after passing through means I for dispersing the material as finely as possible, which may consist, for example, of perforated tubes, nozzles or the like. The material or mixture to be extracted then sinks in a finely divided condition downwardly in the part C of the column and the asphaltic material thus always comes in contact with fresh or pure gasoline which dissolves from the asphaltic material the last traces of oil so that the asphalt is freed practically completely from any oil residues. The solution of extracted oil and gasoline then rises into the upper part E of the extraction column inasmuch as its specific gravity is lower than that of the asphalt. As soon as the extraction column is filled, the supply of crude oil or the like into the column is interrupted. The asphalt which has now collected in the lower part C of the column is then allowed to flow into one or the other of the two distilling vessels F_1 or F_2 in which the gasoline is distilled off from the asphalt. The distilling vessels F_1 and F_2 may, for example, be horizontally arranged and may be either provided with steam coils or heated directly. The vessels F_1 and F_2 are designed to operate alternatingly so that while one vessel is being filled, the gasoline is distilled from the other. However, the two vessels, F_1 and F_2 can also be operated uniformly without interruption, for example, if another container is interposed and the vessels consist for instance of a tube furnace. After the gasoline has been distilled off, it is first led to the cooler K_1 and from there into the container H from which it is returned by means of a pump P_1 to the container A.

After the asphalt has been removed from the column, the solution of oil and gasoline is withdrawn from the column and collected in one of the vessels G_1 or G_2 which are of construction similar to vessels F_1 and F_2, and in which the gasoline is distilled off in a similar manner. This gasoline then also flows through the cooler K_1 to the container H from which it is returned to container A by pump P_1.

By means of the process described above not only a complete separation of the respective materials can be effected, but the process has the great advantage over those of the prior art that the amount of gasoline or similar solvent of light hydrocarbon nature required for the separation is exceedingly small and that its operating costs are considerably less than those of the known processes since it requires less steam, operating power and cooling media. Furthermore, the cost of building and operating the extraction apparatus is considerably reduced since the height of the column may be considerably less than that required for the known processes and since all mixing, stirring or agitating devices are completely omitted.

Example

3050 kg. of a crude oil which has been freed from gasoline and petroleum and partially from gas oil (the hydrocarbon fraction boiling between 280° C. and 340° C.) and which contains 6.2% of hard asphalt was treated with 3227 kg.

of a gasoline with a boiling point between 90° C. and 100° C.

Obtained were:

Oil completely free of asphalt	2379 kg.	= 78%
Oil with only 0.24% of asphalt	305 kg.	= 10%
Asphalt and oil	366 kg.	= 12%
	3050 kg.	= 100%

I claim:

1. A process for the separation of asphalt and oil mixtures occurring in crude mineral oils, residues thereof or similar materials comprising filling a column to substantially one half its height with gasoline, thereafter maintaining the gasoline in a substantially quiescent state, then introducing the material to be separated in a finely dispersed condition and under constant pressure into said column substantially at the surface of said gasoline until the column is completely filled whereby at the same time the materials of different specific gravity are separated and then withdrawing the asphalt at the lower end of the column, and then withdrawing the oil and gasoline solution at the lower end of the column.

2. A process for the separation of asphalt and oil mixtures occurring in crude mineral oils, residues thereof or similar materials comprising filling a column to substantially one half its height with mildly heated gasoline, thereafter maintaining the gasoline in a substantially quiescent state, then introducing mildly heated material to be separated in a finely dispersed condition and under constant pressure into said column substantially at the surface of said gasoline until the column is completely filled whereby at the same time the materials of different specific gravity are separated and then withdrawing the asphalt at the lower end of the column, and then withdrawing the oil and gasoline solution at the lower end of the column.

3. A process according to claim 1, comprising in addition separating the solution of oil and gasoline by distillation and removing any gasoline contained in the asphalt and collecting the recovered gasoline.

MAX LANDAU.