

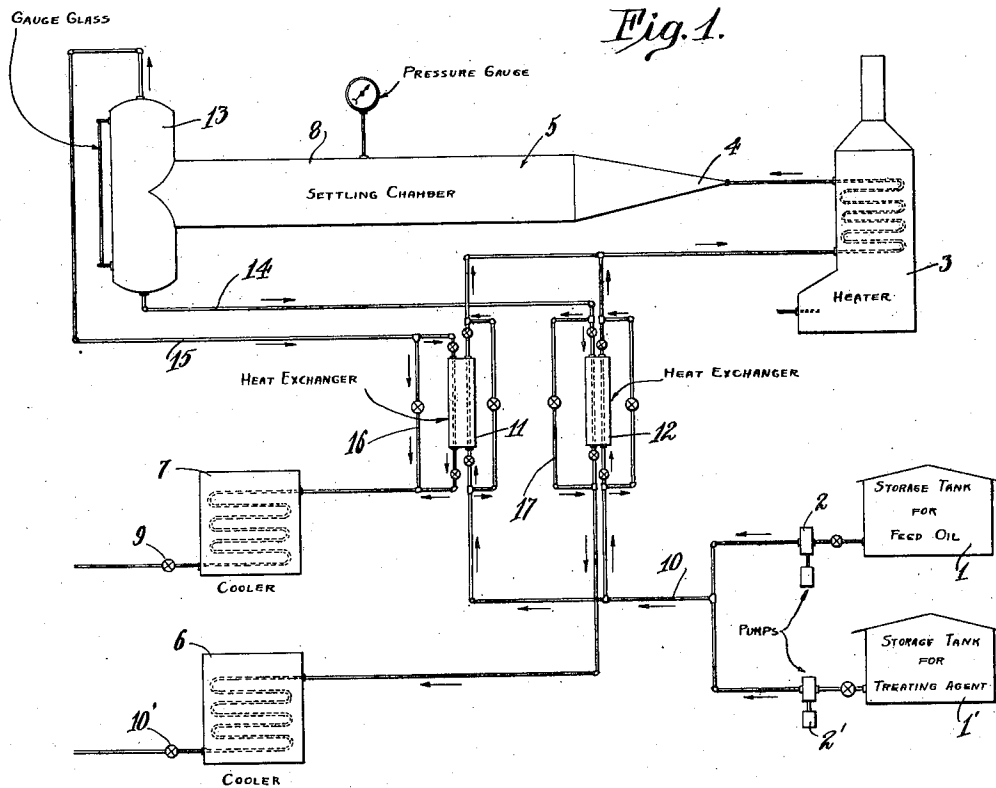
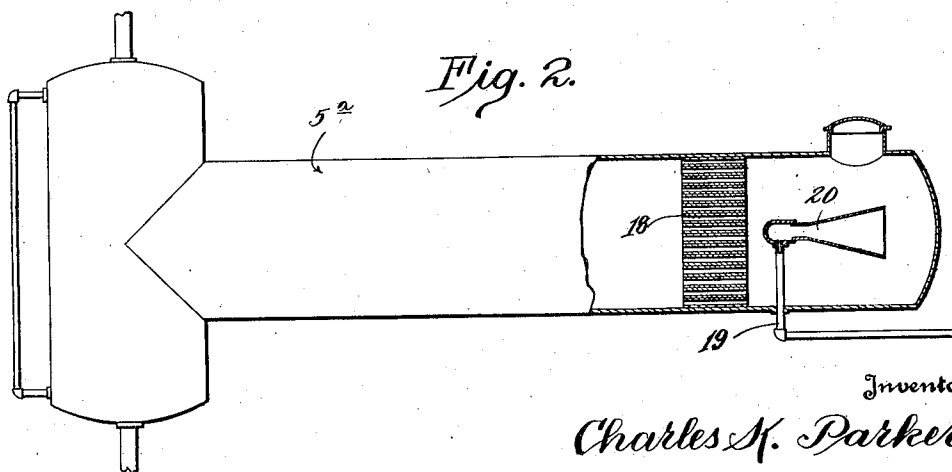
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APPARATUS FOR THE LYE TREATMENT OF PETROLEUM OILS

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APPARATUS FOR THE LYE TREATMENT OF PETROLEUM OILS

Application filed July 12, 1926. Serial No. 121,841.

This invention relates to an apparatus for the lye treatment of petroleum oils, particularly lubricating oils. This application is a continuation, in part, of my copending application Serial No. 48,489, filed August 6, 1925.

In the refinement of petroleum distillates, it is generally necessary to remove acids therefrom. These acids may be either organic acids naturally occurring in the oil or organic acids formed by the action of sulfuric acid upon the oil during the refining process, or mineral acids remaining in the oil after the treatment with acid. The general practice in the art is to remove these acids by neutralizing them with a lye solution such as a solution of sodium hydroxide and then wash the oil free from the soaps and salts so formed with water. In the washing of the more viscous distillates, such as are used for lubricating oils, emulsions are formed which carry away good oil along with the impurities in the wash water. These emulsions also cause water containing impurities to remain suspended in the oil, making it difficult to wash the oil free from impurities. The emulsifying effect becomes progressively pronounced as the viscosity of the oil increases.

An object of the present invention is to provide an apparatus for the lye treatment of petroleum oils by which such organic acids and other acids may be removed from the oils in a continuous manner and in a relatively short time and without producing any emulsion of the oil and lye solution, thus securing a purification of the petroleum oils without the normal emulsification loss of the present practice.

As a basis of the present invention, it has been found that the separation of water and oil is much improved if the operation is carried out in a closed system so that the pressures above atmospheric can be maintained in the apparatus. By such a procedure, the boiling point of the lye solution or water employed is raised and a much higher temperature can be used during the process. These higher temperatures, it is found, cause the soaps produced by the lye treatment to

become much more soluble in the water solution. Moreover, the viscosity of the petroleum oils being treated is also reduced with the result that a very rapid settling occurs. As a result of such operations, the petroleum oils may be purified at a very much less loss. The color and character of the finished oil is improved by the reason of the exclusion of air from the apparatus and oil undergoing treatment, thus preventing oxidation of the oil. The character of the petroleum oils produced is improved due to the reduction of the acidity of the finished oil, due to the reduction of the ash content of the oils from the more complete removal of salts, and the cost of treatment is lowered. An important feature of the invention is the carrying out of the process in a continuous manner and the invention also includes an apparatus particularly adapted for such purifying process.

An important feature of the apparatus of the present invention resides in the provision of means for preventing eddies in the settling chamber of the apparatus, such as might be caused by permitting the reagents to flow into the settling chamber at an improper velocity.

Various objects and advantages of the invention will be apparent from the description of the preferred example of an apparatus embodied in this invention, for which purpose reference is made to the accompanying drawings, which illustrate diagrammatically the preferred apparatus in which the preferred process may be conducted.

In the drawings:

Figure 1 is a diagrammatic view of an apparatus embodying the invention, and,

Figure 2 is a diagrammatic view of a modified form of settling chamber which can be employed in substitution for that shown in Figure 1.

Referring to the drawings, 1 indicates a storage vessel for the petroleum oil to be treated. 1' indicates a storage vessel for the water or lye solution or other treating agent to be employed. The oil is taken from the storage vessel 1 by pump 2 and passed through lines 10 to a settling chamber 5. Cojointly therewith the treating agent, is

taken from storage vessel 1' by pump 2' and passed through the same line 10 to the settling vessel 5. Thereby the treating agent and oil to be treated are thoroughly commingled during their passage to the settling vessel and the treating agent caused to effectively come in contact with all parts of the petroleum oil to be purified. The line 10 may lead through heat exchangers 11 and 12 during its passage to the settling chamber 5 or through a heater 3 or both, as indicated. In any case, the oil and treating agent is passed in the settling chamber 5 at an elevated temperature substantially above the boiling point of water. This temperature of course may be applied to the oil and treating agent prior to their admixture as well as subsequent to their admixture as is the preferred method.

The settling chamber 5 is provided with a tapered throat 4 and with a horizontal elongated central portion 8 and at the discharge end, the settling chamber is enlarged, as at 13, to provide for a more thorough settling of the treating agent and oil, such enlargement 13 being indicated as a vertical drum connected at its center with the elongated central drum portion 8 of the settling chamber. The portion 13 thus having an end extending below and an end extending above the intermediate part of the settling chamber 5.

The separated petroleum oil and treating agent are withdrawn from separate points from the end 13 of the settling chamber, the treating agent being withdrawn from a line 14 at the lower end and the petroleum oil from a line 15 at the upper end. The rate of withdrawal of such an oil and treating agent is regulated so that a pressure substantially above atmospheric is maintained within the settling chamber 5. The treated oil is indicated as passing through the heat exchanger 11, a line 16 being indicated by which the treated oil may be by-passed by the heat exchanger if desired and from the heat exchanger the treated oil is passed through an oil cooler 7 and pressure control valve 9 to a point of storage. The treating agent is passed through the heat exchanger 12, if desired, or it may be by-passed therearound through line 17 and is hence passed through cooler 6 and pressure control valve 10' to a point of storage.

The treating agent employed may be a caustic soda solution of sufficient quantity and strength to effect complete neutralization of the acidic bodies in the oil treated, generally considerable excess of the solution being employed to obtain a very complete neutralization of the oil. The process and apparatus is also adapted for the washing of the petroleum oil with water after such a caustic soda treatment, for which purpose the oil may be passed again through the apparatus

or through another similar apparatus arranged in series therewith.

An important feature of the present invention is the provision of means by which a stream of oil and lye, or other reagent, entering the settling chamber 5 is prevented from setting up eddy currents in the settling chamber which would prevent the proper stratification of the materials. In the embodiment of the invention shown in Figure 1, there is shown a gradually enlarging inlet for this purpose which operates to reduce the rate of flow of the materials entering the settling chamber so that no turbulence is caused by the change in cross section. The angle of divergence of the throat will, of course, depend upon the velocity of the material entering the throat. With certain embodiments of the invention, an angle of divergence of 14° is found satisfactory. It is understood, however, that it is not intended to limit the invention to any particular angle of divergence of the gradually enlarging inlet.

Referring to Figure 2 of the drawings, there is disclosed a modified form of construction of the settling chamber also adapted for the prevention of turbulent flow of the material entering the settling chamber. In this form of the invention, there is disclosed a settling chamber 5^a. This settling chamber is provided with a honeycomb bank 18 of short tubes near the inlet end of the settling chamber 5^a for changing the flow of materials from the inlet end of the settling chamber to the remainder of the settling chamber from turbulent flow to straight line flow. These tubes should be properly proportioned so that the flow of fluid therethrough is prevented from entering in the turbulent condition, the length of the tubes generally being approximately 20 times their diameter. Inasmuch as the proportions for the tubes will vary with the size of the apparatus and quantity of fluid to be passed therethrough, specific figures are not given but they may be readily determined for any given sized apparatus from the discussion of turbulent flow in "Principles of Chemical Engineering" by Walker, Lewis, and McAdams. In certain cases, it may be desirable to employ both a gradually enlarging inlet and the bank of tubes for preventing turbulent flow in the main portion of the settling chamber. Accordingly, I have indicated the inlet line 19 as being provided within the inlet end of the settling chamber 5^a with a Venturi throat 20 which is preferably turned toward the inlet end of the chamber so as to reduce the force of fluid tending to travel toward the outlet end of the chamber.

While the apparatus herein described is well adapted for accomplishing the objects of the present invention, it is understood that various modifications may be made without

departing from the spirit of the invention and the invention includes all such modifications as come within the scope of the appended claims.

5 I claim:

1. An apparatus for the continuous treatment of petroleum oil, comprising a pressure settling chamber having an inlet of gradually increasing cross sectional area at one end, a
10 main middle section, and an outlet enlarged over said middle section connected to said chamber by its expanded end, means for continually admixing and passing thereto at an elevated temperature an admixture of oil and
15 treating agent non-miscible with the oil, and means for continuously and separately withdrawing the oil and such treating agent from such settling chamber.

2. An apparatus for the continuous lye treatment of petroleum oil, comprising a pressure settling chamber elongated in a horizontal direction and having an inlet of gradually increasing cross sectional area, means for continuously supplying to said
25 inlet an admixture of petroleum oil and lye solution, means for continuously heating said admixture prior to its introduction into said chamber to a temperature sufficient to create a vapor pressure substantially above atmospheric, means for maintaining on the mixture
30 passing through the chamber a pressure in excess of its vapor pressure, and means for continuously and separately withdrawing the oil and lye solution from said chamber at points adjacent the end of said chamber
35 opposite said inlet.

3. An apparatus for the continuous lye treatment of petroleum oil, comprising a pressure settling chamber elongated in a horizontal direction and having an inlet of gradually increasing cross sectional area at one end, a main middle section, and an outlet enlarged over said main section, means for continuously supplying to said inlet an admixture of petroleum oil and lye solution, means for continuously heating such admixture prior to its introduction into said chamber, to a temperature sufficient to create a vapor pressure substantially above atmospheric, means for continuously maintaining on the mixture passing through such chamber a pressure in excess of its vapor pressure, and means for continuously and separately withdrawing the oil and lye solution from
50 said chamber at points adjacent the end of said chamber opposite said inlet.

4. An apparatus for the continuous treatment of petroleum oil, comprising a pressure settling chamber provided with an inlet including means of converting turbulent to straight line flow, a main middle section, and an outlet enlarged over said main section, means for continually mixing and passing thereto at an elevated temperature an admixture of oil and treating agent non-miscible
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with oil, and means for continuously and separately withdrawing the oil and such treating agent from such settling chamber

5. An apparatus for the continuous lye treatment of petroleum oil comprising a pressure settling chamber elongated in a horizontal direction and having an inlet line, means at the inlet end of the chamber for converting turbulent to straight line flow, means for continuously supplying to said inlet line
70 an admixture of petroleum oil and lye solution, means for continuously heating such admixture prior to its introduction into said chamber to a temperature sufficient to create a vapor pressure substantially above atmospheric, means for continuously maintaining on the mixture passing through such chamber a pressure in excess of its vapor pressure, and means for continuously and separately withdrawing the oil and lye solutions from
85 said chamber at points adjacent the end of the chamber opposite the inlet line thereto.

6. An apparatus for the continuous treatment of petroleum oils comprising means for continuously mixing oil with an immiscible treating agent, means for heating the mixture, means for continuously supplying such heated mixture under pressure to an enlarged pressure settling chamber through an inlet of gradually increasing cross sectional area, means for reducing the velocity of the mixture to give substantially straight-line flow in the pressure settling chamber, and means for continuously and separately withdrawing the oil and treating agents under pressure
100 from said pressure chamber from points adjacent the end of said chamber opposite the inlet.

7. An apparatus for the continuous separation of petroleum oil mixtures without turbulence, comprising, a substantially horizontal pressure settling chamber having an inlet of gradually increasing cross sectional area at one end and a main middle section, and an outlet enlarged over said middle section.
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8. An apparatus for the continuous treatment of petroleum oils comprising a substantially horizontal settling chamber provided with an inlet of gradually increasing cross sectional area, adapted to convert turbulent to straight line flow, a middle section, and an outlet larger than said middle section, and means for supplying a heated mixture of oil and immiscible treating agent under pressure to said inlet.
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9. An apparatus for the continuous treatment of petroleum oils, comprising means for continuously mixing oil with an immiscible treating agent, means for heating such mixture, a horizontal pressure settling chamber provided with an inlet of gradually increasing cross sectional area at one end, and adapted to convert turbulent to straight line flow, a main section, and an outlet larger than said
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main section, and means for continuously and separately removing separated oil and spent treating agent from the settling chamber from vertically separated points in said outlet.

5 10. An apparatus for the continuous separation of petroleum oil mixtures, comprising a substantially horizontal settling chamber provided with an inlet of gradually increasing cross sectional area, adapted to convert
10 turbulent to straight line flow, a main middle section, and an outlet enlarged over said middle section.

11. An apparatus for the continuous treatment of petroleum oils, comprising a substantially horizontal settling chamber provided with an inlet of gradually increasing cross sectional area at one end, adapted to convert turbulent to straight line flow, and
20 means for continuously mixing oil with an immiscible treating agent, means for conducting said mixture from said last named means to said inlet, and an outlet enlarged over said middle section, provided with vertically separated means for separately withdrawing oil and treating agent.
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Signed at Richmond, California, this 29th day of June, 1926.

CHARLES K. PARKER.

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CERTIFICATE OF CORRECTION.

Patent No. 1,752,350.

Granted April 1, 1930, to

CHARLES K. PARKER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, lines 11 and 12, claim 1, strike out the words "connected to said chamber by its expanded end"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of September, A. D. 1930.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

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